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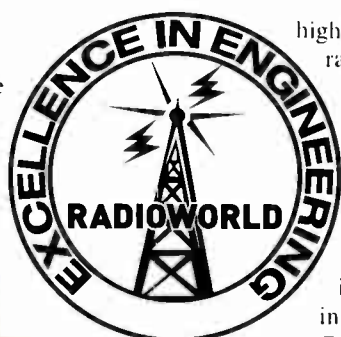
Mike Cooney: Excellence in Engineering

Beasley's quiet, no-nonsense tech leader helps set the radio industry's engineering agenda

BY PAUL J. MCLANE

Michael Cooney is the recipient of the 2016-17 Radio World Excellence in Engineering Award.

Recipients represent the



highest ideals of the U.S. radio broadcast engineering profession and reflect those ideals through contributions to the industry. Cooney is the 13th person we have honored since introducing the award in 2004.

Cooney, 53, is chief technology officer and vice president of engineering of Beasley Broadcast Group, a publicly traded, family-led broadcaster that continues to grow in prominence among U.S. commercial radio groups. He also chairs the National Association of Broadcasters' Radio Technology Committee, where many of the industry's leading technologists confer about radio's future. He serves on NAB's separate Automotive

(continued on page 3)



Noise Floor: Where Do We Go From Here?

Here's what NAB, SBE, ARRL and others told FCC advisors about this growing problem

BY TOM F. KING

This article summarizes comments that were filed in a noise floor technical inquiry conducted by the Technological Advisory Council of the FCC's Office of Engineering and Technology. The TAC had asked users of public communications spectrum, including broadcasters, for input to help it set goals for a radio spectrum noise study.

The author is president of Kin-

tronic Labs Inc.; he was invited to prepare this summary for a presentation to the IEEE Broadcast Technology Society. This paper summarizes responses and concludes with the author's recommendations. A copy also was filed with the commission.

The subject of this paper concerns the licensed and unlicensed users of electromagnetic spectrum and the growing concern over the

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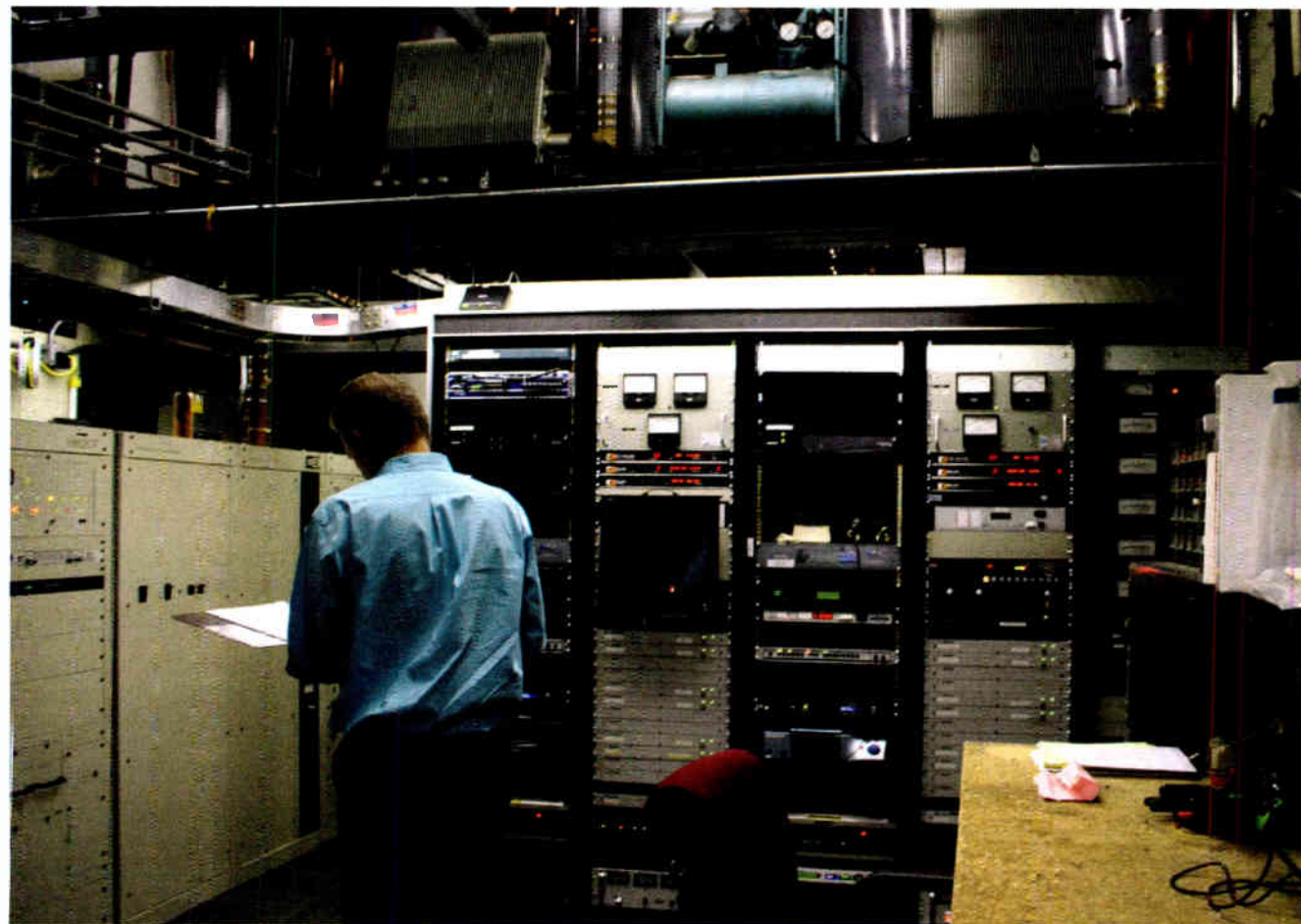
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COONEY

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Digital Dashboard Committee and is also a member of the Technical Standards Committee for the Broadcast Traffic Consortium, of which Beasley is a founding member.

When you talk with Mike Cooney, you get the sense not only of high competence but of directness glimmering from behind a quiet, even-keeled personality (though he insists he isn't always so mild in the office). You aren't surprised to learn that he comes from the upper Midwest, a rural South Dakota town of about 350 people — the kind of place where folks left their keys in their vehicles and where even today they don't lock their doors. His dad was a postmaster, his mom a legal assistant. It was a great place to grow up, but not one with a lot of career opportunities unless you wanted to work the land, as most of his friends did.

Cooney remembers being interested in radio as a child, but his entry into the industry was not exactly planned. He attended Lake Area Technical Institute in Watertown, S.D., studying industrial electronics; and upon graduation, while looking for work, he happened to learn of an opening at South Dakota Public Television and Radio, part of the South Dakota State University. He took a job as assistant chief engineer and microwave technician, and "I just grew from

there; I loved doing it."

This led to a position as a corporate chief engineer for Radio One Broadcasting — not the company we know today with a similar name but a small entity based in Lincoln, Neb. Small, but growing; Cooney helped it expand from two stations to a couple of dozen within just a few years at a time before fast consolidation became common.

For six years in the 1990s, he performed project management and design work for a military subcontractor, a role that included designing and installing radio and TV facilities worldwide,

broadcast facilities, a 45,000-square-foot facility in Kansas City serving nine Entercom stations.

FAMILY ATMOSPHERE

Beasley Broadcast Group came calling in 2007. Now, almost a decade later, Cooney manages engineering and IT and close to 100 technical staff in those departments. He plans Beasley's capital and engineering budgets, leads and designs its large studio and transmitter facility projects, and manages its corporate tower rental activities.

At Beasley he found a "family-type

Cooney heads the tech efforts of Beasley Broadcast Group, which he joined in 2007 and which is expanding thanks to its acquisition of Greater Media.

including high-power radio jobs in the Philippines. He also worked for an AV integrator and ran his own broadcast engineering contract business.

Then he was recruited to work for Entercom, where for eight years he managed the daily activities of 10 to 15 staff members in the engineering, IT and web departments. He led multimillion-dollar capital projects and was the principal design engineer and construction manager for one of the country's largest

atmosphere ... very open-door." He appreciates that he can walk into the office of CEO Caroline Beasley at any time and that he has had the opportunity to sit and talk for hours with patriarch George Beasley. "Corporate here is very much different than a lot of corporate operations I've seen," he told me. "It's very much to support the markets and support the radio stations."

Much of Cooney's work in the past

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COONEY

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two years has involved FM translators to benefit the company's AM holdings. Beasley has almost two dozen translators; Cooney negotiated, purchased and engineered most of them. The company, he said, decided that "if we're going to keep our AMs, and we're going to keep them profitable, we need to expand them into FM wherever possible. We need to either buy FM signals in the markets they're with, or we need to buy a translator for them if possible. ... Also, when it comes time, if you do want to sell the AM, they're vastly more valuable if you can tie a translator with it."

Lately, though, much of his attention has turned to Beasley's acquisition of Greater Media Inc., on which Cooney did months of due diligence work and which netted Beasley 18 more primary signals. The number of stations under his oversight has blossomed to 69, not counting digital multicasts and translators; the growth will bring changes to the company infrastructure, including stations being spun off in Charlotte, and some facilities being consolidated in Boston and Philadelphia/Wilmington.

The entire process makes Cooney



even more aware of what he describes as a real shortage of engineers — "If you're a good engineer, you're probably working." And Beasley, in fact, is on the lookout to fill several positions. However, the acquisition also meant that Milford Smith, Greater Media's longtime VP of radio engineering and himself a recipient of Radio World's Excellence in Engineering Award, saw his position eliminated, though he continues to do contract and consulting work for Beasley. Cooney considers him a friend: "Smitty doesn't have an enemy in the world."

What's next? Talking to Cooney, you get the sense Beasley may not be done acquiring.

"Caroline and I both believe very much that our future is digital; and if anything, that's one of our biggest priorities in the future, developing a digital strategy both from third-party products, streaming, websites, podcasting, all those other products, the non-traditional type revenue."

With Beasley showing itself willing to grow through acquisition, perhaps it will acquire a digital company of some kind. "We're looking at either developing and building our own infrastructure or buying another company. That's probably our biggest priority."

ALL-DIGITAL FM?

The company's interest in digital includes over-the-air broadcasting, and Beasley is an active HD Radio participant. But Caroline Beasley and Mike Cooney are now thinking beyond hybrid digital FM to a more dramatic future: the desirability of a mandate for the industry to convert the FM band to all-digital broadcasting.

"She thinks that we need to be digital, and she wants me to push the conversion of FM to all-digital in the future," Cooney said. He acknowledges that this is a "volatile" idea that may scare some people. However, "If TV hadn't made

it a mandate, we would have never had digital television. There are some real advantages to an all-digital FM signal in the future, including additional data for things like the Broadcast Traffic Consortium and others. There are other services that we could potentially make revenue off with the data."

The ability to make such a conversion someday has always been one of the fundamental selling points of the HD Radio IBOC platform. But of course it could not be accomplished quickly or easily, and would likely be contentious. The process would require the backing of a majority of broadcast-

that'll pick it up at that time."

SPECTRUM CHALLENGES

More immediately, I wondered how Cooney views the spectrum regulatory landscape.

Beasley has some 20 AM stations. Cooney, who was part of revitalization discussions at the NAB's Radio Technology Committee, was pleased with the FCC's translator initiative but feels that other steps so far amount to little more than fluff. He thinks it's unlikely that the FCC will take truly dramatic action.

"To be blunt, I said, 'If we wait around for the commission to solve our problems for us, AM will be dead and gone by the time they try to fix it.' I still believe that. If anything is controversial at all, the FCC won't act on it. ... There's some low-hanging fruit, some easy ones that everyone agrees on like the ratchet rule type things, [but] the other ones, all the tough ones, there's not enough agreement. I just think nothing will be done with them, or at least for years."

What about the separate proposal to create a new Class C4 on the FM dial, which supporters say could help hundreds of Class A FM commercial stations in rural America upgrade their power and coverage? "I'm a little nervous about it because after investing hundreds of thousands of dollars in translators, it could displace some trans-



HONOR ROLL

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He comes from the upper Midwest, a rural South Dakota town of about 350 people – the kind of place where folks left their keys in their vehicles.

ers; creation of a standard, presumably involving the National Radio Systems Committee; and a request to the FCC for a conversion mandate.

"We can do all-digital as we speak," Cooney said. "The problem is the current radios that we have ... will only pick up a portion of the channels. Most people don't know that that requires a redesign of the FM chip. We're finally at a point where a lot of digital radios are being manufactured and cars are rolling off the assembly line with them; if we don't stop that and get the next generation of radio that can handle all-digital, it just puts us further and further behind."

Cooney thus would support an all-digital FM mandate "so that the manufacturers have to start building these and putting them in cars — so that, even if it is 10 or 15 years from now that we go to all-digital, at least there's a radio

lators. I know there's been some studies done on that to say that it shouldn't displace many. Beasley has very few Class A signals, so we don't benefit from it very much. We have some in New Jersey and in Augusta, Ga. Other than that, we have no Class As."

But Cooney expresses concern about the overall direction of FM spectrum management in the United States, particularly the FCC's expansion of the low-power service to allow many more LPFMs.

"I think they were a good idea in principal, but I think we are turning the FM band into what the AM band is now." He noted that there are now 1,600 LPFM stations, and that in the past two decades, more than 4,000 translators have been added to the FM dial.

"My job more and more every day is dealing with, 'Who are we interfering with, or who is interfering with us?'"

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Photo by Jennifer Waits

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GM JOURNAL

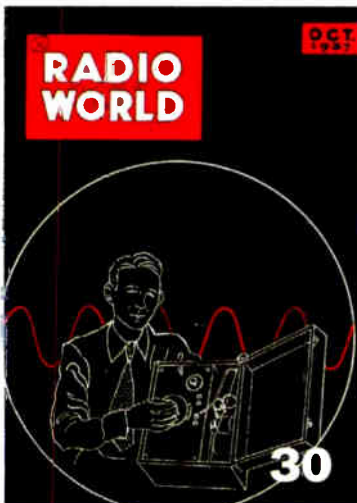
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We've been very lucky recently. Out of 20-something translators we've purchased, we've never had a single complaint of interference. I think that goes back to doing really good engineering practice and studies before you decide to buy one or build one. Many of the smaller groups are not doing that."

But he worries about FM crowding. "If the low-power FMs hadn't come about, I would have been much more supportive of another class. I don't want to say that I'm against [a Class C4], because I'm not. I'm just nervous about trying to give everyone more power, and everyone an FM radio station, and what we're doing to the band."

PRIORITY: DASHBOARD

Recipients of our award tend to be immersed in the industry's growth and new projects, and Cooney is no exception.

He chairs the NAB's Radio Technology Committee, which consists of leading technologists from member companies who advise the association; this puts him in regular contact with his peers at most of the country's other major commercial broadcasters and means he plays a quiet but important role in helping set the industry's conversation about technology strategies. He also serves on NAB's new Automotive Digital Dashboard Committee, which consists mostly of radio CEOs, exploring the industry's future role in next-generation automotive devices and helping build relationships with carmakers.

He credits the work that's been done by NextRadio and the former iBiquity Digital for advancing those relationships, but says the rest of radio needs to come along. "We need to embrace that and start working much more closely with them so that we remain in the dashboard where we belong. ... In my opinion, that's our biggest priority right now, the future dashboard."

I asked him about the growing number of "hybrid radio" ideas that have been put forth, seeking to combine one-way, over-the-air broadcast infrastructure with two-way internet connectivity and all of the data and analytics possibilities it could bring.

He said that Nick Piggott of RadioDNS Hybrid Radio recently addressed a Beasley general managers meeting at the company headquarters in Naples, Fla. "I had him speak because I wanted them to understand hybrid radio better than what they do, and where that's heading ... We are also very supportive of NextRadio. I don't want them to become competitors." Cooney expresses excitement about what hybrid radio could be. "If we can come up with a standard that we all support and that makes sense, I think the [NAB] Technology Committee needs to be

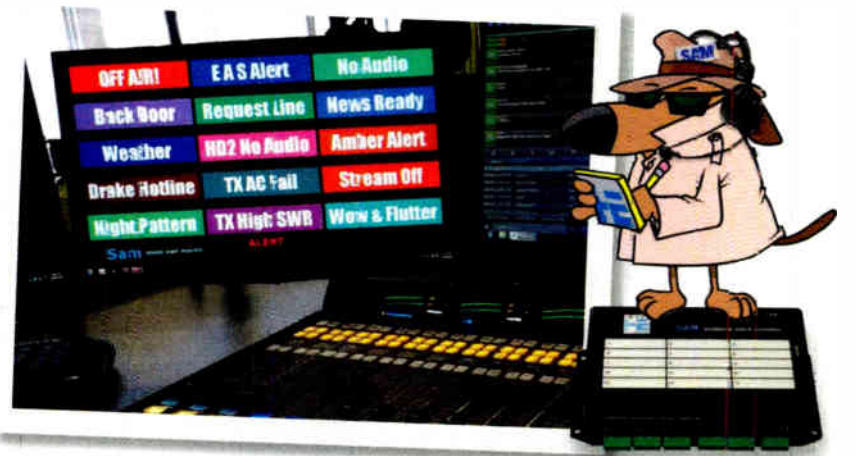


involved in that."

He also is a member of the Technical Standards Committee of the Broadcast Traffic Consortium, a coalition of North American radio organizations that formed a terrestrial broadcasting network to distribute local traffic, weather, fuel prices and other content via their analog and digital signals; Beasley was a founding member. Today Cooney finds

himself researching whether Beasley can make more revenue leasing HD channels to other broadcasters versus using the data for BTC. "If you had an FM all-digital," he added, "you could do both pretty easily."

Accomplished, capable, diligent, no-nonsense — Mike Cooney is well deserving of Radio World's Excellence in Engineering Award.



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NOISE

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degradation in achieving reliable (1) analog and HD AM and FM as well as DTV broadcast reception, (2) wireless communications service, (3) amateur radio reception and (4) broadband internet service as a result of a decreasing signal-to-noise ratio due to an apparent increase in the noise floor in the DC to >1 GHz frequency band.

It is for this reason that the Federal Communications Commission Technical Advisory Council under the direction of the Office of Engineering and Technology issued a Technical Inquiry under ET Docket No. 16-191 in order to request spectral noise measured data from any and all licensed and unlicensed users of electromagnetic spectrum and to respond to a list of questions that included the following:

- Is there a noise floor problem?
- Where does the problem exist? Spectrally? Spatially? Temporally?
- Is there quantitative evidence of the overall increase in the total integrated noise floor across various segments of the radio frequency spectrum?
- How should a noise study be performed?

The responses to these questions will serve to establish a basis from which the TAC could develop a set of achievable goals to present to the chairman of the FCC to act on in an effort to improve the reliability of broadcast and communication services that are being adversely affected by an increasing noise environment. The responsibility for this noise study will be the responsibility of the TAC Spectrum and Receiver Performance working group that is currently co-chaired by Dr. Greg Lapin, who represents the American Radio Relay League, and Lynn Claudy, senior vice president for technology at the National Association of Broadcasters.

GENERAL RESPONSE SUMMARY TO THE TAC TI

According to a summary report prepared by Geoff Mendenhall, consultant to Gates Air Corp. and who is currently serving on the TAC Spectrum and Receiver Performance working group, a

total of 93 submissions were received at the FCC Electronic Filing System, some of which were duplicates. Responses were received from 73 different people or organizations. The breakdown on responders was as follows:

- 23 companies/industry organizations
- 39 RF professionals (broadcast and wireless)
- 31 licensed radio amateurs
- 9 responders did not reply to the questions asked

The four [bullets] below illustrate the most widely used services that are affected by the increasing noise floor.

- Cellphone and broadband internet service
- AM/FM/DTV reception
- Police, fire and emergency responder communications
- Amateur radio two-way communications

Individuals and companies representing each of these sectors of public communications submitted responses to the TAC TI.

HIGHLIGHTS OF SPECIFIC RESPONDERS

[The sections below summarize the filed comments of the named organizations.]

NEWSROUNDUP

PUBLIC FILE:

Commercial radio stations in the top 50 markets with more than five employees must post their public files online with the FCC by Dec. 24. Stations should upload existing documents — annual EEO reports, issues and program list, political reports — already included in the paper public file to the FCC-hosted website. For more info see <https://publicfiles.fcc.gov/>.

SKYWAVE: A group representing 76 black-owned AM stations asked FCC to expedite the end of skywave protection. "Allowing Class D stations the opportunity to receive some amount of nighttime service, and allowing Class B stations to improve their nighttime service, will



NABOB

National Association of Black Owned Broadcasters

be an enormous benefit to the communities served by those stations," the National Association of Black-Owned Broadcasters said. It has long favored this change. The

I. ARRL

The FCC classification of noise emitters is as follows:

- Intentional emitters, such as broadcast stations or mobile telecom cell sites.
- Unintentional emitters, such as high-efficiency fluorescent and light emitting diode (LED) lights, computers, plasma TVs and switching power supplies
- Incidental emitters, such as overhead power lines and motors

Man-made noise sources fall under one of these three categories and together attribute to the overall spectral noise floor with the highest levels being in the large, metropolitan urban areas and the lowest levels being in the rural areas. The ARRL response noted that Section 15.5 of the FCC rules calls for operators of an interference-causing RF device to cease operating the device if interference to authorized services develops.

Operators should be aware of this rule and seek FCC enforcement with supporting documented evidence.

In addition Chris Imlay, the author of the ARRL response, referred to an IEEE Recommended Practice on the resolution of power line noise complaints (P1987) that is being developed by the IEEE Electromagnetic Compat-

ibility Society Standards Development and Education Committee. This document should be distributed to all operators of broadcast and wireless communications services when available.

II. Society of Broadcast Engineers

On May 26, 1999 the FCC requested that the TAC study the noise floor and propose new approaches to spectrum management based on emerging and future technologies. The commission has since 1999 skipped the urgent step of evaluating the RF environment before repeatedly and constantly making allocation decisions. The time is now to proceed with a well-planned comprehensive nationwide noise floor study.

The commercially available range of RF devices has expanded significantly resulting in a previously limited range of 30 MHz to 3 GHz as per the current FCC Part 15 and 18 rules to an expanded range up to 70 GHz; hence a review and updating of the current rules relating to noise interference is in order.

The IEEE is in the process of revising Std. 473, a standard on site surveys, which does include test methodology for the measurement of signals and noise at test sites and at locations of equipment. This should be made available to TAC when completed.

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FCC has tentatively concluded that Class A stations should be protected, day and night, to the 0.1 mV/m ground-wave contour, from co-channel stations; they also should continue to be protected to the 0.5 mV/m groundwave contour, day and night, from first-adjacent stations; and critical hours protection of Class A stations should be eliminated. NABOB pointed to filings by Carl T. Jones Corp. and Hatfield & Dawson Consulting Engineers that technical objections to elimination of skywave protection are "unfounded."

BBG: The Broadcasting Board of Governors said its overall audience reached 278 million people in 61 languages, up from 226 million in 2015. The estimate combines numerous delivery platforms. BBG says it experienced its "largest ever year-to-year audience increase" across its outlets: Voice of America, Radio Free Europe/Radio Liberty, Radio and TV Martí, Radio Free Asia and the Middle East Broadcasting Networks (Alhurra TV and Radio Sawa). The blog BBG Watch, often critical of the organization, has argued in the past that the annual estimates are misleading, but BBG says its performance information is "appropriate, complete and reliable." The organization noted recent initiatives such as new TV programs for Iraqis; social media outreach for VOA and RFA in Southeast Asia; and a conference on internet freedom in Cuba. It said that RFE/RL and VOA "actively engaged online in providing alternatives to Russian disinformation."



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NOISE

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SBE recommendations to the TAC:

- Increased cooperation is needed between manufacturers of Part 15 devices and users of radio spectrum to identify noise sources and take appropriate remedial action.
- Radiated emission limits below 30 MHz in the FCC Part 15 rules for unintentional emitters should be enacted. There are presently no radiated emission limits below 30 MHz for most unintentional emitters.
- Reduced Part 15 limits for LED lights should be enacted to be harmonized with the Part 18 lower limits for fluorescent bulbs.
- Better labeling on packaging for Part 18 fluorescent bulbs and ballasts to better inform consumers of potential interference to radio, TV and cell-phone reception in the residential environment.
- Specific radiated and/or conducted emission limits for incidental emitters, such as motors or power lines, should be enacted.
- Conducted emission limits on pulse-width motor controllers used in appliances should be enacted.
- Substantially increase the visibility of enforcement in power line interference cases.

III. National Association of Broadcasters

The FCC was created to address the interference chaos that threatened to destroy nascent radio services in the early 20th century. The FCC has unfortunately relinquished this role to self-regulation of the manufacturers of consumer products with associated RF emissions, which clearly has led to de-regulation of the noise floor contributors and a resulting increase in the noise floor.

The NAB pointed out that (1) FM HD injection was increased from -20 dBc to -10 dBc in some cases due

to the need to overcome the ambient noise floor, and (2) numerous VHF DTV stations moved to the UHF band to avoid noise interference issues. These are examples of how the FCC has avoided attacking the real source of the problem, which is a rising noise floor.

NAB's recommendations to the TAC:

- The FCC should review the general Part 15 emission limits to determine what improvements are necessary to protect licensed services and adopt strict and enforceable limits that will limit noise interference. As a minimum the commission should adopt and enforce a radiated emissions limit of 0.025 mV/m measured at a distance of 10 meters to protect AM radio operators.
- The FCC should re-examine Section 15.13 of its rules that states that manufacturers of incidental radiators should employ "good engineering practices to minimize the risk of harmful interference."

The NAB proposed the following harmful interference levels shown in Table 1 below.

Table 1. Proposed Harmful Interference Threshold Levels

Band	Noise Threshold
AM	0.025 mV/m
FM	34 dBuV/m
UHF DTV	26 dBuV/m

IV. National Public Safety Telecommunications Council

Public Law 110-140-DEC.19, 2007, Subtitle B, Lighting Energy Efficiency: Energy Independence and Security Act of 2007 established requirements for improvements in energy efficiency of lighting equipment, which set the transition from incandescent to high-efficiency fluorescent and LED lighting on a fast track. Section R404.1 of the 2012 International Energy Conservation Code requires that a minimum of 75 per-

cent of lamps in permanently installed lighting fixtures should be high-efficiency lamps. High-efficiency lamp types include:

- Compact fluorescent lamps
- A T8 or smaller linear fluorescent lamp
- Any lamp meeting minimum efficiency requirements:
 - A. 60 lumens/watt for lamps over 40 watts
 - B. 50 lumens/watt for lamps over 15 watts, but no more than 40 watts
 - C. 40 lumens/watt for lamps rated at 15 watts or less

The NPSTC response included a list of noise interference to public safety communications examples among which are the following two examples:

1. Reported by the New York Department of Transportation: Multi-voltage ballasts for fluorescent lighting in a particular building resulted in noise in the VHF low band, loss of coverage, and garbled transmissions impacting portables, mobiles and base receivers within 50 yards of the building.
2. Industry Canada: Electronic ballasts for fluorescent lights in a nearby store produced 20 MHz wide broadband noise in the 800 MHz cellular band resulting in loss of coverage or dropped calls within 2 km of the store location.

V. State of California Governor's Office of Emergency Services & Public Safety Communications

The response for the CalOES included the following statement: "During the last 20 years, and even more so over the last 5 years, we have encountered more and more interference from sources that were not causing interference prior to that time." In their response they listed the following major sources of noise interference:

- Fluorescent lights
- LED lights
- Computers and embedded controllers
- Switching power supplies and battery chargers
- Industrial equipment
- Power tools
- Solar panel inverters
- Cable TV/internet distribution systems
- Power line communications (PLC) and Broadband over Power Lines (BPL)
- Electric automobiles

In response to the question as to what levels does the noise floor cause harmful interference to particular radio service, CalOES responded with the following levels shown in Table 2 below.

Table 2. Receiver threshold levels for specified service bands

Band	Minimum Signal Level*
Low Band (40-50MHz)	-100 dBm
VHF Band (150-170MHz)	-106 dBm
UHF Band (450-470MHz)	-110 dBm
700/800 MHz Bands	-116 dBm

* Noise floor should be at least 10 dB below these levels.

(continued on page 10)

NEWSROUNDUP

OWNERSHIP: The NAB is suing the FCC over its Quadrennial Media Ownership review and what the association sees as failure to take needed deregulatory steps or to justify that decision. NAB filed in the D.C. Federal Appeals Court but said it has no objection to the case being heard in the Third Circuit, which has been dealing with media ownership challenges for more than a decade. NAB says the FCC unlawfully merged its 2010 and 2014 quadrennial reviews and that what it produced ignores obvious changes to the market. NAB called the decision arbitrary and capricious, a violation of the Administrative Procedures Act. The FCC readopted its limits on joint sales agreements; NAB is also challenging that part of the decision, as well as the preservation of the newspaper-broadcast crossownership rule.

NEXTRADIO: A new feature of the NextRadio app offers more station content in an interactive format. "Newsfeed" content includes content specific to users' favorite



stations and formats, as well as Alert FM messages through a partnership with Global Security Systems. It offers trending tweets from a user's favorite radio shows, artist and song facts and concert announcements and tickets, which can be purchased through Vivid Seats.

HD RADIO: "Continued growth" is the theme from DTS Inc. when talking about HD Radio in cars. The company said 34 model-year 2017 cars will feature HD Radio receivers. Fourteen will be available before the end of this calendar year including Acura NSX; Infiniti QX30, Q60 and QX60; Kia Niro; Lincoln Continental; Nissan Pathfinder and GT-R; Toyota 86, Yaris iA and Corolla iM; Volvo S90 and V60; and Jaguar F-Pace. A number of other brands plan models available after the new year. DTS says its HD Radio "ecosystem" now encompasses 36 auto manufacturers and some 200 vehicle models. Separately, DTS came to the LA Mobility Expo/Auto with information on its hybrid radio project, which has yet to be named and on which it is working with several automakers. The work-in-progress would combine over-the-air radio (AM, FM, HD and worldwide DAB) with IP data enhancements to give an enhanced listening experience.

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World Radio History

NOISE

(continued from page 8)

VI. CTIA Representing the U.S. Wireless Communications

Industry

CTIA highlighted the following RF emitters as major sources of noise interference to the US wireless services:

A. Incidental radiators

- a. Electric motors
- b. Light dimmers
- c. Switching power supplies

B. Unintentional radiators

- a. High-efficiency lights
- b. Computers
- c. Garage door receivers

Commercial Mobile Radio Service is impacted by an increasing noise floor as follows:

- Reduction in carrier's reliable service area
- Lost coverage for cell sites at the outer boundary of a carrier's network
- More dropped calls traveling between cell sites
- Diminished voice quality
- Slower data transmission or lost data packets

Considering the number of cell sites that are presently in operation in the USA, the cost to the service providers in reduced quality of service resulting from noise interference has to be a staggering amount.

VII. AT&T

AT&T has had marginal success in working with large manufacturers of industrial lighting to encourage the incorporation of noise filtering in the associated power modules. In the midst of our government's drive toward the increase usage of high-efficiency lighting, manufacturers are motivated to disregard noise concerns due to the higher product cost of adding filter components.

AT&T is particularly concerned about the potential impact of noise on small cells sharing a support with LED lights. A single faulty power supply conducting noise through power lines can compromise their network service out to a distance of a half mile, which is a significantly large area.

Harmonics from unintentional radiators, i.e. FM broadcast transmitters, are the greatest noise source impacting AT&T Mobility Services. FM station interference can degrade the uplink signal in the 700–2300 MHz band within 2,000 feet of the sta-

tion. Also data speeds in the 3–4 GHz range between a computer and other ancillary devices, such as a video display, create harmonics and noise products that interfere with cellphone service.

AT&T recommendations to TAC:

- Noise from incidental radiators could be mitigated through updated industry standards, better testing protocols for device manufacturers, and clarity in commission regulations for spurious emissions
- Improved testing at a wider frequency range up to 6 GHz would identify the potential for interference to commercial mobile and public safety licensees, avoiding the inefficient and piecemeal approach of identifying and mitigating noise after it occurs.
- The commission should create incentives for FM broadcasters to encourage the use of FM transmitter cabinets that are properly bonded and shielded in an effort to comply with mobile service providers' minimum receiver signal levels.
- Better and updated standards and specifically higher frequency standards for designing, constructing and testing incidental radiators would minimize noise from data busses and interfaces in computing devices.

VIII. National Electrical Manufacturers Association

The NEMA response made reference to two publications on the subject of man-made noise measurements in the United Kingdom and in the U.S. [The publications are Wagstaff & Merricks, "Manmade Noise Measurement Programme," 2009; and Achatz & Dalke, "Man-made Noise Power Measurements at VHF and UHF Frequencies," NTIA Report 02-390, US Department of Commerce, 2001.]

As a result the noise measurements were found to be in good agreement for the most part and resulted in the following recorded noise floor levels as shown in Table 3 below.

Table 3. Measured noise floor levels as a function of frequency and location

FREQ	NOISE FLOOR		
	RESIDENTIAL	CITY	RURAL
300 kHz	88 dB	91 dB	80 dB
1 MHz	72 dB	77 dB	68 dB
10 MHz	45 dB	49 dB	39 dB
100 MHz	17 dB	22 dB	12 dB
200 MHz			4 dB
1 GHz	-2 dB	2 dB	

This data clearly shows that the Medium-Frequency AM band is significantly more affected by the noise floor than the VHF, UHF or mobile cellphone service bands. A reduction of 9–11 dB in the noise floor level is realized between the city and rural environments over the 300 kHz to 100MHz band.

SUMMARY AND CONCLUSIONS

There is a clear consensus from the great majority of the responders to the TAC technical inquiry that a noise floor study is not only needed, but is way overdue. Even though the measured evidence of noise interference was very scarce in the responses, the experiences of broadcasters, public safety communications service providers, amateur radio operators and mobile phone and internet service providers that specifically stated the reduction in service reliability that they have been experiencing in recent years on an increasing scale should be sufficient evidence to the TAC to prove that a thoroughly planned and implemented noise study with inputs from all parties concerned is definitely needed.

Furthermore in these times of natural disasters, war or terrorist activities, secure, clear wireless communications are of the utmost importance. The growing vulnerability of the internet to hackers has to be causing our government, military and the banking industry to consider other forms of communication that are more secure. We cannot afford to allow the producers of products with associated RF emissions in our limited electromagnetic spectrum to be proliferated without regulatory action. The matter of our understanding the noise floor versus frequency and what sources contribute to it is of great strategic importance to assure reliable and secure public communications for the safety of all citizens of the USA. The SBE response made reference to the following statement: "It would be impossible for the commission to engage in effective spectrum management until it develops a more complete understanding of the current state of the radio noise environment." [FCC TAC, Second Meeting Report at 1, 9 (Oct 28, 1999).] This further substantiates the need for the noise floor study.

Comment on this or any story. Email radioworld@nbmedia.com.

NEWSROUNDUP



TECH BUY: Samsung agreed to purchase Harman International for \$8 billion in cash. It described the deal as a shortcut to becoming a major player in "the large and rapidly growing market for connected technologies, particularly automotive electronics, which has been a strategic priority." Harman equips more than 30 million vehicles with audio and connected car systems. Earlier this year, Samsung invested \$450 million in China-based electric car maker BYD, and Harman signed strategic partnership deals with car makers Fiat Chrysler and General Motors. Assuming the deal goes through, Samsung said Harman will operate as a standalone subsidiary, keeping Harman's audio professional and consumer brands intact. Harman brings well-known brands such as Studer, JBL, AKG, Lexicon, Mark Levinson and Harman Kardon.

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Bakeware Keeps Your Hardware Sorted

Also, we share some inexpensive gift ideas for fellow engineers

WORKBENCH

by John Bisset

Read more Workbench articles online at radioworld.com

At one time or another, you've reassembled equipment and were either short pieces of hardware or had hardware left over.

Mark Voris is a frequent Workbench contributor and the engineering manager for the Spirit Catholic Radio Stations, based in Omaha, Neb. Mark writes that he finally found time to do some bench work, and had two Asymetrix 581 distribution amplifiers that were in need of repair.

He finds that keeping mounting screws organized while doing this work can be trying. His solution was a labeled muffin tin. Using the tape labels ensures

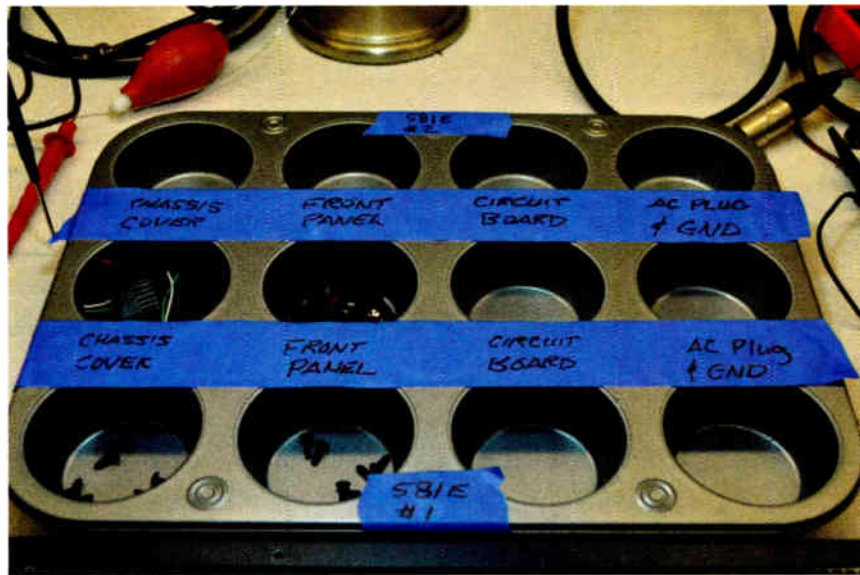


Fig. 1: Use a muffin tin to hold hardware.



Fig. 2: The DA is ready to reassemble; the muffin tin holds all the nuts and bolts.

the right hardware is replaced properly — and the muffin tin is no worse for the wear.

Mark adds that this is the first time he's attempted to work on surface-mount devices. He didn't have the right soldering iron or optics, but replaced capacitors and regulators nonetheless, and the amps work fine. In other words, no factory installed smoke was detected!

Do-it-yourself enthusiast Charles "Buc" Fitch, P.E., writes in with an MCM corollary. While you're buying those MCM audio amp bricks we mentioned, Buc points out another interesting item that the company has on sale. See it at www.mcmelectronics.com by typing part number "58-17903" in the search field.

Described as an electronic survival guts pack, this little bag contains about 60 basic components, of which the most useful is a small proto-board. This is a valuable item to mock up small circuits before committing them to final construction. Buc's thinking of those little interfaces on remote controls and mini-

relays activated by other functions.

At a sale price of \$3.99, the value of the components in the bag easily exceed this cost, so it's a good buy no matter what your current needs are. Consider this a great stocking stuffer for your techno-geek buddies.

Speaking of gifts, one of Buc's favorites for friends is an inexpensive, yet flexible, small digital meter for your car or truck glove compartment. How often have you encountered a simple tech challenge ("Why is my mother-in-law's refrigerator not working properly?"), but you are annoyed because you could have fixed it easily, if you'd just had your meter with you? A useful gift, often available for under \$10.

You could also add the MCM survival kit to the glove compartment, along with that meter.

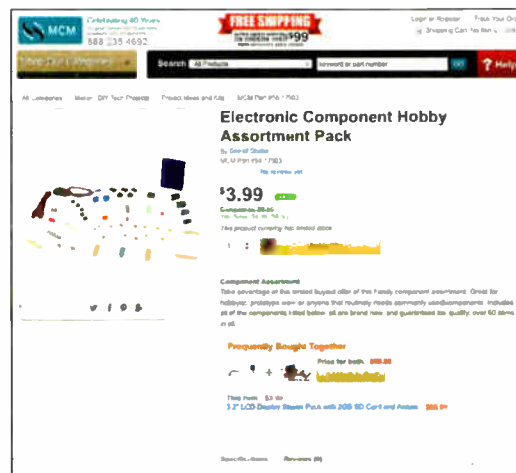


Fig. 3: This MCM "guts pack" makes for a great stocking stuffer.

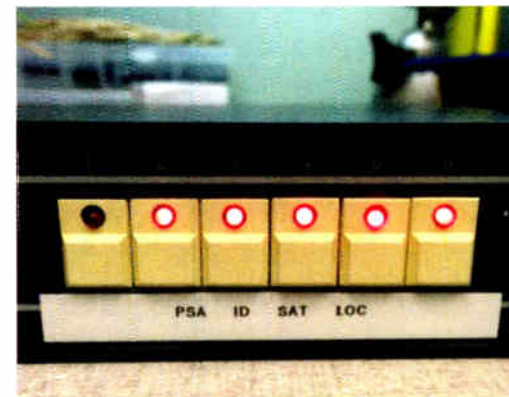


Fig. 4: The switching problem was traced to a defective U25.

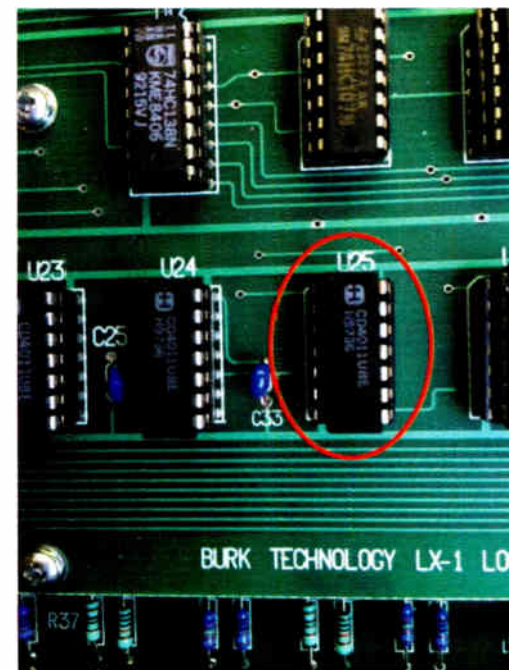


Fig. 5: The inside of the LX-1. U25 is circled in red.

Bible Broadcasting staff engineer Steve Tuzeneu checked out a Burk LX-1 audio switcher he was installing and noticed that the switcher would "mix" all of the inputs selected and not select a single audio channel.

He checked to make sure the "ready" light was on and the mix feature was off, as it is supposed to be. After some trouble-shooting, Steve replaced U25, a chip with the number CD4011UBE. This is a quad dual input NAND Gate IC. The inside of the LX-1 chassis is shown in Fig. 5, with U25 circled in red. Replacing the chip restored operation, permitting the LX-1 to select only one channel at a time, as intended.

An oscilloscope, or even the inexpensive DVM that Buc recommended, can be used to troubleshoot logic like this.

Tips to Workbench can help your colleagues and also qualify for SBE recertification credit. Send to johnbisset@gmail.com. Fax to (603) 472-4944.

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Grassroots Radio Conference Spotlights LPFM

Annual event provides "radio group hug" for attendees

COMMUNITY RADIO

BY JENNIFER WAITS

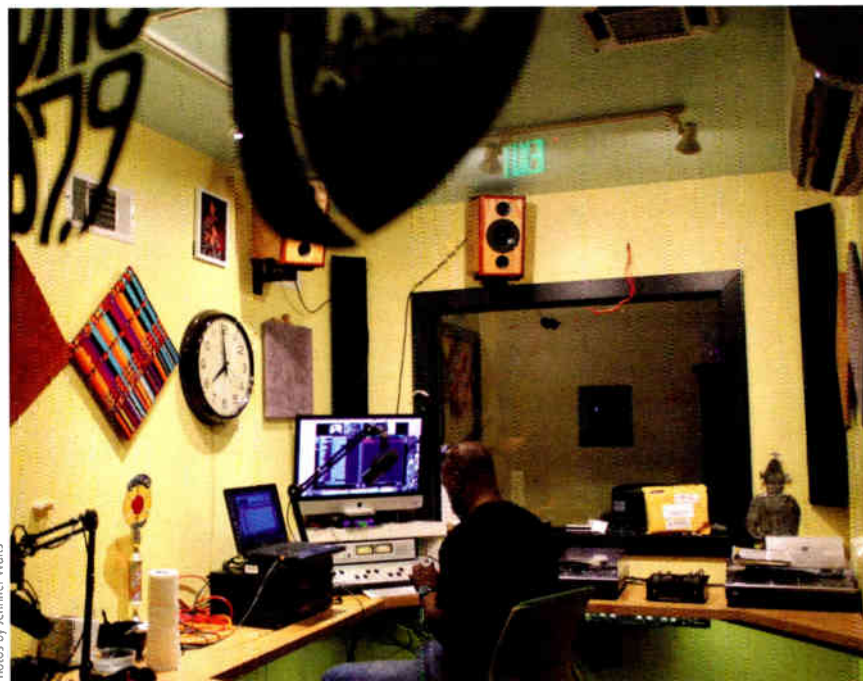
On a warm October weekend, community radio practitioners convened in Hot Springs, Ark., for the 2016 Grassroots Radio Conference. An extension of the loose-knit, 20-year-old Grassroots Radio Coalition, the conference is an annual event, typically hosted by a GRC station. This year, Hot Springs-based station KUHS(LP) organized the event, which drew a crowd of close to 100 attendees from all over the United States.

Hot Springs was abuzz with activity when I arrived during the Friday night opening festivities for the 25th annual Hot Springs Documentary Film Festival, which was being held at the hotel where I was staying. Celebrities and film-goers posed on a red carpet and spot lights shone in front of the 92-year-old Arlington Hotel. As an added perk, GRC attendees were treated to a day pass to the festival.

A national park, Hot Springs is full of fascinating history, known for its spring water and healing baths. Once a gambling mecca and an off-season training destination for baseball players; today, the town is home to gems, including public fountains, rows of bathhouses and a wax museum. Host station KUHS is housed in a vintage building, with lovely architectural details and lore (in a former life, it was stuffed full of pianos), and one of the conference locations was a quirky theater/odds museum called the Maxwell Blade Theatre of Magic.

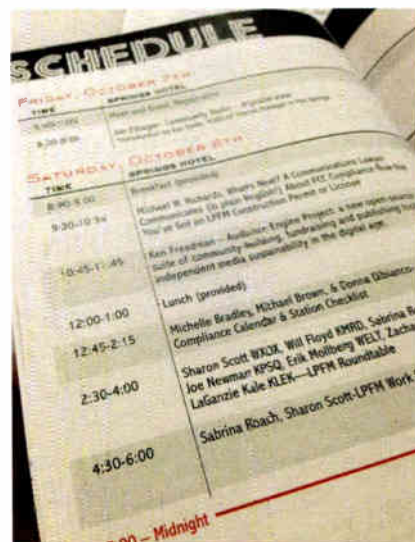
COMMUNITY AND LOCALISM

Conference sessions were spread out over three days, with the opening keynote, "Community Radio — A Global View" by Austin Airwaves' Jim Ellinger. He has traveled all over the world helping to set up community radio stations, and he kept the crowd entertained with his tales from Haiti, Borneo and Panama. A common thread in his talk was the importance of radio



Photos by Jennifer Waits

DJ Cat Daddy at the studio of KUHS(LP).



A glimpse at the GRC schedule.

as a "unique tool" providing local content and information to sometimes isolated communities.

Attendees hailed from a variety of radio stations, including established full-power FM community radio stations such as KPFA(FM) in Berkeley, Calif., KABF(FM), Little Rock, Ark., KKFI(FM), Kansas City, Mo. and WFMU(FM) in Jersey City, N.J.; college radio stations like Hendrix College's KHDX(FM) in Conway, Ark., Delgado Community College's WXDR(LP) in New Orleans and University of Washington, Bothell's LPFM-to-be UWave Radio in Bothell, Wash.; and many LPFM stations from as far afield as New Mexico, Arizona, California, Kentucky, West Virginia, Indiana, Texas and Arkansas.

LPFM work session.

Nuts-and-bolts sessions of interest to all attendees included presentations about automation systems, live remote broadcasts, emergency broadcasting, marketing, management and open-source software tools for radio stations.

Saturday night was capped off with a BBQ dinner and keynote presentation by legendary freeform DJ Clyde Clifford, famous for his show "Beaker Street." Clifford regaled the room of radio enthusiasts with stories from his long career in radio, which started over Little Rock's clear channel 50,000 watt AM radio station KAAY in 1966.

While the sessions were chock-full of information, equally important to many folks were the opportunities to connect with radio experts. Keith Richards, program manager for newly launched KPSQ(LP) in Fayetteville, Ark., told me, "It's not that I've learned it all here, but now I know the people to go to to ask the questions."

A TWILIGHT HIKE

A highlight on Sunday evening was a hike up to KUHS's transmitter site. A group of us caravanned to the trailhead, taking a 15-minute trek to the solar-



GRC sign is featured at Maxwell Blade's Theatre of Magic.

The importance of localism and community was a resounding theme throughout the conference, with LPFM playing a particularly large role. In addition to having a new LPFM as host, a large percentage of the attending stations held LPFM licenses or construction permits. Not surprisingly, much of the conference was devoted to topics that are particularly relevant to these stations. LPFM-specific sessions included Michael W. Richards' talk "What's Next? A Communications Lawyer Communicates (in Plain English!) About FCC Compliance Now That You've Got an LPFM Construction Permit or License," Michelle Bradley's "Compliance Calendar and Station Checklist," an LPFM roundtable and an

powered facility at dusk. After spending much of the day inside for conference sessions, it was nice to see a bit of the landscape and to take in a beautiful sunset. It was nightfall by the time everyone made it back to the parking lot, and cell phone flashlights were utilized to make our way down the hill safely.

Following the hike, many conference attendees met up at KUHS for dinner and tours. The storefront studio features a DJ booth that has a view of the lobby and street, as well as a window overlooking the general manager's office. During our visit, the on-air host, who savors his normally quiet Sunday nights in the studio, was a good sport about the constant parade of interested folks who

(continued on page 22)

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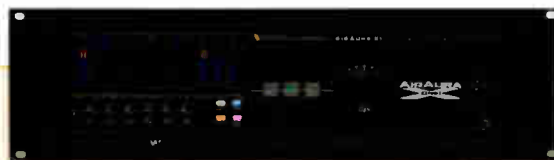
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Grab some lights and a Raspberry Pi, and you'll be in business



The final result in front of the iHeartMedia Toledo building.

BY ALEC CONNOLLY

Thirty-two boxes of Christmas lights, two solid-state relay boards, two IC inverters and one Raspberry Pi: These components were stacked precariously on my desk early in my internship at iHeartMedia Toledo.

My task, according to Market Director of Engineering and IT Gary Fullhart, was to create a holiday light show that synced to our Christmas music station, WRVF(FM), "101.5 The River."

After researching and testing, I found the assignment exciting to build.

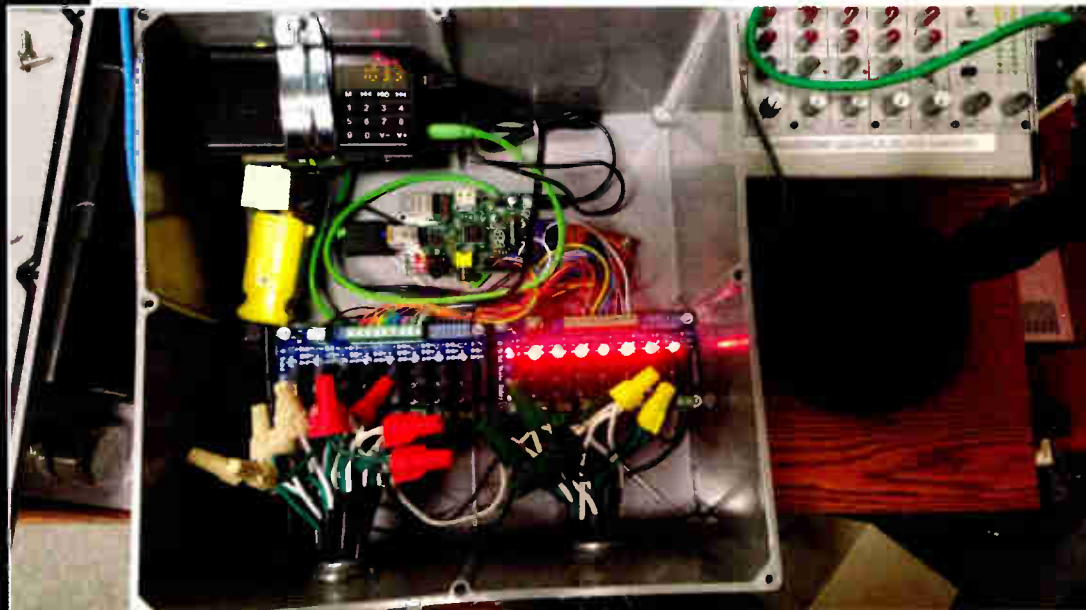
For this project, the Raspberry Pi runs open source software called LightShow Pi. The program takes audio and breaks it across light channels, similar to a light organ. Utilizing the Raspberry Pi Model 2B, a maximum of eight GPIO pins create the light channels.

LightShow Pi reacts to changes in sound; therefore, louder songs or songs with more "action" create a better reaction.

Pre-recorded audio files or an audio source brings the light show to life. LightShow Pi reacts to changes in sound; therefore, louder songs or songs with more "action" create a better reaction. Lights rapidly pulse as they impersonate the sounds of an artist's voice.

On the other hand, quiet selections with less action will cause the channels to drop. After a few seconds, the audio returns and the show resumes.

The first version of this project features eight plugs that correspond to a different GPIO pin on the Pi.



This unit contains a Pi, small radio and two solid-state relay boards.



The second revision features 16 channel outputs.

The second revision uses 16 plugs and an IC Inverter to create alternating channels. Channels 1 and 9, 2 and 10, 3 and 11 and so on run as opposites. The leads from the Pi connect to a solid-state relay board, which controls the power going to each plug. Inside the unit, a radio is the audio source. An external adapter converts the 1/8-inch output from the radio into USB.

Because the Pi is using audio from a radio, and not from inside the station, it continues to sync correctly, even when using profanity delay or with HD Radio delay. Listeners can tune in with

a car radio, and see the light show in real time.

In front of the iHeartMedia Toledo studio building, we constructed a light tree composed of strands of 17-foot LED lights stretched as rays from an existing flag pole.

A multi-colored strand and a green strand wrapped together create an alternating effect. The unit sits mounted on the flagpole and strands extend down from the top.

Multi-colored lights are on Channels 1-8 and the green lights are on Channels 9-16. When the program is inactive, Channels 1-8 are off, activating the green lights.

The program reacts to both changes in audio and the volume of the sound. During commercials or quiet sections of a song, the Pi will turn off all GPIO pins, leaving behind the static green tree.

Programming a python code simplifies the process of changing the patterns on the tree, which also enables testing without an audio source. By using any

(continued on page 22)

HIGH CAPACITY EVENT STUDIO TRANSMITTER LINKS



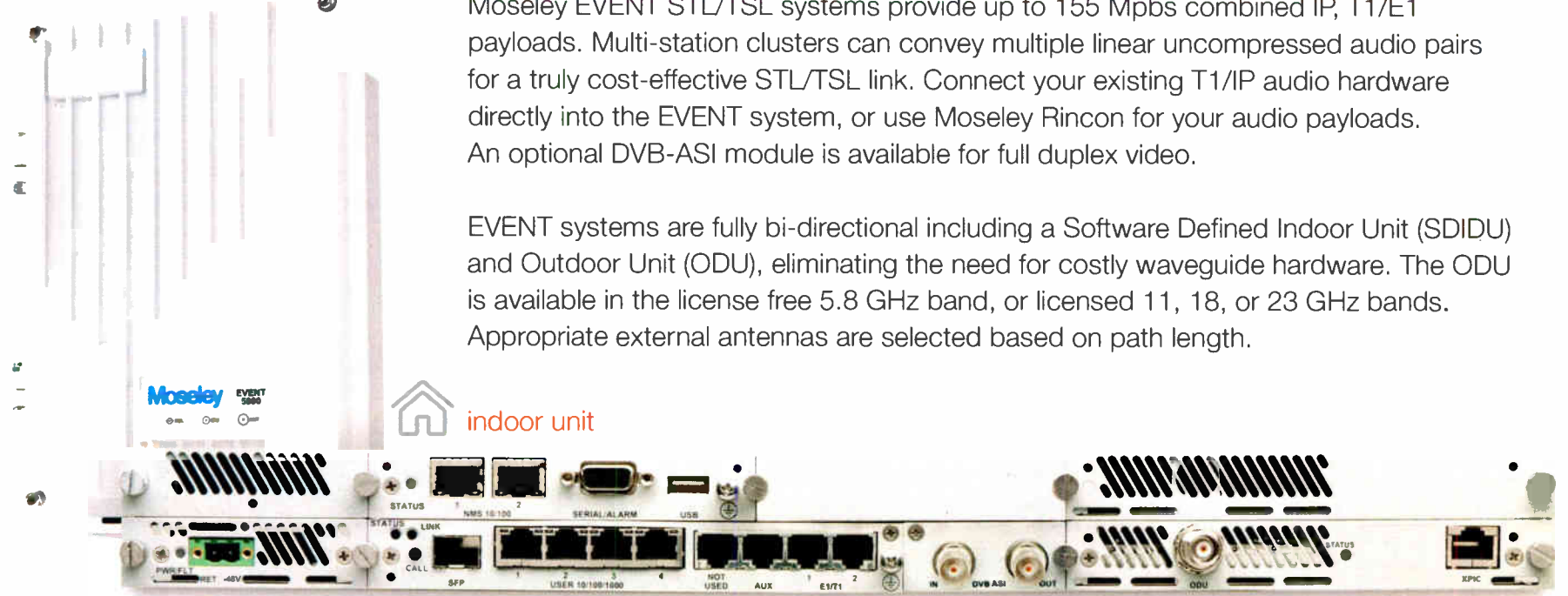
outdoor unit



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indoor unit

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Mike, you have always led by example and continue to be an inspiration for all of us; congratulations to you on this well-deserved award.



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Regards from your friends at NewBay Media, parent of Radio World, Broadcasting & Cable, TV Technology, Radio magazine and other industry leading titles.

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GRASSROOTS

(continued from page 14)

drifted in and out of his domain. A long hallway led to a separate part of the building, which will become brewery/restaurant SQZBX in a few months. While some GRCers gabbed with new friends and munched on leftovers, others took a look at the under-construction space.

KUHS founders Zac Smith and Cheryl Roorda were our guides throughout the weekend, and they happily led tours through the station and the restaurant/brewery. A married couple, Smith and Roorda were in the midst of renovating the old Hot Springs building when they



Jim Ellinger of Austin Airwaves with his transistor radio.

learned about the LPFM application window. Through a partnership with local non-profit Low Key Arts — which also runs a short film festival, an independent music festival, a music and arts festival and a filmmaking program — they applied for and secured a license for the LPFM.

“The restaurant-brewery is a commercial venture that hopefully will generate an income for our family,” Smith said, “The radio station is legally separate, as a non-profit. But we built them both, with lots of help, and their co-location is a deliberate attempt to make a comfortable place that has a deep connection to the community and will serve nourishment in the form of food, drink, music, art and ideas.”

Currently, KUHS(LP) has around 70 DJs hosting a variety of programs, including shows that play almost every imaginable genre of music including soul, country, funk, soundtracks, hip hop, vaporwave, power pop, jazz and more. Live DJs blanket the schedule from early morning until late at night, and when I popped by the station for a daytime visit at the end of the conference, two Monday morning DJs greeted me.

After snapping some daytime photos of the station, I returned to the conference for a few more sessions before heading home. At the event’s conclusion, Roorda shared her impressions of the conference with me, saying she enjoyed getting to “compare notes on the struggles of getting stations on the air.”

She added that the weekend provided much-needed support

Photos by Jennifer Waits



Hendrix College students represented KHDX(FM) at the event.



Cheryl Roorda tours attendees through her future restaurant space.

for many stations. “This is a very special group of innovators, and I’d like to emphasize what a nurturing experience this is for everyone. I’m sure there are lots of people out there struggling with their radio station who could have used this sort of morale boost. A group radio hug of sorts.”

Sharon Scott, founder of WXOX(LP) — aka “ARTxFM” — in Louisville, Ky., has been attending GRC events since 2011, but this was her first since her station launched over FM. “In the past, I have come to GRC hungry for information and taking all I could get. This time, it really felt like our station had something to give back. We’ve learned so much since launching on Valentine’s Day, and it was awesome to share some of this knowledge with the other LPFMs who are just getting started.”

Like many in attendance, Scott is relishing the bounty of new community radio stations. She says, “This year, the most interesting thing for me was connecting with new LPFM stations that are popping up across the country ... I am so excited about this new direction of American radio and can’t wait to see where these new community stations take it from here.”

Jennifer Waits is co-founder of Radio Survivor and a research associate on the Library of Congress’ Radio Preservation Task Force.

DISPLAY

(continued from page 18)

computer on the network or a mobile phone, anyone can control the patterns and make changes to Lightshow Pi using an SSH client. I used PuTTY to access the Raspberry Pi.

OTHER OHIO MARKET APPLICATIONS

For the iHeartMedia Napoleon station, the first version of the modified device was sufficient because we were only decorating windows in front of the building.

The iHeart Lima station uses the second version. With the help of Engineer Josh McKinley and Producer Rodney Thomas, the front of the building and surrounding bushes represent different audio channels. When active, the inverted channels create an all-white background.

The Raspberry Pi is a powerful tool. And with the help of LightShow Pi, you, too, could create a spectacular holiday display for your own stations.

Learn more about LightShow Pi online at <http://lightshowpi.org>.

Send your own tech project stories to us for possible publication at radioworld@nbmedia.com.

Alec Connolly attends the University of Toledo’s engineering program where he majors in Electrical Engineering. He is in his second term of co-op, which he has spent with iHeartMedia. Connolly also works for Learfield as their away game engineer, where he produces the University of Toledo’s football games.



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What Are Your Radio Resolutions?

Managers need to have some honest conversations in order to improve in 2017

New Year's Eve is magical, New Year's Day is hopeful, and on Jan. 2, we put the old behind us and march forward into the new world. Are you prepared?

While we have a few weeks remaining in 2016, please take the time to count your blessings — both personal and professional — and determine what you can do to bring greater success and happiness next year.

Here's a checklist to get you started.

How did your radio station make a difference in your local community over the last 12 months? If your answer is that you did nothing but play songs back to back, take a hard look in the mirror and make a promise that you'll do better starting in January.

Do not use the "I have such a small staff" excuse to rationalize your behavior.

How about a drive to collect coats for

those who are cold? I've executed this promotion several times with just a few phone calls to a non-profit who will help and a retailer willing to serve as a collection center. No staff required.

Learn how to disconnect and then model that behavior for others.

February has "Thank a Mailman Day." It wouldn't be tough for you to get audio of local people thanking their mail carriers by name and talking about some of the nice things they do in the community.

The truth is, there is something that you can do every month — it doesn't have to be large — to make your city or town a better place to live. Incentivize your talent to join volunteer organizations for their good and yours.

How did you treat your employees last year and how can you improve your internal communication and staff morale? Don't let the worst of your staff make you into a curmudgeon with everyone else.

If you can't help someone improve, do them and yourself a favor and move on. Confrontation is difficult, but without it, things do not change.

Simple rewards such as praise (when valid) — and the occasional extra day off — truly motivate people.

When you plan staff events, try not to kid yourself about how much fun they are for your staff. Making people go out to dinner can be a drag when they really just want to be with their families. If your staff has a few kids among them, consider offering babysitting at

PROMO POWER



Mark Lapidus

your next group function so those parents who work for you can easily enjoy themselves. Your staff is — or should be — a bit like extended family, and it's important to show you care.

Live more in the moment! This next year, could you have greater self-awareness of how much you use your phone when the people you're speaking with are directly in front of you?

Leaders are too often clueless as to how they make subordinates feel when their phone appears more interesting than their employees. In meetings, consider leaving your phone in your pocket. That text message can wait a few minutes.

Listen to other radio stations. It's never been easier to monitor stations in your format in cities around the globe. If you work

(continued on page 25)

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Student Scholars Program Boosts Next Generation

Hear from five students about what they learned and why they love radio

CONTINUING ED

BY DICK TAYLOR

In 2015, the Radio Show Student Scholars program was such a success that in 2016, it was expanded to 229 college undergraduate and graduate students.

Students awarded registration scholarships were invited to attend the NAB Educational Foundation/Broadcast Education Association Career Fair and Student Scholars Orientation that kicked off before the 2016 Radio Show began the following day in Nashville. This program garnered the support of 28 radio groups and associated businesses.

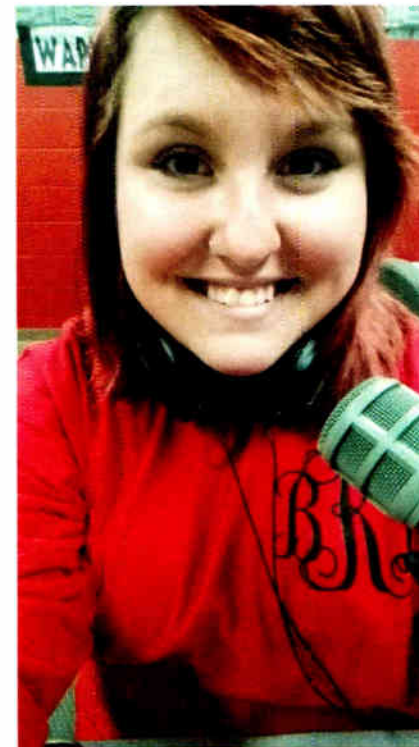
I wanted to know how these student scholars were affected by what they saw,

heard and learned in Music City. I spoke with five to find out why they wanted to be in radio, what they learned at the convention, what surprised them and where they want to take radio in the future.

I interviewed Garrett Britton from Edmonds, Wash.; Brianna Keen from Clarksville, Tenn.; Natalie Melcher from Bowling Green Ky.; Stefano Roman from Boone, N.C.; and Amelia Young from Brentwood, Tenn. — all of whom received a scholarship to attend the convention. They also received financial assistance from a school, state broadcast



Garrett Britton



Brianna Keen



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had never focused on a single career path before, and after giving it a lot of thought, she decided she wanted to become a radio broadcaster.

Stefano played in bands and getting on the radio is a goal every musician dreams about. Besides, said Stefano, radio is fun.

Amelia caught the radio bug working this summer with an internship at the Seacrest Studio at a local hospital. Parents would tell her their child had been having an awful day, but the radio studio made it better, something even the doctors couldn't do sometimes.

SO WHAT DID THEY LEARN?

Garrett told me he learned that radio is on the verge of a new horizon with lots of programs coming into radio and lots of different channels to deliver them, things like NextRadio, CarPlay, Android Audio and podcasting.

Brianna said she learned how competitive the radio field is and that having a mentor is important.

Natalie said she has a clear picture of what industry professionals are looking for when they're hiring and how important mentoring is to advancing in the radio business.

Stefano learned to be passionate about the work you do and to never fear failure — it's inevitable, everyone fails and it's part of the learning process.

Amelia really appreciated the sessions that were especially geared towards the student scholars that talked about how to handle yourself in interviews, on the job and on paper.

association or sponsoring radio company to cover their air, hotel and other expenses.

WHY DO YOU WANT TO BE IN THE BIZ?

Each of the students with whom I spoke saw the magical powers of connecting with others via radio and that was what drew them to want a career in radio.

Garrett said listening to "Brooke and Jubal" on KQMV(FM) in Seattle was what attracted him to radio. "Every single morning they had me laughing, cracking up and always putting me in a good mood," he said.

Brianna said her dad birthed her love of music with her first Sony Walkman. He became her music buddy, and radio was the way they discovered new music.

For Natalie, the light went off in her head when she had to write a paper in high school about what career she wanted to pursue after graduation. She



Amelia Young

WHAT SURPRISED YOU OR WERE YOU NOT EXPECTING TO LEARN?

Garrett quickly said that personal branding was critical. You have to be comfortable with your ego and clearly define who you are; not just for yourself but your listeners too. As in real estate where it's "location, location, location," for the radio personality it's "branding, branding, branding."

Brianna said she was surprised to learn how much of a growing field radio broadcasting is, despite the popularity of online radio. She said that many people tell her radio is dying, and the Radio Show demonstrated to her that radio is full of innovation, which keeps it relevant and up to date with changing technology.

Natalie said she learned the importance of networking and how to confidently walk up to someone and market herself.

Stefano said he was surprised to find out that radio professionals are so easy to talk to and are so willing to



Stefano Roman

help a college student in their career aspirations to get into radio.

Amelia said she loved making lots of contacts. All of the student scholars quickly grasped that it's as much who you know as what you know.

WHERE WILL YOU TAKE RADIO WHEN YOU'RE IN THE INDUSTRY?

Garrett said he feels he will take radio online, specifically in the direction of podcasting.

Brianna says radio's future is in streaming to every device that can receive an audio signal. "Streaming is such an essential aspect of convenience these days, and people are all about what's easiest," she said.

Natalie said she wants to refurbish an Airstream trailer and create a traveling radio station that she can broadcast from as she travels all over the country. She

also thinks it's important to stream, have an app, and she especially loves the NextRadio chip activated in her smartphone because it gives her the capability to carry radio with her wherever she goes. Plus, podcasting allows broadcasters to archive their programs for on-demand listening.

Stefano agreed that streaming and podcasting hold lots of potential but added that the successful ones will be backed by great talent.

Amelia said she plans to use her new professional contacts to inspire her to pursue her radio career.

FINAL THOUGHTS

The Radio Show Student Scholars program was an excellent way of bringing fresh new talent together with the industry that needs it.

Each of the students with whom I talked said how inspired they were by attending and how excited it made them to be working towards a career in the radio industry.

Stefano put it best: "Radio is alive and well, and will continue to adapt to the upcoming future."

GOALS

(continued from page 23)

in rock and you've never listened to the BBC's 6 Music, you're missing the boat.

Do you work in a big market and never listen to a small-market station? I've got news for ya: Country Radio WFLS in Fredericksburg, Va., will make you smile and remind you why you got in the business. Find personalities who can help your talent simply by suggesting that they listen and model.



How can you improve on last year's marketing and how can you convince the boss that advertising is vital to growth?

Do you have an advertising plan on highly targeted social media platforms? If so, are you creating ads that work without sound? Have you finally admitted that organic reach on social media is dead on Facebook and Instagram, and that others will soon follow? Do you ask enough questions of people in other fields about social media, or do you just follow others in the radio industry?



Vacation is important. When you don't take vacation, you get burned out. Fresh ideas don't come as easily.

You've also made your staff uneasy about taking their own vacations because you don't take yours — and when you finally do, you're answering emails within 10 minutes. Learn how to disconnect and then model that behavior for others.

When I'm having a bad day, I think about how precious our time on earth is to all of us. Tim McGraw once wrote a song about a guy who found out he had cancer and suddenly became a nicer person. We don't have to wait for that kind of seismic shift in order to change. Be healthy. Be fun. Be nicer to more people — and to yourself — in 2017.

The author is president of Lapidus Media. Email marklapidus@verizon.net.

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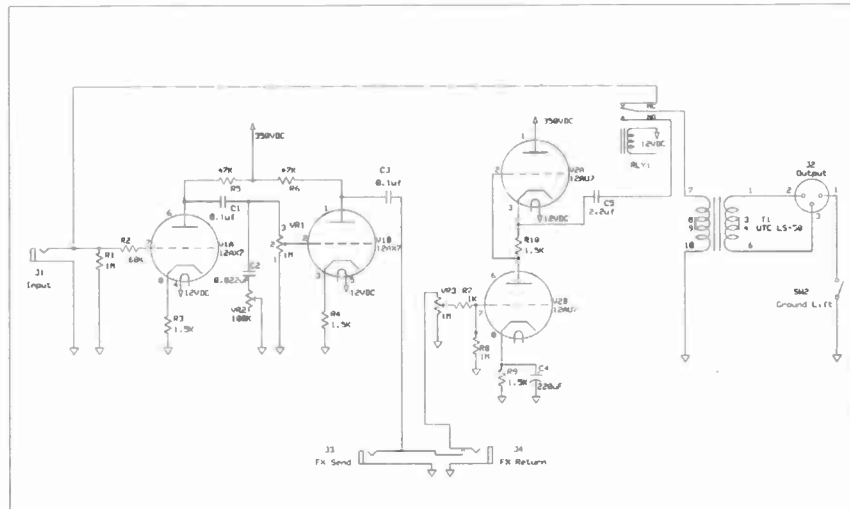
DIYPROJECTS

BY CURT YENGST

After my DIY article "Build Your Own Headphone Amp" in the May 25 issue, the good folks at Radio World asked me to share the process by which I make printed circuit boards.

There are usually two phases to the project, depending on whether it's a circuit of my own creation or I'm using a layout provided by another designer.

It's inexpensive, which is a plus, since most such circuits are one-offs. What are the advantages to printing a circuit board as opposed to just using perf board or point-to-point wiring? Well, for one, neatness. Would you rather troubleshoot a circuit that has nice, laid-out traces, or a rat's nest of wires? Also, the layout image can be easily shared



At the time of writing this article, Curt was working on a bass guitar tube preamp and a couple of other projects, so some of the illustrations here reference those; however the PCB process is the same. Here is the schematic for that preamp.

When finished, I can print out a copy of the trace pattern.

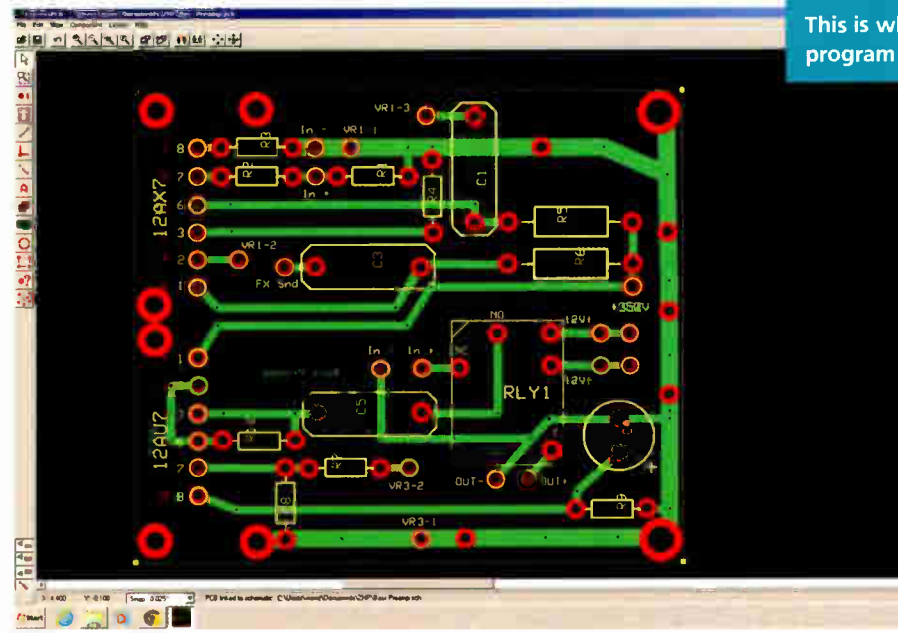
Now comes the fun part! For creating the PCB, I use the MG Chemicals positive presensitized etch process (www.mgchemicals.com). Their presensitized copper-clad boards are designed to react to fluorescent light. In order to protect the areas where I want traces, I first need to create a positive transparent image of the circuit. This is done using transparency film for laser printers, available from some office supply stores. I put a blank transparency in a laser copier or printer and then print the image.

Next, I peel the protective plastic off the board to be etched, exposing the presensitized etch resist, and I place the film on top of that, covering it with a small sheet of glass to ensure good contact. The glass included with picture frames is perfect for this. Then I place it under a fluorescent light for 10 minutes. I use the work light on my bench. Its adjustable arm makes positioning easy. The light on a magnifying lamp works well too. Any etch resist not covered by the traces will be exposed. While it's exposing, I get the chemicals ready and put on my rubber gloves.

The first chemical is the "developer." It gets diluted in a plastic or glass pan, 10 parts water for one part developer. Too much developer will ruin the board by dissolving even the etch resist that was protected by the transparency. It works pretty quickly, removing the green etch resist from most of the board, leaving green circuit traces surrounded by bare copper. A quick rinse with water stops the process.

Then, it's into the ferric chloride etchant solution. This is ready to go right from the bottle. Again, a glass or plastic pan is needed. Ferric chloride is corrosive to metal, smells like burnt rubber, and stains almost everything it touches, so be careful! (You're wearing safety glasses, right?)

This is what the ExpressPCB tracing program looks like.



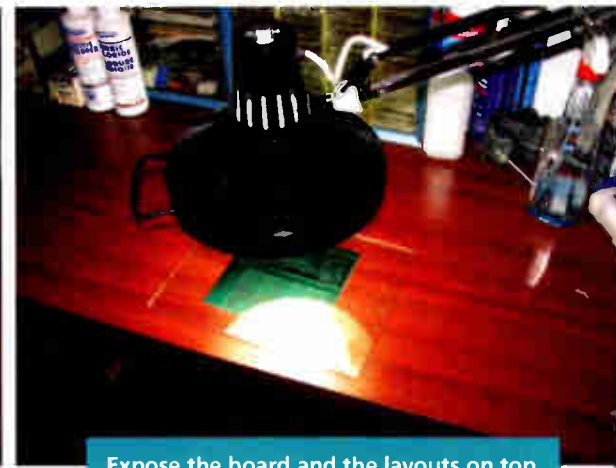
with others or archived for future use. For this piece I'm working on a bass tube preamp of my own design. When I'm creating a circuit from scratch, the process starts with a program called ExpressPCB. This free download (www.expresspcb.com) is actually a pair of programs, ExpressPCB and ExpressSCH. The latter is used to create schematics which can then be linked to ExpressPCB. Linking helps ensure that the layout reconciles correctly with the schematic. ExpressPCB uses a drag-and-drop interface, where I can drag component templates into the design, add component numbers based on the schematic, and the program reminds me what needs to be connected to what.



This is the "transparency" material used to cover sections of the PCB board before exposure to light. Layout patterns can be printed on it in standard copiers and printers.



Chemicals, layouts on transparencies and the light-sensitive board are ready to go.



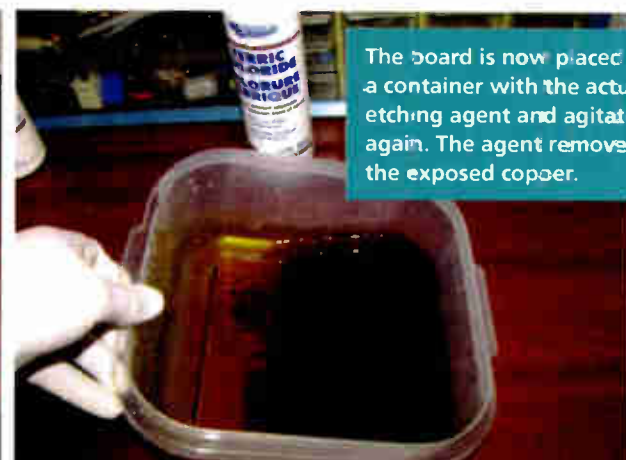
Expose the board and the layouts on top to a fluorescent light.



Exposed board is placed in the developer and gently agitated.



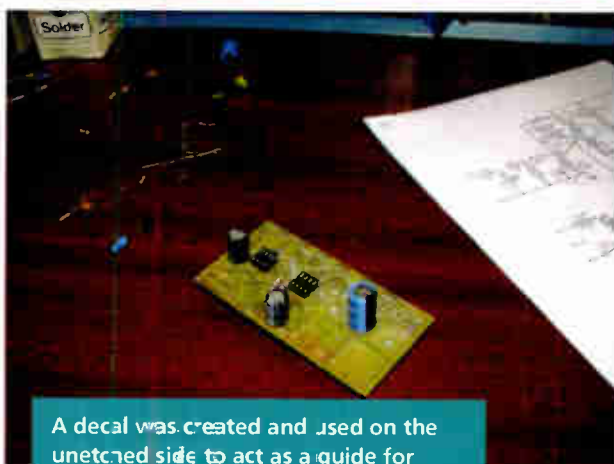
Board after it has been "developed." The etch-resistant material has been removed, leaving exposed copper and etch-resistant circuit traces. Note the multiple projects on a single board.



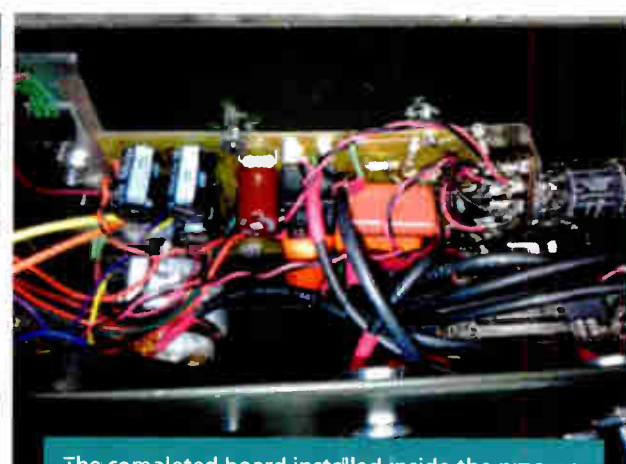
The board is now placed in a container with the actual etching agent and agitated again. The agent removes the exposed copper.



When finished and dried, the four project modules can be cut out of the PCB and then crilled.



A decal was created and used on the unetched side to act as a guide for placing the electronics onto the board.



The completed board installed inside the preamp.



The finished project is inside this ammo container.

I've even seen examples where the traces were hand-drawn or placed with special stickers. (You try hand-drawing a trace for a 16-pin DIP IC. I'll pass!)

Etching your own PCB's can be a great way to give your DIY projects a more professional look, make for an easier build, and also make your designs easily repeat-

able, especially if you're making multiple circuits.

By all means, try this at home!

Curt Yengst, CSRE, is a regular contributor to Radio World.

Email us with your own DIY ideas at radioworld@nbmedia.com.

This is the most tedious part of the process, agitating the solution around the board, waiting for the exposed copper to dissolve. Fresh solution works best, and warming it makes it work faster. Warm it by immersing the closed bottle in a large bowl of hot water. It can take up to a half hour to get rid of all the unwanted copper. Another quick rinse with water, and the board is etched.

The final step is drilling the tiny holes for the component leads and mounting screws. A Dremel tool works well for this. An additional step I like to follow is adding a component graphic to the top side of the board. For this I use ink-jet-printable water-slide decals, available from most hobby stores. Now the board is ready to be populated with components.

There are other methods available. I found a couple that involve using either laser-printed trace patterns or special transfer film and a regular clothing iron to transfer the pattern to a bare copper-clad board, then etching using ferric chloride or ammonium persulfate.

PRODUCTS & SERVICES SHOWCASE

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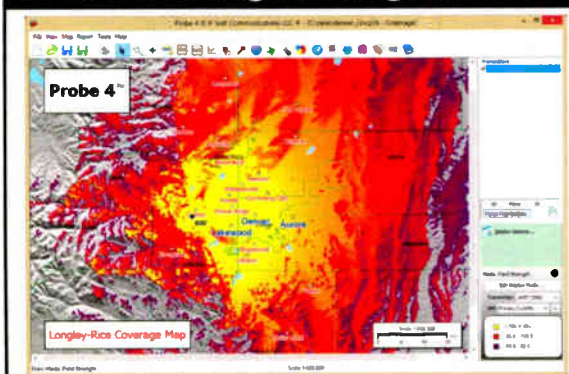
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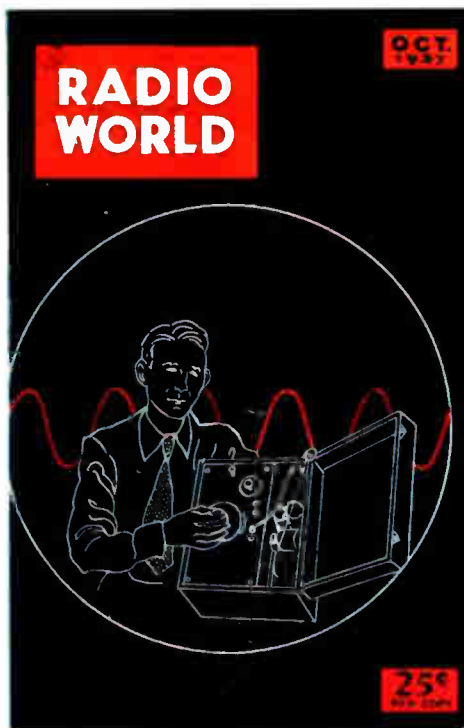
RW HISTORY

Here is the cover from a 1937 Radio World magazine. I think it is both stunningly simple and quite beautiful, and I wanted to share it with you.

David Gleason

www.americanradiohistory.com

Editor in Chief Paul McLane replies: Today's Radio World is not related to that earlier iteration, but we have long appreciated our forebears and have featured the occasional throwback cover. Thanks for sharing this one, David.



HIGH SCHOOL RADIO

Regarding the Jennifer Waits article "100+ Station Tours: What I Learned," Oct. 12:

I was glad to see that you had a chance to tour my first radio station, KBPS(AM) at Benson High School in Portland, Ore. I had the opportunity to serve as chief of student staff at KBPS in my senior year, 1954. Broadcast hours then were 9 a.m. to 9 p.m., Monday through Friday, except when high school football or basketball ran late.

The transmitter was a school-built 250 W unit, using triode amplifier stages. I well remember one evening finding the frequency monitor off-scale when one of the triode stages failed. We were still on the air but somewhere south of the correct place on the dial.

The adult staff and teachers helped many of us gain our First Class Licenses and assisted many to find work at local radio stations while we continued our college careers.

I enjoyed helping grade school classes produce live dramas with music and sound effects which were transmitted to schools in the Portland area, and also recorded on those big transcription discs for schools outside of our signal area.

Thank you for waking some really old memories from a fun time in my life.

Melvin Rydman
Tualatin, Ore.

CORRECTION

The article "Engineers Gather at SBE National" in the Nov. 23 issue of Radio World misstated the purpose of the new SBE Freedom Award. It recognizes an individual or group who has performed extraordinary service to the United States through the use of media technology. Society President Jerry Massey has a separate effort to promote employment in broadcast engineering for those leaving the military.

The story did not provide the full names of two society honors. They are the Robert W. Flanders SBE Engineer of the Year (given this year to Michael Hendrickson, as noted in the article) and the James C. Wulliman SBE Educator of the Year (to Cheryl Lustenberger).

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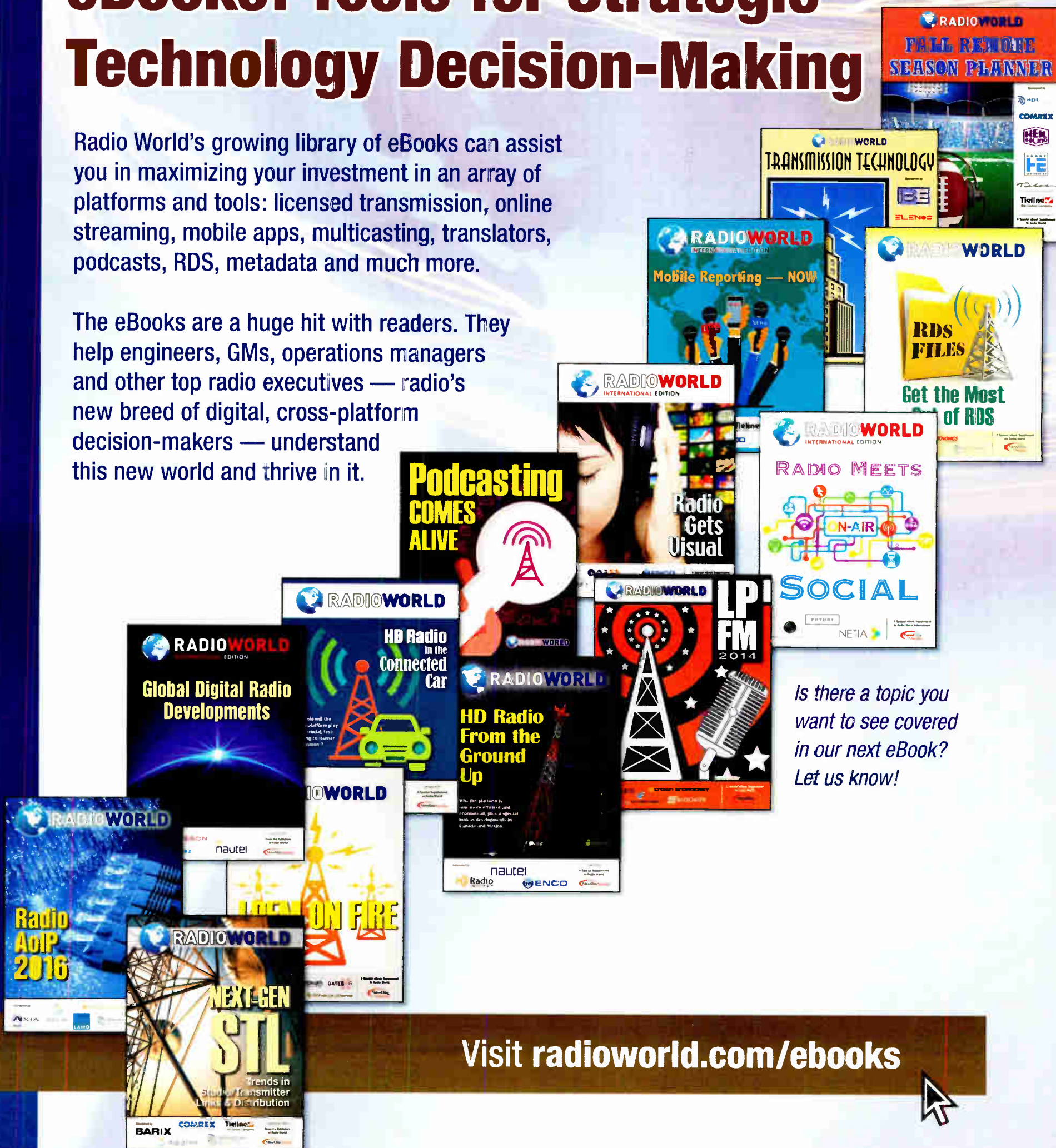
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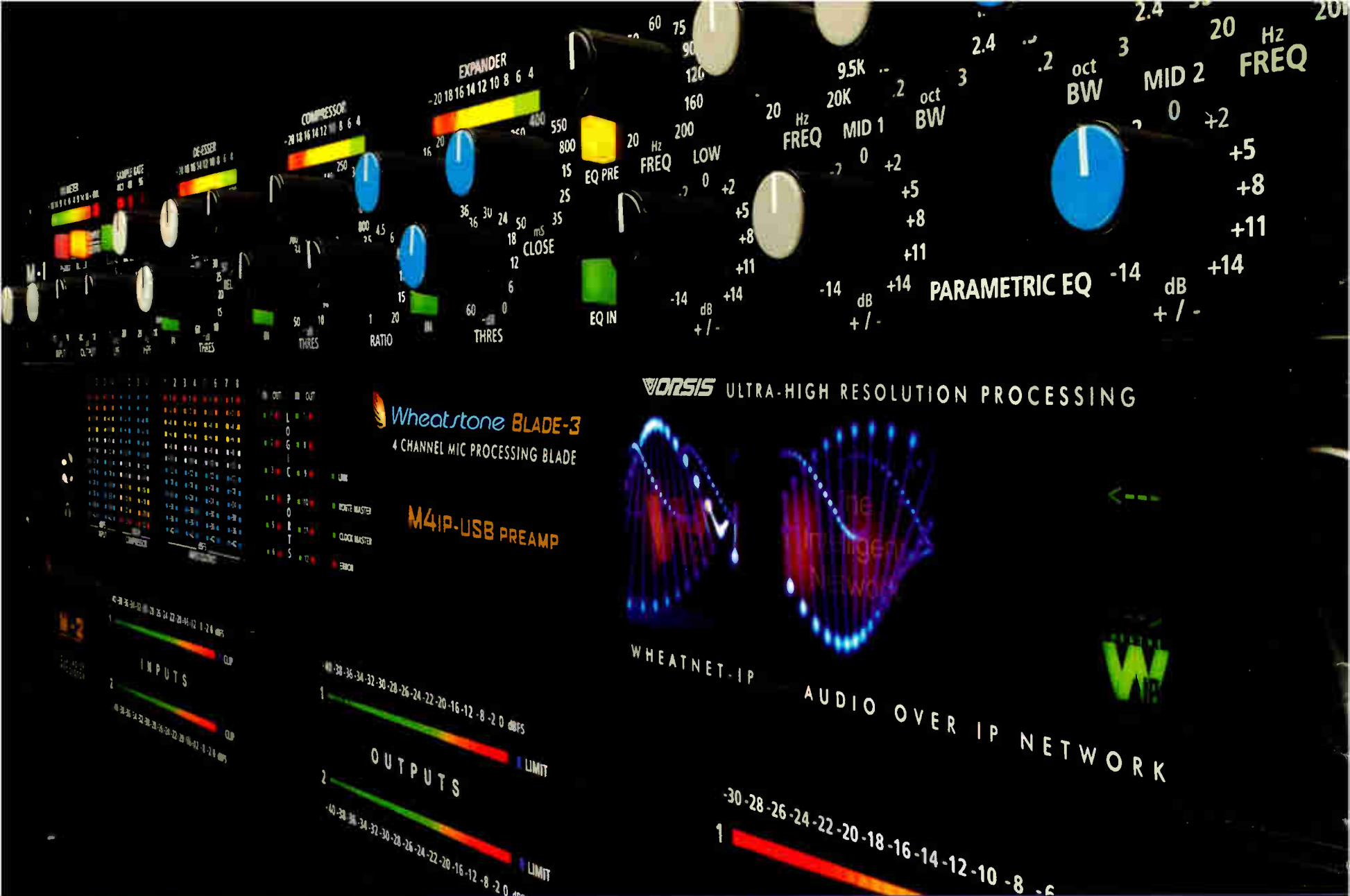
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