

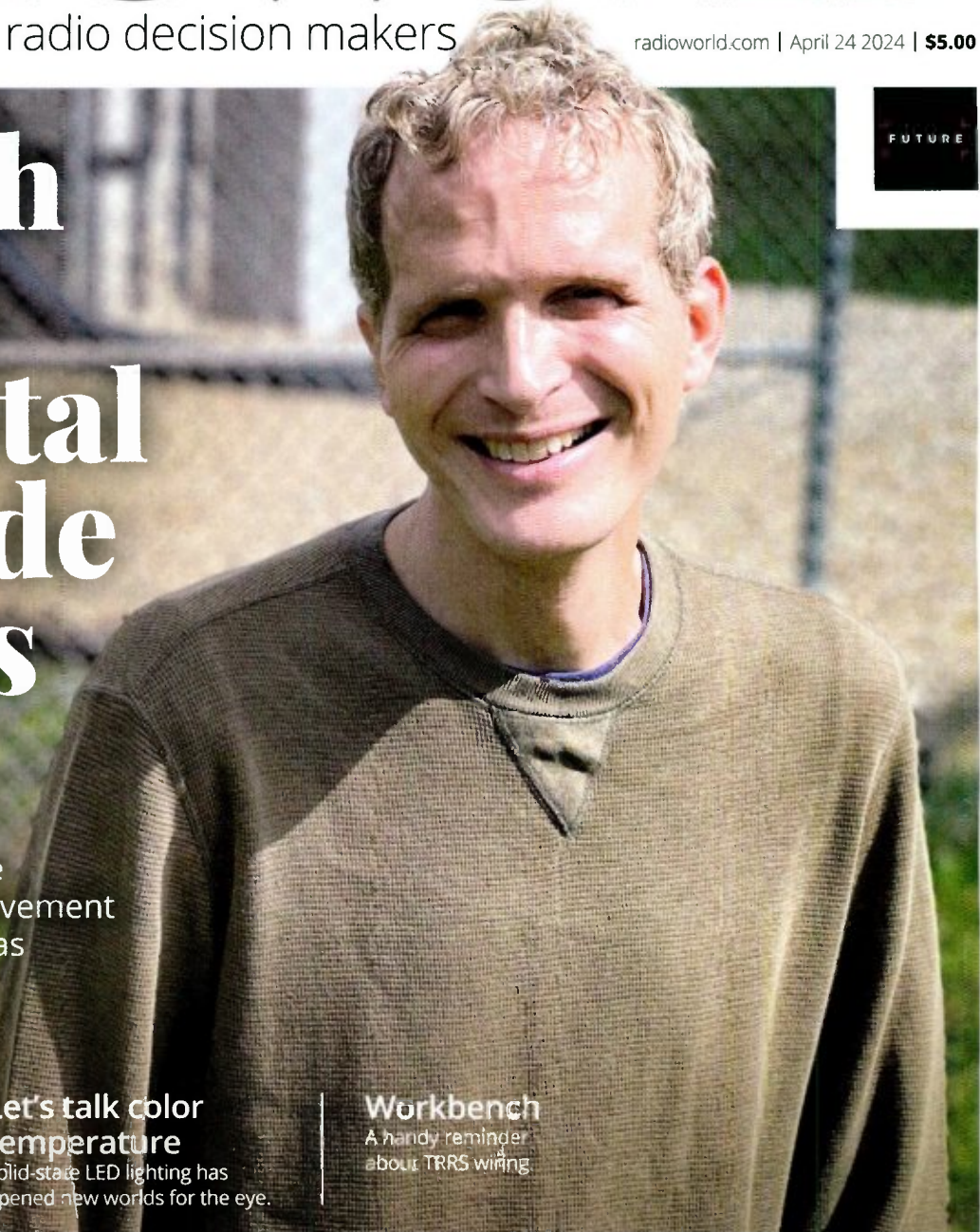
RADIO WORLD

Technology & news for radio decision makers

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His faith in the all-digital AM mode remains strong

Dave Kolesar, recipient of the NAB Radio Engineering Achievement Award, reflects on what he has learned about MA3 HD Radio



More on modes
Also in this issue, Alan Jurison tells the story of MP1* for FM.

Let's talk color temperature
Solid-state LED lighting has opened new worlds for the eye.

Workbench
A handy reminder about TRRS wiring.


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CONTENT

Managing Director, Content & Editor in Chief Paul J. McLane,
paul.mclane@futurenet.com, 845-414-6105

Assistant Editor & SmartBrief Editor Elle Kehres,
elle.kehres@futurenet.com

Technical Advisors W.C. "Cris" Alexander,
Thomas R. McGinley, Doug Irwin

Contributors: David Balik, John Bisset, Edwin Bukont,
James Careless, Ken Deutsch, Mark Durenberger, Charles Fitch,
Donna Halper, Alan Jurison, Paul Kaminski, John Kean, Nick Langan,
Larry Langford, Mark Lapdus, Michael LeClair, Frank McCoy, Jim Peck,
Mark Persons, Stephen M. Poole, James O'Neal, T. Carter Ross, John
Schneider, Gregg Skall, Dan Slenz, Dennis Sloatman,
Randy Stine, Tom Vernon, Jennifer Wats, Steve Walker, Chris Wygal

Production Manager Nicole Schilling
Senior Design Director Lisa McIntosh
Senior Art Editor Will Shum

ADVERTISING SALES

Senior Business Director & Publisher, Radio World

John Casey, john.casey@futurenet.com, 845-678-3639

Publisher, Radio World International

Raffaella Calabrese, raffaella.calabrese@futurenet.com,
+39-320-891-1938

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discuss partnership opportunities. Head of Print Licensing Rachel Shaw
licensing@futurenet.com

MANAGEMENT

SVP, MD, B2B Amanda Darman-Allen

VP, Global Head of Content, B2B Carmel King

MD, Content, Broadcast Tech Paul J. McLane

VP, Global Head of Sales, B2B John Sellazzo

Managing VP of Sales, B2B Tech Adam Goldstein

VP, Global Head of Strategy & Ops, B2B Allison Markert,

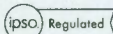
VP, Product & Marketing, B2B Scott Lowe

Head of Production US & UK Mark Constance

Head of Design, B2B Nicole Cobban

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Here comes FM geotargeting

A unanimous FCC endorses the idea behind ZoneCasting



Paul
McLane
Editor in Chief

W

ow, the FCC will allow FM geotargeting. Were you as surprised as I was that when this decision arrived, it was unanimous, with bipartisan support?

As I reported on the Radio World website in early April, the commission approved the concept of allowing FM stations in the United States to originate programming on boosters for three minutes per hour.

Until final rules for processing, licensing and service can be put in place, the FCC will allow existing booster stations to originate programming under renewable

one-year experimental authorizations. The FCC said this will allow it to monitor the rollout of the technology.

It's a big win for GeoBroadcast Solutions, which plans to offer stations a system called ZoneCasting. (The FCC did not exclude other suppliers from offering such systems.) Broadcasters will be able to air targeted content, different from their primary station's signal, to specific areas within the primary's service contour. ZoneCasting will use synchronized booster transmitters and antennas to overlay a stronger, geographically localized signal in the target region.

GBS believes broadcasters will use this to air highly localized programming and ads. In the case of a commercial station, a station might for instance air simultaneous commercials from three different advertisers within three portions of its market or, instead, air three versions of an advertisement from a single advertiser, including one in a different language.

GBS filed its petition in 2020 but was met with stiff opposition from many large broadcast groups, state associations and the National Association of Broadcasters. Among the criticisms were concerns about co-channel interference, disruption to HD Radio signals, increases in the noise floor and a depressive impact on ad rates. Some worried that the change could seriously destabilize the U.S. radio industry.

The FCC acknowledged these concerns but ultimately decided that the public interest would be better served by allowing the change. An example of its response: "We do not think it would advance the public interest for us to reject a new technology based on the fact that it could increase competition among FM stations for advertising revenue and thereby reduce advertising costs."

The approval on the five-member FCC was led by Democrat Geoffrey Starks and Republican Brendan Carr. Starks said in a statement, "Radio is the only media service that, until today, could not offer geo-targeted content. Talk about competing with one-hand tied behind your back."

The NAB had been vociferous in opposition, challenging the idea on business and technical grounds. But GBS said smaller and independent broadcasters were in its corner. It also particularly thanked Educational Media Foundation for its support, noting that it owns the largest number of

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FM signals in the country. "EMF's comprehensive comments on our proposal have been crucial," the company wrote.

In a lengthy footnote, the FCC addressed several criticisms that had been lodged by the NAB. It took note of a suggestion that many of supporting comments had been filed by the same counsel that represents GBS. The commission also noted that NAB had raised concerns about "fraudulent and deceitful conduct" involving GBS's principal, Chris Devine, based on past litigation and proceedings.

But it waved these concerns off for one reason or another, adding that there was plenty of support from organizations with no known affiliation with GBS. It emphasized that it isn't endorsing GBS specifically. "We limit our decision to whether to allow booster stations to originate programming, using the equipment of any manufacturer."

The NAB apparently believes the fight is not over. It noted that the commission "is only authorizing the use of GeoBroadcast Solutions' troubling technology on an experimental basis at this time. The record clearly did not support full authorization, and we appreciate the commission taking a measured step here."

But to me, the FCC's mind has been made up, barring any dramatic new evidence during the experimental rollout phase.

What do you think? Is this change going to revolutionize radio for the better, as some believe? Is it going to cause a death spiral or fatal "race to the bottom" on ad rates, as others fear? Or, as I suspect, will it generate some interesting new applications without causing massive upheaval across the U.S. radio business?

Email me at radioworld@futurenet.com. And you can read my full story at www.radioworld.com. Type "geotargeting" in the search field. 

“ GBS filed its petition in 2020 but was met with stiff opposition from many large broadcast groups, state associations and the National Association of Broadcasters. ”

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Writer



Randy J. Stine

The author profiled Oklahoma broadcaster Will Payne in February.

Kolesar still sees the promise of all-digital for AM

The NAB has honored him as an engineering pioneer

Perhaps it was his sense of adventure, or the fact he comes from an R&D background. Whatever it was, Dave Kolesar knew that once he converted AM station WWFD in Frederick, Md., to full digital transmission, there was no going back to analog for the radio station.

WWFD recently concluded its five-year experimental phase of testing the all-digital MA3 mode of HD Radio, but it remains a full-time all-digital station. The FCC now allows AM stations to use all-digital if they wish.

Kolesar and Xperi Corp. conducted extensive testing on the station's operations through those five years. During that time a few other stations have turned on MA3, but uptake has not been widespread.

Yet Kolesar says he is even more optimistic about the technology today.

"There are lots of questions about the future of all-digital AM, and the same can be said for analog AM, whether it will survive," he told Radio World.

"The sound is FM-quality. You can transport metadata. It looks good in the dash with album art and the station logo, something you can't do on analog AM. There is lots to like."

Kolesar is senior broadcast engineer at Hubbard Radio and this year's recipient of the NAB Radio Engineering Achievement Award.

His primary role for the past 17 years has been as the transmitter engineer for the WTOP flagship news station, its sibling Federal News Radio WFED(AM), and WWFD. He also programs The Gamut, a Triple A music format heard on WWFD. This year's recipient of the NAB award on the television side is Winston Caldwell.

Below

Dave Kolesar



Innovator and advocate

The NAB describes Kolesar as a broadcast engineering pioneer.

"In addition to his efforts to make all-digital AM radio a reality, Kolesar has been an advocate for all-digital AM within the industry, sharing and documenting his work in numerous technical papers and at conferences, and continuing research on ways to improve all-digital AM performance," NAB stated in its announcement.

Kolesar has helped lead the discussion and discovery of all-digital AM radio. He flipped WWFD (820 kHz) to all-digital in 2019, the first AM station of its kind in the United States to do so.

He says he has been "floored" by the results.

"We saw an effective increase in our usable coverage area, thanks to the forward error correction you get with digital broadcasting. Reception is more robust around structures like bridges and under power lines. There is no going back to analog," Kolesar said.

"What we have is a mode of broadcasting that looks, sounds and feels just as good as any other broadcast service in a motor vehicle."

Turning on MA3 means that listeners with analog AM receivers cannot hear a station. Only those with HD Radio receivers can pick it up.

But Kolesar says Xperi's DTS AutoStage and RadioDNS have helped level the playing field for AM stations that use the MA3 mode. In fact WWFD recently sold its FM translator to another company, making WWFD a standalone all-digital AM station.



PHOTO: Jim Peck

electronics engineer in the Information Technology Division of the U.S. Naval Research Laboratory.

He says the jump from lab to field and into broadcasting required some nerve. Yet it also seemed natural, given that he been building Radio Shack AM broadcast kits since he was six. And as a teenager he built what he jokingly calls a "Part 15 and a half" station in his bedroom to broadcast to his neighborhood in Cheverly, Md.

"I had a mentor when I worked in the research lab by the name of Edward Barr. He has passed on now. He never worked in broadcasting but followed the industry closely. He encouraged me to explore my passion for broadcasting and

encouraged me to leave the lab for an industry I loved."

Kolesar expressed appreciation for Joel Oxley, general manager of WTOP, and Dave Garner, VP of engineering for Hubbard Broadcasting, for having the faith in him to offer a job.

"I think they kind of knew what they were getting into when they hired an R&D guy from the Naval Lab. They've allowed to me to go down these different paths."

He credits Xperi for helping put the all-digital AM radio

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Above
Dave Kolesar, left, is shown with Hubbard colleagues George Molnar and Brian Oliger at an NAB Show.

Right
Kolesar in the late 1990s.

"We had found that most of our listeners had already migrated to 820 AM because of its much larger footprint. Part of our strategy from the beginning was to use the FM to promote the better coverage of the AM — and stereo sound, actually. The FM was mono because it was on a noisy channel."

NAB says his insights have benefited other broadcasters considering their AM options.

"I tell broadcasters: If their long-term goal is to keep their AM broadcast transmission alive, I think it is necessary to go digital eventually. Because analog AM radio broadcasting is sliding into oblivion. It's an awful user experience, and digital solves a lot of those problems.

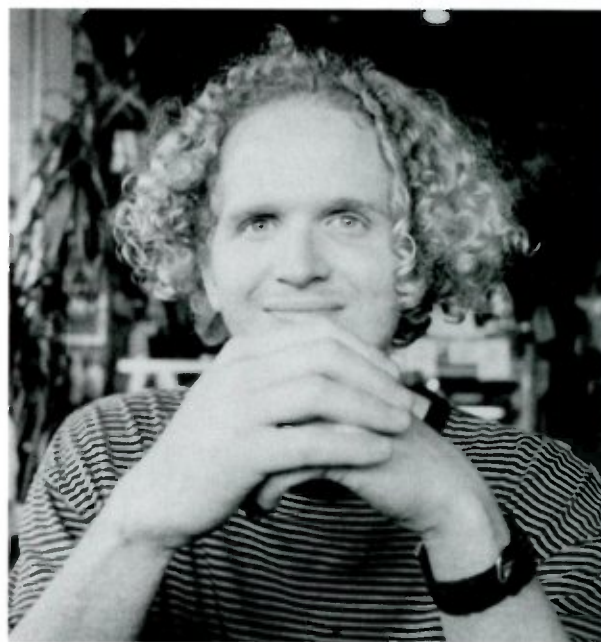
"It's going to be necessary for broadcasters to improve the service so it is once again desirable for listeners. AM needs good content and better technology to meet listener expectations," he said.

Another benefit is better reception within electric vehicles. Kolesar says AM MA3 likely will require less expensive filtering in all-electric cars.

He has given numerous presentations at NAB Show Broadcast Engineering & IT Conferences, including one this year about AM carrier power reduction in the MA3 mode with Xperi's Paul Peyla.

An R&D guy in radio

Kolesar earned a master's degree in electrical engineering from the Catholic University of America. Earlier in his career he worked as an



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“What we have is a mode of broadcasting that looks, sounds and feels just as good as any other broadcast service in a motor vehicle.”



Above
The late Edward Barr, right, who worked at the Naval Research Laboratory for 50 years, was an important mentor. He's shown with Kolesar at the transmitter site of WFED(AM). Barr died in 2021.

feasible to redistribute some of that power to other digital carriers within the signal to improve robustness.

“We hope to do some field trials to see if there are possible tweaks to the MA3 standard itself in order to improve performance.”

Kolesar, 46, is an avid reader who loves technical and engineering books, along with science fiction, historical fiction and mysteries. He is also a past recipient of the Radio World Excellence in Engineering Award and Engineer of the Year Award from Chapter 37 of the Society of Broadcast Engineers. 

station on the air and working with WWFD during the experimental authorization phase.

“They helped us figure it all out. We kind of fumbled our way through it — how to maximize the bandwidth and performance of the antenna system and work through it to make the station sound good.

“When you are Serial Number 1 of anything, there is a lot of stuff to figure out.”

And perhaps his experimentation isn't done just yet. “We are looking at applying for another experimental authority later this year. We want to finish work on ways to reduce the level of the reference carrier in the MA3 signal, as a power saving measure and possibly even to see if it is

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KQED Receives Its World Radio Day Award

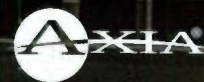
The hardware arrived at KQED to mark its selection as winner of the fifth annual World Radio Day Award.

The award honors a U.S. station that exemplifies the best attributes of the radio industry. Vice President, News, Ethan Toven-Lindsay and Executive Director of Radio Programming and Content DEI Initiatives Ernesto Aguilar are shown.

KQED is one of the country's most-listened-to public radio stations. It provides news and public affairs reporting to northern California via FM broadcasting, streaming and podcasts. Its stated commitment is to “provide people with the knowledge they need to make informed decisions; convene community dialogue; bring the arts to everyone; and engage audiences to share their stories.”

The Academy of Radio Arts & Sciences of America presents the award. Prior recipients include KDKA in Pittsburgh, WINS in New York, WRHU on Long Island and WTOP in Washington.

World Radio Day itself is observed annually to mark the founding of United Nations Radio in 1946. The international day is recognized each year on Feb. 13. 



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World Radio History



John Bisset
CPBE

The author is in his 33rd year of writing Workbench. He handles western U.S. radio sales for the Telos Alliance and is a past recipient of the SBE's Educator of the Year Award.

A handy reminder about TRRS wiring

Also, troubleshooting a Continental 816R-4C aux transmitter

Consultant Frank Hertel sees a lot of electronic devices, in both consumer and broadcast applications, that use 3.5 mm Tip-Ring-Ring-Sleeve (TRRS) connectors. However, many of them use non-standard wiring configurations. Frank decided to share a drawing that you can

clip from this column or take a picture of to keep on your phone as an aid in wiring TRRS connectors.

You might also tape the graphic to the bottom of the equipment, with appropriate notes, so the next guy won't waste time trying to solve the pinout.

Frank's drawing reflects the most commonly used configuration. But be aware of this connector's foibles, solder pin variations and the non-standard wiring used by some manufacturers. In some devices the wiring is perverted, and the equipment may not work properly or at all. Frank also advises that you trace the solder pin connections for each plug. They may be laid out differently, and it's easy to get it wrong.

Test yer backups

Brian Cunningham, CBRE, is a chief engineer for Crawford Broadcasting, based in western New York. He wrote recently in Crawford's engineering newsletter The Local Oscillator about the importance of checking backup equipment regularly.

“As a part of his weekly transmitter maintenance site visits, Brian operates each auxiliary transmitter into a dummy load.”

Tip / Left Ear 1
Ring / Right Ear 2
Ring / Ground 3
Sleeve / Mic 4



Solder Pins Layout may differ with Mfr.

TRRS
Typical Pinout
Used For Many
Computers and Cell Phones

As a part of his weekly transmitter maintenance site visits, he operates each auxiliary transmitter into a dummy load. This ensures proper operation in the event of a main transmitter failure.

When Brian recently tested a Continental 816R-4C auxiliary transmitter, it came up but then immediately shut down. Brian spotted a high amount of reflected power on the IPA when it was on, so he lowered the transmitter's total power output and applied the plate voltage again. The transmitter stayed on but the output power was bouncing and reflected power on the IPA was, again, noticeably higher.

Coming back later with test equipment, Brian checked the performance first of the Continental 802-B exciter and then of the IPA amplifier. Bypassing the IPA and running the exciter directly into the final PA showed no difference in

Right

Frank Hertel's drawing shows the most common pinout for Tip-Ring-Ring-Sleeve connectors.



Tip Goes Here

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World Radio History



Right

A colorful visual for resistor color code values. This image is from the website of Jameco Electronics.

performance. The transmitter would not stay on with power settings above 55 to 60 percent.

Brian then moved to the IPA, and everything was good there. The exciter exhibited no issues and was on frequency, so he moved on to a thorough examination of the final PA tube socket. No visible abnormalities, burnouts or signs of extreme heat.

This led him to suspect a tube problem. Brian had a used tube on hand so he installed it to see if the problem would go away. The rig tuned up beautifully, though the total power output maxed at 85% because of the age of the tube.

I like Brian's step-by-step approach of separating and checking each section of the transmitter: exciter, intermediate power amplifier and final power amplifier. It offers a reminder for all of us in diagnosing serious problems. Figuring out the problem was easy; next came the effort of trying to find a rebuilt tube in stock.

Clip-n-Save

Radio World Editor in Chief Paul McLane passes along another useful image, a color photo of the resistor color code. This appeared on a PDF on the website of Jameco Electronics (www.jameco.com/).

Veteran engineers will remember the verse "Bad Boys Ravish Our Young Girls But Violet Goes Willingly." The first letter of each word is a prompt to help you remember the color sequence. There are numerous variations of that phrase but a visual is handy to keep around. You can find similar images online.

One engineer's favorite "tool"

Bill Traue, CSRE, 8-VSB, AMD, is principal at Bill Traue Technical Service. One tool that he carries in his travel bag is particularly useful in areas where snakes are known to intrude in transmitter facilities. It is manufactured by Smith & Wesson and comes in many models and sizes. Ruger and

	1st	2nd	3rd	Multiplier	Tolerance
0	Black	Black	Black	Black	1
1	Brown	Brown	Brown	Brown	10 ¹ Brown 1%
2	Red	Red	Red	Red	10 ² Red 2%
3	Orange	Orange	Orange	Orange	10 ³
4	Yellow	Yellow	Yellow	Yellow	10 ⁴
5	Green	Green	Green	Green	10 ⁵
6	Blue	Blue	Blue	Blue	10 ⁶
7	Violet	Violet	Violet	Violet	10 ⁷
8	Grey	Grey	Grey	Grey	10 ⁸
9	White	White	White	White	10 ⁹
				Gold	0.1 Gold 5%
				Silver	0.01 Silver 10%

Colt offer options too. Bill notes that they often increase in value over time.

Like any tool, a handgun should be kept clean, wiped down with a lightly oiled cloth from time to time, and you should be well trained in its proper and safe use.

If your contract business takes you on interstates or airplanes, check local laws on what is allowed in your bag, and understand the rules about carrying firearms when flying.

“ One tool in Bill’s bag is particularly useful in areas where snakes are known to intrude. It is manufactured by Smith & Wesson. ”

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Beasley Gets a New Hub of Its Own in Boston

"The design cleverly addresses the technical requirements of a broadcast facility while creating a dynamic and visually captivating space," said Shaun Dolan, partner at Inrush Broadcast Services.

He was describing the new home of Beasley Media Group's Boston brands, which moved from the Dorchester neighborhood into a new 25,000-square-foot space in Waltham in late 2022.

The cluster includes some of the most popular media properties in the region such as WBZ(FM) "98.5 The Sports Hub," which required a large hybrid TV-radio studio flanked by dual-redundant control rooms. In all the integration project involved 18 new rooms for nine stations. The photo here shows a brightly designed hallway with small meeting rooms

and gathering areas.

Corporate technical leadership and advocacy for the project came from Beasley CTO Mike Cooney and VP of Engineering Lamar Smith. The local Beasley team included DOE

Dennis Knudsen and engineers Dan Kaiser, Charlie Henneberry, Steve Conti, Josh Polonksy and Deb Benanti.

V Three Studios was the architect, and J. Calnan & Associates was the general contractor. The integration was done by Inrush Broadcast Services.

The studios have a Wheatstone AoIP infrastructure with 20 control surfaces of various types (LXE, L



and Sideboards). The WideOrbit Automation for Radio system is supported by 27 servers and clients, and the studios use approximately 40 codecs from a range of manufacturers.

You can see more photos of this facility in the Radio World ebook "New Studios That Dazzle" at radioworld.com/ebooks.

— Paul McLane

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104.7 HD4 and 980 AM

Tag Scan Station List Sound

18

Writer



Alan Jurison

The story of the FM IBOC MP11 mode

This extended service mode offers more than 146 kbps usable digital HD Radio throughput

Above
A radio in a 2014 Toyota Tundra is shown tuned to the HD4 channel that was enabled by MP11. HD1 and HD2 are on the standard hybrid P1 partition enabled by service mode MP1. HD3 is on the extended hybrid P3 partition enabled by service mode MP3. HD4 is on the extended hybrid P4 partition enabled by service mode MP11.

M

P11 is the widest-bandwidth backward-compatible HD Radio extended hybrid service mode and provides a commercially viable method for stations to get increased HD Radio audio or data capacity while maintaining backwards

compatibility with analog FM.

The story behind the extended hybrid service mode MP11 is interesting, and the global COVID-19 pandemic paused publicity of the successes and deployment of the mode.

MP11 was conceptualized in the original NRSC-5 documents circa 2005 and authorization for extended hybrid mode operation was adopted by the commission in 2007. However, it was not developed for commercial use until almost a decade later.

It was initially thought (more than two decades ago) that the risk of "host interference" or digital-into-analog

interference on the same station of this widest extended hybrid service mode might be too great. The thought at the time was that broadcasters would consider this mode when there were more digital radios in the marketplace than analog. It was surmised that broadcasters would have to disable FM RDS and FM stereo, and revert to monoaural FM only.

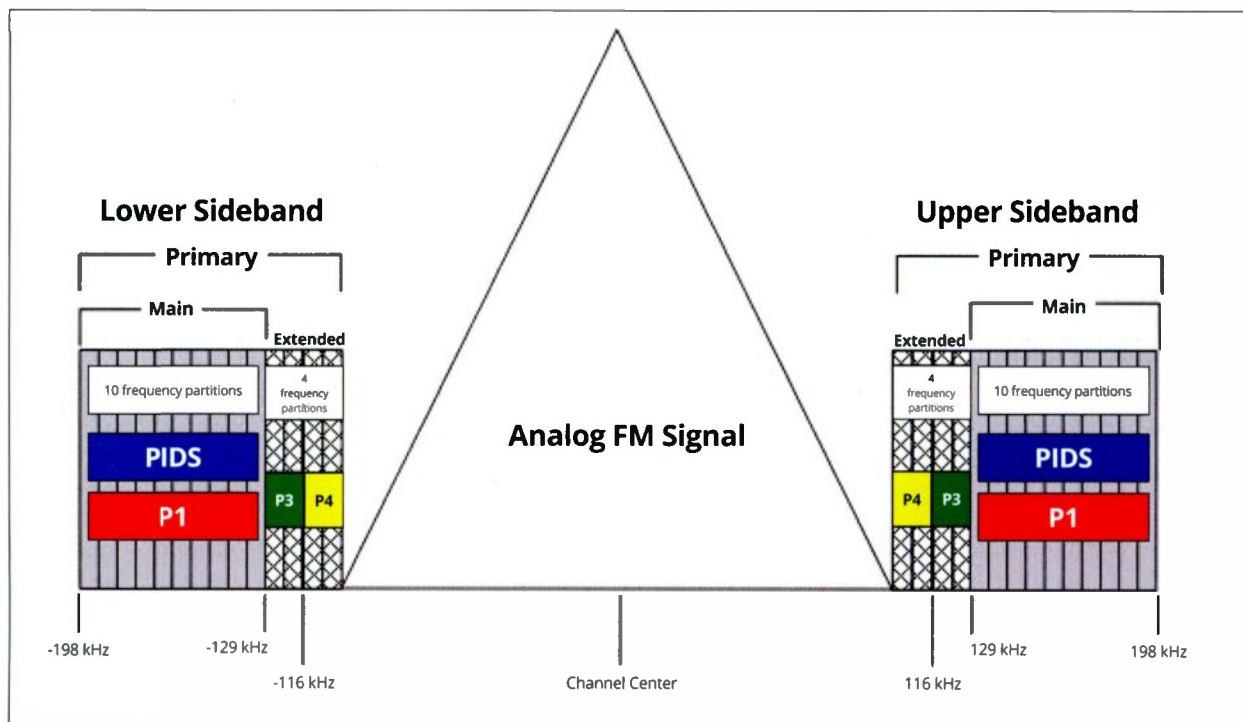
However, advancements in transmission technology have shattered those early theories.

When Xperi started developing the current Generation4 (Gen4) HD Radio platform circa 2014, they included a commercialized development for service mode MP11, and included a feature called PAR2 Carrier Protection, which is an advanced peak-to-average ratio reduction scheme for the HD Radio RF signal.

This advancement was not something envisioned or even possible with the hardware resources the industry had a decade prior. With PAR2 Carrier Protect, there is a

Digital Radio

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Spectral Mapping,
Service Mode
MP11. From NRSC-
5-E HD Radio Air
Interface Design
Description Layer
1 Document FM
Y_IDD_1011s.



way for broadcasters to “have their cake and eat it too.” Stations can remain fully competitive with a stereo FM signal, with analog RDS, and simultaneously transmit in the widest extended hybrid service mode (MP11) without host interference.

Presented at the 2019 Broadcast Engineering and IT Conference at the NAB Show, David Layer of NAB and Michael Rhodes from Cavell, Mertz & Associates outlined the results of extensive lab studies that were performed by PILOT, NAB’s innovation initiative. These tests were conducted with the participation of Xperi and Nautel and are documented at length in a white paper included in the 2019 BEITC Conference Proceedings.

This groundbreaking research proved to the industry that MP11 was a viable option for broadcasters.

In the real world

At iHeartMedia, we had been testing MP11 on Gen4 for a little over a year in our own labs. Receiver compatibility seemed acceptable, but we were waiting for completion

of the more extensive compatibility studies that were underway before putting this service mode on the air.

With the PILOT findings in hand, iHeartMedia set out to find a candidate station to perform MP11 field tests. We were looking for a station that had a full complement of Gen4 HD Radio transmission hardware. Requirements included low-level, common mode FM+HD amplification with a Gen4 Exgine exciter, and a transmitter that had sufficient headroom to support the 1.5dB power increase that occurs switching from MP1 to MP11.


The company’s WTUE(FM) in Dayton, Ohio, went live with MP11 on July 1, 2019, and has been transmitting in that mode continuously since that date.

In our implementation, we were looking to create an HD4 program in the additional 24.6 kilobits-per-second P4 partition. The conversion couldn’t have been easier. We needed to load the latest firmware into the existing transmitter/exciter (earlier firmware versions did not support MP11), and we installed a (then new) Gen4 GatesAir FMXi 4g Exporter. We provided the HD4 audio

“**WTUE(FM) in Dayton, Ohio, went live with MP11 on July 1, 2019, and has been transmitting in that mode continuously since that date.**”

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via AES audio of WONE(AM) Dayton, which offers a sports/talk format.

WTUE was chosen not only because the Gen4 transmitter had the headroom but also because Dayton was a convenient place to test. We had engineering resources nearby in Cincinnati, Columbus and Indianapolis to support the tests. On the day we launched, we were able to have several engineers at key locations within the WTUE coverage area with a variety of different receivers to immediately discern if there were any issues with digital-to-analog host interference.

As the PILOT lab tests established, no host interference was found, and none has been reported since we signed on. WTUE is approaching five years of operation in service mode MP11. (To hear a sample, watch the YouTube video at www.youtube.com/watch?v=SLpbAIEfVDO.)

We had envisioned reporting our successes at the 2020 and 2021 NAB Shows. Both were cancelled due to the COVID-19 pandemic due to the travel restrictions and health and safety concerns at the time.

Advancements in HD Radio IBOC extended hybrid service modes has made headlines more recently, with Radio World reporting on Hubbard's successes on WWWT(FM) in Manassas, Va. Their addition of an HD5 program using the additional bandwidth offered by extended hybrid service mode MP11 is a great use case, and the industry welcomes Hubbard and others who may consider this latest option.

Benefits of MP11

While much time has elapsed since the lab and field tests began, it is great to see broadcasters like iHeartMedia and Hubbard using this mode to provide additional digital services to the public.

This additional bandwidth can be used for additional audio services, helping with AM station and FM translator re-broadcasts. It also helps increase the diversity of formats providing content to underserved audiences.

Service mode MP11 will not work with older Generation3 HD Radio Importer/Exporters, transmitters or excitors. PAR2 Carrier Protect also cannot run on this hardware, as it is computationally intensive and exceeds the resources of

the hardware.


However, there is broad support for MP11 in today's transmission marketplace. Xperi and the manufacturers have all been forward-looking, putting the advancement in their current line of products while not porting it to hardware that is considered borderline obsolete. It's hard to believe, but the Gen3 framework is nearing 20 years old.

It is recommended that Low-Level, Common-Mode FM+HD amplification be implemented when broadcasting MP11. That is the only method that has been thoroughly tested in the lab and out in the field. The use of older combining methods is generally not supported and not recommended.

As of March 2024, three transmission equipment manufacturers offer products that have implemented MP11:

- Gen4 Importer/Exporters:
 - GatesAir FMXi 4g Embedded Importer/Exporter
 - Nautel HD MultiCast+ Importer/Exporter
 - Rohde and Schwarz HDR-900 Embedded Importer/Exporter
- Gen4 Transmitters:
 - GatesAir Flexiva Low Powered + High Power (FAX + FLX) Series
 - Nautel GV2 (Updated hardware/software is potentially available to update a GV to GV2)
 - Rohde & Schwarz THR9 FM+HD Series

While receiver support of extended hybrid service modes is difficult to project, it is safe to say there are millions of vehicles on the road today that can decode new audio channels in the P4 partition of MP11. As time goes by, more automotive receivers will be in the marketplace to tune in to the additional content enabled by the MP11 extended hybrid service mode.

Alan Jurison is a senior operations engineer for iHeartMedia's Engineering and Systems Integration Group. He chairs the National Radio Systems Committee (NRSC) IBOC Standards Development Working Group (ISDWG). His opinions are not necessarily those of iHeartMedia, the NRSC or Radio World. 

New Products Are in Bloom

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Let's talk about color temperature

Solid-state LED lighting has opened new worlds for the eye

Welcome to the era of solid-state lighting, featuring a variety of approaches using light-emitting diodes.

In December I shared tips about light bulbs, lumens and brightness, upon which retired TV engineer Cliff

Kotchka suggested an article about how to choose the correct color temperature with the new LED lamps.

The choices are mesmerizing! These new designs have completely changed what consumers expect of household light!

LEDs offer a new palette of colors to the world of lighting. First, learn these two basic types: soft white and daylight. Soft white refers to warm golden light at 2700 Kelvin, close to the look of legacy light bulbs. Daylight emulates natural sunlight at high noon with a light blue tint at 5000 Kelvin.

What is Kelvin? Lighting designers refer to degrees of Kelvin to measure the light's color temperature. When an old-fashioned incandescent tungsten lamp provides light, its filament heats to a temperature around 2700 Kelvin, which is about 4400 degrees Fahrenheit. Tungsten filaments are not capable of reaching more than about 3300 Kelvin or about 5500 Fahrenheit before the filament melts! Old-fashioned light bulbs are filled with helium, argon or similar inert gases to hinder filament failure at these enormous temperatures. Tungsten filaments will always provide warm orange-yellow light.

Tungsten light bulb design progressed over time. Powdery treatments inside the bulb glass gently diffused light and removed harsh shadows from light presentation.

Writer



Writer Karl Zuk

Retired after a 50+ year career in broadcast engineering, the author holds a degree in theater lighting from Queens College in New York City.

Above

A store display highlighting three kinds of typical LED lighting: warm 2700K soft-white, blue-white 5000K daylight and a couple of super white lamps in center.

Light blue tinting resulted in successful new options for reading and emulating true daylight.

Today's solid-state LED lighting is very efficient but presents some quizzical new challenges. Clever combinations of

LED colors and passive filtering can create quite a variety of colors. Advanced designs allow fine-tuning to exact hues and lighting that can gracefully change color throughout the day, configured via smart phone apps or hand-held remote controls.

Unfortunately, we are still limited to a finite number of colors that various LED phosphors or doping can provide. Often a variety of different-colored LEDs are used to achieve a specific overall color. Some advanced designs are "tunable" using variable masking and filtering of LED elements to vary the resultant look.

One-color, one-"wattage" LED bulbs are incredibly simple and clever in design. Just what is inside?

I was curious so I dissected a basic Sylvania 60-watt soft white LED bulb. The translucent top bulb shape was made of an easily pierced pliable plastic. I found a small circular PC board inside, complete with eight surface-



A clear GE 60-watt tungsten light bulb.

Right
Two Sylvania boxes showing similarities in packaging between soft-white and daylight types.

Far Right
Box from a GE LED light bundle. Four bulbs with two matching remotes.

Below
The round PC board found inside a Sylvania 60-watt equivalent LED bulb.



mount yellow LEDs doped with an orange tint to tune the color to about 2700 Kelvin.

The little system is managed by a single miracle chip, a Bright Power Semiconductor BP5133HC. Only two additional parts were needed to complete the entire bulb: a typical 10uf/200v electrolytic capacitor and a 4.7 ohm current limiting resistor. All of this for 99 cents on sale! Amazing!

Manufacturers of LED light bulbs also must provide adequate filtering of "blue light." Studies have shown that raw LED light includes specific blue and green light elements that can affect your sleep patterns, your skin, your eyes and your circadian rhythms.

Many current LED light bulbs already include some corrective blue light filtering. Block Blue Light is a company that embraces these concerns and takes them to the next level. Their catalog offers many alternative light sources. Are these harbingers to the future of widely marketed bulbs? See www.blockbluelight.com for a new world of ideas.

Today's developers of advanced LED formulations yearn to concoct more accurate true-to-life light that conforms with the Color Rendering Index. Any artificial light we


create needs to have little or no effect on how objects look to the human eye. Red apples need to look authentically red, not brown or bluish-grey. Bananas need to look bright yellow not grey, green or blue. Whites especially need to look white.

Look for GE's Reveal and Sylvania's Tru Wave Technology product lines for finer-quality LED bulbs that meet the highest standards on the color rendering index.

Important tip: When venturing into the world of solid-state LED lighting, first buy only one light bulb to test the results at home. If you enjoy what you see you can buy as many as you like with confidence. Is the light ugly or harsh to your eyes? Return the one light bulb and try again.

Be creative: Don't be afraid to experiment with combining various color temperatures and looks. Do you have four eye-level lamps with warm light but the overall look is just a little too warm together? Try switching a light bulb or two to daylight types to bring up the overall temperature. Or add a couple more lamps fitted with daylight color bulbs. You can also experiment with how brilliant the lights are. You can certainly mix "40 watt," "60 watt" and "100 watt" lamps to fine-tune your visual end product.

Be patient and find a bulb you like. Some "soft white" LED lamps produce a color that looks like a blend of mustard and deep orange tones, while I have seen some "brilliant white" light bulbs in action that will make your eyes weep and cry for mercy. Hand me those Ray-Bans!

Hopefully, you will eventually discover a color and intensity that are just right. 

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“America’s Dairyland” works to grow engineers

In Wisconsin, broadcasters take a multifaceted approach to addressing the engineering shortage

Many veteran engineers are retiring while few skilled young people are stepping in to take their place. Leaders of the Wisconsin Broadcasters Association are well aware and are taking a proactive approach. They are working with colleges and vocational schools that have relevant courses, encouraging the use of apprenticeships, and hosting conferences and seminars, sometimes with the Society of Broadcast Engineers.

Their goal is to provide young adults with opportunities to understand the engineering profession while giving them the training, mentorship and guidance they need to succeed.

MTI

One of WBA’s most popular initiatives is the Media Technology Institute. It was founded in 2012 by engineer Terry Baun, a past president of the SBE. It is a three-day series of seminars to educate attendees about broadcast engineering and technology, held in conjunction with the WBA’s summer conference.

In 2023 WBA renamed it to become the WBA Duke Wright Media Technology Institute, honoring the late Duey “Duke” Wright, a pioneering broadcaster who owned Midwest Communications.

Engineer Bill Hubbard assumed the institute’s leadership role after some 30 years working in the University of Wisconsin system.

Hubbard and Baun worked together from the institute’s earliest days, envisioning it as a way to train people in the basics of broadcast engineering. But as time passed, Hubbard noticed that experienced engineers wanted to attend too, to enhance their skills. Even some general managers signed up.

As might be expected, many of the institute’s presentations focus on topics like transmitter maintenance or repairing versus replacing equipment. But others are about practical matters like preparing for an FCC inspection or contemporary issues like information security. Given all that today’s engineers need to know, Hubbard now uses the phrase “media technology” rather than “broadcast engineering.”

Hubbard says there is also a focus on helping technical people understand the business of broadcasting and

Writer



Donna L. Halper

The author wrote last fall about The High School Radio Project.

improving their communication skills, especially when talking with non-engineers.

“Knowledge of technology alone is not a key to success. Engineers need to communicate with all the departments [at the station] in a way that is understandable.”

Help from the state

Andy Smock, chair and associate professor in the Department of Radio TV Film at the University of Wisconsin’s Oshkosh campus, is developing a program called Media Engineering. He believes the word “broadcast” no longer has much meaning to contemporary students.

Although his school has award-winning outlets WRST-FM and Titan TV, he says most students who get involved want to focus on sports reporting. Yet students in the department also get hands-on experience working with the equipment, setting up for events, and doing audio and video production.

Conversations with Bill Hubbard and with Bill Kerkhof, director of engineering for the department, led Smock to conclude that it could play an important role in training the next generation of engineers. Many of the necessary courses existed already, so he believes the new program will be well-received.

Another avenue for developing engineers is a new media broadcast technician apprenticeship program offered through the Wisconsin Department of Workforce Development.

Amy Phillips is the youth apprenticeship program

Below

WBA held a student forum in February at Lambeau Field, home of the Green Bay Packers, to provide information about careers in media.



Engineering Careers

coordinator there. She said that based on feedback from WBA President/CEO Michelle Vetterkind, Vice President Kyle Geissler, Bill Hubbard and numerous station managers, she identified 16 desired competencies, skills that industry professionals are looking for in the people they hire for media engineering work.

In 2020 the state debuted a Youth Apprenticeship for Media Broadcast Technicians, a two-year program. Phillips has been recruiting high school students who are enrolled in broadcasting, communications, information technology and science, technology, engineering and mathematics, who might have an interest in a media apprenticeship pathway.

Kyle Geissler is working to provide another facet for the WBA approach: reaching out to high school students and encouraging them to consider careers in broadcasting.

He said WBA has cultivated a relationship with SkillsUSA, which partners students and professionals and focuses on skilled trades. The organization is known for its competitions; when Geissler attended one, he was impressed with the enthusiasm he saw.

"They have several competitions that are related to media, in which high school students compete. It's a great opportunity to get those students interested in broadcasting [and] connected with our members."

WBA held a student forum in February at the famous

Lambeau Field, home of the Green Bay Packers, to provide information about a variety of careers in media. About 200 high school and 200 college students came to the venue; the event featured a job fair, speed networking and a keynote address from Packers Radio Network broadcasters and WBA Hall of Famers Wayne Larrivee and Larry McCarren.

Geissler hopes events like this will encourage young people to expand their perceptions of media and "think about engineering, not just sportscasting or news."

Persistence

WBA's outreach to students was led for many years by Linda Baun, who was the association's vice president at the time. She organized an annual WBA Student Seminar, where attendees came from around the state for a day of training, discussion and networking.

Engineering remains a passion of Baun's. "That's where my heart is," she says. She is an SBE Fellow who continues to promote engineering as a profession, carrying on the work of her late husband Terry. She said he believed strongly in the importance of education and took a learn-by-doing approach, including giving people permission to make mistakes.

She sees WBA seminars as valuable in providing opportunities for engineers to brainstorm and learn

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new things.

But while the broadcast veterans quoted in this article are excited about the programs and seminars, they acknowledge the challenges.

Pay for engineers is still low, and Linda Baun notes that over the years, engineering often has not been accorded the respect that other broadcast disciplines have. And even with the expanded outreach, finding new engineers is challenging.

Steve Brown recently retired as director of broadcast engineering for Woodward Community Media. Brown says his company had to do a lot of local and national advertising over an extended period before identifying a good replacement. Broadcast executives around the country often make similar comments to Radio World about the difficulties of filling technical positions.

Brown feels that the WBA and Wisconsin state government "are on the right track" but believes there is more to do. For example, while he likes the idea of on-the-job training, "we need to get to the next step now, and that is actually finding and placing students in these apprenticeships."

And that has been slow to occur. Linda Baun and



several others told us that stations may be hesitant about internships and apprenticeships perhaps in part because of concerns about liability.

But Bill Hubbard believes that media technology is a rewarding profession and that it has a bright future.

"It's open to anyone, male or female. You just need a curiosity about how things work." He and his colleagues will continue to take that message all around the state.

As Linda Baun put it, "We're not just talking. We're doing. We're providing the education, so that students can learn about media technology. And we're putting out good opportunities for growth to occur."

Donna Halper is an associate professor of communication and media studies at Lesley University, former broadcaster and radio consultant. She also writes for the Society for American Baseball Research. She is an inductee of the Massachusetts Broadcasters Hall of Fame and recipient of its Pioneer Award.

Above

A group at last year's Duke Wright Media Technology Institute, held in conjunction with the Wisconsin Broadcasters Association Summer Conference.

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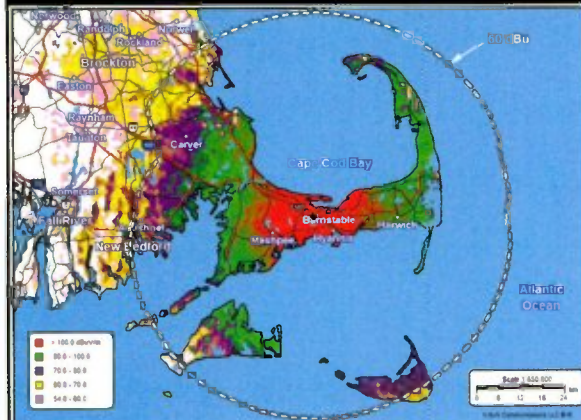
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The best contract is none at all

29

Don't ask me to sign an agreement with stipulations that apply to employees

Michael Baldauf wrote in Radio World recently about "The Thorny World of Contracts for Consulting Engineers" [at radioworld.com search keyword "thorny"].

I am one of those guys out here in "fly-over" country who is relied upon to keep all sizes of radio stations on the air. I do this full-time for more than 40 stations under at least 12 ownerships, all competing with one another.

So, what is the best type of contract? Absolutely none whatsoever.

I am proof that a good engineer can do a professional job for whoever requires my services. I don't pick favorites, and I don't sign contracts or agreements of any kind with any corporation.

I don't even like the term "contract engineer." I do not work for ANY radio station; I work for myself, providing service as any professional services "contractor" would, just like a plumber or HVAC technician.

Any independent engineer should be considered a free agent, available to any station in need of service. We are valuable — and very hard to find these days. Many of us are also a bit grouchy (well I am, anyway), so don't get pushy. Don't upset us.

Baldauf mentioned that one large group is attempting in a multi-page contract to address the following issues. These may make sense for full-time employees but most do not apply to an independent who works with multiple stations and groups.

Requiring the contract engineer to not disclose proprietary information — We engineers all talk freely with one another anyway, you can't stop it. Besides, you have NOTHING secret in the engineering world. Everybody has the same black boxes hooked up the same way, and we're all waiting for the next super-black box to come out. If I happen to overhear something that would be considered proprietary, I would keep it to myself as a matter of being professional. I'm not going out blabbing "Station Q is going Z-Rock in 2 weeks!" because that's not my business, and I don't care.

If the engineer develops new solutions or improvements, they are intellectual property of the station group. Bull! This makes me angry. If I come up with a new way of doing something, it is MY intellectual property, and I will share it with whomever I wish to sell it to or share it with. If anyone must sign that kind of contract, they're not a contractor, they're an employee.

Insurance coverage, liability, etc., are the responsibility of the engineer — Of course. That's just good business practice. I

hold a \$2 million policy on my engineering business, and if a client requires more for any specific project, I tell them to pay for the extra coverage.

Limits — I make sure to have the “money man” for each station on speed dial. I don’t play games with corporate ladders. If I go into a transmitter site that is off the air, I will evaluate it, make a quick estimate, and call “The Man.” My rule of thumb is \$1,000. If it is 1K or less and I have the parts in stock to fix it, I’ll fix it.

Those “legal minds” who are attempting to refine an “engineering contractor’s contract” are wasting time and money trying to fix problems that don’t exist (...what they do best...)

The HVAC contractor doesn’t sign an NDA to fix the heat. The plumbing contractor doesn’t sign any contract to fix a leaking toilet. I don’t sign contracts to come fix your transmitter, or even install a new studio.

“ I don’t pick favorites, and I don’t sign contracts or agreements of any kind with any corporation. ”

The BEST contract is NONE at all. Do the work requested, bill by the hour, plus mileage. Send an invoice upon completion of the work. If the station is a “known problem,” demand cash up front. The station will send you a Form 1099-NEC at the end of the year. If you sign any kind of contract for guaranteed money such as a monthly retainer, you are an employee, not a contractor, and they can control you.

Here’s how you know if you’re an independent contractor, or an employee:

Do you rely on the station’s van and use company tools and test equipment? Then you are an employee.

Do you have your own transportation, tools, test equipment, and perhaps an inventory of parts? Then you are an independent contractor. Don’t sign contracts. Send invoices.

And in answer to the question: “If there is a hole in the roof of the transmitter building, shouldn’t it be possible to get it fixed without permission?”

That’s not my problem. I’m a broadcast engineer, not a roofing contractor. Call “The Man,” let him know, take photos, send them to him, then leave.

Come back when the roof stops leaking. 



Readers' Forum

The ongoing value of shortwave

I enjoyed Kim Andrew Elliott’s commentary “Why We Need Shortwave 2.0.” He’s exactly on target.

I’ve said that the brass at VOA thought the people of Djibouti had laptops and high-speed internet when in fact they were living in houses made from four sheets of corrugated roofing iron — one for a roof, a half-sheet for the left end, another half for the right end, one for a rear wall, and a front wall with a large notch for a door.

Gerhard Straub and I were rebuilding the shortwave and two medium-wave stations for local broadcaster RTD, Radio Television of Djibouti. One piece of equipment arrived in a wooden shipping crate made of quite nice wood, and I asked the RTD technicians to take it apart and build some shelves for the back room.

But one man became very upset. He told me he’d already had “dibs” on it for an addition to his home. I said it was OK, we didn’t need the shelves that badly.

I’ve always been proud to be an American. After I was in Djibouti, I was glad to be an American.

David R. DeSpain, P.E., W0BCG

Those darn wall-warts

Mark Persons wrote recently about “Those Darn Wall-Wart Power Supplies.”

A few years ago, a friend stored his motorcycle at my house, connected to a battery trickle charger with wall wart. I soon forgot about the charger but eventually I noticed a beeping sound coming from my AM radio. It was like Telstar, beeping away all over the dial, even on shortwave.

I disconnected anything in the house that might be interfering, took a portable radio and walked around the house. I didn’t find anything inside, so I tried outside, and sure enough, at the power box, the beeping grew louder. So I went to the front yard power pole. Beeping increased again, so I concluded (erroneously) that it was a neighbor.

Weeks went by. I finally got mad enough to check one more time with a portable. This time it dawned on me: I’d never pulled the battery charger wall-wart. So I did, and the beeping immediately stopped. I looked at the wall-wart to see if this was some sort of cheap imported thing, and what do I see but a logo from the Canadian version of our FCC, assuring me that the device will not interfere with radios.

Ever since then, I’ve hated switching supplies.

*Duke Evans
KBBF(FM), Calistoga, Calif.*



How to submit

Radio World welcomes comment on all relevant topics. Email radioworld@futurenet.com with “Letter to the Editor” in the subject field.



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