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Your guide to radio technology

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A visit to the Super tower

Father and son Joe and Jeff Geerling make a hit video about the Crestwood Master Tower that serves St. Louis.

The changing face of tabletop radios

While some still offer OTA reception, this specialty segment is dominated by online connectivity.

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Remembering Tuto

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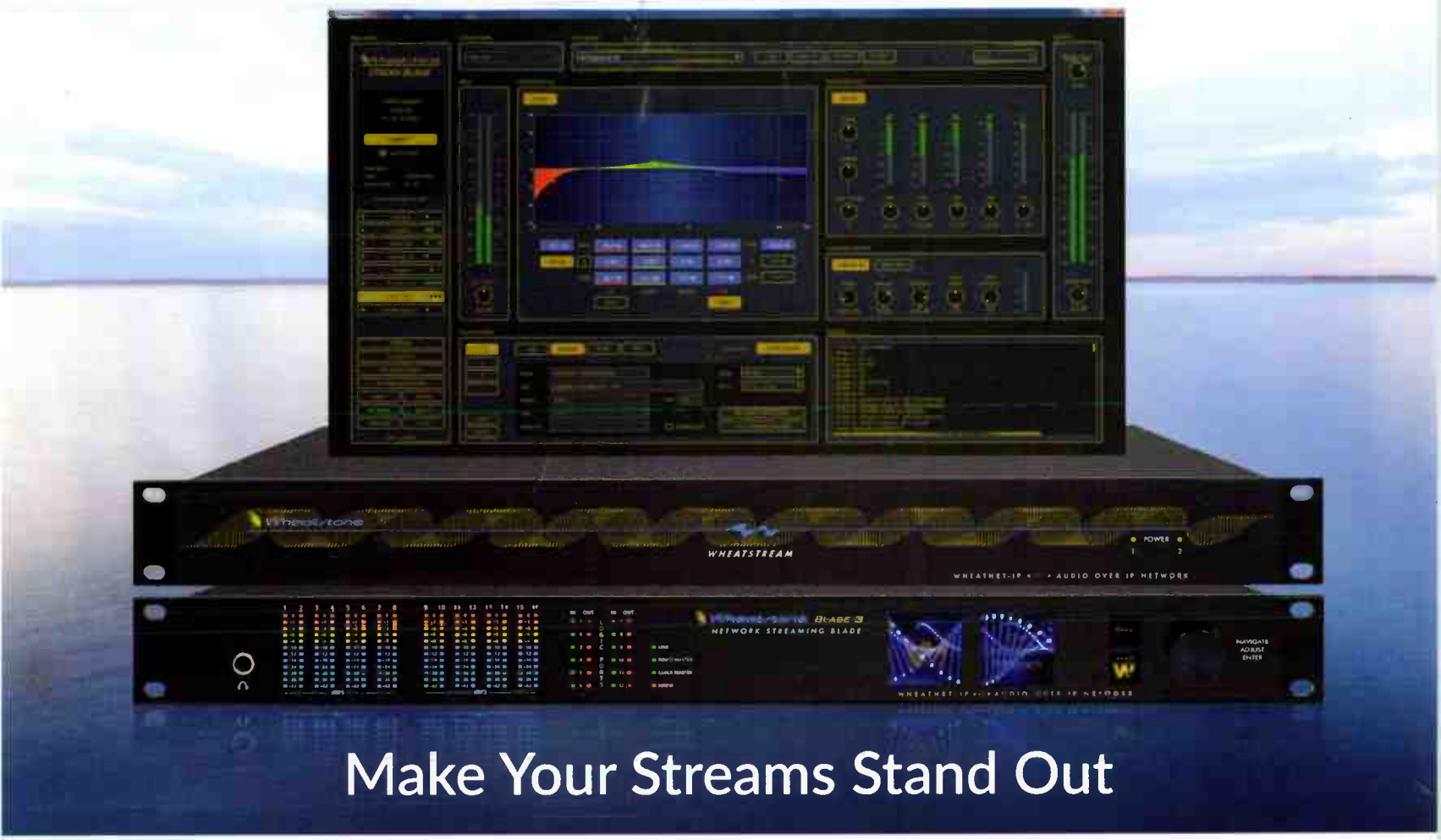

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What will AI mean for radio?

Here's what ChatGPT told me; now it's your turn

Paul McLane
Editor in Chief

Artificial intelligence has been the focus of a number of Radio World articles in the past couple of years, an ebook in 2020 and our news coverage of companies like Veritone, Super HiFi, Adthos, Microsoft and MultiCAM Systems.

But the topic is changing so fast that most of those articles are now dated. And now, with people learning what "generative" and "natural language processing" mean, and with our culture buzzing about ChatGPT and DALL-E and enhanced Bing and all the fun things these tools can do, the professional implications for radio are really dawning.

Here's a thought-starter that I recently shared on the RW website.

I asked ChatGPT — the model from OpenAI that interacts in a conversational way — to give me 10 bullet points on ways that generative AI technology might be used in the radio broadcast industry and its technology infrastructure.

Here's what it spit out (numbered items are from ChatGPT, while the rest of this story is by me — a caution that will become increasingly relevant, I fear):

- Content generation: AI can be used to generate news articles, weather reports and other types of content for radio broadcasts.
- Music selection: AI can analyze listener preferences and playlists to recommend and automatically schedule music for radio stations.
- Voice synthesis: AI can be used to create virtual DJ or host voices that can interact with listeners and present music and content.
- Ad targeting: AI can analyze listener demographics and listening habits to deliver targeted advertisements to specific segments of the audience.
- Speech recognition: AI can be used to transcribe and analyze spoken content in radio broadcasts for improved search and accessibility.

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On the cover

A Dielectric master FM antenna sits atop Missouri's Crestwood Master Tower in a photo taken by drone. See page 18.

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- Quality control: AI can monitor audio quality and signal strength in real time to automatically adjust levels and reduce technical issues.
- Network optimization: AI can be used to optimize network infrastructure and manage bandwidth usage for improved reliability and efficiency.
- Predictive maintenance: AI can analyze equipment usage patterns and predict when maintenance is required to prevent downtime.
- Fraud detection: AI can detect and prevent fraud in ad trafficking and billing systems.
- Analytics and reporting: AI can provide real-time analytics and reporting on listener demographics, ad performance, and other key metrics to inform business decisions.

As you probably are aware, AI is already doing some of these things within various products in radio and audio. But I think we can look at the list above and bet that the technologies that drive our industry are in for potentially massive changes.

> **I think we can look at this list and bet that the technologies that drive our industry are in for potentially massive changes.**

(An aside: While I was putting this story together, I received a press release from Radio Workflow announcing that with their AI tools "radio stations can now produce high-quality, compelling ad copy in seconds without the hassle of writer's block." So file that under No. 1 in the list above.)

I then asked the chatbot specifically to list five radio engineering tasks that could be performed by artificial intelligence, and got this:

- Signal analysis and optimization: AI can analyze radio signals to identify and resolve issues with signal quality and strength, optimizing network performance.
- Equipment monitoring and maintenance: AI can monitor and analyze equipment usage patterns to predict when maintenance is required, reducing downtime and improving equipment longevity.
- Interference detection and resolution: AI can detect and resolve interference issues in real-time, improving signal quality and reducing listener complaints.

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- Frequency management: AI can manage and optimize frequency usage for improved efficiency and reduced interference, allowing for more channels to be utilized.
- Network planning and optimization: AI can analyze network utilization and performance data to optimize network infrastructure and improve overall system efficiency.

Above
I asked the AI program DALL-E to create a cartoon drawing of a broadcast radio tower with a giant threatening figure behind it to represent artificial intelligence. DALL-E kinda got it right, though it looks more like that tower is chasing the figure. (But I love the door!)

You will probably would get somewhat different answers based on how you ask the question; but it's clear that the technology could have significant ramifications in all of our endeavors.

It's also clear that our industry and society itself should not rush into it. The concerns that have emerged over inaccuracies, bias, ethics, potential plagiarism and other issues are serious ones.

In Radio World itself, we're not using language models to create content while our company and the RW team understand them and the broader field of AI better. If we ever do, I'd want that content labeled as such.

But there are so many ways that such technology could be of help in other ways, from identifying potential topics for articles or digging up useful hashtags to performing repetitive administrative tasks like proofing copy. We're all just learning.

What do you think are the implications of this new tech? Are there specific tasks related to your daily work that would benefit from the support of AI, or that might be replaced by it? Do you have any experience using AI, for instance natural language tools like GitHub Copilot to create code? Email me at *radioworld@futurenet.com*.

Newswatch

SAGE UPDATE: U.S. stations that use ENDEC Model 3644 EAS boxes from Sage Alerting Systems should be aware of an important firmware update coming in June.

The cost is $159 unless you purchased the unit after Dec. 12, 2021, in which case the update is free.

The update is to comply with a recent FCC change by Dec. 12 of this year. The rule mandates that alerts received via over-the-air legacy EAS data tones be held by the device while it checks to see if a matching IPAWS CAP alert is available instead. And there are some other changes in how the text for national alerts is constructed.

The update will keep the ENDEC in compliance with Part 11 rules. It also adds usability features that Sage said will reduce the time needed to acquire and review log data, and reduce the number of people that need to access the ENDEC. "It will help to further highlight compliance issues such as failure to receive RWTs and RMTs, and to send RWTs," Sage wrote.

The update will be available through Sage distributors.

OWNERSHIP RULES: The NAB said the FCC should finish its 2018 quadrennial review of media ownership rules before attempting one for the period that ended in 2022.

"While broadcasters wait for the FCC to act, we continue to compete with one arm tied behind our back while Big Tech stifles local journalism," a spokesman said.

The NAB says the delay violates the law, and it asked the commission to focus on concluding the 2018 process by the end of March.

Congress requires the commission to do a review every four years of whether rules governing media ownership remain "necessary in the public interest as the result of competition." This is when the commission, the industry and other interested parties can lay out their rationales, with broadcast ownership interests typically arguing that federal regulations need to be eased or removed due to the fast-changing competitive landscape.

"While delaying the ultimate determination of the 2018 review may have made sense given then-pending litigation, the Supreme Court concluded that litigation nearly two years ago," NAB wrote, referring to the ruling that the FCC can loosen restrictions on ownership of broadcast stations and newspapers.

Also, "how are stakeholders supposed to intelligibly comment for purposes of the 2022 quadrennial review on rules subject to change in a previous unfinished review?"

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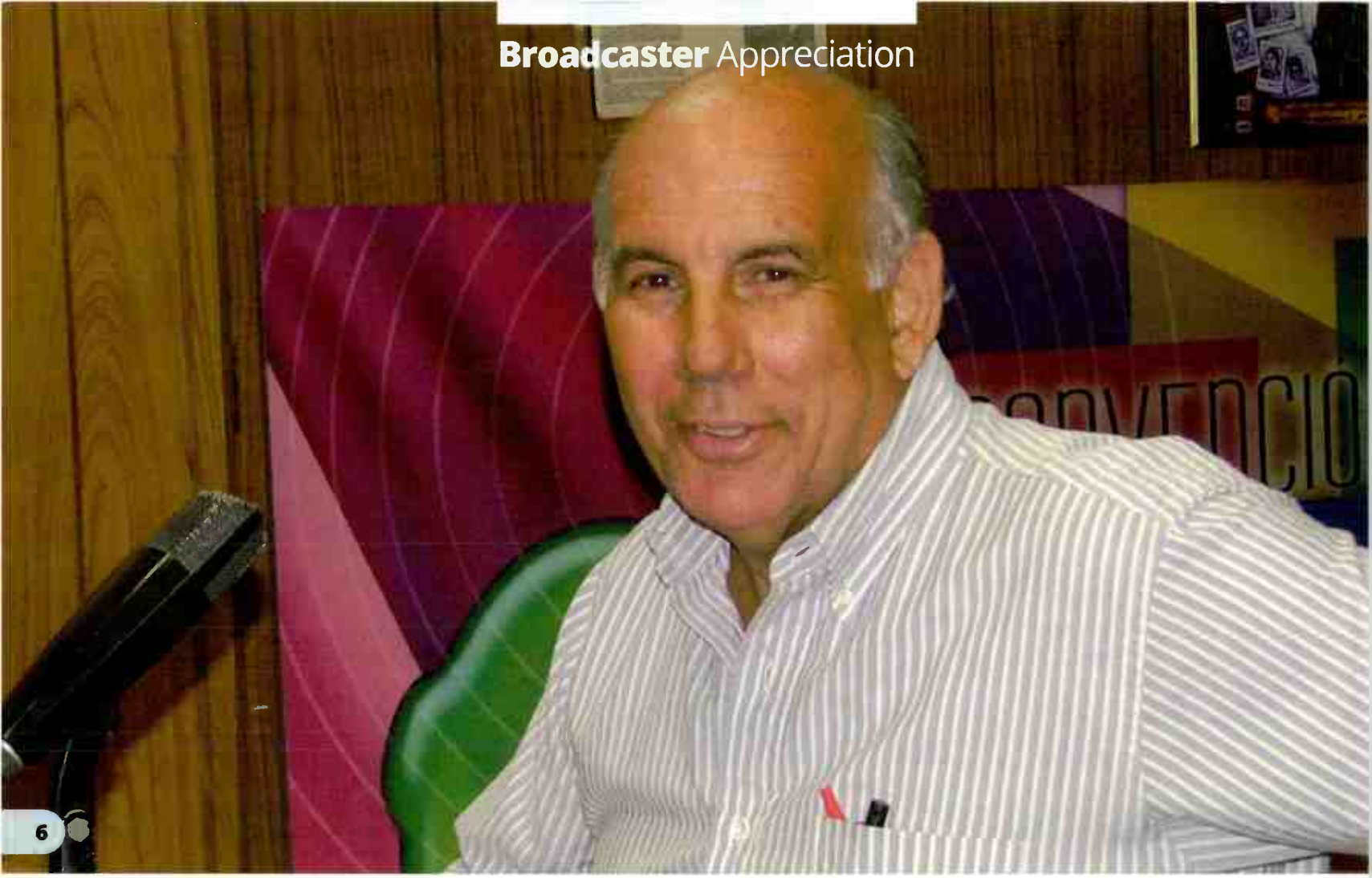

Writer

Randy J. Stine

Radio World's lead news contributor wrote about continued supply chain issues for radio in the Feb. 1 issue.

"Tuto" was a broadcast leader in Puerto Rico

Radio advocate Giménez saw the value in community service

Alfonso Giménez Porrata wouldn't let hurricanes or earthquakes keep one of Puerto Rico's most respected broadcast stations off the air for long. Serving his community by providing life-saving information was vital to him.

Giménez Porrata, president of WPAB(AM) in Ponce, Puerto Rico, died in November after a long illness. He was 85.

Broadcast colleagues describe the influential broadcaster as the pillar of Puerto Rican radio. "He was an excellent mentor, journalist and businessman," according to one radio acquaintance.

He studied electrical engineering for several years at Virginia Polytechnic Institute but returned to Puerto Rico in the 1960s to complete his business degree. He worked as a technician, reporter, manager and president of the station his father helped establish.

Known as Tuto — a nickname given him by a younger sister — Giménez Porrata commented regularly on issues in Puerto Rican society and covered major news events over five decades. "The media should question those who hold power, because if they don't, governments will never improve," he told the publication La Perla del Sur in 2011.

He also was chair of Puerto Rico's State Emergency Communications Committee for the past decade.

Family enterprise

WPAB, named for Puerto Rican American Broadcasting, broadcasts at 550 kHz with 5,000 watts in Playa de Ponce, one of 31 barrios that comprise the municipality of Ponce, an hour southwest of San Juan. The station broadcasts a

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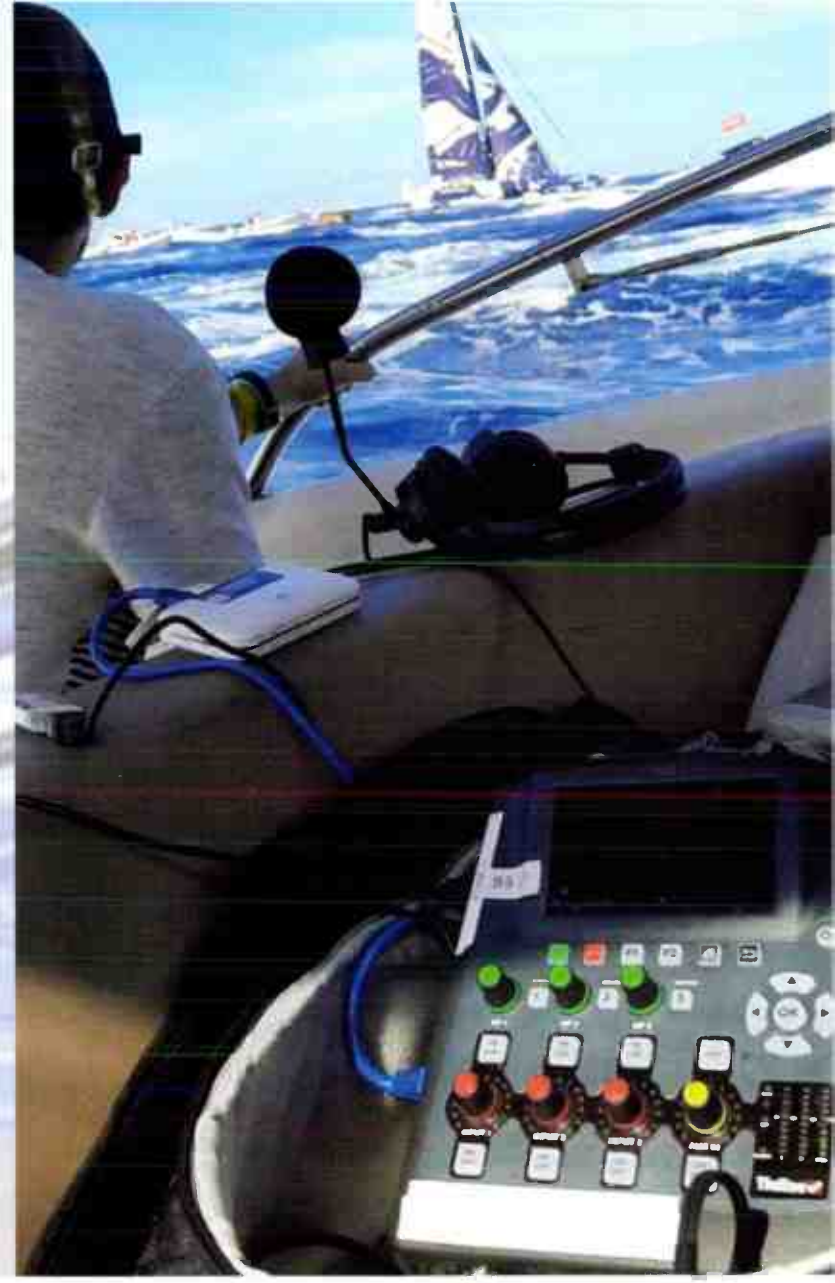

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Spanish news/talk radio format and operates FM translator W226CS on 93.1 MHz.

His father, Alfonso Giménez Aguayo, was an original shareholder and later owner of WPAB. The station is considered by observers of the broadcast landscape in Puerto Rico as one of the most important voices on the island. It was co-founded in 1940 by Giménez-Aguayo when Tuto was 3, according to the station's website. Giménez Porrata worked nearly 60 years at the station.

According to the station site, WPAB became a popular music station, giving valuable exposure to homegrown Puerto Rican artists by playing their music. It later introduced Puerto Rico to a news/talk format in the 1970s and filled a critical role following Hurricane Maria in 2017 and the earthquake in 2020.

Giménez Porrata's career began at a time when AM radio was still king in Puerto Rico. Now FM and HD Radio serve the island and overshadow the senior band; but according to his colleagues, AM radio there still carries some cachet, at least compared to the mainland United States, and serves a critical role in providing emergency information, something Giménez Porrata was passionate about.

His widow Norma Colón Daleccio said her husband was also known as a historian and expert in international politics and that he regularly shared his comments and opinions on air.

"AM radio is the one medium that still keeps the local communities informed when there is an emergency or natural disaster," she said. "The people of Puerto Rico became more aware of the importance of the AM stations when Hurricane María and the earthquakes happened. People here like the accessibility of this medium and the identification it has with them."

Giménez Porrata ascended to the role of president at WPAB by 1992, having learned all aspects of radio and how to run a successful broadcast operation, she said.

"Tuto was trained in every aspect of the operation of the radio station. This includes the engineering and technical aspects as well as the management and administration aspects. He thought it was important to know the business. WPAB was his passion," she said.

Tuto's passing means the loss of a lot of institutional knowledge of Puerto Rico's broadcast history, she continued.

"Just a year ago he collaborated with a pair of writers for a book about the history of radio in Puerto Rico, but still many details were not mentioned. He had many experiences that were not well documented. I'm sad about that."

Giménez Porrata's radio recollections are featured in the book "Un país que se escucha: Apuntes sobre la historia de la Radio en Puerto Rico," which can be translated as "A Country That Is Listened to: Notes on the History of Radio in Puerto Rico." The book, published in 2021, was co-authored by Ismael Torres Otero and Mario E. Roche Morales.

Colón Daleccio in an email to Radio World said the city of Ponce played a pivotal role in Tuto's life, which included many walks along city's seafront boardwalk. The city of 135,000 on Puerto Rico's southern coast is known for its Ponce Creole architectural style.

"As for the connection and importance of Ponce for Tuto, as ponceño (a native of Ponce) and as Puerto Rican, the safety of the community comes first," she wrote.

> **"He led WPAB for most of his adult life and developed it into one of the most important sources of news and information in Puerto Rico."**

"For a dozen years he was the chair of the SECC. Besides being a broadcaster, making sure the EAS functioned as it should was his mission. And not only at WPAB, but at all affiliated stations in Puerto Rico. He had stepped down from his chairmanship just a few days before passing."

Manny Centeno, program manager at the Federal Emergency Management Agency and a longtime acquaintance, said his passing is a loss for radio there.

"Broadcasters in Puerto Rico owe much of their success to folks like Tuto Giménez. To me he was the quintessential broadcaster. He led WPAB for most of his adult life and developed it into one of the most important sources of news and information in Puerto Rico," Centeno said. He too mentioned Tuto's leadership in emergency alerting and the role of AM radio.

"Giménez Porrata contributed to saving many lives in times of emergency. He understood very well his role as a broadcaster serving the public interest," he said.

Colón Daleccio said WPAB has now passed to the third generation of the Giménez family. She says Tuto's children from his first marriage, Alfonso and Maria Luisa, are actively involved in running the station. WPAB has been in the family for more than 82 years.

"Now it is in the hands of his heirs to continue the legacy. I believe some changes are coming, hopefully for the better. We'll have to wait and see."

A wake for Gimenez-Porrata, who had celebrated his 85th birthday shortly before his death, was held in December.

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"How can heat shrink get any better," you ask?

Make it printable!

John Bisset
CPBE
The author has spent over 50 years in broadcasting and is in his 32nd year 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.

Share your expertise
Workbench submissions are encouraged and qualify for SBE recertification credit. Email *johnpbisset@gmail.com*.

Roy Beckman, a senior engineer with Charlotte's Bible Broadcasting Network, shares an improvement on wire marking. You've probably used a Brother P-Touch label maker. Now there's a printable heat shrink tubing cartridge that works with many of the models.

These labels, shown at right, won't fall off because adhesive dries out; nor will the label legend smudge or rub off. What a great idea!

The only caution is that the heat shrink tape doesn't work with all P-Touch models, so check before you buy. Several choices are available from Amazon.

Roy recently took time from his regular duties at BBN to provide a satellite maintenance and re-pointing seminar for a group of field engineers who service the BBN facilities in Central and South America. Engineering refresher courses are always welcome but especially if you are working in a region that doesn't have a lot of tech support or educational resources available locally.

The second photo shows the group at the conclusion of the training, as they gathered around the BBN uplink and downlink dishes in Charlotte, N.C.

What could go wrong?

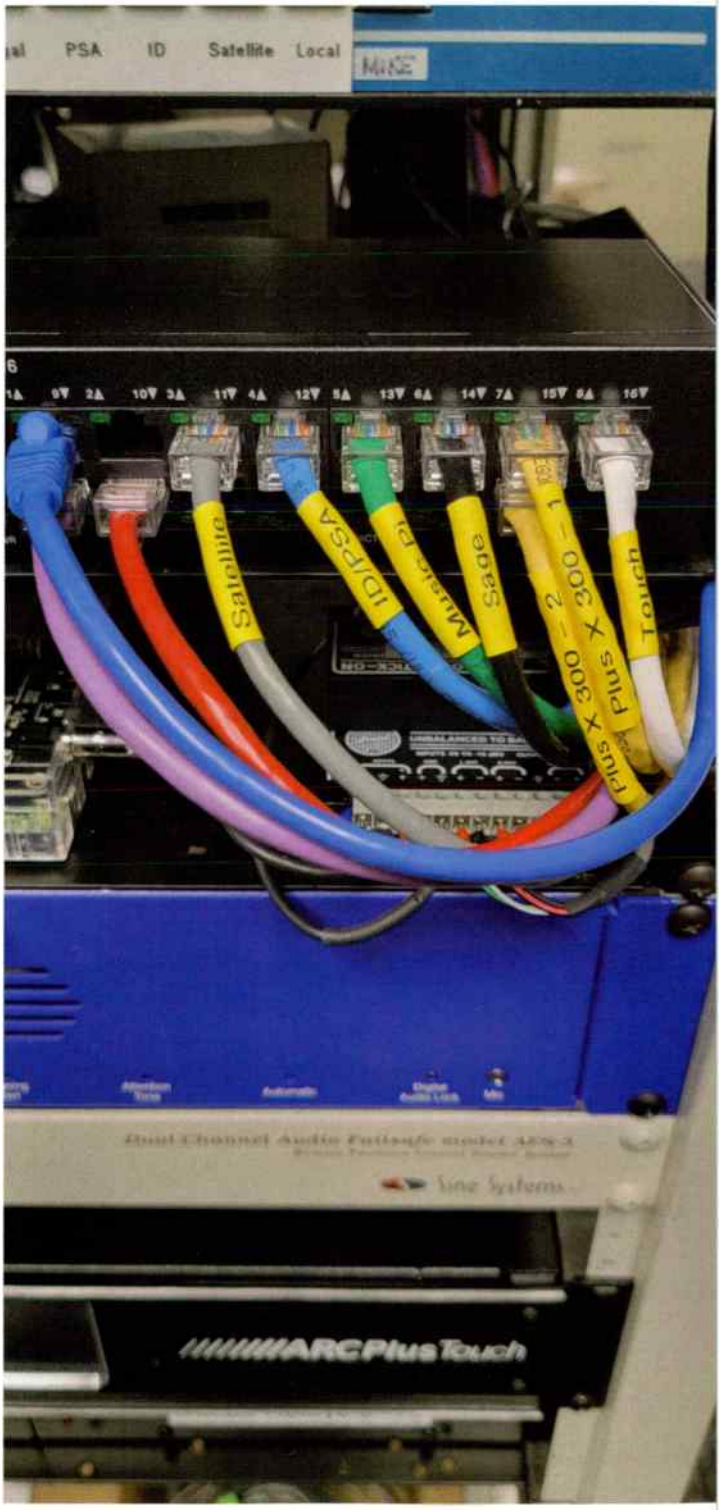
If you're a little rusty on those satellite repositioning skills, there's a good YouTube video prepared by Marcos O'Roarke (aka "SoCal Broadcast Engineer"). You can follow Marcos as he encounters multiple issues during what he had expected would be a "simple" project to repoint a dish.

As all engineers know, even the simplest projects can be fraught with problems, and Marcos' experience is no exception. On YouTube, search for "Pointing a satellite dish FAIL."

It's the little things that matter

Paul Sagi in Malaysia liked our trick about modifying a pair of forceps with a rubber grommet, to hold a bolt. He said a crochet or rug hook could be used to grab onto any springs. As we've seen time and again, every tool has multiple uses!

Speaking of past tips, broadcast engineer Ken Lundgren sends a word of caution after reading Buc Fitch's "Ditch the Wall Wart" project in December.



Right
Printable heat shrink tubing for use with Brother P-Touch labelers.

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If you do decide to lose a wall wart for a piece of audio equipment, think twice about random placement of the AC power transformer inside a box with audio circuitry, because it may induce hum. Ken points out that toroidal current transformers or metal shielded casings are used in such situations.

Buc's project modified a Sine Systems Transmitter Remote Control, so this caution would not apply, but keep Ken's thought in mind should you modify other products' power supplies.

Understanding EMI

And speaking of interference, Engineering Manager Dan Slentz checks in with a brief tutorial he found from Rohde & Schwarz on electromagnetic interference and how it can be detected and debugged using an oscilloscope. The paper discusses near-field, magnetic and electric probes as well as the use of an oscilloscope in Fast Fourier Transform mode.

At *https://www.rohde-schwarz.com/us*, enter "Understanding EMI" in the search field.

Easy pickings

Contract engineer and frequent Workbench contributor Stephanie Donnell, WA1YKL, notes that as copper prices rise, so does the temptation to steal ground cables and strap from transmitter sites.

Top
A satellite alignment primer for BBN field engineers

Above
Marcos O'Roarke is on YouTube sharing the issues he encountered with a dish repointing project.

We've mentioned Garner Wet-R-Dri asphalt-based roofing cement. It's nearly impossible to remove and therefore discourages theft. Copper reclamation facilities also will not accept strap covered with tar.

Stephanie suggests adding a fake ground jumper to the mix. The fake provides a circuit to the site ground that energizes the coil of a small relay. The power for this device can be provided by the wall wart you removed previously!

So long as the relay is "on," it keeps one of the status inputs feeding a Burk site controller "low." If the relay switches off because the fake jumper cable is cut, an alarm condition would occur.

Giving this further thought: For best results, use a bright red or orange cable, lying on the gravel in plain sight, something to catch the thief's eye. You know ... "easy pickings."

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It may not look like a radio studio ...

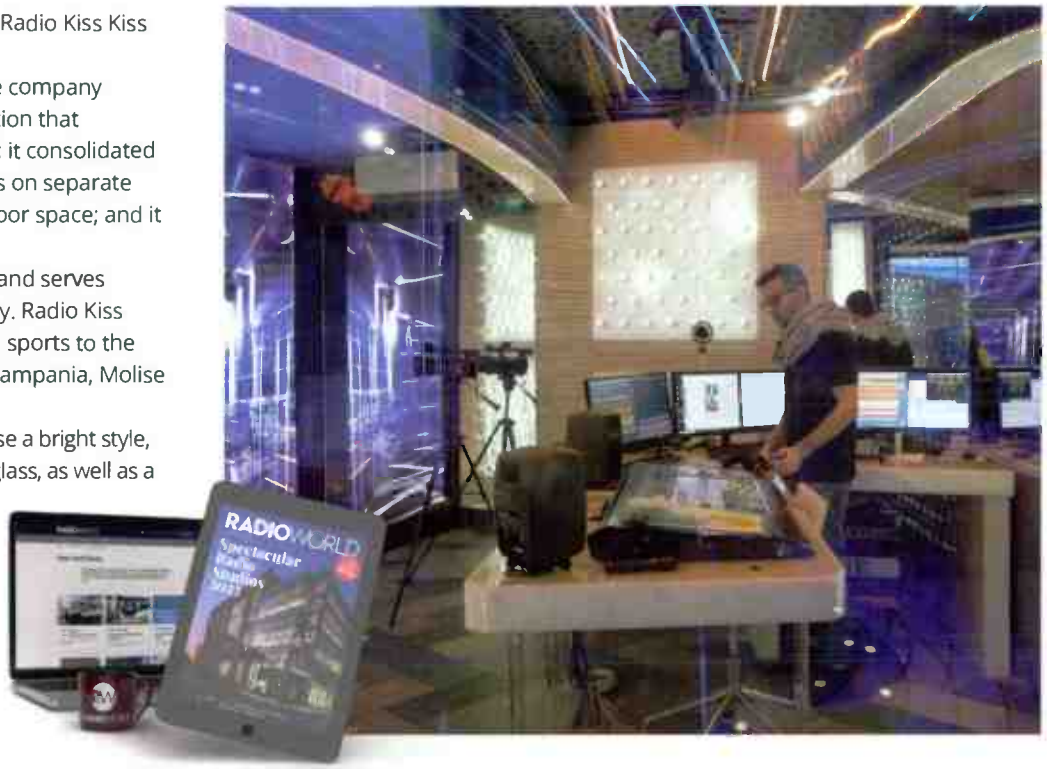
Visual impact is the story for Radio Kiss Kiss Group in Naples, Italy.

During the pandemic, the company completed a studio renovation that implemented audio over IP; it consolidated the studios of three stations on separate floors into a single large interconnected floor space; and it updated sets for visual radio and TV.

Radio Kiss Kiss Italia plays Italian music and serves mostly the southern regions of the country. Radio Kiss Kiss Napoli broadcasts entertainment and sports to the Campania region. Radio Ibiza serves the Campania, Molise and Abruzzio regions with dance music.

For Radio Kiss Kiss Italia, shown, they chose a bright style, with lots of LED bulbs, wood, Plexiglas and glass, as well as a big window along the hall so people can get a wide view of the studio.

You can read about this project and 14 more in Radio World's new free ebook, "Spectacular Radio Studios 2023," a sequel to the popular ebook we published a year ago. Find it at *radioworld.com/ebooks*.



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Writer

Nick Langan

Watch the videos

Find the Supertower videos on YouTube by searching "Geerling Engineering." Also check out "JeffGeerling."

Above
Looking up at the Supertower.

Exploring a 1 million watt broadcast tower

Joe and Jeff Geerling are a friendly pair of YouTube hosts

The father and son team of Joe and Jeff Geerling have teamed up on radio-related projects before.

Joe is a broadcast engineer, working into his fifth decade in the St. Louis market. He was market chief for CBS Radio for 20 years and today is the director of engineering for Covenant Network.

His son Jeff has spent nearly 15 years as a software architect and developer. He founded Midwestern Mac LLC and is active in many open-source software communities.

Jeff recalls that one of his first web programming projects in the late 1990s was to construct an interface to display the current song on 98.1 KYKY(FM)'s initial website for his dad.

Last February, Joe appeared on a video on Jeff's YouTube channel to install a Raspberry Pi IP KVM in a Covenant Network studio. That collaboration went so well that commenters on Jeff's videos began clamoring for more appearances by the senior Geerling.

Over a family vacation, Joe and Jeff came to the realization that the iconic Crestwood Master Tower in Shrewsbury, Mo. — nicknamed by its original engineering community as "the Supertower" — would make for a perfect showcase for a new Geerling Engineering YouTube channel.

Given Joe's expertise with the site, the idea for a video was a natural. In fact they ended up making two.

Ten Class C FMs and more

The father and son duo has a history with the structure, which was built in 1986.

That year, Joe started working with EZ Communications, the broadcast company that had the tower built, doing contract projects and working on remotes. He later was

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brought on full-time and soon became its corporate engineer. The company was later sold to American Radio, which was in turn purchased by CBS in 1998.

Starting when Jeff was around 6, Joe took the boy on numerous visits. Well into his teens, Jeff would tag along when Joe did weekend checkups on newly installed gear or responded to an emergency. Jeff himself was hired for some networking and computer work at the site as he got older.

"It was always fascinating to see such a well-maintained facility, especially in comparison to more rural tower sites, and one with so much activity," Jeff said. "It seemed there was often a new tenant, or some equipment being replaced."

The location of the tower, just west of the city of St. Louis, provides optimal market coverage.

"When the master antenna was built, it was extremely close to the center of the population of the St. Louis Metro," Joe said. "The metro population has shifted a bit west, but the site still has the greatest population count advantage of any site."

The 1,030-foot Stainless G-74 model tower has three faces, each 7 feet in width. The site is owned by American Tower and was originally completed by Lodestar Networks.

Ten Class C FM signals are served by an eight-bay Dielectric TAV-8FN/24U-2 antenna that was installed in 2006.

They are Audacy's 96.3, 98.1 and 102.5; iHeartMedia's 93.7, 103.3 and 107.7; Hubbard's 94.7 and 106.5; Gateway Creative's 99.1; and Bott Radio Network's 91.5.

Above
Jeff and Joe in the FM Combiner room.

Immaculate

Thanks to the cooperation of engineers at Audacy, Joe and Jeff had access to the Supertower on a sparkling November morning to film both the immediate exterior of the site and the interior transmitter rooms.

The duo pulled up to the tower through the neighboring Resurrection Cemetery — "Nobody has ever complained about nearfield radiation here," Joe quips in the second video.

With the sheer number of cables running into the facility, one might wonder if the condition of the transmitter rooms inside resembles a disorderly rat's nest. Nothing could be farther from the truth.

The rooms in the videos appear immaculate. To Chris Nixon, site manager from American Tower, the Supertower's condition is a credit to the quality and cooperation of the engineers who have been present in the Gateway to the West.

"Of our 85 sites I manage in the central U.S., it is among the busiest," Nixon said.

"The engineers who represent the broadcast interests in St. Louis act so professionally. There's an appreciation for the other tenants, as they never know when it might be their own equipment that requires the site to undergo downtime."

Joe cited some of his mentors in the market, including Ed Bench (SBE Fellow), who helped guide engineers in using an FM combiner system at the tower, and Mike Waldman (CPBE, CBNT), who oversaw several special projects at the site related to emergency power and shutdown.

If the cleanliness of the transmitter rooms doesn't hold your attention, the easy-to-understand explanations of the multitude of equipment choreographed by the Geerlings will.

In the first video, Joe details how it is possible to combine 10 FM signals via the custom Dielectric combiner. Nine

> **"There's an appreciation for the other tenants, as they never know when it might be their own equipment that requires the site to undergo downtime."**

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of the 10 FM stations also run separate HD Radio signals through the antenna, and four of those use increased -14 dBc injection levels.

Five additional FMs — full-powers 104.9 of iHeartMedia and Emmis' 105.7, and translators on 95.9, 101.9 and 103.7 — use a side-mounted antenna on the tower, and there are five TV stations, two cellular companies and several public safety and two-way communication entities up there.

All told, just under 1 Megawatt of effective radiated power emanates from the site.

It makes for a handy attention-grabbing video title, but the claim is far from clickbait. In around 18 minutes, Joe and Jeff explain cable management, a GatesAir liquid-cooled FM transmitter, the gain factor of 4 that exists for the master antenna, and the RF lockout system employed for safety when tower work is necessary.

The two have a great camaraderie and their videos are free of jargon or overly technical language, making it easy for both newcomer and veteran engineer to understand.

"I compiled a list of questions I thought people would have visiting the site, and we ran through that list on the day of the filming," Jeff said.

"My dad and I try to include a little more of the father-son banter because I think it can make the videos a little more approachable, especially if we're discussing topics that tend to be a bit dry on their own."

Family plan

The cherry on top are visuals of the majestic tower from a DJI Mavic Pro drone. It was a gift from Joe's son Joel. In addition to the views, as Joe explains, it makes for an excellent tower inspection tool.

Above
Joe standing at the tower base.

Below
Joe explains the liquid cooling for a GatesAir transmitter.

"I could go on and on about drones and their uses," Joe exclaimed, hinting to Jeff at a possible future video topic.

The November Supertower YouTube video had 440,000 views as of February. It sparked so many questions in the comments that Jeff and Joe decided to return for a followup, just prior to when Jeff was scheduled to undergo a surgical procedure.

Some of the queries they addressed in the second video include delving into the concept of ERP further, RF radiation concerns even just being at the base of the tower, and the incandescent safety lighting used on the tower (as opposed to LEDs). The second video was released in early December and has 219,000 views.

"For both my main channel and Geerling Engineering, I try to make videos that I know I want to watch, and also try to make them approachable to as wide an audience as possible," Jeff said.

The Supertower lives on as one of the more unusual master antenna setups in the country, a list that also includes the Empire State Building's master antenna and the taller Senior Road Tower serving Houston. Many tenants have come and gone, "dreams that have started big and failed, but some dreams that have come true," as Joe summarized in the videos.

Jeff, following a successful recovery, and Joe have their sights set on additional father-and-son tower site videos in 2023, including at least two AM towers, helping to showcase the differences from FM with aspects such as grounding. Joe's Covenant Network station antenna sites would surely make for more enthralling video content as well.

The author is operations manager at Villanova University's WXVU(FM) in Villanova, Pa., and a lifelong radio enthusiast, with a special interest in long-distance FM signal reception.

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Writer

James Careless

The longtime Radio World contributor wrote about the surprising resilience of shortwave radio in the Sept. 1 issue.

The changing face of tabletop radios

While some still offer OTA reception, the specialty segment is dominated by online connectivity

Above
The Como Audio Duetto — available in hickory, walnut, black or white — looks like a piece of furniture. The stereo box can tune to internet, OTA FM, Bluetooth streaming, Wi-Fi and DAB+. It offers multi-room capabilities and can be paired with an Alexa device for voice control. At press time the company website was offering a three-room system in white for $130.

There was a time, of course, when radios were fixtures in people's homes. But according to Edison Research's "Infinite Dial 2022" report, the percentage of U.S. homes with "zero" radios inside went from 4% in 2008 to 39% in 2022.

Among the radios that remain, clock and emergency radios have the best chances of justifying their presence to internet-centric consumers. But good ol' fashioned tabletop radios? AM/FM receivers housed in eye-appealing laminated wood cases with big speakers and hefty knobs?

Mass-market companies such as Panasonic and Sony have abandoned such products. But specialty/quality brands such as Como Audio, C. Crane, Grace Digital, Sangean and Tivoli Audio have not.

These brands bring fresh approaches to the tabletop radio segment through innovation and the harnessing of streaming technology. Still, it's an uphill battle in a world obsessed with all things internet.

The drop

There are several reasons conventional AM/FM tabletop radios have been disappearing from homes.

The first and most obvious is that even by the beginning of this century, radio had long ceased being a destination medium around which the family gathered to listen. In recent decades, the more common uses were morning wakeups, rush-hour commutes, sports on the go and weather emergencies, all well-served by portable radios, though there was still some degree of at-home listening.

The consumer electronics explosion has continued to challenge and change those uses as well.

"If you describe radios as only being something with an AM/FM receiver, then there is decline," said Thomas DeVesto, founder, designer and CEO of Como Audio. Broaden the definition to include digital radio and particularly streaming, and the situation looks different.

Smart speakers are another factor driving the decline of tabletops or indeed any type of radio within the home. According to that Edison Research report, more than 100 million people in the United States owned smart speakers in 2022. While the pace of growth had slowed by then, that

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number was still up from 7 million six years earlier. And today many people have multiple speakers at home.

The big strength of smart speakers is their ability to fulfill listener requests for specific content, streamed via the internet.

Unfortunately, "tabletop radios are an antithesis of that movement," said Andrew Wu, Sangean's marketing director.

Or as Paul DePasquale, CEO and designer at Tivoli Audio, put it, "With the development of streaming services, podcasts and mobile options, people are opting for a more on-demand and personally curated listening experience. [But] Tivoli Audio has found there are still many individuals who also want quality audio and design," he continued. "Our (AM/FM) Model One and PAL radios continue to be our best-selling products on a global scale."

Left
The Mondo Elite Classic from Grace Digital streams your favorite embedded apps like Amazon, iHeartRadio, SiriusXM, Pandora, Live365, sleep sounds "and over 100,000 radio stations from around the corner to around the world." It has handy sleep functions and wireless smartphone charging on the top, and it can be controlled by an app. Retail is $250.

Quality and innovation

DePasquale's point about the enduring popularity of quality audio and design explains why his company and the others mentioned are still making money from tabletop radios.

But today the focus is on streaming and other innovations to catch consumer attention

At Como Audio, "Everything we make has both an analog FM radio in it and will support just about every streaming service there is," said DeVesto.

Ease of use is also a priority across the company's listening formats. "I started making my first combination of terrestrial and internet radios over 15 years ago," Devesto told Radio World. "The idea was to take a product out of a box, plug it in, turn it on and listen to a station anywhere

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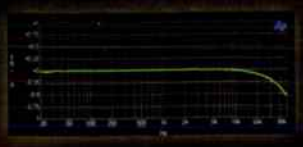

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The Como Audio Duetto, which I sampled for this article, is a good example of DeVesto's design philosophy. It integrates FM/internet radio, Bluetooth audio from smartphones and other sources, and Alexa smart speaker streaming in a sleek, high-fidelity stereo speaker package.

"It's so easy to program and use," the Como Audio website promises. "Set one button to play your favorite Spotify playlist, another to play an internet radio station, and still another to play the music files you've stored on your smartphone."

Renowned radio maker C. Crane Company still offers many AM/FM models in portable formats, but it has doubled down on streaming-only tabletop radios with the third generation of their CC WiFi internet radios.

"We came out with the CC WiFi 3 Internet Radio not too long ago with a remote control," said CEO Jessica Crotty. "It also has Bluetooth reception because people do have apps they want to listen to on a better speaker."

Left
C. Crane's CC WiFi-3 is an internet radio with Bluetooth receiver. It costs around $120.

Right
Available in a number of pretty color combinations, Tivoli's Model One BT has OTA AM and FM, aux in, Bluetooth and wireless capability and retails for $200.

I have tested the CC WiFi 3 in the past and can attest to its quality. Selection is the name of the game for this tabletop radio.

"Our CC WiFi 3 Internet Radio is full of free content, without a monthly fee, from thousands of regular AM/FM stations," said Bob Crane, president and founder.

"We have a pretty strong base of listeners that prefer the form of traditional radio but need the capabilities of internet radio due to listening preferences and in some cases signal limitations or sound quality. Internet radio lets the listener hear a station as if it was broadcast locally, no static, no fade. A lot of people don't want to listen on their computer or their smartphone."

Grace Digital has stayed relevant to consumers by including a range of streaming options in its internet radio-only tabletops, many of which have been launched in the last year or so. A number of the company's Mondo-series tabletops even come in stained walnut wooden cases.

Grace internet radios support built-in apps "such as Pandora, iHeartRadio, Amazon Music and Spotify Connect, as well as have Bluetooth and Chromecast integrated," said co-founder and CEO Greg Fadul.

"While it takes more engineering work to provide built-in apps and Chromecast, we allow the customer to choose how they want to enjoy their music, news and sports. We even have a built-in podcast service that integrates with Apple, the largest podcast aggregator in the world, and as we are the only internet radio company that hosts and manages our own radio station database."

Sangean offers a range of tabletop radios, incorporating AM/FM, internet radio and streaming services, Bluetooth, and in some instances DAB+ and CD players among others.

I sampled the Sangean WFR-32 tabletop, which has a range of nice features. This walnut-encased stereo receiver does it all while delivering excellent stereo sound. The WFR-32 even

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displays local weather forecast graphics along with the time on its LCD screen when the receiver itself is turned off.

Although not a tabletop, the equally excellent Sangean WFR-39 FM-RBDS/Internet Radio that the company sent stood out as the first truly portable/rechargeable WiFi-connected pocket-sized radio that I have seen.

At Sangean, "bigger screens, better visuals, personalized playlists, smarter functions, trendy colors and multiple audio sources" are driving its entire radio line, Wu said.

"There's also the retro route, where there's always going to be a niche group with an ideology of 'the good ol' days,' even if it's the generation of their parents or grandparents. The hipsters, the subreddits like r/OldSchoolCool, all fit into this retro-loving mold."

As for Tivoli Audio, whose iconic Model One AM/FM radio has defined the quality tabletop category for decades? They too are paying attention to consumers' love for streaming, and shaping their tabletop line in response.

"Tivoli Audio has added Bluetooth to all our classic products to allow customers the ability to stream their playlists and podcasts or opt to listen to the radio," said DePasquale. "Adding this capability has allowed people to purchase our timeless designs without forfeiting flexibility.

"We have also released Wi-Fi-enabled products, specifically the Model One Digital Gen. 2 and Music System Home Gen. 2. These offer FM, DAB+ in available markets, Bluetooth and the ability to stream your favorite music and audio apps using AirPlay 2 and Google Chromecast. This allows our consumers to easily connect their products to Wi-Fi without a proprietary app and connect to other products in their smart home ecosystem, because Wi-Fi can offer better sound reproduction than Bluetooth."

By combining quality and innovation, these tabletop radio makers are keeping this technology alive, even though the format has been abandoned by mass-market firms.

As for the future? "Tangible tabletop radios are not going anywhere: If anything, you will see more of them," DePasquale predicted. "It is true that how people consume audio has changed. But people will always like something physical they can touch, something they can experience, and ultimately something that sounds good."

Above
Sangean calls its WFR-32 an "Internet / Internet DAB / AUX / Bluetooth / Spotify Connect / Cloud Music / AirMusic Control Digital Wooden Radio." Online stores had it for around $130 when we checked.

Right
Tivoli PAL BT works as a tabletop or portable speaker; it has Bluetooth as well as OTA AM and FM. Retail is $220.

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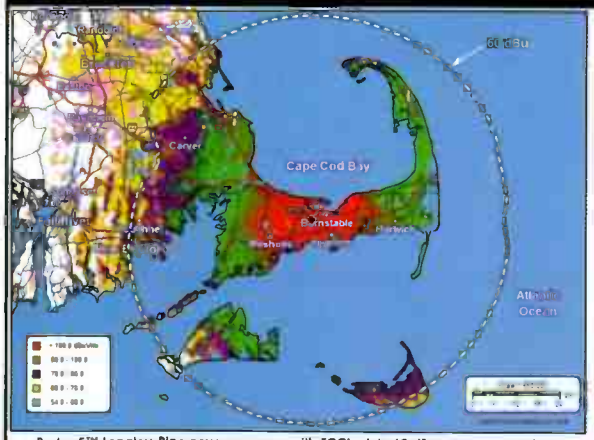

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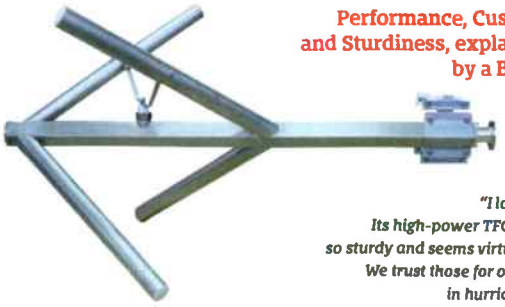

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The merger of engineering and IT

Frank McCoy's commentary "Solutions for the CE Recruitment Problem" in the Dec. 7 issue was most interesting. The consolidation of IT services into a corporate layer instead of a local presence seems to be popular. Frank's article is the first I have seen that speaks against this practice.

His views on what the FM spectrum will look like in a decade are plausible. I have to wonder what role ATSC 3.0 will play in future delivery of audio information and entertainment, I'd like to read his views on that.

Agree completely with the need to possess IT networking skills. What we see now might be similar to washouts in engineering that took place years ago during the transitions from 12AX7s to 2N3055s to NE5532s.

Dale Lamm
Chief Engineer
WHBC(AM/FM)

Add an NWR button

As a radio supporter and owner of two Teslas, I wholeheartedly support the inclusion of AM radio in electric automobiles ("Radio on the Radar," Dec. 21 issue). And since the roofs of Teslas and other EVs are entirely glass, I also advocate for the inclusion of NOAA Weather Radio (NWR) in every EV.

Chips to receive the NWR broadcasts (162.400–162.550 MHz) cost mere pennies, but the reception of a severe thunderstorm warning could give me the information I need to avoid the impact of damaging hail on my roof. I would think the automobile insurance industry would also advocate for NWR ... in every vehicle on the road ... to reduce hail, flood and high wind damage to automobiles and their occupants.

Hey auto manufacturers, why is there no NWR button in our cars?

Bruce Jones
Meteorologist/Spokesperson
Midland Radio Corp.

"These community stations, the weakest among us, will be the most affected by the HD jamming signals. The request should be rejected for this reason alone."

Taking it to heart

Considerable interest is being directed to induction charging systems for battery powered vehicles. Your Nov. 9 issue covered the technology from the radio reception point of view ("Wireless EV Charging Could Pose Threat to AM Reception").

As a recipient of an implanted pacemaker, I've received warnings to stay away from magnetic fields such as those created by motors, generators, transformers and the like.

The fields of these EV charging systems are several orders of magnitude more intense than any of the aforementioned devices. Are the promoters of induction charging aware of the danger this might present? Just asking.

Roger Stubbe
Pella, Iowa

Watch out for the little guys

Regarding "FCC Takes Comments on FM Digital Power Increase":

Hello FCC. Radio engineers strongly oppose more static to our analog stations from the corporate HD jamming signal. The term "in-band, on-channel" fools no one. The truth is the signal is on an adjacent channel, the frequency of someone else, which had been a clean analog signal.

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In this new request from the NAB, again claims are made that nearly 50% of new cars have HD Radio, but I rent new cars all the time and very few have HD Radio. The fact is consumers don't even care if the new car has AM/FM as long as it's Bluetooth. That's the sad state of broadcast programming in America today.

This request also has no provisions to uphold the Local Community Radio Act and clearly is not looking out for the hundreds of LPFM stations barely hanging on to little bits of the radio spectrum between the big corporate stations. These community stations, the weakest among us, will be the most affected by the HD jamming signals. The request should be rejected for this reason alone. And expecting smaller stations to lease this corporate-owned HD technology is unrealistic from an ROI perspective.

Brad Johnson
Salida, Calif.

First Phones and license walls

I really enjoyed reading Buc Fitch's article "The Demise of the First Phone" [published in 2006 and reshared recently in Radio World's SmartBrief e-newsletter].

I was saddened in 1986 when my last FCC First Class Radiotelephone License had expired and was replaced by the "General Radiotelephone Certificate." I remember how hard that I had worked, and studied, to earn that original license back when I was a high school student. In fact, I still keep my framed, expired original FCC First Class License on my office wall — ABOVE my "General" license!

I also remember the "license walls" in broadcast stations. The first one that I ever saw was the one at my high school FM radio station, WHHS, which was organized by the station's technical adviser Charlie Higgins. It was the first Class D FM station licensed to a high school in the nation.

Thanks, Buc, for bringing back the fond, and somewhat sad, memories!

Steve Hemphill
Owner/Licensee of WA2XMN
Major Armstrong's Memorial FM Broadcast Station
Alpine, N.J.

Draw this please

"The Demise of the First Phone" reminded me of a story.

Ken Nielsen was a radio pioneer. He convinced the San Francisco Unified School District to apply for an FM station around 1940. Low-band FM. Their first transmitter was part of RCA's display at the 1939 Treasure Island Exposition, a converted 27 mc diathermy unit. That station became KALW.

I learned a whole lot from Ken during his last year at KALW. His story of how he got his First Phone is interesting. He made an appointment with the engineer in charge of the nearest FCC office. He was shown into the EIC's office. The EIC asked him some questions and then handed him a blank sheet of paper and a pencil. He was instructed to draw the schematic of a 1 kW standard broadcast transmitter and to show component values and typical operating voltages and currents.

That was his test. A real test.

Bill Ruck
San Francisco

How to submit

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

Jocks, too

When I was in college at Oklahoma State University I got a job at KOMA in Oklahoma City. It was a 50,000-watt three-tower directional, and everyone who worked there as a jock had to have a First Class License or have someone with them who did.

So I went to Elkins Institute in Dallas and basically learned the test answers. Best investment I ever made, because it helped pay my college expenses.

The KOMA transmitter at the time was actually on two levels and had water-cooled tubes. I was afraid to get near it but I knew how to switch the pattern at sunset and sunrise.

John David
Former Executive VP, Radio
National Association of Broadcasters

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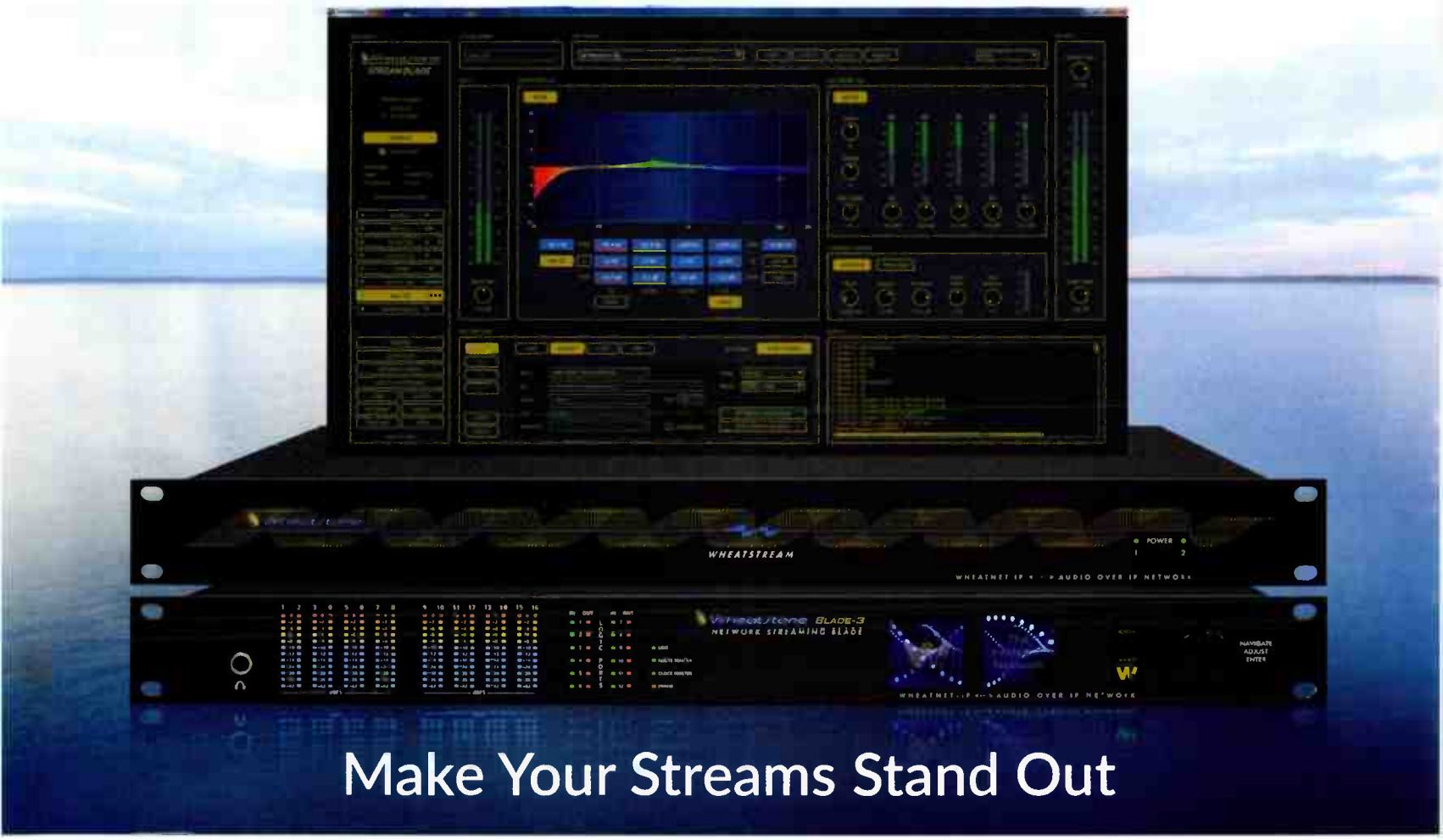

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Preparing for lightning season

What's on your lightning protection checklist?

Cris Alexander
CPBE, AMD, DRB
Technical Editor

A couple of years ago in these pages, I told the story of the worst lightning damage to a transmitter site that I have ever seen.

In the dead of a Michigan winter, lightning struck the 500-foot tower for our Detroit FM station. It traveled down the tower, followed the transmission line inside to the transmitter, then ran across the transmitter chassis looking for a path to ground. It found several, one of which was through the AC power connection to the transmitter, vaporizing all 14 of the fuse holders mounted on the front of the power supply cabinet of the Continental transmitter.

As I told you then, that lightning event showed us a severed ground strap that should have carried the energy from that strike safely into the ground and away from our equipment. It taught me to make checking ground connections, particularly at tower bases and building entry points for transmission lines part of the regular site inspection routine.

In the years since, these inspections have shown up stolen ground conductors and ground bus bars at sites. Thankfully we found the issues before something awful happened in each case.

It's here!

I mention this again for a couple of reasons.

One is that "lightning season" is upon us in the northern hemisphere. Spring tends to bring thunderstorms in many parts of our nation. We get most of our severe weather toward mid-summer where I live in the Rocky Mountain region. But wherever you call home, the coming of spring is a good reminder to check grounds, ground conductors, grounding blocks and bus bars, TVSS modules and whatever other measures you have in place.

Another reason is that copper theft is again on the rise.

Seems like it took a break for the past couple of years, with copper prices dropping into the $3 per pound range.

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Now that they're well over $4 a pound, copper is back on the radar of thieves. Heavy ground blocks, bars and conductors are very attractive targets.

The trouble for us is that there's no immediate indication that our facility's grounding has been hit in most cases. So here's your reminder to add that back in to your visual inspection checklist (if it ever came off).

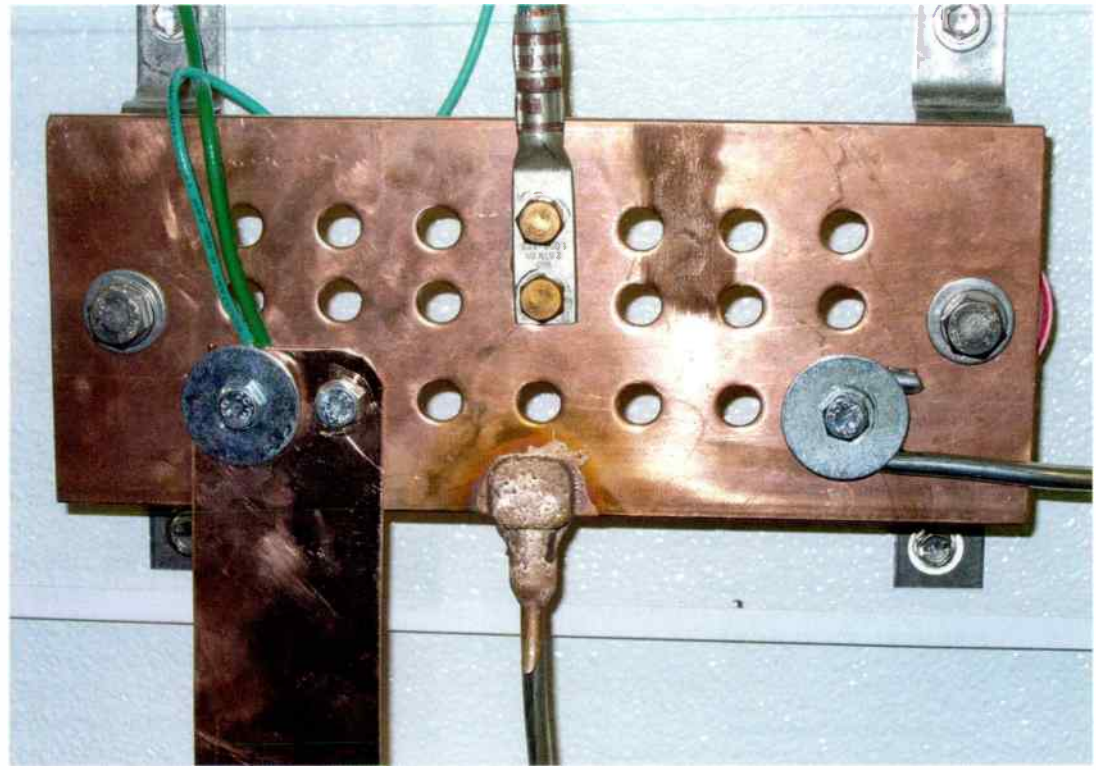
Another thing I have learned over the years about lightning strikes is that even with the best-grounded tall metal objects, all that current to ground creates a heck of an H- (or magnetic) field while the current is actually flowing. That H-field can do all kinds of mischief as its lines of flux cut conductors in the area.

Back in the late 1980s, I took a direct lightning hit to the amateur radio tower in my backyard. The simultaneous blast of thunder was LOUD and very sharp, and just about stopped my heart!

In addition to the screaming smoke alarms and ruined radios, that strike turned our television screen purple. Every image on the screen was purple. I knew exactly what the cause was, and thankfully I had a degaussing loop that I was able to run over the screen and get the colors back right, but it was a good object lesson on the intensity of that H-field.

On many occasions since, we've taken hits on various towers at studios and transmitter sites, towers that were well grounded and where the lightning current was shunted safely off to ground without going through any of our equipment — and yet we still took damage. The harm was entirely to components and devices that were connected to runs of audio, AES or network cables.

In an earlier analog age, we would see input and output op-amps get blasted. In more recent digital days we see switch ports and NICs get damaged. Why? It's because those very intense lines of magnetic flux cut the conductors in audio and network cables and induce a damaging current into the conductors within. That current has to go somewhere, and that somewhere is equipment inputs, outputs and network ports.



Above
Grounding blocks like this one are prime targets for copper thieves if not protected, and a block's absence may not be detected until it's too late.

What's an engineer to do?

There are things that can be done to mitigate this kind of damage.

You can place ferrite cores on network and audio cables. You can use shielded cables; you can run cables in an EMT conduit.

Snap-on ferrites of the type often seen on wall-wart power supplies and other computer cables to maintain Part 15 compliance are relatively cheap and readily available from your favorite electronic component supplier.

There are network surge suppressors available, some of which are very good, but it's impractical to put one on every network cable.

Perhaps the best thing to do is evaluate your facility for the most vulnerable cable runs and protect those with ferrites and conduit. Otherwise, keep spare parts on hand, including shelf spares of your core network switches, all configured up and ready to swap out in a hurry if the worst happens.

The sad truth is that the only way to "lightning proof" a piece of equipment is to put it under the bed where you're sleeping. That way, the lightning has to go through you to get to it. It might still get through, but if it does, it won't matter to you!

In this issue of RWEE, Steve Walker of Wheatstone is going to give us some great pointers on protecting our studio and transmitter facilities from lightning damage. His tips provide a benchmark for evaluating our facilities to be sure we've done things right, hopefully before we find out the hard way that we haven't.

Also, Tom Vernon is going to give us a look at the NAB's PILOT Radio Test Bed that you — yes you! — can use to evaluate the performance of various devices under differing conditions.

So check those grounds and settle in for a good read. We hope you'll learn something.

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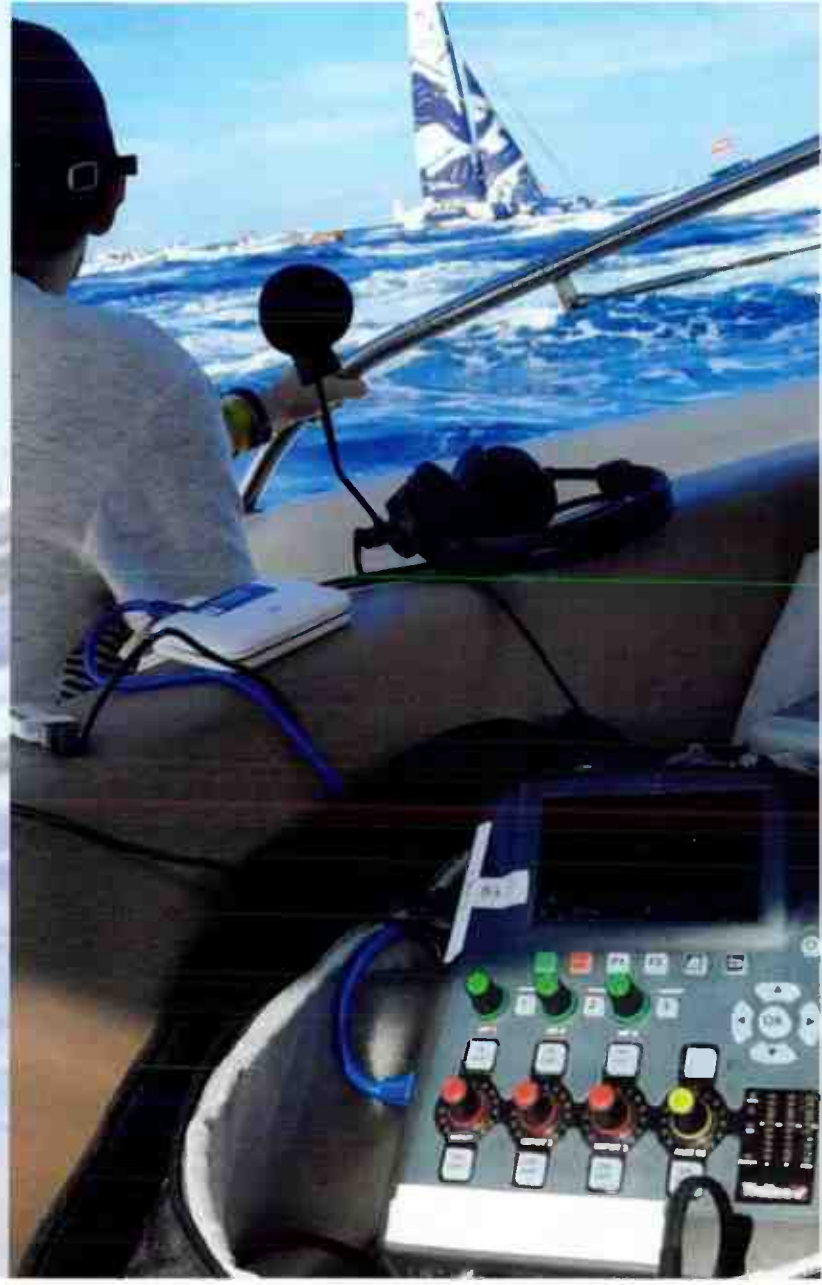

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Writer

Steve Walker
Southwest Tech Engineer, Wheatstone Corp.

Some down-to-earth tips on grounding

A proper scheme goes a long way toward minimizing damage from lightning.

Hardly a week goes by that the Wheatstone Tech Support department doesn't get at least one call from a customer who is having equipment issues due to a lightning strike or power surge.

While it may not be possible to eliminate damage caused by electrical events such as these completely, there are some best practices you can implement in your new studio build (or even in your existing facility) that can minimize the likelihood of consoles or other audio equipment being destroyed by the electromagnetic pulse that results from these events.

Lightning and power surges create short but powerful over-voltage conditions in your electrical systems that can damage sensitive equipment. Replacing or repairing the equipment can be expensive but may seem minimal compared to the loss of revenue if you are taken off the air.

Here are a few things you can do to protect your gear and keep your stations on the air.

Use a UPS

An uninterruptible power supply can go a long way toward protecting your broadcast gear from power surges. It has the added benefit of keeping you up and running during short-duration power loss events as well.

You can protect each studio and your TOC area by installing small UPS units to power each cluster of critical pieces of equipment, but having units scattered around your plant means you need to have a strategy for ensuring that the batteries in those units are replaced regularly,

Above
A Ufer ground at a broadcast facility. (Pronounce it "YOO-fer.")

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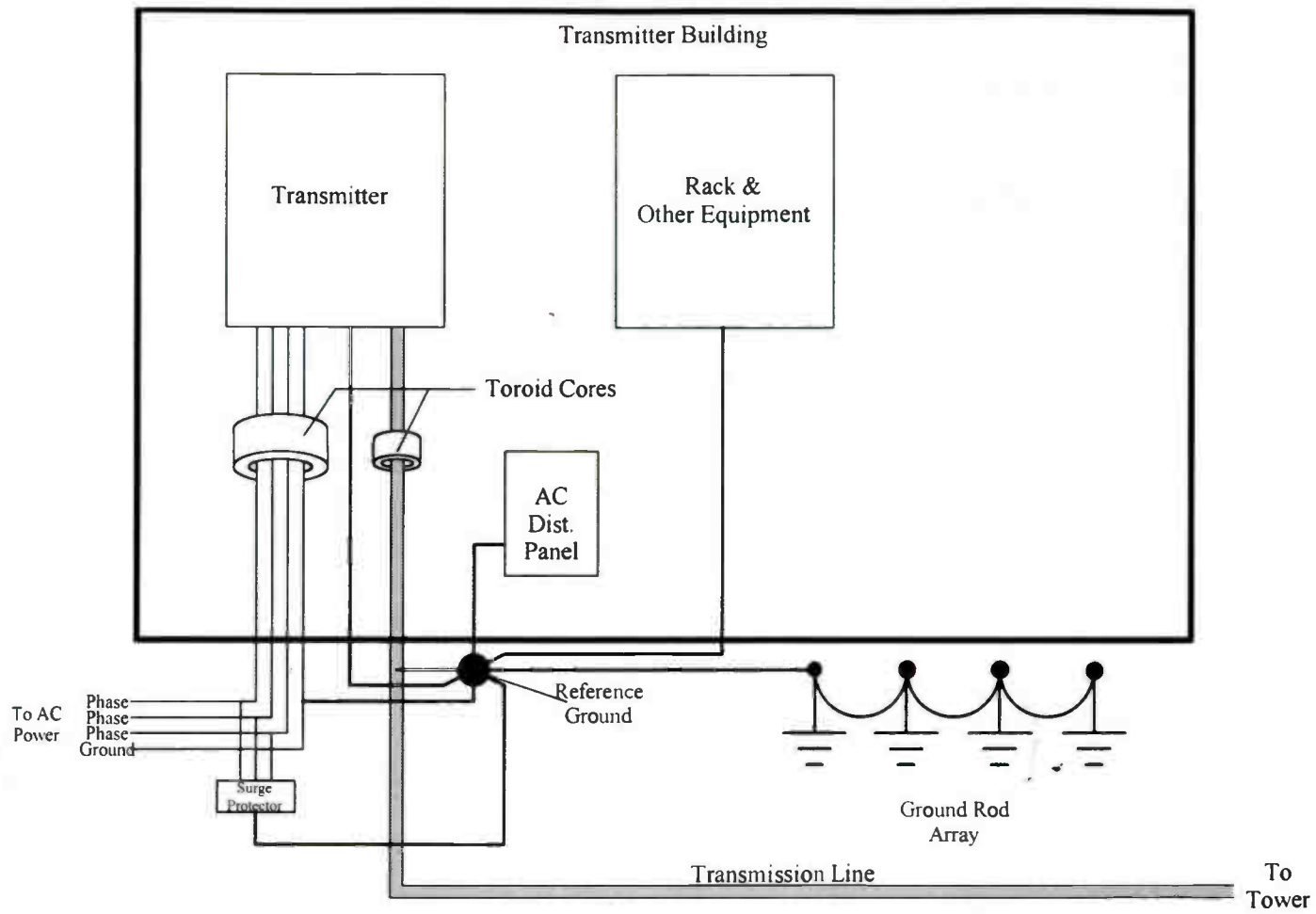

before they start to go bad. Make sure any UPS units you use power the load off the batteries, isolating your gear from the AC mains.

A better, albeit more expensive, option would be a large UPS system that can power your entire TOC and studio core. This is easiest to implement when you are planning a build and might be worth pitching to the decisionmakers as a necessary, integral part of your new plant.

Implement a strategy

UPS systems alone are only part of the solution. A good grounding scheme can go a long way to protecting your expensive studio gear from the destructive force that is packed in every lightning storm that comes your way.

Wheatstone's Jeff Keith says, "Grounding in a broadcast facility is more or less a science. But there are some pretty good ground rules (pun intended)." Here are a few of his suggestions:

Use a single-point ground, also called a "star" ground system because everything comes back, as much as possible, to a single earth-ground point. See the image above.

"The worst possible condition is for surges to have more than one destination because that usually means there's some piece of broadcast gear 'in the middle,'" says Jeff.

Above
A single-point "star" grounding scheme provides the best protection in most cases.

"Temporary (surge-related) voltage differences between AC and audio ground are the cause of most of the failures that we see here at Wheatstone. A thousand-amp surge across an ohm of ground causes a kilovolt voltage drop."

Additionally, you will want to use a large conductor for grounds. It might not be easy pulling a 2/0 or 3/0 copper conductor through your house cabling conduits, but the

> **“The worst possible condition is for surges to have more than one destination because that usually means there's some piece of broadcast gear 'in the middle.'”**

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benefits of a properly designed ground system will pay off big dividends the first time a lightning strike finds that the easiest way through your system is straight to ground. (At transmitter sites you will probably want to use ground straps of at least 2 to 4 inches in width, due to the high RF fields in play.)

"Today we have shielded network cables, too, so there's another 'wire' to consider. And even though network interfaces are transformer-coupled, those transformers are little tiny guys with not much of a 'gap' for a 10 to 20 kV wallop. I've seen cases where an incoming surge jumped right across the transformer and found its way into the Ethernet switch's silicon guts and yes, the magic smoke got let out."

Don't neglect proper grounding and bonding at the studio. Just because you may not have a 1,500-foot tower in your backyard doesn't mean you are immune from lightning damage. Do your research and spend the time and money needed to implement a good grounding system at your studio — whether it's a new build or an existing plant — as well as your transmitter site locations to protect your investment and revenue streams.

More Info
The author can be reached at *steve@wheatstone.com*.

Planning a build?

When building a facility from the ground up, you have a one-time opportunity to create the best ground system you can.

We asked Jeremy Hewitt, senior systems engineer for Inrush Broadcast Services, for his thoughts on facility grounding. He recommends the Ufer ground for new facilities.

"A Ufer ground typically consists of steel reinforcing rod (rebar) directly embedded in concrete. It must be at least 20 feet long, but it is not required to be continuous. If it is not continuous it is permissible for it to be joined via tie wires, welding or exothermic welding. An alternative means of constructing a Ufer ground would be to embed 4 AWG bare copper wire in the concrete."

The photo on page 6 shows a Ufer ground at a broadcast facility. The Ufer ground system is named after Herbert Ufer, a former U.S. Army consultant. He was tasked with creating an effective and relatively inexpensive grounding means for bomb storage vaults in Arizona.

Due to the dryness of the soil, a ground rod might have to be 100 feet long in order to meet the low resistance requirements, which was not cost-effective or practical.

"In order for a Ufer ground to be effective," says Jeremy Hewitt, "the concrete must remain in direct contact with the ground. This means that vapor barriers or thermal insulation must not be installed beneath the slab or foundation. Typically, a Ufer ground produces a resistance to ground of 2 to 5 ohms."

> **"Lightning and power surges create short but powerful over-voltage conditions in your electrical systems that can damage sensitive equipment."**

Optimizing for an existing building

Of course, the Ufer grounding method is only practical when established as part of a new installation.

In lieu of a Ufer ground, multiple ground rods can be used to ensure that a low-resistance path to ground is maintained. Ground rods should be driven into the soil at least 8 feet unless impossible due to encountering rock.

A ground ring in which at least 20 feet of bare copper wire (2 AWG or larger) surrounds the structure and is in direct contact with the earth is another option to ensure a low-resistance path to ground.

Regardless of the type of grounding electrode, the resistance between the electrode and the earth should not be more than 5 ohms. If multiple ground rods are used to achieve this, they should be spaced by half the length of the longest ground rod, for maximum effectiveness. If multiple grounding electrodes are used to lower the resistance, they should be bonded together. In addition, there should be a common connection where all electrical systems are bonded together to ensure that no potential can be created between the systems.

Without a suitable low-resistance facility ground, it is likely that a lightning transient will create a potential high enough to render any built-in transient protection ineffective.

Ideally, an effective facility grounding system would be used in conjunction with an overall surge protective device such that a low-resistance discharge path is created for the surge protective device.

Stay grounded

Grounding for your studio or transmitter facilities should never be an afterthought. You have hundreds of thousands of dollars' worth of high-tech audio, video and RF equipment that depends on being well-grounded for its protection. Lightning strikes and electrical power surges are facts of the engineering life, and as the engineer designing the facility, it's your job to make sure the potentially damaging current has a better choice for where to travel when it comes to visit than directly into your expensive gear.

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Writer

Tom Vernon

Longtime Radio World contributor profiled tower service company LumenServe last fall.

Photo by Paul McLane

NAB PILOT updates radio test bed

System evolves to meet test and measurement demands

Above
Standing with the test bed racks at NAB are VP of Engineering and Technology Policy Kelly Williams; Senior Vice President Technology Lynn Claudy; and VP, Advanced Engineering David Layer. On the telepresence screen is PILOT Executive Director John Clark.

A seldom-discussed aspect of standards development and equipment testing for AM and FM radio is who does the testing and what kind of gear they use.

The National Association of Broadcasters today is in a position to do this type of work as part of its PILOT technology initiative. It has a custom-built radio "test bed" to make those evaluations and gather data. The test bed, which now resides at NAB headquarters in Washington, occupies three racks and is available as a resource for industry projects.

David Layer, vice president, advanced engineering at the NAB, said the test bed has evolved over time to keep up with industry demands.

"It was originally created for the NAB with AM-only capability in 2014. Design and construction were done by Cavell, Mertz & Associates, with Dan Ryson (now with CBS) and Cavell Mertz senior engineer Mike Rhodes as the principal engineers."

At that time, the main impetus was all-digital AM HD Radio co-channel interference testing. Layer said the FCC's technical record on all-digital AM was sparse, so it was up to the industry to supply the necessary data to the commission and push for authorization.

"Under NAB's leadership, all-digital AM was field-tested at nine stations in the United States, where the emphasis was on coverage. Subsequently, it was lab-tested using the PILOT radio test bed, where the emphasis was on co-channel interference. These efforts contributed greatly to the FCC authorizing digital AM in 2020.

"After the AM work was completed," Layer continued, "NAB partnered with Cavell Mertz, Nautel and Xperi for HD Radio FM-band MP11 mode testing in 2017. For that,

(Test bed graphics follow; story text continues on page 19.)

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PILOT radio test bed (2021)

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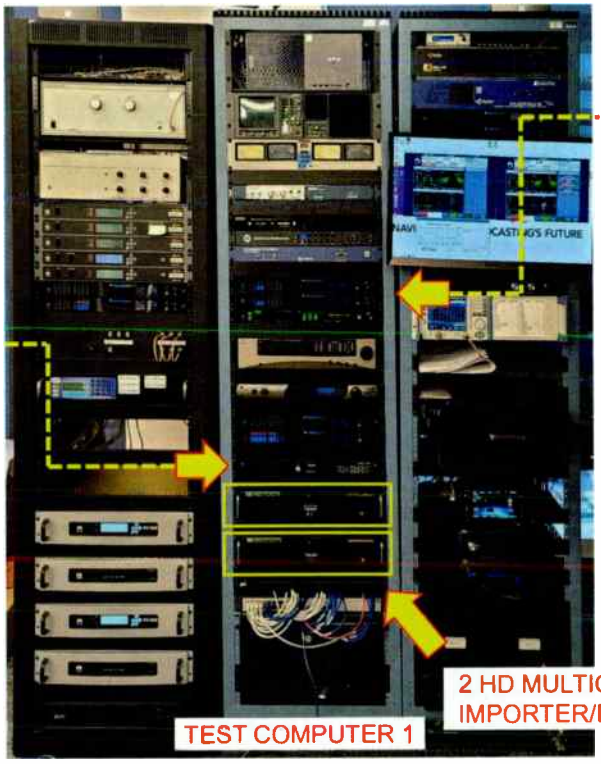

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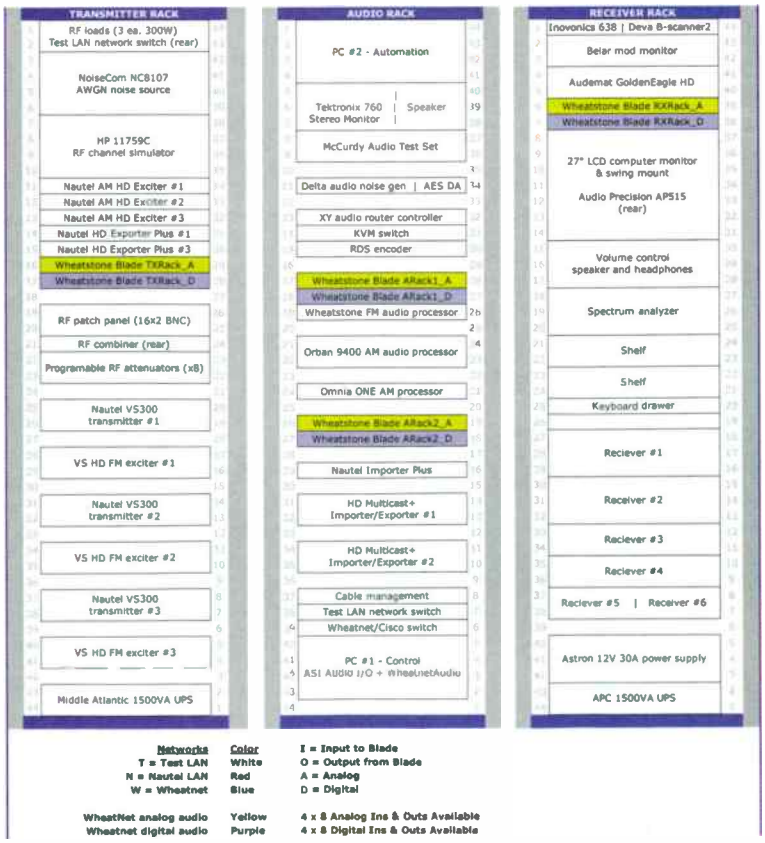

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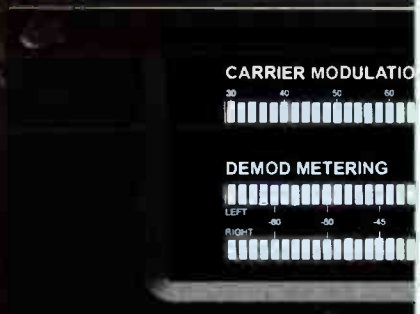

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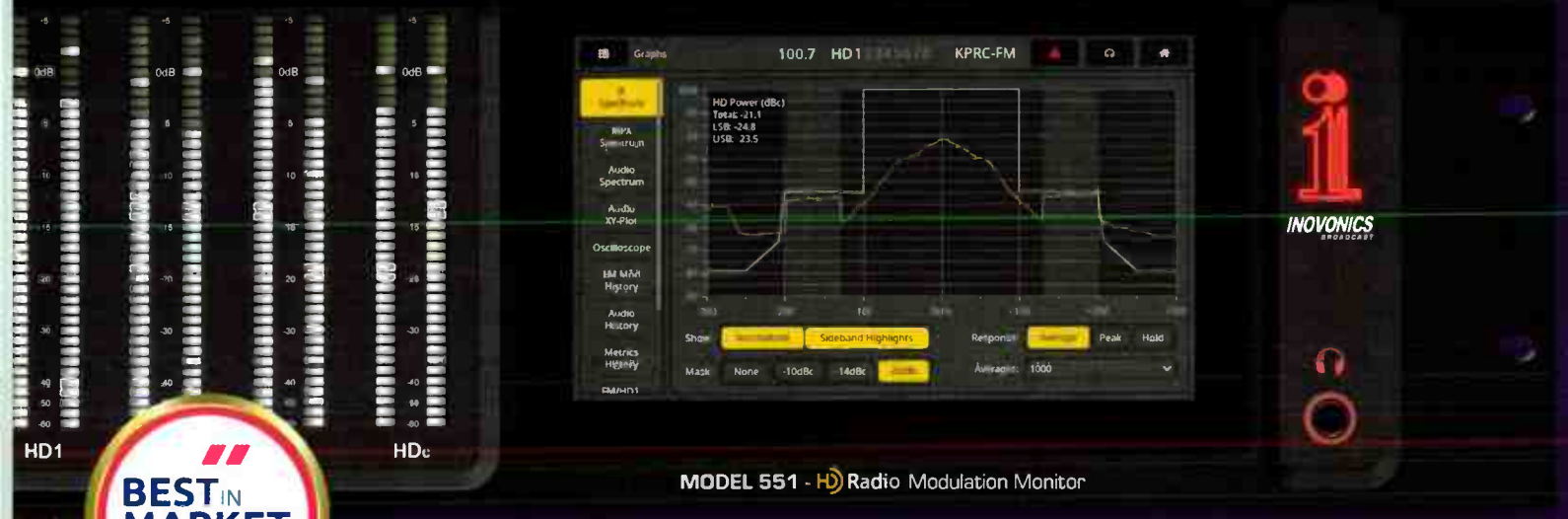

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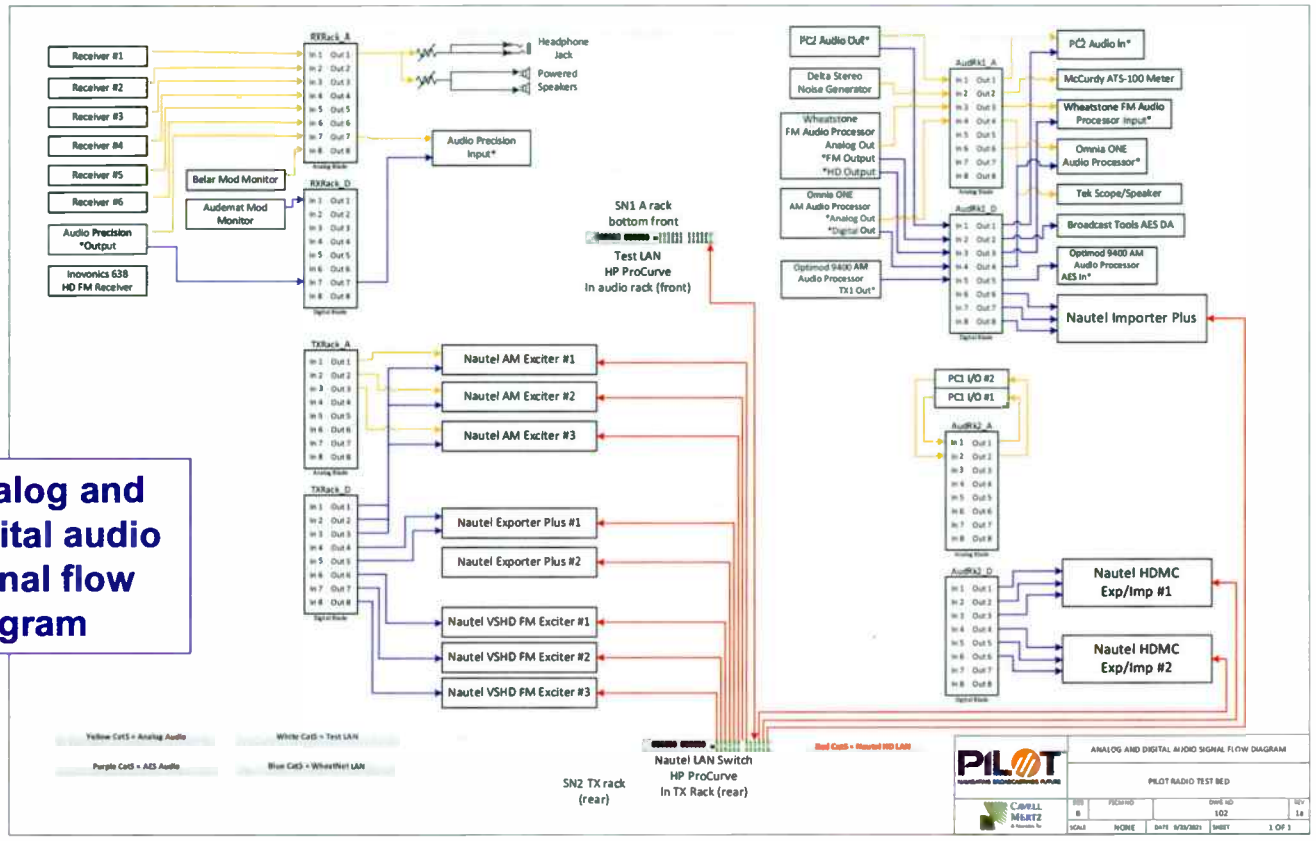
NAB Test Bed

Analog and digital audio signal flow diagram



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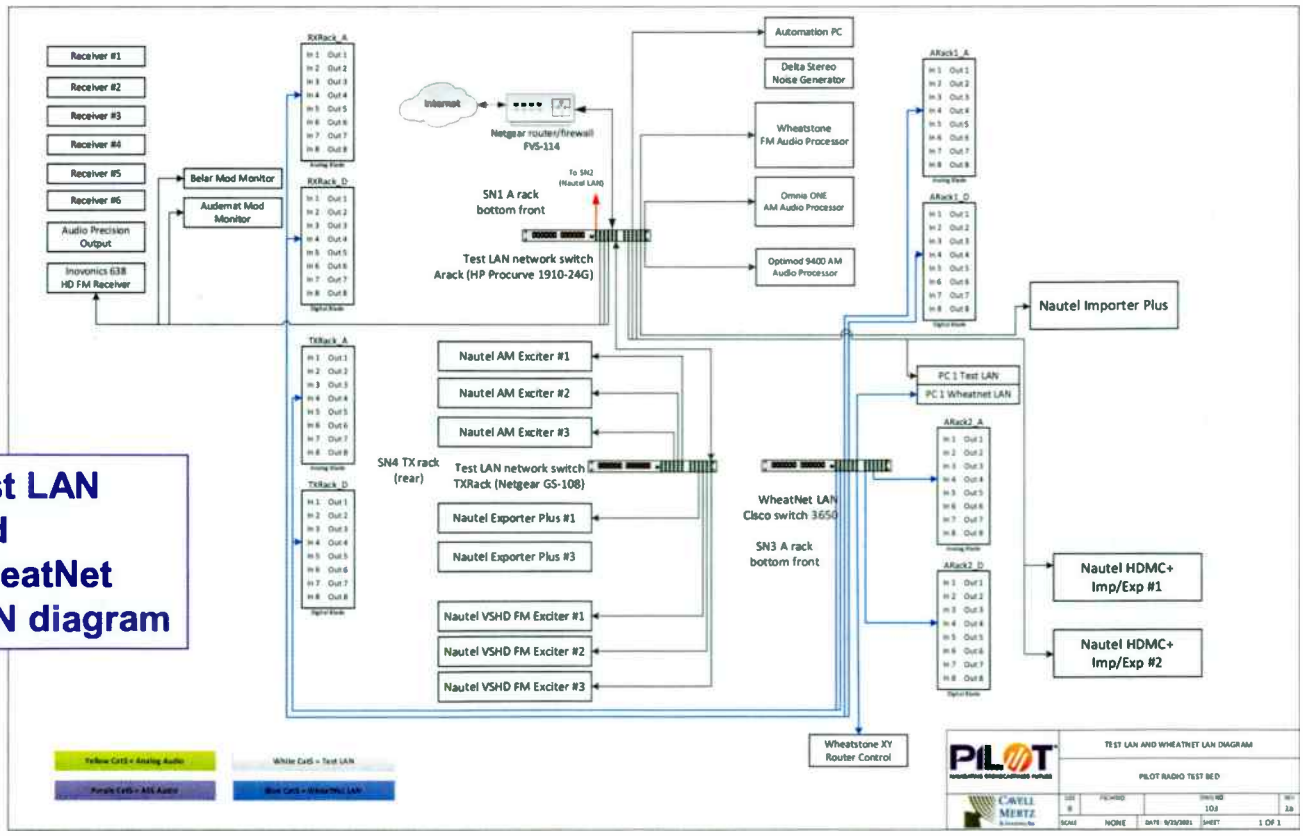
Test LAN and WheatNet LAN diagram



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FM capability and a third rack were added to the test bed. FM transmitters and receivers were installed. Nautel built special test equipment for MP11 transmission. The result of this research was Xperi's rollout of MP11 software, as well as Hubbard Broadcasting and others moving forward with MP11 adoption at their facilities."

In 2021 the test bed moved from the Cavell Mertz offices in northern Virginia to the new NAB headquarters in southeast Washington. It was also time for another upgrade.

"The original audio distribution system was based on conventional patch panels and had become obsolete by this time. It was replaced with audio blades from Wheatstone," said Layer. Two test computers, an RF channel simulator and two fourth-generation Nautel HD Multicast+ units were added, as well.

Last year the test bed was further upgraded to add text and image metadata transmission and reception capabilities. RCS contributed a license for their Zetta playout system, while Xperi contributed a license for its RAPID cloud-based metadata management system.

While the test bed may appear a bit intimidating in photos, the concept is fairly simple and more easily understood with flow diagrams.

The transmitter rack RF path contains three Nautel FM transmitters with associated RF attenuators and patch bays, as well as three Nautel AM exciters, also connected to the patch bay. There is also an HP 11759C RF channel simulator which is currently being integrated into the test bed.

More Info
For information or to discuss project ideas, send an email to *dlayer@nab.org*.

Transmitters and exciters can be configured so that one is generating the desired signal, while the other two can create undesired signals, to serve as co- or adjacent-channel interference. A NoiseCom NC8107A Noise Generator is also available as an RF noise source.

A Mini Circuits ZFSC-6-1 combiner connects to all the sources, and the output goes to a digitally controllable variable attenuator.

> **"Transmitters and exciters can be configured so that one is generating the desired signal, while the other two can create undesired signals."**

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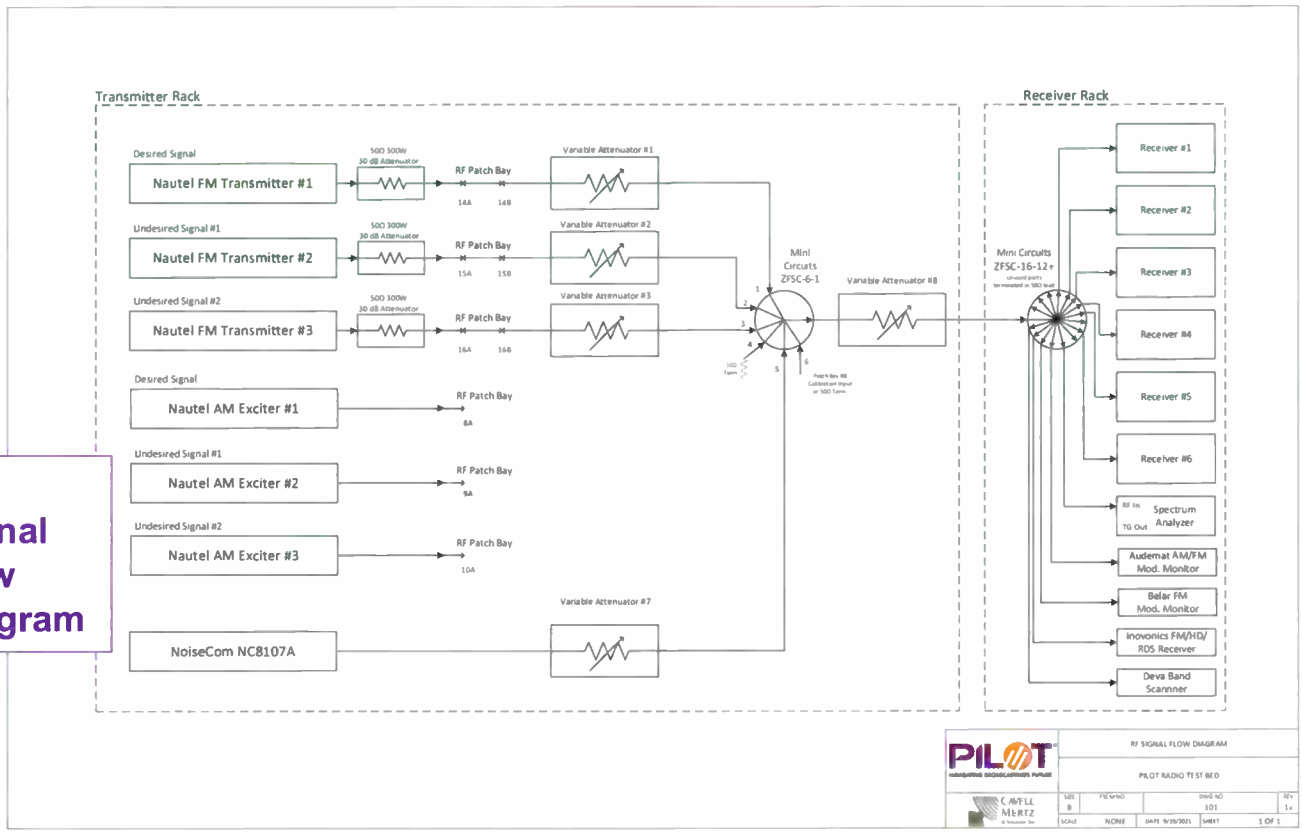
RF signal flow diagram



Use case example – adjacent-channel testing: RF spectrum plot showing three FM-band HD Radio signals

The RF path in the receiver rack begins with a Mini Circuits ZFSC-16-12+ which takes the transmitter rack output and routes it to a number of receivers and measurement devices. This includes up to eight receivers, a spectrum analyzer, Audemat AM/FM mod monitor, Belar FM modulation monitor, Inovonics 638 FM/HD/RCS receiver, Deva Band Scanner, and Audio Precision APx515 audio analyzer.

The audio rack contains analog and digital audio blades, which can route the outputs of all the receivers, RF monitors, audio processors and APx515 analyzer to the inputs of headphones and speakers, and other audio monitors.

Audio processors include a Wheatstone FM, Omnia One AM and Orban 9400 AM. Importers include a Nautel Importer Plus and a pair of HD Multicast+ importer/exporters. Audio monitoring is done via a Tektronix 760 stereo monitor and a McCurdy audio test set.

In addition to the audio and RF paths, there's a fairly robust test LAN and WheatNet LAN. Network switches are a Netgear GS-108 for the test LAN, while the WheatNet LAN uses a Cisco switch 3650. Internet access/firewall protection is provided by a Netgear FVS-114.

Layer adds, "NAB's goal is for the PILOT radio test bed to serve as a resource for the radio industry, and we encourage all stakeholders to reach out with project and application ideas that will allow this test bed to have an impact on the testing and development of broadcast radio technology for many years to come."

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Inovonics Unveils 541 FM Mod Monitor

A fourth-generation modulation monitor for FM stations is the latest product from Inovonics.

"The new 541 incorporates all the necessary features for station setup, regulatory compliance and remote monitoring," the company said. "The 5-inch colorful LCD Touch Screen displays all the essential modulation data in a graphic format on the front panel, or can be viewed remotely on any Web-enabled device."

The 541 delivers information about the transmitted signal in terms of the RF carrier and all subcarriers, the audio component defining the technical quality that the listener hears, and decoding of RDS data and SCA audio.

"The digital architecture of the 541 combines detailed DSP signal analysis with a menu-driven touchscreen display, plus Web server-based total access for remote operation, including measurements, graphical data and direct Web-browser audio monitoring of the off-air program."

Inovonics quotes President/CEO Ben Barber saying that the product reflects its experience in developing the 551 and 552 models. "With the dynamic web interface that can be remotely accessed from any smart phone, tablet or PC, and its SNMP capabilities, the 541 takes innovation to a new level."

Info: www.inovonicsbroadcast.com/product/family/monitors

Tieline Introduces New MPX Codecs

Tieline will unveil two codecs at the NAB Show.

The MPX I and MPX II offer composite FM multiplex solutions for real-time network distribution of FM-MPX or MicroMPX (µMPX) signals to transmitter sites, the company said.

It noted that sending "transmission-ready" FM composite signals from the studio allows stations to keep audio processing and RDS gear at the studio, which it says can save money and operating costs. "Composite MPX over IP signals can be easily replicated and distributed using multicast and multi-unicast technologies and take advantage of rock solid redundancy features like redundant streaming, RIST, FEC and automated SD card file failover."

"The MPX I is ideal for transmitting a composite STL signal from a single station with return monitoring, whereas the Tieline MPX II can transport two discrete composite FM-MPX signals from the studio to transmitters with return monitoring."

The products will ship later this year. Both support analog MPX on BNC, MPX over AES192, and multipoint signal distribution, to deliver composite encoder and decoder solutions for various applications.

"The MPX I and MPX II support sending the full uncompressed FM signal, or high-quality compressed µMPX at much lower bit rates. An optional satellite tuner card with MPEG-TS and MPE support can receive DVB-S or DVB-S2 signals."

The announcement was made by VP Sales APAC & EMEA Charlie Gawley. "By supporting both analog and digital composite MPX signals, broadcasters can transition from analog to digital exciters over time and maximize the value of their MPX investment," he said.

Info: http://tieline.com

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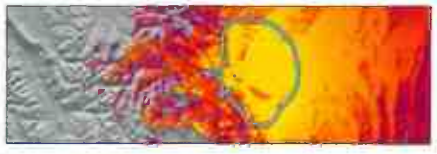

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