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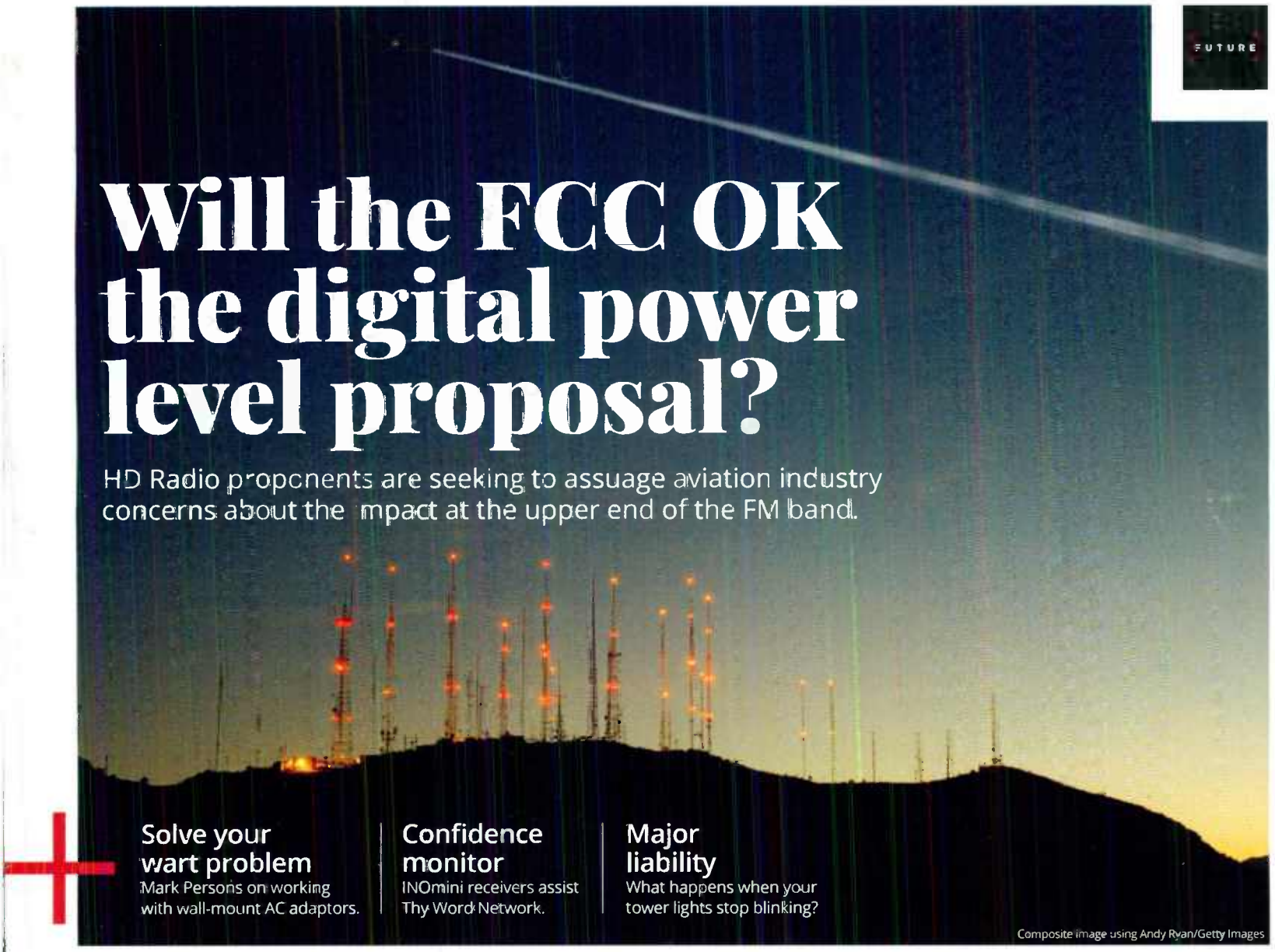
FUTURE

Will the FCC OK the digital power level proposal?

HD Radio proponents are seeking to assuage aviation industry concerns about the impact at the upper end of the FM band.



Solve your wart problem
Mark Persons on working with wall-mount AC adaptors.

Confidence monitor
INOmini receivers assist Thy Word Network.

Major liability
What happens when your tower lights stop blinking?

Composite image using Andy Ryan/Getty Images

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A DIY sampler

Some of our most popular articles feed the "maker instinct"

Paul McLane
Editor in Chief

Over the years we've published many do-it-yourself projects. When I look at data about our website traffic, it becomes evident that you enjoy this kind of article and that these stories remain popular for years after they are posted.

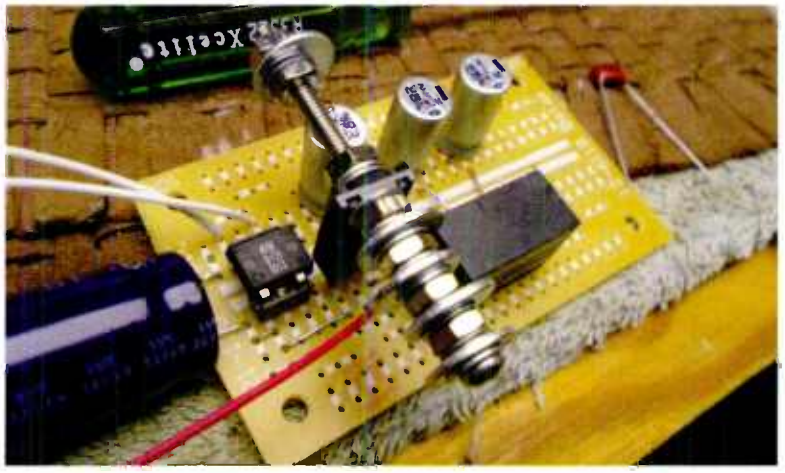
As my friend and colleague Buc Fitch once wrote of his fellow engineers: "It seems almost all of us in the profession possess that 'maker instinct.'"

Some earlier Radio World project stories unfortunately lost their photos in a website migration years ago. If you spot a project story that needs its photos restored, let me know at *radioworld@futurenet.com*.

But I thought I'd share a sampling of more recent articles in this vein that you might wish to revisit or may have missed. Ideas for more are always welcome!

- Michael Baldauf has been sending us delightful articles in the past year or so. In August he checked in with a project to build a sound effects "button box" around an Adafruit Audio FX Sound Board.

  "If you're like me, a little project that's mostly for fun can also serve as stress therapy," he wrote. "This one is actually useful too." You'll find it at *http://tinyurl.com/rw-baldauf*.



An image from Buc's composite demod project.

- Even casual readers know that Buc Fitch loves to share the projects that he has on his bench. In 2022 Buc described building a home-brew composite demodulator to turn baseband into discrete left and right

  "Not only is [it] useful as a confidence check and troubleshooting aid, but in the age of FM translators for struggling AMs, the convenience of having discrete left and right at the transmitter site facilitates separate processing for the mono AM and stereo FM translator." Check it out at *http://tinyurl.com/rw-fitch*.

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Two years prior, Buc provided an easy solution to an everyday engineering problem by showing us how to build an unbalanced-to-balanced adaptor. That one is at *http://tinyurl.com/rw-fitch-2*.

- In 2014 Dana Puopolo helped readers build a simple active transformer. "Here is a circuit that will both match levels and impedances," he wrote. "It's very simple — just a dual opamp IC, four capacitors and seven resistors — yet versatile." He described it at *http://tinyurl.com/rw-puopolo*.

- The Workbench column by John Bisset often features the good ideas of Frank Hertel. In 2021 Frank laid out how to build a dimmer circuit for an LED fixture for your shop or workbench.

  "Frank decided on the ever-so-handy 555 Timer IC, which was configured as an adjustable duty cycle square wave generator," John wrote. Read the rest at *http://tinyurl.com/rw-bisset-2*.

- During the pandemic, Curt Yengst wrote "My Vacuum Tube Headphone Amp Project," prompted by reading a book by Merlin Blencowe about designing high-fidelity tube preamps that his wife had given him. "Could I build a working vacuum tube headphone amp with only the parts I had on hand," he wondered. He did, and you can read his article about it at *http://tinyurl.com/rw-yengst*.

Above
The late Curt Yengst described how to build this vacuum tube headphone amp.

Curt died less than two years later, only 52 years old. He literally was buried with a tweaker in his hand, placed there by his youngest child, age 10, who would often "borrow" his tools to replace batteries in toys.

- And Mark Persons was thinking about this very subject in 2017, when he wrote: "Some of us still do create solutions by hand, even in this plug'n'play world." His article was less about a particular project and more a review of his experiences at "pulling apart and putting together." Check that out at *http://tinyurl.com/rw-persons*.

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Writer

Randy J. Stine

Radio World's lead news contributor wrote about common FCC enforcement triggers in the Jan. 3 issue.

Aviation concerns slow digital power boost proposal

Xperi and NAB hope a compromise will keep their proposal aloft

Supporters of a proposal to allow more FM HD Radio stations to raise digital power and use asymmetric sidebands are hoping that an exception for 107.9 MHz will allay concerns in the aviation industry.

Xperi, the developer of HD Radio, and the National Association of Broadcasters had asked the FCC to allow more stations to increase digital power over the currently authorized digital ERP of -14 dBc, without separate authorization. The goal is to improve digital FM coverage in mobile environments as well as building penetration.

If more stations adopt HD Radio, Xperi and NAB wrote, transmission equipment manufacturers will continue to invest in the development of equipment, reducing costs and expanding the ability of smaller broadcasters to afford the conversion to HD Radio.

Last summer the commission, in a notice of proposed rulemaking, indicated tentative approval of the change and asked for public comment.

But the effort suffered a setback when the Aerospace Industry Association and the Air Line Pilots Association International expressed concern about the possibility of interference between HD Radio stations at 107.9 MHz and the adjacent 108.0–117.975 MHz used by Aeronautical Radio Navigation Services.

The supporters subsequently offered a compromise of sorts, according to people familiar with the issue: Perhaps the changes should be enacted, but FM stations at 107.9 that wish to implement higher power would still need experimental authorizations.

Xperi and NAB are hoping this will provide enough assurance to the FCC to allow stations on the rest of the band to proceed.

More power

The main proposed change is to the methodology for determining a digital FM station's maximum allowable power. It would permit more stations to increase digital FM power up to -10 dBc, or 10% of analog power, without special authorization.

How to handle so-called superpowered FM stations is also one of the questions being discussed; several commenters mentioned potential use cases and procedures that the FCC could consider in its final rules. Many commenters agreed that such stations seeking to increase digital power may still need to request

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Read the Comments
At *www.fcc.gov/ecfs/search/search-filings*, enter 22-405 in the Proceedings field.

authorization if they qualify under the new methodology. Some commenters suggested that superpowered FM stations would only qualify if they are properly spaced from first-adjacent facilities.

The NPRM also would allow FM digital stations to operate with asymmetric sideband power levels. The idea was originally pitched by Xperi, NAB and NPR; the FCC subsequently merged it with the first proposal.

There are approximately 2,600 FM radio stations using HD Radio in the U.S., according to Xperi.

Broadcast groups including iHeartMedia, Audacy, Cumulus Media, Educational Media Foundation and NPR have expressed support for many of the proposed changes. REC Networks too has been supportive of many of them and has offered additional ideas of its own for the commission to consider.

Comments on the FCC's "Modifying Rules for FM Terrestrial Digital Audio Broadcasting Systems" (Docket 22-405) can be reviewed online at the FCC's website.

Aviation concerns

The Aerospace Industries Association said it had identified several locations where licensed FM stations at the top of the band are near airports with active aviation navigation aids.

The Air Line Pilots Association International represents the safety interests of 75,000 pilots flying for 43 airlines in the United States and Canada. The union told the commission that it worries about potential interference on navigation systems in the Aeronautical Radio Navigation Service band, used for navigation and landing systems essential for safety of flight, such as landing during low-visibility conditions at night and during inclement weather.

"Interference from FM digital broadcasting at the upper end of the 88–108 MHz band that affects the operations of these aviation systems would present a significant safety hazard and would disrupt aviation operations by delaying, diverting and canceling potentially hundreds or thousands of flights," the pilots union told the FCC.

ALPA asked the commission to work with the National Telecommunications and Information Administration and Federal Aviation Administration to analyze the risk to aviation. It asked the FCC to consider limitations on the upper part of the FM band and in the use of digital upper sideband and total power of stations at 107.9 MHz.

A pause at 107.9?

NAB told the FCC that it was not aware of any reports of interference to navigational aid receivers from FM digital radio transmissions since stations began operating digital facilities. But Xperi and NAB said broadcasters take these issues seriously and were engaged in "constructive dialogue" with aviation and aerospace stakeholders.

NAB and Xperi last fall asked the FCC to consider moving ahead while creating special rules or a temporary pause for stations that operate at 107.9 MHz while avionics interference investigations are performed.

"To further ensure that aeronautical radionavigation services are protected from potential interference, the commenters submit that digital FM radio stations operating on 107.9 MHz could be required to request experimental authorization from the commission when seeking to increase power levels pursuant to the updated power level formula proposed in the NPRM," Xperi and NAB wrote.

The aviation groups say further testing is needed to assure that power increases for FM stations on 107.9 would not interfere with nearby instrument approaches on runways using a 108.1 localizer frequency. NAB and Xperi told the commission they support such testing; and NAB told the FCC it would report back on any concrete results arising from test efforts. Such testing involving the radio and aviation industries could take several months, NAB said.

Meanwhile Xperi and NAB say the public interest would not be served by delaying the change for stations on the other 99 designated FM channels from 88.1 to 107.7 MHz.

"This approach will bring the benefits of enhanced service under the proposed power formula to as many listeners as possible as rapidly as possible," they wrote.

Apparent caution

Some observers told Radio World that the FCC is probably proceeding cautiously given public reaction to a separate story that made headlines in 2021.

The aviation industry at that time raised concerns that new 5G wireless signals potentially could interfere with airplane altimeters, leading to disruptions at some U.S. airports.

Subsequent studies concluded that 5G signals did not interfere with avionics. The FAA and FCC eventually came to an agreement that 5G signals in the C-band were not interrupting aeronautical navigational devices. However, the public infighting between the wireless carriers and aviation industry garnered a lot of media attention.

"The aviation and FAA folks are very nervous about any new RF service since the debacle with the 5G airport issues," one source told Radio World in an email. "Now any new service or new application is getting a new level of scrutiny."

One broadcast engineering source pointed out that FM IBOC has been authorized since 2002 and said the aviation sector had missed opportunities to comment in the three prior NPRMs that led to the 2002, 2007 and 2010 IBOC orders.

"FM IBOC has been authorized and in use for 22 years," this person said. "Elevated IBOC operations at -10 dBc have been authorized and in use for 14 years. Certainly let's examine the issue. Everyone agrees safety is important. But it is also important to note that FM IBOC and the aviation industry have coexisted peacefully for nearly a quarter of a century."

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Codecs must continue to adapt

Gladding expects more multichannel support and further integration into other platforms

Andrew Gladding is a radio broadcast engineer, interviewer, DJ and music producer. He is chief engineer for Salem Media in New York, which operates WMCA(AM) and WNYM(AM), as well as the chief of WRHU(FM) at Hofstra University and an adjunct instructor there.

This is an excerpt of an interview in the ebook "Trends in Codecs 2024." Find it at *radioworld.com/ebooks*.

Above
Andy Gladding on a visit to San Francisco's Hyde Street Studios.

How will the development of virtualization and of software-integrated air chains change how engineers deploy codecs?

Andy Gladding: As broadcast hardware becomes more soft platform dependent, codec solutions have to follow suit. Codec packages that can live on PC devices and seamlessly integrate with other hardware audio products will expand reach and access for a variety of broadcast opportunities. This will also open new opportunities for collaboration within station frameworks.

Given advances in audio coding and wireless IP, what improvements can yet be made in the quality of audio from the field?

Gladding: AAC+ seems to be the best codec for transport in terms of quality and overhead. The bit usage is lower than standard streaming codecs, while the format can support higher-quality stereo audio streams.

I would like to see more multichannel audio codec packages integrated into software and hardware solutions. This will make point-to-point audio transport easier between facilities that have greater technical demands. Multi-channel transport options would support a range of services, from traditional STL-type utilities to IFB, backhaul of multiple sat receivers from TX sites to the studio and general network audio sharing.

It would also be nice to see codec platforms that can service multiple locations within the same device or software suite.

How will the growing use of the cloud influence how codecs are deployed?

Gladding: Cloud-based audio transport is a real game-changer for our industry. Radio and TV stations are no longer tied to costly P2P telephony services such as ISDN, which have metered channels. Cloud-based transport also encourages collaboration between organizations at great distances, meaning international stations can seamlessly integrate and share production. The opportunities are endless when it comes to cloud-based audio.

What tools are available for sending audio to multiple locations at once?

Gladding: I have been experimenting with DIY Icecast servers recently and have been getting some pretty terrific results. Icecast and Shoutcast servers are relatively easy to set up and can operate at various levels of sonic quality with minimal machine overhead. Both hardware and software encoders and decoders can interface with Icecast and Shoutcast, which can open up new avenues of transport that can handle a variety of user needs. An Icecast server can serve as a great listen line, which can eliminate the need for POTS services and hybrids, reducing overhead. Icecast can also be a practical and inexpensive method to feed multiple decoders at transmitter sites for backup STLs, as they can be set up on a variety of networks, including MPLS and point-to-point connections. This eliminates the need for proprietary point-to-point encoder and decoder hardware to service each location.

> **I have been experimenting with DIY Icecast servers recently and have been getting some pretty terrific results.**

And how do you think codec design will change in the next five years?

Gladding: I anticipate seeing codec solutions more widely deployed onto PC and Linux platforms, with greater direct integration into radio automation and processing / DSP software packages. Virtualization of codecs will be extremely powerful, especially as cloud-based automation and containerized audio becomes more popular.

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A place for every part ...

... and every part in its place

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.

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

I had the pleasure of sharing Workbench tips with the attendees of a webinar put on by the Society of Broadcast Engineers. With the sponsorship of SCMS (*www.scmsinc.com*) the webinar was free, so the next time you deal with SCMS, please express your appreciation for their help in educating engineers and their support of the society. You can watch the webinar on demand. Visit *sbe.org/education/webinars-by-sbe/* and click "On-Demand Webinars," then scroll to "Free Webinars."

When I shared a tip about organizing the parts in your workshop, I showed Fig. 1. Dave Morgan, CBRE, director of engineering for Sinclair Telecable in Norfolk, saw something eerily familiar. He shares Fig. 2, a "master" parts depot at a transmitter site. Similar shelving, bins and methodologies!

Dave admits that his bins are a work in progress, as his team sorts and consolidates parts from various transmitter sites accumulated over decades. This particular site has the space for a "master" parts depot as well as equipment storage.

Given the disappearance of local electronics parts stores, the diversity of parts in this depot amazes Dave. The assortment includes resistors, transistors, ICs, terminals, fasteners, indicator bulbs and wire nuts. Old electrolytic capacitors were tossed due to age, but there are plenty of fresher ones on hand from recent repair projects.

Dave asked us to share with you his system for sorting and storing parts like small capacitors, resistors, transistors, diodes and ICs. It can be awkward to store through-hole components with long leads in the tiny plastic bins that come in a multi-bin cabinet. And carrying them en masse from one site to another is a challenge.

Dave uses Ziploc or similar brand plastic parts bags that come from the supply houses. They fit perfectly inside a Akro-Mils shelf bin (part number 30150, available in various colors and measuring 7 inches wide by 4 inches tall by 12 inches deep). Plastic dividers are part number 40150. The bin can be seen in Fig. 3.

Dave organizes parts in ascending numerical order by value and arranges

Top
Fig. 1: Our image from the SBE Workbench webinar.

Middle
Fig. 2: Dave Morgan's "master" parts depot.

Bottom
Fig. 3: There's even a bin for small parts.

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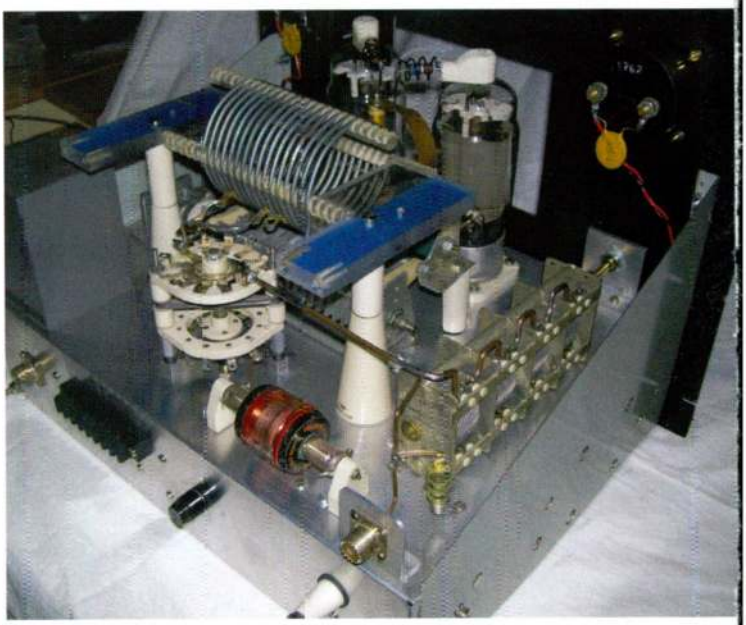


them like an old-fashioned library card catalog. For electrolytic capacitors there are many bags for a certain capacitance, then sorted by voltage rating, form factor (radial vs. axial), bipolar/non-polar and Audio Grade. Dave has yet to sort through other capacitor types like ceramic and film.

Resistors are sorted into bins for the various wattages, then bagged according to type (e.g. carbon film, metal film) and tolerance. Wire-wound resistors are kept in separate bins.

The plastic baggies can be reused; just apply new labels atop the old ones, or scratch through the old markings with a Sharpie or similar brand marker and write in the available white space. New bags are available from Amazon.

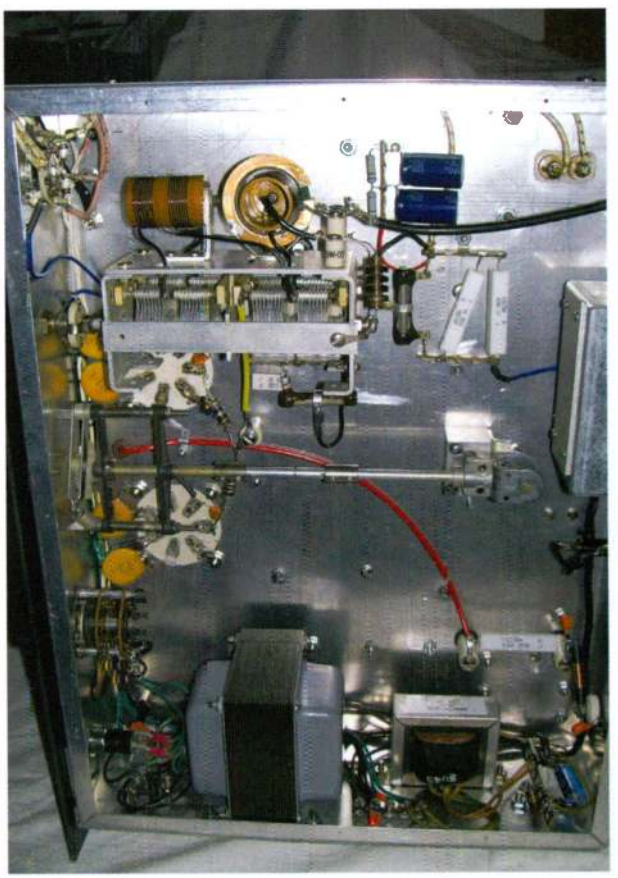
A benefit, aside from getting organized, is that the bins are comparatively easy to transport from one site to another. If an older transmitter needs to be recapped or have carbon composition resistors replaced as they age, you just take whichever bins are needed and go.

So what about ICs, transistors and semiconductors? You'll have to wait for the next issue's Workbench to discover how Dave handles those components.

Above left
Fig. 4: Clifford's 500-watt transmitter.

Above right
Fig. 5: A look behind the front panel.

Right
Fig. 6: A view of the work from underneath. Note the neat construction techniques.



Power cables in color

For a studio upgrade project, Ray Lewis at WHJU(FM) in Conyers, Ga., found that EIA AC power cables are available on Amazon in a variety of colors including red, blue, green, black and white.

Ray is using the color coding when routing to individual uninterruptible power supplies. During an outage, this code for the various UPS units will be helpful and can save time; he'll know what's plugged in where.

On Amazon, enter "Cable Leader universal power cord — colored" for a listing of cable types, lengths and wire gauges.

Home-brew transmitter

Clifford Kotchka is a retired television engineer and a ham radio enthusiast. Figures 4, 5 and 6 show a variety of views of the home-built 500-watt Class C power amplifier, using 813s, that he constructed. Beautiful work. See what you can do in retirement?

World Radio History

Writer
Randy J. Stine

The FCC keeps radio market caps in place

Completing 2018 review, it also rejects NAB's pleas to redefine radio's marketplace

The long-delayed FCC review of broadcast ownership rules for 2018 finally is in the books. The commission in December said it would keep its local limits and caps for radio broadcasters. It also turned aside arguments seeking more deregulation and a different approach to conducting quadrennial reviews.

The FCC voted 3–2 along party lines to complete the review right before Christmas.

In each of the largest radio markets, a licensee can own up to eight commercial radio stations, but a subcap limits a licensee to owning no more than five on each band (FM/AM) in the market. The cap shrinks as market size decreases.

The commission now has retained this rule. It adopted only a minor modification, making permanent an interim contour-overlap methodology that has been used for the past 20 years to determine ownership limits in areas outside Nielsen Audio Metro markets and in Puerto Rico.

The 2018 process had been delayed by, or took place against the backdrop of, numerous factors including litigation over earlier rulings, a Supreme Court case, the pandemic, a second comment period and the lack of a majority on the commission. In September, responding to a plea from the NAB, a federal appeals court gave the FCC 90 days to complete the review.

The NAB had asked the FCC either to repeal the radio rule entirely, or abolish AM radio ownership caps while raising FM limits in big markets and eliminating them in smaller ones.

Tom Williams/Getty Images

Below
FCC Chairwoman Jessica Rosenworcel in a 2022 photo at the National Press Club.

iHeartMedia had proposed eliminating ownership limits on AM stations while retaining the restrictions on FMs. Some broadcasters, including Townsquare Media and Midwest Communications, sought further relaxation to allow broadcasters to "create greater scale" to compete with digital media.

But deregulatory proposals were not convincing to the new Democratic majority on the commission. "Ultimately, we find that allowing one entity to own more radio stations in a market than currently permitted would harm competition without achieving the benefit sought by some of enabling station owners to compete more effectively with social media companies and national advertising platforms like Google and Facebook," the FCC stated, calling the rule a backstop against further "excessive" consolidation.

The FCC's "market definition" remains unchanged after the 2018 review. "We continue to find that the relevant market to consider for purposes of the Local Radio Ownership Rule is the radio listening market."

Broadcasters have been arguing for years that this policy is badly outdated and detrimental to broadcasters and their listeners. But the FCC stated: "[A]lthough the broader marketplace for the delivery of audio programming includes satellite and online audio sources, along with traditional broadcast radio, there are significant differences in the availability, reach, consumer engagement and cost of these services, such that they deliver different value propositions to consumers. Significantly, of the various options available in the broader audio marketplace, generally speaking, only terrestrial broadcast radio both is available without a paid subscription and does not require access to internet service."

Ultimately, the FCC wrote, "We agree with iHeart that 'competitive pressures across platforms within the audio ecosystem are not determinative of what is the relevant market' for purposes of our Local Radio Ownership Rule. We reject NAB's suggestion that the relevant competition is for 'the public's attention and time.'"

The review for 2022 is underway. The FCC took public comments for its 2022 process last winter. The NAB described that as a waste of time under the circumstances.

World Radio History

Writer

Floyd Turner
CBRE
Chief Engineer, Thy Word Christian Radio

Got a Note?
Tell us about your own clever application of a radio technology product. Email *radioworld@futurenet.com.*

A confidence monitor for Thy Word Network

INOmini receivers assist the author in monitoring his network

With eight different signals on the air plus two internet streams, I was looking for a way to have a simple one-look snapshot of everything. Inovonics gave me a way to make it happen.

The project started with a conversation with my friend Ben Barber from Inovonics at an NRB convention in Dallas back in 2021. He was showing their INOmini FM/RDS Web-enabled FM receiver for remote signal monitoring.

It caught my attention because it would not only monitor the on-air signal but also stream that audio out over the internet. With our stations scattered around a three-state area, I began to think about a way to keep both an eye and an ear on all the stations from our main studio.

We have remote controls that we check daily and that contact us if anything goes wrong; but I wanted something that would give me a one-look check on them all.

My confidence monitor idea began to take shape.

I purchased an INOmni 635 for each of my seven FM stations. I already had a Inovonics 525N Modulation Monitor running at my AM station and two Inovonics 610 internet radio monitors watching our streaming signals. Then I set up a standalone PC running 16 GB of memory with a large monitor so I could run multiple instances of Mozilla browser at the same time.

The photos show the result. Each station has its own browser window; and the layout is saved so it automatically loads on startup. It sits in the hallway alongside our TOC racks, and at a glance we can see if all is well.

I have two stations that will need upgraded internet before they can be used reliably, so they are absent from the screen now (will probably go to dual monitors then, too).

A simple mouse click allows us to monitor the audio through a speakers running on the PC sound card, and alarms are available to text us if the audio is low or gone. We also have the PC online with remote desktop software so I can log in with my phone anytime I want to check the system overall health. It is much quicker than logging in to multiple stations!

Our confidence monitor has proven to be a great asset to our operation. While not inexpensive, when it is used in conjunction with our remote control systems, the redundancy factor is helpful ... two is one and one is none!

The author has worked full-time in broadcast engineering since 1984 and is a Senior Member of SBE. He feeds and cares for AM and FM stations from Idaho to Ohio while living in southern Indiana. He is chief engineer, cook and bottle washer for Thy Word Network Christian Radio, which has eight stations in Indiana, Kentucky and Illinois.

World Radio History

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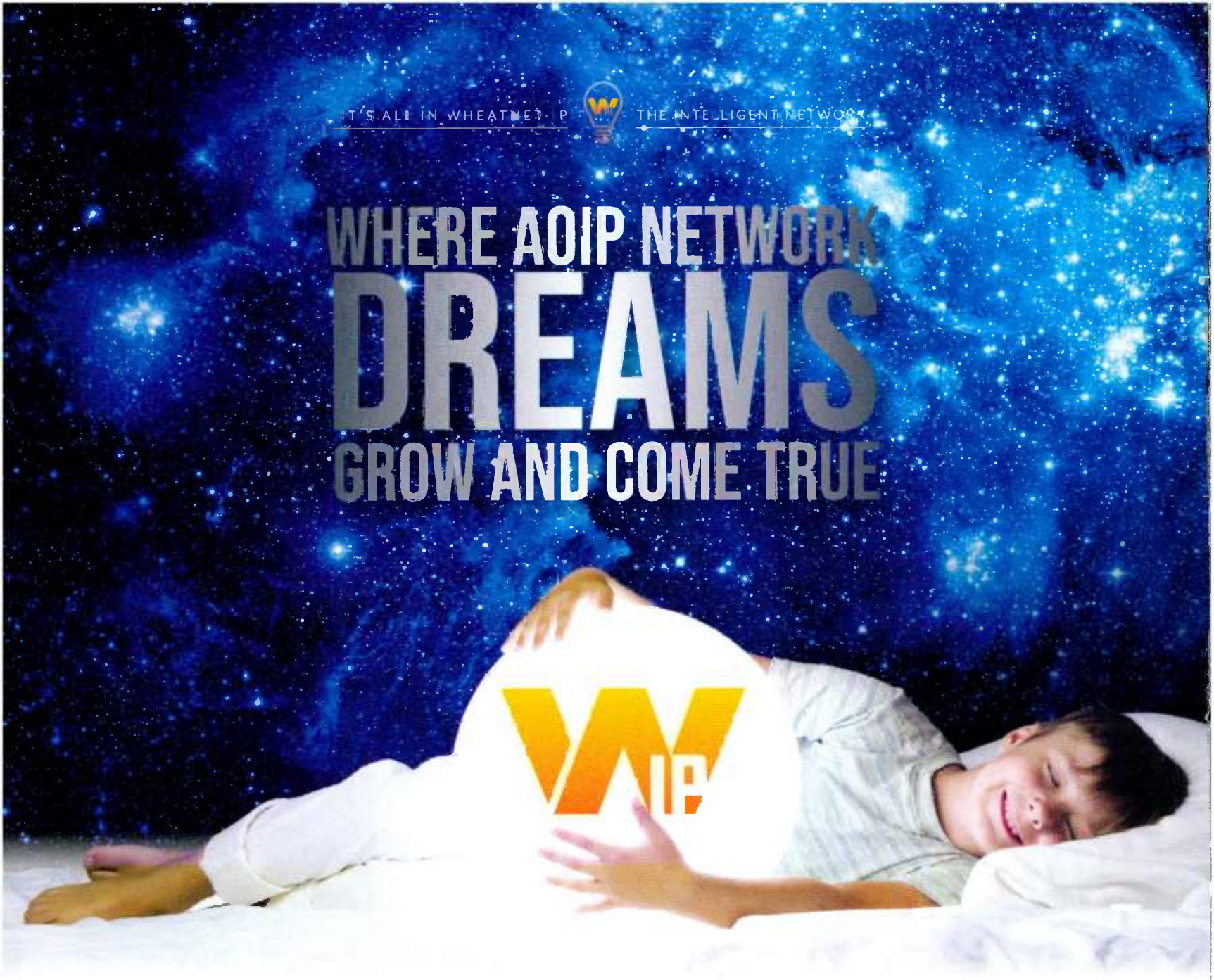

As an engineer, you know how centralized network management is a single-point-of-failure waiting to happen. Distributing network intelligence throughout to every IP point in the network is the smarter approach, because distributed networks like WheatNet-IP automatically build in redundancy - if one part of the network fails for any reason, the rest can keep on functioning. Now you can let your inner child dream on because you already have most of the networkability you need to grow with the times.

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World Radio History

Those darn wall-wart power supplies!

What to know about using these ubiquitous devices in your plant

Writer

Mark Persons

CPBE, CBNT, AMD

The author is a recipient of the John H. Battison Award for Lifetime Achievement from the Society of Broadcast Engineers. His website is *www.mwpersons.com*.

Wall-mounted AC adaptors, sometimes called wall-warts, have been a standard way of providing electricity to low-power devices since the 1970s, powering everything from clock radios to Wi-Fi routers to cell phone chargers to Alexa to electric shavers and toothbrushes. Station equipment racks are overcrowded with them. As you know, some 120 VAC outlet strips are made specifically to accommodate these supplies, which typically measure about 2 by 2 by 3 inches.

Above
Wall-wart supplies are everywhere in modern life. These Chanzon 12V 2A UL-listed 24W AC/DC switching power supply adaptors are available on Amazon.

You might not give much thought to what's inside these apparently simple problem-solvers. They started as convenient devices with a transformer to provide low-voltage AC or a transformer with diodes and capacitor for DC. In either case, they typically provide 3 to 24 volts. Fig. 1 is the schematic of a DC supply.

One real plus for equipment designers is that most of the supplies are United Laboratories-listed and have the UL logo when sold in the United States and Canada. Other countries have similar standards.

The idea here is safety. It takes some of the legal liability burden off manufacturers if their product is powered by one of these adapters that isolates the somewhat dangerous 120 VAC from their equipment.

Friend and fellow Radio World contributor Charles "Buc" Fitch authored a piece for John Bisset in the Dec. 29, 2022, Workbench column. He told of replacing a wall power supply with a switching power supply on a Sine Systems RP-8 Relay Panel to improve its reliability.

Switching power supplies

Most power supplies weigh less today but a closer look at their ratings will tell you they are capable of handling more power.

These are "switching" power supplies with dozens of parts that rectify, then chop up the result at 100 kHz or more to create the desired output voltage. Instead of 12 volts at 0.5 amperes (6 watts), one might provide 12 volts at 1 ampere (12 watts) at half the weight.

Switching supplies have DC outputs because they convert the incoming 120 VAC to well-regulated DC. This regulation helps in maintaining the desired output voltage even when the input experiences voltage spikes and brownouts. The outputs provide clean DC without 60 or 120 Hz ripple voltage that older supplies have. By ripple, I mean a slight variation in output voltage that a filter capacitor can't completely eliminate in older non-switching supplies.

Fig. 2 shows a higher-power switching power supply. I pulled the cover off so you can see the inner workings. Lots of electronics inside. This one uses the universal standard IEC (International Electromechanical Commission) three-wire power cord with ground. As you know, those cables are common to virtually all desktop and server computer systems today, not to mention most rack-mounted broadcast equipment.

Of special interest to me is the short power cord. These are a real problem-solver when trying to keep excess clutter out equipment racks. I love them!

World Radio History

The enigma

After 60+ years in broadcast engineering and 44 years in business, I am mentoring four radio broadcast engineers. One of them recently called with a problem that was difficult to troubleshoot.

It should have been simple to fix a studio on-air warning light that wouldn't come on. There was power and the lightbulb was good.

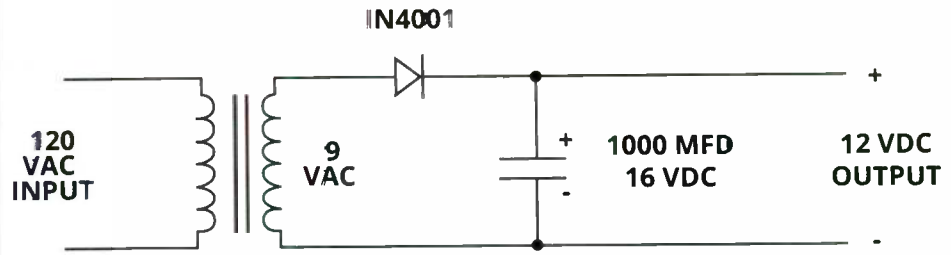
A 120 VAC light outside the studio door was wired correctly. By that I mean 120 VAC was not run through relay contacts in the studio console. Instead, a low-voltage DC control was sent to a Tyco brand SSRT-240D-10 solid-state relay in an electrical box. The relay switches 120 volts to the light.

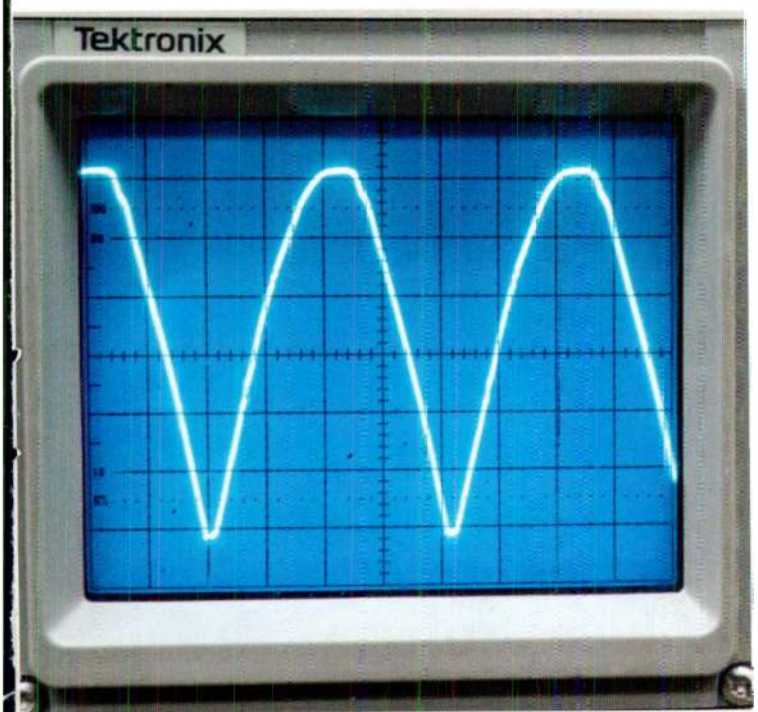
A measurement of the DC control voltage, at the solid-state relay, confirmed that it was getting more than 20 volts. The relay only needs 3 VDC at about .005 ampere of current to make it operate. That's a small fraction of a watt. A replacement solid-state relay did not solve the problem.

How could it be?

The clue was the control voltage that should have read closer to 28 volts from the traditional wall-wart unregulated 24 VDC power supply. A multimeter showed it to have more than 10 volts AC at the output too. Ouch, it should have been near zero.

As mentioned, power supplies of this older kind have a small power transformer feeding a rectifier and a capacitor to make DC with only a small amount of ripple voltage. See Fig. 3. An oscilloscope showed 33 volts peak to peak on the DC waveform when it should have been a fraction of a volt. That's it, the capacitor opened and was no longer able to smooth out the voltage to produce almost pure DC, it was pulsating DC. Electrolytic capacitors are the most common type used in this





Top
Fig. 1: Power supply schematic diagram.

Above
Fig. 2: An uncovered switching power supply.

Left
Fig. 3: An oscilloscope shows 33 volts peak to peak.

> **An oscilloscope showed 33 volts peak to peak on the DC waveform when it should have been a fraction of a volt.**

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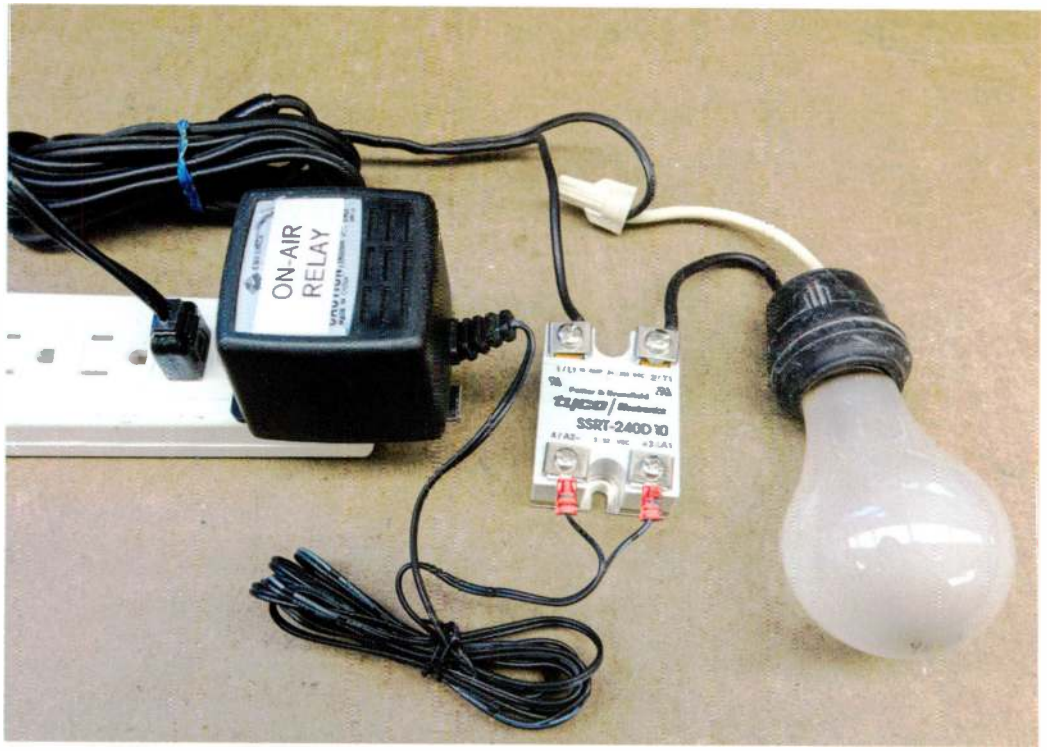

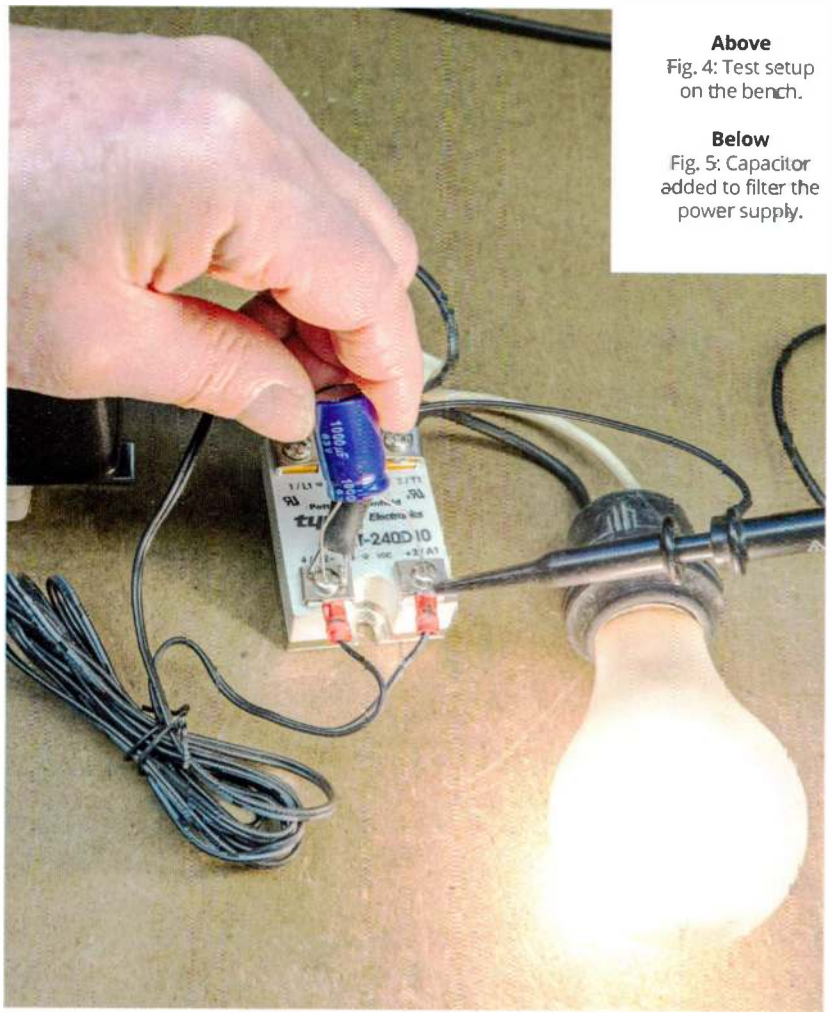

Above
Fig. 4: Test setup on the bench.

Below
Fig. 5: Capacitor added to filter the power supply.

application. They have a limited (5 to 30 year) lifespan and are bound to fail; it is just a matter of when. Capacitors, as you know, are like batteries. They store energy and release it when a circuit needs it. It might happen 60 or 120 times per second in one of these supplies. The harder they work, the shorter their lifespan. In this case it was 21 years.

Fig. 4 shows a test setup on a service bench. A 120 volt/40-watt incandescent lamp is the load, simulating the on-air light that is dark. 120 VAC power is supplied via a two-wire power cord to the solid-state relay and the wall-wart in question supplying control voltage to the relay. Fig. 5 shows a 1000 mfd capacitor being temporarily connected. The lamp lit at that point.

It is common for audio devices powered by wall-warts to develop a hum problem. Again, it is a failed filter capacitor. The life of capacitors in this service is also limited because it is normal for the power supplies to run a bit warm. The warmer they are, the shorter the life of the capacitor.

Going back to Fig. 4, the photo also shows the power supply is marked to help identify it during troubleshooting. The downside is the label covered the specifications part of the transformer. The lesson is to mark everything in such a way to help everyone in the future.

Sometimes I come across a power supply with a deformed plastic case because the supply ran too hot. Even when one is working, I immediately discard or recycle so it can't cause problems in the future.

Switching power supplies are now found inside rack-mounted equipment and transmitters. I like the ability of many to switch automatically between 120 and 240 VAC

"You might not give much thought to what's inside these apparently simple problem-solvers."

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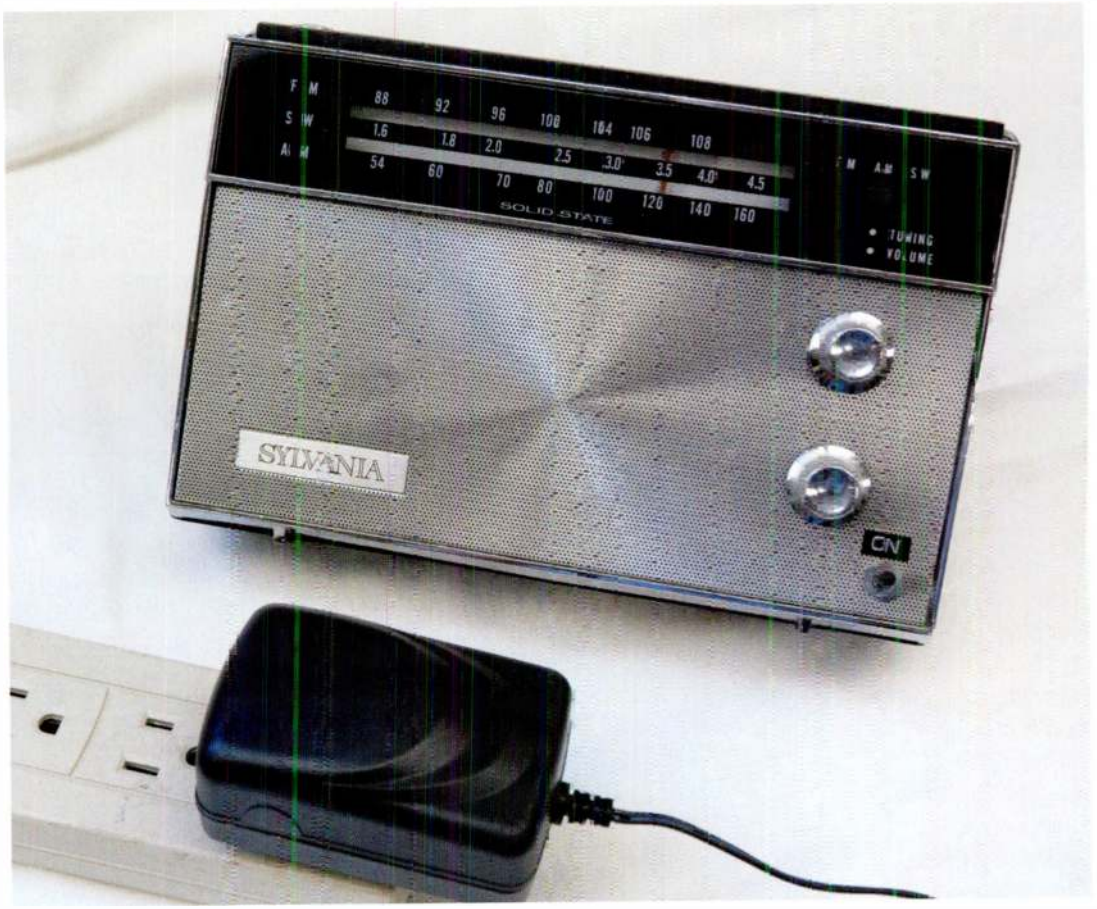

Above
Fig. 6: Testing a power supply for RF noise.

input voltages. What a change from the old days! We are in a plug-n-play world. The downside is that repairing a switching power supply is beyond the ability of most technicians. Repair of a traditional "linear" power supply with a transformer, diodes and capacitor is easy and has been standard fare for most engineers over the years inside of a piece of equipment. No need to throw those out when a one-hour repair plus $10 in parts might solve the problem.

RF noise

Regarding switching power supplies, I recommend you do a quick test at the time of installation.

Tune a portable AM receiver to an open spot on the dial and put it near a power supply. Connect and disconnect the supply from 120 VAC. You may hear noise while the switching power supply is running. If so, that is a problem! Many switching power supplies emit objectionable RF noise. I avoid using them when possible and go for cleaner ones to reduce noise that could contaminate a receive signal, such as off-air monitoring of an AM broadcast station. That could include an EAS monitoring assignment.

Most switching power supplies comply with FCC rules for unintentional RF radiation and/or conducted noise to the power line, but there is a cumulative effect from the millions in use. It is my observation that the noise floor, especially in the AM broadcast band, has risen 10 dB in the past 15 years. The change is accelerating as more and more switching power supplies are put into operation. This is a noise source that spells even more trouble for the AM band!

Ham radio operators are often the first to hear unwanted radio noise because they receive down to the noise level in everyday communications. Hams have found Palomar Engineers at *https://palomar-engineers.com/* has a variety of ferrite toroid rings that can keep unwanted RF from traveling down power cables and into the air.

I hope the knowledge related in this article will help you think through making good engineering decisions.

Comment on this or any article. Write to radioworld@futurenet.com.

World Radio History

Writer

Ken Deutsch

The author says he had a brief radio career but no one noticed.

Larry Walk: 60 years of oom-pahs and smiles

He has been playing polka music on the radio since LBJ was president

Recording artists Jimmy Sturr & His Orchestra, the Brave Combo and Walter Ostanek will probably never come anywhere near the Billboard Hot 100, but collectively they have sold millions of records and won dozens of Grammys.

However, because these stars are all in the polka category, you *will* hear them weekly on WPIC(AM) in Sharon, Pa., and WRQX(AM), Salem, Ohio.

Both are Cumulus stations, and both carry shows hosted by Larry Walk, who has been playing exclusively polka music for 60 years.

"I grew up in Youngstown, Ohio," said Walk, who was born George P. Lesnansky. "My first exposure to polkas was hearing local bands playing at church picnics. I'm not musically inclined myself, but I always enjoyed that type of music because it was so happy."

As a young man, Walk felt there should be more polkas on the air, so in 1964 he went to WNIO(AM) in Niles, Ohio, and applied for a job. The manager at the time, Al DiGellio, told him that if he could sell his own ads for a polka show he could have the air time.

"I went out that afternoon and by the time I got back to the station I had four advertisers for the show," said Walk. "I started out with a half-hour polka show, but within the first month I had so many advertisers that I was upped to an hour a week, and eventually three hours."

The shows that are heard on an Ohio station every Saturday and a Pennsylvania station every Sunday are not the same.

"I built my own studio called Polkaland in my home and I produce both shows from there," said Walk. "There's almost no duplication of music as the shows are separate. It's three hours weekly on WPIC and three hours on WRQX."

Now 81, Larry Walk long ago established his own way of working.

"In the old days I used turntables and cart machines, of course. Now I use MiniDiscs to hold all my commercials," he said.

"I have an hour of commercials on each disc in the order they are to play. If one MiniDisc fails, I pop it out and put in another one. The polka music is all on CD and I have three carousels loaded up so I can play any of 900 CDs with just

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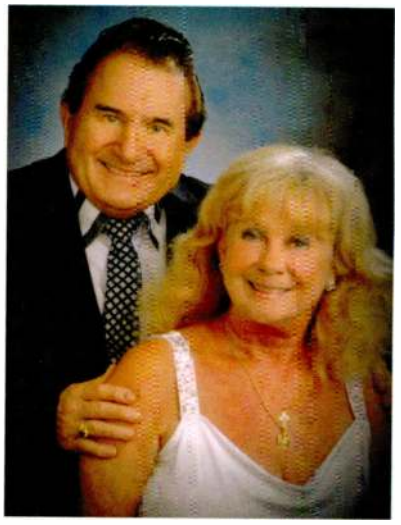

Above
The Polkaland studio.

Above right
Larry Walk with his late wife Diana in an undated photo. She died in 2015.

> **The happiness factor in every song is what separates polkas from other types of music. People need that today for sure.**

the touch of a button. We probably have close to 2,000 polka CDs in our whole collection."

Live events have also been a part of Walk's "all-polka-all-the-time" lifestyle.

"The first live event I ever held," he said, "was at Avon Oaks Ballroom." That's in Girard, Ohio and still in operation. Then he moved to Idora Park in Youngstown.

"That's where we drew the biggest crowds, as people would come in from all over, including busloads of fans from Canada. At Idora it was a 12-hour festival with two national bands and two regional bands. I always believed in keeping our admission prices low to draw the biggest audience. Idora was an amusement park and the kids could go on the rides for a while and then gather around to watch the bands." It closed in 1984.

A big part of Walk's organization for many years was his wife, Diana. They married in 2004 and she worked by his side on the air and at live events until she died at age 69 in 2015.

"She had a heart of gold," said Walk. "She loved polkas and would light up a room with her smile. In fact, I have kept her voice on some of our recorded commercials as a tribute to Diana."

Walk no longer has to worry about hitting the streets to sell the weekly ads to support his show, as most of his advertisers have been with him for 30 years.

"That tells me they must be getting results because these clients can not afford to throw away money," said Walk. "We run about 60 ads a week, and in the summer we pick up seasonal ads, too. Before I retired I was a teacher and I used to go out and sell ads after school until the stores closed around 9 p.m. That's when I got sad because I had to stop selling at that point."

Walk was inducted into the International Polka Association Hall of Fame in 1994. He emcees a live annual event called Simply Slavic that celebrates the area's Slavic communities.

The influence of polkas on our society is waning. The Grammys dropped the category from its awards after 2008, perhaps influenced by the fact that Jimmy Sturr had won 18 out of 24 annual awards.

"As time moves on, mixed marriages have diluted the importance of traditional ethnic foods and music," said Walk. "But polkas are happy music. I call it the musical anti-depressant. Over the years we put on live shows, we always hired security guys, but we never had to use them. They never earned their money because there were never any fights or even a disagreement among the attendees.

"The happiness factor in every song is what separates polkas from other types of music. People need that today for sure. I'll be celebrating 60 years of playing polkas in May, and I'll keep going as long as the good Lord gives me the health to do so."

World Radio History

Let's do this thing

Climbers ascend a tower in the Cayman Islands during a project to combine four FM signals into one antenna for Compass Media.

The job features a Shively 6828-4-CF four-bay antenna with two 2640-04(4)-1/1 FB balanced combiner modules used in conjunction with Shively modules from a prior station combiner.

"The Shively 6828 antenna array was used for its robust design and anti-corrosion properties," said Chris Steckino of Shively Labs.

"The balanced combiner module was chosen to handle the necessary power for the TPO. The 2604 four-pole is a proven design to fulfill its 'plug-and-play' ease of installation with excellent insertion losses, isolation and frequency response."

The new antenna is fed by two new Nautel VS2.5-EIA transmitters.

Mark Lee was Compass Media's technical liaison. Bob Smith of RM Smith Associates of Austin, Texas, developed the concept and installed the system. Steve Vanni of Technet Systems Group assisted with design and supplied the Shively hardware, Nautel transmitters and all materials.

Smith and Vanni have a long history of work for Compass and even helped write the procedures and forms used by the government to grant approval for broadcast licenses.

Steckino did the technical verification and testing of the antenna and combiner system on site.

The project was completed in May 2023. Read this and other project stories in the ebook "Great New RF Installs" at *radioworld.com/ebooks*.

— Paul McLane

Half-width, single-channel device shown in optional twin rackmount. Single rackmount available.

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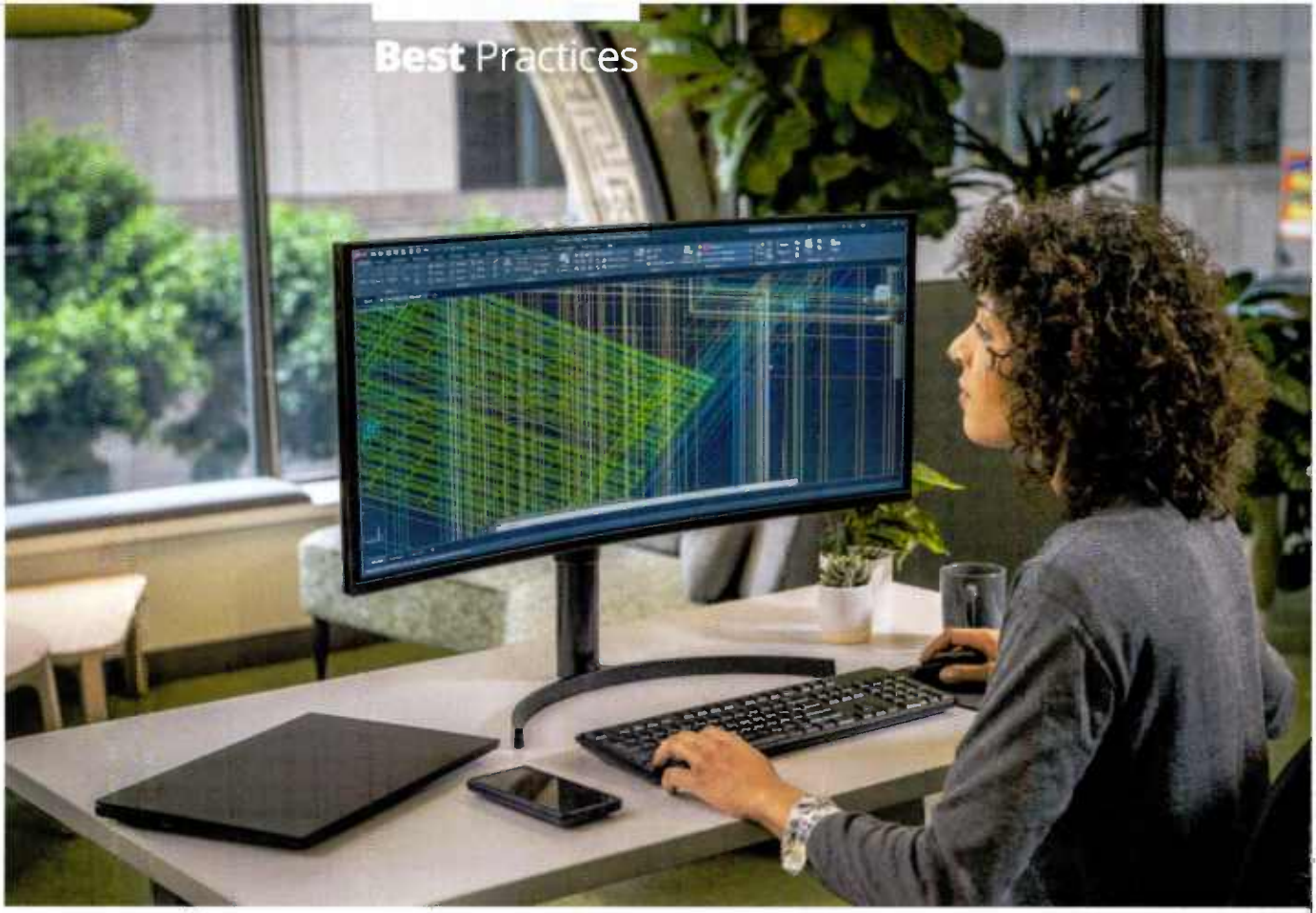
Writer

David Bialik

Consultant and longtime engineer is former director of stream operations for CBS Radio and Entercom.



Above
A promotional image on X for Autodesk AutoCAD.

Document, document, and then document some more

Help your successors, and help yourself

One thing I rarely hear engineers at small facilities talk about is documentation.

Managers of large facilities live on their documentation systems. At smaller plants, though, some engineers seem to think they can protect their job security by withholding documentation. And some complain that creating documentation is a waste of time.

They are wrong.

Good documentation allows the staff of a facility to resolve issues in an expedited manner.

What do I mean by documentation?

Most engineers will use a good computer-aided design program such as AutoCAD or WireCAD. Yes, a good one will be expensive. Look at it as an insurance policy.

Some use capable diagramming software such as Visio or Simple Wires. Their files can serve as a schematic to your facility, showing equipment, wire numbers, racks and rooms.

They can illustrate signal flow and document the workflow. You can obtain libraries of equipment that highlight all the connections. Sometimes the libraries are available from the product support pages or sold by third parties.

Knowing "which" cable in a large bundle is terminated "where" is valuable. Knowing which connector and pins is indispensable!

In today's IP-centric world, most cables are Category-5 or Cat-6, terminated with RJ-45s. But

World Radio History

then you need to know if it is required to be STP (shielded) or UTP (unshielded). Note this in the documentation.

I like to make notes of anything relevant to the safe and convenient operation of equipment. For example a device may need space above and below it for air flow. You or another person will appreciate such details when an emergency repair becomes necessary at an inconvenient time.

The schematics also allow you to plan an upgrade or an equipment replacement. Rack space is a commodity; planning your signal flow with smart equipment placement and the shortest cable runs will lead to a more efficient plant.

Withholding documentation is unwise and could be considered negligent. If you have to put out false traps to demonstrate that you are needed, perhaps you are not.

Good documentation systems allow engineers to take time off. Also, you can manage the inventory. For instance I like to include serial numbers in my notes.

You don't have diagramming skills? This is understandable. Then just use a good spreadsheet.

Maintain current backups of your documents, too. I usually make one before any change so I can always revert to the last "good" state if necessary. Having a bunch of printouts with pencil scratch-outs is no substitute for clean documentation.

Usually, I take my notes and save them as PDF files, representing a printed final version. Besides putting them in the documentation folders on the network, I email them to my iPhone and keep them in the Books app. This is helpful when I'm not in the facility and I get THAT CALL. I can refer to my notes and put myself in the mindset to resolve the issue.

Any good manager will appreciate good documentation. It will also be appreciated by all who follow you. This industry is small. Why be known as the guy who did not document?

Yes, I have worked with managers who did not appreciate documentation and deleted the information; but there is no excuse for being stupid.

> **"If you have to put out false traps to demonstrate that you are needed, perhaps you are not."**

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Send Resume confidentially to **Joe Emert**, VP/GM at **jemert@newvision.fm**

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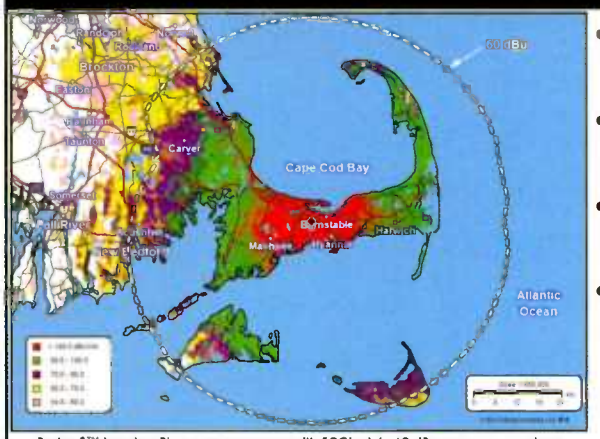

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Scott Cason
Director of Engineering, Kentucky Broadcasters Association

What happens when your lights stop blinking?

Malfunctioning obstruction lights are a major liability to the small station owner

I would like to expand on Randy Stine's article in the Jan. 3 issue "Stay on the Good Side of the FCC," in which broadcast attorneys and Alternative Broadcast Inspection Program inspectors discussed common missteps they see radio broadcasters making.

I am the ABIP inspector for Kentucky and Indiana. The question I ask that gets the most blank stares is "What happens when your tower lights stop blinking?"

Some people have a good answer: The lights are tied into the remote control, which will call out an alarm.

However, there are other people who do not have a valid answer to the question and have a huge liability on their hands just waiting for the moment.

The Federal Communications Commission defers to the Federal Aviation Administration when it comes to marking structures that may pose a hazard to air navigation. The FAA stipulates that "any failure or malfunction that lasts more than 30 minutes and affects a top light or flashing obstruction light, regardless of position, should be reported immediately by calling 877-487-6867" (see Advisory Circular AC 70/7460-1M).

One answer I get is "We check and log the condition of the lights once a day." My follow up to that is: "Fifteen minutes after your check, the top beacon goes out. How do you know?"

Another answer I receive is "My remote control will text/email on any alarms." But I have learned from experience with my own tower that a 3 a.m. text or email may well not wake me up.

The bottom line: You need a monitor system that will alert you to a failure within the 30-minute window that the FAA gives you to notify them.

If your remote control does not have a call-out feature, there are several auto-dialers on the market that will place a phone call when an alarm in the form of a dry contact closure is presented. I can recommend the one I use if you need it.

You still need to check your lights on a quarterly basis and log it. Quarterly on-site inspections of the lighting system will ensure proper operations of the alarm reporting system. Keep the logs for the required two years.

Do not depend on the alarm system to alert you to failures without checking its proper operation on a regular basis. If your tower light system is based on LEDs, there should be an alarm output for the infrared LED side as well.

If all this sounds a little complicated, and it can be, there are companies out there now that offer tower lighting as a service. They install a new LED lighting system, maintain and monitor it, all for a monthly or annual fee. If you own multiple towers across many states, this may be a viable option.

Malfunctioning tower lights are a major liability to the small station owner. Proper attention and oversite will prevent a tragedy from occurring.

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If I do a 50% crop, my magnification is 16X. If I do a 100% crop, it's 32X!

At left is a photo of one of my Nikon Z series cameras with my Canon lens. Below it are two photos I took of a 6 GHz tower-mounted STL radio/dish at my studio building in Keene, N.H. The first shows an unaided eye view at approximately 50 mm; the other is a closeup of the serial number on the dish mounting arm. This camera was handheld — no tripod!

Ira Wilner
Broadcast Engineering and Technical Services
Putney, Vt.

High-end optics

I enjoyed the photo spread by Mike Pappas, "The Nighttime Beckons," as well as Larry Langford's tip about binoculars "To Inspect Your Tower, Why Not 'Go Steady'?" [Both articles appeared in 2023; find them at *http://radioworld.com* by typing those headlines in the search tool.]

Mike and I share a passion for photography. He spared no expense to equip himself with the fine Nikon D850 DSLR camera. I stayed with the lower-cost, mostly hobby product line until now and was therefore able to hopscotch up to Nikon's flagship Z9 mirrorless and shutterless camera!

Along the way I acquired Canon's best zoom super-telephoto lens, their EF 100-400mm f/4.5-5.6L IS II USM lens, which is less expensive than the new Nikon 100-400mm S series for Nikon's mirrorless cameras. A Fringer EF-NZ adapter enables the Canon to work perfectly with Nikon Z cameras.

This brings me to the piece by Larry about using image stabilizer binoculars. Magnification of 18X is amazing but pricey. Well, if you already have cameras and lenses or know folks who do, you can make similar observations and capture them with full-resolution images at the same time.

How to submit

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

Tell us about color temperature

To Karl Zuk, regarding his article "Lumos! Give Me Some Light!" in the Dec. 6 issue:

Long before the lightbulb ban, way back in the early transition days, I started buying incandescent light bulbs and managed to collect enough lamps for two lifetimes! I rather detested CFLs for their harsh light and RFI, plus they often melted down. These were just not for me.

I have to admit now that the new LED numbers are much better. Selecting one, however, can be a little challenging as there are too many choices.

Although I'm not a lighting engineer, color temperature has been important to me in my career as well as in my personal environment. I much prefer the warm soft glow of an incandescent lamp, even a halogen.

Before I retired almost a decade ago, I spent nearly 45 years of my life with ABC in Chicago in the television engineering department. My experience began with quad machines, image orthicons, vidicons and vacuum tube distribution amplifiers and ended in the era of thumb drives, cameras with factory pre-registered solid-state imaging blocks and high-density processors.

I don't have any liking for the new stuff as there is nothing to tweak. Just point the camera at the white card and press a button. Color temperature? Who cares? It used to take a couple of hours to completely align a camera chain from scratch. I miss using my greenie!

All that said, a good article on how to choose the correct color temperature with the new LED lamps would be helpful. You could also compare the new lamps to the old incandescent ones. If the article pitched color temperature as an important but often-overlooked factor in creating a pleasant and productive workplace, even a magazine like Radio World might publish it!

Cliff Kotchka

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