RADIOWORLD

Your guide to radio technology

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PILOT's initiative moves forward.

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RADIOWORLD

Vol. 46 No. 6 | March 2 2022
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CONTENT
Managing Director, Content & Editor in Chief Paul J. McLane, paul.mclane@futurenet.com, 845-414-6105
Technical Advisors Thomas R. McGinley, Doug Irwin
Technical Editor, RW Engineering Extra W.C. "Cris" Alexander
Contributors: Susan Ashworth, David Bialik, John Bisset, Edwin Bukont, James Careless, Ken Deutsch, Mark Durenberger, Charles Fitch, Donna Halper, Alan Jurison, Paul Kaminski, John Kean, Larry Langford, Mark Lapidus, Michael LeClair, Jim Peck, Mark Persons, Stephen M. Poole, James O'Neal, John Schneider, Dan Slentz, Randy Stine, Tom Vernon, Jennifer Waits, Steve Walker, Chris Wygal
Production Manager Nicole Schilling
Managing Design Director Nicole Cobban
Senior Design Directors Lisa McIntosh and Will Shum

ADVERTISING SALES
Senior Business Director & Publisher, Radio World
John Casey, john.casey@futurenet.com, 845-678-3839
Publisher, Radio World International
Raffaella Calabrese, raffaella.calabrese@futurenet.com, +39-320-891-1938

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Indeed there's an app for that

And you don't have to hold it upside down

Paul McLane
Editor in chief

I've never quite gotten over the fascination of having a supercomputer in my pocket.

This is a kid who was thrilled to get his first electronic calculator, even though the most impressive thing I really ever did with the thing was to spell out "SHELL OIL" upside down with the LCD digits.

Growing up, I too hoped for jetpacks and Dick Tracy wristwatches. But I don't think I really expected ever to be able to have a face-to-face video conversation with my brother from hundreds of miles away on a high-quality screen in my hand.

Now such capability and many others are part of everyday life — if not exactly humdrum, then at least commonplace.

And just when I get accustomed to all the things I can do with my current iPhone, Apple comes out with an even better one. I have barely scratched what my current one can do, either on its own or with third-party apps added. But I try to pause and appreciate how incredible these tools really are and how much information we can call on at will, compared to all of the humans who have lived before us.

I'm musing on this because of our story on page 18, in which I asked a bunch of our friends and readers to tell us about their most useful smartphone apps. They mentioned electronic tools, satellite finders, IP scanners, unit converters and several others of interest. Check it out, and let me know your own faves. Drop me a note at *radioworld@futurenet.com* and tell me what apps you love and how you use them.

Meanwhile, thanks to the internet, I now know from the website Dr. Mike's Math Games for Kids that there are more than 230 words that work for the Upside-Down Calculator Word Game. My childhood "SHELL OIL" would be:

710
77345

That information makes me happy.

THIS ISSUE

Industry Pushes Back Against New Disclosure Rule

Oral arguments were set for mid-April in the broadcast industry's lawsuit against the FCC, seeking to overturn an FCC order mandating disclosures for foreign government-sponsored programming.

In March the National Association of Broadcasters, the Multicultural Media, Telecom and Internet Council and the National Association of Black Owned Broadcasters filed a reply brief with the federal appeals court. They are the organizations that brought the suit against the FCC.

They say the court should set aside the rule because it violates not one but three crucial standards: the Communications Act, the First Amendment and the Administrative Procedure Act.

The groups noted that the FCC order tells stations to engage in "reasonable diligence" to determine the true source of the programming aired on a station, which mandates independent investigation of government websites.

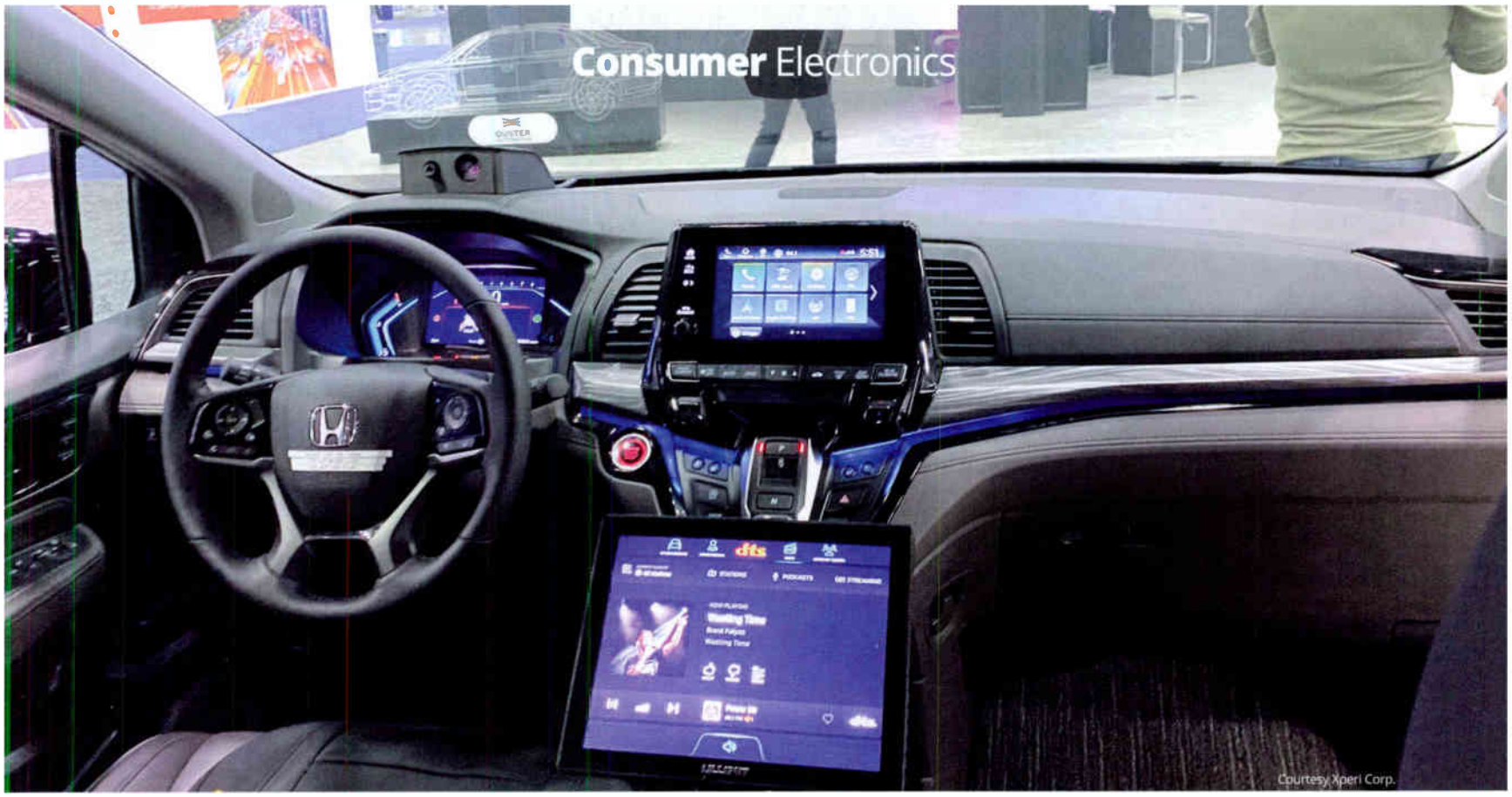
"But the broadcaster's statutory duty is far narrower," they said. "Congress required only that each broadcaster 'shall exercise reasonable diligence to obtain from its employees, and from other persons with whom it deals directly' information necessary to disclose to the public the person who paid for the programming." The plaintiffs concluded: "The commission cannot ignore the restrictions Congress has placed upon a broadcaster's duty of diligence."

The lawsuit is being heard at a federal courthouse in Washington.

E. Barrett Prettyman Federal Courthouse by NCinDC Creative Commons license

They also criticized "the regulation's extraordinary reach and sheer pointlessness" and said mandatory investigation "redresses a phantom harm never known to occur: namely, a foreign governmental entity registered under the Foreign Agents Registration Act or a U.S.-based foreign media outlet registered under Section 722 of the Communications Act who leased broadcast time without disclosure."

And they say the rule imposes substantial burdens on thousands of broadcasters to address the phantom harm. It said the FCC's limited evidence — which in any event concerns no "harms" that the order redresses — can't justify requiring every commercial broadcast station in the country to conduct independent investigations for every existing and future lease.



Courtesy Xperi Corp.

Above
Xperi Corp. showed its DTS AutoStage platform in a Mercedes vehicle.

Writer

Randy J. Stine

Our Feb. 16 issue featured the author's interview with Steve Koenig of CES.

Dashboard is radio's focus in consumer electronics

Fred Jacobs comments on themes of CES 2022

Radio occupied a small if still relevant spot at this winter's Consumer Electronics Show.

Jacobs Media President Fred Jacobs, who led tours of the floor for broadcasters, said the exhibition included lots of audio innovation, though it wasn't focused on broadcast radio.

"CES has never been a place where a lot of radio specific products are introduced. But the acceleration of technology in recent years has seemingly pushed it even further to the background," Jacobs said.

The crowd at CES was smaller — the Consumer Technology Association estimated 40,000 — and some major exhibitors backed out because of COVID concerns. Companies nevertheless displayed and launched a myriad of consumer electronics products.

We asked Jacobs to recap his experience. (This is the second in a two-part series about the recent CES; Radio World's Feb. 16 issue featured comments from Steve Koenig of CTA.)

CES is when the consumer technology world debuts the latest and greatest in tech, but the impact that broadcast radio makes seems negligible. Why?

Fred Jacobs: Perhaps because radio is an established thing and CES is more about technology breakouts.

There were glimpses of radio. Victrola displayed a few retro-looking radios. It was kind of lame. But what CES does offer is a chance for radio attendees to better understand the current marketplace and where technology is going. And how it affects the radio biz.

You again led tours of CES with groups made up of broadcasters. What resonated for them?

Jacobs: Every year with our tours we spend a few hours running around the Las Vegas Convention Center, and at a certain point those on the tour they ask us "Hey, where is radio?" Outside of Xperi and a few odds and ends, there usually isn't much connected with broadcast radio. But we really dig and try to connect the dots for radio execs and understand the implications of the new technology we find on radio.

For me the big thing this year, similar in scope to what we have seen in the past, was dashboard technology and the

direction it is moving. Radio is not going to be Numero Uno in the dash any longer. And we are talking about vehicles made today. Radio will have to coexist with all these other media options.

Radio broadcasters came away from the tour talking about a future where radio is one of many choices in the vehicles we will drive — or that will drive us. Radio managers are realizing that if their content isn't compelling and attention-getting, the multitude of dashboard choices will weaken radio's position as a driving companion.

Xperi again had a major presence, featuring its DTS AutoStage platform. What do you think of their efforts?

Jacobs: Xperi had a great location. All the auto stuff is in the new West Hall, and Xperi was right in the middle of that. The radio broadcasters with us enjoyed their time with Xperi, and that exhibit looked really good. Every year it seems to get bigger.

Most of the broadcasters on our tour had not experienced AutoStage. So here is this gleaming new Mercedes sedan sitting there with Xperi's latest in-dash experience. The broadcasters asked lots of good questions about how AutoStage is going to work and how the rollout is going. I think they were just thankful and excited to see something radio at CES that looked really good.

What did vehicles on display at CES look like and was radio still visible in the dash?

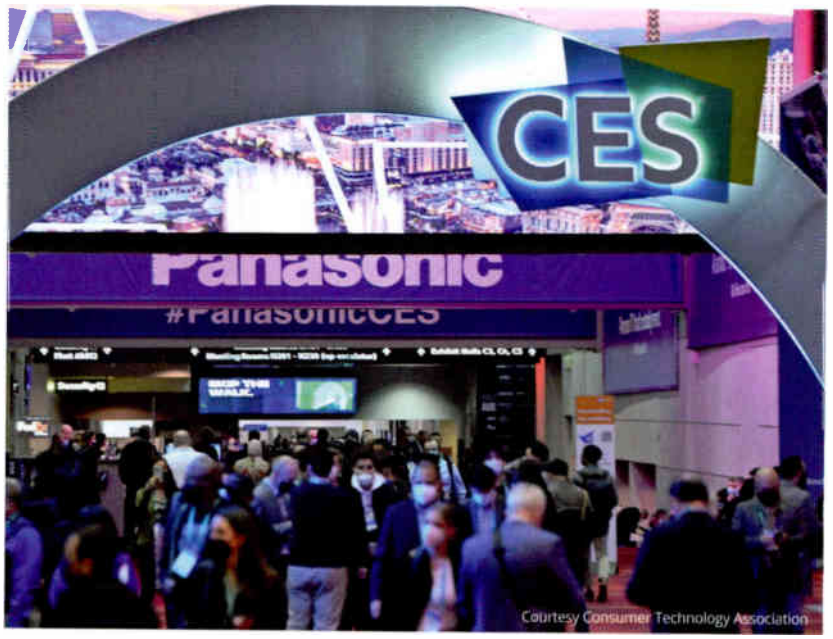
Jacobs: You're seeing more dashboards that are pillar-to-pillar with one big screen. There was a Turkish car maker, called the Togg, which had a screen from the driver stretching across to the front-seat passenger. It was really cool. Then there are screens in the back.

The whole idea is that everyone in the vehicle can have a different entertainment experience, which is kind of scary. But at the same time it potentially opens up an avenue for more people to listen to the radio station of their choice while someone else is watching a movie.

An Israeli-based company, Silentium, had a display in Eureka Park *[an area at CES reserved for startups and young businesses]* of personal sound bubbles. Not a physical bubble, but the idea being without wearing AirPods or headphones, everyone in the car will be able to listen to whatever audio they want. It's not physical barriers; it's more of an acoustical or directional way of doing it by sending out inverted sound waves that cancel out noise and sound.

It hasn't been perfected yet, but it's a bow to the future passenger economy in cars, where companies are trying to monetize everyone in the car.

CES was scaled way back due to concerns over COVID. How different was it?

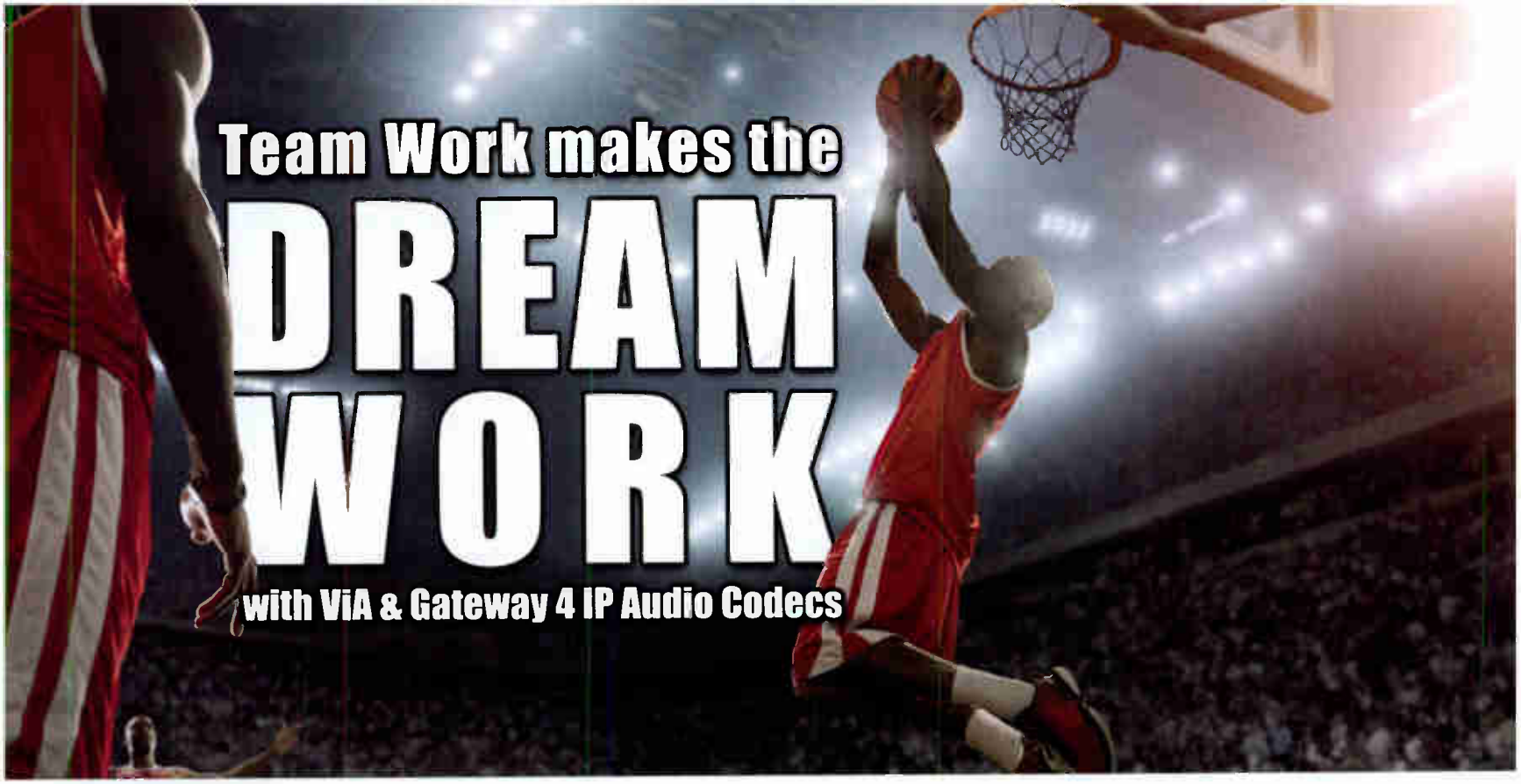


Courtesy Consumer Technology Association

Above
A hallway view at show opening.

Below
Caroline Beasley, Fred Jacobs, Paul Jacobs and Heidi Raphael were among radio industry pros walking the floor.

> **I think radio has struggled to find its place in the audio landscape, which is ironic.**



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* The Gateway 4 codec supports 4 channels only and is not upgradable to support more channels.

Courtesy Fred Jacobs

> **Radio is not going to be Numero Uno in the dash any longer.**

Above
Paul and Fred Jacobs, unmasked.

Jacobs: For those who have been to CES previously it was quite different. It was still a huge exhibition. You had about half of the normal displays, but you still had a sense that you couldn't see it all.

The first timers still had a sense of ooh and ah, but even for vets like us, what happens is you start shifting your focus away from hot new gadgets and you start recognizing technology trends and technology themes.

There were three different flying cars at CES that I noticed. That's kind of cool. But when you explore, after a few days you see this fountain of practical technology applications of these autonomous vehicles and electrification. Those are the moments for attendees where they start connecting the dots and seeing similar trends and where radio can possibly fit in. You see where the world of technology is moving and you can't help but go home with a different feel for what you might want to do.

Coming back from CES, the overall feel is that dashboard displays are becoming more sophisticated. AI is becoming an increasingly bigger part of the technology package and the vehicle will learn your preferences.

That can benefit or hurt radio. If you have the right content it's an opportunity, too. Radio has to think about competing with everybody in the car and not just other radio stations up and down the dial.

RW The home smart speaker sector is more mature now. Any new audio components catch your eye that might stream a radio station?

Jacobs: Not really. Millions of homes in the U.S. now have smart speakers. In terms of revolutionary new technology to listen to a station's stream or a podcast, there was nothing special. It's all about the car, really, for radio broadcasters.

RW You've written on your blog expressing a worry that U.S. radio is sitting out an audio renaissance of sorts.

Jacobs: I think radio has struggled to find its place in the audio landscape, which is ironic, and in a few different areas.

Research shows that more people are listening to audio than ever before. People's audio pie and the numbers of listening minutes have been growing, but radio listening is not growing. The other piece is podcasting. For the publishers, podcasting has been a cash cow. But we've learned that most broadcasters haven't been able to take advantage of the podcasting movement. Some broadcasters have purchased podcasting companies, but those have little to do with their broadcast holdings. So it seems most radio stations are not participating in a meaningful way in the podcasting space.

Where radio is doing a better job is with smart speaker listening. That has been accelerated by COVID and the realization that people are not listening to more radio on traditional AM and FM radios, but they are listening more on non-traditional devices like mobile phones, tablets and smart speakers.

RW Final thoughts on the CES experience?

Jacobs: As we visited a number of carmakers, I think broadcasters are beginning to realize this whole idea of how radio stations are displayed in the dash is going to be critical. They can't just brush this off. And individual station owners are realizing they can effect change with their own station's dashboard displays, whether it is RDS or HD Radio with Artist Experience.

Once you see these dashboard displays at CES, you realize that this is an area where radio has fallen behind. Yet it is within our own control to look good in these new vehicles. That's why Steve Newberry from Quu was there and interacting with OEMs. *[Quu offers software and services to add visuals to radio broadcasts.]* He and his company are very eager to find out what these vehicle screens are capable of and how he can market products to help radio broadcasters maximize it to their benefit.

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Writer
Randy J. Stine

Android Automotive project completes first phase

Initiative under auspices of NAB PILOT seeks to influence the key new OS

This story is adapted from the ebook "Radio's Call to Action.: DTS AutoStage." Find it at radioworld.com/ebooks.

NAB PILOT, Xperi and several major radio companies are part of a group that has been working to ensure that radio is integrated into Google's open-source Android Automotive operating system for connected cars. John Clark, executive director of PILOT, says they are ready to pitch Google executives to make the case for broadcast radio to be supported properly in that system.

The Android Automotive OS will be a standalone system with user apps installed directly to the car's system — no smartphone required. ("Android Automotive" is distinct from "Android Auto," where the system runs on the user's phone.)

Android Automotive OS is expected to be available in about 50% of new cars in the next seven years. General Motors, Ford, Audi and Stellantis are among those with plans to integrate the platform.

Clark says the goal of PILOT's initiative is to help define what radio will look like in these dashboards and ensure that radio can benefit from the rollout.

He said Xperi is doing much of the development work. Also involved are Beasley Media Group, iHeartMedia, Audacy, Salem Media Group, NPR and BBC. The group also took input from Ford and Audi.

Google itself is a member of NAB PILOT, and Clark said the group has had conversations with the company throughout the process.

"An extensive amount of work has been done. This round of work is finished, so now it's time to reach back out to Google," Clark said in late 2021. He didn't specify a timeframe but hoped the presentation could be done early this year.

The group's work includes a recommendations document. Though specifics have not been made public, Clark says it outlines vendor extensions and other parameters that the group would want Google to incorporate into Android Automotive.

Clark says it has defined standards in broadcast radio that should be supported, like RDS, dynamic text, station logos, slide show images and multicast channels.

"I would describe this process as making sure all the services radio broadcasters have put in place are fully functional in the (Android) system itself."

Clark says it is vital that the broadcast be a part of Android Automotive with full functionality, which in turn will help leverage a truly hybrid experience, as envisioned by a platform like Xperi's DTS AutoStage.

"Then folks like Xperi can begin layering in things coming over the IP connection. But to get to hybrid we have to make sure the radio broadcast piece is there."

How long might it take for this work to bear fruit?

"Google is probably working on a two-year implementation cycle for release in an open source software environment — I'd say more than one year but less than three, to get things vetted, tested and hardened. You have to remember we are talking about the entire operating system for the dashboard. So they are working through a lot of things not related to radio. Think about voice control and the impact of that alone."

But Clark emphasizes that time is short for radio to "bend the ear" of the big tech company. For instance, Ford says it will turn over its operating vehicle systems to Google beginning in 2023. The automaker's deep integration of the Android system will include voice-activated Assistant, Google Maps and other automotive approved Android apps, according to an announcement from Ford.

Clark said it is possible that NAB will be able to demonstrate what broadcast radio in an Android Automotive OS environment could look like at the NAB Show in April.

"We hope to showcase a radio interface on Android Automotive that takes advantage of all features of broadcast radio."

Right
John Clark, and a cover of Radio World's ebook from which this article is taken.

John Bisset
CPBE
With more than 50 years in broadcasting, the author is in his 31st 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.

Weigh in
Workbench submissions are encouraged and qualify for SBE recertification credit. Email *johnpbisset@gmail.com*.

Get funky with the Adafruit Audio FX

Send us your project ideas for this nifty sound board

Some of the most fun I've had as an engineer was coming up with gadgets to help radio jocks better execute their shows.

Our internet forager Dan Slentz writes in with something for your crazy DJ. It's a neat little board that resembles an Arduino "computer" circuit, but it's self-contained and meant for only one thing: to play audio.

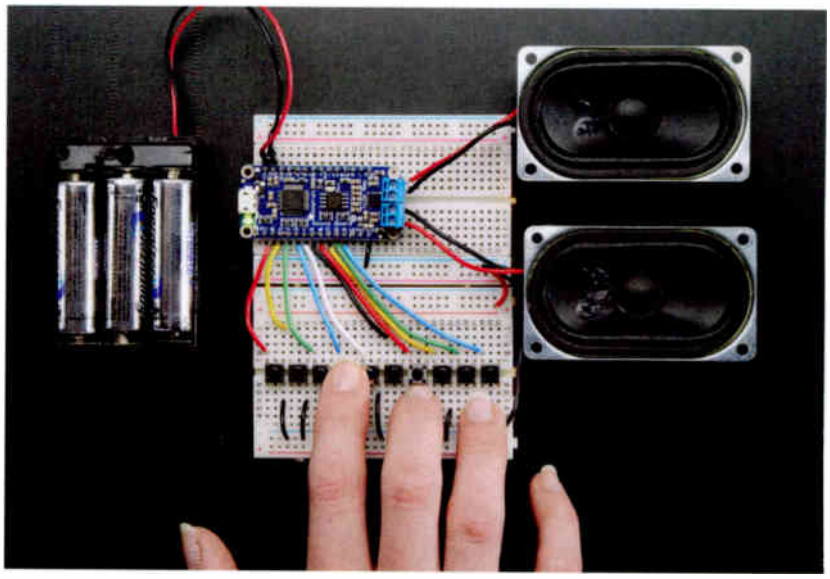
No other micro-controller is required, only 3 to 5 VDC. There's 16 MB of storage on board, so not even an SD card is needed.

The length of stored audio depends on whether the audio is mono/stereo and the sample rate, but audio is stored on the Adafruit FX Sound Board itself; no external drive is necessary.

If you plug in a USB cable to connect your Windows computer, you can drag and drop audio files onto the board as if it were a USB key. Dan and I are sure that readers will find some cool and clever uses, like a sound effects box for the crazy DJ.

Dan likes that the Adafruit Audio FX Sound Board is a cheap solution to playing audio with decent quality, where you might need something repeated. In addition to a sound effects box, add a relay, and the board, which measures 2 inches by 1 inch, can be used to play short messages on a telephone.

Dan adds that an engineer could throw this in a little "jiffy box," add a few AA batteries and turn it into a line identifier/repeater for tracing audio circuits.



Above
Adafruit Audio FX Sound Board + 2x2W Amp — WAV/OGG trigger

> **"Can you come up with some more creative ways to use this clever little board?"**

Another idea is a remote audio "bumper box" for sports events. The remote announcers could use this for bumpers leading in and out of local spots.

The Adafruit Audio FX Sound Board can be found on Amazon. The device is in stock and costs about $20–$30 at this writing. If you buy one, please share your application with your fellow engineers. Email me at *johnpbisset@gmail.com* and let me know what you did.

A real buzz kill

Ben Dawson, P.E., has been following our discussions about mic cabling.

He commented on John Schmidt's observations in the Dec. 8, 2021 column. It discussed the use of three-wire-and-shield cables, with the ground carried through on the third wire and the shield tied only at the end that connects to whatever active device is in use.

Ben is a principal at Hatfield and Dawson Consulting Engineers. His experience has been that in high RF and other electrically noisy environments, this technique is commonly employed. At Seattle Center, for example, which was downhill from three analog TV stations, this was the method employed by staff and visiting A/V users to eliminate persistent television sync buzz. Many rock 'n roll and county/western roadies also seemed to be aware of this technique.

Back in the 1940s and '50s, audio users of Cannon "P" connectors — ancestors of XL and UA connectors —

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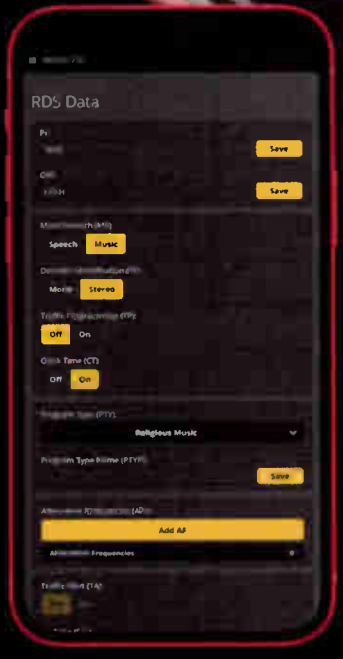

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Above left
Mounting the EAS AM receive antenna on the station's roof.

Above right
Note that the RF connectors are weatherproofed.

Right
Ryobi USB Lithium 2AH lithium-ion rechargeable battery

sometimes used Pin 2 as the ground. Ben still has a short cable with two P connectors wired for transition to Pin 1 ground from Pin 2 ground. And then there's the dichotomy as to whether Pin 2 or Pin 3 should be the positive source.

For more interesting reading, check out "A History of Audio Connectors" at *http://coutant.org/xlrhist/index.html*.

(Before even Cannon "O" and "P" connectors, Hubbell twist-lock connectors were used for microphones!)

Get loopy!

Last issue I clarified an earlier discussion about the physical construction of Ken Beckwith's EAS loop antenna. Ken is a field engineer with Educational Media Foundation. His antenna, which we described in a 2019 column, was made using PVC pipe.

Lance Coon of Carroll Broadcasting built Ken's design and sent us a couple of pictures of his finished product, shown here.

The loop antenna is clustered with an FM receive antenna on the building's roof. Notice the weather-sealing tape that Lance used to wrap the RF connectors of both antennas. No chance of corrosion or water ingress ruining the connectors or cables.

Lance reports that the antenna works great and says the construction is solid. The antenna has already lasted a night of sustained 50 mph winds, with gusts of 70 mph.

If you are having trouble picking up an AM's EAS signal, try it. Details are in our Workbench column of Sept. 24, 2019. At *radioworld.com*, type "Construct an EAS receive loop antenna" in the search tool.

Useful connection

It goes without saying — but we'll say it anyway — that lithium-ion batteries used in power tools are some of the most compact and dense batteries manufactured.

Now power tool companies Ryobi and DeWalt are exploring USB-C battery options. Specifically, Ryobi is the first manufacturer to add a USB-C charging port on the battery, permitting the same charger and battery to be used to recharge your computer, tablet or phone.

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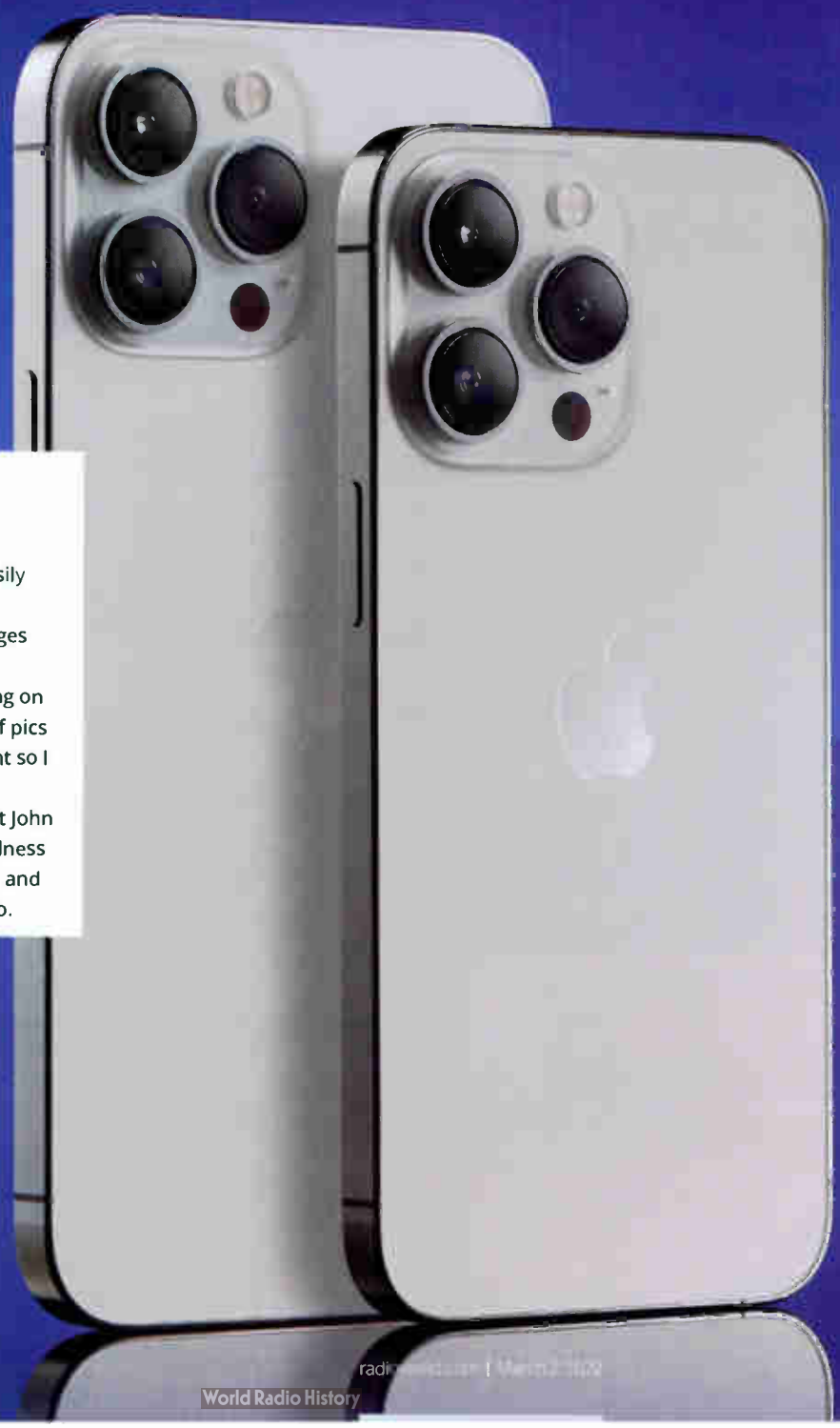
What's your favorite app?

Here are nine smartphone tools popular with our readers

What's your fave?
Tell us your favorite app and why. Email *radioworld@futurenet.com.*

The iOS App Store launched in 2008 with 500 apps, according to the Business of Apps website, which says that today, the App Store has 1.85 million different apps available to download, while Android users have 2.56 million on the Google Play Store.

We asked a few Radio World readers and contributors to, name their favorite apps.



Photography: Olly Curtis

Camera

Perhaps the most useful app of all, and easily overlooked, is your phone's camera.

"I constantly document wiring and changes with it so I can update drawings," said RW contributor Dan Slentz. "Also, when working on gear or a transmitter, I tend to snap a lot of pics just in case I 'misplace' a wire or component so I remember where it went."

Workbench readers know that columnist John Bisset has preached often about the usefulness of your phone's camera in troubleshooting and educating your boss about the work you do.

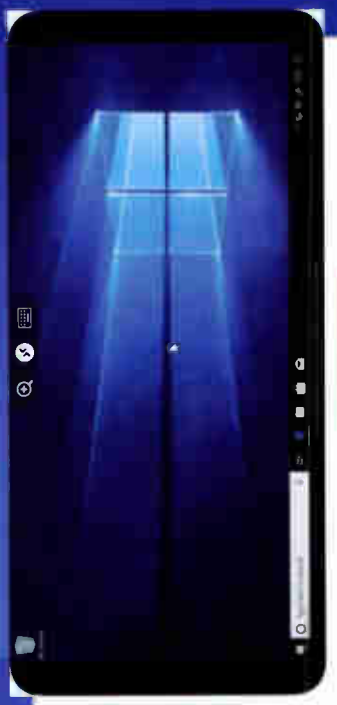
SatFinder Lite

Randy Williams, chief engineer at Learfield, recommends SatFinder Lite from Droidware UK, free for Apple and Android users, as a tool to help in setup and alignment of a satellite dish or antenna.

"A user can program the satellite name or orbital slot from the list of satellites provided, and save to your settings. Then the app syncs to your phone's internal GPS, compass and camera features, allowing you to point the camera of the phone toward the horizon. And it will display the satellite arc and the location of the satellite you are looking for by look angle."

Williams says the app isn't a precision instrument but will get you 95% of the way there in tuning your satellite antenna by giving you azimuth/elevation data from the camera lens to get a dish in the reception ballpark.

The app works for DirectTV, DishNetwork and C-Band satellite locations.



Microsoft Remote Desktop Client

"Microsoft Remote Desktop Services is a common means of accessing Windows systems remotely, and is built into most versions of Windows," says Shane Toven, senior broadcast engineer for Educational Media Foundation. "It can be used in conjunction with a VPN client, or configured with a gateway server for external access."

Use Microsoft Remote Desktop for iOS or Android to connect to a remote PC or virtual apps and desktops made available by the admin of your organization.

Luci Live Lite

Engineers like Greg Dahl of Second Opinion Communications and Tony Peterle of WorldCast Systems use various versions of Luci Live for audio streaming over IP. It's made by Technica del Arte, which offers wideband codec apps for iPhone and Android.

"These are considered among broadcasters to be the easiest-to-use and best performing apps on the market," writes Comrex in a tech note. There's info on the Technica del Arte website about how to connect their apps to studio codecs from Comrex, Telos, Orban and other manufacturers.

"Even the SE version has everything I need," says Tony Peterle. "Bidirectional stereo audio streaming with a variety of algorithms from which to choose. Very useful when trying to diagnose why a particular stream isn't arriving at a particular site. Put Luci Live in the middle and find out which end has the blockage. Hint: It's usually the receiving end, where public traffic has to transit a firewall, but it's nice to be able to confirm and show that to others."

Cisco Anyconnect Secure Mobility Client

"Using a VPN for remote access to your facility's network is critical to maintaining security and protecting against external attacks," says Shane Toven.

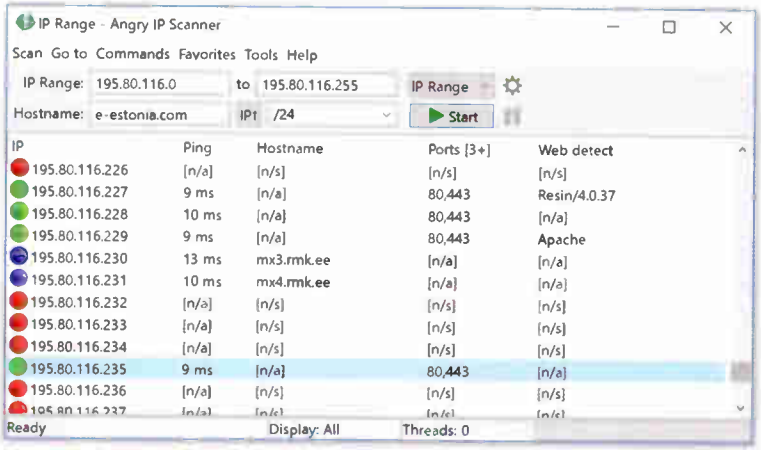
"Depending on your network infrastructure, you may have a manufacturer-specific client, or you may be able to use the client built into your phone's operating system."

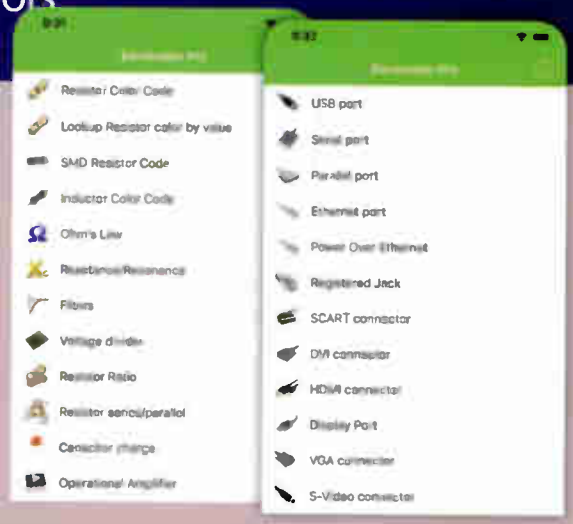
Angry IP Scanner

"This app will scan the currently connected subnet, or any other reachable subnet, for active hosts," says Paul Thurst, principal/owner of Data Wave. "It can also be used to find open ports. I like this particular IP scanner because there is also a PC version that operates the same way."

This is free, open-source software written by Anton Keks, co-founder of Codeborne.

"Angry IP scanner simply pings each IP address to check if it's alive, then optionally it is resolving its hostname, determines the MAC address, scans ports, etc. The amount of gathered data about each host can be extended with plugins," according to its website *https://angryip.org/*. It has additional features, like NetBIOS information — computer name, workgroup name, and currently logged in Windows user — favorite IP address ranges, web server detection and customizable openers.





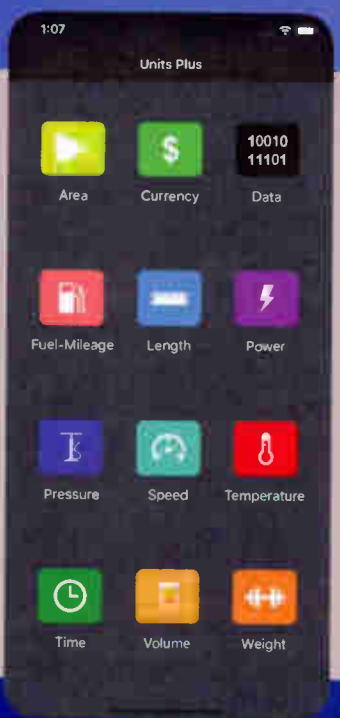
Electrodoc Pro

Paul Thurst likes this app, formerly called Electrodroid, for its many useful collection of electronics tools and references including Ohm's law, resistor color code, filers, voltage divider, reactance/resonance, resistor series/parallel, capacitor series/parallel, NE555 calculator and more, as well as converters including dB to Watt, frequency, and analog to digital. It also has an extensive list of pinouts.

Unit Converter

"This is exactly what it sounds like: a converter for almost any unit into any unit," says Paul Thurst.

The app, developed by Alan Mrvica, includes tools to convert area, computer data, fuel mileage, length, power, pressure, speed, temperature, time zones, volumes dry and wet, and weight/mass. It also can convert 155+ world currencies.



Datadog

DATADOG

Another app recommended by Shane Toven of EMF. "This service allows you to create custom dashboards to monitor all of the systems and applications within your infrastructure at a glance. Its companion app makes those dashboards readily available on your smartphone or tablet."

Datadog is a monitoring and security platform for cloud applications. It integrates and automates infrastructure monitoring, application performance monitoring and log management.

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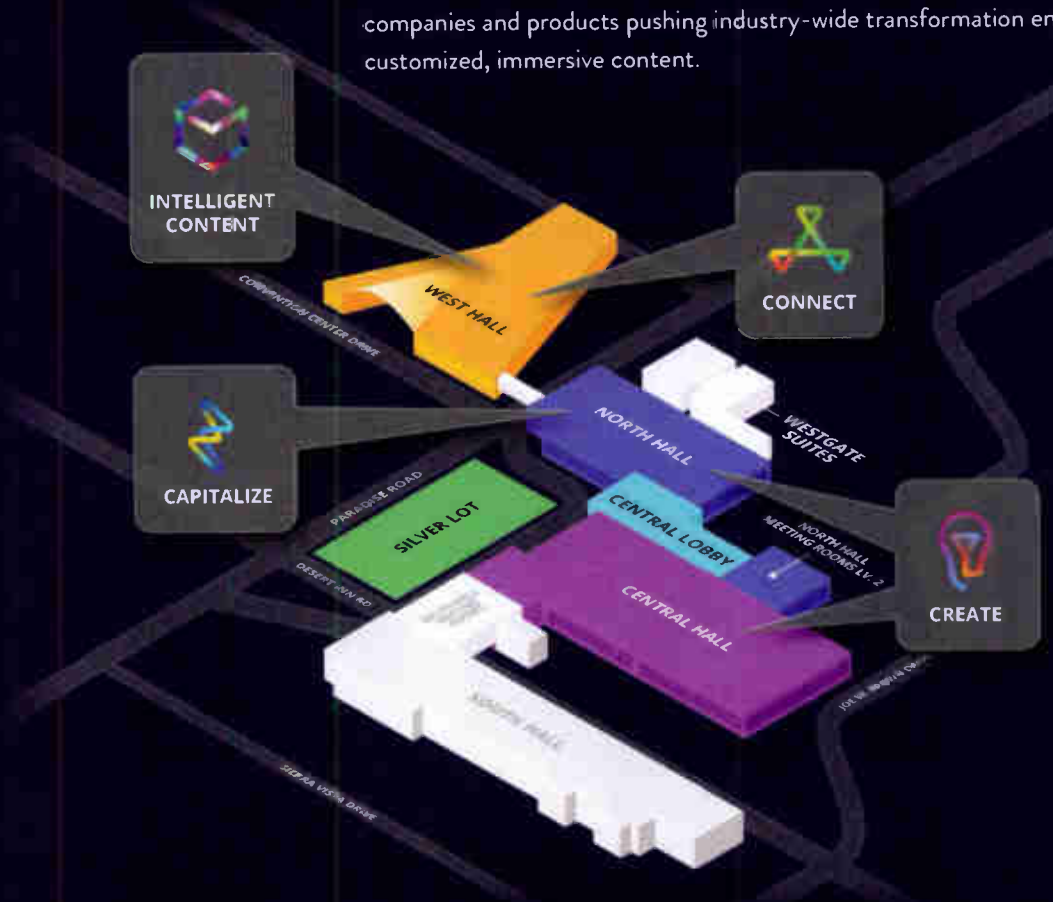

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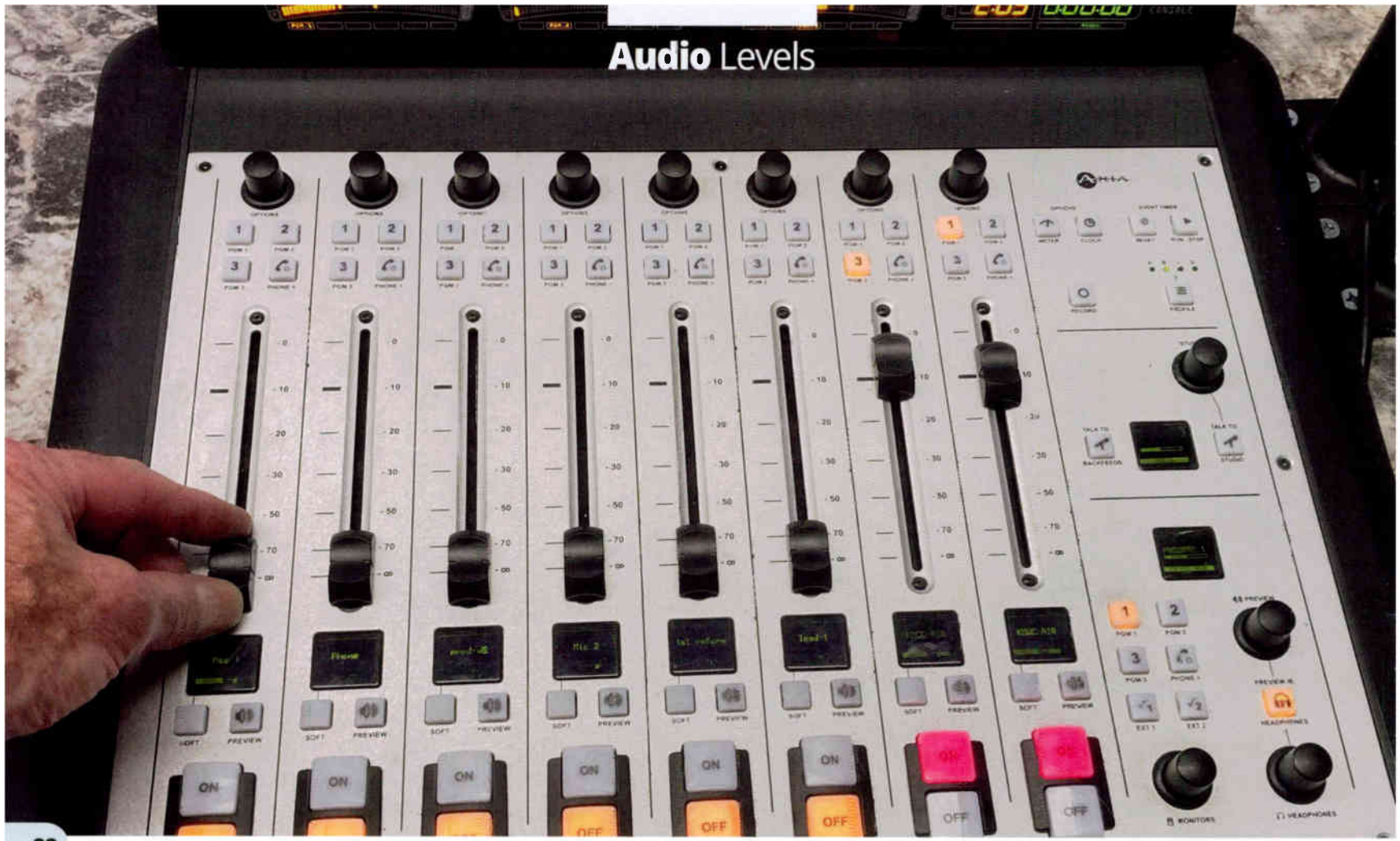


Writer

Mark Persons
WØMH, CPBE
Retired broadcast engineering consultant and recipient of the SBE John H. Battison Award for Lifetime Achievement.

More Persons
The author's website is *www.mwpersons.com*.

Does anyone know what the correct level is?

Consistency is the key to good radio audio. Take pride in yours

Establishing and keeping to a standard audio level, especially in studios, has been a problem since the first radio station went on the air.

Back in the 1960s, audio console output levels were usually +8 dBm (eight decibels above one milliwatt into 600 ohms) for tube and early solid-state consoles.

That +8 was a compromise between headroom and noise. A 1969 vintage Gates Statesman audio console had 74 dB of dynamic range between peak clipping at +18 dBm and the noise level. That makes 64 dB between normal program level and noise. It was fine for AM stations, where a signal-to-noise ratio of only 45 dB was FCC-required between 100% modulation and no audio.

Then came FM with an FCC-required 60 dB or better signal-to-noise ratio in the entire audio chain. The Statesman's 64 dB signal-to-noise left only 4 dB for additional noise in the station audio before it could not make FCC specs.

Fig. 1 on the facing page shows an oscilloscope view of a normal voice, where there is just enough dynamic range to accommodate it. Vertical peaks are just at the equipment limits. I prefer an oscilloscope to see exactly when peak clipping occurs. There is a discussion of this in a Nov. 9, 2016, article I wrote in Radio World (at *radioworld.com*, type "Calibrate Analog Audio Consoles" in the search field).

If you are following the numbers, you will realize there was only 10 dB between 100% (0 dB on the meter as seen in Fig. 2 on page 24) and audio clipping. The same microphone and voice sounded different from one audio console to another depending on the voice and the operator running the controls.

My testing of audio, with an oscilloscope 50 years ago, showed that some voices can have as much as a 16 dB average to peak ratio. From that I deduced that ALL audio

consoles need their analog VU meters calibrated to show 100% when peak clipping occurs 20 dB higher. The extra 4 dB takes care of audio when operators let levels run hot.

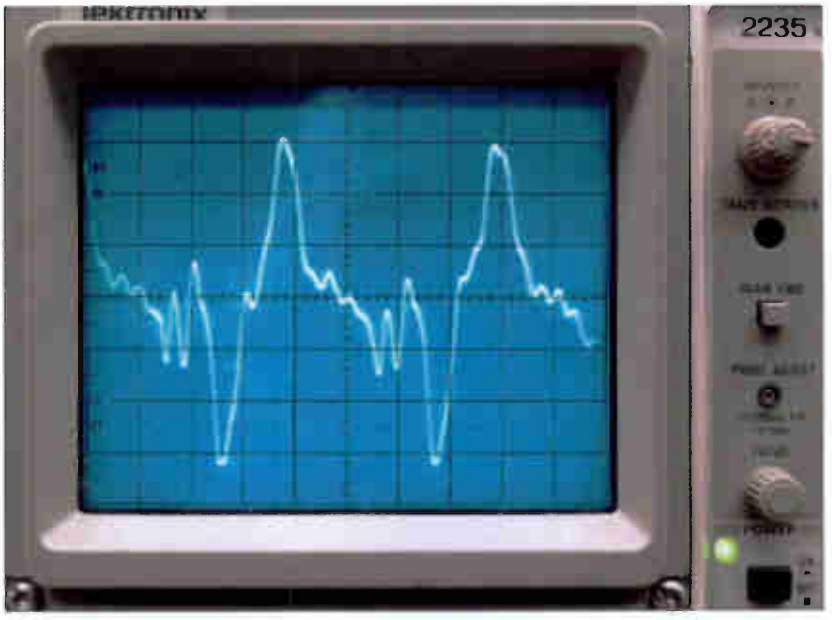
Fig. 3 shows audio driven into peak distortion. Not all people hear peak clipping distortion, that grungy and tearing sound added to the original content. Women listeners are the first to tune out. Ouch!

Recalibrating a meter to fix that on an older console meant maybe –2 dBm output level when the VU meter said 100%. The signal-to-noise ratio would then be degraded by 10 dB. Those with good ears would say the audio was not distorted, but there was there was hiss in the background. Which one is more acceptable?

Hi-Fi home stereo systems were gaining popularity in the 1960s and had better audio fidelity than what broadcasters could provide. No wonder there was a push to design and build better audio consoles, especially for classical stations. For rock and roll listeners of the day, distortion and hiss hardly mattered because the sound was just loud!

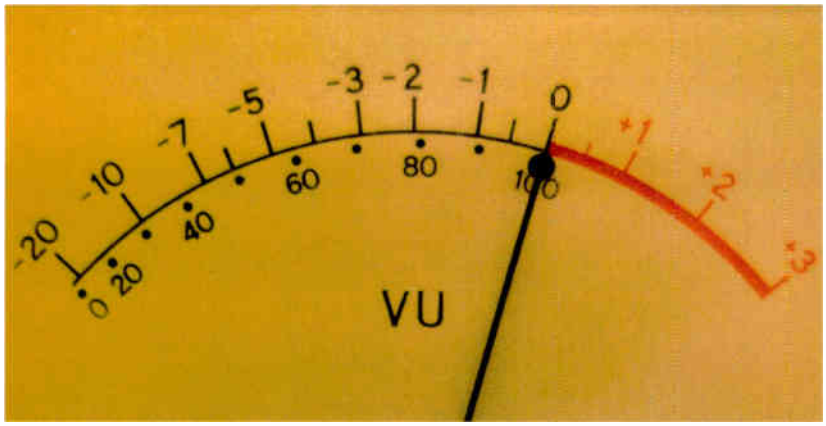
Audio quality improved when integrated circuits such as the NE5532N hit the market. These and similar operational amplifier chips make it possible to send and receive balanced audio without the need for transformers.

As you probably know, even the best transformers color the sound of audio a bit. While that coloration may be desirable and sought after in some recording studio settings, the goal is generally to keep a broadcast air chain as clean as possible. Doing without transformers solved that problem.

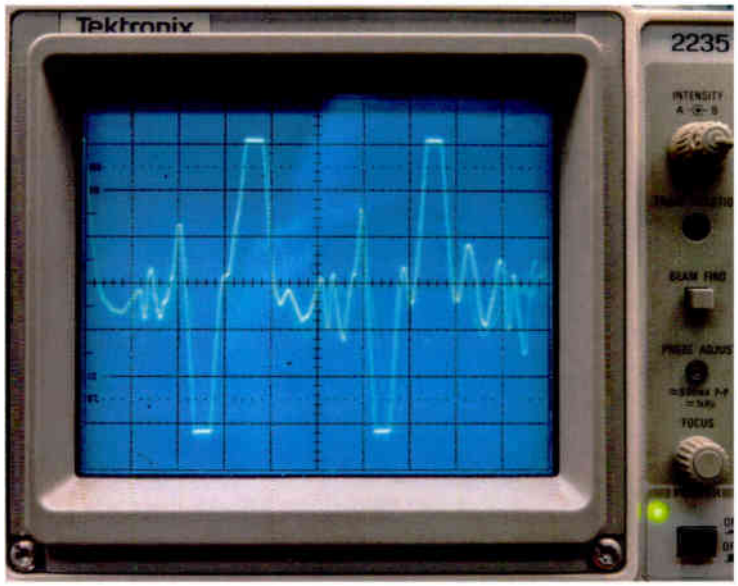


Above
Fig. 1: Voice audio with high peaks.

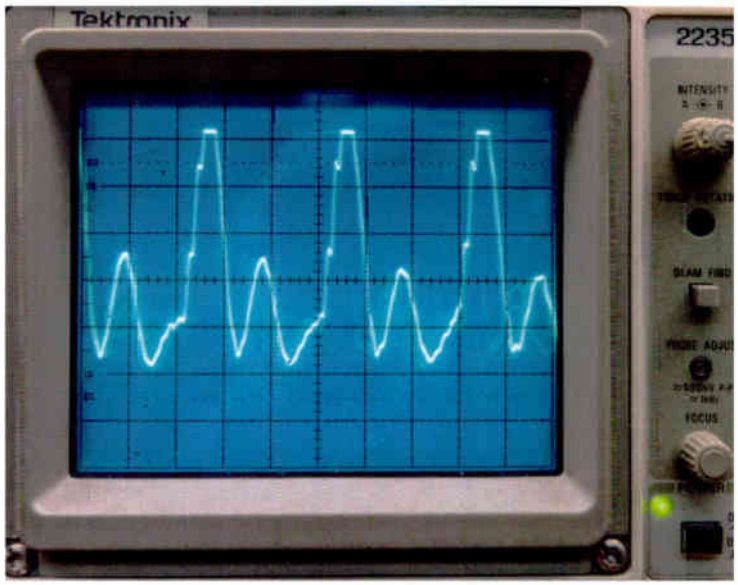
ICs can deliver about +24 dBm. The specified normal output level on most consoles, using this technology,



Top left
Fig. 2: An analog VU meter indicating 0 VU.



Top right
Fig. 3: High peak-to-average ratio with clipping.



Right
Fig. 4: High asymmetry with positive clipping.

is +4 dBm, which yields 20 dB of headroom. Typical examples are the Radio Systems RS-12A and Arrakis 150 through 12,000 series audio consoles. That 20 dB is necessary to help protect from peak clipping when operators like to hear mechanical VU meter needles "click" as they drive the audio hard and the needles into the peg. There is still 80 dB or more between normal program level and the noise floor. We've come a long way!

Devil and details

Audio processing has been helpful in fixing audio level problems but can do little for distortion. Some newer digital processors attempt to de-clip audio by mathematically recreating the original waveforms. This is a problem that shouldn't exist in the first place if proper procedures are followed. Once the audio is clipped, it is permanently damaged.

Taking a step back in time to the early 1960s, there was the aptly named Gates Level Devil that expected +8 input but could be adjusted to work on low-level audio for up to 25 dB of gain boost or reduction. It fixed a lot of problems caused by inattentive operators. The goal was to keep audio levels constant for ease of listening.

One story from back then told of a minister who came into a radio station to do a live radio program and insisted the Level Devil be taken out of the circuit when he was on the air!

As far as audio levels go, console inputs of the 1960s were designed to accommodate a fairly wide range of source material through the use of input attenuators. There was no standard, as I recall. Cartridge and reel-to-reel tape decks might be capable of 0 dBm but could easily be turned down to match what a console channel happened to be optioned for. A phono/turntable preamplifier might deliver only –15 dBm.

I was constantly reminding operators to watch audio levels to keep the sound consistent because I could hear audio level problems when listening on the air. Operators, as you know, use their ears, under tightly pressed headsets to determine audio quality, rather than being bothered to read VU meters. They do not realize the listener doesn't have the same headsets.

Automobile environments are a special listening challenge with maybe only 15 dB of listening range above the noise while on a busy highway. It is a lousy deal when a listener has to turn the radio volume up and down while hearing radio audio should have come in at a consistent level.

Try it yourself — put an oscilloscope on voice audio in a studio so you to see what you are hearing or observe the waveform in a digital editor. Intentionally record a voice at an audio level that is too high. You will hear the peak clipping distortion, caused by running audio beyond the limits of the equipment, and you will understand that more is not better.

Digital levels

What is standard when recording digitally?

On some devices, the LED VU meter reads –14 dBFS (14 dB below full scale) when audio is normal. On an Axia Radius console, meters change from green to yellow at –20 dBFS and from yellow to red at –10 dBFS. They are peak reading so that helps. Average reading meters will not tell the story. When meters touch the red, there is 10 dB of digital headroom. You might need that or more headroom for an occasional peak.

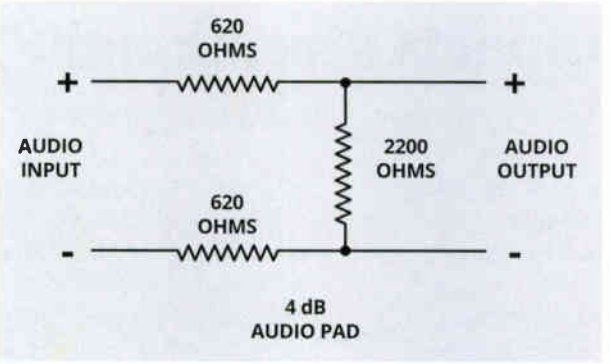
Remember that 0 dBFS is an absolute limit, and digital clipping is even more destructive than analog. At that point there are no more bits left to represent the signal.

Since noise is no longer an issue, I highly recommend –20 dBFS as a digital reference level for +4 dBm or 0 VU in the analog world, especially when you think that noise might be at –90 dB or more. It is embarrassing and inexcusable to let audio go into audible peak clipping distortion that ruins an otherwise great sound.

I have toured radio studios and watched LED VU meters indicating anything between a consistent –20 and over-the-top red-lined. I'll bet listeners hear that and tune away. They don't know why; they just find another station.

Yes, it is true that today's audio processors do a fairly good job in fixing audio level problems. However, it is up to

Continued on page 26



Left
Fig. 5: Schematic of a 4 dB balanced audio pad.

> **The goal is generally to keep a broadcast air chain as clean as possible. Doing without transformers solved that problem.**

NAB supports directional FM modeling

But it asks the FCC to put guardrails in place

For more on this subject, see the cover story of the Feb. 9 issue of Radio World Engineering Extra. Read it at *radioworld.com/digital-editions*.

The National Association of Broadcasters supports the idea of allowing computer simulations for FM antenna directional patterns.

"NAB believes that computational simulation of FM directional antennas is already mature and can produce comparable accuracy to physical measurements, thus minimizing the potential for new interference," it wrote in comments filed with the Federal Communications Commission this winter.

But it cautioned that "electromagnetic modeling software is complex, can be subject to manipulation, and limited by the accuracy and completeness of the input data."

In November the commission opened an NPRM and proposed to permit the modeling. The change was urged in a joint petition from Dielectric, Jampro, Radio Frequency Systems and Shively Labs, as well as broadcaster Educational Media Foundation.

The most common reason to use a directional antenna by a commercial full-power FM station is to allow it to "short-space" to another FM station while maintaining contour protection to that station.

NAB urged the FCC to require that full documentation of the underlying data and its sources be available to the commission and to "interested parties upon request."

It wants the FCC to require the following: a statement of the qualifications of the people responsible for modeling; a complete description of the antenna system; limits of 15 dB max/min in the azimuth plane and of 2 dB/10-degree rate-of-change in the azimuth plane; and certification by a licensed land surveyor or equivalent that the antenna is oriented properly and installed at the correct height.

"The position of the antenna on the supporting structure, including its height, offset from the structure and orientation are perhaps the most important input variables to the computer model. Even small discrepancies in the installed antenna, such as orientation with respect to Magnetic North rather than True North, or shifting the height by a few feet during installation to avoid a gusset plate on the tower, can result in significant changes to the radiation pattern and will require that the model be updated and rerun. Therefore, a licensed individual must certify the proper installation of the antenna." RW

Continued from page 25

the production staff and engineers to keep the station plant running so the processing can do its job properly when fed with consistent audio input levels.

Audio pads

The original +8 dBm standard evolved to +4 dBm and now 0 dBm on some studio devices. Many, but not all, analog audio routing switches have audio level controls. If the ones you encounter do not, you should install resistive audio pads to bring higher-level sources down to match the lowest level in the facility.

Fig. 5 shows a simple balanced audio pad. It assumes the audio source has a low drive impedance and all devices being fed by it are bridging (10K ohm or higher input impedance). The values chosen are standard and are 1/4 watt resistors or larger. Make it variable by substituting a 5000-ohm variable resistor for the 2200-ohm fixed resistor.

Today, many studios have a mix of traditional analog on punchblocks and StudioHub on Cat 5. The next step is AoIP, or audio over internet protocol. Audio levels can get out of hand if all sources are not matched.

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

What about podcasts?

Podcasts typically come to me without any audio processing and often have 10 dB or more disparities between voices during an interview. Some operators deliberately adjust audio level to emphasize a point. This doesn't go well when listening in a car with high ambient noise. No listener should have to crank the volume up and down to follow the content.

I've also noticed a 10 dB or more level difference from one podcast to another, even from one episode to another. Automobile manufacturers should look into simple audio processing for non-processed material like podcasts and CDs. That could enhance the user experience in a noisy road environment.

Consistency is the key to good audio. Take pride in the sound of the facilities you work on. Radio depends on keeping listeners. RW

New HD Radio Mod Monitors From Inovonics

Inovonics is out with Models 551 and 552 for advanced FM and HD Radio signal monitoring applications. It said they incorporate "all the necessary features for station setup, regulatory compliance and remote monitoring."

The Model 551, shown, has a 7-inch TFT touchscreen to display modulation data in a graphic format on the front panel; the same data is also available via a remote Web interface. In addition, full-time audio outputs are available for FM and digital channels HD1 through HD4.

Model 552, which occupies a single rack unit, is for remote installations where the graphic Web interface will suffice. It also has a lower price point.

Beta units shipped a while ago and Inovonics used those to make final firmware tweaks before shipping.

President/CEO Ben Barber stated that the last two years have seen "great strides" in its mod monitor development work. He pointed to the dynamic web interface that can be accessed from a smartphone, tablet or PC, as well as its SNMP capabilities, as an example.

Info: inovonicsbroadcast.com

Mackie Rolls Out Portable Streaming Mixer

The M•Caster Live Portable Live Streaming Mixer is new from Mackie, targeting social streamers, gamers and podcasters. It's pitched as a simple way to connect with a streaming platform and retails for $259.

The mixer connects to the user's smartphone headphone jack, or via USB to a computer running OBS or similar software. It can be powered with an external battery.

Features include preset-based ContourFX to shape the voice with a knob. The StreamFX voice changer lets the creator disguise their voice or do characters.

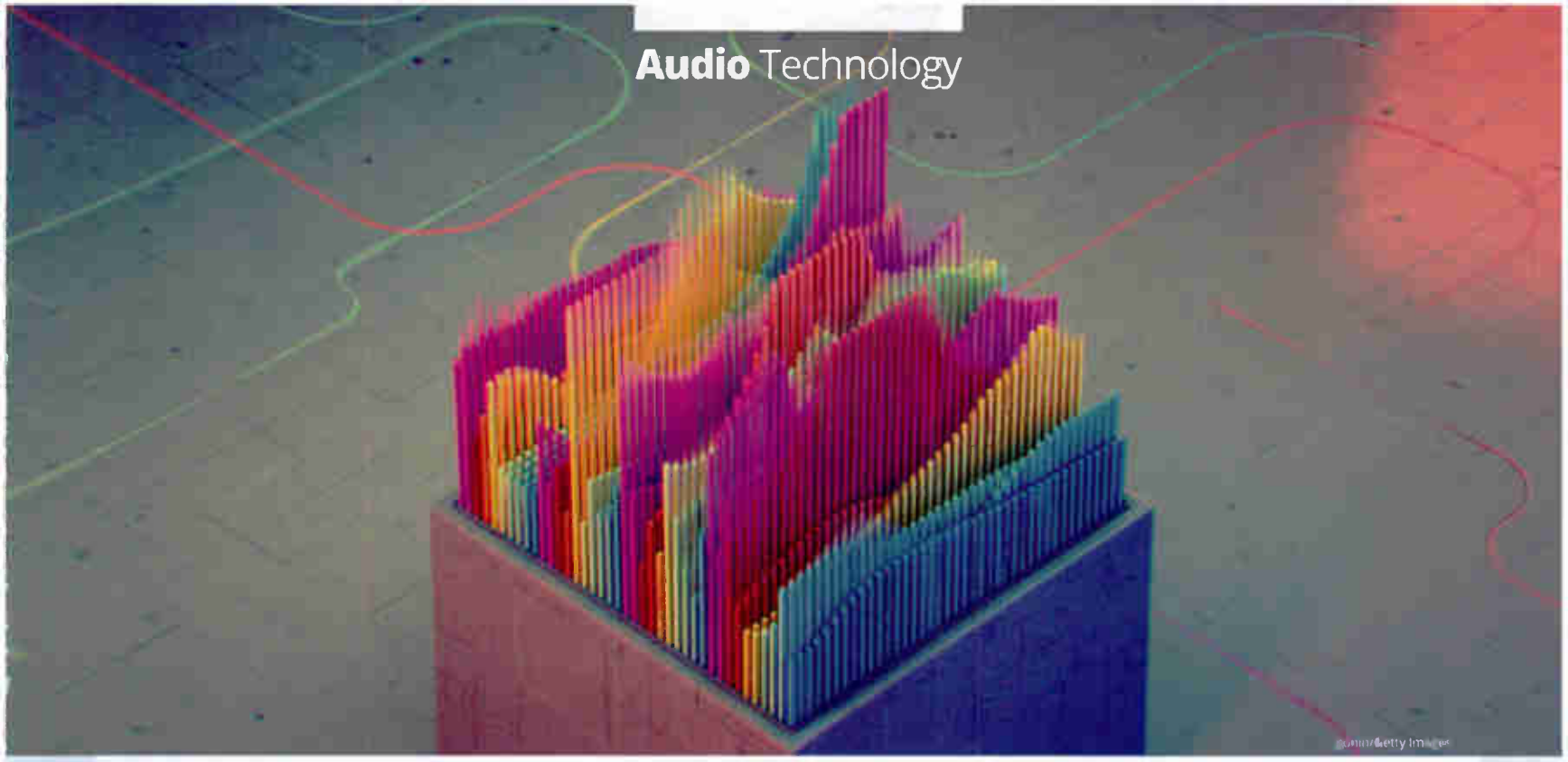
M•Caster Live comes with a software bundle from Accusonus, including a perpetual license of the ERA Voice Leveler and De-Esser plugins, and a three-month All Access Suite subscription that adds audio repair tools such as Noise Remover, Voice Deepener, Mouth De-Clicker and Reverb Remover.

"Users can explore the Voice Changer plugin, adding fun effects to their projects, or search the music libraries of SFX and Music Cellar for high-quality, royalty-free sound effects and background music."

Info: https://mackie.com/en/products/mixers/mcaster-live

BROADCAST EQUIPMENT EXCHANGE

BROADCAST EQUIPMENT EXCHANGE



Writer
Frank Foti
Telos Alliance & Syndicate of Sounds

More Info
Find out more about this topic at *syndicateofsounds.com*.

DejaVu: The streaming "Wow" factor

Broadcasters who stream can present content in true discrete 5.1 surround

A number of years ago, 2003 or so, Steve Church and I had an idea to enhance HD Radio for FM. To our ears, the HD system for FM lacked a "wow" factor, as the conventional HD signal sounded very similar to the FM-Stereo counterpart.

Just as HDTV offered an incredible advance in visual resolution, we felt the listener needed to experience something similar, with HD broadcast audio. Basically, provide a significant reason why HD Radio was the next step beyond FM-Stereo.

At that time, the record label/audio industry was in the midst of promoting a couple of newer audiophile formats: SACD (Super Audio CD) and DVD-A (DVD Audio). Both of them allowed higher sampling rates, as well as offering discrete, linear 5.1 surround sound.

Record labels began reissuing older catalog material in newly produced 5.1 surround sound. Most were of the rock, and classical genre, along with some box sets of complete album catalogs of well-known artists.

We found this exciting for a few reasons, as we were able to hear incredible recordings, by favorite artists, in a whole new light. Also, we got an idea of how to enable this on FM radio.

The HD Radio platform was still fairly new, and looking for a means to attract consumers of the new tech. As mentioned we felt there was not a significant sonic reason why a consumer would be drawn to this — until we heard music in surround.

We've been very fortunate to have maintained a strong business and collegial relationship with the crew at the Frauhofer Institute (FhG), in Germany. On account of this, we learned they had recently developed a new method to transport 5.1 surround within a coded audio environment. This is known as MPEG-Surround.

A simple description explains the usage of the left/right stereo channels for audio transport coding, and at the same time data reducing the surround cues, which are transported alongside the main stereo audio. Then, during the decoding process, the surround cues will properly assign and derive each of the surround channels accordingly. This method provides discrete 5.1 surround and operates within a coded environment platform. The surround cues require very little data, normally around 5 kbps.

Given the data rate of the HD Radio system, MPEG-Surround was the perfect fit for FM broadcast. Automotive listening is the perfect experience for this, and it would

surely add the needed "wow" factor to HD Radio, or so we thought.

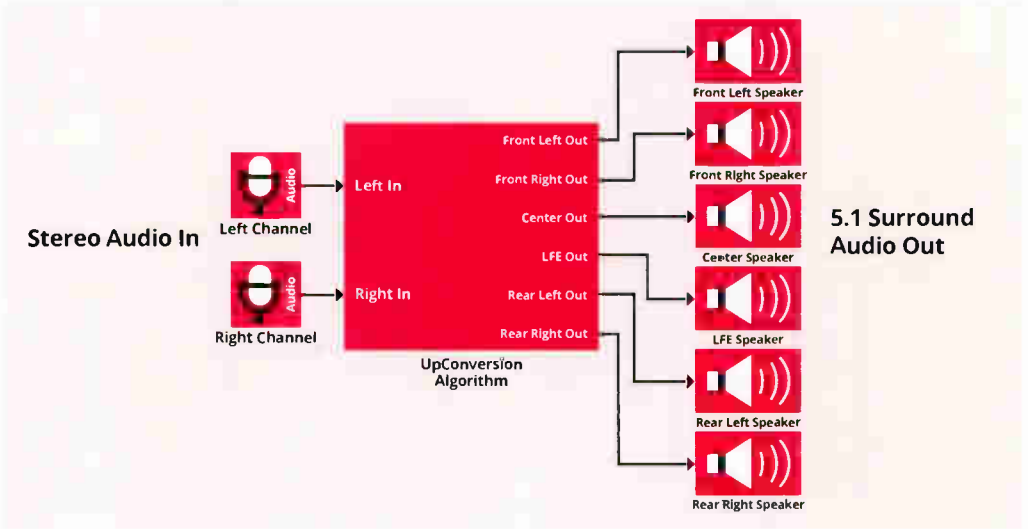
Telos, along with FhG, built an operating prototype of this system, complete with demonstrations inside a BMW automobile at a couple of NAB Shows in Las Vegas. Anyone who heard the demo was blown away.

So, what happened?

Two mitigating circumstances negatively impacted this innovative idea: the record labels were too quick to pull the plug on producing more surround content, and broadcasters were reluctant to invest in the infrastructure changed needed to add this transmission method to their facilities — even though the Telos Alliance made this all easy and affordable via their AoIP tech, which allows 5.1 surround to easily coexist with stereo signals.

The lack of content was quite possibly the biggest challenge. It would have been very confusing to consumers as to whether their reception was stereo of surround.

Given all that has been expressed here, there has always been a concept that intrigued me. Would it be possible to render discrete 5.1 surround from existing stereo material?



"HD Radio is basically another streaming platform, except we're not dealing with transmitters and receivers."

Relevance to radio

This idea is not new, and there have been various upmixing applications available, which will output a "surround" signal.

Most, if not all, of these render surround using some form of simulation, or trickery to generate the added sound field. Most of them employ time delay, phase manipulation, reverb or switching to derive surround.

My goal was to develop an upmixer algorithm that operates in real time, without any of the aforementioned gimmicks — find a linear method that preserves original production integrity and creates discrete surround.

After much research into managing sound fields, I was able to develop a method that creates discrete surround, as it expands the original stereo stage into discrete Left, Right, Center, Left-Surround, Right-Surround, and LFE (Low Frequency Enhancement) or sub-woofer for short.

This method is now known as DejaVu and is marketed through Syndicate of Sounds. The accompanying image is a basic illustration.

The system has been vetted out by some of the biggest names in the recording industry: Gary Katz, Hugh Padgham, Frank Filipetti, Giles Martin and Jean-Michele Jarre to name a few. Each of them has provided the proverbial "thumbs up" to the tech.

So, how does this apply for streaming? Well, after all that background information provided here, it's really very simple. All of the work done for the HD Radio application ports over 100% to streaming! After all, HD Radio is basically another streaming platform, except we're not dealing with transmitters and receivers.

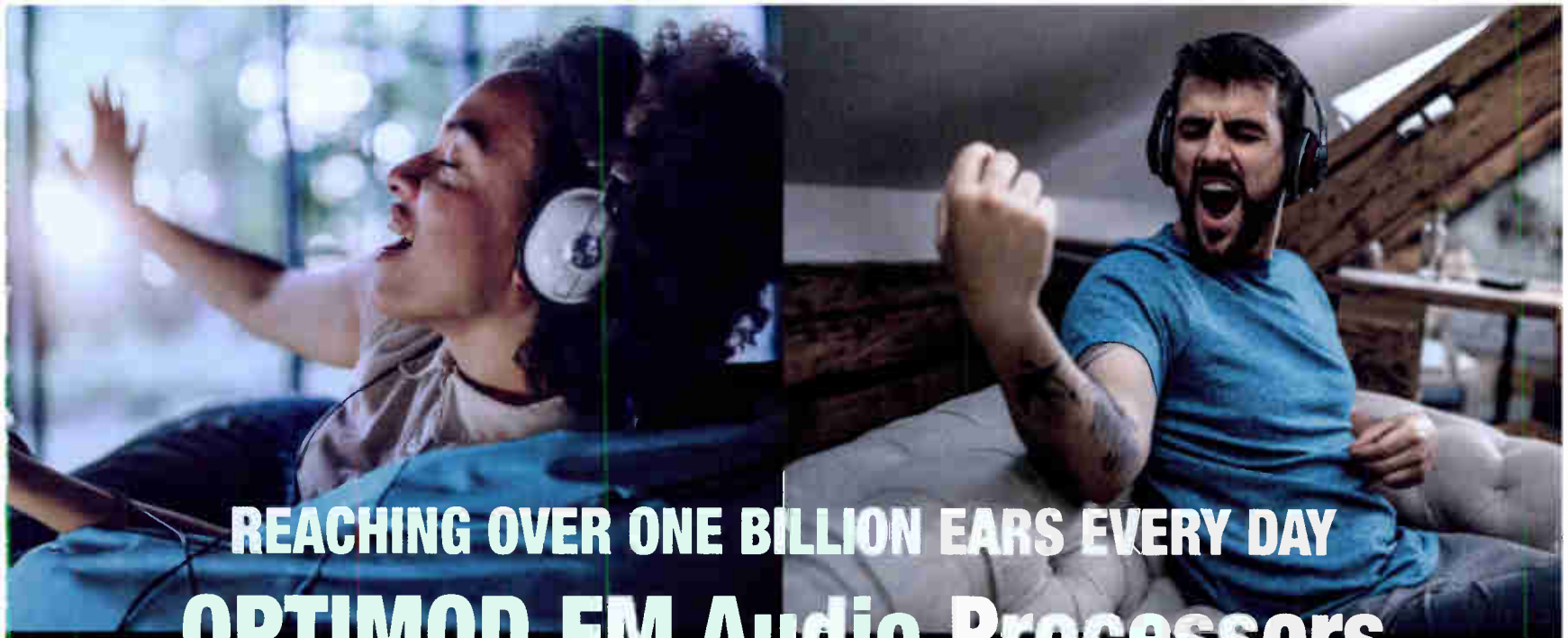
Instead of the need to rely on discrete produced 5.1 material, all we need is a great-sounding discrete upmixer for 5.1, and a transport mechanism, like MPEG-Surround, and we are good to go! For the consumer, just about any player app will automatically provide 5.1 surround if an MPEG-Surround signal is present. The players default to this now.

For the streaming installation, all that is needed is a transport codec that both employs the DejaVu upmixer and contains MPEG-Surround as a streaming selection. Basically, a stereo audio connection in, and the output is both stereo and surround, all neatly packaged in a standard streaming format.

For broadcasters who stream, this is an excellent way to add a truly amazing wow factor to your online signal, and it does not require any change to your existing infrastructure. Now all content can be presented in true discrete 5.1 surround.

As of early February, the Telos Alliance is finalizing a software update that will enable their streaming product to offer both the DejaVu upmnixing function, coupled with MPEG-Surround for the transport stream.

Letters
Comment on this or any story. Email *radioworld@futurenet.com.*



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All-inclusive Linux and AoIP appliance. No Windows® drivers, updates or PC needed. Add Streamblade to any audio network via WheatNet-IP, analog, AES3, or AES67 inputs or add Wheatstream to any existing WheatNet-IP or AES67 compatible networks.

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STREAMING AUDIO PROCESSORS

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