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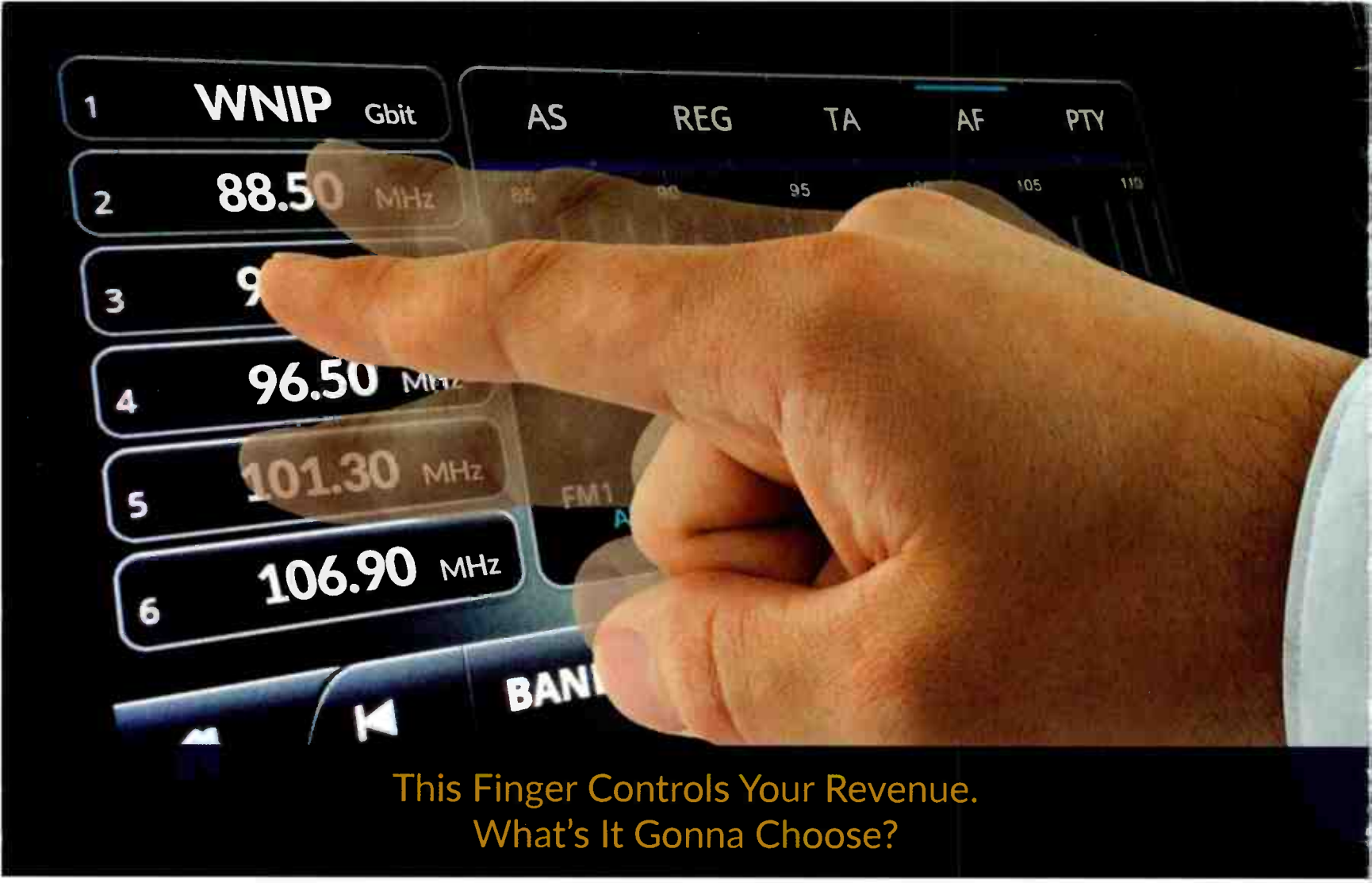

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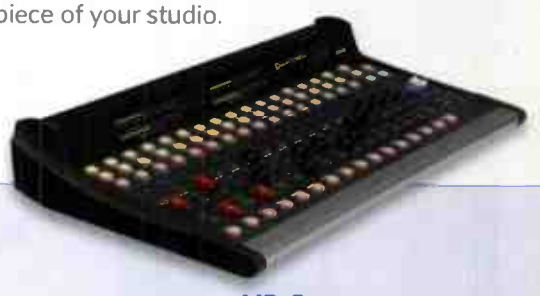

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Extensive use of large windows and glass along the corridors gives the KTNN facility an expansive feeling, as well as views of the surrouinding andscape.

On the cover: Open sight lines provide an open feel in the KTNN's studios, which feature SAS i-SL control surfaces. Photo Credit: KTNN KWPK

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VIEWPOINT

Broadcast's Bread and Butter

I've often joked that you practically have to be a historian to be a broadcast engineer, at least in North America.

Every day, I deal with technical anachronisms that would leave many shaking their heads in the second decade of the 21st century. Digital modulation schemes are ubiquitous, and "amplitude modulation" and "frequency modulation" are not well known to those just getting in to radio (excuse me — wireless transmission) today.

From a practical standpoint, with so much of this older technology in everyday use, there remains a need for people who know it well enough to keep it going, and thus we do our best to provide resources for those who find it interesting, and those who are just learning now.

One often hears that there are few ways for disc jockeys to get trained and to build on successes and experience, since many small and medium markets rely heavily on satellite-based programs or voice tracks from larger-market stations. There's a parallel inside the engineering community, as well; with consolidation has come reductions in the overall numbers of radio engineers needed — at least, that's the paradigm we've been working with for the last 20 years.

Perhaps the real problem, though, is that radio certainly lacks glamour, at least compared to the dot-com world. Interestingly, I still find quite a few younger people who like the business and who want to advance in it and build careers.

For those reasons, Radio magazine is doing our best to present information that is interesting and useful for all readers, including those just starting out in the business. This "old" technology remains our bread and butter, even as we spend more and more space on digital systems. To that end, we have articles this month that should prove useful to beginners. Veterans will find them interesting, as well.

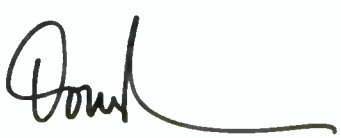
Jeremy Ruck discusses the bane of many a radio engineer: a bad monitor point for an AM directional. Just what approach do you take when one of your monitor points stubbornly remains above its limit? Mr. Ruck describes, point by point, the way to handle it. I've been doing this a long time, and I found this article especially enlightening.

In Tech Tips, we finish out our series on troubleshooting. This is becoming a lost art, but we're doing our best to keep it alive.

And in Sign Off, the Wandering Engineer discusses yet another lost art — the composition of technical manuals. "Years ago," technical manuals not only described what the gear did, but why and how. There was a lot to be learned. To a large extent, that content is missing today.

Growing up on the West Coast, and driving at night (home from work no doubt), I remember hearing what was practically a beacon on the AM band — KTNN blasting in on 660 kHz. The Navajo Nation has expanded their broadcasting facilities over the years, having added a couple of FMs, and recently, they built a beautiful new facility. This month we'll tell you all about it in our Facility Showcase.

We're not all about technical history, as many readers know; we're also about keeping you up to date on the latest radio technology. This month, we did some research in to the many, many IP codecs that are available now, and we're sharing what we learned with you. This article will give you a good reason to hang on to this month's issue. May I suggest you put it on the shelf when you're done reading it?



Doug Irwin, CPBE AMD DRB | Technical Editor

Radio
THE RADIO TECHNOLOGY LEADER

May 2017 | Vol. 23 No. 5

NewBay Media, LLC
28 East 28th Street, 12th floor
New York, NY 10016

SUBSCRIPTIONS: Free and controlled circulation to qualified subscribers. Customer Service can be reached at: newbay@computerfulfillment.com or by calling 888-266-5828 (USA only) or 978-667-0352 (Outside US) or write us at Radio Magazine, P.O. Box 1884, Lowell, MA 01853, USA. Back issues are available by calling Customer Service.

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REPRINTS: For custom reprints and eprints please contact our reprints coordinator at Wright's Media 877-652-5295 or NewBay@wrightsmedia.com.

Radio, Volume 23, Number 5, (ISSN 1542-0620) is published monthly by NewBay Media LLC, 28 East 28th Street, 12th floor, New York, NY 10016. Periodical postage paid at New York, NY and additional mailing offices. Postmaster: Send address changes to Radio, PO Box 1884, Lowell, MA 01853.

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Noncommercial Radio Regulation Relief

by Lee Petro

Last month, the Federal Communications Commission tweaked its rules for noncommercial broadcasters, expanding their ability to conduct fundraising events for third parties, as well as providing relief for their preparation of biennial ownership reports due Dec. 1.

DISASTER RELIEF AND NON-COMM FUNDRAISING

First, the FCC has long prohibited noncommercial broadcasters from interrupting or suspending their station's regular programming to conduct on-air fundraising for third-parties. Instead, these broadcasters were required to seek a waiver from the FCC prior to the event, which the FCC has granted in limited circumstances.

For example, the FCC has granted waivers to permit fundraising in the wake of Hurricanes Andrew, Katrina and Sandy; the Sept. 11, 2001, terrorist attack; and the tornadoes that struck Moore, Okla., in 2013. The common threads running through the FCC's waiver approvals is that the fundraising was tied to a significant event that occurred in the local community, and that fundraising would be limited in duration.

On the other hand, the FCC has denied waivers when the fundraising would have addressed long-term or ongoing issues.

To that end, the FCC revised its rules to provide the flexibility to noncommercial broadcasters to conduct fundraising for third-party organizations up to 1 percent of their total annual airtime, i.e., approximately 88 hours annually or 1.7 hours per week for full-time broadcast stations.

The new flexibility will not be available to those noncommercial broadcasters that receive funds from the Corporation for Public Broadcasting. During the proceeding, all but one CPB-funded station informed the FCC that they did not wish to have this new-found ability. For these stations, the FCC will continue to review waiver requests.

In the event that a station elects to conduct a fundraiser, it must disclose to its listeners that the programming is being provided for the benefit of the third-party organization. While the FCC did not adopt specific language for the disclosure, the FCC will require that the public be informed at both the beginning and the end of the programming, and at least once each hour during the program.

Finally, while the FCC will permit the broadcast licensee to be reimbursed by the third-party organization for the station's expenses in producing and conducting the program, the station is not permitted to receive "additional consideration" beyond those verifiable costs.

FRNS

The FCC also adopted rules to permit noncommercial broadcasters to obtain "Special Use Federal Registration Numbers" for their board members when filing their biennial ownership reports (FCC Form 323-E). The FCC requires officers, directors and other persons with reportable ownership interests in commercial broadcast stations to obtain a Federal Registration Number, which is included in the biennial ownership reports filed by commercial broadcast stations (FCC Form 323).

In January 2016, the FCC extended the requirement to obtain personal information (including Social Security numbers) from each officer and member of the board of noncommercial broadcasters, as well.

While the noncommercial broadcaster could obtain a Restricted Use FRN, which only required the last four digits of a board member's Social Security number, the licensee was required to certify that it used "reasonable and good faith efforts" to obtain the complete information from each board member, if it used a Special Use FRN.

The order also indicated that the FCC may take enforcement action against those board members refusing to provide sufficient information for a noncommercial broadcaster's use of a Restricted Use FRN. Then-Commissioner Pai and Commissioner O'Reilly objected to this language. Immediately prior to the leadership transition at the FCC, the Media Bureau, acting on delegated authority, denied the pending requests to reconsider the requirement.

Upon the ascension of Chairman Pai, the commission returned the reconsideration petitions to "pending" status, and last month's order granted the requested relief. As such, noncommercial broadcasters will now be able to use Special Use FRNs, which will not require the collection and disclosure of personal data for each board member.

It is expected that this revised rule will become effective prior to the Dec. 1 filing deadline for all broadcast stations.

Petro is of counsel at Drinker Biddle & Reath LLP. Email: lee.petro@dbr.com.

DATELINE

June 1 — Annual EEO public file reports for stations located in Arizona, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, West Virginia, Wyoming and Washington, D.C., with five or more full-time employees.

June 1 — Broadcast Mid-Term Report (FCC Form 397) for stations located in Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming with 11 or more full-time employees.

July 10 — Issues/Programs Lists for second quarter of 2017 must be placed in/uploaded to stations' public inspection file.

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Jeff Robbins, Sun Prairie Media Center

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Compare and Contrast These AoIP Codecs

by Doug Irwin, CPBE AMD DRB

The use of audio-over-internet protocol codecs for STL applications is becoming more and more commonplace. This is especially important now because the large telcos are much more interested in providing high-speed IP connectivity than they are in providing (what we could now consider) old-fashioned wirelines.

This month we're going to look at the players you know and some you may not in this space. In addition, we'll cover the companies that have methods in place to share multiple, different network connections to pass audio from point A to B.

CrossLock is the name given by Comrex to the technology, employed in BRIC-Link II, enabling the simultaneous use of two networks and the transmission of two identical streams over them.

COMREX

For nailed-up STL connections, consider the Comrex BRIC-Link II. It's a full-duplex stereo encoder and decoder in a small form-factor package, and it offers a stereo or mono linear mode that does not compress audio, in addition to FLAC lossless compression, AAC/HE-AAC modes, Opus, and VoIP standards G.722 and G.711. Its built-in jitter buffer manager automatically balances delay and stability, dynamically increasing and decreasing delay based on network performance. End-to-end coding delay in linear modes is less than 25 mS and FLAC modes are less than 30 mS.

CrossLock is the name given by Comrex to their technology employed in BRIC-Link II, enabling the simultaneous use of two networks and the transmission of two identical streams over them. In the event of network issues, CrossLock provides a seamless transition between the two audio paths.

BRIC-Link II has an embedded web interface, allowing the user to access all controls remotely. The page displays connection status, network diagnostics and audio level meters for remote monitoring. Users are also able to configure profiles for various connections with point-and-click connection commands.

TIELINE

Tieline's Genie STL is also a single RU, full-duplex audio codec capable of sending 24 bit 96 kHz SR linear PCM audio or by way of the following audio codec algorithms: Enhanced aptX, LC-AAC, HE-AAC v1 and v2, AAC-LD, AAC-ELDv1 and v2, Opus, MPEG II, MPEG Layer-3, Tieline Music and MusicPLUS, G.722 and G.711 algorithms. The unit features auto-switching, dual redundant AC power supplies, dual 1 Gigabit (10/100/1000) Ethernet ports, a low-latency in-band RS-232 aux data channel, and codec "wizards" and GUI for configuration and control.

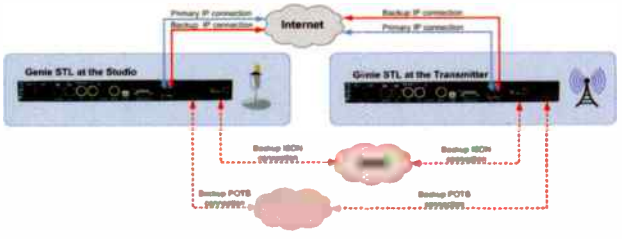
The Genie features automated jitter buffer management, FEC and error concealment techniques. These features dynamically respond to variable conditions over unmanaged IP networks such as the public internet. Tieline also offers a feature known as SmartStream Plus which operates as such:

1. The codec can stream simultaneous redundant data streams from both Ethernet ports, allowing it to deliver redundancy by switching back and forth, without loss of audio, from the nominated primary data link to the backup link if one fails and then subsequently recovers. (Using IP links from two different IP network providers is recommended.)
2. When multiple redundant audio streams are sent, the decoding codec automatically reconstructs audio into a perfect single stream on a first-packet-arrived basis to ensure audio integrity.

TELOS

The Telos Z/IP One is a 1 RU rack-mount IP codec that users typically associate with remote broadcasting, but it can be used for nailed-up STL connections as well. Z/IP One includes the codec algorithms for AAC-ELD, AAC-HE, AAC-LD, MPEG 4 AAC, MPEG 2 AAC, MPEG Layer 2, G.711, G.722 codecs, plus linear audio and (optionally) aptX Enhanced coding. It includes dual Ethernet ports for separate streaming and control: LAN for local control with Livewire audio and GPIO, and a separate WAN port for connections to wide area networks.

Z/IP has both analog and AES inputs/outputs.



In addition to two IP network connections, the end-user can configure the Tieline Genie STL to make use of ISDN or POTS for end-to-end connectivity.

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Telos Z/IP One features dual Ethernet ports for separate streaming and control: LAN for local control with Livewire audio and GPIO, a separate port for connections to wide-area networks.

The user configures it via its built-in Web server. "Push Mode" is used for one-way network transmission to a single location, and "Multiple Push Mode" is used for audio distribution to multiple destinations. A time-aligned RS-232 channel is available for remote control or metadata, e.g., RDS. A time-aligned 8-bit parallel GPIO port is available for signaling and control.

WORLDCAST

Worldcast has an extensive line of AoIP codecs — including the APT IP Codec and the IP Silver — but the device that I want to make sure you know about is the Surestreamer.

Like some of the other codec devices manufacturers mentioned in this article, APT's Surestream is a means by which more than one network is used to move IP packets from one end to the other, but the Surestreamer is unique in that it's an outboard unit, and it can sit in front of any existing single-port IP audio codec from any manufacturer. It's agnostic to the codec device (as long as they use UDP or RTP). Like the other redundancy schemes we've talked about, Surestreamer continues to provide a continuous audio stream, even when one of the contributory links suffers a total Loss of Connection. Surestreamer's dual IP ports can be connected to two wired networks or via a wired and a wireless network.

Worldcast's Surestreamer is unique in that it can sit in front of any existing single-port IP audio codec from any manufacturer. It's agnostic to the codec device (as long as they use UDP or RTP).

Surestreamer can also be deployed as a multicast or multiple unicast node to reduce connectivity costs by migrating the stream replication function away from the source encoder and closer to the decoding devices.

Configuration of the Surestreamer is done by way of its embedded webserver. It functions both as an SNMP manager and agent. Performance monitoring and system event logging is provided. Data throughput for LAN connections is 10 Mb/s; for the LAN, 20 Mb/s (and varies with packet size).

DEVA

DEVA has an extensive line of broadcast products, including the DB910, a small form-factor, full-duplex audio codec. The DB910 has analog inputs/outputs as well as AES ins/outs, all accessible via 1/4-inch TRS connectors. (32, 44.1 and 48 kHz SR supported.) Codec algorithms include linear PCM, HE- AAC (versions 1 and 2), as well as MPEG-1 and MPEG-3 (decoding).

When powered up, the DEVA DB910 device will announce its IP address through the headphones. It can use DHCP to derive an IP address, and UPnP is included for local discovery.

Configuration of standard bitrates, and variable bitrate, are supported on the encode side. It will stream as a Shoutcast/Icecast compatible TCP server, or Icecast Source Client using RTP. By way of its built-in MP3 player (SD-card based), it can provide backup audio for the decode side in the event the stream is lost. The unit includes six general purpose inputs/outputs for signaling end-to-end or remote control. The user configures the DB910 via its embedded web server, using a standard browser.

When powered up, the device will announce its IP address through the headphones. It can use DHCP to derive an IP address, and UPnP is included for discovery of local networks.

GATESAIR

The GatesAir Intraplex IP Link family of IP audio codecs includes the

IP Link MPX was designed specifically for MPX over AES transport via IP.

Digigram Iqoya supports VLAN tagging (802.1q and 802.1p), DSCP (otherwise known as DiffServ) and can stream in unicast, multi-unicast, multicast and multi-multicast formats.

IP link 100 (Single set of bidirectional stereo audio channels), the IP link 200 (two sets of bidirectional stereo audio channels) and the IP Link MPX.

Each of these devices needs 1 rack unit of vertical space. Standard codec algorithms include linear, AAC-LC, Opus and G.722; optional codecs available are AAC-HE, AAC-HEv2, AAC-ELD, MPEG2, MPEG3 and Enhanced aptX. Transparent AES (at 192 KHz SR) also supports MPX over AES (also optional). Protocol encapsulation includes MPEG-TS, RTP and Shoutcast/icecast. Configuration and control of IP Link is done via its embedded web server (using any of the IP interfaces).

The IP link codec includes three separate Ethernet ports and thus supports redundant network connections. Optionally, the IP link includes a feature known as "stream splicing," which enables the device to switch from one IP stream to another (provided over separate networks) for the sake of redundancy. Silence sensing can be used to activate the switching process — and the IP Link can also switch to a USB drive or another audio source should the need arise. IP Link can also encode the same audio source in different formats for primary and secondary STL connections or those to a streaming service.

The IP Link MPX is, as its name suggests, designed specifically for MPX over AES transport via IP. Flexible sampling rates and sample size options allow the user to optimize the needed bandwidth. The unit features a single bidirectional FM MPX composite signal, redundant input MPX signal ports with automatic failover based on signal activity and redundant output MPX signal ports. Two channels of SCA mixing are available. GPS support for precision digital timing reference and the SynchroCast option provide dynamically managed precision delay for single-requency network broadcasting and simulcasting.

DIGIGRAM

Digigram is probably not a company you associate with AoIP codecs, but they have an extensive line. The Iqoya is a single RU, full-duplex codec with two RJ45 ports that can be used for separating management traffic from streaming traffic or for the generation of redundant streams (with up to 2 seconds of delay in the redundant stream).

Iqoya supports VLAN tagging (802.1q and 802.1p), DSCP (otherwise known as DiffServ) and can stream in unicast, multi-unicast, multicast and multi-multicast formats. Like many of the other codecs in this article, it also manages network conditions often seen on the

public internet — excessive jitter, lost packets, duplicated packets, and disordered packets; it also features selectable FEC (+10 percent, +20 percent, +33¨ percent, +50 percent, +100 percent).

Iqoya is FNS/ACIP compliant (EBU Tech 3326) and will stream in RTP or UDP modes, in addition to HTTP streaming (Icecast/Shoutcast). Auxiliary data transport is done in-band via data tunneling, supporting RS-232 (RDS UECP) and eight GPIOs. Control, monitoring, alarming can be done through SNMP (SET, GET, Traps) and configuration is done via a secure web connection (https) and FTP connections.

BARIX

Barix is among the most well-known AoIP codec manufacturers and has an extensive product line. The exstreamer 500 is a full-duplex codec with balanced audio inputs and outputs (using phoenix connectors). The encoding side can make use of MP3, G.711 or PCM; the decoder can make use of those in addition to AACPlus and Ogg Vorbis. Streaming protocols include TCP, UDP, RTP and multicast. The exstreamer 500 also supports four relay inputs, four relay outputs, and serial in/out (RS-232 or 485). Configuration is done via its embedded web server.

The Barix exstreamer 500 is a full-duplex codec with balanced audio inputs and outputs, by way of phoenix connectors.

STL applications don't require full-duplex codecs and for this reason you could always consider the well-known instreamer (encoders) and exstreamers (decoders) from Barix to send audio in one direction only. Common features between instreamer and exstreamer include the AACplus, MP3, Ogg Vorbis and G.711 algorithms (in addition to PCM); inputs/outputs via RCA connectors, RS-232 support, and the need for an external power supply (9-30 VDC, 12-24 VAC), which comes supplied. Configuration is done via the embedded web servers.

2WCOM

2wcom is a manufacturer with which you may not be familiar. Their MM01 is single rack unit, full-duplex codec suited for STL purposes. Codec algorithms included are MPEG layers 1, 2 and 3 and PCM. Optionally the MM01 can use MPEG 2/4 AAC LC, HEv1 and v2, AAC-LD, Enhanced-aptX, or MPX over AES (192 kHz SR). In addition, the MM01 supports EBU Tech 3326, Ravenna, Livewire, precision time protocol, session announcement protocol, session initiation protocol and session description protocol. Configuration of the MM01 is done via an embedded web server, and the unit supports SNMP control.

By way of an optional GPS interface, and using PTP, the 2wcom MM01 can be used for microsecond accurate latency control in single frequency network applications.

The MM01 includes two Ethernet WAN ports and can make use of what 2wcom calls Stream4Sure seamless switching, using their dual streaming mechanism: redundant contribution of IP packets to different transmission paths. (Another Ethernet port is included for management purposes.)

Optionally, the MM01 can use GPS and, by way of PTP, can be used for microsecond accurate latency control in single-frequency network applications.

Mayah GeMINI Studio supports eight channels in and out simultaneously, in analog and AES formats.

MAYAH

Another long time manufacturer of IP codecs is Mayah. Their GeMINI Studio is a small codec, offered in two variations: 1 RU, half-rack width, with an external power supply, and 1 RU, full-rack width, with redundant power supplies.

GeMINI Studio supports eight channels in and out simultaneously, in both analog and AES formats (using dB type connectors). Codecs supported include OPUS, FLAC and AAC HE. The unit also supports AES67, RTP, RTSP and SIP.

AEQ

AEQ has been in the audio codec field for many years and offers (among others) the Phoenix Venus 3, a single RU full-duplex codec with both analog and AES inputs/outputs.

It supports SIP and is 100 percent compatible with N/ACIP EBU Tech-3326 technical recommendations; codec algorithms included are G.711, G.722, MPEG-2, OPUS, and AEQ's LD low delay algorithms. AAC algorithms are provided as options.

The Venus 3 supports SNMP, providing one means by which the user can monitor its status, and alarms. It also includes four sets of GPIOs. Via its Ethernet interface it can be controlled remotely by way of a PC; included in the control software are real-time VU meters, contact list management, event logs and alarm logs.

When studying any device type, whether it's consoles or transmitters or audio codecs, make sure you include the usual suspects as well as manufacturers you don't know as well. Sometimes it seems a bit risky to go with an unfamiliar manufacturer, but keep in mind that none of them has a monopoly on good ideas or methodology.

The underlying technology is the same (i.e., sending IP packets from one location to another), and each is dealing with the same network issues (packet loss, out-of-order packets, delayed packets, etc.) so most of these designs are going to have more similarities than differences. Comparing features can provide a useful learning experience.

Down to the Component Level

by Doug Irwin, CPBE AMD DRB

We continue our series on the basics of troubleshooting. We've previously, we talked about analysis paralysis,and the downside of the shot-gunning technique. This month, we'll go in to what I refer to as the "induction" technique.

The intermittent nature of most problems is what makes them difficult to resolve. You just can't be there at the station or at the transmitter site 24 hours per day to see when a piece of gear acts up.

But in some cases, you can try to induce the symptom in the piece of gear, using an external stimulus. Let's consider an example.

Let's say you have a remotely located FM transmitter site that uses a radio studio transmitter link as its "main" and a wireline STL of some sort as a backup. One day, the station just goes silent, creating panic among programming types. Just as suddenly, the audio comes back, and sounds completely normal.

The next day it happens again. This time, you switch to your backup STL and the problem immediately goes away. You also take note that this happened about 2 p.m. in the afternoon (and it's summertime, by the way).

So, you visit the transmitter site and note that the receiver is working, and its metering is completely normal. There's no sign of any problems at all. Still, you decide to either take the receiver back down the mountain (leaving only the wireline STL); or you install your spare receiver (which you do have, right?).

So, how could it be troublesome at the transmitter site, yet work perfectly on the bench?

When you get back to the shop, you plug this receiver in and hang an antenna on it, noting that you pick up the local STL transmitter fine. It sits on your bench for days and continues working normally.

Use caution with the rubber mallet: A few love taps should be all you need to discover intermittent connections.

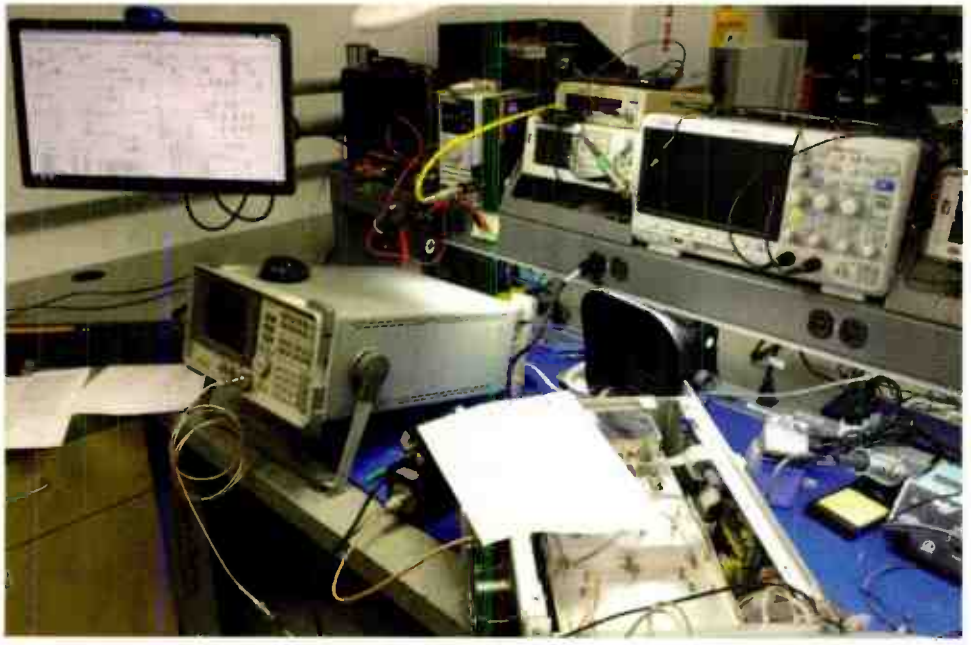
So how could it be troublesome at the transmitter site, yet work perfectly on the bench? Is there any way to try to induce the symptom? Yes, there is. (Note that the transmitter site is getting rather warm in the afternoon. Could this be a clue?)

Open the receiver, and very carefully, apply some source of heat to its inside. This could be a 100 W incandescent bulb or something like a small heat gun. Warm the insides up for an extended period (this is why the lightbulb is better). Does heat cause the problem?

If so, narrow it down to the particular components that are heat-sensitive. The small heat gun works well for this.

Another way to check for the same symptoms (i.e., temperature sensitivity) is to use freeze spray. You can target individual components then. With the spray, you will note that the vast majority of components are not sensitive. If you find some that are, and those "mute" the audio output of the receiver, consider changing them.

Sometimes temperature extremes can reveal bad contacts, such as edge connectors. Another technique — and I can't emphasize

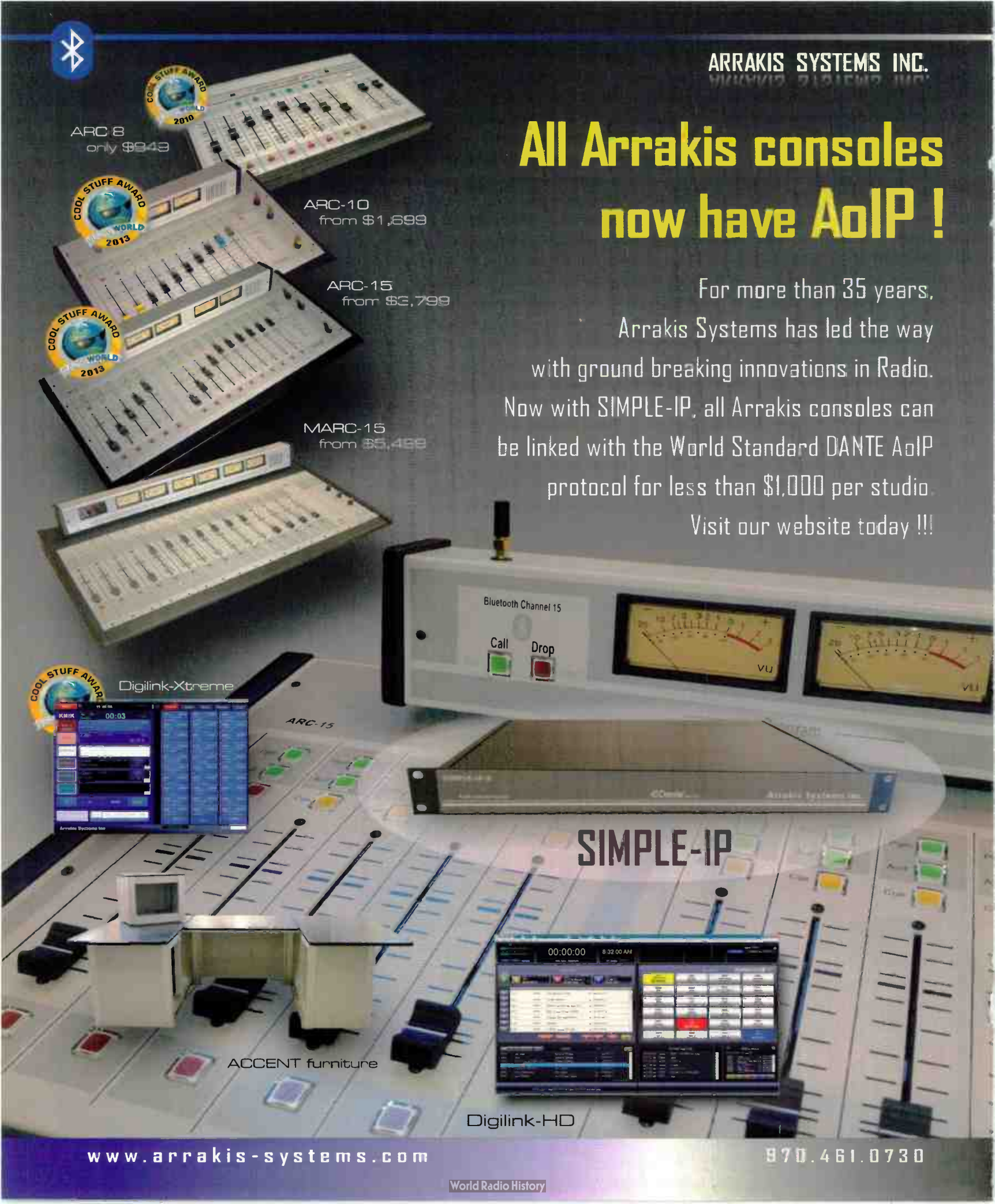


Troubleshooting is made easier in a comfortable environment, with plenty of light, the right tools and the correct manual.

caution enough when it comes to this — is to use a rubber mallet to gently tap on a device in order to reveal marginal contacts. Seriously — don't bang on a piece of gear; just use the mallet to give it some gentle shocks. See if any of these shocks reveal the same symptom you are looking for (in this case loss of audio). If so, open the receiver, and manipulate each and every connection inside of the device to see if they are solid or if they reveal a problem.

Troubleshooting is becoming a lost art, I'm afraid. The playing field is different today then it was even 10 years ago. Rare is the occasion that we must get down to the component level.

Still, the techniques I've discussed are valid, even in the era of board swaps.



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Geo-Fencing, Geo-Blocking

by Brian Galante

Brian Galante of Dimension PR is a spokesperson for StreamGuys.

If your station is a flagship for a professional sports team, you'll likely learn about geographical rights restrictions soon (if you haven't already).

Your station's contract with the team, though allowing for local over-the-air broadcasts, may restrict listeners from your stream, depending upon where they are located.

"Geo-fencing" is the function of defining virtual borders upon which location decisions are based. A geo-fence could, for example, be a set of cities that allow ("geo-targeting") or prohibit ("geo-blocking") access to content. A simple way to define who is inside the allowed area would be by outlining the area on a map, using longitude and latitude lines as borders. Geo-fencing could also be specific to the user themselves, such as when the user is at home or at work.

"Geo-blocking" is the function of prohibiting access to content based on user location. This is critical for territory and rights management.

A sports broadcaster may have the rights to stream a game only within the same metro area as the OTA broadcast; conversely, geo-blocking can be used to implement local blackout restrictions for sports and concerts, preventing streaming within the event's host city unless all tickets have sold out. Broadcasters may also wish to implement geo-blocking based on their interpretations of royalty considerations.

Whereas geo-blocking is used to prohibit access, geo-targeting is used to allow access and increase relevance by providing specific, targeted content based on location. Geo-targeting is often used to deliver different versions of programming based on the location of the user, or targeted advertising applications based on the user's location.

HOW IT WORKS

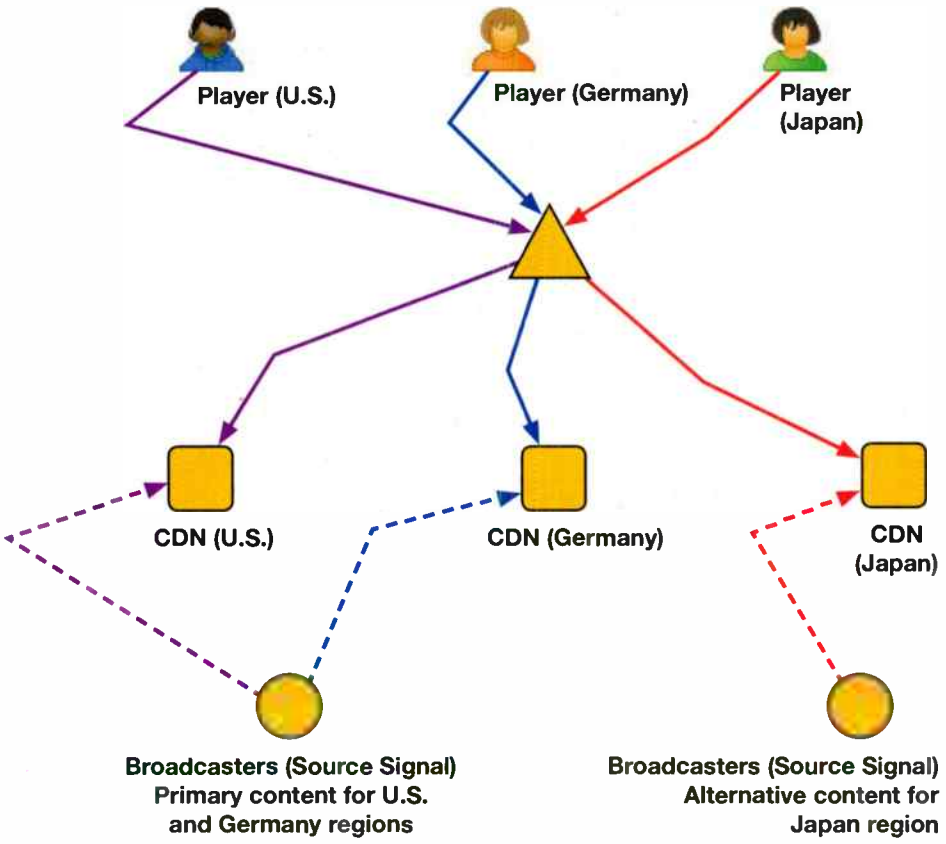
StreamGuys is a U.S.-based CDN that provides streaming clients with both geo-blocking and geo-targeting systems. Let's take a look at how their implementation works.

As mentioned, geographic decisions are made by identifying where the end-user is, and so the accuracy of geo-targeting or geo-blocking is determined by the available data. The location of end-users can be determined with or without their participation.

Smartphones and almost all modern PCs and browsers can be enabled to share end-user data regarding location. This is usually an opt-in capability, with the user prompted to allow location sharing. Once enabled, mobile devices typically send GPS-based latitude and longitude data. Even devices which lack a proper GPS can send latitude and longitude coordinates; for example, the Google Chrome browser can provide highly accurate information from its database of Wi-Fi access spots.

If the end-user opts out from sharing location data, geographic decisions can be made based on the IP address of the user. The IP address is usually available in the network session's request for the content, and can be looked up in IP address databases from many providers to determine the corresponding location.

IP-based location accuracy is only as good as the database itself; such info is usually very



Geo-targeting engine routes user based on their location.

accurate at the country level, reasonably accurate to the city level, but inaccurate at the block and street address level. There can also be false identification for individuals who are behind networks which share IPs between users, like larger corporate networks and some mobile networks.

In the StreamGuys system, the source channel is set up server-side to look up the client geo-location. The source channel then decides if the client is allowed to access the requested resource, with these steps:

- Client player requests content from *http://channel.streamguys.com/SportsGameContent*.
- Streaming server *channel.streamguys.com* receives request, then looks up the client location via lat+lon or IP.
- Once the location of the requesting client is determined, the stream is either served or blocked depending upon the specific application. Broadcasters have the option of sending the blocked users to an alternate feed as well.

Broadcasters often use a mix of geo-blocking and geo-targeting. For example, a station could prohibit access to content such as a soccer game from a specific country, while also presenting the option of alternative content to blocked users — either different programming, or at least a service message explaining the restriction.

StreamGuys integrates geo-blocking at the server level, since many savvy end-users can bypass client-side blocking solutions. SGalerts monitoring and alerting solutions can check content availability from various regions, verifying the integrity and operation of geo-location functionality and policies.

KTNN talk studio and control position. Custom furniture by Ominrax.

KTNN Educates and Entertains the Navajo Nation

By Judy Bandstra

There are many things that define a nation: language, customs, traditions. But it is the people of a nation who keep those things alive. It takes patience, perseverance and a strong voice to retain an ancient language and culture in the modern world.

For the native people of the Four Corners region of the southwestern United States, that voice is KTNN, "The Voice of the Navajo Nation." The vision for the future of the station has evolved over time, encountering many obstacles along the way, but now, after more than a decade, that dream has finally become a reality.

KTNN, which is owned by the Navajo People, is not the only radio station broadcasting to the Navajo Nation, but it is the largest. It started in February 1989 as a 50,000 watt directional AM station broadcasting from an old modular building that was the office space for the Navajo government.

The Navajo Nation is a huge land base that extends into three states. KTNN's powerful AM signal reaches from the tower in Sawmill, Ariz., to Albuquerque, N.M., to Phoenix and to parts of Utah in the daytime. At night, it reaches Canada, with reports of clear reception from Japan and Finland.

From their FM site on Deeza Bluff in Arizona, they also transmit KWRK(FM), 96.1 MHz, a mostly syndicated country format, along with KTNN(FM) at 101.5 FM, a simulcast of KTNN programming.

The station is an invaluable resource for the Navajo People, some of whom live in very remote areas with no other access to news and information. KTNN produces all local content, except for the top of the hour news. The majority of the time, the programming is broadcast in the Navajo language, with news and sports in both Navajo and English.

"A lot of things are geared toward our culture," General Manager Troy Little says.

Some of the programming is seasonal, in accordance with Navajo culture, but he says the focus of the content is to "educate and entertain." Sunday night programming is all in the Navajo language and includes "sacred stories passed down from our ancestors," which can only be spoken of in winter, he says. In the spring and summer they talk about other things in the Navajo culture.

As an integral part of the community it serves, the new station had to be not only a technical enhancement, but also an asset that was welcoming to the community.

From concept to completion, the project took 14 years and has gone through many changes.

KTNN acquired the land to build the new station in 2006. When the economy entered the Great Recession, the financial institutions funding the project dropped out as well.

Photo Credit: KTNN KWRK

SAS i-SL control surface.

ENTER V THREE STUDIOS

The building went through two prior designs. Little's predecessor on the board wanted a larger building to allow for leased office space. When Little took over as GM in 2009, he decided to concentrate on the current need, but allow for future expansion. He took the project in a whole different direction, choosing V Three Studios in St Louis to do the design. Once V Three was on board, Little says he knew it was "gonna be a completely different ball game."

When V Three project lead Josh Hellman took over, there was a design in place but nothing yet existed on site.

"This was a unique project in that it was a clean slate," Hellman said. His goal was to "create a showcase piece with the design" that had a "good and quick visual connection to the space."

As part of the design, Hellman said he tries to connect people with what is really going on in that space. For example, someone in the lobby can see into all of the main on-air studios and the equipment room.

"We try to highlight equipment rack rooms and really bring those to the front," Hellman said.

There are five racks with space for two more, a cable tray that branches out to clusters of studios directly adjacent to each other, with four main studios on exterior walls with windows

Space for guests to relax just outside of KTNN studios.

Photo Credit: KTNN KWRK

and four production studios. This cluster design takes advantage of what Hellman calls the "acoustic envelope."

Little loves the new design. "It's a real radio station," he said.

KTNN broke ground in June 2016 and contracted Greenberg Construction in Gilbert, Ariz., to build the new facility. Hellman says the only real snag was getting local utility companies to get permanent power and infrastructure to the site. They had to have temporary utilities brought in to begin construction. Otherwise, he says, the project went pretty smoothly with "very minimal curveballs."

Native Innovations, a small network IT company in Flagstaff, Ariz., installed the cable infrastructure. Owner Gerome Tsosie says one of the reasons his company was selected is because of the "Buy Indian First" initiative, which gives first preference to Navajo companies.

Tsosie says his company is "probably the only Native American-owned IT company in the state of Arizona."

He and his team of five employees pulled 15,000 feet of Cat-6 cable to interconnect the new audio routing system with the new studios and existing equipment. He also installed a 24-port patch panel in each studio to enable patching between the studios and the equipment rack room.

New furniture, by Omnirax, completes the new studios' aesthetics. "It's beautiful," Little said, "all the colors, and everything matches."

Omnirax's David Holland said, "What made this project unique for Omnirax is that it provided the perfect opportunity to furnish an entire facility. We worked closely with Kurt Kerns [principal/owner of V Three Studios] on right-sizing the spaces and we'd already designed all the studios by the time we met Troy Little in person at NAB. At that in-person meeting he fell in love with our WeDesk line of office furniture and entrusted us with the task of furnishing all the private offices, conference room and storage needs. We even supplied the chairs throughout the facility. We understood how important this project was to the Navajo Nation,

Photo Credit: Kline Kehrer

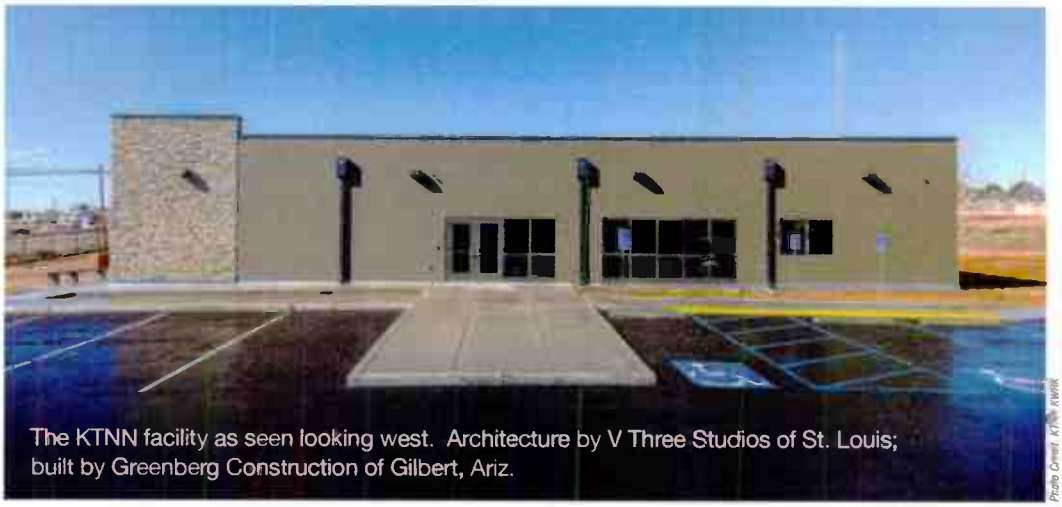
From left to right: Troy J. Little (general manager), Oscencio Tom (board of directors member), Don Taylor (president, M. Greenberg Construction), Tina James-Tafoya (board of directors member), Stan Robbins (chair of the board of directors) and Chris Quigley (superintendent, M. Greenberg Construction).

Photo Credit: Kline Kehrer

KTNN's break room provides a bright and comfortable location for staff members to take a meal.

and we were happy to engage in 'collaborative ergonomics' with Kurt, Troy and SAS to help realize Troy's dream, and along the way make both his furniture and seating headaches go away."

The station also erected a new Rohn 45GSR 40-foot tower at the site to hold two new Marti SC48 4-foot STL antennas.



The KTNN facility as seen looking west. Architecture by V Three Studios of St. Louis; built by Greenberg Construction of Gilbert, Ariz.

Photo Credit: KTNN/KWRK

COMBINING NEW AND OLD

In the studios, Little replaced the existing system from the old facility with a new SAS system. "We needed to get updated on a lot of things," he said.

Little and Audio Director Nathan Chester chose SAS because they said it was more flexible than other options. The legacy gear they needed to integrate into the new system was analog, and they required a system that would allow them to continue to use some old equipment, with the ability to update to newer technologies in the future. SAS Vice President Al Salci then designed a system to fit KTNN's needs.

It uses a 512 I/O 32KD frame in the equipment room with modules to interconnect with the engines in the studios and with existing gear in the equipment room. There are four RIO DSP engines, each with two paired audio consoles. The KTNN control room and talk studio are paired on one RIO. The KWRK control room and news studio are paired on another. The production studios are paired two each to the third and fourth engines. All signaling between the RIOs and the 32KD frame is done via 100baseT cabling. The analog audio inputs and outputs are converted to RJ45 by SAS dongles. The system is AVB-compatible

— the studio RIOs can support AoIP devices. Analog modules can be swapped with digital modules on future upgrades.

Salci says the advantage to his multichannel, multi-bus system is the discrete DSP engine architecture, which eliminates the issue of a single point of failure and reduces data flow through the main frame, since processing is done in the individual engines.

Chester configured, connected and tested the SAS system. He has a degree in audio production but had never configured a system before. "It took a lot of trust from Troy as a general manager to let me do the configuration," he said. He says it was "mostly easy," with not too many issues.

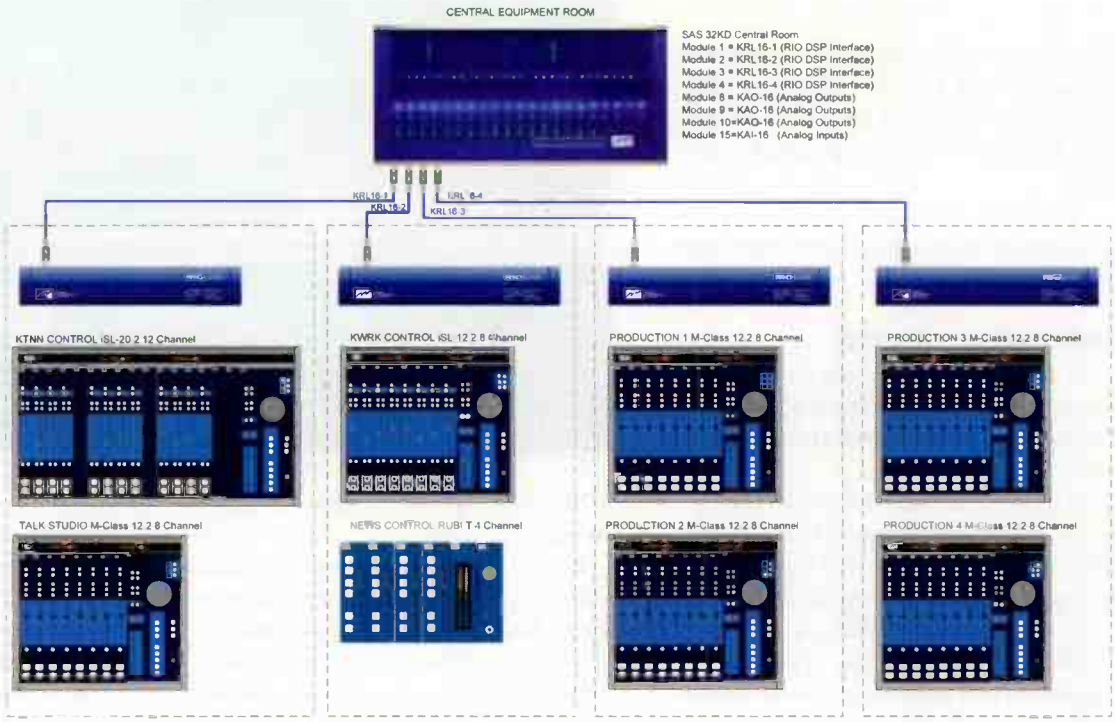
Chester spent a lot of time reading the manual and relied on SAS to answer all of his questions. They also did remote dial-in sessions to help with the configuration. He was impressed that Salci answered most of his questions.

Operationally, he couldn't be happier. "It just works! Can't beat that," he says.

And Chester is glad Little gave him the opportunity to configure the new system because the knowledge he gained will enable him to train his nine operators.

If he had it to do again, he said, "I would sit down with SAS and map it out" — after that "it was a piece of cake."

In accordance with Navajo cultural tradition, a shaman performed a ceremony to bless the building before KTNN moved in.



SAS system design for the KTNN facility, showing locations of i-SL, Rubi-T and M-Class control surfaces.

The station went live on March 7. Chester says they expected to be off the air for a day or two while they made the transition, but instead, they switched over live during a boys' basketball game with no interruption. "We just flipped one switch to another switch," Little said.

The new system is a noticeable improvement. "It sounds a lot better, clear, beautiful," Little continued. "I think this is a really good asset for the Navajo Nation. I think the community will love it. It's their radio station."

The grand opening on March 29 was met with great enthusiasm from the community. More than 1,000 people attended the event at lunchtime and more than 500 showed up that evening for an unplanned celebration that featured a group of native dancers.

At the end of a journey that spanned more than a decade, the vision has finally materialized. The man who was entrusted to bring that vision to life looks beyond the struggles, preferring to focus on the positive. "I have learned patience," Little says. "Having to wait has been a blessing." 0

Photo Credit: KTNN KWRK

Left to right: Tim Lewis of M. Greenberg Construction, GM Troy Little, acting lead on-air talent Dee Yazzie, Music Director Nate Chester and Promotions Coordinator Marcia Peshlakai.

Judy Bandstra has been a broadcast engineer for nearly 20 years, the last two with Colorado Public Radio. Prior to that, she spent seven years in the U.S. Navy as an RF technician.

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What To Do About Bad Monitor Points

by Jeremy Ruck, PE

In a more golden age of AM broadcasting, problematic monitor points struck fear into the hearts of station engineers. The significant level of agitation and disquietude felt back then just doesn't seem to be around anymore. Whether that is due to ABIP participation, budget cuts at the Federal Communications Commission or other factors is a philosophical discussion for another day. The fact remains that problematic monitor points are rule violations, and issues with them must be corrected in order to be rule -compliant.

Boiling it all down, only three factors are the genesis of a monitor point problem. While more than one may be present in a given situation, any issue can ultimately be attributed to a problem with the antenna, a problem with the point itself, a problem with the measurement, or some combination of more than one factor. The challenge is to identify the cause, and then correct the issues in a timely and efficient fashion. (Note that while an unusually low monitor point value is not necessarily a rule violation, it may be indicative of a performance issue, and so should be investigated.)

Regular monitor point measurements are the preferred course of action. The current rules require that the monitor points be run "as often as necessary" to ensure that they are within limits for those arrays with approved sample systems, and at least once every 120 days for unapproved systems. The failure to know the locations and conditions of the monitor points when the inspector arrives is typically considered poor form and an embarrassment. In the event that it is the commission checking out an interference complaint, you can bet your monitor points have already been checked before their arrival at the station.

When I worked for the late Don Markley, he told me about a station in eastern Illinois where the engineer called him and said a monitor point was "gone." As it turns out, actually, the monitor point was "gone" due to strip mining in the vicinity. No doubt, this is a hyperbolic example of environmental change, but over time, some fluctuation in the environmental conditions should be expected.

Monitor point descriptions should include GPS coordinates, of course, along with a description and a photo from which distinctive landmarks are easily visible.

BEGIN YOUR INVESTIGATION

With that in mind, the absolute last thing you should do is to start turning on the cranks to bring the monitor point back into compliance without looking a little deeper into the array. When acquiring data concerning the current state of the antenna system, it is good practice to work outward from the array. The most obvious place to start is with the cranks. Are the cyclometer readings consistent with historical values? If not, continue avoiding the temptation to adjust them back to the perceived norms.

If no issues are found here, slide over to the common point and transmitter power output meters. In a directional antenna, the input power to the array will be greater than the nominal power on the license. Typically for nominal power values of less than 5 kW, the input power to the array is 8 percent greater, and for those in excess of 5 kW, 5.3 percent greater. These increases are utilized to offset the array losses. Check the measured values against the license or other documentation to ensure consistency. There are some arrays with odd designs that have efficiency problems, and so the authorized input power will not necessarily

agree with these values.

Next, examine phase monitor readings. Operating parameters are on the license, and actual phase monitor indications should have a ratio within 5 percent, and phase within 3 degrees. When looking at the parameters, ensure that you are accurately measuring the sense of the phase. Digital monitors indicate the sense on the display, whereas on one of the common analog types, the sense button must be pushed. When pushing this button, if the meter moves to the right, the phase is leading the reference tower, while left movement indicates a lagging phase. Extra care must be taken when close to 180 degrees, in which case an extra length of cable can be inserted.

If unsure about the condition of the phase monitor, one of the samples can be connected to all the inputs using an assortment of short cables and tee type adapters. When doing so, each input on the antenna monitor should indicate a similar loop ratio, but the phase will shift slightly as you go through the test jumper cables, since each cable adds a bit of delay. One channel at significant variance by this method may be indicative of a problem with the phase monitor.

Problematic monitor points are rule violations, and issues with them must be corrected to be rule-compliant.

The next step should be checking the base current ratios. Although no longer required by the commission to be measured, base current ratios provide an additional crosscheck on the health of the array, and are quite valuable. To calculate the ratios, the current at each tower is divided by the measured value at the highest current tower. The actual current values may vary over time and seasons depending on the ground system health, but you should find the ratios remaining constant. While checking the base currents, also inspect components in the ATU cabinets, and ensure there is nothing problematic.

If everything here looks good, and the parameters are within tolerances and expected norms, move further out to the monitor point itself. Are there any noticeable environmental changes in the vicinity, and what is the meter orientation? Orientation of the meter should be towards the station, with off-axis orientations likely indicative of some environmental disturbance like re-radiation. If so, perform a visual inspection of the vicinity to identify potential culprits such as towers, power lines, or other

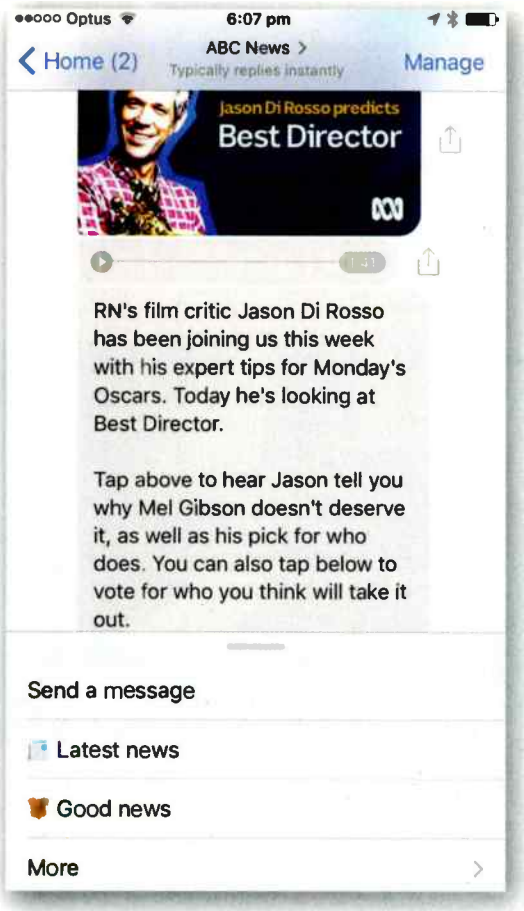
CONTINUED ON PAGE 31

The Next Audio Distribution Mechanism: Facebook Messenger?

by James Cridland

The Australian ABC, like every broadcaster and news provider, wants to make sure that as many people get to consume their output as possible — in whatever environment they want to consume it.

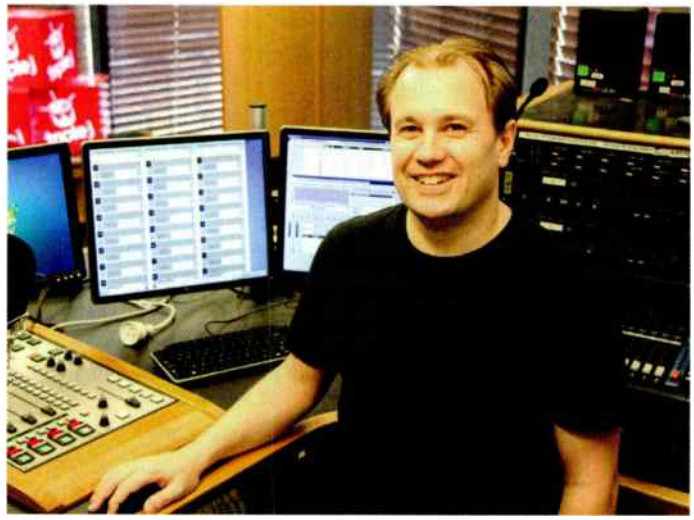
The publicly-funded organization has been experimenting with news headlines and alerts on a number of different platforms for a while. Instant messaging services have been particularly interesting to the corporation as a way to quickly reach audiences.



Here is an example of one experimental message sent by ABC.

An experiment using WhatsApp was popular — possibly too popular.

"We had to type each alert into an actual mobile phone," Lincoln Archer, Deputy Editor for Mobile at ABC News Digital, told me. "It became quite popular, with thousands of people using it — but you could only send to relatively small groups of people. By the time we'd sent the alert out to the 23rd different group, perhaps the breaking news we were telling people about wasn't actually breaking any more."



Andrew Davies

In a coffee shop next to the ABC's sun-soaked riverside headquarters in Brisbane, Australia, Lincoln told me that they've used Facebook Messenger since November 2016.

He explained that the ABC's use of Messenger is not just another hooked-up RSS feed, blasting news alerts out to users. There's a different tone of voice for ABC News on Facebook Messenger — "It's different because it's a different medium," he said to me.

The ABC News Facebook Messenger experience is more conversational and friendly in style than traditional bulletins or articles. Frequently using emoticons, the messenger alerts gives users "just enough" information about a breaking news story.

A February message about Donald Trump's tense telephone conversation with Australian Prime Minister Malcolm Turnbull came with a uncomfortable-looking smiley face — another message about an airline suspending flights had a button to find out more marked "Wait, what?" A button marked with a little cute puppy allows the reader, at any time, to ask for some good news.

Since Facebook Messenger is a much more intimate experience, it was only natural that the intimacy of audio should be explored. Working with Andrew Davies, Distribution and Partnerships Coordinator from ABC Radio, the team recently made a number of pieces of original audio to accompany the network's Oscar coverage.

Five pieces of short audio were made, presented by Jason Di Rosso from ABC Radio National's movie program "The Final Cut" — once more, produced bespoke for the platform to reflect the different tone of voice. The audio was produced as an MP3 and sent out to Facebook Messenger users during the week — with the audio playable directly from within the Messenger app.

The next week, they asked for feedback — and it came back overwhelmingly positive. More than 80 percent of people who listened to the audio liked it, according to the figures.

Interestingly, said Andrew Davies, some

Lincoln Archer

"We'll need to think more about discoverability, and how to raise awareness about future in-Messenger experiments." — Andrew Davies

commented on the audio quality — perhaps because many were listening to the audio using their headphones. "Some said it was too tinny," Davies said, "which surprised us a little since we weren't sure that audio quality would matter too much on this platform."

While the audio was positively regarded from those who listened, the main learning from this experiment was that around 50 percent of the audience didn't listen to the clips.

"We'll need to think more about discoverability, and how to raise awareness about future in-Messenger experiments. In the future, we'll need to consider how we can better prepare people for audio and make it easier for them to come back to it at a time when they can listen," Andrew added.

The ABC plan more use of audio in future within Messenger, and have encouraged users to indicate whether they want to be part of other Messenger experiments in the future. Over 10,000 have.

Read more from James Cridland online at radiomagonline.com/blogs.

CONTINUED FROM PAGE 29

metallic structures. Re-radiation is identified by orienting the meter at right angles to the station in the vicinity of the offending structure.

The reality is, points sometimes just go crazy, and so if nothing is identified at this point, run a skeleton proof on that radial. Take a few measurements either side of the monitor point along its azimuth at points listed in the last full proof of performance, which should be in your public file. After obtaining these measurements, divide each by the field strength in the proof to obtain a ratio. For no changes to have occurred, each these ratios need to be within a few percentage points of unity.

If the bulk of the point ratios are consistent, but the ratio at the monitor point is vastly different, then a problem with the point is likely, and a new one should be selected according to Section 73.158 of the rules.

Conversely, when the ratio at the monitor point is consistent with those at other locations, make an analysis of the measurements by determining the average of these ratios. Multiply this average by the value indicated on the measurement graph in the proof, and compare to the authorized value on the radial making sure the units are consistent. If the resulting product exceeds the authorized pattern limit, the pattern may be misadjusted.

At this point, checking with your engineering consultant may be worthwhile, as a deeper issue may be present.

The proof of performance will also contain other useful information. The field strength measurements used as a basis for the proof are tabulated in the proof, including the measurement dates, which may provide some insight into monitor point readings and seasonal variances. If the original measurements were obtained during summer months, and the array was tuned close to, or at, the limits, then seasonal variations may exist that float the field strength value above the limit. It is typically prudent, therefore, to tune arrays with monitor points 10-15 percent low to allow for these seasonal variations.

SELECT A NEW MONITOR POINT

Ultimately, if it becomes necessary to select a new monitor point, do some planning. Check alternate points for environmental issues that may cause problems downstream. Are there other power lines and towers in the vicinity? How about pipelines? Such locations should probably be avoided.

Look at the plot in the proof for the radial in questions. Find points in the vicinity of the current monitor point that provide a good fit to the curves. Points that are outliers, either high or low relative to the trend, typically should be avoided, as should ones with potential access issues.

As a side note, one of my favorite locations to put a monitor point, if possible, is in a cemetery. Nothing changes, and the local environment is good as long as the sun is up.

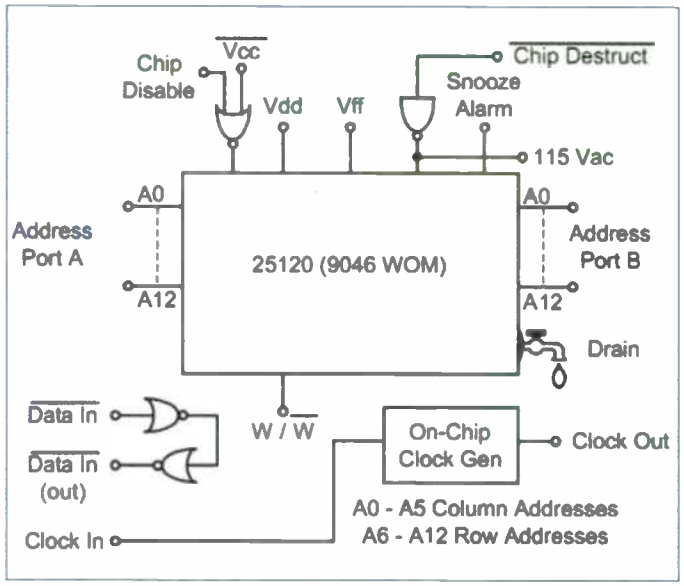
When changing a monitor point, accurately describe the route to that monitor point, from either the transmitter or the previous point. Additionally, a photograph of the point and the meter in the correct measurement position is required. This photograph must show landmarks and features that can be viewed throughout the year. GPS coordinates are also extremely valuable, and should be provided, included the map datum, in the description to the monitor point provided to the commission.

Remember that a monitor point above its limit is not necessarily indicative of a problem with the antenna itself. Similarly, a clean bill of health should not necessarily be assumed if all monitor points are well below their limits. When one or more go wrong, resist the temptation to starting turning cranks, and look deeper into the situation.

Ruck is the principal engineer of Jeremy Ruck and Associates, Canton, Ill.

Loving the Manual

by the Wandering Engineer



Pin out for the Signetics "Write Only Memory" released in 1972. While the 25120 is no longer available, the author can, upon request, supply a schematic using discrete components that duplicates the WOM function.

When hiring broadcast engineers, there are two particulars to which we give special attention.

First and foremost is certifications. Little else says as much about a broadcast engineer's dedication to their profession than having taken the time and effort to get certified.

The other trait is far subtler. Do they read manuals? Broadcast engineers from climates with long winters (or sans significant-other) tend to spend long evenings reading manuals. There is a lot of information in a manual — and way back when, there was fun and education in manuals.

It used to be that the design and manufacturing engineers, who often are surprisingly literate (most of the folks who write for this rag are broadcast engineers first), also did the drawings and wrote the text.

With time, increasing technical complexity and the need to specialize, manuals became disconnected and the province of non-engineers — professional writers operating under the tyranny of lawyers and marketers. Gone was the fun and too often the tutelage. Manuals have become a bad read — buried in boilerplate, lost in detail and too often devoid of meaning.

Google might replace the consumer manual, but it shouldn't replace the commercial manual.

A manual is the ultimate sales tool. Before we buy a piece of gear, we at least thumb through the manual. If it's good and helpful, it's probably indicative of a good piece of gear. Nothing says "I don't get it" like not having the manuals available on the web. Some idiot somewhere might be arguing that proprietary information is at risk if these are published. If the manual sucks, we run. If this gear gets into a station, it's often a "corporate buy," courtesy of the finance department that's laser-focused on cheap.

A manual should be all about edification. It should be full of helpful hints, advice and ideas for utilizing and (dare we say) enjoying the product. It should give you a firm understanding of the physics and design objectives behind the piece. We should never have to reverse engineer it. We should admire the brilliance of the engineers and product managers behind this creation. We might not agree with the tradeoffs, but we expect to understand them and at least respect them.

The manual is a vendor's tool to work around issues. If for any reason the thing doesn't work like one expects, and innovative products often don't, this is the manufacturer's opportunity to avoid unpleasant surprises and cut down on service calls. Broadcast engineers have very sensitive BS meters and, by definition, are critical thinkers. We value straight talk above perfection. Cover ups don't work.

Google might replace the consumer manual, but it shouldn't replace the commercial manual.

And contrary to common conviction, broadcast engineers have a sense of humor. If you want to gain our trust and you are good at what you do, you are more than welcome to have a little fun now and then.

The 1954 Gates manual for a BC1-F clearly states that "if you install this transmitter and it doesn't work, it's almost certainly your fault…" We can respect that.

Manufacturers, if your lawyer has a problem with this, (metaphorically) shoot the lawyer. Just because they can't change a light bulb, intentionally obfuscate with paragraphs of unintelligible legalese and insist on pages of boilerplate warnings about not operating your transmitter in pools of standing salt water (*duh!*), doesn't mean they get to turn a manual into a boring, brain-dead blob, suitable only for temporarily insulating a shorted transformer from a chassis.

Please make manuals great again!

The Wandering Engineer is an industry stalwart who has been in broadcasting since the days of Marconi and Tesla. He gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

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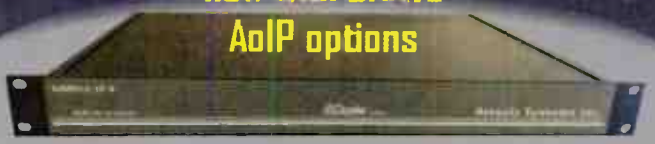

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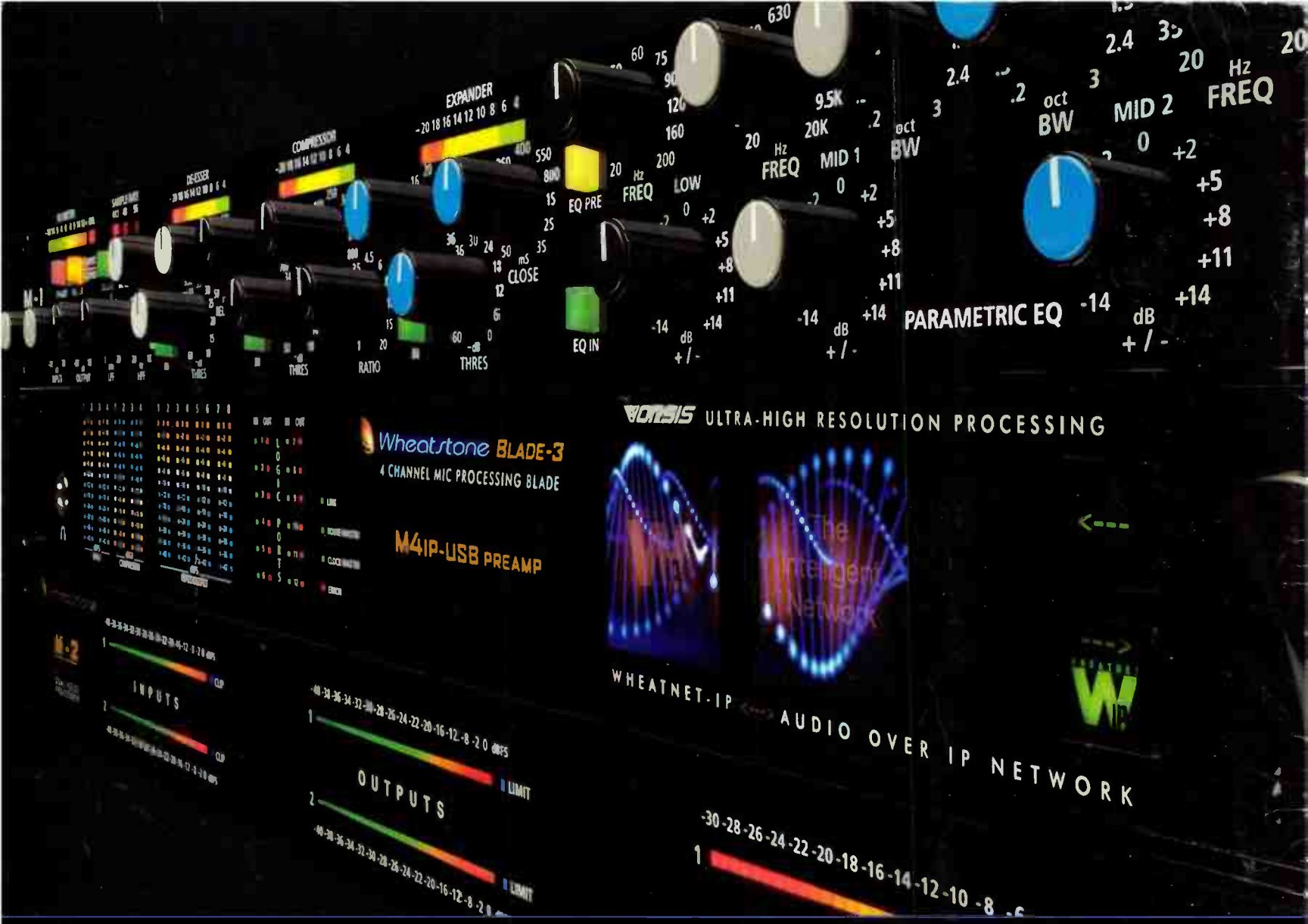

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