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Is IP connectivity now ready to replace SDI in television facilities? ST 2110 adopters weigh in with their views. – p. 8

BTS IEEE

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President's Message

Ralph Hogan, BTS President

This will be my last "President's Message" as the Broadcast Technology Society's president. My term will close on Dec. 31, 2022, and I will be succeeded by president-elect Paul Shulins. The last couple of years have been challenging for BTS with Covid-19 travel restrictions, canceled conferences, loss of revenue from the IBC, and moving to a virtual meeting and conference environment. Most of that is behind us now, and we are starting to see travel to conferences and meetings. The IBC is beginning to recover financially, and the industry is scheduling more and more face-to-face events. Many companies are also re-evaluating their travel policies, but still have travel restrictions in place. We will continue to see hybrid events moving forward as this has proven to allow global communications to grow at a reduced travel expense and the ability to include greater participation from a larger, more diverse geographic area.

BTS is a member and part owner of IBC, ATSC, Radio DNS, and 5G-MAG, representing our global technology involvement. We participate in standards development and industry collaboration to further the future of our partners. During the past two years, we have participated in the following events:

- ABU DBS 2021
- NAB Show 2021
- IBC
- 5G FED Conference
- 18th European Digital Forum
- Broadcast Asia

To support our Young Professionals, BTS has offered a number of events:

- The 2022 BTS Graduate Student Workshop, Oct. 18, 2022, a virtual event, hosted by Rafael Sotelo
- The 2022 IEEE BTS YP Workshop hosted by the University of Basque County, June 14, 2022
- The University YP Webinar, Broadcasting: The Past and the Future in the Connected World, April 12, 2021, with presenters Peter Siebert, broadcast industry advisor, and Madeleine Noland, president of ATSC
- YP Initiative Education webinar "Broadcasting: The Past and The Future in a Connected World," Aug. 19, 2021

The Distinguished Lecturer program has also been active with these DL virtual events:

- Multi Sensorial Media Broadcasting, May 3, 2022, with Maurizio Murroni presenting
- Commercial and Technical Aspects of Next Generation Video Coding (NGVC) Technologies for Broadcast and Broadband, March 24, 2022, with Peter Sibert presenting
- "Can I Really Protect My Broadcast Station From Ransomeware?" with Wayne Pecena presenting
- "Power-based Non-Orthogonal Multiplexing in Next Generation TV & 5G" with Dr. Liang Zhang presenting

I am proud of the work that the Society has done over the past two years. We have had an excellent ExCom who has worked diligently with BTS staff between AdCom meetings to adjust to the changing times and challenges that have cropped up. I look forward to 2023 and how the industry will continue to come back and grow in the world's economy.

Ralph Hogan
BTS President
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Inside

Cover: A portion of the IP-based broadcast facility used to air the 2022 FIFA World Cup coverage. Cover photo courtesy of Fox Sports

From The Editor

Celebration Of Two (Widely-Spaced) Broadcasting Milestones And Some Musings About Integrated Circuits

By James E. O'Neal, Editor-in-Chief, BTS Life Member

As we near the close of 2022, it's very encouraging to note the progress that has been made in past year or so in the rollout of ATSC 3.0 or "NextGen TV" in the United States. The number of markets with 3.0 service is increasing by leaps and bounds, with signals expected to be available in more than 70 television markets by year's end, allowing most of the country's television audiences to experience the manifold benefits that come with the new DTV transmission standard. Advancing this milestone even further is the news that Hisense has now joined LG Electronics, Samsung and Sony in manufacturing NextGen-capable receivers. More good news on this front comes from the Consumer Technology Association, which reports that some 4.5 million of these new sets are expected to make it into U.S. homes before 2022 is over. Of course, the transition to NextGen TV is stymied by lack of spectrum that has necessitated agreements between broadcasters in most every market to establish a" lighthouse" station and transfer program streams around accordingly. This is an awkward and kludgy arrangement at best, but given the loss of TV spectrum to the broadband wireless providers, it's the best that can be done, and it is working in terms of delivering 3.0 to potential viewers (and adopters). However, there are some suggestions within the industry now perhaps a line in the sand needs to be drawn as to ending this hybrid 1.0/3.0 transmission situation altogether. The FCC, in its official blessing to the airing 3.0 signals a few years ago, did not specify a definite date for sunsetting the two-decade-old U.S. ATSC 1.0 "mainstream" over-the-air DTV delivery standard. With the encouraging news about NextGen TV market availability and set penetration, perhaps it's now time give some serious thought to set a date for pulling the big 1.0 shutoff switch.

As part of readying the Alexandra Palace space suitable for television in 1936, the BBC had this mast erected at one end of the large building. The original low-band VHF "sound and vision aerials" were removed long ago, but the tower remains as an historical landmark.

That Other TV Milestone

Recently, I've examined several very significant broadcasting historical "firsts' on this page, and, as I'm writing this near the end of October, can't ignore an early-November event from 86 years ago. This is, of course, the startup of the world's first regularly scheduled "high-definition" television broadcasts, by an organization that's still very much with us, the British Broadcasting Corporation. The Germans were broadcasting television on a fairly regular basis before the BBC got into the act, but were anything but HD, as a 180-line standard was employed. In truth, the "Beeb" went on the air Nov. 2, 1936 with a 240-line service, but this was in the name of "fair play" to accommodate the two British television contenders, Baird Television (John Logie Baird's company) and EMI (which had strong ties to the Marconi Wireless Telegraph Company). A coin toss placed Baird at the historical start of scheduled BBC television broadcasting, with plans to alternate between his 240-line mechanically-scanned system

and the 405-line all-electronic EMI system. (Of course, this added greatly to the cost and complexity of the early British TV receivers, as they had to accommodate both standards.) Surprisingly, Baird's system was a better performer when it came to scanning motion picture film, but the overall superiority of the EMI system forced an early end to these "A/B" comparisons, with the BBC continuing to broadcast 405-line television for the next 50 years (with the exception of a shutdown mandated by WWII).

Both the BBC and the ATSC are to be congratulated for their foresight and hard work in initially getting "first-gen," and later, "NextGen TV" on the air.

The Lowly (And Mostly Unappreciated) 'Chip'

We've all certainly aware of the global "chip shortage" which first started making the news a couple of years ago. This has been linked to many factors including integrated circuit production facility fires, the extremely cold weather that hit Texas in early 2021, causing power outages that shut down operations of chip fabricators in that state, a big upsurge in demand for chips due to demand for computers and associated electronic devices brought about by the pandemic-driven remote working and distance learning, as well as a plethora of other causes, which has created a "perfect storm" of sorts in terms of getting chip-dependent items to market, including a lot of new high-tech vehicles. (Even global climate change has impacted production, as a lot of water is required in the process.)

While a lot of effort and money has been and is being expended to get production and delivery of integrated circuits back to a pre-pandemic "normal," the experts predict that it this won't happen until 2024 at the earliest. Meanwhile, the manufacturers of all of those wonderful chip-dependent devices are soldiering-on as best they can to work around the slowdown in i.c. production and deliveries.

I mention this, as I (and I assume many of us in the broadcasting sector) have more or less taken semiconductor chips for granted. When I was a high school and college student in the 1960s, transistors were finally being developed to the point that they could take over some of the jobs long held by vacuum tubes. There was some amount of "buzz" in the industry trades about the advent of newer solid-state devices that could replace groups of transistors and associated passive components, with the goal of making electronic devices smaller and more reliable due to the need for fewer connections and connectors. However, it was not until the decade of the 70s that integrated circuits and the realization of what they could do began to really take hold. I distinctly recall my first purchase of a 741 operational amplifier (opamp). (This chip was designed by the Fairchild semiconductor folks in the mid-1960s, but—like the transistor—they didn't really become available to hobbyists until several years later.) Now I was certainly aware of operational amplifiers and what they could do, but my frame of reference were the ponderously big boxes in the engineering labs built around vacuum tubes and myriad associated components. All of a sudden, that had changed and here was a device I could hold in my hand that was about the same size as an ordinary TO-5-cased transistor.

After this initial bit of "marveling" passed, I began to build things with the both the analog and digital chips that were becoming more and more available, affordable, and varied in the things they could do. Also, I couldn't help but notice the new broadcast gear coming in the door that incorporated more and more of these tiny pre-packaged circuits.

What sparked my musing on chips was the downsizing of some of my library and the sorting through of a large pile of older magazines. One of these that caught my eye was the November 2001 issue of the **IEEE Spectrum**, which featured a story ("Extreme Ultraviolet Lithography: Will It Be Ready In Time") on what might become a brick wall in the evolution of "Moore's Law" if this then-new technology for chip fabrication could not be adequately perfected. The article predicted that extreme ultraviolet (EUV) lithography might be ready in 10 to 15 years or so, but expressed some amount of pessimism due to the physics and mechanics of working with EUV technology. (EUV is something of a misnomer, as the wavelengths involved, around 13 nanometers (nm or one-one thousandth of a micron), are really in the soft x-ray portion of the spectrum.) These exceedingly short wavelengths can't be focused by ordinary optical lenses, require special high-power lasers and plasma creation for their generation, and, complicating the process is the contamination of the special mirrors that are used for focusing by particles created in the laser plasma process.

This 21-year-old article sparked my interest in EUV chip production, with its forecast of a possible breakthrough in the technology by perhaps 2010 to 2015. Some research

continued on page 13

BTS And DVB Partner In IBC Conference Session

Speakers examine broadcast platform changes, delivery specifications and more

By Peter Siebert

AMSTERDAM

After a long break of three years, the IBC conference and tradeshow opened its doors again here on September 9. This was a long-awaited moment for many, as we all had missed meeting friends, business partners and new customers at this event for a long time.

An important part of the IBC show is the annual technical conference, where industry experts report and discuss the latest trends and future technological directions. As in past years, the IEEE BTS has organized a half-day conference session. Considering the relevance of standardization and that today's standards will be the products of tomorrow, the BTS partnered with DVB, the European broadcast standardization organization in putting together the program. The session title was "DVB: Shaping the Future of Television," and the event was moderated by BTS's vice president of conferences, Peter Siebert.


Peter MacAvock

In the proceedings, six DVB officials and experts reported about the latest developments and strategic direction of that standards development organization or SDO. The first speaker was the DVB chairman, Peter MacAvock. His presentation—"DVB: still setting the standard for media delivery?"—set forth his views of the current status of broadcast, with MacAvock pointing out that the traditional 24/7 live broadcast modality is being threatened by video-on-demand (VoD) services. He observed that while the average viewing time for broadcast television has steadily declined, it has increased at a constant growth rate for VOD services such as "YouTube" and subscription VOD services. MacAvock stated that as a consequence, broadcasters don't invest in "broadcasting" anymore, and noted that their focus instead is on linear and on-demand online services. He observed, however, that commercial broadcasters have to realize that online advertising revenue is miniscule when compared to "classical" broadcasting, and noted that it is fair to say that broadcasters subsidize the investment in VOD services with their traditional broadcast service. MacAvock explained that the future that the DVB organization is trying to embrace is based on the trend to Internet Protocol (IP) based delivery.

In his presentation, MacAvock admitted that there are already several organizations with a strong foothold in this area, but stated that he is convinced DVB can play an important role.

Keeping DVB Relevant

The next speaker, Emily Dubs, who is head of technology in the DVB project office, explained how DVB will be a relevant contributor for IP-based content delivery.

She first presented an OFCOM study comparing delivery cost between broadband and digital terrestrial television, or DTT, delivery, noting that in some scenarios now the cost of broadband delivery per user is lower than that obtained with DTT and this trend will become more pronounced in the future.


Emily Dubs

Dubs stated that as of 2026 in all DTT scenarios IP-based delivery will be the most cost-efficient technology. As a consequence, the DVB organization is working on the necessary specifications for IP-based delivery. Most relevant is a mechanism for finding these services. Different from classical digital broadcast a receiver cannot perform a channel scan to find all available services. With DVB-I, a technology was specified to address this problem. DVB-I specifies how information about services can be combined to a service list and where to find such service lists. With this information the receiver can present a list of available services to the end-user and also tune to such a service. Broadcast as well as broadband delivered services can be combined in a service list. The technology is therefore well suited to support also hybrid broadcast and broadband reception. Besides DVB-I, additional technologies have been specified by DVB for IP-based delivery. The DVB-MABR protocol supports multicast for delivery of live broadcast over IP. In addition, DVB-NIP specifies a native encapsulation of IP packets for DVB-T2/S2/C modulation replacing the classical Transport Stream (TS) encapsulation.

Making Matters Easier For The TV Viewers (And Broadcasters)

Next on the program was TP Vision's Peter Lanigan, who chairs the commercial DVB group for DVB-I. Lanigan provided additional information about DVB-I, explaining that when television sets are equipped with a native DVB-I protocol stack, then broadcaster-specific apps are no longer necessary. He said that DVB-I-enabled sets will find the relevant services (channel guide), then present an electronic program guide and allow the user to select the channel of their preference. Lanigan added that this will spell the end of the TV viewer having to switch between apps in order to view content from different providers. Lanigan noted that this approach has advantages for all involved parties, with manufacturers only having to implement the DVB-I application and no longer being required to support multiple apps. He said that it would also do away with the need for broadcasters to develop specific apps, relying instead on a common DVB-I app that is supported by all devices.


Peter Lanigan

Lanigan noted also that with such an implementation, end-users would no longer need to operate several apps, instead selecting content through the DVB-I interface on their viewing devices, which could be a TV, smartphone or tablet. He observed too that DVB-I is not only useful for standalone OTT delivery, but also in hybrid broadband/broadcast use cases, adding that for the user it is transparent as to whether a service is delivered via broadband or broadcast. That user will see one service list which presents all available options.

Lanigan said that the first version of the DVB-I specification was published three years ago, and since then, many organizations have become interested in the new technology and have tested it in various field trials. He stated that in support of these activities, the DVB Project has provided a reference client implementation which is available free of charge to interested parties. He concluded by stating that this application has been deployed in various field trials organized by German public and private broadcasters, Mediaset in Italy, and also by IRIB in Iran. (Reference implementations and further information about DVB-I and related field trials are available at *www.dvb-I.tv.).*

Next up was Thomas Wrede, who also reported about DVB's IP-based specifications.

Wrede, who is chair of the DVB Commercial group for satellite (DVB CM-S) and also with the Technology Vision Consulting UG, offered a look at the IP-based broadcast delivery solution for DVB-S2/S2X and DVB-T2 delivery, DVB-NIP. He noted that since the beginning of digital broadcasting, the MPEG-2 transport stream has been used for AV delivery. The recent trend to consume AV content on handheld devices such as smartphones and tables has now triggered a need for IP-based delivery. Wrede said that by using IP encapsulation instead of an MPEG-2 transport stream offers several advantages, noting that most relevant of these is that it provides interoperability and compatibility for all modern consumer devices by seamlessly blending broadcast and OTT delivery. He added that in addition, it enables new use cases such as feeding 5G or terrestrial transmit towers and public Wi-Fi hotspots via satellite.


Thomas Wrede

Wrede reported that work on DVB-NIP started with the defining of use cases and commercial requirements in CM-S, and the resulting Commercial Requirements (CR) document was approved in April 2020 and was followed by work on the technical specification, which was published in February 2022 as DVB BlueBook A180. He said that in line with the DVB toolbox approach, this specification is based as much as possible on already existing DVB technologies, and noted that the NIP specification covers IP encapsulation and signaling for distribution of AV content for DVB-S2/S2X- and DVB-T2-based broadcast delivery schemes.

He said that broadcasting with DVB-NIP is expected to reduce costs and will complement OTT's one-to-one distribution. Wrede cautioned, however, that the market introduction will be confronted with various challenges, as DVB NIP is not backwardly compatible with existing broadcast systems, requiring the simulcasting of broadcast services. He said that on the equipment side, NIP-Gateways need to be developed and deployed and when it comes to TV devices, and it will take some time before the new technology will be integrated.

Based on this, Wrede stated that the first steps in moving in this direction is the creation of greenfield service platforms by satellite operators and the development of professional and consumer NIP gateway devices.

5G's Role In Broadcasting Discussed

DVB is not only working on IP related technologies but also in bringing 5G Broadcast and the DVB service layer together. In connection with this initiative, DVB has joined forces with 5G MAG by creating a Joint Task Force (JTF DVB & 5G-MAG). This group is working on recommendations on how to align 5G Broadcast and DVB-I. The next presentation focused on this, with an important driver in this initiative, Qualcomm's Thomas Stockhammer, providing an update.


Thomas Stockhammer

Stockhammer observed that 5G Broadcast was developed at the request of various broadcasters and manufacturers to be able to offer

a broadcast-friendly solution in 3GPP which would provide downlink-only transmissions from the high-power high-tower (HPHT) infrastructure that's typically used for DTT. He noted that the most relevant features as defined in 3GPP Release 14 and 16 provide SIM card-free operation, capability to create wide area single frequency networks or SFNs, a receive-only mode, and free-to-air reception. He reported that the necessary changes to allow operation in the relevant UHF broadcast bandwidths of 6-, 7- and 8-MHz are now in preparation.

Stockhammer said that first implementations of 5G Broadcast are now available from Rohde & Schwarz (transmitting equipment) and Qualcomm (handheld receivers). He reported that several field trials are also taking place in various countries, with one important trial occurring at the May 2022 Eurovision Song Contest held in Turin, Italy. There both local and remote participants could follow the show on handhelds provided by Qualcomm via 5G Broadcast. Stockhammer said that the current 5G Broadcast solution provides the physical layer, but does not specify transport and service layers, with this being accomplished within the JTF DVB 5G-MAG group, which is currently working on an ETSI Technical Recommendation (TR) addressing the requirements for the technical group to provide specifications for network and client-side interfaces and APIs between broadcasters and network operators, as well as client devices. He noted that 5G-MAG is also working on the necessary reference tools for validation and verification, with these tools being developed in an open-source SW Project. Stockhammer concluded by stating that all with these activities AV broadcast becomes an integral part of the wider 5G ecosystem and will benefit from 5G features such as edge computing, authentication, and interactivity.

Another important topic for video distribution is video coding. The final session speaker was Dolby Laboratories' Jason Power, who is also chair of the DVB commercial group for AV coding (DVB-CM-AVC, and provided an update about the latest developments in this area.

Power noted that the main driver for new video codecs is the need to provide improved viewer experience in connection with both UHD (4k and 8k resolutions) and High Dynamic Range (HDR) at reduced cost and data rate requirements. He reported that in following the usual DVB approach, the CM-AVC group began by defining use cases and commercial requirements covering broadband and


Jason Power

broadcast delivery. Power stated that an important goal is to reduce the data rate while keeping the video quality the same as compared to the current HEVC video coding scheme. He said that there should be a saving of at least 27 percent for 4K broadcast and that five UHD services need to be fitted within a T2 multiplex, versus the current three services that can be accommodated. He added that for broadband delivery of 4k content, the 30 percent in data-rate reduction goal is the group's goal, and reported that DVB has identified three candidate video codecs that are commercially qualified for addition to the DVB toolbox based on claims about their features and benefits, subject to technical and IPR validations. Power listed these codecs as follows:

- AV1, which has already been adopted widely in devices and is used by global OTT service providers
- AVS3, which has adoption in China and could extend the market reach of DVB solutions
- VVC, which brings greatest efficiency gains and has robust industry backing via MPEG

Technical work has progressed quickly. The DVB Codec Toolbox BlueBook A001 was updated in February 2022 with VVC, and in July 2022, with the addition of AVS3. The specification of the BlueBook update for AV1 and validation of compliance to the CRs and DVB's IPR rules is underway. A new version of the corresponding ETSI specification (TS 101 154) us scheduled to be published in due course.

A Successful Event

The "DVB: Shaping the Future of Television" program was well attended, with about 75 participants. It was also quite interactive with question and answer sessions that resulted in some engaging discussions. All responses and comments that were received about the event were very positive, demonstrating that broadcast technology is a relevant topic and will remain so. Innovation is still occurring, and the IEEE BTS will continue its cooperation with standards development organizations such as the ATSC and the DVB.

A video recording of the event is available at: *DVB: shaping the future of television | Video | IBC*.

Fox Sports

Making The Most Of ST 2100 Requires Effort

A broadcaster, a consultant and a media IP authority offer thoughts on the issues that must be addressed when deploying SMPTE ST 2110.

By Phil Kurz

One could get hungry while listening to Andrew Starks, Alliance for IP Media Solutions (AIMS Alliance) board member and director of product management at Macnica Americas, talk about where the Media & Entertainment (M&E) industry is on its journey to IP in general, and SMPTE ST 2110 specifically.


Andrew Starks

"Thinking about where we are in a 24-hour day with our adoption, we're probably somewhere around breakfast time," he said. "If midnight was when we first tried—when we made things as easy as possible with SMPTE ST 2022, we're at breakfast time with ST 2110," he said.

But before broadcasters unroll their napkins and pull their chairs to the breakfast table for a heaping helping of SMPTE ST 2110 to replace SDI workflows, there may be a few things to consider—not the least of which is that while the industry may be past the early adoption phase of the IP standard, there are still a number of issues that can or do arise.

None of this, or what follows, is to say ST 2110 isn't successfully in use today. It's simply to acknowledge there are a range of issues that must be accounted for before systems go operational. For broadcasters coming from the plug-and-play world of SDI workflows, that can be eye opening.

What's written here is based on a real-world implementation of ST 2110 and the experience of a consultant and someone actually helping to guide the direction of IP for media. While it may be impossible to identify everything a broadcaster must consider based only on their experiences, the issues presented are not uncommon and should be anticipated when thinking about deployments.

Fox Sports And The World Cup

Fox Sports relied on ST 2110 to produce its 2022 FIFA World Cup coverage from Qatar. Its production commitment was massive, operating from 12 different venues, the International Broadcast Center (IBC) in Doha and four different stages with more than 20 cameras, production switcher and two additional control rooms devoted to supporting its digital footprint and shows it provided for Twitter and its online partners.

"The IBC is our hub for everything," said Kevin Callahan, vice president of field operations and engineering at Fox Sports, who was interviewed weeks before the event. "Anything that has to do with host coverage will be processed there." That includes ingest for features to be edited in Los Angeles, ingest for the Fox MAM archive, inserting the clock on match coverage and integrating the broadcaster's own coverage elements, such as its announcers for match feeds. Both the IBC and Fox's main stage location were full of ST 2110 systems that are connected to each other via compressed JPEG XS. Any SDI was converted to ST 2110 before being added into the production workflow.


Kevin Callahan

Central to the IBC are four flypacks with 20 racks specially built by the broadcaster for easy transport. These were populated with ST 2110 processing technology, and the top half of each folded down, so the racks are 62-inches high for shipping and thus capable of fitting on the lower deck of an airplane.

"When we were looking at the future designing the system, we chose IP," he said. "We were able to run simultaneous 3 Gig and 12 Gig workflows, so we have our standard 1080p as well as our UHD 4K 12 Gig running at the same time throughout the system. As more and more sources go 12 Gig in the future, the system can still perform."

While adopting ST 2110 to protect against untimely obsolescence as the industry evolves, Fox Sports, in the short term, needs the system to perform today. Callahan has identified several issues that had to be addressed before the World Cup began. Many are related to how different vendors have implemented ST 2110. He observed that different implementations can create problems.

"One of the nice things about SDI is there was a standard put out many, many years ago and everybody adhered to it," he said. "With 2110, there are specifications, [but] specifications leave a lot of room for interpretation we are finding out."


Fox Sports

Outside view of the 2022 Qatar World Cup International Broadcast Center.

ST 2110-7, the specific standard within the 2110 that deals with redundant paths to protect against signal loss in the event of a failure, is an example.

"There are multiple ways to meet the standard, and to get that failover you expect will be different for different vendors," said Callahan.

Achieving the level of protection envisioned for 2110-7 for every component in the system simply may not be doable.

"The engineers on my staff and I have had

the conversation: 'We've never had this before, is this worth it in terms of a particular device?'"

While the engineering team "ultimately finds a solution and moves on," they will reach a point where they "have to live with it [not having 2110-7 redundancy for some devices]," he said.

Such interoperability issues are not confined to 2110-7, however. "Another issue we have been battling is payload ID—something that's not a 2110-only issue, but is when you get into advanced formats like HDR and 12G," said Callahan.

It is essential that payload IDs are recognized and passed through all of the different pieces in the system. Certain pieces of equipment, however, will rewrite the payload IDs to something that is incorrect, requiring operators to correct the errors manually or tell the receiving device to ignore it and restamp it with the correct payload ID on its output, Callahan noted.

Another area is discovery and registration. "NMOS works and is fantastic in terms of discovery and registration, but there's still a lot of work we are doing to update the NMOS tables and the like," said Callahan.

Better NMOS implementation and support would certainly help with orchestration which has proven to be "quite time-consuming," he said, adding one person has spent months defining all streams, senders and receivers as well as all associated information.

Orchestration has proven to be quite time-consuming. "We have massive spreadsheets defining all of our streams, all of our senders and all of our receivers and what they are addressing, what their information is, what they are registering as NMOS," he said. "That's where there still is a lot of work to be done in the IP realm."

Setting up network switches to pass Precision Time Protocol (PTP) is quite important, and if overlooked can cause a "very unfavorable result," he cautioned.

Looking back at the design, implementation and setup of the ST 2110-based live production flypacks, Callahan offered one piece of advice: "plan, plan, plan."

"We were lucky. We are working with Diversified, and we have great engineers on our team. They were able to find most of these gotchas," he said.

More ST 2110 Perspective

Deloitte also consults media and entertainment companies on cloud and ST 2110 deployments. From interoperability to payload ID, many of the issues Callahan has encountered sound familiar, observed Deloitte's lead consultant, Frank Albano.

"It's very possible you are going to have an interoperability issue," he said. "While interoperability is not that bad of an issue, it just feels painful because it means you have to figure out what the issue is."

Fox Sports

A portion of the Fox Sports Qatar World Cup 62-inch rack multiple flypack IP setup.


Frank Albano

If M&E enterprises have the money, they should do proof-of-concept (POC) testing before making final decisions about which ST 2110 technology to integrate into their final systems to head off interop issues, he advised. If not, having a great relationship with the control system vendor is a must.

"I'll give you an example. One vendor in their SDP [Session Description Protocol] file identified the number 1 as 1, but another identified it as 1.00, which created a problem," he explained. "So that one little line where it said put a value 1, 2, 3, 4, the value might be 1.00 and the other might be 1, and they just don't work. It's not devastating. It doesn't take down the network, but it's still painful."

The good news is vendors are all open to working together to resolve these interoperability issues, he noted.

"It works 98 percent of the time, but there is going to be a situation where no one has yet taken Vendor C and used its technology with Control System A. You may be the first to use it, but once it's done, it's done. I would hope in five years you are not going to find these problems," he said.

Addressing orchestration, as Callahan explained, is a lengthy process, but one that is manageable, according to Albano.

"You have to fall back on your implementation team if you've outsourced a team, as well as the control system software team. The first question will revolve around the flows—what's going to be required of the system to meet the needs of the facility, which can be very time-consuming," he said.

AIMS board member Starks recommends that broadcasters not forget about SDI equipment and networks as they are considering their control plane. "That's something that we don't do right now, but it is needed because if you can represent your SDI router and the SDI gear and the IP gear, now you can see the full system," he said.

Doing so would put an end to engineers having to put on their SDI hats to deal with one set of problems, and their ST 2110 caps to solve problems related to the IP-based network. "It just becomes a management headache. There are solutions for money out there that fix this, but I think it would be nice if there were a more coherent way to represent hybrid ST 2110-SDI systems," said Starks.

Beyond a hybrid of SDI and 2110, there's the issue of Pro AV equipment that frequently is used in broadcast and broadcast production for a variety of jobs, ranging from simply wanting to plug in a laptop and feeding video wall displays, to lighting, and even pyrotechnic control systems, he noted.

"ST 2110 flat out does not work in that environment," he said. "It was missing quite a lot, and it was just tuned to synchronous broadcast. The AV world is much simpler. So, we [AIMS] started IPMX."

IPMX, or the Internet Protocol Media Experience, carries compressed and uncompressed video, audio and data over IP networks. The protocol, consistent with ST 2110, allows users to "dial back" certain requirements, like setting up PTP clocks, and take advantage of plug-and-play operation, which does away with interoperability issues, he noted.

Fade To Black

The SMPTE ST 2110 suite of standards has moved beyond the early adopter phase as more broadcasters and other M&E enterprises adopt the standard. However, at this point, issues with interoperability, orchestration and other aspects of the standard remain.

Over time, as all of the possible combinations of ST 2110 equipment find their way into systems and unexpected differences in implementation of the standard are revealed and corrected, today's interoperability headaches will recede into memory.

Orchestration will likely get easier over time as well as new tools to document all of the devices on the network offer assistance and NMOS continues to improve.

One day, these issues will be a distant memory, likely regarded as the necessary growing pains of reaching maturity. Until then, next up in Starks' analogy is lunch. When will that arrive? "When it's better than what it replaces. That's the goal to make it better in every way than it was," he said.

New possibilities along with new issues in the cloud

By Phil Kurz

IP adoption for television workflows is by no stretch limited to SMPTE ST 2110. The cloud, whether public, private or on-prem, increasingly is being adopted for a range of workflows in broadcasting—from contribution and production to scheduling, playout and distribution.

The Sinclair Broadcast Group (SBG) is in the public cloud in a big way. It has run its four diginets (ATSC 1.0 digital subchannels) from the AWS cloud for the last few years. The group has also moved its sports archive and has begun to archive its news in the AWS cloud as well as relying on the cloud for its content management pipeline, according to Del Parks, the president of technology for Sinclair, which owns or operates 294 local television stations and 21 regional sports networks in the United States.

All syndicated shows and programming are uploaded to the cloud where it is quality control checked to—among other things—ensure closed captioning is present, the timing is correct, the associated metadata is right, the content is properly encoded for its different stations, and is ultimately placed into a file so all SBG local stations running a given show can retrieve and air it.

One commonly expressed concern about relying on the public cloud—as Sinclair is doing—are the egress charges that mount as content is pulled out of the cloud.

However, Parks takes a bigger view of the associated charges in the cloud relative to the expense of previous workflows.


Del Parks

"You have to know what you're doing," said Parks. "Like anything, you have to design it the right way. We did a thorough financial analysis [before adopting the cloud workflows], and we are in a good spot.

"If you don't think about it ahead of time, you can get in the cloud and maybe be surprised by the charges. But there are benefits, like offering an alternative to handling media in 50 markets with 50 different people. With the cloud, you just handle it once."

The efficiencies add up. For example, a syndicated show like "Judge Judy" is ingested into the cloud once, not multiple times—once each by [the] individual stations. Once QC'd, it is then encoded to the correct HD format—720p for Sinclair's ABC affiliates and 1080i for its CBS stations, Parks stated.

The most important piece of advice he can offer when considering moving workflows to the cloud is to work with a reliable, experienced consultant. In Sinclair's case, the company selected Deloitte, which has worked with many Media & Entertainment Industry organizations on their IP transitions—both in the cloud and not.

"If you wanted heart surgery, would you go to the guy who's only done one heart operation, or would you go to the guy who's done 100?" Parks asked, rhetorically.

Frank Albano, lead consultant at Deloitte, however, acknowledges that basing video workflows in the cloud may be costly, especially for a ME Industry organization that wants to maintain the highest video quality.

"When you set those standards really high, and you start to examine the cost model, it starts to not become an economical model [that is sustainable]," he said. "However, you have to keep asking yourself—'where are we going to be in five years?'—because five years ago we probably weren't even thinking we would put video into the cloud and take it back down without a noticeable 40-second or minute-long delay."


Frank Albano

The latency issue is particularly concerning in live production scenarios.

"If you are going to offer me a solution with ultra-low latencies, what's the quality?" he asked, noting that there is a trade-off between quality and latency. "I am not saying it's undoable. It totally is. It just becomes a matter of does the end product match my business requirements in terms of quality?"

Hearst Television is not as far along its cloud journey as Sinclair, according to Stefan Hadl, the company's newly appointed senior vice president of broadcast engineering and technology. The broadcast group, which owns 33 local television stations in the United States, has begun experimenting with the cloud, evaluating it for various workflows.


Stefan Hadl

"The biggest thing is the cost of egress," he said. "It costs you money to move baseband video out of the cloud, and even files out of the cloud. If you can keep it all up there and work up there, it's fine. But you always have that last step, so at the moment that cost is a factor."

Still, Hearst has "an eye towards a future in the cloud" for many of its studio workflows.

"It can't be a lift and shift of what we do today," said Hadl "It's more of what can we do better by putting it up in the cloud? What gives us better workflow efficiencies, better economics and better capabilities?"

The element of the unknown is also a factor when it comes to future cloud adoption, according to Hadl.

"If we move a given workflow up to the cloud, what other issues am I going to have? What control do I have?"

While some of this may be defined in the terms of a service-level agreement (SLA) between a broadcaster and a public cloud provider, it's "just a piece of paper," said Hadl. "I really have no control over the AWS's of the world. Services spin up, and they spin down. It's going to be on them, and all I have is an agreement that they're going to do these things. That's a lot to consider."

From The Editor

continued from page 4

revealed that the first prototype EUV i.c. fabrication device didn't arrive until 2006 and could produce one wafer in slightly less than 24 hours. In 2018, a Dutch company, ASML, after spending $9 billion (U.S.) in R&D finally overcame what were thought by many to be insurmountable challenges and demonstrated a "practical" EUV lithography machine for chip production. Today, the throughput is some 200 wafers per hour. Even so, these wonderful machines are monsters in many ways, weighing in at some 180 tons, requiring multiple large cargo airplanes to transport, and consuming more than a megawatt of electrical power in operation. To date, only about 100 of them have been produced.

Going beyond the creation and implementation of these massive and amazing machines which make the smartphones and ultra-compact computers possible, along with fueling the computational power in data centers, some additional research provided even more insight into the complexities of chip production and delivery. I learned that more than 700 steps are involved in producing the latest chips, and that each of these has to have a "yield" of 99.99 percent or better, due to this very large number of processes required. (There are statistical losses in each step and these accumulate greatly after going through hundreds of individual operations.) When you stop to think about it, it seems almost amazing that such chips can be mass produced at all, much less at prices low enough to make their way into everyday consumer devices. I think we tend to take for granted the number of things chips do these days—even down to controlling power windows in automobiles. I was a bit amazed just this week when I opened up a balky electric leaf blower and found that its motor was controlled by several i.c.s.

To state that we could not have today's television and radio broadcasting technology without massively complex chips is really a gross understatement. We owe these little packages of silicon, ceramic and metal a really big "thank you." (It goes almost without saying that we are all indebted to Texas Instrument's Jack Kilby and Fairchild Semiconductor's Robert Noyce, who, in the late 1950s each developed the concept of integrated circuits and built the first crude such devices.)

Let's hope that the chip industry gets back on track sooner rather than later.

A Note Or Two Of Appreciation

I almost always close out this column with "thank yous" to those individuals who have made editorial contributions to **Broadcast Technology**. In addition to all of our regular columnists, special thanks go out to BTS member Peter Siebert who provided a report on some of the activities at this year's IBC show. I'd also like to express my gratitude to Amal Punchihewa, who once again has provided a report on an industry event, this time the Asia-Pacific Institute for Broadcasting Development's 2022 Asia Media Summit.

Our members' contributions to this publication are always welcome. Please keep them coming!

James O'Neal
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Charting A Bold Path Forward

By Madeleine Noland and Jerry Whitaker

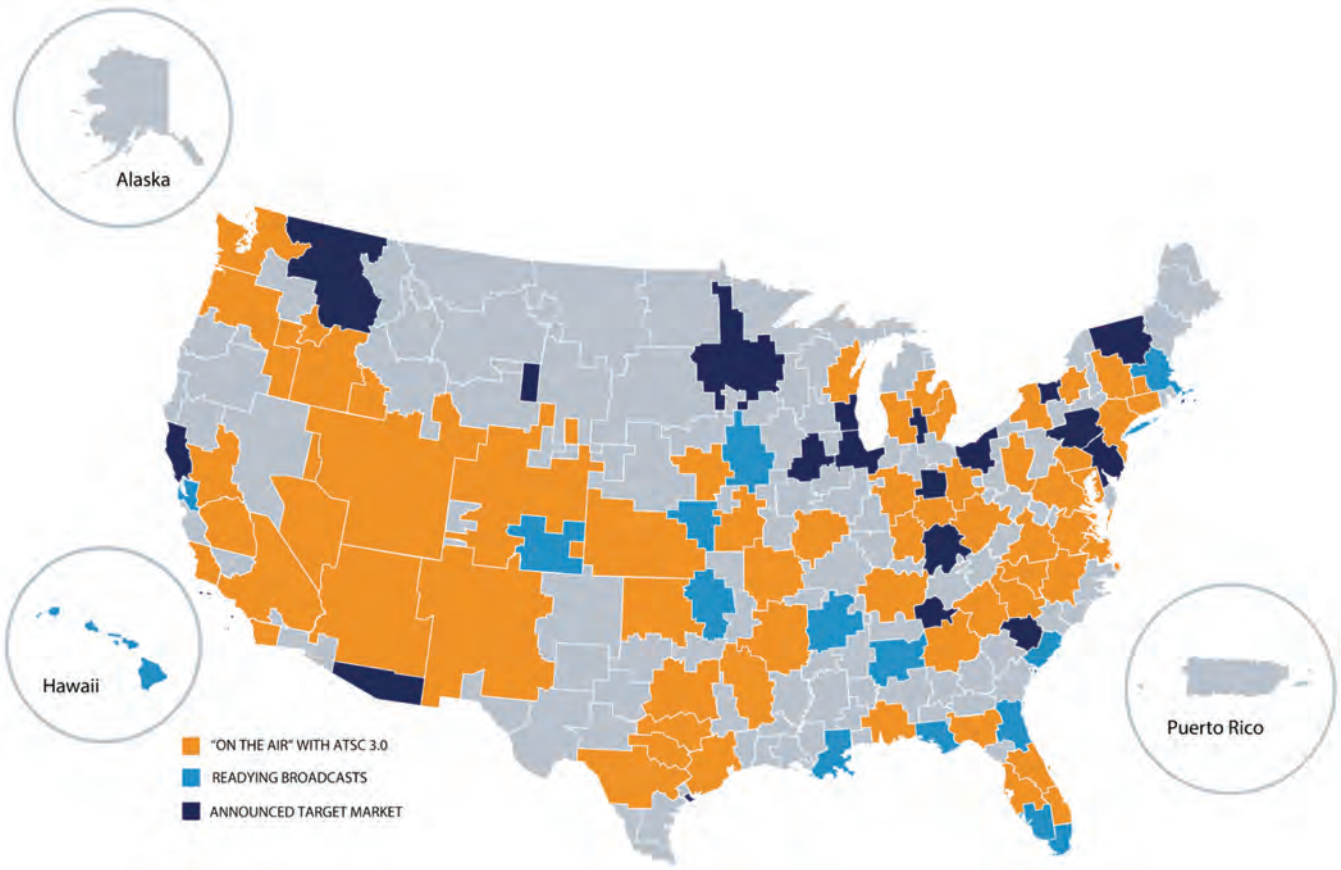
Advanced Television Systems Committee

ATSC will celebrate its 40th anniversary in 2023. The organization has accomplished a great deal since its founding in 1983. From the first published standard, A/49, "Ghost Canceling Reference Signal for NTSC" (May 1993), to A/300:2022-04, "ATSC 3.0 System" (April 2022), ATSC has pushed the boundaries of technology to provide advanced services to the public. Work continues on all aspects of the NextGenTV system in the various Specialists Groups, Ad-Hoc Groups, Planning Teams, and Implementation Teams.

A Very Busy Fall

In 2022, we are enjoying the return of the major trade shows, and this fall has been particularly busy with gatherings for SCTE Cable-Tec Expo, SMPTE Media Technology Summit, and CTA Technology & Standards Fall Forum, and the return of IBC and NAB New York . By all accounts, these events are approaching their pre-Covid attendance numbers. Both IBC and NAB NYC were brimming with exuberance, as people reconnected with friends and colleagues from near and far.

The ATSC booth at NAB NYC event was very busy, with rotating exhibits from ATSC Platinum Sponsors, Pearl TV, Gaian Solutions, and Hewlett Packard Enterprise. Fincons Group Deputy CEO and CEO International Francesco Moretti joined up with ATSC President Madeleine Noland for a Tech Chat in which he unpacked the details of a new NextGen TV interactive application being piloted by Nexstar. A number of ATSC 3.0-related announcements were made, including Pearl TV's new "*FastTrack Program*" to accelerate development and consumer deployment of low-cost upgrade accessory receivers such as dongles and set-top boxes, and



U.S. ATSC 3.0 implementation progress as of Oct. 31, 2022.

expanded support for digital video advertising technology in its Web TV platform, *RUN3TV*. Bitrouter *TV2025*announced that the ZapperBox has successfully completed beta phase. TV NewsCheck returned with a highly informative program featuring C-suite panelists and speakers discussing their vision of the future of television services.

Throughout 2022, broadcasters have continued to launch ATSC 3.0 services. NextGen TV service is now available in 60 U.S. markets, reaching more than 55 percent of households, and in over half of Jamaica with broadcasts emanating from Kingston and Montego Bay. The latest deployments are tracked on the ATSC website *Deployments page*. New NextGen TV models from Hisense have reached store shelves, joining the growing line-up of products from Sony, LG, and Samsung.

Updated Documents Published

ATSC members are continuing to hone and develop the ATSC 3.0 standard suite, with recent updates to the following documents:

- *A/331:2022-09*, "Signaling, Delivery, Synchronization, and Error Protection"
- A/341:2022-09, "Video – HEVC"
- *A/344:2022-03 Candidate Standard Revision*, "ATSC 3.0 Interactive Content", Ongoing work on Broadcast Core Network, VVC, CMAF, and Inter-Tower Communications Network continues apace.

Among the updates of particular interest is the publication of a new Candidate Standard (CS) that describes changes to *A/53 Part 3:2013*, "Service Multiplex and Transport Subsystem Characteristics." A/53 Part 3 is one of the central documents of the ATSC 1.0 standard. U.S. broadcasters are continually working to optimize bandwidth, especially during the channel-sharing transition period to ATSC 3.0. This new CS specifies methods for improving the compression of ATSC 1.0 "diginets" by utilizing AVC coding technology. Reducing the footprint of ATSC 1.0 "diginets" will provide more opportunities to utilize spectrum for ATSC 3.0 services. Comments and feedback on this CS are requested. The CS phase for the A/53 update is currently slated to run to Jan. 31, 2023.

The ATSC's 2022 NAB NYC exhibit.

Pearl TV's new RUN3 interactive web platform.

Board Of Directors Election

Autumn also brings the annual ATSC Board of Directors election. The ATSC Board is comprised of 15 members, five who are appointed by the five founding organizations of ATSC: the Consumer Technology Association, the Institute of Electrical and Electronics Engineers, the National Association of Broadcaster, the Internet & Television Association, and the Society of Motion Picture and Television Engineers. The remaining 10 are elected by the membership from among its own ranks. Elected directors serve up to two consecutive three-year terms; this year there are four seats up for re-election.

The ATSC Board of Directors serves a number of roles, but perhaps the most important is setting the strategic direction of the organization. Last August, the Board conducted its annual strategy retreat. A wide range of topics were discussed, and two primary initiatives emerged: development of an international strategy and accelerating the adoption of NextGen TV in the United States.

ATSC is grateful for the service of its exemplary board of directors, past, present, and future. The leadership provided by those 15 people has a far-reaching impact on broadcasting worldwide.

The Rollout Of ATSC 3.0

South Korea was the first country to broadcast 3.0, with the U.S. and Jamaica now launching services. ATSC Planning Team 6—"Global Recognition of ATSC 3.0," works to identify international opportunities and organize responses when inquiries from various countries emerge. Two groups have spun off from PT6 to address specific needs: Implementation Team 2—India, and Implementation Team 4—Brazil, which are actively supporting testing and exploration in those countries. ATSC members are also involved in international standards organizations including ITU-R and 3GPP. As international interest in ATSC 3.0

develops, so must the standard itself in order to serve each country's particular needs. The Board has determined that a more deliberate strategy would help identify and allocate the resources needed to effectively support and execute the activities.

The United States. has made amazing progress since the ATSC 3.0 standards suite was first published. In spite of the pandemic, more than 50 markets, approaching 60 percent of the U.S. population, now have 3.0 service. But that success is not enough; we need 100 percent of the United States able to receive 3.0. Broadcasters describe ATSC 3.0 as the future of the business and a key factor for consumer entertainment and information. However, the full impact of NextGen TV cannot be realized until we are able to sunset ATSC 1.0 and devote all the bandwidth to ATSC 3.0 services. Indeed, estimates suggest that the full ATSC 3.0 rollout will result in a 500 percent increase in capacity over ATSC 1.0 once ATSC 1.0 is shut off. Although our OTA system is state-of-the-art, its success in the United States is not assured without continued effort across the ecosystem, including within ATSC. To accelerate the transition process, the Board agreed to develop a 2023-2025 activity list to prioritize how ATSC should support of the U.S. rollout of NextGen TV, providing industry leadership in encouraging broadcasters, professional equipment manufacturers, and consumer equipment manufacturers to offer ATSC 3.0 services and products and resolve implementation challenges.

Television Jamaica

Claire Grant, general manager of Radio and Television Jamaica (left) and Michael Henlin the operation's chief technology officer, (right) explain the operations of the new ATSC 3.0 transmission system to the Hon. Robert Morgan, Jamaica's Minister of Information during the initial switch-on of ATSC 3.0 in Jamaica on Jan. 31, 2022.

Looking Ahead

As we mentioned at the beginning, 2023 will mark ATSC's 40th anniversary, and we anticipate another busy and productive year ahead. The first two quarters will kick off with the ATSC booth at CES 2023 in January, heading into NAB Show 2023 in April, followed by the ATSC NextGen Broadcast Conference in June in Washington, DC. A/300:2023, the central pillar of the ATSC 3.0 suite of standards, is expected to be published in the spring, and we are very excited to watch the work of the Planning and Implementation Teams, Technology Groups, and the Board of Directors unfold throughout the coming year.

Get Involved

Work within ATSC is open to all groups with a direct and material interest in the work. Membership information can be found on the ATSC website (*https://www.atsc.org/members/become-a-member/*). The benefits of membership are numerous, including:

- Involvement in developing and approving Standards and Recommended Practices for the digital terrestrial transmission industry.
- Involvement in Planning Teams exploring new technologies and verticals that are emerging in the broadcast industry.
- Develop and share information on the implementation of ATSC Standards and Recommended Practices.
- Coordinate/harmonize with standards-setting bodies around the world.

All ATSC Standards and Recommended Practices can be downloaded at no charge from the ATSC website (*https://www.atsc.org/documents/*).

About The Authors

Madeleine Noland *is president of the, Advanced Television Systems Committee (mnoland@atsc.org). Widely respected for her consensus-building leadership style, she chaired the ATSC technology group that oversees the ATSC 3.0 broadcast standard before being named ATSC president in May 2019. Previously, as a representative of LG Electronics, she chaired various ATSC 3.0-related specialist groups, ad hoc groups and implementation teams since 2012. A 15-year industry veteran, Noland held key technology management and standards roles at Backchannelmedia Inc., Telvue Corp. and LG. She received* ***TV NewsCheck's*** *"2019 Futurist" Women in Technology Award and was named one of 2018's "Powerful Women in Consumer Technology" by* ***Dealerscope*** *magazine. In 2016, she received ATSC's highest technical honor, the Bernard J. Lechner Outstanding Contributor Award. She graduated cum laude from the University of Massachusetts.*

Jerry Whitaker*, Vice President for Standards Development, Advanced Television Systems Committee (jwhitaker@atsc.org). Whitaker supports the work of the various ATSC technology and specialist groups and assists in the development of ATSC Standards and related documents. He currently serves as secretary of the Technology Group on Next Generation Broadcast Television, and is closely involved in work relating to educational programs. He is a Fellow of the Society of Broadcast Engineers and a Life Fellow of the Society of Motion Picture and Television Engineers. He has served as a board member and vice president of the Society of Broadcast Engineers.*

DRM News

By Radu Peter Obreja
Marketing Director
Digital Radio Mondiale

Progress of DRM Receiver Solutions

Digital Radio Receivers—So Much More Than Standalone

The question of receivers remains paramount, no matter which digital broadcast standard is being talked about, considered, or rolled out. Digital radio cannot be received on analog receivers. Replacing a legacy of possibly hundreds of millions of radio receivers has been a daunting task for all the digital pioneers of the major digital terrestrial broadcasting standards for the last 20 years, at least.

DRM, the new kid on the block (as it entered the group of top standards years later), is efficient, flexible and has benefitted from developments already achieved by the open standard like DAB+. While for some standards the standalone receiver numbers remain an important success measurement, DRM has taken a more diversified route, in part because of the way it has been adopted in various parts of the world.

Both this year's IBC DRM virtual event, which was held on September 6, as well as the DRM Consortium's physical presence during the IBC exhibition in Amsterdam, were very well attended. The many world-wide online viewers and the visitors in Amsterdam were particularly impressed by the drive to "show and then tell"' about receivers, rather than the other way round, which had been the case some years back.

The much-awaited session on DRM receivers during both events gave the participants the opportunity to learn about new digital radio solutions and products in this sector.

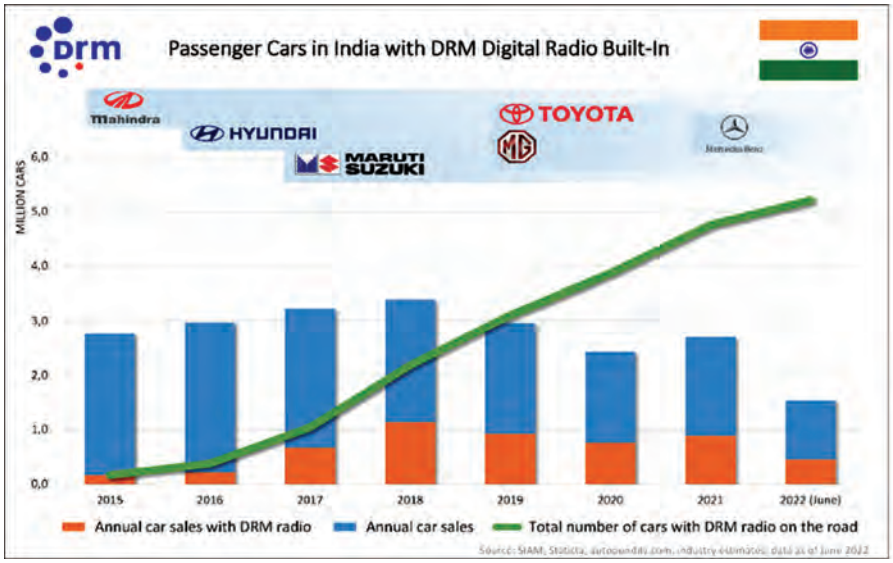
DRM Offers The Solution That Matches A Country's Needs

It is important to stress that the development of DRM radios does not cover only the desktop versions but is also the result of the specific requirements in countries where DRM is being considered or rolled out.

For instance, one major announcement during IBC was related to the 5.2 million cars on Indian roads (end of June this year) with line-fit DRM receivers. Radio is still being listened to extensively on the subcontinent, as many people use either their mobile for this, or spend a lot of time in cars travelling long distances, or are stuck in traffic jams in big cities. Therefore, the inclusion of DRM radios in the vehicles dashboards is essential for this huge country.

Th excellent figure of about 5.2 million represents a significant growth, since 2015 of around 30 percent of all new cars equipped with such devices in India. The graph in Figure 1 clearly illustrates this achievement.

Since older cars are also extensively used in large countries like India, the Chinese company Gospell unveiled their new aftermarket DRM radio for the automotive industry. This was shown in Amsterdam in September and is the Stereo Digital Radio Receiver GR-520. This new product supports all analog and digital frequencies and can be installed in older vehicles being available for orders by distributors for now.



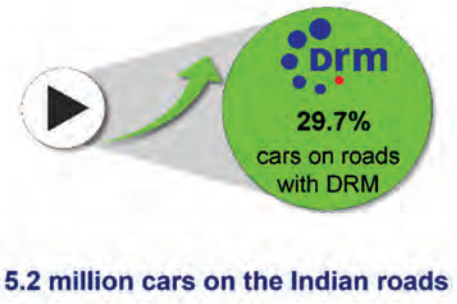
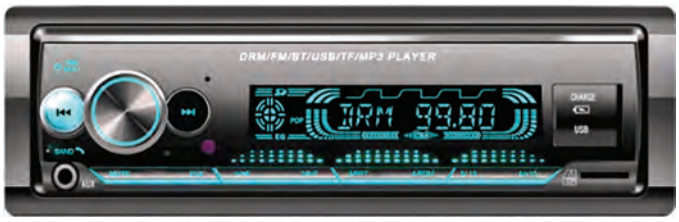


Figure 1.

Aftermarket car radios have been developed also by Starwaves in Germany designed for Asian and African countries mainly (car box radio).



Gospell's model GR-520 DRM stereo digital radio receiver.

The receiver industry also takes into consideration and develops DRM digital radios based on current service requirements, which are perfectly met by key features of the DRM standard, such as the Emergency Warning Functionality (EWF). Countries in Asia and Africa are very often struck by natural disasters, have all sort of emergencies, and EWF, part of the DRM standard, is therefore a requirement in DRM radios when broadcasters have decided for the DRM standard roll-out.

Since DRM can be deployed on all broadcast bands (above and below 30 MHz), digital shortwave is ideal for distance education, with lessons broadcast towards schools in locations where Internet does not exist, is of unstable quality or too expensive. This is a project the DRM Consortium is working on, and which has encouraged Starwaves to create a new desktop receiver with integrated Wi-Fi hotspot. This radio receives the DRM signals and distributes them to multiple devices accessible by pupils (e.g., tablets).

The Fraunhofer IIS mobile solution.

Solutions for DRM reception on mobile phones were also received with great interest at IBC in Amsterdam. Starwaves offers a DRM App for Android phones and tablets in conjunction with SDR RF dongles, available on major platforms such as Google, Huawei and Amazon.

Exciting mobile phone solutions were also demonstrated by Fraunhofer IIS (Germany), such as the receiver kit software SDR (demodulators and decoders) for mobile phones, automotive, and consumer devices.

All such receivers could not be produced without the development of chips, modules or SDR solutions. One such pioneering work is being conducted by CML Microsystems in conjunction with Cambridge Consultants in the United Kingdom. Their small and cost-effective DRM product is a multiband broadcast receiver module which, as presented at IBC, could be a real game-changer. This ready-made module, working on normal batteries with at least 12 hours life, and with all the IPs paid, could be easily incorporated in DRM radio casings by local manufacturers. They can build receivers suitable for their own market and based on local tastes. The module supports all analog bands as well as the full DRM frequencies in both AM and VHF. The module is expected to be available from Q1 2023. It is in final tests and its low-energy consumption, its ease of use and low bill of materials could potentially unlock the huge market for low-cost DRM receivers.

NXP and Skyworks, global semiconductors manufacturers have complete portfolios of automotive qualified DRM chipsets suites for car receivers (both for AM, and lately for the FM bands as well).

Other companies located in India, such as Inntot and OptM, as well as the South Korean manufacturer RF2Digial, contributed to the IBC DRM events by presenting their solutions for DRM use in cars, on desktops, or through TV.

Digital Receivers On The Ascendant

The development of DRM receiver solutions has received an impetus by the commitment of countries to roll out DRM, such as India, currently the largest digital radio rollout globally, and by Pakistan or Indonesia, where the use of the Emergency Warning Functionality is essential.

Demonstrations of DRM have just finished in Australia, while some are going on in Denmark. The interest shown on the African continent (e.g., South Africa and Southern Africa) stimulates and shapes the way in which the receiver and automotive industry can meet the demands of modern listeners.

It is important to remember that the key elements for any DRM radio manufacturer to start planning and producing receivers are the early announcements by local stakeholders about the adoption of DRM and day at which the rollout will start. This needs to be doubled or matched by substantial orders by distributors. The increasing size of the orders is directly linked to the unit price reductions expected by future customers.

The receiver conundrum is not solved yet, but for DRM the latest developments are offering clear and ingenious solutions able to bring about the orders in volume. If you want to join us on this journey, write to: *projectoffice@drm.org*

For more information on DRM receivers, please visit *products.drm.org*

About The Author

Radu P. Obreja *is the marketing director of the DRM Consortium. He has extensive experience in business development, marketing and PR, having worked for large international companies in various industries, such as Visa International and Visa Europe, where he also held the position of vice president. He is a member of the DRM Steering Board, and is actively promoting the rollout of the DRM standard in Asian, African, and South American nations, as well as in some European countries.*

5G MAG

By Jordi J. Gimenez

5G-MAG Open Software Tools Accelerate 5G Media Ecosystem

Jordi Gimenez

The 5G-MAG Reference Tools development program (*developer.5g-mag.com*) is 5G-MAG's response to support the creation of new media services within a dynamic world of apps, software-centric solutions and agile developments. The program aims at accelerating the ecosystem of open software reference tools to support 5G Media applications. Successful results during 2022 show how broadcast distribution can be integrated under the on-line and streaming ecosystem. For 2023 we are targeting a further expansion of the tools to optimize the on-line distribution of media content to 5G devices.

First Demos At 2022 IBC Show

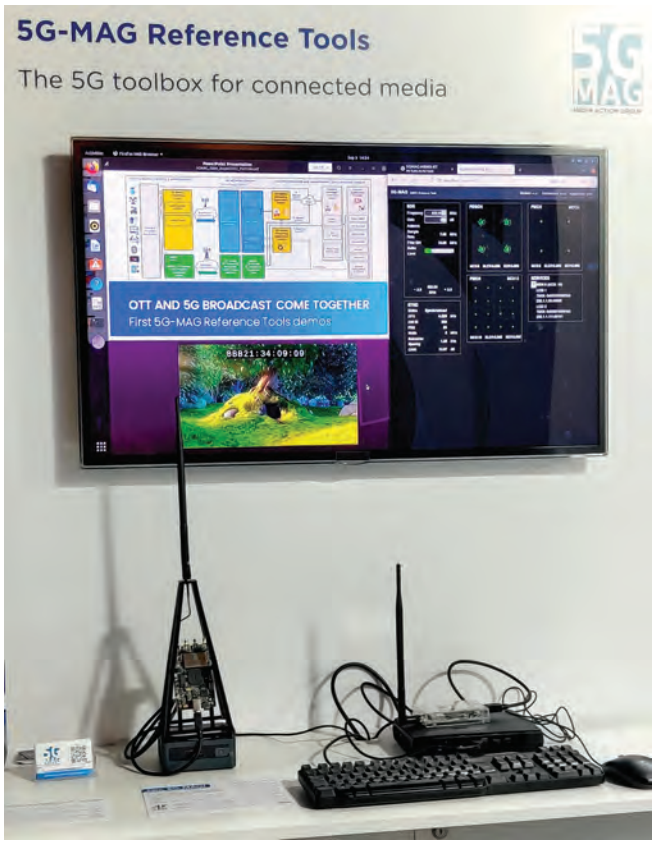
The recent IBC Show in Amsterdam (Sept. 9–12) was an opportunity for 5G-MAG to show the current open software toolbox in action. Even more, the tools have been deployed in pre-commercial applications developed by ORS, Bitstem and Fraunhofer FOKUS, active contributors to the 5G-MAG Development Program.

OTT streaming and CDN integration over 5G Broadcast with commercial media apps or the dynamic provisioning of services according to user demand are two key demos shown during the 2022 IBC show.

Target 2023 Projects Ready To Go!

5G-MAG Reference Tools already implements a toolbox for 5G Broadcast (as defined in the 3GPP standards in Release 16 as LTE-based 5G Terrestrial Broadcast,). This was the result of joint efforts among developers that led to the first end-to-end software package (including an open-source transmitter, receiver and client components) available to the community.

With 3GPP Release 17, 5G Media specifications are expanded into the domains of 5G Media Streaming with dynamic



5G-MAG exhibits at the September IBC event.

continued on page 29

RF Report

Building an ATSC 3.0 Transmitter in GNU Radio

By Doug Lung

Almost a year ago I received an email Ron Economos saying that he had finished his GNU Radio transmitter for ATSC 3.0. I finally had a chance to download his software and his GNU Radio Companion flow graph and test it myself.

It worked!

While there are some limitations, I'm hoping some expert readers will add the missing features.

Introduction To GNU Radio

Before describing the steps I took in building the transmitter from Ron's GitHub source and getting it running, it's worth looking at GNU Radio. As the ATSC 3.0 standard was being defined, I saw ATSC 3.0 demos that used Ettus software-defined radio hardware to generate the signals and receive them. Looking at the laptop screens driving the demos, it was clear that at least some of them were built using GNU Radio. Unfortunately, the GNU Radio code used to create these demos was never available publicly, as least as far as I could determine.

GNU Radio is a free and open-source software development toolkit that provides signal processing blocks to implement software defined radios. The primary interface is GNU Radio Companion, which has a list of "blocks" that call up various GNU Radio tools that can be combined to create software defined "radios." I put "radios" in quotes because the platform is not limited to transmitting and receiving. It can provide monitoring, such as a constellation diagram, eye pattern or spectrum display, and through the use of virtual sources and sinks, it provides a platform that can do test signal generation and demodulation without any hardware. The blocks have defined input and output types and provide a way to send different parameters such as frequency, amplitude, code rate and more, to the GNU Radio components.

Figure 1. ATSC 3.0 test setup.

There are several GNU Radio tutorials and videos on the web. Building an FM radio receiver or a simple spectrum analyzer isn't difficult. GNU Radio will work with most software defined radio hardware. I've used it with the Airspy SDRs, the original SDRPlay SDR (GNU Radio helped me fix the Linux driver for it), the inexpensive $40 RTL-SDR, and the more expensive Ettus B200. The B200 is the only SDR I own that can transmit. There are lower cost options with transmit capability, including the Analog Devices ADALM-PLUTO and Chinese "PLUTO Plus" clone, and the HackRF One SDR.

Ron Economos's ATSC 3.0 transmitter was designed to run on the Ettus B200/B210 SDRs. The B200 sells for around $1,200. The B210 is more expensive, as it includes a second transmit output, which is not needed here, but might be useful if building something like a vector network analyzer. I bought my B200 many years ago with the goal of using it to build an 8-VSB modulation analyzer. However, I never got around to that, and mainly ended up using it as an RF source and spectrum display for measuring filters and other RF components. The B200 has a frequency range of 70 to 6,000 MHz and a bandwidth of up to 56 MHz.

The ATSC 3.0 transmitter SDR is designed for the Ettus USRP B200 or B210. It uses the "uhd" driver, so I would imagine the program would work with other Ettus SDRs using the same driver. Ettus SDRs are commonly used to provide relatively low-cost software-defined 4G LTE or GSM base stations, and as a result, Chinese clones that claim compatibility with the "uhd" driver are available for half the price of the Ettus

SDRs. They also have a case, which isn't provided with the B200 or B210, and in some instances claim slightly better specs. I have not tested any of these clones and would be interested in hearing from any readers who have. The HackRF One and ADALM-PLUTO/PLUTO-Plus SDRs may also work but will require changing the "uhd" blocks in the ATSC 3.0 transmitter GNU Radio Companion flow graph.

Figure 1 shows the test setup I used, with my Ettus B200 SDR and the HDHomerun kickstarter version ATSC 3.0 receiver. As you can see from the photo, I coupled the output of the B200 through a 10 dB attenuator directly to the HDHomerun. I also tested with the Airwavz Redzone receiver (not shown). I haven't had a chance to do any tests with antennas.

Building The ATSC 3.0 Transmitter

The first step in building the ATSC 3.0 transmitter is to install GNU Radio. The transmitter requires GNU Radio version 3.9 or later. I used version 3.10.1.0. The versions available from the repositories for Ubuntu/Kubuntu 22.04 or later, and Fedora 36, or later, will work. Install the gnuradio and gnuradio-devel packages. If using the Ettus SDR or Chinese B200 clone the "uhd" driver is required. For Fedora 36, the packages were uhd, uhd-devel, uhd-tools, and uhd-firmware. For documentation, install uhd-doc. For Ubuntu/Kubuntu or other Linux distributions, use the repository search feature, like "apt-cache search" on Debian-based distributions, to track down equivalent packages.

The software also requires fftw3, specifically the single precision floating point version. On my Fedora 36 setup, I installed fftw fftw-devel, fftw-static, fftw-openmpi-libs-single, fftw-mpich-libs-single, fftw-openmpi-devel, and fftw-mpich-devel. The first three may be all that's needed, but after a day in dealing with missing library error messages before discovering the correct packages I wasn't taking any chances.

While attempting to configure and compile the ATSC 3.0 transmitter, I found several other packages were needed. The configuration/make scripts provide error messages that help in tracking down missing libraries and programs. On Fedora 36, I had to install pybind11-devel, python3-pybind11-devel, python3-pybind11, gmp, gmp-devel, spdlog, spdlog-devel, libsndfile-devel, and doxygen.

Once the packages are installed, clone or download gr-atsc from *https://github.com/drmpeg/gr-atsc3*. Follow the instructions there for compiling the program. Once you're finished, add the line:

local_blocks_path = /usr/local/share/gnuradio/grc/blocks
to the file /etc/grc.conf if needed.

There is an additional item to check. After I had all the required packages installed and the compile, make and make install proceeded without errors, but GNU Radio Companion failed to start the transmitter and issued a message saying the atsc3 modules were not found. It turned out "make install" put them under /usr/local/local/lib64/python3.10/site-packages/. I moved the atsc3 directory to /usr/local/lib64/python3.10/site-packages/ and that cleared the error.

Once all these steps have been completed, change to the gr-atsc3/examples directory and start the vv-031.grc example with the command:

gnuradio-companion vv031.grc

You should see a screen similar to that in Figure 2 – vv031.grc Block Diagram. The "tx gain" window won't appear until the program is run. You can drag the blocks around if they are overlapping each other. The program requires a transport stream and the location of the file has to be set in "file source" block. Use the link on the GitHub page to download advatsc3.ts. Double click on the "file source" block and enter the full path to the file in first line ("file"). At this point you can click on the "Run" drop down menu at the top of the window and click "generate" to create the Python file with the ATSC 3.0 transmitter program or "execute" which will create the Python file, if needed, and run it. You can also use the play and stop icons in top of the window at the middle to start and stop the program. At this point, unless a uhd compatible SDR was attached you'll get a run time error—"No devices found…".

Testing The Transmitter

I recommend testing the SDR before attempting to use it with the ATSC 3.0 transmitter program. The "uhd-tools" package provides the "uhd_usrp_probe" program that will load the correct firmware on the SDR and provide information on the device. If it doesn't run, check the USB cable and port on the computer. The Ettus B200/B210 require USB 3.0. I found my B200 didn't like the external 12 VDC power supply that I'd connected it to, but ran fine on USB 3.0 power alone.

Once uhd_usrp_probe runs with no errors, rerun: gnuradio-companion vv031.grc and there should be no errors and the transmitter gain window should appear. It's probably a good idea to provide some termination on the SDR's output. I found a 10 dB pad provided a good output level for the HDHomerun and Airwavz Redzone tuners with the gain settings in the program. It isn't hard to add a constellation diagram. Figure 3 shows how I connected the QT GUI Constellation Sink to the output of the ATSC3.0 Modulator. I didn't have to change any settings in the Constellation Sink block to get the display shown in Figure 4.

I connected my tinySA spectrum analyzer to the 10 dB pad and verified the signal was present and at the correct level for the tuners. Note that the program, as designed, outputs the signal on 429 MHz in the 70-cm amateur radio band. This is also cable Ch. 58. The channel center frequency can easily be changed to a broadcast UHF channel by changing the

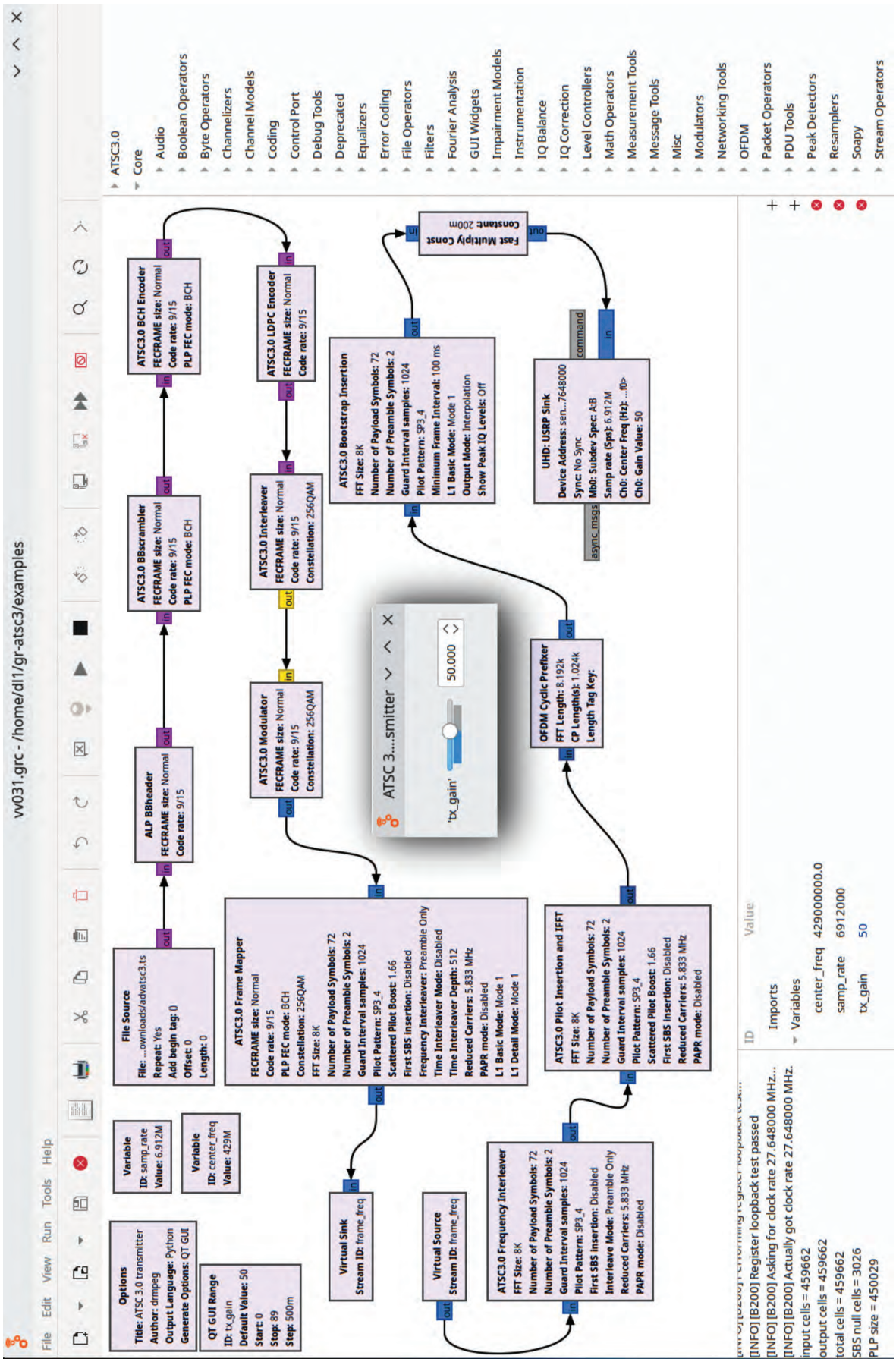


Figure 2. vv031.grc block diagram.

frequency in the "Variable" center_freq block in the upper left of the flow diagram.

Changing the frequency to 605 MHz (Ch. 36) allowed me tune in the signal on the Airwavz Redzone tuner and TvXplorer v2. While TvXplorer provided signal level and SNR measurements and basic PLP info there was no video. Figure 5 shows the TvXplorer screen. This is because the ATSC 3.0 transmitter is not providing any low level signaling (LLS) information and video is in an ATSC 1 style transport stream, not an IP-based ROUTE/DASH or MMT ATSC 3.0 stream.

I hooked up the HDHomerun box and did a scan, but it found nothing. That wasn't surprising since without LLS the box couldn't find the channel info. With the help of Ron Economos, I was able to not only get the HDHomerun working with the ATSC 3.0 transmitter, but with the transmitter's LDM mode as well. Use the hdhomerun_config program to receive the ATSC 3.0 transmitter. The program is available for Windows, Mac and Linux operating systems and can run from the command line or a GUI. See *https://info.hdhomerun.com/info/hdhomerun_config for more details. (*See *https://github.com/Silicondust/libhdhomerun* to download and install the libraries.) Information on downloading and installing the GUI for Linux can be found at *https://www.silicondust.com/support/linux/*.

Figure 6 shows the channel and information for reception on the default 429 MHz center frequency. Other channel formats and channels be selected. Clicking "View" will display the video in VLC (Figure 7).

Testing the GNU Radio ATSC 3.0 transmitter with LDM is more complicated. The vv320.grc flow graph available in the same "examples" directory as the vv031.grc flow graph will transmit an LDM with robust and enhanced PLPs. You will need new file sources for the LDM flow graph. The *https://www.w6rz.net/rickmorty5_1atsc3.ts* clip is about 1 GB in size and is H.264-encoded with a total transport stream bit rate of around 4.7 Mbps. This is used for the robust layer PLP. The *https://www.w6rz.net/rickmorty6atsc3.ts* clip is almost 4 GB and is encoded in MPEG-2 with a total transport stream rate of approximately 20.3 Mbps. This clip is used for the enhanced layer PLP.

Modify the two file source blocks in the flow graph to add the full path to these files. Figure 8 shows the flow graph diagram for the LDM version of the transmitter. Please note that I've added a QT GUI Constellation sink to show the LDM constellation. I increased the number of points to 4096. Figure 9 shows what the LDM constellation generated in this flow graph looks like.

The hdhomerun_config_gui program will not, by default, display the two LDM PLPs. Here are the instructions Ron Economos helped me with that allow the program to see the two PLPs. Note that 10802529-0 in these commands should be replaced with the device ID from your HDHomerun ATSC 3.0 tuner:

1) Tune hdhomerun_config_gui to the channel—it should find one PLP.
2) On the command line, enter: hdhomerun_config 10802529-0 get /tuner0/plpinfo It should display the info for the two PLPs, but with the enhanced QAM64 layer not locked.
3) Turn on both PLPs with: hdhomerun_config 10802529-0 set /tuner0/channel atsc3:58:0+1. Both PLPs should be displayed and show "lock=1".

After this, the "Program" button in hdhomerun_config_gui should allow selection and viewing of the two PLPs. I had hdhomerun_config_gui running while entering the commands in a separate terminal window.

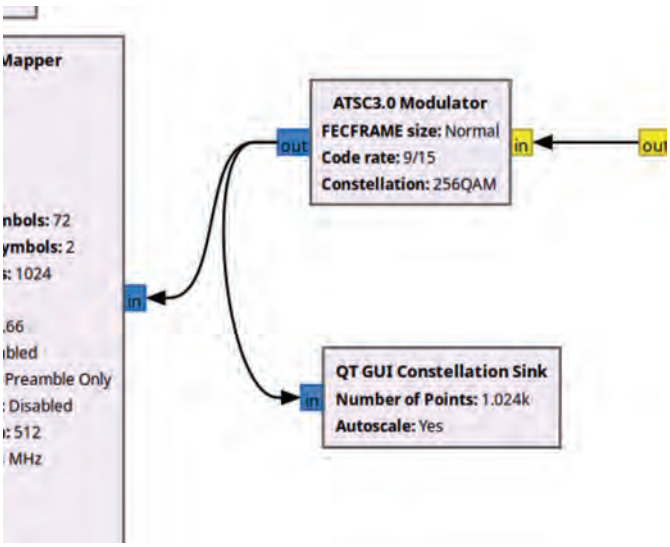


Figure 3. Add constellation graph.

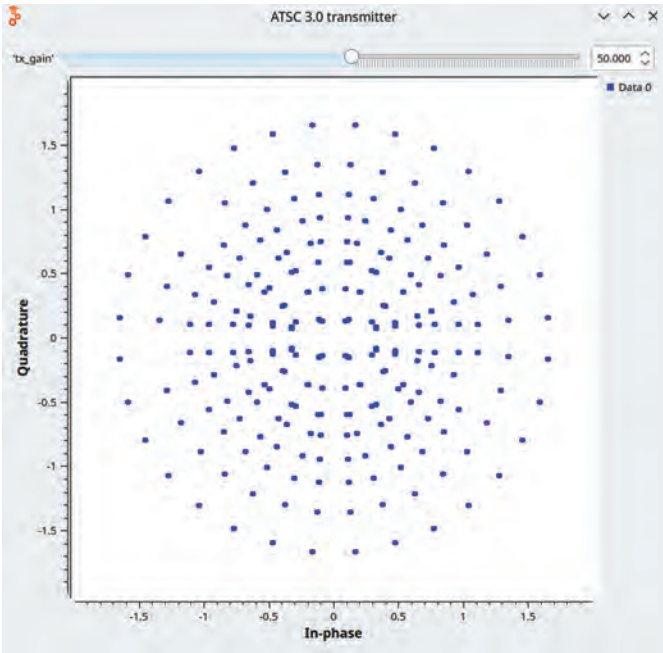


Figure 4. Constellation graph display.

Figure 5. Redzone Receiver Display.

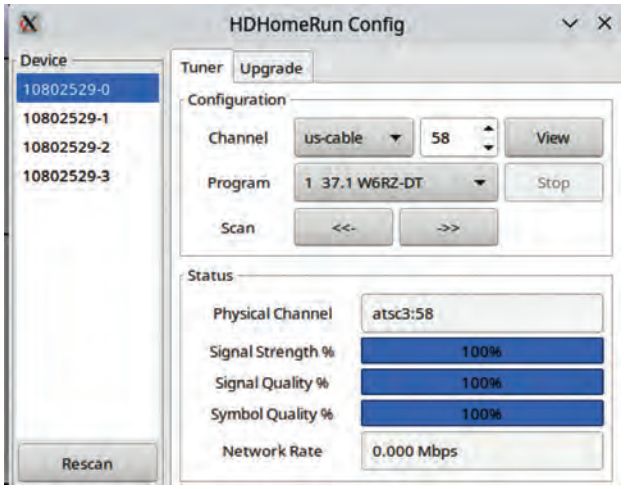


Figure 6. HDHomerun GUI.

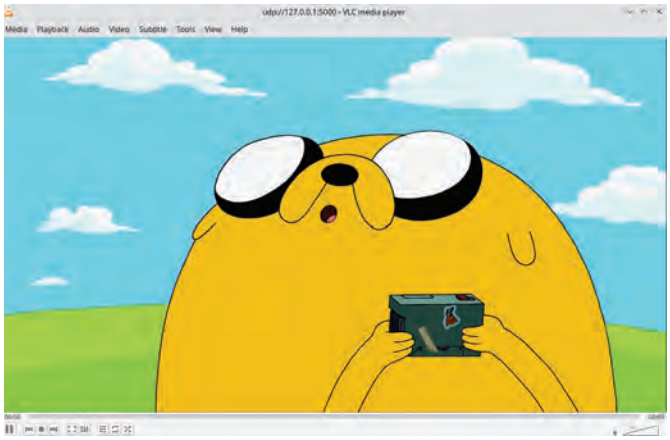


Figure 7. Video from HDHomerun.

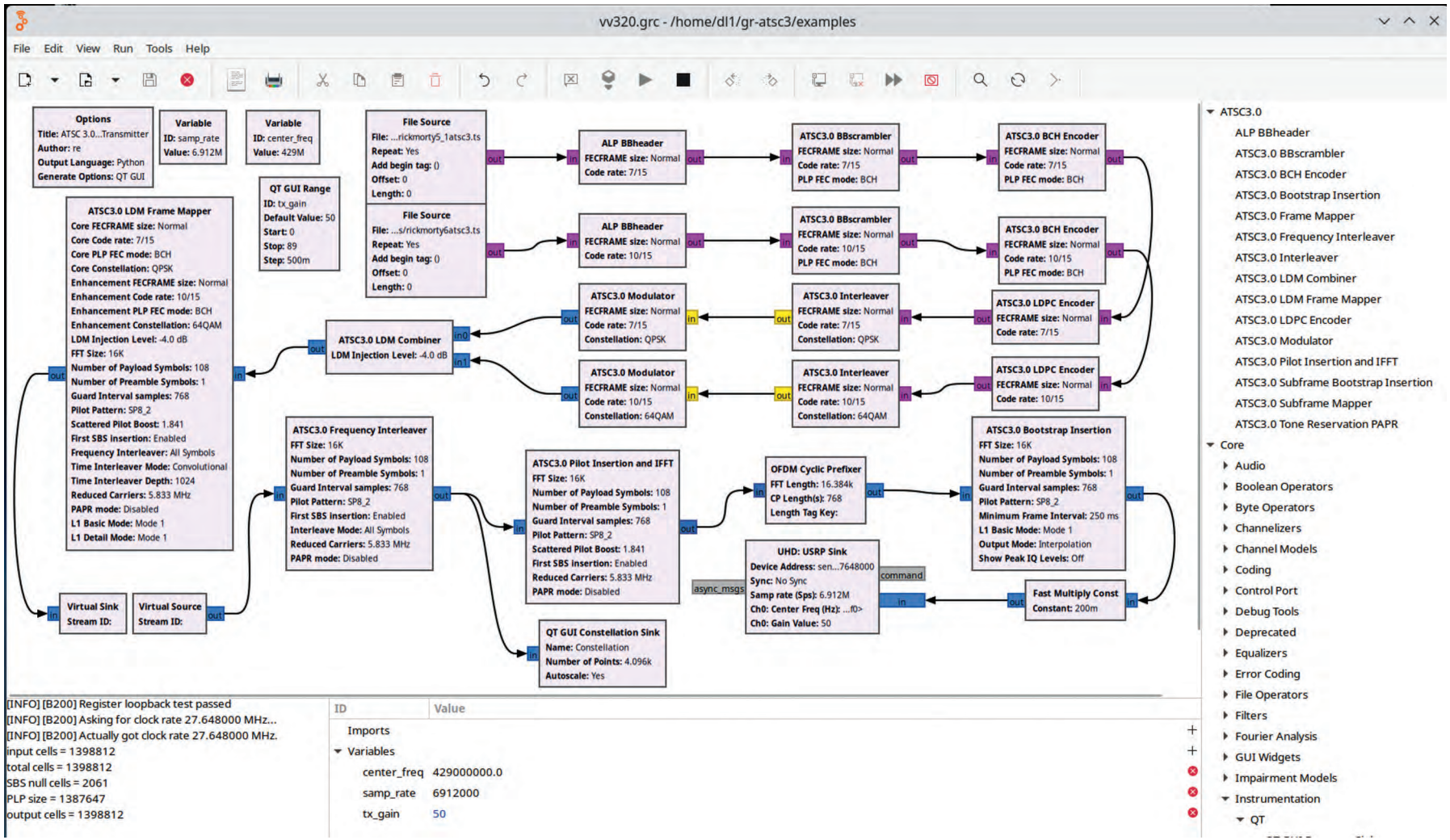


Figure 8. vv320 LDM GRC block diagram.

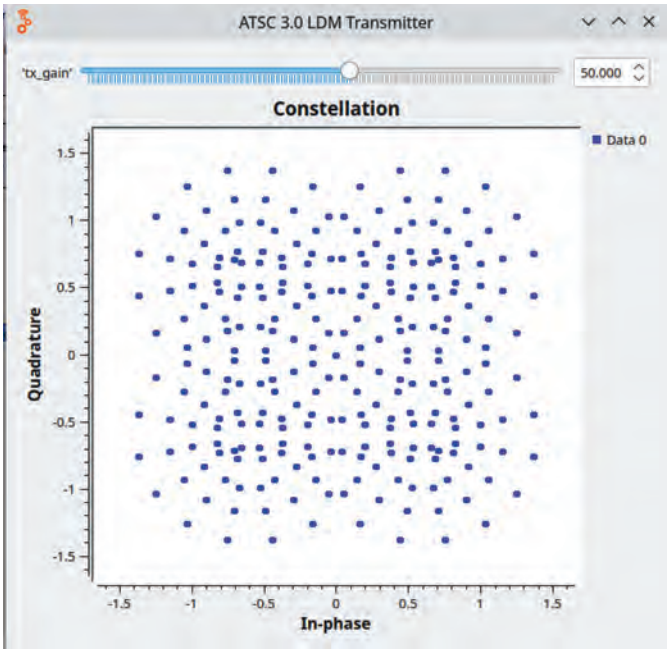


Figure 9. LDM constellation graph.

Future Work—Help Wanted!

The GNU Radio ATSC 3.0 transmitter is a great tool for experimenting with different modulation and coding parameters, as well as learning about how ATSC 3.0 generates waveforms. The major limitation is that the program does not have a block to add low level signaling (LLS), which means that TV sets won't find it when doing a channel scan. It would also be nice if the program accepted an IP input, but obviously this would greatly complicate the creation of input streams for the program. Perhaps a simpler approach would be to develop blocks that would take a previously encoded STL-TP file. Ideally it would use the transmission parameters in the STL-TP stream to setup the modulation, coding and other PLP configurations. Combining Ron Economos' program with an STL-TP input would provide a simple, inexpensive way to test different ATSC 3.0 configurations on different TV sets and troubleshoot problems where there is no access to distant over-the-air signals.

The current GNU Radio ATSC 3.0 transmitter requires a very simple ATSC 1.0 format transport stream with just basis PSIP (PMT, PAT, TVCT). I have been looking for a simple way to create such a transport stream on my own, but have not found a solution yet. The ffmpeg program (*https://ffmpeg.org*) allows creation of transport stream multiplex but I haven't found information on how to include TVCT channel PSIP data. GStreamer (*https://gstreamer.freedesktop.org/*) has an ATSC mux that looks like it could do everything but I haven't had any luck finding examples on how to do this. One way to get test streams beyond the ones Ron Economos provides might be to simply copy an over-the-air transport stream from a station. Using a program such as TSDuck (*https://tsduck.io/*), it should be possible to remove unwanted program streams from it. If readers have ideas on how to generate an ATSC transport stream from an input video and audio file and some basic PSIP data, please let me know. I'd also be interested in hearing your experiences with this GNU Radio ATSC 3.0 transmitter. Please email me at the address below.

In my next column, I'll look at a collection of downloadable tools for receiving and checking ATSC 3.0 signals.

Your comments and questions are always welcome. Email me at *dlung@transmitter.com*.

DAB Radio News And Views

By Will Jackson, Communications Manager, WorldDAB

Provision of Radio Station Logos to Automotive Receivers

Will Jackson

In the last edition of **Broadcast Technology**, we looked at how radio is facing increasing competition in the car, highlighting that one of the best ways for broadcasters to secure their place on the dashboard screen is to provide metadata.

As modern automotive devices evolve, users are more accustomed to interacting with larger format screens that are able to show richer visual information. With automotive manufacturers looking to improve the user experience of such devices, the use of brand logos to enhance radio service navigation becomes more commonplace. Devices need to source brand logos for display, and broadcasters have an interest in being able to ensure this is always the correct one, and that there is a mechanism for them to provide updates.

This article explains how broadcasters with services on FM or DAB can supply and update these brand logos.

The Brand Logo Process Explained

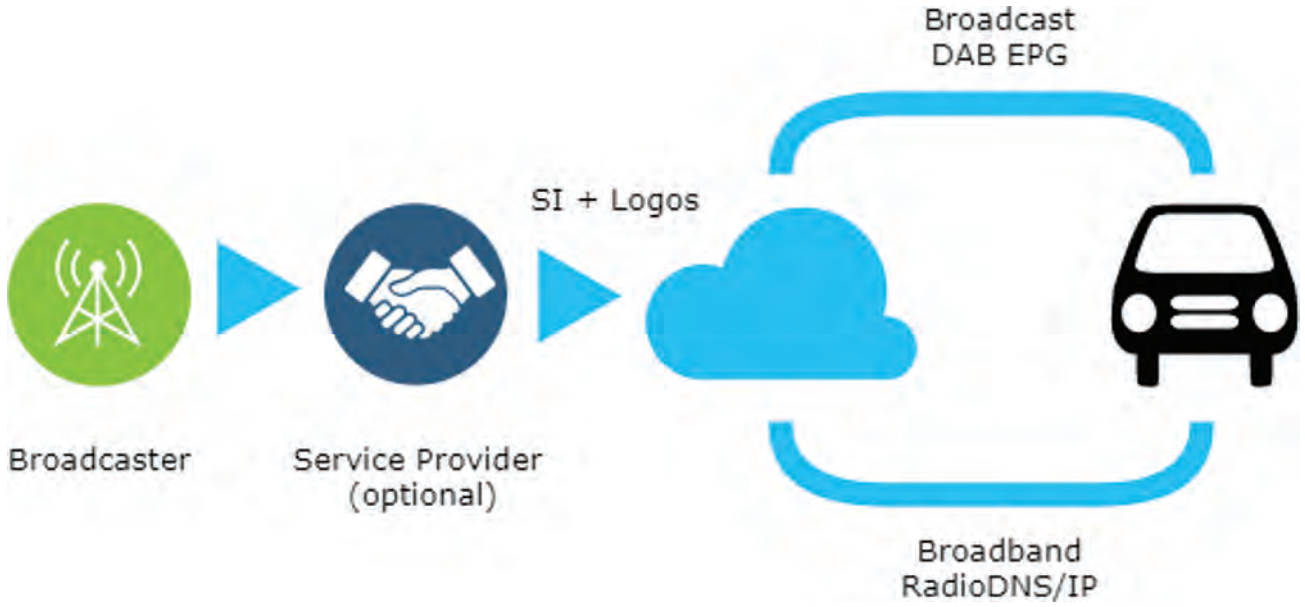
Broadcasters produce logos to a set of defined sizes and make them available publicly over IP for IP-connected devices, and for broadcasters on DAB, transmit the logos over DAB for devices without an IP connection.

Automotive manufacturers acquire those logos either through the broadcast signal, or through an IP connection periodically and use them to update an internal cache of logos on the receiver.

In both cases, the logos are signaled to devices using the Service and Program Information standard (ETSI TS 102 818 v.3.1.1), to create a Service Information (SI) file containing a list of radio services alongside their logos. This open standard works equally for signaling of logos over DAB and/or IP, meaning that making logos available once can work for both connected and non-connected devices.

For all broadcasters:

- You must produce versions of your station logos in five sizes and put them on a web server
- You must create a Service Information (SI) file which describes your stations and weblinks to their brand logos, and put it on a web server
- You must register with RadioDNS to be able to link your broadcasts to your SI file
- You should provide a license to allow manufacturers to use your logos
- You should indicate how long manufacturers can cache your logos, usually 30 days.



If you are broadcasting on DAB/DAB+, you should transmit four of your logos and your SI file over DAB.

For each of your stations, you must create versions of logos in the following sizes (width x height in pixels): 32 x 32, 112 x 32, 128 x 128, 320 x 240, and 600 x 600. You should create them using the PNG image format. Save these logos on a web server so that they can be reached publicly using a weblink (URL).

An SI file is simply a text file containing your station information in a standardized format (XML). If you rely on a third-party service provider to manage your information and data, ask them to support and supply your data in this format. RadioDNS has a series of HOWTO files for creating your own SI files, and an online tool for generating your easily creating your own: *https://radiodns.org/developers/documentation/#howto*

In either case, your SI file needs to be available on a web server so that it can be reached publicly using a weblink. Send the weblink to your SI file by email to *registrations@radiodns.org*. RadioDNS will process this request and reply.

How To Transmit Your Logos Over DAB

The DAB multiplex that your stations are transmitted on must also signal and transmit a DAB SPI service, which will require cooperation with the multiplex operator. It is recommended that this request be made with the other stations on that multiplex, as a joint request. The DAB SPI service will need to transmit the four smallest logo sizes for each station on the multiplex (width x height in pixels): 32 x 32, 112 x 32, 128 x 128, 320 x 240.

Although a function of configured bandwidth and the total size of files being transmitted, the device acquisition time—the time required for a device to receive and decode a file being transmitted—should be less than five minutes. The precise implementation of the DAB SPI service will be determined by the multiplex operator and the nature of how your services are being provided, and you should ask them whether they support using your SI files directly.

If your multiplex operator or service provider fully supports transmission of DAB SPI directly from your SI files, you should send your SI file weblink to your multiplex operator and instruct them to set up a DAB SPI service for your stations.

If your multiplex operator or service provider does not support transmission of DAB SPI directly from your SI files, there are free, open-source tools that can be used to generate a DAB SPI service from your SI files.

You should offer your logos under a license, so that manufacturers know that they have explicit permission to use them. You can refer to the common license being developed by RadioDNS, or you can write your own. This license must be provided as a link in your SI file (HOWTO). If you write your own, or you don't provide a license, some manufacturers may choose not to use your logos.

You should first decide how long a device can cache your logos, before removing them from the cache. It is recommended that this be given a period of 30 days, as a balance between ensuring the logos are kept updated, along with a need to consider device constraints. Note that this is the maximum time that a device may cache a logo, and does not mean that this defines how soon a logo will update on a device, once you choose to change it. There are additional technical means by which a device can determine whether a logo needs to update its cache before this time. For logos available on a website, your web server can be configured to do this by setting a period of expiry on your logo files. This can then be picked up by and be used as the expiry time for logos then transmitted over DAB.

WorldDAB—the global industry forum for DAB digital radio—is committed to helping car manufacturers and broadcasters achieve the best possible digital radio experience for drivers. With our extensive network of DAB+ industry professionals, we help vehicle manufacturers and broadcasters resolve issues related to in-car DAB+. There are more details on how to use metadata, including a detailed information sheet and FAQs at:

https://www.worlddab.org/automotive/metadata

5G MAG

continued from page 19

QoS policies, event exposure, Multicast Broadcast Services, Edge applications, among others, with an eye on the future developments towards XR and the Metaverse.

For 2023 (and after having successfully established the Reference Tools program in September 2022), efforts are now gathered to expand them into new applications. This summer, Target 2023 (*https://www.5g-mag.com/target2023)*, a process open to the media and telecom industries to on-board use cases has been instrumental in drawing the picture of what 5G-MAG developers may be able to deliver for 2023, with the roadmap presented at the 2022 IBC show.

Here are some of the details on which 5G-MAG Reference Tools contributors are currently focused:

- BBC Research & Development is contributing to the development of base 5G Media Streaming features such as Content Hosting and Media Session Handling, providing a framework for contributors to add more advanced functionality. Meanwhile, it is working to implement multicast–broadcast support based on 3GPP Release 17 Multicast and Broadcast Services (MBS).
- Dolby is contributing with the development of a reference implementation of a DVB-I player. The implementations are focused on the support of 5G Media Streaming as an entry point to different delivery mechanisms including unicast and broadcast. Dolby also provides a free cloud-based content creation service to contributing members, supporting HDR and NGA for experimentation and demonstration purposes.
- ORS and Bitstem are contributing to the implementation of 5G Broadcast On-Demand functionalities leveraging QoE Metrics or Consumption Reporting and Data Collection. These tools will enable the dynamic service provisioning of content over dedicated broadcast networks according to user demand or the support of certain quality profiles.
- Qualcomm plans to contribute to enable new use cases around the use of DVB-I over 5G Media Streaming (unicast), DVB-I Hybrid Service over 5G Broadcast and 5G Media Streaming and Emergency Alerts and Media Services through 5G Broadcast.
- iTEAM-UPV plans to contribute to the fine-tuning of the 5G Broadcast transmitter according to Rel-17 specifications; initial prospects into the use of 5G Broadcast waveforms for satellite broadcast services; and the support of multicast-broadcast services (MBS) under 5G Core and NR-RAN.

The 5G-MAG Reference Tools contributors also include Eurofins Digital Testing, Fraunhofer FOKUS and ID TOLU.

The Downward Path to Broadcast Engineering—No. 29

A big transmitter, a shorted transformer, and no money for a replacement—what to do?

By Joseph M. Davis, P.E.
President
Chesapeake RF Consultants, LLC

During my junior year of college (more than 40 years ago), I was lucky enough to be named chief engineer of a 50 kW (ERP) FM station. I had worked part-time at this station for several years in various capacities and was very familiar with the studio and transmitter operations, and I coveted becoming a radio CE one day.

The bad news was that the station had a longstanding "cashflow problem," as the manager put it. On payday employees proceeded immediately to the radio station's bank to cash their paychecks while there was still enough money in the account to cover them. The equipment was low-budget with no backups, some items requiring frequent repair, and certainly no opportunity for replacement.

Any transmitter failure would be an immediate off-the-air problem, sometimes taking me out of class to resolve it. A recurring transmitter issue was a shorted rectifier stack on the three-phase high-voltage power amplifier supply, sometimes triggered by a lightning storm, sometimes for no apparent reason. Upon arriving at the site, I quickly learned that if the transmitter's main breaker (200 Amps) was tripped, indicating that one of the six rectifier stacks had shorted and I would use an Ohmmeter to find out which was at fault.

Fortunately, there were some spare rectifier stack assemblies for getting the transmitter back on the air without too much delay, and my task was to solder in new rectifier diodes on the bad assembly for next time. But with the so-called "cashflow problem," the station's business account at the local electronic parts store had been suspended, requiring me to buy the parts for cash and turn in an expense report for reimbursement.

The tower site was in a very rural area about 40 minutes from the studio. The 25 kW FM transmitter had been installed in a used mobile home trailer. The site's telephone had been disconnected for nonpayment of the bill, leaving me to a 20-minute drive to the nearest payphone. I had rigged up a microphone to the 67 kHz subcarrier generator so I could talk back to the studio for meter calibration and other purposes, but this was useless if the station was not on the air.

One day an "off-the-air" call came in and when I arrived at the trailer site, I found the transmitter's main breaker tripped again. A quick check of the rectifier stacks showed all were okay, so I reset the breaker and hit the startup sequence. Fans and filaments came up fine. After a warm-up delay the plate contactor engaged, and simultaneously the main 200 Amp breaker violently tripped. Uh-oh. Checking the rectifier stacks more thoroughly, by using the Ohmmeter on each diode (12 diodes per stack; six stacks total) showed no obvious issues.

I remembered that a couple years earlier one of the high voltage chokes had shorted to ground and was replaced to restore operartion, so I disconnected the rectifier output from the rest of the high voltage supply. Again, the main breaker tripped so violently that the whole trailer shook when the contactor engaged. So, it was now down to either something undetected with the rectifier stacks, the high voltage or primary wiring, or (given the station's shaky economic situation) a possibility that I really didn't want to consider—failure of the transmitter's three-phase 40 kVA plate transformer.

An Incandescent Light Bulb Troubleshooting Tool

I checked, but the Ohmmeter wasn't particularly helpful in this case, as the normal DC resistance on the transformer's primary windings was very low. Not wanting to keep using the three-phase 200 Amp main breaker as a troubleshooting device, I sat down to think a bit. In my mind a light bulb came on, literally! One of my electronics instructors had previously described a light bulb technique for troubleshooting, where a 60-Watt incandescent light bulb is placed in series with the transformer primary winding and then connected across the 120 Volt AC line (all with the secondary disconnected). If the lightbulb glows dimly or not at all then the transformer's impedance at 60 Hz is high and should be OK. If it's at full brightness then the transformer winding is shorted.

About this time there was a knock at the trailer's door. One of the station's salesmen had stopped by to see when the station would be back on the air. He'd had to drive there thanks to that pesky cashflow problem and the disconnected transmitter site telephone. However, at that time, I could offer no prediction for him. I also had no incandescent light bulb, as all the working lights at the site were fluorescent tubes. So, I turned everything off and went for food and supplies.

Upon returning with a supply of light bulbs, I checked each of the three-phase plate transformer's primary windings. The first one made a 60-Watt bulb glow dimly, so did the second. At the third winding, the bulb went to full brightness. So now I knew where the specific problem was, but of course there was no spare plate transformer.

Reconnecting everything a piece at a time except for the shorted transformer phase primary winding, and setting the other two primaries to lower voltage (via a front-panel delta-wye switch) I was able to achieve a reasonable plate voltage for reduced power operation. The station was back on the air at about 25 percent of normal power.

Big Three-Phase Transformers Don't Come Cheap

I returned to the studio location and briefed the station manager about the situation before calling the transmitter manufacturer to see about a new plate transformer. Sure, they had one, but it would cost five thousand dollars, and it would have to be sent COD (collect on delivery), and that was after first paying off several other past-due bills the station had accumulated.

Given the station's continuing cashflow problem, the manager informed me that funds simply were not available and instructed me to shop around for a cheaper alternative solution. During the next few days, I found out the source for the transformers used by the transmitter company and gave them a call. They also quoted $5,000 and said it would also have to be a COD shipment. My next call was to a custom transformer manufacturer with basically the same story—they wanted several thousand dollars, and would expect the money to be paid on delivery of the transformer. My instructions from the station manager were to keep on shopping around.

Finally, I spoke with an electrical industrial manufacturer located about an hour away that could repair the existing transformer. The shop said they would have no problem in rewinding a three phase 40 kVA dry transformer—just bring it in for a two-week turnaround. The cost of the rewinding job would be $5,000, and they would bill us later. The manager loved this and told me to make it happen.

A 21-year-old Davis with the big AEL FM25KD and its even bigger power supply problems.

As One Problem Is Solved Another Surfaces

While rewinding the transformer solved the station manager's payment issue, it presented a new problem as to how to stay on the air for the two-weeks the job would require.

There was another radio station in the region that had a similar transmitter, but with an upgrade from 12 kW to 25 kW that had required a larger plate transformer. I knew that they had kept the smaller plate transformer and my next call was to them to see about borrowing it. I figured I could use their old one to keep our transmitter on the air at reduced power while the rewinding job took place. Unfortunately, the owner of the other station was only too aware of our station owner's financial situation and declined to loan the transformer as he figured the chances of ever getting it back were very small.

Finally, I contacted a "friend of a friend" and through this connection was ultimately able to borrow a plate transformer from a 5 kW AM station that was temporarily silent pending a sale. The stipulation was that there was a "drop dead" date for returning the transformer, as the station had to be ready to go back on the air when their new owner took charge in about a month.

Our station worked fine with the AM loaner transformer, albeit at reduced power, but even with the lower power the owner was happy to have the station on the air.

Broadcast Engineering Sometimes Requires A Lot of Physical Labor

Moving these three-phase power transformers around was quite an experience for me and some helpers. The defective 40 kVA transformer was the size of a large ice chest and weighed about 400 pounds. In order to get the transformer out of the mobile home trailer transmitter "building" and into a pickup truck we had to disassemble the chain-link fence around the transmitter building. (Matters were a bit easier at the electrical manufacturer's plant, as they were equipped with an overhead hoist and trolley for handling such big transformers.)

Two weeks passed and I was informed the rewinding process was running a little behind, but should wrap up soon. Finally, two days before the loaner transformer had

to be returned the repair was done and I went to get it. The helpers met me at the site that night and we got it into position. I was anxious about it working after all of the violent breaker trips from before. I took the time to check things out with the light bulb, and the rewound transformer passed that test with flying colors. I then powered everything powered up and was gratified (and relieved) to see that the transmitter plate voltage was now normal.

No Rejoicing Just Yet, Though

I slowly increased the RF power to the licensed level with no issues at first, but shortly after achieving this I noticed a slight burning odor. My first thought was that it was just some paint or varnish on the rebuilt transformer that was responsible for the smell and this would go away in time. However, I then noticed an orange glow down low in the transmitter cubicle. This was on one of the transformer mounting bolts. There was no doubt about it—for reasons yet to be discovered, the mounting bolt was heating to the point of an orange incandescence.

After some experimentation, we found that by setting the transmitter's front-panel control to the low power position (switching the transformer input from delta to wye) the heating did not occur and the transmitter would able to operate at about 50 percent power.

I felt compelled to leave the rewound transformer in place at reduced power, since a commitment had been made to return the loaner transformer by the next day. So, we loaded up the loaner transformer and I took it back to its home station.

Another Transformer Swapping Exercise

My next step was to contact the company that had rewound the 40 kVA transformer. When I described the glowing bolt, the product manager said to bring it back and they would resolve that problem. Upon discussion of the loaner transformer being no longer available, he agreed to loan us a 25 kVA single phase electrical utility company "pole pig" step-down transformer to use in reverse while the bolt heating problem was being resolved. So, in one long night, it was off to the electrical manufacturer to pick up the "pole pig" then back to the tower site to remove the newly rewound 40 kVA transformer and temporarily wire in the "pole pig" for reduced power operation, and back to the electrical manufacturer with the 40 kVA transformer to be repaired further.

A week later the 40 kVA transformer was ready, again. This time at installation there were no complications and full power was achieved. Within a few months our station had a new owner running things and cashflow was no longer a problem.

The main lesson here is that working at a financially unstable low-budget operation—while sometimes frustrating—can provide considerable troubleshooting and work-around experience. Jumping into that "frying pan" was a terrific way for me to get going as a new CE, and I would not change a thing.

About The Author

Joe Davis *is a television and radio consulting engineer with more than 40 years of experience, and is president of the consulting firm Chesapeake RF Consultants LLC. He received his Bachelor of Science in Electrical Engineering Technology degree in 1982 from Old Dominion University in Norfolk, Virginia, and since 1980 has worked directly for and then served as a consultant to various television and radio stations in engineering capacities, including transmitter and tower site relocation, facility upgrade, signal propagation, interference evaluation, FCC technical regulatory matters, and in the evaluation of human exposure to radiofrequency (RF) electromagnetic fields. He is a licensed Professional Engineer in Virginia and is a full member of the Association of Federal Communications Consulting Engineers (AFCCE), and has served two terms as that organization's president. He is also a member of the Institute of Electrical and Electronic Engineers (IEEE), the National Society of Professional Engineers (NSPE), and the Society of Broadcast Engineers, and holds an FCC General Radiotelephone License (formerly First Class) as well as an amateur radio Extra Class license. He was the 2016 winner of the BTS's Matti S. Siukola award.*

BTS Young Professionals, the NAB Show, and the BMSB

Hosted By Samina Husain, BTS Secretary

In this last edition of the 2022 BTS newsletter, we look back at a year of opportunities to meet at in-person events such as NAB and IBC. In addition BTS had a number of informative webinars with industry experts from around the globe sharing their thoughts. Plus we have celebrated a significant milestone for women, with IEEE 25 years of Women in Engineering. We have been resilient through 2022 and are moving forward with positive prospects for the future.

I am always encouraged with articles that inspire us to explore outside of our boundaries. In this edition we have three articles:

Enthusiastic about the future of broadcast and media technology, and the challenges they bring; Kylee Peña, product marketing manager—Pro Editorial, Adobe gives us her perspective.

How did you connect during the pandemic? Elena Gribanova, program manager at Cisco Global Marketing Corporate Communication—CiscoTV, reflects back at the challenges, transformations, collaborations and successes of building a solution in times of need.

Part 1 of 2, a pilot study from Radio Televisyen Malaysia. Ts. Nurulhusna Mohamad Kasim, Radio Televisyen Malaysia (RTM) and Pn. Mardhiah Nasir, executive director, IPSB Technology, provide the outcome, relevance and potential of radio. Stay tuned for part 2 in the next edition of ***Broadcast Technology****.*

As a reminder, I want to raise an important matter to IEEE BTS members eligible for Senior Member status. As is aptly stated on the ieee.org website: "IEEE membership enhances every stage of your career. As an established professional the IEEE membership identifies you as superior talent. Advancing your member grade can bring added peer recognition to your accomplishments." *Please reach out via* bts@ieee.org *if you have any questions on this matter. We are happy to provide you support in the process of your membership elevation.*

Call To Action

Support the Women in Broadcast column and contribute with an article: Tell us your stories; please reach out and share your thoughts regarding women in engineering/broadcast, recognizing their contributions and achievements. Contact us at bts@ieee.org.

The Future Of Media Technology Is Multidisciplinary

By Kylee Peña
Product Marketing Manager—Pro Editorial
Adobe

Engineers are problem-solvers. In my 15-year broadcast and media technology career, I've had the pleasure of being a part of teams of engineers solving real problems under immense pressure and time constraints. (I've also had the pleasure of watching the same engineers quickly brainstorm and engineer a rapid solution to fix the signal flow of a Nintendo 64. Both are equally impressive.)

But we've reached a point in our industry where convergence with other disciplines has never been so important and messy—and fascinating. The Internet, as we know it, is evolving in front of us, with the nature of ownership of content shifting. The way consumers wish to experience stories has expanded, and the platforms and media from which they can choose are facing unprecedented competition.

This is the convergence presenting many new problems for media technology engineers—and these problems are not easily defined, let alone solved. That's why we also need to be a part of the conversations shaping Web3 right now.

Web3 In Storytelling

Hindsight has given us names for the first two generations of the Internet—Web 1 and Web 2. Web 1 was defined mainly by its own simplicity: a largely read-only experience. Remember GeoCities? The shift to Web 2 was marked by social media: read and write. Consumers began to generate content as much as they consumed it. Today we're seeing

a third component taking shape with Web3: read, write, and *own*.

Web3's incorporation of concepts like the blockchain and token-based economics is creating opportunities to rethink how we transact with each other and with the media we consume. A decentralized Internet—one that is peer-to-peer and immutable, instead of relying on third parties to create trust—may fundamentally change the business models behind media.

Non-fungible tokens (NFTs) are one major expression of this kind of Internet. While NFTs have become overwhelmed with odd art projects, there's far more to this technology than a bored ape. An NFT is simply a unique identifier that certifies authenticity and ownership through cryptographic techniques. Some early uses of NFTs in media technology are through virtual writer's rooms (such as Women of Mystery hosted by JumpCut Media) where an individual can purchase a token to gain access and prove ownership of the IP they will share. Other uses are in NFTs being used to "vote" for funding films (such as on the platform Shibuya), with the token becoming linked to the film's life cycle. NFTs are also beginning to support derivative works (such as fans participating in the universe of the story) or provide royalties to creators.

Any engineer should look at these concepts—cryptography, authenticity, derivations—and see a future where things like data transport and security or media asset management are fundamentally changed. And that only scratches the surface of what this convergence can bring to entertainment.

Meta-What?

If there's a word everyone hates right now, it's *metaverse*. Simply put, "metaverse" is a broad term used to describe the universe of 3D-rendered immersive environments. Metaverse is separate from Web3, but it's an area of focus that has become linked to it. There isn't one expression of the metaverse, just like there isn't just one website on the World Wide Web. This loosely defined space is seen as a huge opportunity for some, and a confusing frustration for others. It's also not a new concept. The game "Second Life" launched in 2003, and technically fits in this definition.

The opportunity for storytelling in the metaverse is both huge and limited: the potential is incalculable, but the supporting technology leaves a lot to be desired. Much of what is presented as a metaverse experience is in virtual reality (VR), utilizing an expensive, uncomfortable headset to access. Other metaverses are just plain underwhelming: in October 2022, Meta made headlines when they announced their metaverse avatars would now have *legs*.

But for every floating torso, there's an emerging metaverse that promises to shake things up. For example, the Brooklyn Nets' "Netaverse" uses more than 100 high-resolution video cameras surrounding the court that help to render a 360-degree virtual reality experience in nearly real time. The viewer can step into and around the basketball court during a live game.

The metaverse is still just a weird, novel concept where people are trying things and mostly failing at them. But pieces of the metaverse are already in our world—ever use a Snapchat filter?—and will continue to proliferate in small ways until we find a 'verse we can refuse. How can we be at the forefront of making that killer meta-app?

Facing The Future Together

The future of broadcast is full of problems that can't be easily defined. We're facing a horizon full of vocabulary we've never used, technologies that are still half-baked, and many open standards and protocols that are unproven. But one thing should be clear: none of us can face this future alone in the silos of our own discipline.

As a graduate student studying the convergence of design, business, and technology at USC, I've explored entrepreneurship and innovation over many months and realized just how much effort it takes to break out of the expected. Humans just aren't good at predicting the future of technology. That's why it takes a village to brainstorm, iterate, implement, and learn from interesting new solutions. That's why we must actively become part of these conversations now.

Problems such as creating and refining human interface and interaction paradigms, asset reuse in virtual production pipeline, or the governance of user or artist-created content require a diverse set of perspectives from experts in media, the blockchain, legal, user experience, design, computer science, and so much more. There are major gaps—or opportunities—in the space between funding and distribution of media. Could you be the one to bridge that gap into a brand-new world for media technology?

CiscoTV: A Fusion Of Enterprise And Broadcast Enriching And Transcending Their Traditional Spheres

By Elena Gribanova
Program Manager
Cisco Global Marketing Corporate Communication—CiscoTV

While Cisco Systems is a household name in technology, many are unaware that Cisco has a full-fledged broadcast division called CiscoTV. CiscoTV provides a multimedia platform for all major leadership communications, internal and external global events, such as CiscoLive, Customer/Partner Summits and Internal All Hands.

When the deadly pandemic triggered lockdowns, global corporate teams had to be all-virtual, and leadership communications became critical. At the same time, the CiscoTV operation was itself hampered due to loss of physical access to the production spaces and systems. The need to virtualize the control rooms and extend secure remote access to the production systems became inevitable.

In the first weeks of the pandemic, a small group of us at CiscoTV sprang into action. We had to build a virtual broadcast production platform and scale it rapidly. The physical control systems including the switchers, routers, ingest, processing and playback servers, had to be replaced with web portals and/or virtualized graphical representation of the GUIs of the control point clients. Such virtualization was achieved by augmenting commercial capability with home-grown scripts, tools, and applications.

Cisco Webex took center stage as virtual production room, comms space and a viewing platform. Traditional multi-viewer baseband feeds were converted into Webex teleconference bridges IOs, and streamed over the network to the subscribed viewers and carried monitoring feeds to the operators, TDs, and producers. In addition, Webex bridged the teams across the globe into a common PL bridge for comms. Cisco's DCNM provided remote monitoring of fabrics that hosted and provided access to all our content and the core of the asset management system. The security architecture of this remote broadcast production was augmented as well.

CiscoTV became a powerful communication platform for the Cisco executive leadership team to connect with the entire global team. With popularity, the demand grew and need for scale. Porting over the pre-pandemic established manual workflows into the virtual spaces allowed us to resume our business. However, scaling without a change to our operating processes caused significant challenges.

Remoting manual control over multiple ISPs network connections to the operators' homes with the consumer level SLAs became challenging and constraining. Depending on the operator location over the globe, the propagation latencies and bandwidth constraints were hurdles. Finding and onboarding qualified operators to accommodate the rapidly growing demand became difficult. All this constrained our ability to scale our global production. Therefore, the need to replace manual controls with the automated controls became inevitable.

We set out to automate our manual operations. Multiple broadcast channels became programmable, run by scripts executing complex instructions based on the predetermined logic. That allowed us to transition operating staff into the network operation center roles. The army of remote operators manually controlling each individual channel earlier shifted to monitoring multiple broadcast channels simultaneously running in parallel, controlled by a network time clock and schedules. Algorithms monitored and ran automated failovers with minimal manual interaction from remote operators.

All this transformation to automation allowed us to scale to the number of channels required, eliminating potential for human error, including latency and poor judgement. The algorithms were based on a predetermined decision tree based on the multiple weighed factors dynamically feeding into their equations. Building additional ingest and playback systems with pooled and protected resources independent from control rooms allowed us to scale on demand. The number of physical or virtual control rooms was not a constraint anymore. In addition to playback, automation was extended to content creation, processing, and distribution processes.

As a result, CiscoTV was able to broadcast eight simultaneous channels playing region specific content to multiple social platforms, partners, customers, and corporate audiences in multiple time zones across the globe with our teams from the United States, the United Kingdom and India monitoring and controlling these channels remotely across the world.

Our asset management system keeps track of millions of media assets to ensure safety, privacy, and availability. We developed a virtual method to ingest and monitor content coming in and out of our virtual control rooms and protect it in our multi-tier automated archive system. New workflows were developed to proxy edit the content remotely with the army of freelance craft editors and animation/graphics artists.

We introduced machine translations of closed captions to multiple languages in order to address the shortage of live captioners and to make our transmission available to the global audience. We also incorporated ASL into our leadership messaging, to make Cisco TV broadcasts more

inclusive. Finally, virtualizing our productions increased our systems sustainability and reduced the carbon footprint by transitioning our control rooms into resource independent virtual platform where the modules and channels can spin up and down based on the production load.

In summary, we had built a large-scale television network internally at Cisco TV without a multimillion-dollar budget or a large staff. This was possible due to our commercial broadcast experience that helped us architect and automate the corporate communication platforms. The developing phenomenon of the fusion of different industries; Broadcast and Enterprise Networking in this case, enriched each other with the technologies and workflows that transcended their traditional applications and markets. Incorporating and enhancing each other technologies and innovations opens new frontiers and markets for all the players.

Expanding National Radio Reach Via Podcast: How Radio Televisyen Malaysia (RTM) Used Web Metrics And AI Capabilities For A Proof Of Concept (Part 1)

By Ts. Nurulhusna Mohamad Kasim
Radio Televisyen Malaysia (RTM)
And Pn. Mardhiah Nasir
Executive Director
IPSB Technology

Broadcasters, especially national radio stations, face the fact that their radio shows are a one-time experience. This causes the listeners to miss out. Since podcasts are on-demand and available instantly, there's a gold rush in podcasting with huge potential for cut through. In comparison to other mediums, podcasts are a relatively new market. Establishment and getting noticed via a podcast are relatively easy, and right now, there's less competition, but that won't be the case forever. The market is growing fast.

Therefore, to make sure radio has to continue to evolve to stay relevant, RTM (Radio Televisyen Malaysia) has embraced podcasting as its new audio on demand (AOD) radio services. RTM conducted a pilot study in October 2020, where they will continue to explore podcast capability as ultimate audio offering audio narrative focusing on new voices, new forms and new technologies.

The Current Explosive Audio Trends

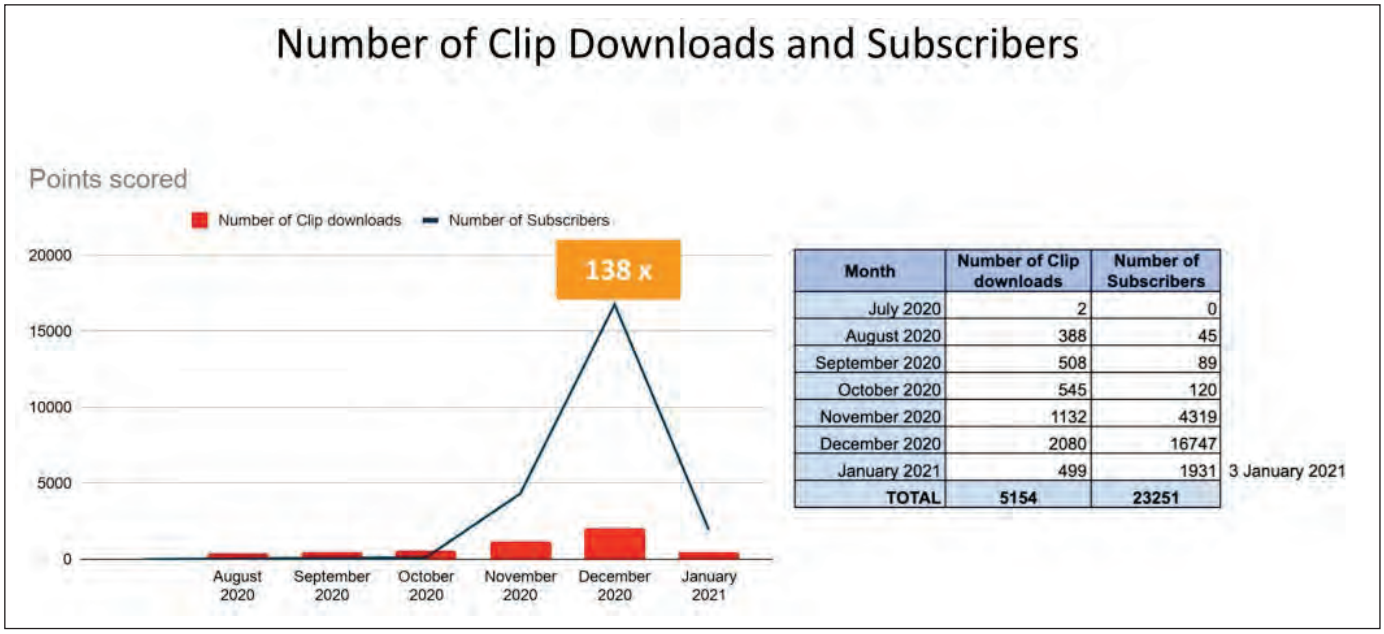
As shared by Stephanie Donovan, Triton's Global Head of Revenue at ABU's annual RadioAsia Conference, Sept. 6, 2022:

- Audio consumption is up; time spent on audio is a full one hour and 20 minutes longer in 2022.
- Global spending is up, with our data showing that global spend is up 78 percent, the APAC programmatic spend for the year to date is up 108 percent and Singapore specifically up 137 percent.
- In car listening for online audio and podcast listenership is increasing, with online audio and podcasting increasing 42 percent and 34 percent respectively.

RTM Podcast Pilot Study With Triton Digital And IPSB Technology

RTM chose Triton Digital as podcast technology partner and IPSB Technology as system integrator to gauge podcast digital capabilities to serve a wider audience with higher quality services. The pilot program also provides a 360 audio strategy with its amplification feature by social sharing on new media such as Facebook and Twitter, and using audiogram as native piece of video content from live TV and radio content for sharing on radio station social

Picture 1. Podcast Artworks for stations.



Month	Number of Clip downloads	Number of Subscribers
July 2020	2	0
August 2020	388	45
September 2020	508	89
October 2020	545	120
November 2020	1132	4319
December 2020	2080	16747
January 2021	499	1931
TOTAL	5154	23251

media, starting with four Radio Stations—NasionalFM, AiFM, MinnalFM and Radio Klasik. This activity was conducted within six months, starting in July 2020 and completed in January 2021.

According to Richard Palmer, director of market development for Asia Pacific at Triton Digital, "Public service broadcasters can work smarter and employ cutting-edge digital technologies to increase efficiency, save money and better serve our audiences, ranging from content production, technical innovations, organizational change, commercial opportunities, and audience engagement."

Analytics: What Is It And Why Does It Matter In Podcast?

In the podcast creative industry, there are several methods for measuring audience numbers. The following are some of the more common methods as proposed by Triton Digital:

Downloads

For every user that listens to a podcast episode online or as audio on demand, each would count as a unique file download.

It helps analyzers understand why a particular podcast is more popular compared to others. However, while a download is not necessarily listened to, it is an indication of the listener's intent to listen to the podcast (Triton Digital Sdn Bhd, 2021, 2).

Listeners

This metric is used on a per-episode, per-podcast, per-network, or per-publisher basis and the listener duplications will be removed across different episodes and shows that each user is listening to (Triton Digital Sdn Bhd, 2021, 3).

Gross Downloads

Gross download differs from downloads as it calculates the number of downloads that include repetitive downloads from the same user. In other words, it includes both unique and non-unique downloads as well as bot downloads and downloads from web crawlers (Triton Digital Sdn Bhd, 2021, 4).

Downloaded Hours

Downloaded hours do not differ much from a normal, general download. This metric represents the maximum potential listening hours if all actual downloaded content was listened to.

Based on the IABTech Lab Podcast Measurement Independent Certification, amongst the four aforementioned criteria of measuring its audience, the most relevant based on the report from 2021 are the number of downloads and the number of listeners (IAB Tech Lab, 2021, 2).

RTM Podcast Pilot Results

During our Pilot Podcast which was conducted via website *https://rtmklik.rtm.gov.my/*, we immediately were able to see the impact as soon as we turned on the podcast to the public RTM over achieving the initial target for the pilot by 138 times. Do bear in mind that the pilot was run only for three months and without any promotion. It has proven to be one of the services sought out by the audience.

Conclusion

The potential is endless for RTM and other public or private broadcasters to grow and connect with new audiences.

continued on page 46

Asia Media Summit Examines Terrestrial Content Delivery

Event focuses on 5G and changing consumption patterns

By Amal Punchihewa

The 17th Asia Media Summit (AMS), which is organized by the Asia-Pacific Institute for Broadcasting Development (AIBD), was held in a hybrid form on May 23, 2022. The mid-day event (Malaysian time) was hosted in Fiji and coordinated from Kuala Lumpur, Malaysia.

The AMS provided a meeting point for AIBD members and broadcast and media stakeholders to come together and discuss topical issues relating to the broadcast and media policy, capacity development and knowledge sharing across the Asia-Pacific region (APAC) and beyond. The event was supported by the Republic of Fiji's Ministry of Information, and Walesi, the common broadcast network provider in Fiji, along with several other media and broadcast stakeholders. It attracted more than 20 in-person delegates and more than 100 others participated online.

Background

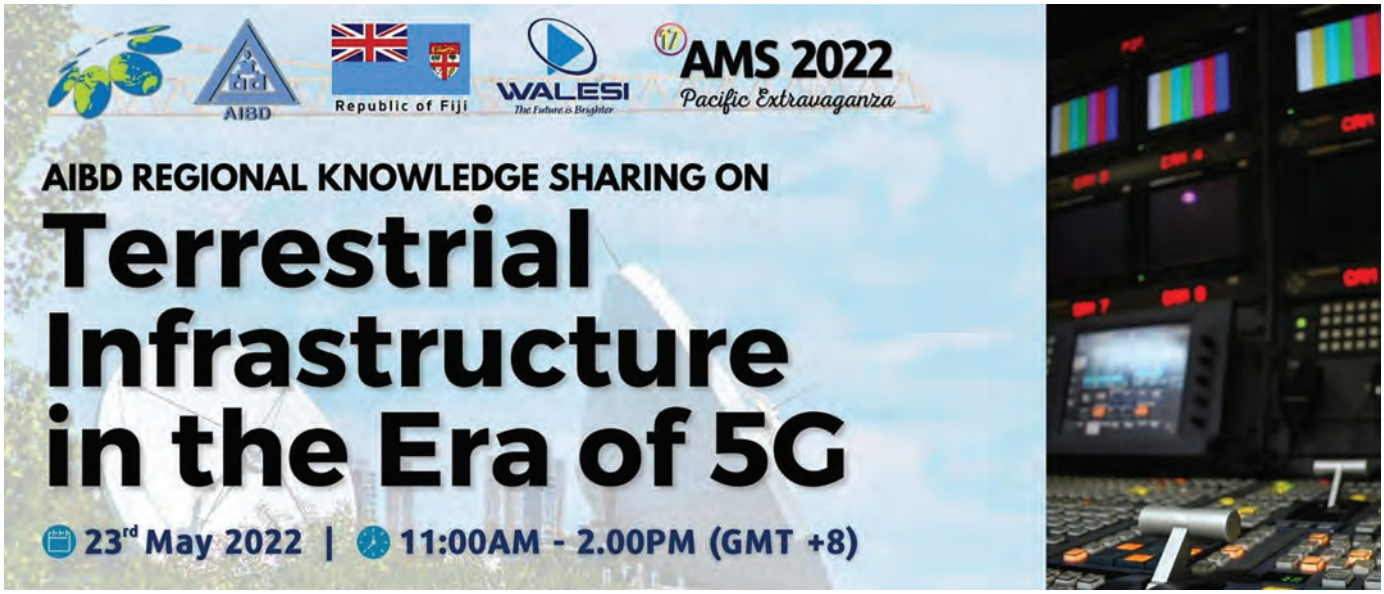
5G is a buzzword that people utter and hear extensively these days, and the broadcast and media industry has been working with the developers of 5G mobile technologies. Currently, 5G is predominantly a terrestrial network like its precursors—radio and television broadcasting networks—using ground stations. As revealed by several market research organizations, 70 to 80 percent or more of all Internet traffic involves the streaming of real-time multimedia in this era of IP-driven services. This includes both live broadcast events and over-the-top (OTT) linear and on-demand streaming media content. Although the popularity of on-demand viewing is increasing rapidly, the potential audience for live and linear content is still huge. When radio listening and television viewing is studied and analyzed, it is apparent that, more than ever before, consumption of television and radio is taking place everywhere via iPads, smartphones, laptops and, large screen televisions and conventional radio devices. The public is consuming increasing amounts of on-demand content; however, linear radio and television are still huge and will be for many years to come.

Aims And Objectives

The goal of this pre-summit workshop of Asia-Media Summit AMS-2022 was to explore the potential of a wide range of terrestrial infrastructures that can be used for broadcasting and media services.

Some of its key objectives were:

- to create awareness of emerging terrestrial distribution technologies



- to share knowledge among regional broadcasters and media on how to utilize available and emerging terrestrial infrastructures
- to ascertain what the potential terrestrial distribution technologies are
- to examine what opportunities 5G could offer as a terrestrial infrastructure
- to place emphasis on, and to explore the need for, the optimization of existing infrastructures

Participants represented 23 countries (19 of which are APAC countries), and included public sector and private industry players, including: top and senior management, producers, technical support staff, broadcast engineers, telecommunication engineers, spectrum experts, regulators, regional broadcasters (television, radio, and new media), editors and content creators.

Getting Down To Business

The event began with a welcome and opening remarks from Dr. Amal Punchihewa, a leading technologist and expert in the broadcast and ICT industry. In his address, Punchihewa noted that while it was unfortunate that not everyone could join the conference in person, technology made it possible to participate virtually and to share knowledge. He observed that AIBD is an organization formed by several UN bodies, including UNESCAP and UNESCO, to help the development of media and broadcasting in the Asia-Pacific region (APAC) in the 1970s, after having identified a lack of capacity and knowledge in broadcasting and media and in helping in policy formulation. He reminded his audience that the early developments in this area were very slow, but revolutionary. This included the development of monochrome television and the transition to color, which commenced two to three decades later. Punchihewa stated that today, such advancements can be both rapid and evolutionary in nature.

Speakers Provide Information On 5G And Its Uses

Following Punchihewa's remarks, the event shifted to presentations on 5G infrastructures and the future of the technology in broadcasting. These were followed by a question-and-answer session and a moderated discussion.

The first presenter was Tengku Razman Othman, customer solution manager at Caton Technology Asia (S) Pte Ltd., who examined 5G and its features, its capabilities and use cases, the potential of 5G for broadcasting, media, and entertainment industries, and how 5G could improve the quality of experience for media audiences.

"Broadcast could be either multicast and/or broadcast. Broadcast has not been adopted by mobile operators for many years," said Othman. "They always do unicast. Understanding multicast and broadcast will be a new transition mindset for them. We have been doing broadcast multicast from day one. This is our technology…our strength, to understand the broadcasts as one-to-many from day one. We need to work with the current mobile operators about this technology. If not, they keep using unicast as a way to design the infrastructure.

"Lots of broadcasters are making available content online as well as additional content, but they have spent quite a lot of money on it because [they] have tried to make it available for varying device sizes and so on. On-demand, you can always watch it when you feel like it and it will [be served] by CDNs. But if it is live sports or [a] concert, you want to get the results within the same second, rather than 20 seconds later. I think that will be a big challenge if the current technology [cannot address the] latency issue in live sports…Can you live with that delay? If a neighbour says goal on my TV and then you just say I did not see the goal yet… World Cup is coming up at the end of December 2022. Who wants to receive a one-minute delay in the content moving forward?"

Next on the program was Matt Ashe, regional manager at, Benchmark Broadcast Systems (S) Pte Ltd, who talked about direct-to-home satellite (DTH) and digital terrestrial

Presenters (clockwise from top right) Nils Aherns, Matt Ashe, Tengku Razman Othman, and the AIBD's program manager, Nabeel Tirmazi, surround moderator Amal Punchihewa in this screen shot of the summit proceedings.

television, 5G broadcast and 5G for contribution and DVB-NIP (Native IP).

The final presentation came from Nils Ahrens, the APAC regional manager of broadcast and media at Rohde & Schwarz Australia Pty Ltd, who discussed 3GPP standards both currently available and forthcoming, spectrum availability for both MNO (5,10,20 MHz) and BNO (6,7,8 MHz) 5G broadcast infrastructure networks, commercially available and prototypical receivers, business cases, multicast-as-a-service (MaaS) applications, and further trials and testes.

Ahrens also commented about challenges in the handling of content.

"So far, we have seen it from the receiver's point of view, [a] subscriber watching a 5G broadcast or a 5G base station, which means [that person is] asking for a prompt and a unicast here, [and can] select content from the electronic program guide. Now from the content owner's perspective, that is quite a bit different because content owners have to inform ahead…regardless of whether they are accessing DVB-T2, or whether they are operating on an OTT platform. It is a little bit more complex because you have to support Android and iOS devices. But that is one investment for infrastructure cost. The real cost for the content is that of the upload to the CDN. That is ongoing 24/7 and 365 days a year. That makes the OTT distribution expensive. Still, with that there [is] no guarantee that either CDN or [an] ISP provider will give you a good quality of service for [every] subscriber in the network, simply because they cannot.

Ahrens noted that even the best predictions available to system operators cannot accurately forecast peak demand times and the number of people who will want to view content.

"There is no guarantee that will allow [operators] to say, 'I will give you the advertiser [a] guarantee that your content will be distributed to that to that area or these subscribers. They simply cannot [guarantee that]."

During the question-and-answer session, a participant from India, Padabinda Das. asked about spectrum bands are identified for use in 5G broadcasts. Das wanted to know is these will be from 5G bands already identified, if additional bands will be required, or any spectrum band has been identified for 5G broadcast?

Rohde & Schwarz's Nils responded that consideration is currently being given to UHF spectrum, as 5G broadcasting is a broadcast technology, and that this depends on creating amplifier technology for transmission devices. He observed that manufacturers are unlikely to develop new high-power transmission devices for serving larger geographic area, and noted that the broadcast industry could reuse devices already in use, as they are well-suited for such transmissions.

A number of other questions were also fielded by the three presenters.

Moderator Punchihewa posed this final question to all three presenters: "As an expert in the industry, based on your past and recent experiences, along with what you have heard and are hearing, do you think 5G broadcast will replace the current, or 'traditional.' broadcasting services in the coming 10 years?" All three presenters agreed that traditional broadcasting will be around for many more years to come, most likely over two decades.

Summit Takeaways

A number of conclusions were reached during the conference. These included:

- Linear and traditional broadcasting— both television and radio—will be operational at least for another two or more decades.
- There are many ways to deliver content, and they are all coming together to form a single ecosystem known as DVB-NIP (Native IP)
- Collaborations from 5G-MAG and other organizations representing the broadcasting industry with 3GPP have made 5G broadcasting technically possible.
- 5G broadcasting could be a part of the broadcasting mix in the future, provided that all stakeholders work together to build a wider 5G broadcasting ecosystem.
- The ecosystem includes consumer devices and business models.

In addition, the event produced the following outcomes:

- The audience received insight on what 5G could offer in future for the broadcasting industry.
- Broadcasters were asked to work with national spectrum regulators, mobile network operators (MNOs), and other industry stakeholders to protect adequate UHF spectrum for 5G broadcasting in future.
- Broadcasters were informed that 5G broadcasting can be a practical reality if broadcast stakeholders closely work with the mobile industry. Hence, collaboration was requested with organizations such as 5G-MAG, a not-for-profit organization, to make 5G broadcasting a commercial success.

About The Author

Dr. Amal Punchihewa *is a researcher, educator, advisor and consultant in ICT, Media, and Broadcasting with close to four decades of experience in the industry, academia, and research. Amal is a Chartered Professional Engineer and Fellow of IET(UK) and a senior member of IEEE(USA) He is also a distinguished lecturer of IEEE-Broadcast Technology Society. Amal facilitates and advocates technical guidelines and standards, and provides expertise related to the convergence of media, and evolving technology needs. He advocates, encourages, and manages member communities, and help them to understand the trends that shape the media, to empower media & ICT stakeholders to continue to take good strategic decisions. He is also the technical advisor of the AIBD and a member of the AIBD international advisory board.*

ITU Report

By David Guerra Pereda, BTS Member

Channel Bandwidth At The Dawn Of Television

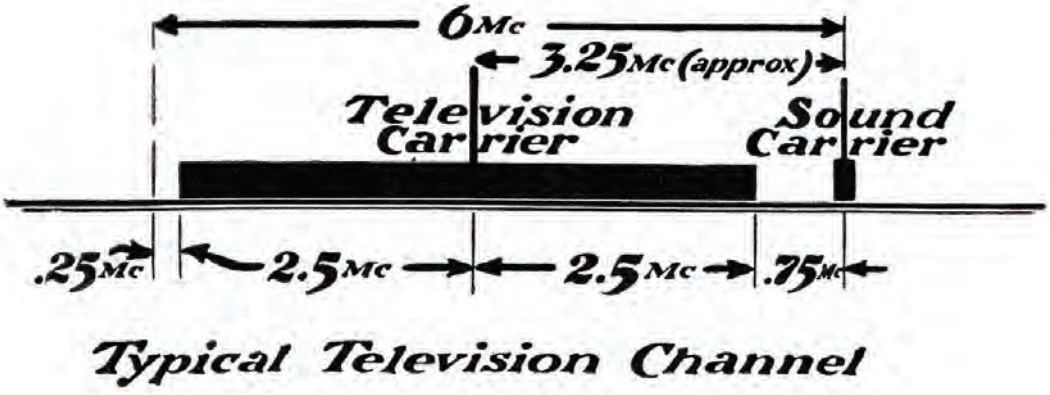
By surfing the History Portal of the ITU-R website, one can come across really remarkable documents, with some of them "real gems" for a number of reasons, such as the high quality of the scanning and digitization process, the noblesse oblige factor, and the fact that in those historical documents a certain standard, that nowadays may be taken for granted, was established.

In the fifth meeting of the International Radio Consultative Committee (CCIR, the former ITU-R), which was held in Stockholm in 1948, channel bandwidth of broadcast TV services was established and black and white television standards were discussed. It should be remembered that a few years prior to World War II, several countries had successfully put the first electronic TV systems to the test.

In the corresponding ITU-R documents of the History Portal, one can find the full collection of contributing documents, proposals, annexed communications and meeting minutes with the adopted agreements. It is then possible to retrace the steps that lead to certain decisions such as the original channel bandwidth of TV services. For a start, a contribution from the Netherlands, by the Natuurkundig Laboratorium der N. V. Philips, stated that to keep receivers affordable for the market, the number of frames per second was to be maintained equal to the frequency of the mains; which for Europe is 50 Hz (c/s or "cycles per second" as the way it was written back then), while, for bandwidth economy 2:1 interlacing was to be used. In addition, given that TV picture was comprised of horizontal lines, the number of lines was to be increased in order to minimize vertical gaps, while keeping bandwidth constant. These considerations led to line numbers of around 600 with a 4-MHz maximum video bandwidth for video only, as this made those vertical gaps between lines negligible when the pictures were observed from a distance five times the picture height. The use of the groundbreaking "vestigial side band" system [developed by RCA's Waldemar Poch and David Epstein] for modulation of the picture carrier wave, would allow a reduced total channel bandwidth of 6 MHz, which, not by chance, was in agreement with the rules fixed by the U.S. Federal Communications Commission, thus paving the way for the most economical receiver construction possible in a worldwide economy of scale.

(Rather interestingly, the contribution by the Netherlands that was mentioned was submitted to Study Group 1, whose concern in 1948 came under the heading of "Separation between frequencies allocated to radio stations.")

Meanwhile, in the Study Group 6 of that time (which was labeled "Broadcasting Problems"), we can find the question of uniformity, or at least, compatibility, of worldwide TV systems more clearly enunciated for "*the interchange of television programmes amongst countries […] at the lowest cost,*" and for "*the most economical expansion of the television services, and in the production of receiving equipment at minimum cost*". Yet, in this second contribution on the matter, channel bandwidth was left out of the list of aspects to be dealt with on the



Radio Engineering Magazine

The pre-vestigial sideband transmission 6-MHz channel utilization plan presented to the U.S. Federal Communications Commission in mid-1936.

agreement table. Such studies were to be part of Recommendation n° 29 ("Television Standards") which was to be developed within the newly proposed Study Group 11 ("Television Including Questions relating to Single Sideband").

However, the quest of CCIR scientists and engineers for compatibility back then could not be achieved through direct choice of one standard from a single manufacturer of a specific nationality, as this would have granted a de facto dominant position of the market to the industry of that nation for at least a decade or more. Hence, the national politicians within CCIR, with their loyalty to the domestic industries of their respective countries, played a major part in the TV sets that were marketed at that time and, as a consequence, the technical mission of CCIR failed, leaving the world divided into three black and white television standards. So, where did those national standards come from?

Early Television Line Standards

Before the aforementioned proposal of around 600 lines was presented in 1948, TV standards had had a development of sorts in several Europe countries and the United States. France started to emit 455-line television images in 1937, while Great Britain retained the 405-line service it had initiated in 1936. Germany elected to go with the 441-lines used in the United States prior to 1941 (in that year, the United States had moved to a national standard of 525-lines following recommendations from an industry-wide study group, the first National Television System Committee or NTSC.) Shortly after the war, France established an 819-line standard and defended this choice over all others with lower line counts.

But, where did the 6-MHz channel bandwidth proposal mentioned originate?

After a lot of laboratory and field testing conducted by RCA in the early 1930s, it was demonstrated to be technologically possible for the 343-line/5.75-MHz bandwidth TV system that had been developed to be scaled up to 441-lines and fit within a 6-MHz bandwidth, with AM full double-sideband modulation being used for video and audio carriers. As RCA had by then established itself as the company with the most completely developed TV standards by far, and despite the presence of other actors of TV industry, the FCC went ahead and adopted the 6-MHz channel bandwidth in order to foster the spectrum allocations needed for the further development and eventually, commercialization, of television broadcasting. Moreover, AM vestigial sideband was on the horizon[1] and a bandwidth of 6 MHz was considered sufficient to accommodate "next-generation" higher-resolution TV systems. In fact, that was the case for the 525-line U.S. NTSC system, but not European ones using 625 or 819 lines. (Philips' commercial interests in the United States appear to be the main driver for the CCIR 6-MHz channel bandwidth proposal in 1948.)

Invoking The Teachings Of Jean-Baptiste Joseph Fourier

Before finishing this column, I can't resist indulging in one more paragraph that's archived in the ITU-R History Portal documents. It's extracted from a reply letter by Dr. Van der Pol to the Chairman of the CCIR Stockholm meeting, and is quoted here in its entirety

"*During discussions on channel separations, frequency spectra, single sideband transmissions, receiver bandwidths, carrier suppression and the like, I once visualised what effect all these discussions would have had on the great physicist and mathematician Fourier, supposing he could have been present at our meetings and were sitting next to Mr. Lahaye. No doubt he would have been very deeply impressed by all the innumerable technical consequences of the fundamental and deep mathematical concepts which he originated and which are now, in a superficial way, common knowledge even to a schoolboy when he tunes in a broadcast programme on a certain frequency.*"

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[1] Editor's note: In early 1937, RCA's Waldemar Poch and David Epstein published a paper ("Partial Suppression Of One Side Band In Television Reception" —in both the Jan. 1937 *Proceedings of the IRE*, and the Jan. 1937 issue of the *RCA Review*—describing television transmission bandwidth reduction by use of suppression of the lower AM sideband. Poch and Epstein referred to their technology as "selective side-band transmission." A few years later, another RCA engineer, George H. Brown had a lower sideband reduction filter constructed, in accord with the bandwidth-limiting technology proposal of Poch and Epstein. This was installed at RCA's experimental TV transmission facility at New York City's Empire State Building and was in use when NBC began its first regular television service in 1939. Brown renamed the Poch/Epstein modulation methodology as "vestigial sideband," and published his own paper ("A Vestigial Side-Band Filter For Use With A Television Transmitter" on the practical application of technology in the Jan. 1941 *RCA Review*.

FOBTV Technical Committee Conducts August Virtual Meeting

Members provide updates on global TV initiatives

By James E. O'Neal

The Technical Committee of the FOBTV (Future of Broadcast Television) hosted a virtual meeting on Aug. 31, 2022, with representatives of a number of television research and standards organizations providing members and guests with updates on their group's television-related 2022 activities.

The two-and-a-half-hour event began with the organization's secretary-general, and vice president of China's National Engineering Research Center for DTV (NERC-DTV, Yao Wang, calling it to order at 10 a.m. Eastern Daylight Time. The global meeting attracted some 75 individuals, with representation from most of the world's major television broadcasting and standards development organizations.


Yao Wang

After preliminaries, the meeting began with an update on activities within the ATSC organization, presented by its president, Madeleine Noland. She noted that updating of the existing standard was continuing and that all related documents are available at the ATSC website. Nolan also described the work conducted by the ATSC's Technology Groups, Planning Teams, and Implementation Teams, stating that "all these Specialist Groups are collectively responsible for the ATSC 3.0 standard." She stated that there was also a Specialist Group, which is responsible for the ATSC 1.0 standard, with some work still going on in that area.

Noland then described several initiatives underway, including India's exploration of ATSC 3.0, and a Implementation Team that is supporting Brazil's exploration of ATSC 3.0, on-going studies in new codec technologies, inter-tower communications between TV stations, as well as another "work in progress," the 5G-ATSC 3.0 harmonization initiative.


Madeleine Noland

She acknowledged the adoption of the ATSC 3.0 standard in Jamaica earlier this year and described the situation in the United States with regard to the public's adoption of NextGen TV receivers, stating that "the Consumer Technology Association anticipates that 2024 will be an inflection point, with about 40 percent of the TVs sold in the U.S. having NextGen TV capabilities."

The National Association Of Broadcasters' Report

Lynn Claudy, senior vice president of technology at the National Association of Broadcasters, was the next presenter and focused his initial remarks on the status of over-the-air (OTA) television delivery in the United States.

Claudy cited a recent survey from the New York-based Nielsen audience measurement and data/analytics organization, which revealed that OTA numbers of about 15 percent have been fairly consistent for the past several years, with the penetration of cable delivery lessening and adoption of TV programming via broadband (cord cutting) on the ascendency.


Lynn Claudy

He noted too that the survey found the percentage of OTA viewers was even greater than 15 percent in some locales, citing the city of Albuquerque, New Mexico with more than 30 percent of television homes there using antennas for reception.

In further describing the transition to ATSC 3.0 within the United States, Claudy observed that sales of 3.0-related products were up, and that more and more stations were offering NextGen-TV service. He did note one impediment in the transition, however. "We're looking forward to ending ATSC 1.0, but the problem is that there are no extra channels," said Claudy. He lamented that channel sharing was now the only way to get 3.0 on the air, but that the bitrates in sharing arrangements are low, and this constrains 3.0 services.

"Until we have enough ATSC 3.0 receivers out there, we really can't talk about turning off ATSC 1.0, which means we really can't talk about a vibrant ATSC 3.0 service that covers the entire country and has all of the broadcasters in it," said Claudy. "If we really want to turn off ATSC 1…we need all new sets to have 3.0 capability and we need cheap

alternatives to receive ATSC 3.0 for those who don't want to buy or who can't afford a new TV set."

Claudy described the on-going NextGen TV transition as "marketplace driven," and described this type of transition is "messy and uncomfortable."

An Update On DVB Activities

Emily Dubs, the head of technology at DVB, Europe, followed Claudy, and began with a description of the DVB-NIP (native IP) document that was published in February of 2022.

"[It] covers hybrid delivery of signals using Internet, OTT packaging formulas, [and] native IP via broadcast," said Dubs. She noted that satellite use cases are "driving market introduction," and that a wide range of benefits would likely be derived from this application of technology. She highlighted in particular a "new solutions page" that provides detailed information on the specifics of IP-based delivery.


Emily Dubs

Dubs also spoke about the establishment of a new work group to liaise with 5G players, and a special task force to work with the 5G-MAG group. She described her organization's on-going initiatives in the areas of low-latency content streaming, targeted advertising, next-generation codecs for television, and also mentioned several planned DVB events including the 2023 DVB World conference, which is now set to be held in Brussels, Belgium on June 14.

Television News From Japan

Ryoichi Nakai, director of the research and development headquarters for the Japanese Association of Radio Industries and Businesses (ARIB) standards organization was the next speaker, and began his presentation with a review of the schedule that has been established for implementing advanced terrestrial broadcasting in Japan. He also discussed on-going projects in the areas of improvements in video and audio, as well as activities in the areas of multiplexing, conditional access and protection of rights. Nakai stated that "the results will be reported to the Ministry of Internal Affairs and Communications by the end of the year."


Ryoichi Nakai

He described work on a portable millimeter-wave transmission system for television program coordination, the development of IP-interfaces for audio, video and data in connection with TV program production, and also Advanced Media Workflow (AMWA) Networked Media Open Specifications (NMOS) for control of productions in connection with ARIB standards work in that area.

Nakai then briefly reviewed other standards and technical report activities within his organization, which include terrestrial and satellite-delivered broadcasting, closed captioning, microwave systems for program contribution, a portable OFDM-based microwave system for UHD program contribution, and more. He advised those wanting further information on ARIB activities and standards to visit the organization's website, *https://www.arib.or.jp/english/std_tr/index.html*

Kenichi Tsuchida, executive researcher, at Japan's NHK Science and Technology Research Laboratories offered the next report, which focused on innovative work going on within the organization. Tsuchida noted in particular 360-degree presentation technology, describing volumetric capture involving 24 robotic cameras that could automatically track the subject being imaged. He said that by 2030 to 2040 this 360-degree research could lead to 360-degree "full dome" display technology.


Kenichi Tsuchida

He described activities in the area of advanced terrestrial broadcasting, stating that some of this centered around improved or advanced coding technologies, as these were necessary "in order to deliver video and audio services with high quality and high functionality, we are developing encoding and composite equipment that supports VVC and MPEG-H3D audio."

Tsuchida stated that his organization had developed a high-capacity transmission system that can accommodate two 4K programs and one 2K within a single 6 MHz channel.

He described a head-mounted light field display that can produce more natural 3D images with less visual fatigue than with current 3D "goggles." Tsuchida also noted work going on in the area of the sharing of 3D experiences between persons via head-mounted displays, as well as a "thinner than paper" (0.07 mm thickness) OLED display using organic material that is not degraded by atmospheric moisture and can be arranged in any desired shape due to its thinness.

He concluded his overview of his organization's on-going projects by providing website locations where more information is available on these initiatives.

What's New At ETRI

Following the presentation by NHK's Tsuchida, Sung-ik Park, principal researcher at Korea's Electronics and Telecommunications Research Institute (ETRI) described his organization's recent work in connection with ATSC 3.0-based terrestrial mobile broadcasting, ATSC 3.0-based backward-compatible MIMO (multiple-input and multiple-output) field verification, a broadcast-based real-time kinematic (RTK) service to provide extremely high (CM-level) positioning accuracy, and a comparison of the performance of ATSC 3.0 and 5G Broadcast delivery.

In connection with the 3.0-based terrestrial mobile broadcasting, Park described the use of diversity reception

of signals using as many as four antennas, use of smartphones equipped with a special on-board chipset from Saankhya Labs manufactured under the auspices of the Sinclair Broadcast Group for 3.0 reception in cars, as well as delivery of targeted advertising in mobile environments.


Sung-ik Park

In describing the recent MIMO work, Park cited a previous trial in 2020 and 2021 involving the use of MIMO technology for the delivery of massive amounts of data at speeds of up to 113 Mbps. However, most of his MIMO update focused on testing involving delivery of an ATSC 3.0-based signal. Park offered a description of the trials:

"SISO (single-input and single-output) or MISO (multiple-input and single-output) is applied to LDM core layer," he said. "A legacy ATSC 3.0 receiver can then decode core layer of the LDM-MIMO signal. MIMO is applied to the LDM enhanced layer. [And the newly-developed] MIMO receiver can decode both the core and enhanced layers of the LDM-MIMO signal.

Park noted that a data rate of 2.6 Mbps was achievable with an LDM-plus-MIMO core layer, and that 80.9 Mbps was realized via an LDM-plus-MIMO enhanced layer, which could provide 8K UHD delivery to fixed-location receivers.

In describing ETRI's 5G Broadcast and ATSC 3.0 evaluation, Park stated that this involved the performance of each delivery modality in terms of delivering content at various distances and data rates, as well as the cost to implement delivery systems.

Sinclair's Mark Aitken And The ATSC 3.0/5G Convergence

In his presentation, Mark Aitken, the Sinclair Broadcast Group's senior vice president of advanced technology, focused on the convergence of broadcasting and 5G wireless broadband technology.

Aitken began with a look at the rollout of ATSC 3.0 within the United States.

We expect by the year's end about 62 percent of the U.S will have 3.0 availability," said Aitken. "If we get some of the major owned-and-operated (O&O) markets on line, it's projected that it will be about 75 percent or more by the first full quarter of next year."


Mark Aitken

He noted the global recognition of ATSC 3.0 by the ITU, and described ATSC 3.0 initiatives outside of the United States, focusing particularly on India.

"What we see (in India) is that 5G convergence is driving an understanding of the useful role of 5G in digital terrestrial broadcasting," said Aitken, in commenting about a recent conference in that country and initiatives that are underway in the area of direct-to-mobile (D2M) there.

"India is truly embracing NextGen broadcasting in the context of a direct-to-mobile strategy," he said, adding that 5G stakeholders in India are now focused on defining a direct-to-mobile service.

Aitken observed that a "slice" of spectrum between 526 MHz and 582 MHz had been set aside for D2M purposes

"It is clear that ATSC 3 fits into 5G," he said, noting that a "Work Item" focused on defining the internetworking of non-3GPP networks within a 5G environment was being submitted to the 3GPP organization, and that "a lot of large organizations" were supporting this Work Item.

He added that the ATSC is also moving along these lines.

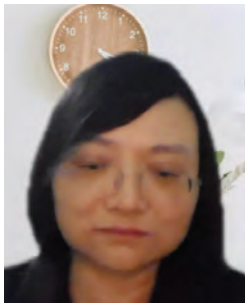
"They are working within ATSC to define a core network, because that core network is an essential part in ensuring a prominent role for broadcasting in that 5G-converged environment," said Aitken.

He stated that many broadcasters that had previously been focused solely on television were now recognizing the new opportunities associated with an IP-based wireless standard.

"We think that convergence truly makes broadcast relevant in the ecosphere of information and content distribution and many other wireless activities.

Broadcasting Technology Advances In China

Yiling Xu, the deputy research director at China's NERC-DTV/Shanghai Jiao Tung University, provided the next report in which she described the latest activities, one of which is what she termed a "3-4-5" model or approach for FOBTV. She noted that this involved the merger of various "worlds" (human, physical, and meta) and dimensions (such as "immersive," "IP-centric," and "interactive"). In addition, she spoke about 4K/8K pilot broadcasting program in China and the development of a "next-generation media transport standard" that emerged from work in information technology media-efficient coding. In particular, she stressed some of the innovative development utilized in coverage of the February 2022 Winter Olympic Games that were held in Beijing, China. These included simultaneous playout of activities being captured to both small- and large-screen display devices, the display of extended amounts of data to small-screen devices, multilingual and multiview coverage, along with the presentation of real-time game data and interactive coverage.


Yiling Xu

Following Xu's report, Shen Yan, principal engineer at China's SparkLink Alliance, brought FOBTV members and others up to date on his organization's efforts to promote wireless technology for use in smart homes, smart cars, smart manufacturing and other "smart" areas and endeavors. Yan stated that SparkLink's purpose was to bring about collaboration


Shen Yan

among all such "smart" entities. He observed that networking "space" is now expanding beyond traditional communications to many other areas, and that in connection with this such attributes as high speed transmission, perfect synchronism, ultra-low latency, "wire-like reliability" and the ability to support many levels of access were essential.

Yan also described applications of such networking in home audio and video transport applications, including the interconnection of multiple devices such as loudspeakers for delivering multichannel audio. He noted that another area where it could come into play was with synchronism of audio with video being delivered to the speakers.

In his remarks, Yan stated that his organization, SmartLink, would like to establish a formal alliance with FOBTV with the signing of a memorandum of understanding.

5G-MAG Update

Jordi Giménez, head of technology at 5G-MAG/EBU, Europe, offered the next report, with an update on 5G activities.


Jordi Giménez

Giménez stated that these included collaboration in the areas of content production and consumption, with a focus of areas that include user requirements, market trends and ecosystems. He described 5G's role in transitioning to cloud-based operations, as this would provide "IP-based content anytime, anywhere to any device [as well as] offering personalization and interactivity."

Giménez reported on the on-going efforts in the area of LTE-based 5G terrestrial broadcasting, stating this was something that would be demonstrated at the September IBC event. He also talked about efforts in the areas of 5G media distribution via mobile networks, emergency alerting based on 5G Broadcast, an updating of the 5G Broadcast standard, as well as on-going liaison with DVB in connection with DVB-I over 5G systems.

"We are looking forward now to initiatives for 2023," said Giménez. "We're starting to make plans to implement various other use cases."

Brazilian Initiatives

The final television system update in the meeting came from Luiz Fausto, chair of the Technical Module, at Brazil's SBTVD/TV Globo. He noted that work was underway on developing the next-generation of digital television for his country, with the concept of turning television into "an app-based experience," with every broadcaster serving as an app.


Luiz Fausto

"We want our system to be IP-based," said Fausto. "[And we want to go] beyond the concept of SFNs that we have today. We want to have frequency reuse with the same channel used by adjacent stations transmitting different content."

He described the new Brazilian DTV initiative as existing in three phases, with the third phase beginning early in 2022 and ending in August 2024. Fausto said that the launch of the system, TV 3.0, was expected in 2025.

An open discussion period moderated by the Yian Wu from Canada's Communications Research Centre ended the FOBTV meeting.

Chairman Wang concluded the meeting with an announcement of the FOBTV's next meeting, which is now scheduled to take place at the April 2023 NAB Show in Las Vegas, Nevada.

Expanding National Radio Reach Via Podcast

continued from page 37

In part 2 of this story, we will look into future technologies combining Podcast and Artificial Intelligence, the key to unlocking RTM's potential and transformation to be a vital source of information, entertainment, and education.

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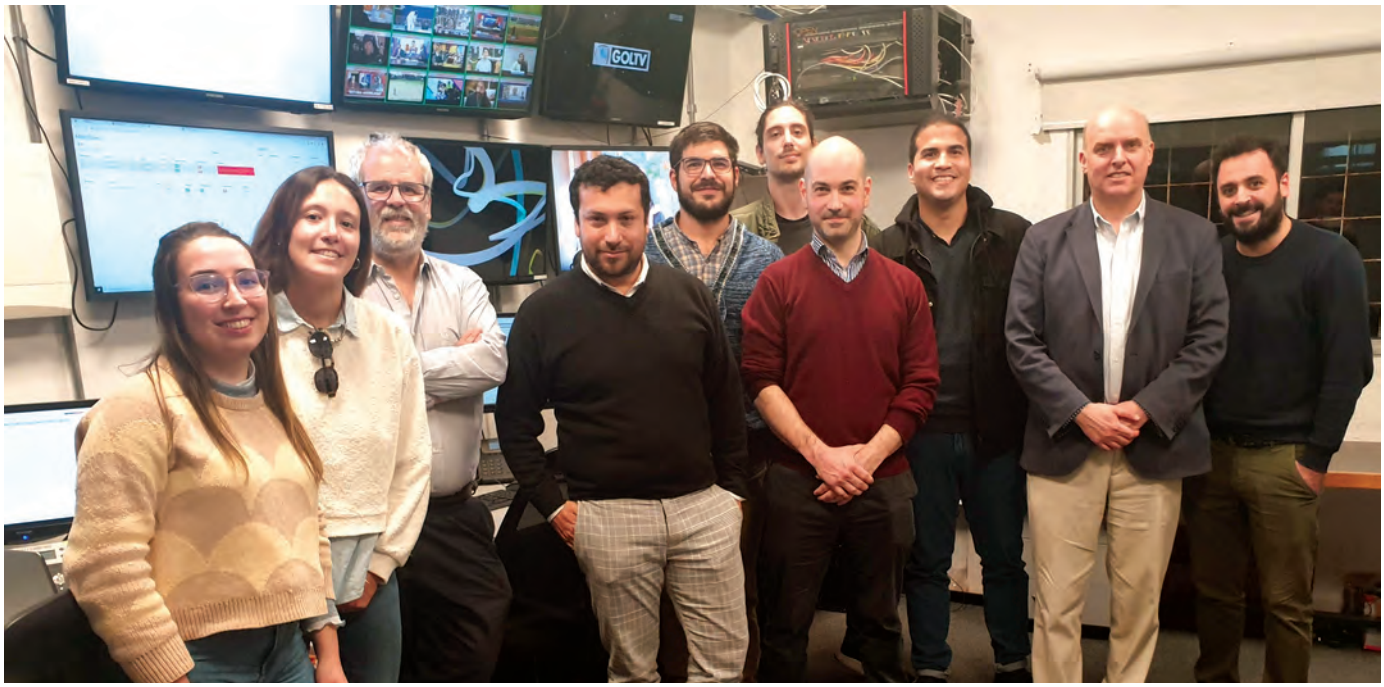
Uruguay Chapter Observes IEEE Day

The Uruguay Chapter of the Broadcast Technology Society observed the annual IEEE Day on Oct. 4, 2022 with a tour of the Montevideo TCC CATV (community antenna television) facility. The visit was arranged for students enrolled in a multimedia-over-IP course at the city's Universidad de la República.

The facility visit included an explanation of the operation of the company's live and video-on-demand delivery platform,"TCC VIVO," which was provided by TCC's chief technology officer, Marcelo Coggan, and its head of engineering, Pablo Flores.



Chapter Students from the Universidad de la República visit TCC Facility organized by the Uruguay Chapter.

Upcoming Events

of Interest to BTS Members

- **Jan. 5–8, 2023** – CES Show and Exhibition; Las Vegas Convention Center, Las Vegas, Nevada
- **Feb. 20–23, 2023** – HPA Tech Retreat; The Westin Mission Hills Golf Resort & Spa, Rancho Mirage, Calif.
- **April 15–19, 2023** – NAB Show; Las Vegas Convention Center, Las Vegas, Nevada
- **May 13–15, 2023** – AES Europe Convention; Helsinki, Finland, Aalto University
- **May 19–21, 2023** – Dayton Hamvention 2032; Xenia, Ohio - Greene County Fairgrounds and Expo Center
- **May 23–25, 2023** – NRB 2023 Christian Media Convention; Orlando World Center Marriott, Orlando, Florida
- **June 7–9, 2023** – BroadcastAsia 2023; Singapore - Singapore Expo
- **June 14–16, 2023** – IEEE International Symposium on Broadband Multimedia Systems and Broadcasting; Beijing, China
- **Sept. 15–18, 2023** – IBC Show 2023; Amsterdam, Netherlands – Amsterdam RAI
- **Oct. 25–26, 2023** – NAB NY Show; New York City, N.Y. – Jacob Javits Center (co-located with AES convention)

(IMPORTANT NOTE: Due to the on-going global pandemic; all of the event dates and locations listed above are subject to change with little notice, with many events being cancelled, rescheduled or postponed. When making plans to attend any of these trade shows, conferences, or meetings, *always* confirm details with event organizers first.)

If you have information on broadcast-related events that may be of interest to other Broadcast Technology Society members, please submit them at least three months in advance to the Broadcast Technology editor at BTSeditor@ieee.org.

Editorial Deadlines

Broadcast Technology *welcomes contributions from its members. Please forward materials you would like included to the editor at* BTSeditor@IEEE.org. *Here are our editorial deadlines for upcoming issues:*

Issue	Due Date
Quarter 1	Jan. 10, 2023
Quarter 2	Apr. 3, 2023
Quarter 3	June 28, 2023
Quarter 4	Oct. 31, 2023

What's New

Broadcast Technology presents new product releases from broadcast equipment manufacturers

PZT Camera

JVC Professional Video, a division of JvcKenwood USA Corporation, is now shipping the latest in its line of PZT (pan/tilt/zoom) remotely-controlled cameras, the KY-PZ510 series. The new cameras offer an 80-degree field of view and are equipped with the company's Smart auto-tracking feature that allows the camera to automatically follow the movements of a single individual.

The KY-PZ510 line also incorporate Vertical Interval Timecode (VTIC) with Network Time Protocol (NTC) to enable synchronization of multiple cameras. They also support H.264 and H.265/HEVC encoding, and provide 4K/60 video outputs via both HDMI and streaming connections.

For additional information, please visit the JVC Professional Division at *http://pro.jvc.com.*

2.4 GHz Belltpack Intercom System

Riedel Communications has announced the release of a new Bolero beltpack intercom system that operates in the 2.4 GHz band instead of the standard DECT (Digital enhanced cordless telecommunications) frequencies, providing users in regions where DECT frequencies are either limited or not authorized.

Bolero 2.4 GHz provides users with essentially the same feature set included with the DECT version, and provides the same three network modes: integrated, standalone link, and standalone 2110 (AES67).

Although the new 2.4 GHz system was primarily developed for international users, it can also be of use in areas of the United States where the number of DECT carrier frequencies are limited.

For additional information, please visit Riedel Communications at *www.riedel.net.*

Mac Studio Computer Rackmount

Sonnet Technologies' new RackMac Studio enclosure provides rack-mounting of either one or two Mac Studio computers within a compact 3RU-high by 9.5-inch-deep enclosure. Computers are secured behind a removable front panel, with the enclosure also providing front panel operation of Mac rear-mounted power switches. Access is provided to computer SD card slots and there's a panel-mounted passthrough USB cable that connects to a computer's USB-A port to allow users to easily connect a keyboard, mouse, thumb drive or other USB devices.

The small profile of the enclosure makes it ideal for mounting in travel racks and shallow molded rack cases.

For additional information, please visit Sonnet Technologies at *www.sonnettech.com.*

IP Transport Appliances

For-A's new SOAR (Software Optimized Appliance Revolutionized) secure IP transport appliance technology provides a means for web distribution of content with very low latency. The devices allow content creators, live event producers, and others involved in content production and distribution an easy way to transition to IP.

The SOAR-A system utilizes RIST transport protocol and offers gateway-free streaming from any browser to any browser, allowing content to be viewed on ordinary computers, tablets and smart phones. It's compatible with WebRTC (Web Real-Time Communication) supports the conversion and delivery of SD, HD, 4K and NDI signals to SMPTE ST 2110.

For additional information, please visit FOR-A at *www.for-a.com*.

RF-Over-Fiber Interface

Wisycom's new BFL 1 RF-over-fiber interface provides users with the ability to provide extended RF coverage without worrying about cable loss issues when remotely-located receiving antennas are used, even when deployed miles away from the receiver. The unit incorporates a custom-designed laser illumination source with a dynamic range of more than 90 dB to greatly improve signal quality and an enhanced noise floor with wireless microphone ad IEM/IFM audio systems.

The BFL 1 utilizes 16 filter banks to protect against intrusion of unwanted signals and features a high contrast OLED display, a long-range Bluetooth 5 programming link.

For additional information, please visit Wisycom at *www.wisycom.com*.

Intercom Control Unit

Pliant Technologies' new CCU-08 CrewCom intercom control unit provides users with as many as eight four-wire ports and monitors and controls any device connected to the CrewNet network. The unit supports up to 82 of the company's Radio Packs across all RF bands. (As it contains no radio itself, the unit is frequency agnostic.) It retains all of the features of Pliant's previous intercom control products, the CCU-22 and CCU-44.

The CCU-08 incorporates Pliant's latest CrewCom firmware updates, which include a high-density mode, faster configuration upload speeds, and a new Radio Pack paired list that provides users with the ability to view and manage—from a single software location—a list of all Radio Packs paired to control units.

For additional information, please visit Pliant Technologies at *www.plianttechnologies.com*.

openGear 4K ST 2110 Audio/Video Processing

Cobalt Digital's 9904-UDX-4K 12G/6G/3G/HD/SD UHD openGear card with its up/down/cross conversion/frame synchronization and audio processing/embedding/de-embedding functionalities is now available with the company's Indigo 2110-DC-01 option that provides high-density 4K ST 2110 audio and video processing. (This factory add-on option is also available for Cobalt's 9905-MPx audio/video processing and conversion card.)

The Indigo 2110-DC-01 option adds native SMPTE ST 2110 support for the cards, and provides multiple 25G Ethernet interfaces. It natively performs all processing via IP, eliminating the need for connection of multiple processing units and other devices in the signal path, thus providing additional reliability and cost-effectiveness when moving signals between SDI and IP platforms.

For additional information, please visit Cobalt Digital at *www.cobaltdigital.com*.

Calling all Chapter Chairs

The IEEE Broadcast Technology is interested in your chapter activities, but have you ever wondered how to write a chapter report. Below are some directions that can help you get your chapter noticed.

Information for submitting Chapter Reports:

• Chapter Reports ideally should run approximately 200 to 500 words. (If a really newsworthy or unusual event is being described, we can accept slightly longer Reports, but nothing greater than 800 words.) We are looking for a summary of the event program or presentation. Please keep Reports straightforward and focused on the event. When someone is mentioned in a Report, it is very important that we receive the person's full name, title or position, organization they are affiliated with, and their connection with the story.

- Please identify all recognizable persons in your photos. We need their names, with title or position and affiliation. (Example: Mr. John Smith, vice president of consumer electronics production, Ajax Corporation.) If there is more than one person in a photo, please clearly identify everyone from left-to-right; please do not assume that we know persons depicted and will be able to fill in this blanks.

•This need for complete identification also applies to place and building names. Please make sure to provide the complete location of the event. (Don't just say the meeting took place in Smith Hall, as readers will likely not know that Smith Hall of part of the School of Engineering at Jones University.) Provide complete information about meeting venues.

• Very important—submit your Report as a straight Word file with no embedded logos, pictures, etc. Please do not send PDFs.

• Pictures are a very important part of every Report; however, they need to be good quality and tell a story; i.e., if a presentation is made at your meeting, your photograph should show the presenter standing at a podium, or at a chalkboard, etc. Group photographs are nice, but we really need at least one good photo of the lecturer making his/her presentation. Image size is very important too. An image that is acceptable on a Website is not necessarily large enough for publication in a printed magazine. Images must be at least 250 kb in size (one to two MB preferred). These must be sent as .jpg file attachments—no PDF— and PLEASE DO NOT EMBED IMAGES IN REPORTS.

• Please include answers to all of the following questions in your first paragraph: **Who** was involved? **What** happened? **Where** did it take place? **When** did it happen? **Why** (what was the reason?). Further, if the event you are describing was facilitated by an institution (university, company, etc.) that provided a meeting room, refreshments, etc.. Please include this information in every Report.

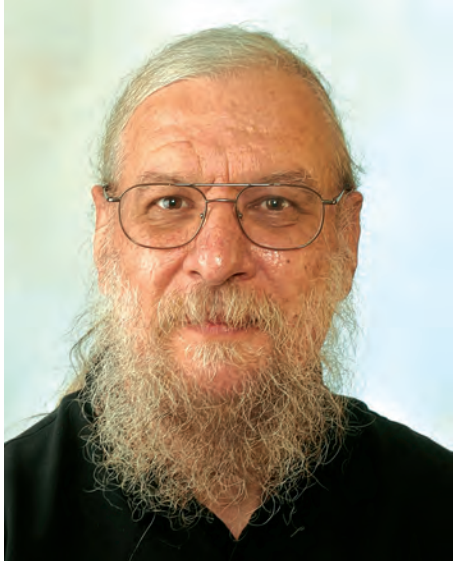
• Also, when submitting a Report, please provide complete identification about yourself, including your title or position and the name of the organization that you are affiliated with.

• Lastly, Reports must be timely. They need to be received by the **Broadcast Technology** staff no later than two to three weeks after the meeting or event took place.

If these items are not received in the required order, the Editorial Assistant will contact you for a revision. The **Broadcast Technology** editorial staff thanks you for your cooperation. We look forward to receiving and publishing your Reports. If you have any questions please send an email to btseditor@ieee.org

Richard Chernock Honored With 2022 Jules Cohen Award

The IEEE Broadcast Technology Society is delighted to announce that the 2022 Jules Cohen Award is to be presented to Richard Chernock of the United States.



The Jules Cohen Award is the Society's premier award and recognizes major contributions to the industry, integrity and professionalism, and a record of sharing expertise for the benefit of colleagues, and of the industry as a whole.

Throughout his career, Chernock has received praise from his peers, not only for for the integrity and professionalism associated with his work, but also for his generosity in the mentoring of others along the way. His commitment to excellence has been a hallmark of his career, especially in connection with his work in chairing groups that led to the development of the ATSC 3.0 digital television transmission standard.

"These values closely match those of the late Jules Cohen and make this award particularly appropriate" said Peter Symes, Awards Chair for the IEEE Broadcast Technology Society. "BTS is honored to award Rich with the 2022 BTS Jules Cohen Award. Rich is a valued member and important contributor to the mission of the society. Congratulations Rich on an amazing career!"

Background

Dr. Chernock is now retired. Previously he was the Chief Science Officer at Triveni Digital. Previously, he was a Research Staff Member at IBM Research, investigating digital broadcast technologies. Dr. Chernock is chairman of the ATSC Technology Group on ATSC 3.0 (TG3) and chairs the AHG on service delivery and synchronization for ATSC 3.0. He was previously chairman of the ATSC Technology and Standards Group (TG1). In another life, he used transmission electron microscopy to study materials characteristics for advanced ceramics packaging and semiconductor technology at IBM. His ScD was from MIT in the field of nuclear materials engineering.

The IEEE International Symposium on Broadband Multimedia Systems and Broadcasting 2023, the 18th in the series

IEEE

BTS IEEE Broadcast Technology Society

Beijing, China | June 14th-16th | www.bmsb2023.com

welcome to contact us at info@bmsb2023.com

The IEEE International Symposium on Broadband Multimedia Systems and Broadcasting 2023, the 18th in the series, will be held in June 14-16, 2023, Beijing, China. The symposium is the premier forum for the presentation and exchange of technical advances in the rapidly converging areas of multimedia broadcasting, telecommunications, consumer electronics, and networking technologies.

Important Dates

Submission of extended abstract/full paper : January 10, 2023

Notification of acceptance : March 11, 2023

Submission of camera-ready paper : April 25, 2023

Authors are invited to submit extended abstracts (2 pages) or full papers (6 pages) of your research on the review process.

Topics of Interest (but not limited to)

◆ Multimedia Transmission

- Channel modeling & simulation
- Channel coding, modulation, multiplexing
- Advanced signal processing for transmission
- MISO and MIMO processing
- Channel estimation and equalization
- Antenna technologies
- Propagation and coverage
- Terrestrial and satellite delivery
- Mobile TV and advanced HD radio
- Next-generation of broadcasting standards
- AI-based communications
- Technologies beyond 5G
- UAV communication and route planning

◆ Multimedia Networking

- IPTV and streaming
- Internet TV and OTT
- FeMBMS, 5G NR MBS, MooD & SC-PTM
- VoD, interactivity, datacasting
- Multimedia NFV & SDN
- Traffic and performance monitoring
- Networking and QoS
- Broadcast applications to smart cities
- AI for multimedia networking intelligence
- Broadcast core network

◆ Multimedia Service, Quality and Content

- Multimedia for connect cars and IoT
- Multimedia datacasting
- Multimedia security
- Quality evaluation and dataset
- Audience measurement & behavior study
- Quality of experience
- Future broadcasting services
- Convergence of broadcast and broadband
- Distributed or edge/fog-based multimedia service
- Cloud-based multimedia service
- AI for advanced multimedia service management

◆ Multimedia Signal Processing

- Multimedia coding: image, video, audio
- Error resilient and concealment
- 3D, virtual reality, multi-view video
- AI-based multimedia coding
- Scalable video coding & Content adaptation
- Retrieval and indexing
- Synthetic imaging and rendering
- Objective video and audio quality assessment

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BTS Resource Center NOW OPEN

The IEEE Broadcast Technology Society now offers a new Resource Center, providing a single location to access all available virtual content. The Resource Center button is located on the home page of the BTS website, *resourcecenter.bts.ieee.org*. New content is added everyday.

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