RADIOWORLD

What's Next for HD Radio

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A Special eBook Supplement to Radio World

NewBay Media

ABOUT THIS EBOOK

The HD Radio digital broadcast format has now been in the U.S. radio marketplace for more than a decade. Many perceptions about it were formed early in its rollout but echo today.

For this special eBook, Radio World steps back and attempts a high-level perspective and update of changes in recent years, and discusses the possible direction it will take next. We sought comment from proponents, critics and other observers.

RW contributor Randy Stine lays out the station and receiver numbers, and what participants are saying about them. News Editor/Washington Bureau Chief Leslie Stimson asks skeptics to comment. IBiquity's Rick Greenhut discusses the "translator strategy" and expanding data applications. RW Technical Adviser Tom McGinley asks three HD Radio proponents to discuss what engineers should know if they are considering implementation. And John Kean of NPR Labs explains how an IBOC "power allowance calculator" can help FM stations understand their HD Radio upgrade options.

Radio World is committed to presenting all responsible viewpoints on this and other topics. Comment on any article by emailing radioworld@nbmedia.com, attention Letter to the Editor.

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What's Next for HD Radio?

IBiquity senses "critical mass," while many smaller-market stations remain on the sidelines

BY RANDY J. STINE

The HD Radio rollout in the United States has been characterized by some observers as painfully slow in the 10 to 12 years since its launch. But it has nourished the growth of numerous new audio channels and at least two nationwide data networks from which some broadcast owners profit. Meanwhile, the technology's developer expects HD Radio to speed ahead to much wider radio broadcast industry adoption and sustainability.

That growth, and whether HD Radio ever becomes the "star of tomorrow," may hinge a great deal on willingness of radio broadcasters in small and medium markets to overcome apprehension about the cost of conversion.

Market indications for the in-band on-channel digital radio technology are overwhelmingly positive, in the view of iBiquity Digital Corp. Original Equipment Manufacturers, widely known as OEMs, are cranking out HD Radio receivers at a faster pace. New digital and data services are gaining traction. In-car HD Radio listening is up. And the economy is moving forward out of its recession, according to the tech developer.

IBiquity reports there were 17.5 million HD Radio receivers in consumers' hands at the beginning of 2014, with sales of receivers doubling in 2013. Of those, 15 million are in vehicles. The company predicts another 7.5 million HD Radio receivers will be sold this year.

The technology is part of radio's larger "battle for the dash," and iBiquity expects approximately 50 new HD Radio receiver models this year, including models from Kenwood, Pioneer, Alpine, JVC and Sony.

It's important to keep in mind when talking about iBiquity that it is owned in part by broadcasters — 15 of them are investors, according to the company website, including Clear Channel and CBS Radio — as well as "strategic

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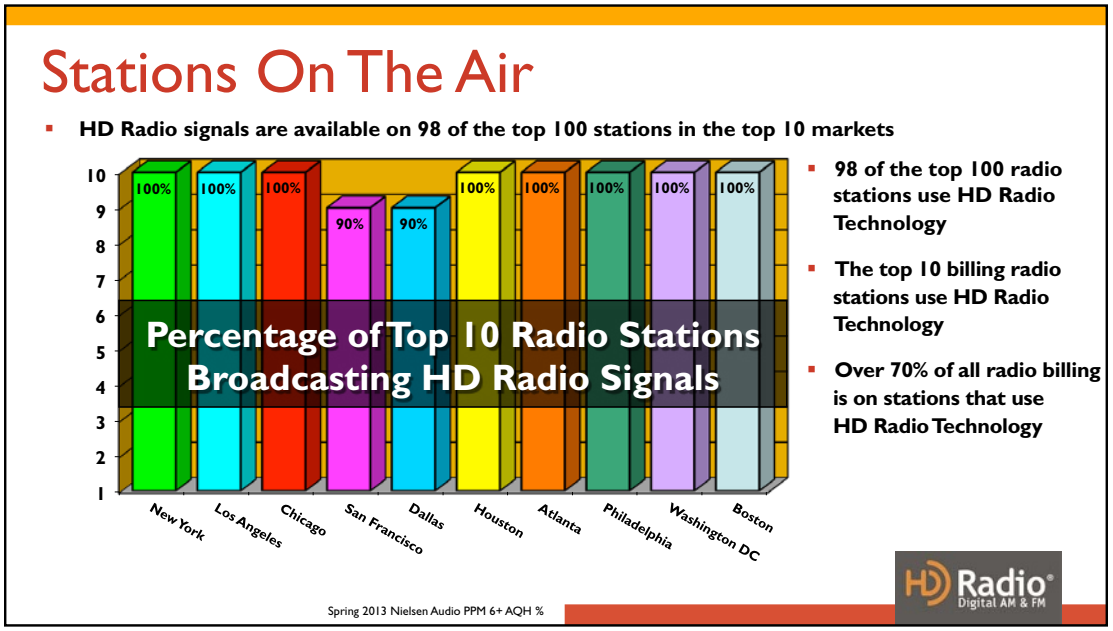

HD Radio has tended to be a big-market, big-company platform so far. This slide from an iBiquity presentation emphasizes its penetration in the largest cities.

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partners" Ford Motor Co., GatesAir (formerly Harris), Texas Instruments and Visteon. Ownership also includes financial institutions like Grotech Capital Group, J.P. Morgan Partners, New Venture Partners and FirstMark Capital.

However, many radio owners and engineers still look at the platform with skepticism or noncommittally. They express concern about the business model, possible interference (especially on AM), digital's smaller coverage footprint, and costs of implementation. Judging by integration numbers, the technology has not yet made its business case to the majority of stations.

FCC data indicates there were 15,358 licensed AM and FM radio stations at the beginning of 2014 in the U.S. (excluding LPFMs and translators). Of those, there were approximately 2,060 HD Radio stations on the air as of March. Most (1,810) were on FM rather than AM (250). The multicast capabilities of FM HD has produced an additional 1,480 multicast channels (HD2, HD3, HD4), according to iBiquity.

Four years ago, by contrast, Radio World reported there were about 2,000 stations on the air, so licensee growth since then has been incremental at best, though the number of multicast channels has grown from 1,100.

AM digital in particular has struggled to gain mainstream acceptance by consumers and manufacturers. It's also been dogged by some coverage and performance problems, including broadband antenna issues, specifically at night, observers said. This takes place against a larger period of AM industry introspection about its health and future. The NAB continues to work with the FCC on AM radio revitalization, with "AM HD remaining a part of a potentially creative solution" to keep AM relevant, according an NAB spokesman.

On FM, the biggest radio markets have largely converted to HD Radio, observers agreed, and iBiquity believes 70 percent of all radio billing is on stations that use HD Radio technology. Further, 23 stations on BIA/Kelsey's list of the top 25 billers — and 94 of the top 100 — are said to be in HD Radio. Nearly nine of 10 listeners can listen to an HD Radio station, and almost eight out of 10 do so, iBiquity says. HD Radio penetration, the company believes, has "reached critical mass."

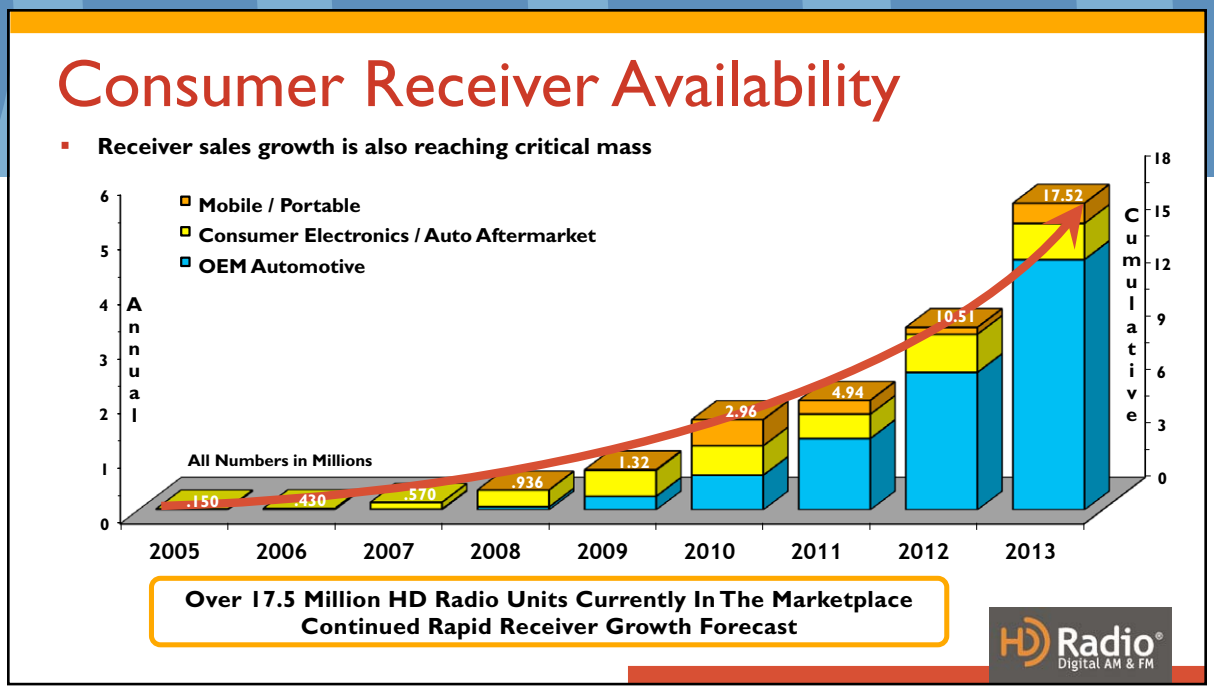
However, the majority of U.S. radio stations — clustered in small and medium markets — remain outside the cusp of conversion.

LOOK AND FEEL

The HD Radio transmission standard, adopted by the FCC in October 2002, promises enhanced audio quality. But the benefits of better audio on the main channel have tended to take a back seat in business discussions to the promise of new revenue sources via data and the addition of multicast channels.

In addition, some broadcasters are using FM translators to rebroadcast HD2-4 channels, in effect creating more analog FM signals, according to iBiquity, and providing another means to monetize the technology.

> Analog radio will not be able to deliver that experience and will not meet those consumer expectations.
>
> — Bob Struble



iBiquity believes HD Radio will win its battle for receiver penetration.

Behind much of the thinking by proponents is that ultimately, the U.S. radio industry must "go digital" to compete with new platforms of the 21st century.

IBiquity President/CEO Bob Struble said the majority of broadcasters understand that digital broadcasting is their future. "I don't think this dynamic has changed much in the last several years. But 'future' could be next month or it could be five years from now."

Radio also must remain relevant and competitive, he said: "To have a look and feel and a consumer experience that is up to what people expect, you have to be HD. Analog radio will not be able to deliver that experience and will not meet those consumer expectations."

DRIVEN BY DATA

Several engineers for major broadcast groups declined to comment for this story, saying their technology strategies are "closely held."

Not bashful is the nation's largest radio company, Clear Channel Media and Entertainment, which has added HD Radio to some 500 of its analog FMs; most of those are in the top 100 radio markets, said Jeff Littlejohn, executive vice president of engineering and systems integration, and an iBiquity board member.

Clear Channel is optimistic about the opportunities that data over an HD Radio signal presents radio stations. Traffic data receivers and car radios using The Artist Experience, a visual component, are becoming more commonplace, Littlejohn said. "Automakers are really high on HD Radio. We are seeing really good progress there, and we are really excited about the additional features available like traffic and the album art."

The group's Total Traffic & Weather Network provides information on traffic, weather, news, sports and fuel prices and interacts with several aftermarket navigation systems and is included by some leading automotive manufacturers, according to Clear Channel.

"Datacasting has become a real business for us since we launched it with Garmin back in 2005. It really transformed from an analog FM RDS service to an HD Radio service that we monetized and made profitable," Littlejohn said.

Clear Channel also has told the FCC it advocates all-digital operation on AM.

One way in which a number of other broadcast owners participate in HD Radio revenue is via the Broadcaster Traffic Consortium. The BTC is a nationwide broadcasting network that distributes location-based data including local traffic, weather and fuel prices to navigation devices and in-dash systems, and thus competes with Clear Channel's effort in that area.

Its membership consists of 23 groups including founders Beasley Broadcast Group, Bonneville International Corp., Cox Radio, Emmis Communications, Entercom Communications Corp., Greater Media, NPR and Radio One.

At inception in 2007, BTC relied on RDS-TMC broadcasting over FM analog signals, but in 2011 it began adding HD Radio distribution. The consortium said HD Radio now contributes 20 percent of BTC's total revenue.

It quoted Greater Media CEO Peter Smyth

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saying his company "is now seeing a return on our investment in BTC. The transmission of traffic data via our HD signals allows us to be an integral part of the digital dashboard."

In BTC's view, HD Radio offers "affordable bandwidth" for activities like traffic that require a lot of it. "The smooth launch with auto manufacturers Honda and Mitsubishi last year has opened the door for additional automakers to realize the value of HD Radio Data real-time traffic with BTC," it stated.

BTC Technical Product Manager DeAndra Barkocy was quoted as saying that the revenue BTC is generating for partner stations "has really helped them commit to continuous improvement. We have broadcasters upgrading HD Radio systems, increasing power and dedicating the resources needed to maintain our 24/7 broadcast requirements." Barkocy said broadcasters "are contacting us about how to partner with the BTC. They see us as a viable stream of revenue for a broadcast that they already have on the air."

Paul Brenner, president of the consortium and chief technology officer at Emmis, told RW in an email, "Broadcasters should learn from BTC in that our success with the automaker is happening because we offered an industry-wide solution that solves a problem for them (more efficient distribution of content and reinvention of an existing platform)." He believes the same can be accomplished through support of the NextRadio app, which he and Emmis are also pushing.

Radio World also sought comment from Cumulus Media, the nation's second-largest radio company by station count, but had not heard back as of deadline.

SUCCESS AT KING

The HD Radio service can deliver technical improvements to radio's performance, supporters say.

For example, Clay Freinwald, owner of a Seattle-based technical service that bears his name, believes that on FM, HD Radio works "and is here to stay. The time of fence-sitting is over."

Using KING(FM) in Seattle as a success story, Freinwald said that in analog, the classical music station was basically unlistenable in a moving vehicle due to topography of the market, thanks to so-called "picket fencing." Converting to HD Radio "changed that. It made a classical station listenable in a moving vehicle, something a zillion dollars could not do with analog."

As for a disparity between analog and digital coverage areas, Freinwald said many stations should have jumped on the opportunity to increase their HD power but have not, because owners want to see immediate return on their investment.

> Most of the buzz we hear right now concerns Internet plays, not HD.
>
> — Jay Mitchell

COST REDUCTIONS

Struble believes owners in the small and medium markets eventually will see two developments as more digital radios come out and as more cars are produced with HD Radio, offering stations "a real revenue opportunity."

He believes competitive pressures will come into play too. If one station is using Artist Experience "and it's popping up when somebody tunes to that station, and you tune to the next guy and he doesn't,

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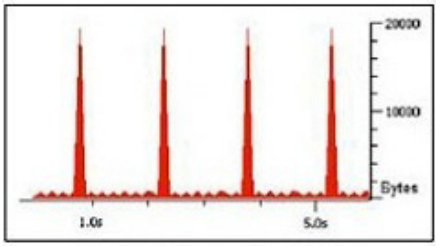

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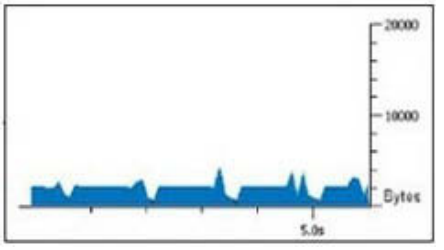

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that could end up being a competitive issue. It's the chicken-and-egg all over again."

Costs remain an obstacle cited by non-adopters. Broadcasters have complained of high fees since the launch of the digital technology, and iBiquity has subsequently reduced them more than once.

Five years ago, the published fee was $25,000, though after discounts an average station at the time paid about $15,000, a company official told Radio World then.

Now, the one-time licensing cost for a commercial FM is $10,000, payable over five years with no interest charge or carrying charge, according to Rick Greenhut, director of U.S. broadcast sales for iBiquity. Noncoms pay $5,000, commercial AMs pay $7,500. Multicast channels involve a separate licensing fee based on a revenue-sharing model, Greenhut said. (See box.)

The company estimates the cost of an iBiquity license to a station typically is 10 percent of its total conversion costs. This is in addition to the hardware cost of conversion; broadcasters can expect to spend $30,000 to $200,000 per station, with an average of $100,000 based on a station's existing equipment and power levels, according to iBiquity.

The licensing price reduction is seen as an incentive to smaller-market broadcasters. But even those who have adopted the technology have struggled to find ways to monetize it, according to one observer.

"My sense of it is that, similar to the larger markets, most of the smaller-market operators have either adopted HD Radio or are not considering doing so," said Jay Mitchell, publisher of "The Small Market Radio Newsletter."

"And that word spreads rapidly. Most of the buzz we hear right now concerns Internet plays, not HD."

Radio broadcasters are faced with making many decisions on multiple technologies along with HD Radio, according to NAB. Those options include participating in initiatives such as iHeartRadio and NextRadio and the related

HD Radio Licensing

The one-time HD Radio license fee for a commercial FM station is $10,000. Stations have the option to pay a lump sum, or use a payment plan of $2,500 down and the balance over five years with payments of $125 per month. There is no interest fee or carrying charge. This fee licenses the main channel in perpetuity, and the digital simulcast of the analog signal becomes the HD1 channel.

If a station adds HD2, HD3 or HD4 channels, multicast fees are ongoing. Each multicast channel costs the greater of either $1,000/year, or 3 percent of the incremental net revenue generated solely by that channel, as reported by the station. IBiquity officials say this means that until a multicast channel generates $33,333 annually on its own, the amount due is the $1,000 minimum, billed at $250 per quarter. Rebroadcast of HD2, HD3 and/or HD4 channels on analog or digital translators does not incur further charges.

Commercial AM stations pay $7,500, with $1,500 down and the five-year no-interest payment option at $100 per month. The technology does not currently permit multicasting on AM.

For non-commercial stations, the fee is $5,000, payable with a $2,000 down payment, and the remaining $3,000 can be spread over five years with payments of $50 per month. Multicast and data fees are $500 per year per additional channel vs. the $1,000/year for commercial stations. LPFMs bear the same cost, with no recurring multicast or data fees.

push for FM radio chips in cellphones.

For example, The Cromwell Group, based in Nashville, Tenn., owns 23 radio stations in mostly small and medium-sized markets and has converted five of its stations to HD Radio, but it is involved in other technology too, according to owner Bud Walters.

HD Radio, he said, "is very important, but at the moment we are more focused on getting the NextRadio App in smartphones and on the dashboard."

'NO COMPELLING REASON'

Much of the commentary about HD Radio in online forums and outlets such as RW's letters section tends to be stridently negative. For some critics, the technology and its business model were never well thought out, and the fact that it can be licensed through only one provider rubs them the wrong way. (See related story, page 12.)

But when Radio World sought comment from broadcasters who hadn't adopted, responses tended to focus on business cases. Some believe activating FM chips in cellphones will do more for small-market broadcasters, at least in the short term, than HD Radio. Others cite numerous factors.

"I'm not planning on adopting HD Radio. The cost of the upgrade, the lack of receivers and limited coverage area of HD are the reasons," said Tom Mogush, owner and general manager of WMQT(FM), Ishpeming, Mich., which is in the Marquette market. Mogush said he hasn't seen a "compelling reason" to convert.

Nicolet Broadcasting President Roger Utnehmer said it's hard for him to justify the expense of installing HD Radio on his four FM stations in Door County, Wis. "HD is a significant investment for a small-market broadcaster. With receiver penetration low in small markets, I don't believe it a prudent investment, yet."

Another factor Utnehmer cited is the older demographics of Door County. "Our median age is 47, which is 10 years over our state median. Older demos are less likely to invest in new technology, so the older demos are less likely to buy HD receivers."

Gleason Media operates five stations in small markets in western and central Maine. Company President/GM Dick Gleason has "no interest" in adopting HD Radio for WOXO(FM), Norway, Maine, saying: "There is no curiosity in the market about [HD Radio] at all. There is more talk about satellite radio."

Despite such audible pessimism, other owners in small markets are making the move to adopt HD Radio.

Bruce Goldsen, president/GM of Jackson Radio Works, licensee of WKHM(FM), Brooklyn, Mich., expects to launch his FM digital signal by the first of April. The broadcaster spent about $40,000 on equipment for the upgrade — it already had a HD-ready transmitter in place — and will multicast programming with music content on the HD2 and audio from a sister AM station on the HD3 channel.

Goldsen said iBiquity's lower licensing fees helped him decide to make the investment in the technology. "We have also acquired two FM translators. The ability to re-feed the HD2 signal on a FM translator in a way helps us introduce HD and monetize the conversion."

Jackson is approximately 60 miles west of Detroit, and has about 33,000 residents. The city's proximity to the Motor City played a role in Goldsen's decision making, saying: "This is American-made car territory and many of the new models feature HD now."

Detroit has about 50 digital signals, according to iBiquity.

PMB Broadcasting LLC, in Columbus, Ga., now owns two HD Radio stations. The most recent convert, WLTC(FM), Cusseta, Ga., has an HD2 that features a classic rock format, which is also simulcast on an analog translator.

"Right now, the translators are the path to monetization for us," said Joseph Brannan, assistant general manager for the five-station cluster. "Conversion costs and the lack of ROI particularly, as the group does not have translators, is holding back smaller broadcasters" from converting.

Brannan's group in Columbus includes four full-power FMs and four translators. "Without the allowance from the FCC to rebroadcast HD channels on translators, the conversion would not have happened now."

Radio World News Editor/Washington Bureau Chief Leslie Stimson contributed to this piece.

Battling for Earshare:

CES 2014 Confirms Radio's Competitive Challenge

HD Radio Technology is Table Stakes in Hyper-Competitive, Connected Audio Market

As usual, my time at this year's International Consumer Electronics Show a few weeks back got me thinking hard about what lies ahead for broadcast radio. I'm excited by it all and inspired to share a few thoughts.

Folks go to CES to see the future and plan for it, and there was much to see in Vegas that will impact the radio industry. I was happy to spend time at the Show with more broadcasters than I have in previous years. It's essential for industry leaders to see firsthand the incredible breadth and power of new consumer information and entertainment technologies, and feel the rapid pace and disruptive potential of these innovations. Products shown at CES have and will continue to change the way radio is used by consumers and, by definition, how it does business going forward.

Coming out of this CES, I've identified five broad trends that are fundamentally changing the competitive landscape for radio broadcasters. For the most part, they are continuations or confirmations of developments we have been monitoring for years, which deepens my conviction on their transformational effect, and not surprisingly, on the importance of over-the-air digital broadcasts to keep up in the rapidly changing audio market. Here's what I saw and how I think it impacts radio:

The Ascendance of Car Infotainment Systems

Five years ago, not a single car maker exhibited at CES. This year, 9 of the top 10 automakers had booths. That's really stunning, considering that the very next week after CES, the year's biggest auto show in Detroit takes place. That's because consumer electronics in cars – the infotainment system – has become a critical buying factor in new car sales, as important as acceleration, gas mileage and safety ratings. So automakers are at CES to show off how cool and advanced their dashboards have become, and to meet and do deals with all those new services clamoring to get into the vehicle (which as discussed, is why more broadcasters should be in Vegas).

Happily, every one of those nine exhibiting automakers were showing their excellent HD Radio offerings, which is instructive. More broadly, we announced at CES that HD Radio technology is now offered by every car manufacturer, and was built into 1/3 of all new cars sold in America last year. Increasingly, HD Radio technology is broadcast radio to many automakers.

Increasingly, cars are coming with big, bright color screens as part of these infotainment systems. They want advanced HD Radio features like iTunes Tagging and Artist Experience to take advantage of those screens and provide listeners with the experience they expect. Analog radio basically presents a blank screen and has fallen behind competitively. Of course AM/FM has great content, but position on the screen is being decided by automotive product people who are demanding visually enhanced experiences. In many ways the blank analog screen has lost its position on the screen to other more fully-featured services. HD Radio broadcasting has become table stakes to stay current, if you'll pardon the Vegas-oriented pun.

> "What IoT means for broadcasters is this: in a very short period of time, every device that has an AM/FM tuner, will also have an internet connection. "

The Connected Car is Here

Staying with car trends, because they are so important to broadcasters, this CES confirmed that the connected car is here, now. This was a bit of a 'Back to the Future' CES for me. As far back as 2011 (http://bit.ly/1epBRXj), I've been writing about cars coming with internet connectivity in the dashboard and a wide variety of web-based infotainment services. I have an advantage staring into the crystal ball about cars: we work closely with all of the automotive manufacturers and because they have a 3-4 year development cycle, we quite literally know what is coming. We have 2015-16 car radio in our labs now for testing.

Bob Struble
President and CEO, iBiquity Digital

All nine automakers highlighted their connected offerings. For the most part they are very compelling, with a broad offering of popular streaming, social media and other linked services. Audi and GM had big announcements about deals with wireless carriers to build 4G connectivity directly into the dash, upping the ante. Google announced deals with four automakers to integrate Android in the car, and Apple's iOs in the car is moving forward with twelve automakers. All the big connected players are intensifying the 'Battle for the Dashboard'. If you didn't see it at CES, just head down to your local auto dealer and take a look.

You'll see there what we highlighted at the Show, several cars with advanced HD Radio traffic services provided by Clear Channel and the Broadcast Traffic Consortium over their nationwide HD Radio networks. These free-to-the consumer services allow broadcasters to compete with connected services and make real money doing it. They're avail-

able on both higher end cars like Lexus, but also the affordable vehicles we had in our booth: Toyota Corolla, Honda Civic, Mazda 3, Mitsubishi Lancer.

For broadcasters the bottom line is all cars will soon have internet connectivity and everything that brings. Radio is jockeying with dozens of digital infotainment services in the car for listener time and attention. It requires the industry to upgrade its basic offering to remain competitive in the dashboard. CES again showed that HD Radio technology can help and basically a competitive requirement.

Fewer Home and Portable AM/FM Products

A trend that keeps me up at night is the dwindling supply of home and portable AM/FM products. What I saw, or more accurately didn't see, in Vegas should concern all broadcasters. Outside of what is being built into cars, there are a whole lot less consumer electronics products with AM/FM tuners. Yesterday's clock radio is probably a dock, table radios and boom boxes have become bluetooth speakers, and my generation's transistor radio or headphone radio or Walkman is now a ...mobile phone. And again, you didn't have to go to CES to see this, head over to Best Buy and count the 'traditional radio' products. There's a lot fewer.

Nielsen Audio tells us that in home listening still accounts for 36% of 12+ AM/FM listening, less for kids, but there are still a ton of receivers out there - a billion including cars on the road by most counts. But it's hard not to look at these product trends as anything but forward indicators. Our industry must work collectively to turn it around - with lower cost and more fully-featured home and portable products, with HD Radio technology serving a critical role. Maybe there specific programming or promotional efforts that could shore up home listening. And it emphasizes the importance of out-of-home devices, solidifying AM/FM's position in cars as discussed above, and bringing broadcast radio to phones, as NextRadio is working with Sprint to do.

More Internet Radio Players (Really)

Most all of the streamers had a major CES presence, perhaps led by Pandora and iHeart highlighting their progress in cars. The Show served as a launching pad for yet another entrant, Beats Audio, with a subscription-only curated offering and a prominent partner in ATT. Last year's entrants, Google Play and Apple's iTunes Radio, were also present at CES. And although neither has yet become the category killers some thought, the gang is really all here and talking a big game. Less talked about is that no one has yet made a nickel of profit streaming.

What does this all mean for broadcasters? As I have opined previously (http://bit.ly/1h6ByWq), streaming will be a potent competitor, even with unbridled competition and without an established business model except perhaps as a loss leader for other businesses. But broadcast radio retains tremendous distribution efficiencies. AM/FM broadcasters streaming established broadcast content probably makes sense for brand extension and to serve listeners, but economically it's hard to argue that this is not trading a 40% margin listener for a subzero one.

Above, all it emphasizes that radio cannot forget about its core broadcast product: it's proving to be a better business even in this hyper-targeted, hyper-competitive world. That means what it always has - great creative programming, meeting the needs of local communities, effective promotion and engagement, super serving advertisers. And for sure it means upgrading the product technically, with HD Radio technology and other means, to deliver a state of the art user experience. Listeners won't tolerate a 1972 look and feel in 2014.

The Internet of Things (IoT)

More broadly, the final important CES theme for broadcasters is what is being called 'The Internet of Things' (to the cool kids, it's 'IoT'). IoT means a lot of things and will be a long time coming, but stated simply, it projects a world where virtually all devices are connected to the internet and share data broadly. Big vision.

With connected sensors and actuators embedded in all sorts of physical objects - from roadways to pacemakers - churning out huge volumes of data for analysis, the world becomes more efficient and automated. Traffic is rerouted, people are told to go to the emergency room, the power grid is optimized, etc. People have joked for years about connected toasters, but that's what IoT envisions, with the resulting data improving our lives. We learned just after CES that Google paid $3.2 billion (!) for Nest, a connected thermostat company. That's a big bet on IoT.

What IoT means for broadcasters is this: in a very short period of time, every device that has an AM/FM tuner, will also have an internet connection. And that has profound competitive implications.

As is often the case, ubiquitous connected devices will bring both threats and opportunities to broadcast radio (http://bit.ly/1epBRXj). The threat is fairly obvious - listeners and advertisers will have additional choices on where to spend their infotainment time and ad dollars in places like car dashboards, where broadcast radio once had a monopoly position. But the opportunity exists to make AM/FM a more interactive medium.

And that's where hybrid radio comes in - pairing the distinct distribution advantages of broadcast with the interactivity that IP brings. There is a lot of activity around this idea and I'll have more to say about it in it in a future piece. As they say, stay tuned.

A Great Broadcaster, an Annual Tradition.

Watch our long time friend and legendary broadcaster Dave Graveline's 'Into Tomorrow' profile of HD Radio Technology from CES.

So as always, CES was an eye opener. I'm proud of the continued rapid HD Radio progress we were able to showcase, and believe it is great news for broadcasters. But the trends toward broad connectivity and a tremendously competitive audio market are also accelerating. Broadcasters must redouble their efforts to keep their hard fought place in the media mix.

Part of that effort must be an upgraded presence at CES, because increasingly that is where the future of radio is being decided - by car and receiver product people. We have been honored to carry the broadcast flag at CES for may years, and we were excited to give the NextRadio folks a presence in our booth. But it's past time for broadcast radio reinforcements to tell AM/FM's story to this critical audience.

HD Radio technology is a key part of that effort, and we are here to help. Call us, it's all we do, all day, every day.

Thanks for reading and let me know what you think: email to thoughts@ibiquity.com. I read, consider and try to respond to all of them.

Bob Struble
Columbia, MD
February 2013

Skeptics Say HD Radio Is Not a Success

Critics remain vocally opposed, particularly when it comes to the AM system

BY LESLIE STIMSON

Bob Savage

Those who criticize HD Radio cite several reasons, including what they consider high equipment costs and licensing fees, lack of equivalent coverage and potential interference to either the host analog station or to neighboring signals.

People contacted for this article scoff at iBiquity Digital's claims that, at 17.5 million receivers sold as of January, the tech developer has reached a tipping point in the market. Though licensing and equipment costs have come down over the years, skeptics don't believe many more broadcasters will flock to convert.

> The problems remain of glitchy firmware, slow support response from manufacturers and the constant headache of aligning the two signals because of encoding delays.
>
> — Bob Savage

Bob Savage, owner of WYSL(AM) in Avon, N.Y., filed a complaint in 2007 against CBS Radio station WBZ(AM), Boston, claiming WBZ's HD Radio signal was interfering with WYSL's FM analog signal and resulting in lost protected nighttime, critical hours and some daytime service in the Rochester suburbs. CBS said WBZ was not interfering with WYSL.

Savage licensed an FM translator in 2010 that now simulcasts WYSL. His views about the digital radio technology haven't changed, for both AM and FM.

Equipment cost alone isn't the main impediment for broadcasters, according to Savage. "The gear is still fearsomely expensive to operate and maintain, particularly so when high-level combining is used for digital and analog signals. The problems remain of glitchy firm-

ware, slow support response from manufacturers and the constant headache of aligning the two signals because of encoding delays."

The digital coverage area is much smaller than that of analog; and most listeners can't hear a difference between the "highly-hyped" digital product and analog, he said. Savage also counters the notion that HD Radio receivers are making inroads, saying that digital receivers have become more plentiful "only in the sense that many car radios now contain processor chips which can decode HD. So people are getting the system without being aware they're getting it. Most couldn't care less, even in the rare instance of 'HD awareness.'"

IBiquity has acknowledged the smaller digital coverage area relative to analog, saying it was the result of being cautious in its power request when it went to the commission for approval of its technology. Eventually the commission allowed FMs to raise their hybrid digital power level, from the original 1 percent of authorized analog effective radiated power up to a maximum of 10 percent of authorized FM analog ERP.

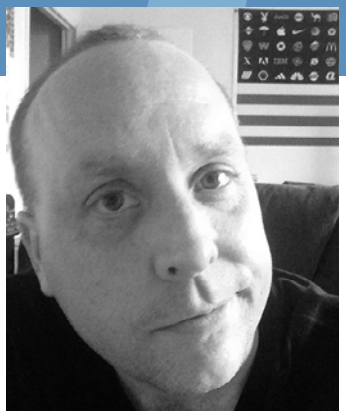
Many stations have raised digital power by some 2 or 3 dB if their transmitter had the headroom to do so, or they wait until they're replacing their unit to do a full increase.

'FUNDAMENTAL DETRIMENTS'

John Anderson is a former radio journalist and now an assistant professor and the director of broadcast journalism in the Department of Television and Radio at Brooklyn College, City University of New York; he recently authored a book, "Radio's Digital Dilemma."

His views are similar to those of Savage. Anderson believes the "fundamental detriments" of the HD Radio system have not "been meaningfully addressed" since the technology was authorized by the FCC.

"The system 'works' but only to a certain degree, and not universally. No extended features of the HD system have any meaningful traction (in the HD space), and many of them, especially datacasting, at best replicate what newer, IP-based content delivery systems already offer as native to their design," Anderson told RW. IBiquity has argued otherwise and says it continually improves the technology.



John Anderson

Anderson acknowledges costs have come down but says the system still has "software-like" licensing fees that many "broadcasters refuse to accept on principle."

He noted that several commenters in the FCC's AM revitalization docket suggested testing Digital Radio Mondiale as a potential digital radio technology for the United States. Anderson said many of those "cited the open nature of the [DRM] system more than anything else. Were iBiquity to abandon broadcaster-licensing fees, or cap them to some nominal one-time payment, it would see an immediate positive response within the industry. At this point, what is there to lose?"

Several people contacted for this piece pointed to HD Radio's problems in AM hybrid mode.

Toronto-based broadcast consultant Barry McLarnon (who did not respond to a query) keeps an anecdotal count of how many AMs he believes have turned off HD Radio. On his website, he estimates out of some 300 AMs licensed for hybrid AM digital, 172 actually are doing so, with most of those operating in the daytime and some 58 operating both day and night. His site is *topazdesigns.com/iboc/station-list.html.*

'BREATHING ROOM'

IBiquity has told the commission it believes authorization of all-digital mode offers AM broadcasters the best long-term solution to the problems that have caused listeners to turn to alternative forms of programming and entertainment.

"[T]he dramatic audio quality upgrade the digital signal enables will address many of the concerns about analog AM audio. … [T]he all-digital system increases the power levels of the OFDM carriers. This enhances the range of the digital signal and reduces susceptibility to power line interference, further improving the listening experience."

The company also wrote: "There are analog AM stations today that have few existing listen-

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ers but cannot convert to digital due to interference constraints. If these stations were allowed to convert to all-digital operations, they could enjoy the upgrade in audio quality digital can offer and develop a more commercially viable path to success."

However, the Broadcast Warning Working Group, a group comprising mostly engineers involved in alerting, thinks it may be time "for an honest and rigorous revisiting of IBOC for AM to see if turning it off can help revitalize this troubled band by giving amplitude modulation signals 'breathing room.'"

The BWWG wrote to the commission regarding AM: "While listeners may perceive an apparent enhancement of quality from the digital signal, the realities of in-car AM listening frequently negate that advantage when IBOC car radios apply the 'blend' mode whenever a digital signal drops out. Further, digital transmission cannot magically solve the noise floor problem. When the noise floor increases beyond a certain level, the integrity of digital transmissions is impaired to the point where the signal suddenly goes away."

Engineer Richard Rudman describes himself as "not a fan" of AM HD Radio. Though he is a member of the BWWG, he stressed that he was speaking only for himself for this article.

Rudman said on a recent drive into Los Angeles from Ventura County, he tuned in KNX(AM) on the "101" highway.

"On that drive, KNX went in and out of 'blend' mode countless times. Each time that happened there was a perceptible and, to me, disconcerting change in audio quality. For whatever reason, in my 2013 Ford F-150, I found the analog blend clearer and easier to hear while driving than the HD product," Rudman said. "In fairness, their HD audio quality would probably sound OK had I been listening on a radio in a home or office, and the number of blend transitions would not be an issue."

He continued, "I fully understand why the 'blend' mode had to be adopted. HD is either there or it is not; the ultimate binary decision. However, for AM, and for me, HD does not work. Give me properly processed amplitude modulation set for emissions adhering to the NRSC mask, and I am happy. AM radio is first and foremost a mobile content delivery system. It isn't call it 'AM drive' for nothing, and 'AM' in that sense does not stand for amplitude modulation."

> For AM, and for me,
> HD does not work.
> — Richard Rudman

John Anderson believes the radio industry should be discussing the "difficult" question "about whether or not the HD system actually represents the natural end-state for digital broadcasting in the United States. If it is, then some fundamental revisions to the ground rules governing the design and operation of the technology should be considered in order to make improvements and promote its uptake."

Sam Brown is a radio and telecom professional in the Washington area and a former AM station owner. He filed AM revitalization comments to the commission as an individual.

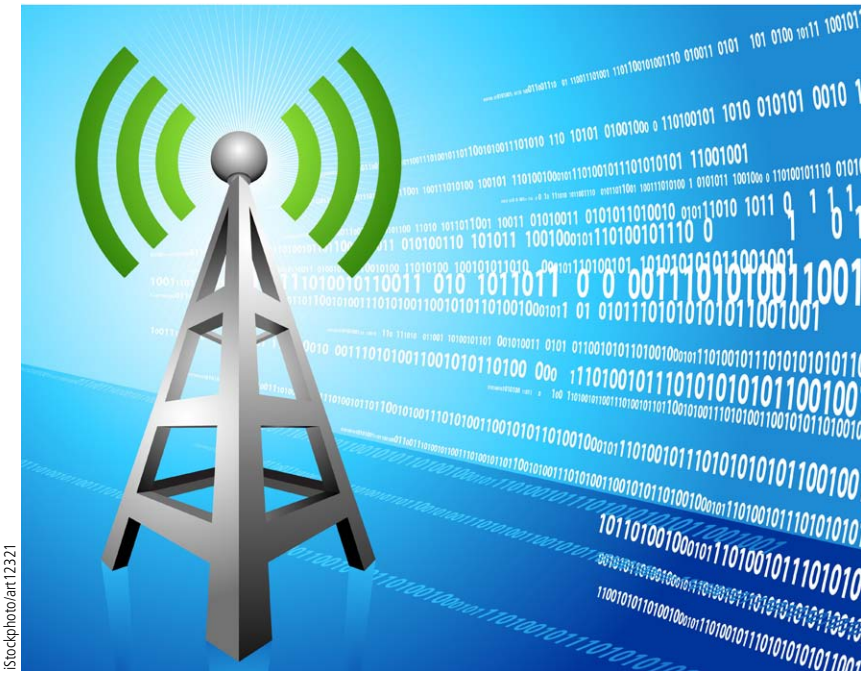
All-digital AM operation should continue to be tested and encouraged if it works, he wrote; but he recommends eliminating hybrid IBOC AM: "It is a 'clear failure,' as the coverage is very limited, the interference with adjacent- and second-adjacent stations is substantial, and the switching back and forth between digital and analog audio bandwidth and fidelity makes it virtually unlistenable." ●

Translators and Data: The Changing HD Radio Landscape

From Analog Simulcast to Digital Original

BY RICK GREENHUT

The author is director of U.S. Broadcast Sales for iBiquity Digital Corp. and HD Radio.



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One of the comments I hear all the time from broadcasters is that while it's nice that all automakers are now including HD Radio Technology in almost 200 different vehicles, they still have listeners who don't have home or car digital receivers. "How can I monetize my HD2 channel if not all my listeners can even hear it?" It turns out that a plain vanilla analog translator combined with HD Radio Technology can allow you to use that analog signal to help you move into tomorrow's digital world while monetizing that transition.

The Spring 2013 Nielsen Audio Nationwide data counted almost 5 million listeners to just HD Radio multicast channels (HD2/HD3/HD4) alone, not counting their main channel audio. Well, at least some of that listening was actually to plain ol' analog broadcasting, via the increasingly popular and profitable HD Radio-On-Translator play.

Simply put, a station puts a format either complementary to or completely different from their main channel on their HD2 or HD3 channel and simulcasts it on an analog translator, in effect getting another unique FM signal in the market for a fraction of the cost of a new station.

This is the perfect venue for specialty formats that might not be economically viable for your main channel. Think classical, jazz, foreign language, alternative etc. — from a sales point of view, formats with a small but loyal audience that could be *very* attractive to niche advertisers specializing in those same markets. One savvy marketer has his salespeople refer to them simply as "Metro" stations. If your local dry cleaner has three stores all clustered within the coverage area of your translator signal, it could well be the most efficient buy in the market for that business.

In effect, it's like getting another unique analog FM signal for a tiny fraction of the cost of a new station. And remember that while translators are limited by the FCC to 250 watts power, there is no limitation to the height of the antenna. Get that translator's antenna up high enough, and you can have a signal that seriously rivals many Class A stations for just the cost of the HD Radio upgrade.

It's the best of both worlds: Stations get instant incremental revenue from selling an analog signal that couldn't carry separate content without an HD2 to feed it, and they stake out

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the digital high ground, establishing their digital broadcast presence in a marketplace that now adds HD Radio receivers in cars at the rate of one every 4.5 seconds. The HD2 signal gets established in the market on the analog translator, and as more listeners buy cars with HD Radio receivers, listening will move from the analog simulcast to the digital original.

Using translators in this way is like training wheels on a bike, allowing a seamless transition from analog to digital while bringing your listeners along for the ride.

What if your station or group doesn't own translators? There are plenty of companies who own multiple translators (think religious broadcasters) who may be willing to lease or sell one that covers an area that could be critical to the success of your HD Radio-On-Translator station

It's instant revenue, and stations in markets like Decatur, Ill., and Columbus, Ga. (not to mention Atlanta, Denver and Cincinnati) have been generating audience while at the same time creating new advertising dollars. It's not a zero-sum game — more channels equals more opportunities to sell new advertisers on radio's pinpoint targeting ability, low cost and high efficiency in reaching key target demographics. There are more than 150 HD2, HD3 and HD4 channels being simulcast on analog translators nationwide as we speak. And you don't need to be one of the "big guys" to play; many standalone FMs with one translator are successfully reaching new audiences (and new advertisers!). In fact, more than half of those are standalone stations or part of a group owning less than three radio properties.

Since 2012, a rapidly growing percentage of all digital upgrades have involved an HD Radio-on-Translator initiative, often in small and mid-sized markets. By getting the equivalent of a new analog station with the HD2 simulcast on a translator, the immediate ROI on the HD Radio upgrade is compelling. And with the cost of HD Radio-specific equipment continuing to come down, the cost to upgrade continues to diminish. If you already want or need a new transmitter, going digital has never been cheaper.

And for those who say "I don't want to compete with my own station," it now comes down to "Would you rather someone else did?" Why share your P1s with your competition (or Pandora, TuneIn etc.) when you could be sharing them with your own HD2 channel on an analog translator? Audience gained, whether from your other signal or at the expense of the competition, is still audience available for you to sell as part of a combo package, while at the same time making the competition less efficient. Why suffer *tune-out* when you have the opportunity to benefit from *tune-over*?

> Get that translator's antenna up high enough, and you can have a signal that seriously rivals many Class A stations for just the cost of the HD Radio upgrade.

As my first boss described his local market AM/FM combo revenues long ago, "As long as it goes to one of my stations, I'm happy. At the end of the day, it all goes into the same pocket." That same rough-and-ready wisdom is still true today for digital HD Radio channels.

Here in the Washington, D.C., area, a great example is CBS bringing back the legacy

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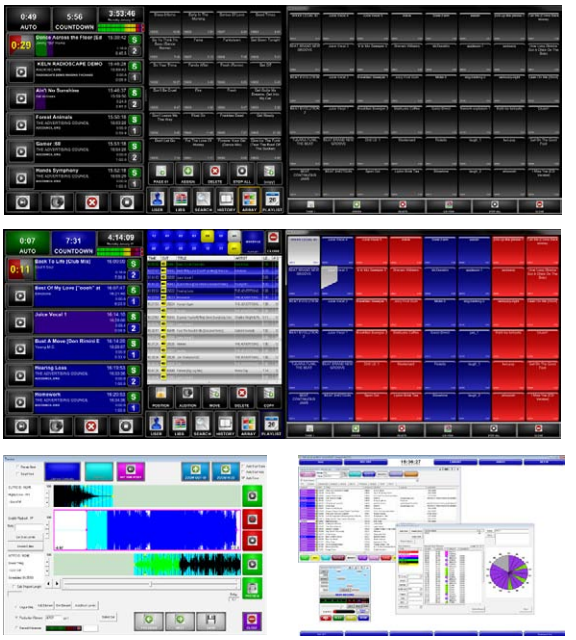
Automate Your HD Channels with DAD.

Introducing the all new DAD, the latest generation of the world's most powerful and flexible radio automation system. DAD gives you all the tools you need to make your broadcasts sound better, make running your station easier and give you unrivaled power and control. DAD is used at radio facilities all over the world, large and small, 24/7.

From manual, to live assist, to fully automated and everything in between, stations use DAD to create their sound for their market in their way. Use DAD to automate HD channels or even a webstream.

The all new DAD is the latest in a 25 year line of world class automation software suites backed by ENCO's industry leading service and support. DAD will help you reduce costs, make the most of your time and grow with you into the future.



Key Benefits

USER FRIENDLY: Award winning Presenter interface for live assist playout. Fast paced changes easily made on the fly. Customizable module based architecture.

POWERFUL ENGINE: Build custom commands with logic to control or automate just about anything.

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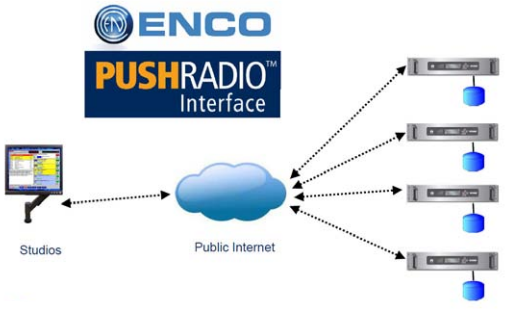
CENTRALIZED CONTENT: Share content across multiple stations. Easily break away for local commercials, liners and jingles and rejoin seamlessly.

EASY INTEGRATION: Seamlessly integrate into any environment. DAD supports all modern audio routing and console systems, traffic/billing suites, music scheduling software suites, even Nautel transmitters via the ENCO Push Radio™ Interface.



REMOTE VOICETRACK-ING: Voicetrack into your playlists from anywhere in the world via Web Browser, iPad, or Windows PC. No VPN required.

WORLD CLASS SERVICE : ENCO's only focus for the last 25 years is your automation and playout needs. ENCO's responsive client support and software quality are second to none.

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No two DAD installations are alike. In fact, many sites use DAD in completely different ways in different studios. That's just one of the major benefits of using DAD; it's incredibly flexible to meet your needs.

DAD is a modular set of tools designed to allow you to choose how you want to install, run, operate and integrate it every day. No longer will you be constrained by the automation system sitting at the core of your operation. Let DAD free you up to create radio how you want with the resources you have on hand.

VIRTUALIZE YOUR AUTOMATION SYSTEM

Increase reliability, reduce operating expenses and gain flexibility and scalability with the all new ENCO1.

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LANDSCAPE, continued from page 16

alternative rocker WHFS, via an HD2/translator simulcast on Baltimore's WWMX. In Decatur, Ill., Cromwell Broadcasting surveyed their marketplace and determined there was a market for an R&B format, and took the HD2 channel of WYDS, programmed it with that audience in mind and has delivered substantial ratings performance ever since.

What would *you* do with the equivalent of another Class A signal in your market?

The trick here is to *not* think of this as a complicated technology play, but a new station programming decision. Just fill in the blank: "If I had a new Class A station in this market, I'd program _____". That's it.

One station outside the top 100 markets took that approach, and they shared their math with us. It tells a compelling story:

Move antenna closer to home market:	**$50,000**
New transmitter/HD Radio-specific equipment:	**$62,000**
Purchase of additional local translators:	**$95,000**
TOTAL INVESTED:	**$207,000**
New revenue generated via HD2/HD3 simulcasts on analog translators in first 20 months of operation:	**$408,000**

This station had the luxury of multiple translators for both HD2 and HD3 channels, so they got, in effect, several new analog radio stations for their HD Radio upgrade. The net net here is they produced a 197 percent return on investment in under 20 months! Know of anywhere else in radio today that people are seeing that kind of explosive revenue growth?

LEASE YOUR BANDWIDTH

But translators are not the only way stations are generating new dollars from HD Radio Technology.

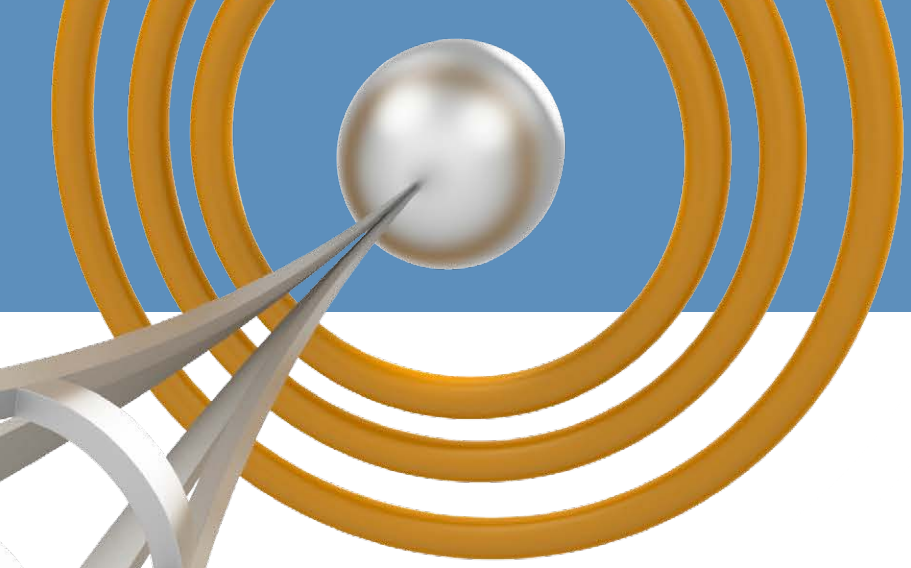
Oddly, one of the biggest HD Radio advantages is one that is totally invisible to programmers and listeners alike, but much-loved by station managers and their corporate accountants. It's the revenue stream that comes from leasing bandwidth to traffic service providers. No audio at all, just bits and bytes, sending traffic updates in the background to navigation units made by companies like Garmin and in factory-installed navigation units offered by automakers like Mitsubishi, Lexus and Toyota, all free of charge to the consumer.

There are basically two players in this space at present: Clear Channel, using Clear Channel stations almost exclusively, and the Broadcaster Traffic Consortium, or BTC, comprising various groups like Emmis, CBS, Beasley, Hubbard, Cumulus, Entercom, Cox, Radio One, Greater Media, Bonneville and NPR among others.

It's a simple and mutually beneficial transaction. Stations lease a traffic provider a small portion of their digital bandwidth to carry traffic and weather data to navigation units in various makes and models of cars. In exchange, the traffic provider pays those stations on a revenue-sharing basis, using the dollars generated by selling advertising, making those services free to consumers and a moneymaker for the stations.

So if at the next broadcaster convention you hear someone say "No one is making money from HD Radio Technology," don't be surprised if several broadcasters around you smile knowingly. Between HD Radio-on-Translator, traffic data and plain ordinary spot sales on digital channels, BIA/Kelsey reported over $13 million in just HD Radio-on-Translator revenues alone in 2012. Add to that the 650 or so stations getting a quarterly check from a traffic service provider, the 100 or so who lease an HD2 or HD3 channel to a niche or foreign-language broadcaster for cash and those countless others who simply sell spots in the time-honored radio tradition, and there are *a lot* of stations realizing significant revenues from their HD Radio upgrade.

Let's not forget that radio is currently the *only* medium consumers use that is not fully digital. But using HD Radio Technology and an analog translator can serve to help you move into tomorrow's digital world, and, most importantly, help bring your current and future listeners along for the ride. ●



The HD Radio Rollout: After 10 Years

Three proponents offer their takes on what a prospective digital broadcaster should know

Jeff Detweiler

HD Radio marks its 10th anniversary this year as U.S. radio's digital delivery platform, if we date it to the Second Notice of Proposed Rulemaking by which the FCC regulated digital radio. Twelve years have passed since the commission authorized commencement of HD Radio broadcasts.

Its proponents note that virtually all auto manufacturers now are supplying HD Radio receivers in one or more new car models, and believe that the format will come to be expected by consumers, much as RDS has over time. However the majority of radio stations have as yet not converted their transmission systems.

What should radio stations that have yet to make the investment know about it? Radio World Technical Advisor Tom McGinley conducted a virtual interview with three of the major players in the rollout about the state of HD Radio and how it has evolved.

Jeff Detweiler is executive director of broadcast engineering for HD Radio developer iBiquity Digital Corp. Jeff Littlejohn is executive vice president of engineering and systems integration for Clear Channel Media + Entertainment, the nation's largest radio broadcaster, and an iBiquity board member; he is also recipient of the 2014 NAB Radio Engineering Achievement Award. Glynn Walden is CBS Radio senior vice president of engineering and co-founder of the broadcaster coalition that invented HD Radio, USADR, now called iBiquity Digital.

***RW:** Early HD Radio technology adopters ignored the chicken-and-egg reality and knew there would be few listeners and receivers in the beginning. That has been slowly changing for the better. What are the current estimates of the total number of HD Radios now in use by U.S. consumers?*

Detweiler: We believe there will be continued strong growth of receiver sales. With over 17.5 million HD Radio receivers currently in the marketplace, sales of HD Radio receivers have doubled this past year. Over 5 million new HD Radio-equipped cars shipped in calendar 2013 alone. All major automobile manufacturers now offer HD Radio as standard equipment in at least one or more models. In the U.S., an HD Radio-equipped car is sold every 4.5 seconds.

***RW:** The vast majority of HD Radio receivers being sold are car radios. What about portables, component tuners, tabletops and smartphone HD radios?*

Detweiler: There has been an overall reduction in the market for non-auto radio receiver sales, so it is understandable that there has not been a big increase in this area. Several portable and desktop models are available from $49 to $149. Some were recently introduced at the CES show in January. Of particular interest to broadcasters is the new Insignia Narrator ITR-1, a desktop receiver that supports Artist Experience.

Jeff Littlejohn

Glynn Walden

***RW:** How many or what percentage of your company's AM and FM stations have added HD services with supplemental channels? If there are some not yet equipped, how soon will HD be added?*

Littlejohn: At Clear Channel (CCM+E), we have converted virtually all of our FM stations to HD in medium and large markets (almost 400 stations). We made this investment very early on and really have led the industry in adopting HD. Overall, about two-thirds of our stations operate with HD Radio technology.

Walden: Virtually all of our CBS Radio stations are transmitting an HD signal, with most of the remaining scheduled to be converted in 2014. *[CBS Radio owns approximately 126 stations, according to its website.]*

***RW:** In general, to what extent has your company developed services and alternate formats on the supplemental HD2, -3 and -4 channels? What kinds of revenue-producing solutions seem to work for those?*

Littlejohn: We have HD2 on most of our CCM+E FM HD stations. In some of our largest markets we have added HD3 services to meet demand. With more HD receivers available, and with HD2/HD3-to-FM analog translators, there has been growing demand for these additional services. We have successfully launched new formats and brands to large and medium markets. Our HD data service Total Traffic + Weather Network has been successful and provides a very tangible benefit to drivers.

Walden: CBS Radio has made all of our AM stations available on HD multicast channels. We've also created a number of niche specialty formats, as well as developed brand extensions of our most popular stations. Examples include KROQ-HD 2 "ROQ of the '80s," KXTE-HD 2 "SIN 107.5" (EDM, electronics dance music) and WOMC-HD3 "The Boulevard" featuring nothing but music from Detroit artists.

***RW:** The Artist Experience, iTunes Tagging and real-time traffic information services are enhancements for HD. Tell us about those and other new features that have been added recently.*

Detweiler: Artist Experience, iTunes Tagging and Real-Time Traffic allowed HD Radio Technology to differentiate itself from other digital services. Stations can display station logo or full song/album art or related artist images or generate revenue through visual advertisements. Over 600 stations now support Artist Experience, which translates to 1,100+ program channels when you include multicasts.

There are two national networks providing traffic services with more than 110 markets covered by both service providers: Honda and Mitsubishi using the Here traffic network from Nokia; Toyota, Lexus and Mazda using data from

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"Of particular interest to broadcasters is the new Insignia Narrator ITR-1, a desktop receiver that supports Artist Experience," Jeff Detweiler said.

10 YEARS, continued from page 21

Clear Channel Total Traffic Network. These HD Radio broadcasts provide real-time traffic updates, weather and traveler information.

New for 2014 is HD Emergency Alerts, a CAP-compliant service, for delivering emergency notification via HD Radio audio, text and image formats.

Littlejohn: CCM+E developed a standardized platform for our HD transmissions to have a consistent experience from station to station and market to market. It also helps us to centrally manage and monitor our HD transmissions. All of our FM HD stations employ PSD Title and Artist with iTunes Tagging on music formats, Artist Experience with Station Logo, and carry our Total Traffic + Weather Network data services, which serve factory installed infotainment systems in select Toyota, Lexus and Mazda vehicles. We offer HD2 and sometimes HD3 channels depending on market conditions.

We are getting great feedback regarding our Artist Experience and Station logo service, as well as our Total Traffic + Weather Network data services, which won the 2013 Telematics Update award for best navigation solution.

Walden: All of our music-programmed HD-equipped CBS stations are delivering Artist Experience, and some of the talk stations have added the feature.

***RW:** Has the proprietary HDC data compression codec changed or been improved in any way since the original standard was adopted?*

Detweiler: iBiquity maintains an ongoing program of code improvement which includes the HDC codec. Over the years, parametric stereo and optimization for lower bit-rate multicast channels have been added to the HDC codec feature set.

***RW:** In what other ways has iBiquity's software that runs the HD transmission equipment as well as the HD receivers been improved in recent years?*

Detweiler: Over recent years iBiquity has enabled broadcast equipment manufacturers to take greater control of the HD Radio software elements. This led to embedded designs that offered greater performance at significantly reduced cost. Manufacturers continue to independently innovate, providing products that have their own unique branding.

On the receiver side of the equation, cost and power reduction continue to be a common theme. The addition of Artist Experience and Traffic and Information Services have fostered the development of information-rich color displays in automotive receivers. Recently we developed new receiver technology that takes advantage of multiple antennas in the vehicle and improves signal reception. The technology is being evaluated by several OEMs for future model years.

***RW:** The first generation of IBOC transmission equipment (exciters, importers and exporters) was a bit challenging to set up and keep running reliably for many engineers. The equipment vendors have made significant improvements to their offerings over the years. What can you tell us about that evolution and the current generation of IBOC gear being sold and installed?*

Detweiler: HD Radio technology follows a typical new technology development curve from generation to generation. The decision to launch on a PC platform was appropriate due to the flexibility it offered. With regard to the reliability, we have over 100 of our own that run 24/7 in our development labs. Many stations still use first-generation systems 12 years after their introduction. However, as you suggest, they require an intimate knowledge of the technology to setup and maintain.

A significant improvement in the system design was achieved when we consolidated the HD Radio software function into a core piece of software and opened up the interface for the audio and system control to the manufac-

> Artist Experience, iTunes Tagging and Real-Time Traffic allowed HD Radio Technology to differentiate itself from other digital services.
>
> — Jeff Detweiler

turers. This allowed products to have the manufacturer's traditional look and feel. This evolution also enabled the HD Radio software to reside on a Digital Signal Processing (DSP) Core, a design model more familiar to broadcast engineers

The second major improvement was separating the Exciter into two functional blocks called the Exciter Engine or "Exgine" and the "Exporter." The Exgine, which resides at the transmitter site, generates the Layer 1 OFDM modulation. The Exporter, which is typically installed at the studio end, is the final multiplexer for the HD1, Multicast (HD2, HD3, etc.) and data services. This separation of system function enables the topology to take advantage of the compressed nature of the encoded audio and data content, significantly reducing the studio-to-transmitter link (STL) data burden. The embedded Exporter and Exgine offered faster boot times, reduced complexity, improved configuration and reduced the hardware costs by almost 50 percent.

Walden: The first-generation equipment was unreliable and it created a great deal of frustration; however, updates to those older systems significantly improved the reliability. The current generation of HD equipment is far more reliable. However in those limited cases where problems do occur, they can be very difficult to track down and resolve.

***RW:** An IBOC digital power increase of up to –14 dBc was enacted in 2010 and then up to –10 dBc in 2011. These increases have improved HD coverage and reliability for the stations that have implemented them. How would you characterize those improvements as a function of incremental power increases from the original –20 dBc?*

Detweiler: At –14 dBc the digital signal replicates the analog free-space coverage. At –10 dBc indoor reception is improved.

Littlejohn: After the power increase was approved, CCM+E internally evaluated all of our stations and increased those that had the headroom with existing equipment. Also, over the years at stations that had a need for new transmission equipment (i.e., site improvements, upgrades, major moves or changes) we generally have improved HD power as well and achieve –14 dBc where it is economically feasible.

We have found increases in the –17 dBc range to only provide slight benefits in the field. As one might expect, the most tangible benefits we have found are at –10 dBc power level. We are presenting some of our own research and findings of elevated power operation at the upcoming NAB Broadcast Engineering Conference in April.

Walden: Many of our CBS stations are now operating at either –14 or –10 dBc and there are more scheduled for conversion in the first half of 2014. The power increase leads to nearly eliminating the listener calls about not being able to receive the HD signal, and my own observation is the –14 dBc signal nearly matches the coverage of the analog signal.

***RW:** How would an engineer go about deciding the maximum allowable and the most appropriate HD power level for a given station? Is elevated noise interference to the analog host a valid concern for the highest levels of power increase?*

Detweiler: A station should always strive to use the maximum authorized facilities to ensure consistent coverage. At –10 dBc, broadcast implementations that maintain consistent analog and digital power ratios have proven to be compatible with the host analog signal. Regarding

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increased noise levels in some receivers, I have not heard of any complaints. The issue was only observed in the lab on a small subset of older ('70s vintage) wideband HiFi receivers and only in the extended hybrid modes. Beyond that, we are not aware the NRSC has seen any evidence presented for evaluation. I believe John Kean [of NPR Labs] was thorough in his modeling.

Littlejohn: I'm not aware of any interference complaints for our FM IBOC operations. Research done prior to allowing the digital power increase indicated that the FM band was compatible with this increase in almost all cases and that seems to have been proven out.

Walden: We attempt to equip all of our CBS stations to operate at –10 dBc as ultimately all but a limited number of stations should be able to operate at –10 dBc.

***RW:** Is asymmetrical HD Radio transmission a practical and viable choice for stations? When is it appropriate and what are its limitations?*

Detweiler: Asymmetric transmission is appropriate for maximizing the station coverage. The maximum asymmetry may not exceed 4 dBc and any individual sideband may only vary between –13 and –17 dBc.

Littlejohn: We have done lab testing with asymmetrical, but have not done any field testing. Our other colleagues in the industry have done some field trials and have had success with it. We encourage further research in this area and if it is proven to be a benefit, we would like to see this authorized for any station to employ. We think asymmetrical transmission offers good promise to help reduce any interference issues while maximizing coverage.

Walden: We have not done any asymmetrical stations yet at CBS.

RW: What are the current FM HD/analog combining techniques being used and how do you anticipate new designs will improve efficiency and performance going forward?

Detweiler: For transmission at elevated power (–10 to –14 dBc), the most efficient methods employ separate radiating elements (dual antennas or free space combining using opposite polarization). However, this method requires accurate modeling to maintain host compatibility and typically prejudices the digital coverage due to lower placement on the tower. Dual-input antennas are limited in their ability to provide sufficient isolation and may require a separate isolator to achieve mask compliance, but offer improved digital/analog coverage parity. The method which provides the most consistent coverage is the use of common amplification with common antenna.

Littlejohn: We have stations using all techniques at CCM+E. There have been a lot of advancements in low-level combining products in the past few years. Many of our latest implementations are low-level. Today, we generally use a mix of low-level, interleaved antennas, back-fed combiners or separate HD antennas for stations depending on various factors (cost, site restrictions, etc.).

Walden: Every installation needs to be evaluated as to the best method for combining signals; all of the methods have been used at CBS.

***RW:** What is your current thinking about AM HD Radio right now and what special thoughts might you have for AM stations about the technology? Is the hybrid mode still worth doing?*

Detweiler: Many stations experience success with hybrid AM digital. AM stations continue to upgrade to HD and share very positive results.

One important note is the addition of the Core Only AM mode (officially known as the Reduced Digital Bandwidth Configuration for MA1). In this configuration the Secondary and Tertiary carriers are turned off, allowing the analog signal to be transmitted at nearly the

full 10 kHz NRSC bandwidth (9.6 kHz) with full modulation. Core Only also eliminates any issue of crosstalk from digital to analog on stations with less than desirable antenna systems.

If your station experienced any of these concerns, you should contact your exciter manufacturer for instructions on using the Core Only configuration.

Littlejohn: The FCC is accepting comments on the AM revitalization NPRM. There are a number of ideas and quick fixes being proposed. However, the long-term solution for the AM band will need to include a change in modulation scheme to digital or a relocating of the band to a more noise-free environment. We are encouraged by the AM all-digital test results and fully support moving forward with more validation.

Walden: We are using the AM hybrid mode on our CBS AMs as it provides a high-quality service to the rapidly increasing number of HD radios, and it is important to ensure that digital radios are installed in vehicles making it possible to move to all-digital AM. Furthermore, analog reception on an HD AM radio is dramatically improved as additional interference and noise reduction technology comes free in an HD chip that is not economically practical in conventional analog receivers.

***RW:** How are the AM all-digital field tests coming along and which stations are participating in those tests?*

Detweiler: NAB Labs is testing AM all-digital (MA3) using diverse transmission facilities and locations. Preliminary results shared with iBiquity look very promising.

Littlejohn: NAB Labs has been conducting field testing along with iBiquity, and we are encouraged by the initial results. David Layer will be presenting his initial findings at the NAB Show in April.

Walden: We have been participating and we look forward to the testing program to build on the results we achieved in Charlotte.

> CCM+E developed a standardized platform for our HD transmissions to have a consistent experience from station to station and market to market. It also helps us to centrally manage and monitor our HD transmissions.
>
> — Jeff Littlejohn

***RW:** The hybrid modes of AM HD (MA1) occupy about 30 kHz of channel bandwidth whereas the all-digital MA3 modes only occupy about 20 kHz, the same as present analog. All-digital would significantly reduce the adjacent-channel interference issues and could put to rest many of the complaints and bad rep that AM HD has received. How do you see that playing out as stations decide to convert to all-digital in the future?*

Detweiler: All-digital mode MA3 holds great promise for AM broadcasters. Increased digital coverage, a signal profile that fits the signal raster and the potential for data services are compelling reasons to give it a thorough evaluation. NAB Labs' MA3 testing is on the cutting edge of this effort and will certainly provide useful insights. Preliminary information shared by those involved with testing indicates the all-digital was working well. If these results are consistent for the majority of stations, that would be very encouraging news.

Walden: The 30 kHz all-digital system was designed to operate with adjacent-channel all-digital interferers at 0 dB d/u, so potentially in

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an all-digital AM transmission system first-adjacent channel interference is expected to be far less of a problem than with analog transmissions. With the current enhancements to the iBiquity codec, it is no longer necessary to have the additional enhanced carriers to deliver FM stereo quality, which allows a possible AM HD operation within 20 kHz. Many of the broadcasters that could most benefit from all-digital may want to use the previously used enhanced carriers to deliver a second channel. In the early days of HD Radio development, I constantly heard from smaller broadcasters desiring to carry local events such as high school sports without interrupting their main channel.

***RW:** There are still some concerns about adjacent-channel interference caused by HD Radio transmissions. While that is certainly valid for the AM hybrid mode, what has been the real-world experience for FM stations after 10 years of HD operations in most all significant-sized markets?*

Detweiler: To date, no credible interference complaint for AM or FM has been received by the FCC on properly spaced stations. For FM, even at elevated power levels, this has not been a problem.

Littlejohn: We are not aware of any interference issues with FM HD.

Walden: There have been no verifiable interference situations with FM. In the case of AM there are situations where interference has occurred at night. The ones that I have evaluated have resulted from significantly weaker groundwave signal levels than are allowed by the allocation.

***RW:** Much of the resistance to adding HD Radio transmission has been about the upfront costs, without a compelling business plan to cover those reasonably soon and make it sustainable. What does it cost to license HD and the supplemental channels now, and what are the specifics of the payment plans available?*

Detweiler: We have simplified our U.S. domestic rate, so our current one-time license fee for a commercial FM station is now just $10,000. Stations have the option to pay that as a lump sum, or use the payment plan. The payment plan allows them to pay just $2,500 down, then spread the remaining $7,500 over five years with payments of $125 per month. There is no interest fee or carrying charge involved. This fee licenses the main channel in perpetuity. Of course, the digital simulcast of the analog signal automatically becomes the HD1 channel.

The only ongoing cost is the multicast fee when the station adds HD2, HD3 or HD4 channels and a fee for datacasting if the station adds these services.

Each multicast channel costs the greater of either $1,000 per year or 3 percent of the incremental net revenue generated solely by that channel. To put it another way, until that multicast channel generates over $33,333 annually on its own, all the station would pay is the $1,000 minimum, billed at $250/quarter. And rebroadcast of HD2, HD3 and/or HD4 channels on analog or digital translators does not incur any additional charges beyond the standard multicast fee noted above.

Commercial AM stations pay $7,500, with $1,500 down and the same 5-year no-interest payment option. This comes to $100/month. Our technology does not currently support multicasting on AM, so there are no additional fees.

For noncommercial stations, the fee is $5,000. That is payable with a $2,000 down payment, then the remaining $3,000 can be spread over five years with payments of $50 per month. Again, there is no interest fee or carrying charge involved. Multicast and data fees are $500/year per additional channel vs. the $1,000/year for commercial stations. LPFMs are the same cost, but there are no recurring multicast or data fees.

Again, this rate structure is only for domestic U.S.-licensed stations.

RW: What common HD Radio technology questions does iBiquity encounter, and what other concerns should a station be thinking about? What are the best sources of information on implementing HD Radio?

Detweiler: In my opinion, the best source of information is typically the transmission equipment manufacturers who deal with the day-to-day installation issues and posses the latest information about their products.

The most common questions relate to diversity delay time alignment, which typically surface from word clock synchronization problems. Most recently, questions about implementing Artist Experience and HD Emergency Alerts have been more commonplace.

***RW:** The mobile device market is slowly adding FM radio to smartphones, but there appears to be resistance from some carriers and manufacturers. How important is this market for FM analog and HD Radio and your company? Should including HD Radio in such devices be an important addition and priority, or will direct Internet streaming of radio's content on such devices be adequate for consumers?*

Detweiler: Streaming has its place and should be supported but due to the high costs of bandwidth, infrastructure and royalties, should always be secondary to the over-the-air signal. Broadcasters must work to make their programming available on as many platforms as possible to reach the consumers. Broadcasters and consumers should always seek out the least expensive option for delivery of programming and right now that is over-the-air, either analog or digital. The cost of integrating HD Radio technology into portable devices has been dropping rapidly, and the explosion of new programming (over 1,400 new multicast channels) means that broadcast radio is better positioned than ever to offer a wide variety of programming, free to the consumer and with the low operating cost of broadcast distribution.

Littlejohn: We are encouraged by the adoption of FM in smartphones. We think this space is evolving, and we believe that the carriers should continue to unlock the FM chipset in phones. Insofar as getting HD in phones we like the idea, however at this point economics and design limitations keep us focused on analog FM for now. Of course, our iHeartRadio App also allows listeners to stream our stations onto any smartphone.

> We are using the AM hybrid mode on our CBS AMs as it provides a high-quality service to the rapidly increasing number of HD radios, and it is important to ensure that digital radios are installed in vehicles making it possible to move to all-digital AM.
>
> — Glynn Walden

Walden: The smartphone is the new "don't leave home without it" device, and we want our stations to be available on them. The cellular data usage is increasing and bandwidth is being squeezed, especially in metropolitan areas, with streaming being an incredibly inefficient use of the wireless spectrum. While current streaming of audio does not generally overload the wireless system, the cellular spectrum does not have enough capacity, nor will it ever, to support all radio listening. Listening to over-the-air radio via FM chips will avoid an overload of the wireless system. The addition of HD Radio to the cell phone allows for more programs, especially AM multicasts, to be delivered via the FM band, further reducing cellular congestion. Let us not forget that when our listener uses an FM-equipped cell phone they are listening to radio without paying a fee. ●

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What Are My HD Radio Upgrade Options?

This IBOC Power Allowance Calculator for U.S. FM stations can help

BY JOHN KEAN

The author is senior technologist of NPR Labs.

As HD Radio grows in interest to consumers, more broadcasters are considering an increase to their digital transmission power as authorized by the FCC.

In January 2010 the FCC released an Order in MM Docket 99-325 permitting up to a 10-fold increase in digital power in certain cases, and a four-fold "blanket increase" for any full-service station upon notification. To help stations determine their upgrade options, NPR Labs developed an online IBOC Power Allowance Calculator with funding support from Nautel Ltd. The background of the FCC's power increase, the calculator application and some examples are discussed below.

Background

The originally-authorized power level of HD Radio (IBOC) is 1 percent, or –20 dBc relative to the analog host FM power. As broadcasters began to install and use IBOC, it became apparent that digital coverage fell short of FM host's analog service, particularly for indoor and portable coverage. Although IBOC receivers were designed to switch back, or "blend" to the analog service when digital reception failed, this tended to happen with annoying frequency within the station's authorized service area, and all ancillary data services, such as program and artist information, disappeared as well. Work

To estimate the allowable HD Radio power between the blanket level of –14 dBc and the maximum IBOC power of –10 dBc, the calculator must compute the field ratio of the two stations toward any point on the 60 dBu contour of each protected station.

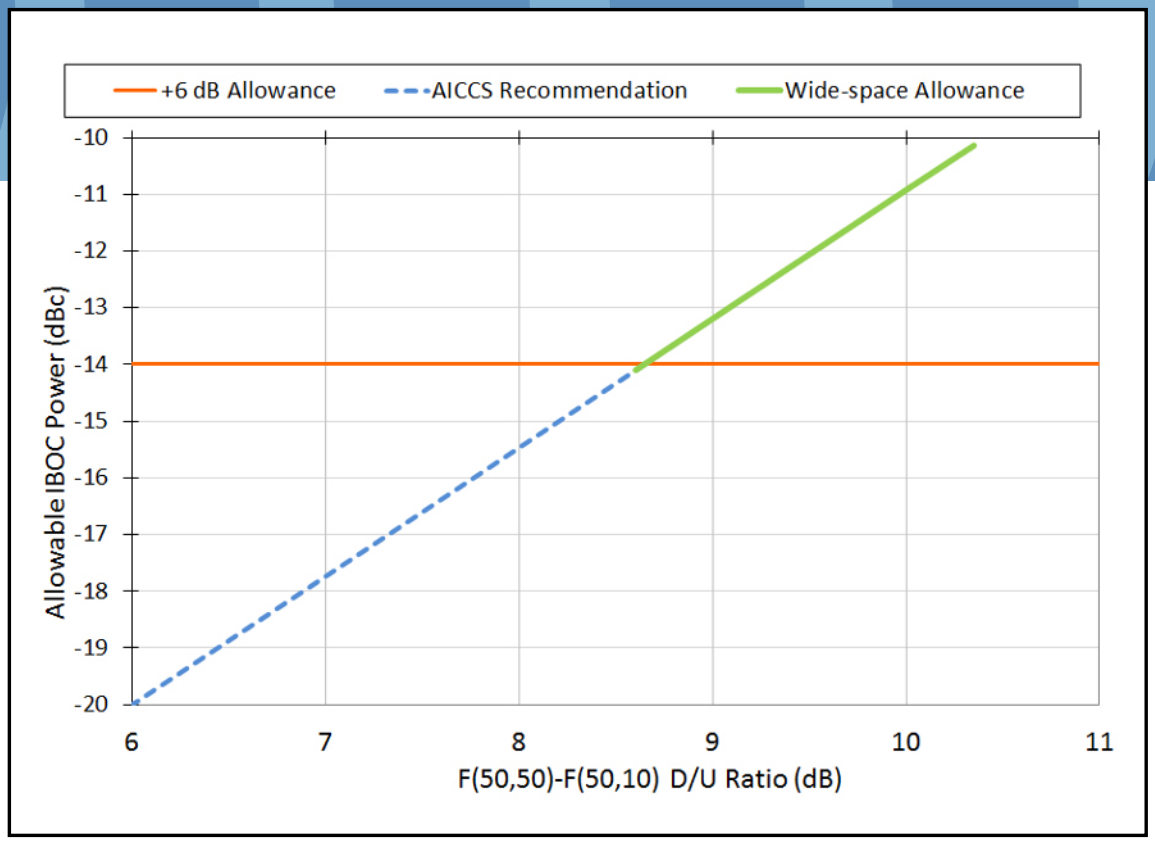

Fig. 1: IBOC Power Allowance Chart

on increased digital power began shortly after the start of widespread commercial service in 2002.

Putting IBOC on the air adds digital sidebands in a station's upper and lower first-adjacent channels. However, the FM allocation rules, developed by the FCC more than 60 years ago, were reflective only of analog-to-analog protections, which assumed very little energy fell outside an FM station's own channel.

Based on its earlier studies of IBOC technology, in 2009 NPR Labs conducted a large listener-based study of compatibility between IBOC digital sidebands and first-adjacent FM reception. That study produced a recommended IBOC sideband power based on the field strength ratio between the IBOC candidate's host FM carrier and a potentially-affected neighbor's 60 dBu contour (see Fig. 1). The diagonal line on the chart shows that interference to the analog station's reception can be avoided with a maximum IBOC power level determined simply by the number of dB the F(50,10) field of the IBOC station is below 60 dBu, at the protected station's 60 dBu F(50,50) contour,. The ratio starts from from 6 dB, which is also the minimum protection ratio for analog FM.

In late 2009, NPR and iBiquity Digital Corp. submitted a proposal, in consultation with a broad range of commercial and noncommercial station licensees, which proposed a four-fold (6 dB) increase in allowable digital power above the original 1 percent standard. The FCC adopted this "blanket" increase as part of its 2010 Order, shown as the horizontal orange line at –14 dBc in Fig. 1.

However, increases above the blanket digital power are determined by the method in NPR's study, shown by the green chart line. The potential for interference to closely-spaced first-adjacent neighbors exists at power levels above –20 dBc, according to NPR's study. Consequently, the FCC adopted an "interference remediation" to protect existing FM services that may receive harmful interference as a result of the blanket IBOC power allowance.

The increase is applicable to both reserved band and non-reserved band stations of all classes, except for grandfathered super-power Class B stations. Per the FCC Order, their power is governed by the higher of: "–20 dB relative to their analog carrier as is permitted by the current rules, or at least 10 dB below the maximum analog power authorized for this class of station as adjusted for height, absent any grandfathered super power."

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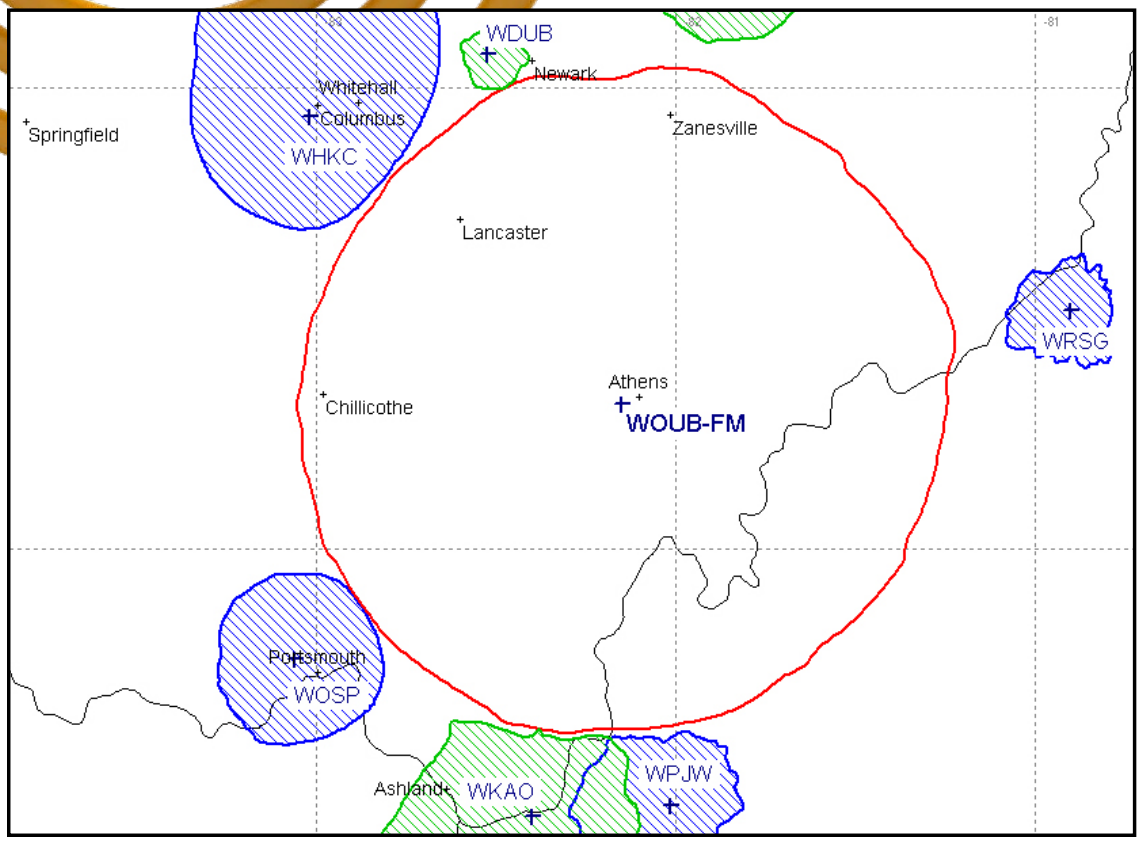

Fig. 2: WOUB Contour Map

Calculator Methodology

To estimate the allowable HD Radio power between the blanket level of –14 dBc and the maximum IBOC power of –10 dBc, the calculator must compute the field ratio of the two stations toward any point on the 60 dBu contour of each protected station. Although the Order uses a table for easy reading, the calculator uses this formula for each sideband:

Allowable IBOC power = [2.27 * (60 – (IBOC station F(50,10) dBu)) – 36.6]

The following shows how this formula is applied for two different station examples.

The first considers WOUB(FM), Channel 217B, Athens, Ohio, as a hypothetical IBOC power-increase candidate. The case study is shown in the center of the map in Fig. 2. The pertinent first-adjacent neighbors surround WOUB, with their protected F(50,50) 60 dBu contours shown in green (on Channel 216) and blue (of Channel 218). WOUB's 54.0 dBu F(50,10) field strength, shown by the red contour line, is very near several of the protected contours; this is the closest spacing permitted by the analog allocation rules.

Putting this field strength into the above formula we have:

Allowable IBOC power = [2.27 * (60 – (54 F(50,10) dBu)) – 36.6] = –23.0 dBc per sideband

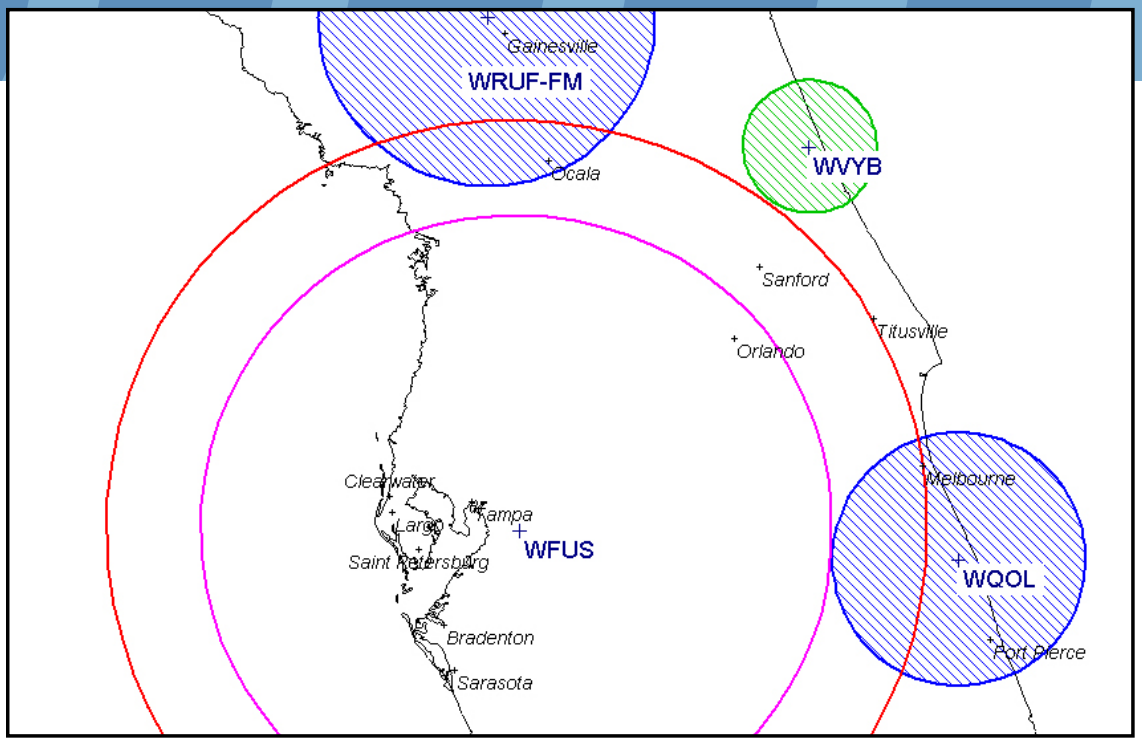

Fig. 3: WFUS 43.5 and 52 dBu Contours

While –23 dBc per sideband is the original IBOC power level of –20 dBc symmetrical, the blanket increase allows WOUB an increase in IBOC transmission power of 6 dB, or –14 dBc with symmetrical sidebands. As this station's limit is the same on both sidebands, the increase applies equally to both sidebands, resulting in –17 dBc per sideband.

The other case study uses WFUS, Channel 278C0, Gulfport, Fla., for potential IBOC power increase, as shown in Fig. 3. Three first-adjacent channel stations are pertinent for this test: WRUF, Channel 279C1, Gainesville, WQOL, Channel 279C2, Vero Beach, and WVYB, Channel 277A, Hollyhill. Again, the F(50,50) 60 dBu contours of the lower-channel stations are shown in green, and the upper-channel station is shown in blue.

The F(50,10) 52.0 dBu contour of WFUS, in magenta, just touches the protected contour of WQOL, resulting in an allowable IBOC power increase on the upper digital sideband to approximately:

Allowable IBOC power = [2.27 * (60 – 52) – 36.6] = –18.4 dBc (lower sideband)

It is apparent that the red contour does not reach the protected contour of WRUF, leaving an additional allowance for digital power if a directional antenna were employed for the IBOC transmission.

For the upper sideband, the F(50,10) 43.5 dBu contour of WFUS, in red, is in contact with the protected contour of WVYB, resulting in an allowable IBOC power increase on the lower digital sideband to:

Allowable IBOC power = [2.27 * (60 – 43.5) – 36.6] = +0.9 dBc (upper sideband)

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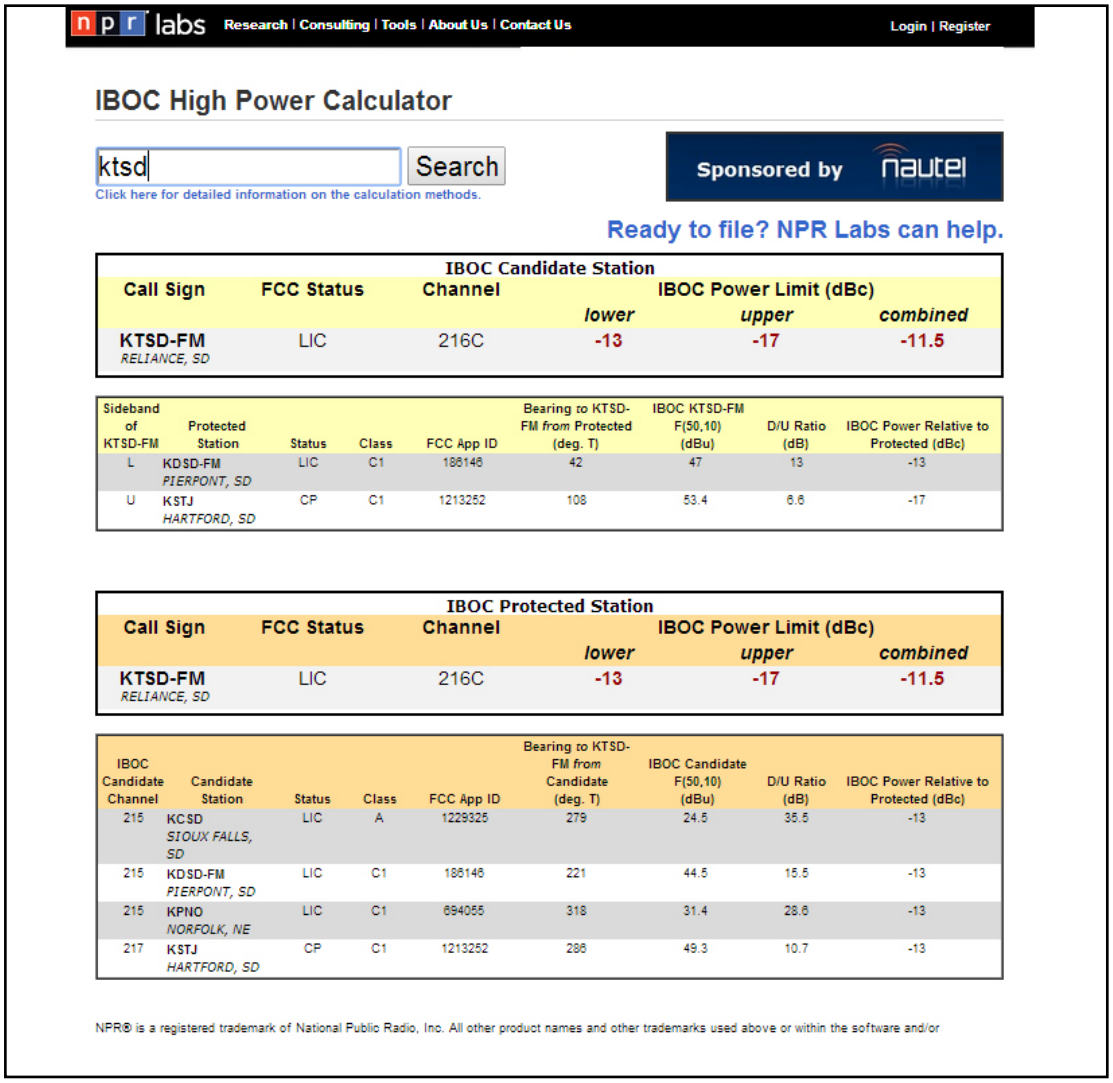
This, of course, exceeds the maximum allowable IBOC power, so the upper sideband of WFUS may be up to –13 dBc.

The values determined for IBOC power are not necessarily limited by the ratio on the direct line between the candidate station and each first-adjacent neighbor. Due to variations in antenna height above average terrain or directional antenna patterns, variations in the shape of the protected service and candidate interference contours may cause the allowable power calculation on a non-

Fig. 4: NPR Labs Calculator Screen



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IBOC Candidate Station

Call Sign	FCC Status	Channel	IBOC Power Limit (dBc)		
			lower	*upper*	*combined*
KTSD-FM *RELIANCE, SD*	LIC	216C	-13	-17	-11.5

Sideband of KTSD-FM	Protected Station	Status	Class	FCC App ID	Bearing to KTSD-FM from Protected (deg. T)	IBOC KTSD-FM F(50,10) (dBu)	D/U Ratio (dB)	IBOC Power Relative to Protected (dBc)
L	KDSD-FM *PIERPONT, SD*	LIC	C1	186146	42	47	13	-13
U	KSTJ *HARTFORD, SD*	CP	C1	1213252	108	53.4	6.6	-17

IBOC Protected Station

Call Sign	FCC Status	Channel	IBOC Power Limit (dBc)		
			lower	*upper*	*combined*
KTSD-FM *RELIANCE, SD*	LIC	216C	-13	-17	-11.5

IBOC Candidate Channel	Candidate Station	Status	Class	FCC App ID	Bearing to KTSD-FM from Candidate (deg. T)	IBOC Candidate F(50,10) (dBu)	D/U Ratio (dB)	IBOC Power Relative to Protected (dBc)
215	KCSD *SIOUX FALLS, SD*	LIC	A	1229325	279	24.5	35.5	-13
215	KDSD-FM *PIERPONT, SD*	LIC	C1	186146	221	44.5	15.5	-13
215	KPNO *NORFOLK, NE*	LIC	C1	694055	318	31.4	28.6	-13
217	KSTJ *HARTFORD, SD*	CP	C1	1213252	286	49.3	10.7	-13

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direct bearing to be slightly less than on the direct path. For more accuracy, NPR Labs' calculator determines the allowable power at minutely-spaced intervals along the protected contours, and lists the allowable digital power at the most critical azimuth.

The calculator considers the directional antenna patterns of all stations in the calculations, if applicable. The calculator uses licensed facilities or construction permits for all stations, whichever is newer. Station engineering data is updated monthly.

The calculator provides several added items of data from each study:

- Identifies first-adjacent stations related to a digital power increase that are close-calls, to help asses opportunities and limits,
- Determines the power for each digital sideband, for those considering asymmetrical transmission, and the total sideband power for transmitter system planning,
- Provides the Facility ID, bearing and other technical information to identify the stations studied,
- Provides a reciprocal study, that is, it identifies other stations that must protect the target station, if they transmit IBOC.

These features can be seen in Fig. 4. Readers are invited to visit NPR Labs' website for analysis of all CPB-qualified public radio stations. For other stations, visit the Nautel RF Toolkit page.

We've put out best care into designing the calculator, but users should use it as a guide, and perform a detailed contour engineering study before planning a high-power IBOC power increase. Stations that seek to increase digital power above the blanket values are required to file an application with the FCC setting out compliance with the Order. ●

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