Digital Radio

It is Time to Retire Hybrid AM HD Radio?

by Edward A. (Ted) Schober, PE

Back in the early 1990s Gannett, CBS and Westinghouse formed USA Digital Radio to design In-Band-On-Channel broadcasting. They later merged with Lucent Digital Radio to acquire the additional technology and skills to become HD Radio. The plan was that each and every radio station would have its cake (analog broadcasting) and eat it too (a companion digital stream). It was planned as a transitional technology which allowed every existing broadcaster to transition to a digital platform. Every AM and FM station would start transmitting in both analog and digital, and when there were enough digital receivers, the analog would be shut off allowing an improved digital signal.

The FM HD Radio hybrid system worked fairly well with near CD quality out to approximately 75% of the analog signal range. On the other hand, the original AM hybrid HD radio system was absolutely terrible, with a codec (coder and decoder of the analog signal to bits and back again) that had worse subjective quality than the analog signal and coverage that extended to only a tiny fraction of the analog range.

Many of the initial problems with FM Hybrid HD Radio were solved in short order by the bright folks at iBiquity. They figured out how to send some extra channels and data to boot. They recently got the FCC to permit higher FM HD power levels to improve coverage and building penetration. The FM Hybrid system does most of what was promised, and the FM pure digital system does much more.

AM Hybrid was no easy fix. The terrible AM HD codec was improved from "really nasty" to "not nearly so bad." It still transmitted an obviously poorer quality signal than analog FM and arguably worse than the AM signal. AM HD Radio is hampered by the negligible amount of "information space" left over after the analog AM signal is transmitted.

As time went on, the AM Hybrid digital coverage problem only got worse because the amount of radio frequency noise in the AM band increased from CFL and LED lighting, computers, automotive electronics and the "Internet of Things." The AM signal leaves a paucity of information space to squeeze in data to carry digital audio along with the AM analog signal, and noise makes even less space.

Early on, the mantra of the broadcaster-owners of iBiquity was that digital radio had to be for AM also. AM radio was still a place where money could be made. The AM Hybrid HD Radio system was designed to be the best possible compromise, squeezing both AM and digital into a tiny, noisy sliver of spectrum. It was a fool's errand; never accomplished despite prodigious effort.

I was involved with an iBiquity medium wave experimental station in Frederick, MD. It showed outstanding digital-only HD radio performance, when the AM signal was shut off, and the data used the space the AM signal formerly occupied. This station, transmitting daytime at 10 kW in the expanded band in Frederick, MD, provided dropout-free mobile service past Harrisburg, PA a distance of over 100 km. That is a range unheard of in the low conductivity North East.

I have been a booster of digital-only broadcasting in the Medium Wave band (if it is digital, then the band is no longer AM) as it has the potential to provide CD quality over a large area in spite of all the noise. The HD Radio codec can produce decent audio at the higher data rates available in digital-only HD Radio modes, and the royalty free Opus codec of DRM 30 provides the possibility of two programs on an AM channel or full CD quality.

Since the late '90s when Hybrid AM HD Radio was introduced, the quality of the AM band has declined. Noise sources from bad and overstressed power lines, thousands of noncompliant switching power supplies, light dimmers, home computers and RF noise from automotive computers and equipment, means that the already pitiful range of AM HD Radio is now even worse. When I read David Layer's recent reports of iBiquity medium wave HD Radio, I was seriously disappointed and reported my observations.

While FM Hybrid HD Radio is a qualified technical success, the consumer and retailer acceptance has been anything but.

AM Hybrid HD Radio is neither a technical nor consumer success. There are many AM HD exciters still sitting in racks, unpowered. A number are still in operation, mostly at major stations whose licensees held ownership in iBiquity. People don't listen to Hybrid HD AM Radio because the AM signal of a well engineered AM station often sounds better on a decent radio than the Hybrid AM HD signal does.

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In the early days of HD Radio deployment, there were hundreds of complaints filed with the FCC about received adjacent channel interference from stations operating with Hybrid AM HD Radio. The FCC, as far as I know, never responded to these complaints. As a result, some of the stations receiving interference have done unlawful things to stay alive. I am aware of a Top 10 market, independently owned directional AM station, that reverted to its omnidirectinal backup antenna, at full power, to gain back areas lost due to interference from two 50 kW second adjacent stations in the same market broadcasting AM HD Radio. I have an Atlantic coastal client with 1.9 kW in the middle of the band who lost 20 miles of coastal coverage when a first adjacent channel station began broadcasting in AM Hybrid HD radio.

AM Hybrid HD Radio has many negatives:

1. Serious first adjacent channel interference to stations in adjacent markets.
2. Second adjacent channel interference to stations in the same market.
3. First adjacent channel interference to distant stations at night.
4. Degradation of the AM signal quality of the host station.
5. HD Coverage is greatly reduced from the AM analog signal
6. HD Radio receivers are optimized for hybrid AM HD Radio, not digital only.

None of these problems are present in either medium wave digital only HD Radio (when the receivers are optimized for digital only modes) or for DRM 30 digital radio.

Medium Wave Digital Only (DRM 30 or HD Radio) has many positives:

1. Digital only HD Radio interferes with first adjacent channel stations similarly to Analog AM and DRM 30 can share service areas with first adjacent stations. Existing stations will receive no interference.
2. Both digital-only systems (when properly adjusted) have negligible second adjacent interference potential.
3. First adjacent channel interference would return to Analog levels with Digital only HD Radio, and be eliminated with DRM 30.
4. There would be no host AM station to degrade.
5. Digital only HD Radio coverage would be slightly less than AM Analog coverage with existing receivers, and DRM 30 would have superior coverage to AM Analog. Digital-only optimized HD Radio Receivers would have coverage comparable with DRM 30.
6. New HD Radio receivers would be optimized for Digital-only because there would be no Hybrid mode stations.
7. Digital-only stations would have audio quality as good or better than FM, and DRM30 has the possibility of additional program channels.

AM Hybrid HD Radio has not influenced the overall acceptance of HD Radio. The FM HD Radio system has struggled for the past ten years on its own merits, with AM Hybrid HD Radio less than a footnote in the mind of listeners. My car radio receives HD Radio. I turned off the AM HD function because the switching and back and forth from Analog to HD was so distracting that I could not listen to it. (At the time I gave up on it, most of the stations were reasonably timed, but the difference in sound from noisy and dull to gritchy and harsh was too annoying.)

Now that many AM stations have FM translators, some with strong FM translator signals now have nearly all their listeners on FM. I have a good FM Translator for my Virginia AM station. Virtually all our listeners listen to the translator or the stream. I would operate the Medium Wave station in digital-only mode if it was permitted on a permanent basis. I believe that a reasonable number of other station operators would do likewise.

Many AM licensees are losing money on their AM operations, holding on to them in hopes of an FM translator, relocation with a digital signal to TV Channel 5 and 6, or the hope that the FCC might revise regulation so that the medium could survive by technical improvements. I believe that if conditions were right, many licensees with a cluster of AM stations would convert their weaker station(s) to become digital Medium Wave translator(s), to repeat their stronger AM Station(s).

Now that DTS purchased iBiquity, taking ownership from the big broadcasters, they no longer have vested interest in continuing Hybrid HD AM. The Hybrid AM HD system is fatally flawed, and now it is acceptable to recognize the elephant in the room. Since AM Hybrid operation causes serious interference, generates no income for the broadcaster and has no effect on sales of HD radio receivers, it is time to shut the operations down. The FCC should modify section 73.404 to delete the word hybrid in its reference to digital broadcasting on Medium Wave stations, and authorize digital-only operations.

In the interim, while waiting for the FCC to act, I challenge all broadcasters to turn off their AM Hybrid HD Radio equipment, and inform the FCC. No one is listening to hybrid AM HD Radio, nor will anyone ever listen to that signal in the future. Lets let it die peacefully

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