All-Digital AM Update

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Outline

• All-digital history

• Hubbard/WWFD All-Digital Operation
  – Process and Setup
  – Measurements: Signal strength and output power

• Bryan Broadcasting
  – Petition FCC to allow voluntary adoption of all-digital AM
  – Comments from Ben Downs, GM/VP
  – Other markets/stations showing interest

• FCC next steps
All-Digital History

• NAB Labs (now called PILOT) did all digital tests from 12/2012 to 10/2014
  – Multiple stations/power levels/markets
  – Followed up with in-lab testing in 2015 and 2016
• WWFD, 820, Frederick, MD on air since July, 2018
  – Filed for Extension on June 5, 2019
• Bryan Broadcasting filed petition on March 25, 2019
• In response, FCC issues NRPM 19-311 on October 29
Why All-Digital AM?

• Advocates say all-digital MA3 mode AM offers these advantages over MA1 or analog-only AM:
  – Audio quality that approaches that of analog FM
  – Coverage that equals analog-only AM signal during the day
  – Better immunity to environmental noise and interference
  – Potentially significant reduction in adjacent-channel interference
  – Support for data services
  – Potential support for multicasting additional audio channels
WWFD All-Digital Project

• In the MA3 Core + Enhanced mode, reception tests show reliable reception to WWFD’s 0.5mV contour in the daytime.

• In the MA3 Core-only mode, reception tests show reliable reception to WWFD’s 0.1mV contour, generally, and not during critical hours or in noisy environments.

• During severe electrical storms, signal appears to be robust enough to not affect listeners in the 2.0mV contour, the station’s defined service area.
WWFD All-Digital Project

• At night, the Core + Enhanced MA3 mode appears to work to half the station’s Nighttime Interference Free (NIF) contour: NIF is 10.8mV, so coverage is good to about 5.4mV

• Air chain is as follows: automation system output to Telos Omnia 7AM+HD; that output fed to Nautel HDMC+, combined importer/exporter; that E2X output connects to the Nautel NX5 HD input

• WWFD uses Artic Palm CSRDS software for metadata that includes logo and album artwork
WWFD All-Digital Project

- MA1 Mode
WWFD All-Digital Project

- MA3 Mode
WWFD All-Digital Project

• MA3 Mode Summary:
  – Unmodulated carrier retained
  – MA1 analog signal replaced with higher-power primary sidebands
  – Secondary upper sideband moves to higher frequencies
  – Tertiary lower sideband moves lower frequencies
  – Overall bandwidth is reduced, making the all-digital waveform less susceptible to adjacent channel interference
WWFD All-Digital Project

5.0 / 2.0 / 1.0 / 0.5 / 0.25 mV/m contours shown

All-digital signal fills in 0.5 mV/m protected daytime contour

Class: B – 820 kHz
Daytime Power: 4.3 kW
Day – Non-Directional

Enhanced Mode = Green
Core Only Mode = Yellow
Mute Mode = Blue

5.0 mV/m population = 215,124
2.0 mV/m population = 456,791
0.5 mV/m population = 2,777,722
WWFD All-Digital Project

10.8 / 5.0 / 2.0 / 1.0 / 0.5 mV/m contours shown

All-digital signal fills in 2.0 mV/m protected nighttime contour

Class: B – 820 kHz
Nighttime Power: 430 W
– Directional Southwest

Enhanced Mode = Green
Core Only Mode = Yellow
Mute Mode = Blue
WWFD All-Digital Project

On-air waveform photo into antenna system
WWFD Artist Experience Photos

- ITR Sparc radio
- First ever images transmitted on MW band in the US!
WWFD Artist Experience Photos

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WWFD All-Digital Project

• Power Calculations
  – To properly measure power in the MA3 mode, an RMS power meter is required that can handle the peak-to-average ration (8-11dB)
  – Nautel transmitters display the RMS power, not carrier power, in the MA3 mode
  – Residual carrier is 38% of RMS power in MA3 mode. Therefore, to produce a 1kW carrier in the MA3 mode, you need 1/.38 or 2.63kW RMS
WWFD All-Digital Project – More Info

• Dave Kolesar (Hubbard) and Mike Raide (Xperi) article in *Radio World Engineering Extra* (October 16, 2019) as well as 2019 NAB Broadcast Engineering and Information Technology Conference (BEITC) paper/presentation

• Nautel website in “Resources/Webinars” section, and specifically, the webinar “All Digital AM in the Real World”

• Be looking for second part of RWEE article as well as second paper at the 2020 BEITC
Ben Downs, Bryan Broadcasting

• Bryan Broadcasting petition filed with FCC on March 25, 2019
• Ben Downs comments on all-digital AM via email on November 8, 2019:
  – All-digital has been demonstrated as superior for solving problems most say are AM’s biggest limiting factors: poor audio quality on bad receivers; amount of impulse noise on the AM band from everything from power lines to telephone chargers to automobile electronics
  – All-digital is a tool that needs to be made available as an option to AM broadcasters
Ben Downs, Bryan Broadcasting

• Ben is worried that the questions posed in the NPRM “may let perfect become the enemy of good.”
  – “There are things that can be done better in [the] MA3 [mode], but it’s software and can be adjusted with the passage of time.”

• The conversion to all-digital may not be right for every situation:
  – If you have an AM station that is successful despite the band’s problems mentioned above, it’s not a solution for you
Ben Downs, Bryan Broadcasting

- Ben stressed that the DRM approach is not the solution in the U.S.
  - “It’s taken us over 15 years to get to the 60 million receiver mark. I have no confidence in somebody who tells us we need to start over from 0.”
  - “Every day there are more and more AM HD receivers sold. Can you say the same about new AM listeners?...We have with the MA3 mode a solution that could maybe...just maybe...bring new listeners back to AM.”
Interest in Other Markets

• In past six months (since NAB), I’ve had inquiries from stations in Philadelphia, Hartford and Washington, DC, about the cost and process to go all-digital
  – These stations have eagerly awaited the NRPM that the FCC recently released
  – They are prepared to spend the money necessary to convert
  – They represent single-owner as well as group owner stations of various powers and patterns – some directional, some non-directional
FCC Next Steps

• MB 19-311 released on October 29, 2019
  – “We tentatively conclude that a voluntary transition to all-digital broadcasting has the potential to benefit AM stations and provide improved AM service to the listening public.”

• Commission is seeking comment on this conclusion

• Seeking proposals for technical standards for all-digital AM and impact on existing analog stations and listeners

• Seeking to establish the procedure for stations to go all-digital
FCC Next Steps

• Commission recognizes that AM has struggled with decline in listenership
  – AM stations are susceptible to electromagnetic emissions from multiple sources
  – These issues have resulted “…in AM radio being largely dominated by low-fidelity voice formats such as talk radio...sports, religious programming, and news.”

• Seeking comments on how to, among other things, minimize co-channel interference from all-digital stations
FCC Next Steps

• Seeking comments on whether to allow all-digital operation at night

• Tentatively conclude that “...operating power limits (73.21) should be applied to unmodulated analog carrier signal; and the HD Radio Emissions Mask incorporated by reference in the NRSC-5-D Standard should determine allowable power for the digital sidebands”
FCC Next Steps

• Proposing that stations desiring to operate all-digital simply notify them using FCC Form 335-AM within ten days of commencing all-digital operation

• Seeking comments on effect of all-digital AM operation in an emergency and its impact to consumer access to emergency information

• Seeking comments on the one-time fee charged by Xperi
FCC Next Steps

• Seeking comments on “…the overall state of readiness of AM listeners to transition to digital broadcasting.”
• Seeking comments on availability of HD receivers, market penetration, affordability of receivers
How to File Comments

- If you feel strongly that allowing AM stations to voluntarily move to all-digital operation, now is the time to go on record with the FCC to support this NPRM
- File comments electronically via the Internet using the Electronic Comment Filing System (ECFS) at: http://apps.fcc.gov.ecfs
How to File Comments

• Paper comments addressed as follows:
  Office of the Secretary, FCC
  445 12th Street, SW
  Room TW-A325
  Washington, DC 20554
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  – Dave Kolesar, Hubbard
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• References:
Acknowledgements and References

• References Cont’d:
Thank You!

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