

**FCC FACT SHEET\*****All-Digital AM Broadcasting; Revitalization of the AM Radio Service**

Report and Order – MB Docket Nos. 19-311 and 13-249

**Background:** Analog AM radio stations currently face many hurdles in today’s competitive media marketplace, including lower audio quality compared to other radio formats and interference from electrical devices. And while AM stations may currently operate in hybrid mode—using analog and digital signals at the the same time—hybrid analog/digital operation has not been widely adopted due to the technical constraints of the AM band. All-digital broadcasting has the potential to significantly improve the audio quality and listenable coverage of AM transmission compared to analog or hybrid analog/digital broadcasting, and provide additional services to which FM or satellite radio listeners are accustomed, such as song and title information. Therefore, the Commission issued a Notice of Proposed Rulemaking (NPRM) proposing to allow AM broadcasters to use an all-digital signal on a voluntary basis. In so doing, the Commission sought to improve and modernize the AM radio service and thereby help ensure the future of this important service.

**What the Order Would Do:**

- Allow AM stations to convert to all-digital operation on a voluntary basis.
- Establish technical rules for all-digital AM broadcasting.
- Require each all-digital AM station to provide at least one free over-the-air digital programming stream that is comparable to or better in audio quality than a standard analog broadcast. Otherwise, digital subcarriers can be used for broadcast or non-broadcast services, including song and title information.
- Require all-digital AM stations to avoid prohibited interference (as currently defined in the rules) to other broadcast stations.
- Confirm the obligation of all-digital AM licensees, like any audio broadcast provider, to participate in the national Emergency Alert System (EAS), including ensuring that any other stations that are monitoring the all-digital station either be able to: (1) receive and decode an all-digital EAS alert; or (2) adjust their monitoring assignments to receive EAS alerts from another nearby station.
- Establish a 30-day waiting period before converting to all-digital so that transitioning AM stations can provide adequate notice to the Commission, consumers, and other potentially affected stations.

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Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of
All-Digital AM Broadcasting
Revitalization of the AM Radio Service
MB Docket No. 19-311
MB Docket No. 13-249

REPORT AND ORDER\*

Adopted: []

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I. INTRODUCTION

1. In this Report and Order, we adopt rules to allow AM radio stations to broadcast an all-digital signal using the HD Radio in-band on-channel (IBOC) mode named MA3.1 A voluntary conversion to all-digital broadcasting will benefit many AM stations and their listeners by improving

\* This document has been circulated for tentative consideration by the Commission at its October 2020 open meeting. The issues referenced in this document and the Commission’s ultimate resolutions of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public’s ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The Commission’s ex parte rules apply and presentations are subject to “permit-but-disclose” ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission’s ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR §§ 1.1200(a), 1.1203.

1 HD Radio is the brand name of the digital broadcasting technology owned and licensed by Xperi Corporation (Xperi). In 2015, DTS Inc. acquired iBiquity Digital Corporation (iBiquity), the original developer and licensor of the HD Radio digital system. In 2016, Xperi acquired DTS Inc. All-Digital AM Broadcasting, MB Docket No. 19-311, Notice of Proposed Rulemaking, 34 FCC Rcd 11560, 11560, n.1 (2019) (NPRM). For convenience, we will refer to iBiquity and/or its successor Xperi as “Xperi.”

reception quality and listenable coverage in stations' service areas. This action will also advance the Commission's goal of improving and modernizing the AM radio service and thereby help ensure the future of this important service.

## II. BACKGROUND

2. *Status of AM service.* AM radio provides a crucial service to American communities, particularly in rural areas of the country.<sup>2</sup> Many AM stations broadcast local programming, such as local news, weather, and community events. Moreover, listeners rely upon AM stations to provide critical information in times of emergencies and natural disasters.<sup>3</sup> However, as explained in the *NPRM*, the AM service has struggled for decades with a steady decline in listenership caused by interference and reception issues and the availability of higher fidelity alternatives.<sup>4</sup> In particular, AM stations have been affected by the rising RF "noise floor" from various sources such as power lines, phone chargers, fluorescent and LED light bulbs, computer monitors, and flat-screen TVs.<sup>5</sup> Manufacturers of AM receivers have attempted to reduce interference by using a narrower receiving bandwidth—but at the cost of audio fidelity.<sup>6</sup> As the CTA explains, very narrow audio bandwidths lead to a "tin can" effect even in the best of signal conditions.<sup>7</sup> As a result, AM stations are largely confined to voice-only formats (e.g., talk radio) and have consistently lost audiences to FM radio, satellite radio, and online streaming services that offer higher sound fidelity and a broader array of programming.<sup>8</sup>

3. *Benefits of digital broadcasting.* Digital broadcasting has the potential to significantly improve the AM service.<sup>9</sup> One key benefit of digital modulation is that it can operate with a much lower

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<sup>2</sup> See *NPRM*, 34 FCC Rcd at 11561, para. 2, see also, e.g., REC Comments at 5 ("AM radio has a critical role in our nation's infrastructure."); Smith and Henry Reply Comments at 11 ("AM radio is a longstanding American institution, a source of unique voices, and one that we can ill afford to abandon, particularly in light of its unique groundwave and nighttime skywave propagation characteristics and tremendous reach, especially in times of local, regional, and even national emergencies."); California and Missouri Broadcasters Comments at 2 ("Many local communities still have but one 'community oriented' resource: their AM station."); Legate Comments at 3; CTA Comments at 5.

<sup>3</sup> See, e.g., REC Comments at 1-2 (emphasizing that "many communities, particularly rural ones, are dependent on AM stations for local and emergency information"); Smith and Henry Reply Comments at 1-2.

<sup>4</sup> *NPRM*, 34 FCC Rcd at 11560, para. 2.

<sup>5</sup> *Id.*; see also CTA Comments at 3 ("Digital devices are only increasing and, as a result, the noise floor is unlikely to fall."); Bryan Comments at 3 ("No modern audience will accept the low audio quality that is heard by anyone who tunes into the AM band; the noise floor problem represents an existential threat to AM radio."); Hubbard Comments at 3 ("For many years, music programming formats have been difficult for standard AM stations to sustain due to poor audio fidelity in the AM service and vulnerability to noise from power lines and other electrical sources."); California and Missouri Broadcasters Comments at 2-3 ("Ambient noise has become the big killer of analog AM reception."); REC Comments at 5; SBE Comments at 3-4; Carl T. Jones Comments at 1; Universal Stations Reply Comments at 3; Smith and Henry Reply Comments at 4; Legate at 1.

<sup>6</sup> Schober Comments at 4 ("Exceedingly high electromagnetic noise levels have destroyed the ability of legacy wide bandwidth receivers to function properly . . . problems of noise and interference from automotive and in home electronics has incentivized the designers of AM receivers to decrease bandwidth, sharpen IF skirts and limit sensitivity to the point that the AM receiver audio performance can only be characterized as abysmal."); NAB Comments at 2.

<sup>7</sup> CTA Comments at 4.

<sup>8</sup> *NPRM*, 34 FCC Rcd at 11561, para. 2; NAB Comments at 2; Xperi Comments at 9; Hubbard Comments at 3; REC Comments at 5.

<sup>9</sup> See, e.g., Xperi Comments at 2 ("HD Radio broadcasting provides many benefits over traditional analog radio, including crystal clear, static-free sound, multicasting, enhanced metadata (including artist, song title, and album information), traffic services, and enhanced digital emergency alerts."); NAB Comments at 2 ("Digital broadcasting

(continued....)

signal-to-noise ratio than analog.<sup>10</sup> As a result, especially in a high-noise environment, digital radio can provide improved audio quality and superior listenable coverage.<sup>11</sup> Digital operation also eliminates the tradeoff between receiver audio bandwidth and noise performance.<sup>12</sup> In addition, digital broadcasting allows visual and other metadata, such as song and artist identification, station identification, and emergency information, to be transmitted along with the audio content.<sup>13</sup> Such auxiliary information is increasingly expected by consumers and considered to be a vital component of modern broadcasting.<sup>14</sup> Finally, digital broadcasting offers the future possibility of multicasting separate AM audio subchannels.<sup>15</sup>

4. *The HD Radio technology.* In the United States, the only technology for digital broadcasting in the AM and FM bands approved by the Commission is the HD Radio IBOC system. The HD Radio digital technical operating parameters are set out in periodic publications issued by Xperi (HD Radio Specifications), which in turn are incorporated into the NRSC-5-D Standard.<sup>16</sup> The HD Radio system has two AM service modes: hybrid (MA1) and all-digital (MA3).<sup>17</sup> The Commission adopted the

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is generally less vulnerable to interference and provides improved audio fidelity and a wider audio bandwidth; Accordingly, AM broadcasters will be able to reach more listeners with a more pristine, reliable signal and expand their content offerings.”); Crawford Comments at 1 (“When a receiver locks in the digital mode to one of our stations, particularly one playing music, as the receiver blends from analog to digital, the contrast is dramatic. The highs and lows of the audio open up, the stereo image widens out, and the noise that seems to be ever present on almost any AM frequency disappears. Listeners experiencing this effect for the first time are quite often amazed at how good an AM broadcast can sound in this mode.”).

<sup>10</sup> Analog AM modulation imposes an input signal (the audio programming) onto a carrier wave by modifying the amplitude (height) of the wave. Digital AM modulation converts the data to be transmitted into an encoded bitstream (i.e., data packets), which is then imposed on the carrier wave and decoded to reassemble an audio signal at the other end by the digital receiver.

<sup>11</sup> See *NPRM*, 34 FCC Rcd at 11561, 11567, paras. 3, 12; Crawford Comments at 4; SBE Comments at 5; Xperi Comments at 11-12; California and Missouri Broadcasters Comments at 3.

<sup>12</sup> CTA Comments at 4.

<sup>13</sup> See *NPRM*, 34 FCC Rcd at 11561, 11567, paras. 3, 12. Xperi states that all HD Radio receivers have the capability of receiving program metadata from AM stations. Xperi Comments at 13.

<sup>14</sup> Crawford Comments at 3 (“Our observation in recent years has been that listeners have come to *expect* radio display of song or program title/artist, and that stations whose transmissions do not include such information are at a competitive disadvantage.”); Xperi Comments at 13 (“Program metadata, such as textual artist and title information, is an important aspect of an all-digital system and is available on all HD Radio receivers currently deployed.”); SBE Comments at 5 (“AM stations using an all-digital signal can transmit ancillary information, placing them on a par in terms of flexibility with FM digital and satellite DAB service.”); Carl T. Jones Comments at 1 (arguing that metadata would enable the AM broadcaster to compete with FM stations on the digital dashboard); CTA Comments at 2; Hubbard Comments at 4; NAB Comments at 4-5; NPR Comments at 2.

<sup>15</sup> Xperi Comments at 10, 13 (explaining that HD Radio technology has the potential to accommodate an AM HD-2 multicast channel); Hubbard Comments at 4 (“[I]n December 2019, WWFD tested an HD-2 multicast channel . . . The ability to multicast puts AM stations on par with FM stations that frequently provide HD-2 and HD-3 channels for listeners.”).

<sup>16</sup> The current IBOC standard is available to the public for free online at the National Radio Systems Committee (NRSC), NRSC-5-D In-band/on-channel Digital Radio Broadcasting Standard, <https://www.nrscstandards.org/standards-and-guidelines/documents/standards/nrsc-5-d/nrsc-5-d.pdf> (Apr. 2017) (last visited Sept. 21, 2020) (NRSC-5-D Standard). See also Xperi, “HD Radio AM Transmission System Specifications” (Rev. G) (Mar. 13, 2017) (HD Radio Specifications).

<sup>17</sup> Xperi, “IBOC AM Transmission Specification” (Nov. 2001) (2001 HD Radio Specifications) at 8; NRSC-5-D Standard at 14. For convenience, we use the terms “hybrid” and “MA1” interchangeably. We also use “all-digital” and “MA3” as well as “digital carrier” and “digital sideband” interchangeably.

HD Radio IBOC system in 2002, authorizing hybrid digital operations initially on an interim basis<sup>18</sup> and adopted hybrid operational and licensing rules in 2007.<sup>19</sup> In hybrid mode, the transmission includes both analog and digital signals, with the analog carrier occupying the center of the assigned frequency. The digital signal is transmitted in primary and secondary side bands on either side of the host analog signal, as well as underneath the host analog signal in tertiary sidebands. The total power of all the digital sidebands is significantly below the total power in the analog AM signal.<sup>20</sup> This configuration means that—in order to accommodate both types of signals—a hybrid transmission occupies 30 kHz of bandwidth. In all-digital MA3 mode, there is no modulated analog carrier signal (and therefore no analog reception), and the analog signal is replaced with the primary sidebands whose power is increased compared to the hybrid levels. In addition, the secondary and tertiary sidebands are moved to either side of the primary sidebands and their power is also increased compared to hybrid operation.<sup>21</sup> Using an all-digital MA3 signal, two configurations are possible: a 10 kHz primary carrier-only configuration (“core-only mode”) or a 20 kHz configuration using all-digital sidebands (“enhanced mode”).<sup>22</sup>

5. *AM hybrid operation.* As noted in the *NPRM*, AM broadcasters have not widely adopted the HD Radio hybrid mode, with fewer than 250 AM hybrid stations today out of a total of over 4,500 AM stations.<sup>23</sup> This low rate of adoption is due to multiple factors, most of which stem from the hybrid signal configuration described above. With the analog carrier occupying the center frequencies of the hybrid signal, the digital carriers operate with less power and are placed at the “edges” of the signal.<sup>24</sup> This configuration results in limited signal robustness (resistance to noise and other interference) and increases the relative likelihood of causing or receiving adjacent channel interference.<sup>25</sup> The wider bandwidth also places significant demands on AM antenna and transmission systems, often requiring significant modifications.<sup>26</sup> While the hybrid mode has the capacity to transmit metadata, one commenter

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<sup>18</sup> *Digital Audio Broadcasting Systems And Their Impact On The Terrestrial Radio Broadcast Service*, First Report and Order, 17 FCC Rcd 19990 (2002) (*Digital Radio First Report and Order*).

<sup>19</sup> 47 CFR § 73.404(a); *Digital Audio Broadcasting Systems And Their Impact On The Terrestrial Radio Broadcast Service*, MM 99-325, Second Report and Order, First Order on Reconsideration and Second Further Notice of Proposed Rulemaking, 22 FCC Rcd 10344 (2007) (*Digital Radio Second Report and Order*).

<sup>20</sup> 2001 HD Radio Specifications at 7; NRSC-5-D Standard at 14. In hybrid mode, the power of the digital sidebands is limited to prevent self-interference with the analog carrier signal and with first-adjacent stations.

<sup>21</sup> 2001 HD Radio Specifications at 7; NRSC-5-D Standard at 9.

<sup>22</sup> NAB Labs All-Digital AM Test Project I at 20. In core-only mode, data throughput is limited to 20 kilobits per second (kbps), so the primary digital carrier can only support mono audio or parametric stereo. NAB Labs All-digital AM Test Project I at 20; *see also* Crawford Comments at 3 (suggesting that core mode may also be useful in reducing the impact of adjacent-channel interference); Hubbard Comments at 7. In enhanced mode, data throughput is 40 kbps and the secondary and tertiary sidebands can provide full stereo and additional data. Both modes, however, support metadata such as station identification, program information, and emergency alerts. NAB Labs All-digital AM Test Project I at 20.

<sup>23</sup> *NPRM*, 34 FCC Rcd at 11576-77, para. 37.

<sup>24</sup> *See id.* at 11562, para. 4.

<sup>25</sup> *See* Crawford Comments at 1-2; Xperi Comments at 11, 17; Lebyrk Comments at 1; Schober Comments at 3; Hershberger Comments at 1; REC Comments at 4; Broadcast Electronics Comments at 3; Peter Laws Comments at 1. For the purposes of this *Report and Order*, “adjacent channel” means any first-, second-, or third-adjacent channel.

<sup>26</sup> *NPRM*, 34 FCC Rcd at 11577, para. 37; Dave Kolesar and Mike Raide, “Upgrading an AM to All-Digital: Why, How and Lessons Learned,” *Radio World*, available at <https://www.radioworld.com/tech-and-gear/upgrading-an-am-to-all-digital-why-how-and-lessons-learned> (last visited Oct. 25, 2019); Crawford Comments at 2.

states that it is unreliable.<sup>27</sup> Finally, constant signal shifting from analog to digital and back again in weaker reception areas can detract from the hybrid listening experience.<sup>28</sup>

6. *All-Digital Testing.* The benefits of all-digital AM radio have been demonstrated by field and laboratory testing carried out by NAB Labs (now PILOT) and the experimental operation of all-digital station WWFD, Frederick, Maryland (WWFD), pursuant to a special temporary authorization (STA).<sup>29</sup> As discussed in the *NPRM*, from 2012 to 2014, NAB Labs conducted a series of AM all-digital performance field tests at nine radio stations, followed by laboratory testing of all-digital interference to co-channel stations.<sup>30</sup> This work was summarized in two technical papers published in the 2015 and 2016 NAB Broadcast Engineering Conference Proceedings.<sup>31</sup> The NAB Labs field testing concluded that all-digital transmission results in a clearer, more robust signal, with greater daytime coverage than a hybrid signal. Hubbard, the licensee of WWFD, also reports a significant improvement in WWFD's audio quality and signal robustness in the all-digital mode.<sup>32</sup> Hubbard further states that although WWFD had no ratings in its home market of Frederick, Maryland for the five years it was an analog station with the same format (adult album alternative music), now that it is operating in all-digital mode, it is ranked by Nielsen in the Frederick market.<sup>33</sup> Finally, Hubbard relates that it has tested an HD-2 signal on WWFD, as well as musical track data and a station logo image.<sup>34</sup>

7. *Comments.* AM broadcasters overwhelmingly support the proposal to allow all-digital AM broadcasting,<sup>35</sup> as do broadcast engineers,<sup>36</sup> technology companies,<sup>37</sup> and some individual listeners.<sup>38</sup>

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<sup>27</sup> Crawford Comments at 3.

<sup>28</sup> *Id.* at 1-2 (“From a listener perspective, the low power of the digital carriers in the hybrid mode makes them susceptible to interference, particularly from noise, and receivers frequently transition between digital and analog in noise-prone and/or weak-signal areas.”).

<sup>29</sup> See File No. BSTA-20180628AAI (granted on July 6, 2018) (extended by BESTA-20190605ABK (granted on July 12, 2019)). Media Bureau (Bureau) staff has granted two other all-digital experimental authorizations: WTLC(AM), Indianapolis, Indiana, and WIOE(AM), Fort Wayne, Indiana, but neither licensee has notified the Commission that it is currently operating using an all-digital signal. See *John F. Garziglia, Esq.*, Letter Decision, File No. BSTA-2020501AAC (MB May 14, 2020); *Gregg P. Skall, Esq.*, Letter Decision, File No. BSTA-20200507AAA (MB May 29, 2020).

<sup>30</sup> *NPRM*, 34 FCC Rcd at 11563, para. 6. The stations that participated in the NAB Labs field testing were: WBCN, Charlotte, North Carolina; WNCT, Greenville, North Carolina; WBT, Charlotte, North Carolina; WD2XXM, Frederick, Maryland; KTUC, Tucson, Arizona; WDGY, Hudson, Wisconsin; WSWW, Charleston, West Virginia; KKXA, Snohomish, Washington; and KRKO, Everett, Washington.

<sup>31</sup> See David H. Layer, “NAB Labs All-digital AM Test Project,” published in 2015 NAB Broadcast Engineering Conference Proceedings at 19 (2015) (NAB Labs All-digital AM Test Project I); David H. Layer, Michael D. Rhodes, and Daniel G. Ryson, “NAB Labs All-digital AM Test Project – Part II, Co-Channel Laboratory Test Results,” published in 2016 NAB Broadcast Engineering Conference Proceedings at 50 (2016) (NAB Labs All-digital Test Project II). Digital copies of the entire 2015 and 2016 NAB Broadcast Engineering Conference Proceedings are available for purchase at [http://www.nabstore.com/NAB\\_Broadcast\\_Engineering\\_Conference\\_Proceedings\\_p/cp150.htm](http://www.nabstore.com/NAB_Broadcast_Engineering_Conference_Proceedings_p/cp150.htm) and [https://www.nabstore.com/NAB\\_Broadcast\\_Engineering\\_Conference\\_Proceedings\\_p/cp160.htm](https://www.nabstore.com/NAB_Broadcast_Engineering_Conference_Proceedings_p/cp160.htm), respectively. The NAB Labs All-digital AM Test Project I and II are also available in ECFS under proceeding RM-11836 (see letter submitted by NAB on Oct. 23, 2019) and MB Docket 19-311 (see letter submitted by NAB on March 4, 2020).

<sup>32</sup> Hubbard Comments at 2, 5 (explaining that all-digital transmission “provides an improved, consistently high-quality listener experience, in terms of audio fidelity and signal robustness”).

<sup>33</sup> *Id.* at 3.

<sup>34</sup> *Id.* at 4.

<sup>35</sup> See NAB Comments at 1; Puerto Rico Broadcasters Association Comments at 1; California and Missouri Broadcasters Association at 1; Crawford Comments at 1; Bohach Comments at 1; Winnekins Comments at 1; Schober Comments at 1-3; Bryan Broadcasting at 1; Joint Commenters at 1-2 (consisting of 17 broadcasters);

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No broadcasters opposed the all-digital proposal and only eight individuals opposed it.<sup>39</sup> As discussed below, some commenters acknowledge the potential benefits of all-digital AM broadcasting but urge that additional conditions be met before adoption of all-digital HD Radio—such as more testing regarding interference and performance, limited or experimental operation, or consideration of alternative technologies.<sup>40</sup>

### III. DISCUSSION

#### A. Authorization of All-Digital AM Broadcasting

8. We adopt the proposal in the *NPRM* to allow AM broadcasters, at their discretion, to broadcast using the HD Radio all-digital MA3 mode.<sup>41</sup> The record establishes that all-digital AM has the potential to significantly aid in the revitalization of the AM service. Commenters overwhelmingly agree that all-digital operation can alleviate many of the problems stemming from hybrid operation, allowing AM broadcasters and listeners to take full advantage of the potential benefits of digital broadcasting.<sup>42</sup> Because an all-digital signal does not include a modulated analog component, the digital sidebands are more powerful and closer to the center of the channel. Therefore, they are better able to overcome noise

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Hubbard Comments at 1; Mount Wilson Comments at 1; NPR Comments at 2; iHeart Communications Reply Comments at 1-2; Universal Stations Reply Comments at 1.

<sup>36</sup> See Society of Broadcast Engineers Comments at 1; Carl T. Jones Comments at 1.

<sup>37</sup> See Consumer Technology Association (CTA) Comments at 1; Xperi Comments at 1; Nautel Comments at 1; Broadcast Electronics Comments at 1.

<sup>38</sup> See Wood Comments at 1; Peter Laws Comments at 1.

<sup>39</sup> Laub Comments at 1; Minnicino Comments at 1; Wells Comments at 1; Bowers Comments at 1; Mazurek Comments at 1; Lebryk Comments at 1; Talbot Comments at 1; Weddle Comments at 1. These commenters primarily object to the potential loss of service to analog listeners. See *infra*, para. 11.

<sup>40</sup> See Legate Comments at 1-3 (advocating additional testing on technical issues such as coverage areas and emissions mask compliance); DRM Comments at 1-3 (urging consideration of DRM as an alternative transmission technology); Hershberger Comments at 1-3 (advocating for DRM); Dolby Comments at 1-3 (advocating for DRM); Hardis Comments at 10-12 (contending that all-digital should only be authorized based on a fully-disclosed, non-proprietary technical standard); Henry Comments at 1 (advocating for DRM and further testing); Smith and Henry Reply Comments at 2 (advocating for more testing); REC Comments at 2-3 (opposing all-digital authorization for higher power AM stations to avoid loss of emergency communications). Two commenters address specific issues without commenting on the overall merits of all-digital broadcasting. Edward Thierbach Comments at 1 (discussing the need for adequate emergency communications); Kintronics Comments at 1-4 (discussing the technical aspects of all-digital conversion).

<sup>41</sup> See *NPRM*, 34 FCC Rcd at 11564, para. 8.

<sup>42</sup> See Xperi Comments at 11 (“As the WWFD experiment has demonstrated, the audio quality of an all-digital AM signal is similar to the audio quality of an FM analog signal, which is particularly well-suited for music.”); Bryan Broadcasting Comments at 7 (“All-digital AM finally gives AM listeners an audio product that can compete aurally with other audio sources”); Carl T. Jones Comments at 1 (“[Digital radio] would provide the AM broadcaster with the ability to deliver a pristine audio signal even in the presence of the high levels of environmental noise that exists today”); Hubbard Comments at 2 (“In Hubbard’s experience, the data conclusively confirm that all-digital MA3 operation provides an improved, consistently high quality listener experience, in terms of audio fidelity and signal robustness.”); Mount Wilson Comments at 2 (“100% digital AM has the potential to revive the AM Band”); Peter Laws Comments at 1; Smith and Henry Reply Comments at 5; Winnekins Comments at 1; Puerto Rico Broadcasters Comments at 1; Crawford Comments at 1; CTA Comments at 1; California and Missouri Broadcasters Comments at 3; Wood Comments at 1.



and interference from other stations than are hybrid stations.<sup>43</sup> Commenters agree that even when a digital signal is relatively weak, such as at the outer range of its signal coverage, it may still be received and decoded by digital receivers, thus placing an undistorted or listenable signal over a greater area than either analog or hybrid transmissions.<sup>44</sup> Finally, commenters note that because there is no “blending” from analog to digital as takes place with hybrid operation, there is no change in audio fidelity between the two types of transmission and no need to time-synchronize the analog and digital signals to avoid the audible effects of constant shifting back and forth in weaker reception areas.<sup>45</sup>

9. Importantly, commenters believe that all-digital operation will increase the format choices that AM broadcasters can offer to their audiences, including the option of music programming (in full stereo if using enhanced mode).<sup>46</sup> Hubbard asserts that all-digital operation will also allow AM broadcasters to provide program and station information along with the main audio stream more reliably than in hybrid mode.<sup>47</sup> Finally, commenters note that the all-digital mode is designed to potentially support an HD-2 second programming stream.<sup>48</sup> Having these capabilities will help “level the playing field with FM analog and digital broadcasts, doing much to remove the disparity between AM and FM signals from the listener’s perspective.”<sup>49</sup>

10. *Impact on listeners.* We reject assertions that we should mandate some or all AM stations to continue broadcasting in analog because all-digital broadcasting would disenfranchise analog listeners.<sup>50</sup> The AM hybrid mode, authorized in 2002, was designed to ensure continuity of service during the early stages of the digital transition. In this respect, we note that combined hybrid analog and digital broadcasting has not been an effective transition model for AM stations, as it is for FM stations, due to the comparatively narrow frequency spacing in the AM band.<sup>51</sup> In light of the unique needs of the AM service and the limitations of the AM analog and hybrid modes, we believe that the public interest in the valuable service and long-term viability of AM stations outweighs a possible loss of service to

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<sup>43</sup> NAB Labs All-digital AM Test Project II at 63 (“[A]s expected, all-digital signals are very robust in the presence of analog interferers”); Crawford Comments at 2; Xperi Comments at 12; CTA Comments at 3; Bohach Comments at 1.

<sup>44</sup> See *NPRM*, 34 FCC Rcd at 11568, para. 13; Hubbard Comments at 5-6 (“While the total effective throughputs for MA3 and MA1 are similar ... the reception area for all carriers (primary, secondary, and tertiary) leading to full audio quality is much larger for MA3 than MA1.”) (internal citation omitted); SBE Comments at 5; NAB Comments at 6. Digital reception varies from analog reception in that it does not gradually degrade as you move away from the transmitter as analog does (except that the secondary and tertiary carriers are lost before the primary carrier). NAB Labs All-digital AM Test Project I at 20. Rather, reception abruptly ceases and is replaced by either silence or static, depending on the receiver. *Id.*; see also Smith and Henry Reply Comments at 1 (claiming that digital “dropouts are highly annoying to most listeners, more so than the corresponding noisy intervals with analog signals.”); Crawford Comments at 3.

<sup>45</sup> See Crawford Comments at 2. Moreover, according to Xperi, an all-digital signal may still be received even if one sideband is completely impacted, because the all-digital waveform has redundant upper and lower sidebands. Xperi Comments at 23.

<sup>46</sup> Hubbard Comments at 3-4; CTA Comments at 5; SBE Comments at 5.

<sup>47</sup> See Hubbard Comments at 4 (“MA3 allows AM broadcasters to have both aural and visual parity with other broadcast services in the automobile dashboard.”).

<sup>48</sup> California and Missouri Broadcasters Comments at 4; Hubbard Comments at 4 (reporting that it tested an HD-2 multicast channel in December 2019).

<sup>49</sup> Crawford Comments at 4.

<sup>50</sup> Laub Comments at 1; Minnicino Comments at 1; Wells Comments at 1; Bowers Comments at 1; Mazurek Comments at 1; Talbot Comments at 1; Weddle Comments at 1; see also REC Comments at 1-2.

<sup>51</sup> This technical limitation differentiates AM stations from FM and TV stations where such transitions are more technically feasible.



existing analog listeners as broadcasters and the listening public transition to an all-digital environment. While we are mindful of the possibility of some consumer disruption, we conclude—based on the record evidence before us—that all-digital service represents a significant and perhaps singular opportunity to preserve the AM service for future listeners. In this respect, we emphasize that all-digital operation is purely voluntary; broadcasters can determine for themselves whether their listeners are ready for all-digital radio. Because radio advertising revenues are almost exclusively based on audience size, broadcasters have a compelling incentive to reach as many listeners as possible and to minimize any loss of listeners through a change in transmission technology by waiting until a significant portion of those consumers can receive the station digitally.<sup>52</sup> As NAB points out, broadcasters “would have no incentive to convert to digital if the number of receivers in their market were insufficient to support the expense, or if too many listeners would lose access to their broadcast. These are decisions best left to the good faith business discretion of broadcasters.”<sup>53</sup> Moreover, any disruption to analog listeners will take place gradually, as AM stations individually decide their audience is ready to convert to all-digital, with full notice to consumers (as explained in paragraph 39, *infra*), and ample opportunity to adjust to the new technology. In many cases, this transition will be eased by the fact that listeners will still be able to receive programming on the AM station’s FM translator, thus minimizing any disruption in service (more than 2800 AM stations currently have a cross-service FM translator).<sup>54</sup> In addition, our recent elimination of the rule prohibiting duplicate programming by commonly owned radio stations will facilitate this transition and lessen the impact on listeners by allowing broadcasters to provide the same programming on both analog and all-digital stations operating in the same market.<sup>55</sup> For these reasons, we are not persuaded that it is necessary or advisable to mandate continued analog operation by some or all AM stations if, in their judgement, all-digital broadcasting would better serve them and their listeners.

11. *Coverage.* We confirm our tentative conclusion in the *NPRM* that an all-digital signal offers the potential of greater useable signal coverage compared to existing AM stations—whether analog or hybrid.<sup>56</sup> Because all-digital signals are not compromised by environmental noise in the same manner as analog signals, we agree that all-digital operation should provide superior listenable service over at least the predicted analog service area.<sup>57</sup> REC questions if further study is needed regarding whether power reductions are necessary in order to replicate existing analog service areas.<sup>58</sup> We disagree, finding that a key benefit of all-digital broadcasting is its potential to increase a station’s listenable service area

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<sup>52</sup> Joint Commenters Comments at 2 (positing that the “concern that analog radio listeners may be harmed if a particular AM station chooses to go all-digital is misplaced. Unless a radio station licensee is independently wealthy and is running a radio station as a lark (which is rare), both commercial and non-commercial radio stations have listeners which are essential to the station’s survival. It is the broadcast licensee itself, not the FCC, that best can discern what mode of broadcasting is most likely to attract audiences now and in the future.”); *see also* Winnekins Comments at 1; Schober Comments at 4.

<sup>53</sup> NAB Comments at 10

<sup>54</sup> *See* paragraph 15, *infra*.

<sup>55</sup> *See Amendment of Section 73.3556 of the Commission’s Rules Regarding Duplication of Programming on Commonly Owned Radio Stations*; Report and Order, 35 FCC Rcd 8383 (2020) (*Non-Duplication Order*).

<sup>56</sup> *NPRM*, 34 FCC Rcd at 11568, para. 13; Hubbard Comments at 5 (“MA3 has proven to be superior to both the hybrid (MA1) mode of HD AM and standard analog AM transmissions in terms of signal coverage.”).

<sup>57</sup> *See, e.g.*, Xperi Comments at 15; Hubbard Comments at 9 (“WWFD’s operations have demonstrated that a similar coverage area to analog (in the absence of increased noise) is achieved with MA3 operations. While it is possible that, over time and with more real-world data to analyze, the Commission may want to examine possible adjustments to these power limits, it is likely premature to make any such changes now.”).

<sup>58</sup> *See* REC Comments at 3 (suggesting that the Commission study whether all-digital power should be reduced to replicate current analog service areas).

while operating at the same nominal power, provided this increased coverage does not cause prohibited interference, as discussed in paragraph 27, *infra*.

12. Testing and experimental operation reported in the record support our conclusion that all-digital operation will provide improved listenable coverage. Field testing by NAB Labs demonstrates reliable all-digital daytime reception beyond the subject stations' analog predicted 0.5 mV/m contour and generally out to the 0.1 mV/m contour or beyond along some radials.<sup>59</sup> NAB Labs compared the listenable coverage of four AM stations in both hybrid and all-digital mode, concluding that "the all-digital AM coverage proved to be of greater extent and significantly more robust than the hybrid AM coverage."<sup>60</sup> Similarly, Hubbard reports that in all-digital mode it has experienced reliable daytime signal coverage to its 0.5 mV/m predicted contour (including the two "critical hours" after local sunrise and before local sunset) with reception up to its 0.1 mV/m contour under ideal circumstances.<sup>61</sup> Hubbard notes that the all-digital WWFD transmission "provides a listenable signal even at relatively low signal strength levels," and that even at the point that the primary carriers only are decoded, the data throughput at those levels "is still superior to analog AM broadcasts."<sup>62</sup> All-digital (groundwave) nighttime reception as tested by NAB Labs was generally reliable to or beyond the test stations' analog predicted night interference-free (NIF) contours.<sup>63</sup> Hubbard reports that while WWFD's nighttime reception varies, it is always present within half the value of the NIF contour (calculated to be 5.4 mV/m for WWFD).<sup>64</sup> Crawford contends that this level of nighttime coverage would be sufficient in many cases and that "nighttime all-digital coverage of many stations will extend well beyond the NIF contour, depending on the nature of the nighttime interference."<sup>65</sup> Each station will determine the extent of its likely coverage based on its own circumstances.<sup>66</sup>

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<sup>59</sup> NAB Labs All-Digital AM Test Project I at 24.

<sup>60</sup> NAB Labs All-Digital AM Test Project I at 37.

<sup>61</sup> Hubbard Comments at 5. Hubbard states that the WWFD secondary and tertiary carriers tend to drop out past the daytime 0.5 mV/m contour, with primary carrier reception measured out to the 0.1 mV/m contour. *Id.* Without the secondary and tertiary carriers, the WWFD bitrate drops to 20.2 kbps mono audio (which Hubbard claims is still superior to analog AM broadcasts). *Id.* at 6.

<sup>62</sup> Hubbard Comments at 6.

<sup>63</sup> NAB Labs All-Digital AM Test Project I at 24, 37 (explaining that the single anomaly might have been due to unaccounted-for low ground conductivity in the region and that if the actual ground conductivity were taken into account than the observed all-digital coverage would have occurred outside the NIF for that station as well). AM propagation characteristics vary markedly between daytime and nighttime. During the day, when ionospheric reflection does not occur to any great degree, AM signals travel principally by conduction over the surface of the earth ("groundwave" propagation). During nighttime hours, however, in addition to groundwave propagation, the ionosphere reflects AM signals back to the earth's surface, allowing them to travel hundreds of miles through "skywave" propagation.

<sup>64</sup> Hubbard Comments at 5 (noting that on some evenings immediately after nighttime pattern change, primary carrier reception for WWFD was confirmed out to the nighttime 0.5 mV/m contour).

<sup>65</sup> Crawford Comments at 3.

<sup>66</sup> Class A stations—which are the only AM stations with skywave coverage—will want to consider additional skywave coverage data as it becomes available. Currently, the record indicates that skywave coverage will vary. During the NAB Labs testing, Class A station WBT's (Charlotte, North Carolina) all-digital nighttime coverage at first apparently experienced interference, but subsequently exceeded the hybrid coverage by approximately 50% to 70% and extended beyond its 5 mV/m NIF. NAB Labs All-digital AM Test Project I at 28. NAB Labs notes that the skywave coverage varied from night to night, which "is consistent with the behavior of skywave medium-wave signals." *Id.* This increased coverage is only a concern to the extent it causes interference, which is discussed at paragraph 27 *et seq.*, *infra*. [This footnote is confusing. Why were the coverage results poorer than anticipated if they were much better than hybrid coverage (by approximately 50% to 70%)?] [We removed the quote and clarified the test results]

13. *Efficiencies.* We find that all-digital operation will result in energy and spectrum efficiencies. The record indicates that all-digital operation will result in similar energy usage for AM broadcasters as compared to analog, while producing a clear signal over a wider coverage area.<sup>67</sup> Likewise, the all-digital HD Radio MA3 signal conforms to the existing AM channel spacing and emissions mask requirements, while providing additional services not currently offered in analog AM, such as full stereo audio, metadata, and possible multicast channels. Therefore, we find that it makes full and valuable use of the limited spectrum provided by an AM channel.

14. *Receiver base.* We are not persuaded that the current level of availability of digital receivers should delay voluntary all-digital AM operation. Although commenters debate whether the existing receiver base is adequate to support widespread digital AM service,<sup>68</sup> the data provided by Xperi shows sufficient receiver penetration (an estimated 70 million receivers shipped to North America, with 90% still in use) to support a voluntary option for AM broadcasters to start all-digital broadcasting based on their own circumstances and market conditions.<sup>69</sup> The majority of HD Radio receivers in service (60.9 million) are installed in cars, require no changes to receive all-digital service, and thus present no direct additional cost to consumers.<sup>70</sup> We also anticipate that our regulatory approval of the HD Radio all-digital transmission technology could help boost consumer sales of HD Radio receivers by removing any uncertainty about the future of the AM HD Radio system. Moreover, as discussed in more detail in paragraph 10, *supra*, it will be in most broadcasters' interest to transition to all-digital only when there are a sufficient number of listeners with digital receivers in their market. For these reasons, we are confident that as the number of digital receivers increases, more markets will be able to support all-digital broadcasting.

15. *Cost of conversion.* We find that the potential costs of conversion should not inhibit AM broadcasters from having the option to voluntarily transition to all-digital operation. The record indicates that the cost of conversion will vary widely from station to station;<sup>71</sup> however, because conversion is voluntary, stations can make their own decisions whether to pursue all-digital operations based on their own financial and technical situation as well as the needs and interests of their audience and the number

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<sup>67</sup> Xperi Comments at 16; Hubbard Comments at 6; *see generally NPRM*, 34 FCC Rcd at 11568, para. 14. Broadcasters considering all-digital operation should note that the MA3 mode does not support modulation-dependent carrier-level (MDCL) technology. Xperi Comments at 16. MDCL is a blanket term for various transmission algorithms that are used to reduce power consumption by AM radio stations. *Media Bureau to Permit Use of Energy-Saving Transmitter Technology by AM Stations*, Public Notice, 26 FCC Rcd 12910 (2011). While this technical limitation may be a factor for individual broadcasters in deciding whether to convert to all-digital, this does not militate against us allowing MA3 as an option for AM broadcasters generally.

<sup>68</sup> NAB Comments at 5; CTA Comments at 2, 6 (“[T]he consumer technology industry is prepared to support the launch of all-digital AM radio, with HD Radio receivers already widely available to listeners in vehicles and elsewhere at affordable price points.”); Carl T. Jones Comments at 2 (estimating that 25% to 30% of the total AM receivers in use can receive an all-digital AM signal); *but see* REC Comments at 8 (“Whether production of HD radios by the consumer electronics industry would be stepped-up as a result of HD AM is unknown and is predictably unlikely.”); SBE Comments at 7 (“[T]here is likely not sufficient HD Radio receiver market penetration to sustain an all-digital conversion in many locations.”).

<sup>69</sup> *See* Xperi Comments at 5-6.

<sup>70</sup> *See* Xperi Comments at 6.

<sup>71</sup> *See* Kintronic Comments at 1 (“Each Medium Wave broadcast site tends to be unique in terms of the frequencies, power levels, tower geometries, patterns, and the physical layout involved. These unique characteristics often extend to the RF feed network as well, both in the network topology, and in the margin available in the voltage and current ratings of components and in the network branch adjustment range.”); Carl T. Jones Comments at 4 (noting that variables that can affect the conversion cost include “the number of towers, the height of the tower(s), the power of the station(s), the number of stations multiplexed on the tower(s), and the unique design of the directional antenna system(s)”); Xperi Comments at 18.

of digital receivers in their market.<sup>72</sup> When doing so, broadcasters may wish to consider the relevant factors raised by commenters in the record. First, as discussed above, is the potential economic impact of losing existing analog audiences.<sup>73</sup> NAB points out that more than half of all AM stations now have FM translators, “potentially softening the blow of any loss of listeners and serving as an important part of an analog-to-all-digital transition strategy for AM broadcasters.”<sup>74</sup> We agree, and anticipate that FM translators—although a secondary service—may help facilitate this transition for many stations by mitigating listener loss.<sup>75</sup>

16. Second, we note that all-digital broadcasting places fewer new demands on the transmission system than hybrid operation, therefore minimizing the technical and equipment costs of conversion.<sup>76</sup> Kintronics sets out in detail the system parameters that would be needed for all-digital conversion, concluding that “the measures required on the antenna system for many sites will be minor, and the majority of antenna systems should be capable of digital transmission.”<sup>77</sup> The cost of conversion for AM stations that are already broadcasting in hybrid mode is likely to be minimal.<sup>78</sup> For facilities requiring a major overhaul to accommodate all-digital transmissions, however, the costs will be considerably more. Overall, Xperi reports that the prices of HD Radio-specific transmission equipment have dropped by approximately 80% in the last ten years.<sup>79</sup> Third, we recognize that another cost of voluntary conversion could be licensing fees.<sup>80</sup> According to Xperi, it “currently offers AM stations a perpetual license to use HD Radio technology with no initial or recurring costs to the broadcaster.”<sup>81</sup>

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<sup>72</sup> *NPRM*, 34 FCC Rcd at 11575-77; paras. 33-37; NAB Comments at 10.

<sup>73</sup> NAB Comments at 9; Mount Wilson Comments at 1 (noting that audiences may be limited while markets evolve).

<sup>74</sup> NAB Comments at 9-10; Bohach Comments at 1 (“Virtually all our listeners have migrated to our FM signals. Our AM signal serves no useful purpose anymore. The idea of creating a viable all-digital signal that rivals the best FM sound quality and provides the metadata services that are expected today are strong inducements for us to make the investment.”); Universal Stations Reply Comments at 2 (stating that switching to all-digital may be harder for stations that are “unable to acquire an FM translator or allocate an existing license due to prohibitive costs or spectrum constraints.”).

<sup>75</sup> While we recognize that FM translators are a secondary service and, as such, are subject to displacement, we anticipate that our recently adopted translator interference procedures will facilitate interference remediation, thereby helping to ensure continued operation. *Amendment of Part 74 of the Commission’s Rules Regarding FM Translator Interference*, Report and Order, 34 FCC Rcd 3457 (2019); see also REC Comments at 2.

<sup>76</sup> See Crawford Comments at 2 (noting that although “some load orientation optimization may be required in some cases,” all-digital broadcasting “removes a big technical and economic impediment to digital conversion for many licensees.”).

<sup>77</sup> Kintronic Comments at 3 (noting that compatibility may not be possible for some systems, “such as directional arrays with very high RSS/RMS ratios”); see also Carl T. Jones Comments at 4-5 (stating that while many stations are capable of passing the all-digital signal without any change to their existing equipment, the “vast majority of stations will require some modification to their impedance matching or phasing and coupling systems to meet the load impedance VSWR and symmetry requirements.”). Carl T. Jones also contends that certain directional antenna systems, typically those with high RSS/RMS ratios, may not be possible to convert. *Id.*

<sup>78</sup> Xperi Comments at 18; Kintronic Comments at 2 (stating that antenna systems that were designed for MA1 operation should meet the transmission requirements for all-digital broadcasting).

<sup>79</sup> Xperi Comments at 18-19; see also Carl T. Jones at 4 (estimating that the cost of conversion can range from \$0–5,000 for a non-directional station to convert the impedance matching equipment, through \$5,000–20,000 for simple directional stations to convert the phasing and couple systems, to several hundred thousand dollars for complex directional arrays and multiplexed sites); SBE Comments at 6 (estimating that even without extensive antenna changes, licensing and signal generation equipment could be “in excess of \$25,000”); Crawford Comments at 3.

<sup>80</sup> Legate Comments at 3; Schober Comments at 7.

<sup>81</sup> Xperi Comments at 5, 18; see also Bryan Broadcasting Comments at 8 (stating that it has entered into two fee-free licensing contracts with Xperi). We note that Xperi does not specify the duration of this offer.

Because we are not imposing a mandate to convert to all-digital, we believe that stations will take the cost of licensing fees into account as one of many factors when deciding whether to convert.<sup>82</sup>

17. In sum, we emphasize that each AM licensee will make its own determination whether to convert to all-digital, taking into account the factors described above, such as the specific conversion costs and whether listeners in its market have access to digital receivers. Therefore, we anticipate that while some broadcasters may be prepared for immediate conversion, many broadcasters may choose to postpone all-digital conversion based on their own circumstances and the readiness of their market.<sup>83</sup> This gradual rate of conversion will help facilitate an orderly transition by allowing both the Commission and the industry to make any adjustments that may be necessary to the all-digital framework adopted herein.

## B. Operating and Technical Rules

18. *Nominal power.* We are persuaded to modify our proposal for how all-digital stations will calculate their compliance with the allowed operating power (nominal power) limit for AM stations set out in section 73.21 of the rules and individual station authorizations. In the *NPRM*, we proposed to apply the existing nominal power limits to the unmodulated analog carrier signal at the center of the MA3 waveform.<sup>84</sup> While this proposal garnered some support,<sup>85</sup> Nautel and Xperi argue that this approach would hinder adoption of all-digital transmission because it would require significant infrastructure investment to accommodate the higher peak power levels inherent in the MA3 signal structure.<sup>86</sup> Instead, Nautel proposes to use the average power of the all-digital signal (including the unmodulated analog carrier power and all of the digital sidebands) to determine whether the station is complying with the nominal power limits set out in section 73.21.<sup>87</sup> We agree with this proposal and note that no commenters oppose it. We find that this nominal power limit is technically feasible, as demonstrated in the NAB Labs experiments and WWFD's experimental operation.<sup>88</sup> Using the average power to calculate compliance with the nominal power limit will enable more stations to use existing transmitters for all-digital operations, thus reducing the cost of upgrading to all-digital and allowing more stations to convert.<sup>89</sup> In addition, this method of calculating nominal power will result in a lower operating power for all-digital stations, which will be less likely to cause interference with analog signals while still maintaining improved listenable coverage areas.<sup>90</sup>

19. We decline requests to create a blanket exception to the requirement in section 73.1560 of the rules that AM stations must "maintain antenna input power as near as practicable to the authorized antenna input power and in any case not less than 90 percent."<sup>91</sup> This longstanding rule is intended to

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<sup>82</sup> In this regard, we note that Xperi has committed to license the HD Radio technology on reasonable and non-discriminatory terms and conditions. *See* footnote 120, *infra*.

<sup>83</sup> *See* Legate Comments at 3; REC Comments at 4.

<sup>84</sup> *NPRM*, 34 FCC Rcd at 11571, para. 23.

<sup>85</sup> *See* Crawford Comments at 3; Hubbard Comments at 8.

<sup>86</sup> Nautel Comments at 5; Xperi Reply Comments at 2-3; Smith and Henry Reply Comments at 9.

<sup>87</sup> *See* Nautel Comments at 2; NAB Reply Comments at 5-6; Xperi Reply Comments at 2-3; 47 CFR § 73.21.

<sup>88</sup> *See* Xperi Reply Comments at 3; Nautel Comments at 2.

<sup>89</sup> *See* Xperi Reply Comments at 2.

<sup>90</sup> *See* Smith and Henry Reply Comments at 9.

<sup>91</sup> *See* 47 CFR § 73.1560(a)(1) (requiring AM stations not using modulation dependent carrier level (MDCL) technology to maintain antenna input power as near as practicable to the authorized antenna input power and in any case not less than 90 percent nor greater than 105 percent of the authorized power); Nautel Comments at 5 ([W]e recommend that the Commission take a flexible stance on licensed power limits and allow operation up to 25% below licensed power limits . . ."); Xperi Reply Comments at 3 (urging that "stations with aging infrastructure should be permitted to conduct MA3 operations at less than the stations' authorized power limits").

“control station power so as to insure coverage in accordance with the terms of the station authorization while preventing unexpected interference to other stations.”<sup>92</sup> All-digital licensees that, for operational reasons, wish to reduce power below the limits currently allowed may either apply for special temporary authorization pending an equipment upgrade or request a waiver of section 73.1560.<sup>93</sup>

20. *Digital spectral emissions limits.* We adopt a modified version of the spectral emissions limits proposed in the *NPRM*.<sup>94</sup> Specifically, we only find it necessary to apply the emissions mask set out in section 73.44 of the rules to all-digital operations.<sup>95</sup> The section 73.44 emissions mask attenuates—or limits—spectral emissions outside a bandwidth of 20 kHz to the point where they do not cause significant adjacent channel interference.<sup>96</sup> We agree with commenters that these emissions limits will adequately protect stations on adjacent channels from all-digital interference.<sup>97</sup> Although testing indicates that the digital signals may cause some increased degradation to analog signals, in most cases this will be masked by the noise floor, and in any case there is no evidence that interference will occur within service areas that are currently protected under our rules. In the unlikely event that such prohibited interference should occur, the interfering station must follow the remediation procedure set out in paragraph 32, *infra*, to promptly resolve the interference.

21. We decline to additionally impose the stricter spectral emissions limits set out in the HD Radio Specifications and incorporated into the NRSC-5-D Standard (HD Radio emissions limits), as proposed in the *NPRM*.<sup>98</sup> First, as mentioned above, commenters and testing support our conclusion that our longstanding section 73.44 emissions limits will adequately protect stations on adjacent channels from all-digital interference. Second, the record indicates that these stricter HD Radio emissions limits may not be set at technically feasible levels and may need to be revisited in light of field data from all-digital experimental operation.<sup>99</sup> NAB Labs, in particular, reports that the nine radio stations that underwent field testing as part of the NAB Labs All-Digital AM Test Project had difficulty complying with the HD Radio emissions limits.<sup>100</sup> We thus conclude that requiring compliance with these limits could hamper the deployment of all-digital service. However, the Commission may revisit whether compliance with the stricter standard is necessary or advisable as we gain more experience with all-digital operation.

22. *Power measurements.* Recognizing that this is an evolving and highly technical area, we provide all-digital licensees the flexibility to choose any reliable and reasonably accurate method to

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<sup>92</sup> *Rust Communications Group, Inc.*, Memorandum Opinion and Order, 46 FCC.2d 663, 667, para. 7 (1974).

<sup>93</sup> See 47 CFR § 73.24(i). Such requests should state, at a minimum, the technical reason for the request, the station’s proposed operating power, and the predicted signal strength coverage at that operating power (including a showing of community of license coverage as required by section 73.24(i) of the rules).

<sup>94</sup> *NPRM*, 34 FCC Rcd at 11572, para. 24.

<sup>95</sup> See 47 CFR § 73.44.

<sup>96</sup> *Amendment of the Commission’s Rules to Improve the Quality of the AM Service by Reducing Adjacent Channel Interference and by Eliminating Restrictions Pertaining to the Protected Daytime Contour*, Notice of Proposed Rulemaking, 3 FCC Rcd 5687, 5689, para. 18 (1988); see also *Amendment of the Commission’s Rules to Improve the Quality of the AM Service by Reducing Adjacent Channel Interference and by Eliminating Restrictions Pertaining to the Protected Daytime Contour*, First Report and Order, 4 FCC Rcd 3835 (1989).

<sup>97</sup> See Xperi Comments at 24-25, n.52; Hubbard Comments at 9; Crawford Comments at 4.

<sup>98</sup> *NPRM*, 34 FCC Rcd at 11572, para. 24; 47 CFR § 73.44.

<sup>99</sup> See, e.g., NAB Labs All-Digital AM Test Project I at 20; Xperi Comments at 24-25, n. 52; Legate Comments at 2; Crawford Comments at 4; Hubbard Comments at 9.

<sup>100</sup> NAB Labs All-Digital AM Test Project I at 20.

measure their compliance with the Commission's operating power and power spectral density rules.<sup>101</sup> However, should an issue arise regarding emission mask compliance, we will evaluate the measurement technique used for conformity with industry best practices. For its laboratory testing, NAB Labs used a spectrum analyzer and the method described in the HD Radio Specifications, which states that measurements of an all-digital transmission signal, "shall be made by averaging the power spectral density in a 300-Hz bandwidth over a minimum time span of 30 seconds and a minimum of 100 sweeps."<sup>102</sup> Hubbard believes that the preferred method is the thermocouple RF ammeter, noting as well that "[t]he majority of digital transmitters should include measurement tools capable of accurately monitoring compliance with the proposed operating power and emissions mask limitations."<sup>103</sup> Legate advocates the use of integrated circuit technology.<sup>104</sup> Consistent with existing rules governing power measurement in other contexts, we are persuaded to permit more than one appropriate measurement method.<sup>105</sup> No commenter opposes any of the methods discussed above, and we find any of these methods to be acceptable.

23. *Use of digital subcarriers.* We adopt the proposal in the *NPRM* that each all-digital station is obligated to provide at least one free over-the-air digital programming stream that is comparable to or better in audio quality than a standard analog broadcast. Xperi supports this proposal, noting that "free audio programming remains at the core of the digital radio service"<sup>106</sup> Beyond this requirement, an all-digital licensee can use its additional digital bitrate capacity for either broadcast or non-broadcast services consistent with our technical rules.<sup>107</sup> We note that this capacity varies depending upon the mode of operation. WWFD initially operated in core-only (reduced bandwidth) configuration while it modified its facility to enable transmission in enhanced mode (greater bandwidth).<sup>108</sup> Therefore, subject to the digital notification requirement discussed in paragraph 37, *infra*, we will permit each AM broadcaster to select either core-only or enhanced mode transmission as their situation dictates. Because of the competitive advantages and consumer expectations regarding program and station metadata, however, we reject Legate's suggestion to require that additional digital data capacity be used only to enhance audio fidelity, particularly stereo audio.<sup>109</sup>

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<sup>101</sup> See *NPRM*, 34 FCC Rcd at 11573, para. 26 (seeking comment on whether the Commission should specify what types of measurements will be acceptable to demonstrate compliance with the Commission's rules).

<sup>102</sup> NAB Labs All-digital AM Test Project I at 71; HD Radio Specifications at 13; *see also* Nautel Comments at 2.

<sup>103</sup> Hubbard Comments at 8 (stating that an upcoming technical paper will outline various methods of verifying digital power based on the use of unmodulated carrier power as a reference and discuss "findings that the use of thermocouple RF ammeters for base current and common point power measurements yielded the same results, which may eliminate the need for continuous wave measurements.").

<sup>104</sup> Legate Comments at 2.

<sup>105</sup> See, e.g. 47 CFR § 73.267 (if the provided formula for calculating operating power is not appropriate for the equipment used, the licensee should "use a formula specified by the transmitter manufacturer with other appropriate operating parameters.").

<sup>106</sup> See Xperi Comments at 14 (explaining that "free audio programming remains at the core of the digital radio service").

<sup>107</sup> Because the record does not establish that an audio stream on an HD-2 subchannel is currently technically feasible, we will evaluate requests to rebroadcast multicast channels on an FM translator on a case-by-case basis until a more fully developed record is available on this subject. [What about the Hubbard test referenced earlier?] We are not convinced that the Hubbard test demonstrated that a full second audio stream is currently feasible. This conclusion is reinforced by our exchanges with the applicant for all-digital station

<sup>108</sup> See *NPRM*, 34 FCC Rcd at 11567-68, para. 12; Hubbard Comments at 3-4; paragraph 4, *supra*.

<sup>109</sup> See Legate Comments at 2.



24. *Carrier frequency tolerance standard.* We impose the same carrier frequency tolerance applicable to analog and hybrid stations ( $\pm 20$  Hz) on all-digital AM stations.<sup>110</sup> We decline at this time to impose a  $\pm 1$  Hz AM carrier frequency tolerance standard on all AM stations as proposed in the *NPRM*.<sup>111</sup> A carrier frequency tolerance standard refers to the amount, in hertz, that a carrier's actual operating frequency may depart from its assigned frequency. As explained in the *NPRM*, off-frequency analog signals degrade all-digital signals to a greater degree than signals that are locked or within 1 Hz of each other, and vice versa.<sup>112</sup> While the record is clear that a stricter standard would improve all-digital (as well as analog) reception,<sup>113</sup> it is less clear that this improvement is worth the burden of imposing the costs of such an upgrade on an already struggling AM service. Although new transmitters may be capable of maintaining a stricter carrier frequency tolerance standard using GPS synchronization, several commenters argue that older AM facilities—including analog stations—may have trouble maintaining the proposed carrier frequency tolerance or that the cost of doing so may be prohibitive.<sup>114</sup> We find persuasive Xperi's argument that "the tighter frequency tolerance of 1 Hz . . . could encumber the transition of existing analog stations to all-digital."<sup>115</sup> Because we expect all-digital adoption to be gradual at first, we are reluctant at this time to make sweeping rule changes to improve reception for the relatively small number of all-digital stations that are initially expected to convert.<sup>116</sup> However, we reserve the right to revisit this issue as the all-digital service matures, and, in the meantime, encourage AM licensees to make every effort to maintain or improve their frequency tolerances to help avoid interference to other stations.<sup>117</sup>

25. *NRSC-5-D Standard.* Although we permit its use, we decline to incorporate the NRSC-5-D Standard by reference into the Commission's rules, as proposed in the *NPRM*, for the reasons set out below.<sup>118</sup> The NRSC-5-D Standard sets forth the technical parameters for broadcasting digital audio and data signals in the AM service. Based on the record, we conclude that the potential negative consequences of codifying the NRSC-5-D Standard outweigh the benefits.<sup>119</sup> The main argument for

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<sup>110</sup> See 47 CFR § 73.1545(a) (imposing a  $\pm 20$  Hz carrier frequency departure tolerance on AM stations).

<sup>111</sup> *NPRM*, 34 FCC Rcd at 11573, para. 27.

<sup>112</sup> *NPRM*, 34 FCC Rcd at 11573, para. 27 (citing NAB Labs All-Digital AM Test Project II at 63).

<sup>113</sup> See NAB Reply Comments at 4; Smith and Henry Reply Comments at 8-9; Crawford Comments at 4; Xperi Comments at 24-25; Hubbard Comments at 10; Hershberger Comments at 2; Nautel Comments at 9; Schober Comments at 9-10.

<sup>114</sup> See NAB Reply Comments at 4 (arguing that in "today's extremely challenging economic climate for radio broadcasting" such a requirement would be "a burden and counterproductive to the FCC's goal of AM radio revitalization"); Schober Comments at 10; Hubbard Comments at 10; Crawford Comments at 4.

<sup>115</sup> Xperi Reply Comments at 3 ("While state-of-the-art transmitters typically have the capability to synchronize to an external reference (which would allow newer installations to meet the requirement), upgrading existing installations to the suggested frequency tolerance would be cost prohibitive. In the interest of moving forward with digital operations and not encumbering existing analog stations, Xperi recommends that the FCC defer consideration of this requirement until more digital stations are operational.").

<sup>116</sup> Analog-to-analog interference is beyond the scope of this proceeding.

<sup>117</sup> See, e.g., Crawford Comments at 4 (stating that it already "strives to maintain its carrier frequencies within a 1 Hz tolerance as a means of reducing beat note interference to and from co-channel stations, particularly at night.").

<sup>118</sup> *NPRM*, 34 FCC Rcd at 11574, para. 31.

<sup>119</sup> Because we do not adopt the NRSC-5-D standard, we do not address the issue of whether the NRSC-5-D standard is complete without a fully disclosed and publicly available codec. Hardis Comments at 7-8. However, we note that Xperi has committed to license on reasonable terms and conditions that are demonstrably free of any unfair discrimination all patents necessary to implement NRSC-5, either with or without the HD Radio codec, and that it is possible within the NRSC-5 standard to use audio source coding and compression schemes other than Xperi's HD Radio codec. *Digital Radio Second Report and Order* at 10344, n.22; Letter from Michael Petricone (Consumer

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incorporation by reference raised by commenters in the record is regulatory certainty—incorporating the NRSC-5-D Standard into the rules would “provide a more organized package of rules” and make it clear that HD Radio is “the one and only digital radio system approved for use in the United States.”<sup>120</sup> According to NAB, by codifying a single standard, the Commission would avoid the type of regulatory uncertainty that led to the “AM Stereo Wars” in the 1980s.<sup>121</sup>

26. We reject this argument. Here there are no competing standards leading to industry confusion, as in the “AM Stereo Wars.” Rather, there is only one DAB technology approved for use in the AM band in the United States. Moreover, there is no evidence that NRSC-5-D is not effective as a voluntary industry standard—i.e., that it is failing to ensure rule compliance, technical feasibility, or compatibility between transmitters and receivers.<sup>122</sup> Therefore, upon review of the record, we conclude that there is no need for the Commission to incorporate by reference a detailed set of technical parameters merely to emphasize the fact that there is currently only one authorized AM DAB system. Moreover, if we were to consider incorporating by reference the NRSC-5-D standard in the future, we would likely aim for consistency across services, and thus would consider AM all-digital, AM hybrid, and FM hybrid technical standards at the same time. We also note that, as a voluntary industry standard, the NRSC-5-D Standard can be more readily updated in response to technological developments or operational feedback from all-digital stations, as several commenters anticipate is likely to be necessary in these very early stages of all-digital broadcasting.<sup>123</sup> Finally, we emphasize that by approving use of HD Radio technology, we do not foreclose the possibility of authorizing alternative technologies in the future, if they are properly before us.<sup>124</sup>

27. *Prohibited interference.* We authorize all-digital operations subject to the requirement that such operations do not cause prohibited interference (as defined in sections 73.37, 73.182 and 73.187 of the rules) to other broadcast stations and follow the remediation procedure set out in paragraph 32, *infra*.<sup>125</sup> We continue to adhere to the principle—as the Commission explained in 2002—that “some

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Electronics Association) and Valerie Schulte (NAB) to Marlene Dortch, Secretary, FCC, dated May 18, 2005, in MM Docket No. 99-325.

<sup>120</sup> NAB Ex Parte at 4, 12; *NPRM*, 34 FCC Rcd at 11574, para. 31; *see also* SBE Comments at 5-6 (“An appropriate, single technical standard for all-digital AM stations is the NRSC-5-D Standard.”); Xperi Comments at 26 (explaining that incorporating the NRSC-5-D standard into the Commission’s rules would “provide the industry with greater regulatory certainty, better organize the Commission’s digital radio rules, and promote international adoption of the HD Radio system.”); NPR Comments at 4.

<sup>121</sup> NAB Ex Parte at 2 (citing Federal Communication Commission, “AM Stereo Broadcasting,” <https://www.fcc.gov/media/radio/am-stereo-broadcasting> (last visited Sept. 21, 2020)). At that time, NAB explains there were five systems competing to become the AM stereo technology standard, and the Commission elected to let the marketplace decide between them. Implementation of AM stereo was thus delayed because neither broadcasters nor receiver manufacturers wanted to invest in what could be a losing system. Ultimately, the Commission selected a single system in 1993 under a Congressional mandate, but “the momentum for deploying AM stereo had already been lost and the AM stereo service never flourished.” *Id.*

<sup>122</sup> We emphasize that by declining to incorporate by reference the NRSC-5-D Standard into our rules, we do not intend to undermine its effectiveness and use within the industry.

<sup>123</sup> *See* Hubbard Comments at 9 (“[T]he NRSC-5-D emissions mask likely needs to be relaxed to accommodate real-world experiences with MA3 transmissions”); Smith and Henry Comments at 9; Hardis Comments at 3.

<sup>124</sup> We would consider arguments regarding the multi-system compatibility of all-digital receivers in the context of any such future proceeding. *See* DRM Ex Parte at 2; Hardis Comments at 9; Schober Comments at 6; Henry Comments at 1.

<sup>125</sup> *See* 47 CFR §§ 73.37, 73.182, and 73.187; *Digital Radio First Report and Order*, 17 FCC Rcd and 20001, para. 29; NAB Comments at 9 (“For example, the station operating in all-digital mode may reduce power or reach some other arrangement with an aggrieved co-channel station. Moreover, if such an agreement proves out of reach, the Commission has procedures for imposing a power reduction or even terminating a hybrid digital station’s operation.

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additional interference outside a station's protected contour is an acceptable tradeoff given the larger public interest benefits at stake."<sup>126</sup> We agree with Hubbard that "in order to avoid disincentivizing a station from voluntarily transitioning to all-digital, the current AM allocation scheme should not be altered to protect analog stations beyond the contours to which they are currently entitled."<sup>127</sup>

28. The Commission's objective for many years has been the creation of a viable all-digital AM service.<sup>128</sup> To achieve this objective, however, we need to have confidence that the transition to all-digital will not create harmful interference for existing analog and hybrid digital AM operations. Ultimately, in an all-digital environment, both adjacent and co-channel interference are expected to be less due to the data encoding and error correction inherent in digital transmission<sup>129</sup> and the "capture effect" where only one station (the stronger one) is heard.<sup>130</sup>

29. Regarding adjacent-channel interference, we agree with NAB Labs that, because an all-digital signal pulls a significant amount of the signal energy into the center of the channel as compared to hybrid, the "exhaustive hybrid AM tests already conducted [prior to the authorization of the hybrid mode] represent the worst-case adjacent-channel interference conditions for the HD Radio AM system."<sup>131</sup> This view is reinforced by several other commenters that predict that all-digital operation, due to the narrower bandwidth and concentration of power toward the center of the channel, is less likely than hybrid to cause interference to adjacent channels.<sup>132</sup> We are cognizant, however, that although hybrid operation places both primary and secondary sidebands on first adjacent frequencies, all-digital operation in enhanced mode would remove the primary sidebands but still leave secondary and tertiary sidebands within first

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NAB submits that the Commission's current policies and procedures for preventing interference by hybrid signals should equally suffice for all-digital AM operations."); Xperi Comments at 23-24 (suggesting that the Commission use the interference policy set out for hybrid AM stations to allow reduction of 6 dB to the secondary or tertiary sideband of an all-digital signal); NPR Comments at 3 (urging the Commission to ensure that the transition to all-digital radio does not cause harmful interference).

<sup>126</sup> *Digital Radio First Report and Order*, 17 FCC Rcd at 19995, para. 15 ("Spectrum management necessarily involves tradeoffs between interference and service.").

<sup>127</sup> Hubbard Comments at 8.

<sup>128</sup> *Digital Radio First Report and Order*, 17 FCC Rcd at 20003, para. 37 (stating that the "ultimate goal" is a "fully digital terrestrial radio service"); SBE Comments at 2 ("SBE views, and has viewed the current MA1 (hybrid) mode as a temporary step toward authorizing the full-digital MA3 mode. MA1 was never intended to be the ultimate goal, because it does not offer AM licensees the full benefits of digital broadcasting."); Xperi Comments at 2; Schober Comments at 10.

<sup>129</sup> See Schober Comments at 10.

<sup>130</sup> Hubbard Comments at 6; see NAB Labs All-digital AM Test Project II at 63 ("The results suggest that if all AM stations were digital, co-channel interference would be less, thus potentially increasing groundwave coverage for a given power level and carrier frequency.").

<sup>131</sup> NAB Labs All-Digital AM Test Project I at 41.

<sup>132</sup> NAB Comments at 3 ("Interference from all-digital AM signals to first-adjacent channels is essentially eliminated as a concern when utilizing the core mode of operation, and greatly reduced (compared to the MA1 hybrid mode of HD Radio operation currently authorized by the FCC) when utilizing the MA3 enhanced mode of operation"); Hubbard Comments at 6 ("Because MA3 transmissions stay entirely within a 20 kHz channel, any adjacent-channel interference that may have been experienced by stations operating in the MA1 mode will be reduced or eliminated."); NAB Labs All-digital AM Test Project I at 41 (predicting that all-digital AM will cause "significantly less interference to adjacent channel signals by virtue of its reduced RF bandwidth (either  $\pm 5$  or  $\pm 10$  kHz) compared to hybrid AM (with a bandwidth of  $\pm 15$  kHz)"); Xperi Comments at 21 ("In particular, the HD Radio system is designed not to impact stations operating in analog within those stations' 0.5 mV/m contour."); see also *NPRM*, 34 FCC Rcd at 11569, para. 17.

adjacent channel frequencies, at the same power level as the primary sidebands of the MA1 mode.<sup>133</sup> Thus, although much signal energy is removed from adjacent channel frequencies in all-digital mode, enough remains so that we cannot definitively say that significantly less adjacent-channel interference will be caused by all-digital operation as compared to hybrid operation. Therefore, we find that the record is not conclusive with regard to the extent to which all-digital operations may represent an improvement over hybrid with respect to adjacent channel interference. However, we agree with NAB Labs that the reduction of signal energy in the adjacent channel frequencies in all-digital operation is likely to reduce adjacent-channel interference and in any case it will not exceed existing hybrid levels. In this respect, we are encouraged by the fact that WWFD, which is operating in all-digital, has not received any interference complaints from neighboring adjacent-channel stations.<sup>134</sup> Moreover, we are confident our existing rules will allow us to address any adjacent channel interference in the unlikely event that all-digital causes prohibited interference and the stations are not able to resolve the issue on their own.

30. With respect to co-channel interference, experimental all-digital operation and field testing do not indicate any additional risk of co-channel interference. No stations have reported co-channel interference caused by WWFD.<sup>135</sup> In addition, NAB Labs tested the effect of station WSWW on four co-channel neighbors in both analog and all-digital modes and found that “in each case, the impairment to the co-channel station was essentially equivalent irrespective of whether the interference from WSWW was from an analog or an all-digital AM signal.”<sup>136</sup>

31. NAB Labs lab testing indicates, however, that in a noise-free environment, all-digital operation has the potential for greater interference than either hybrid or analog operation.<sup>137</sup> This behavior can be attributed to the more powerful primary digital sidebands in the all-digital waveform.<sup>138</sup> This potential for interference is mitigated in the presence of a high level of environmental noise, in which case the all-digital interference is likely to be subsumed by the overall noise floor, masking the interfering effect of the all-digital signal to the point that there is “essentially no difference in audio quality between the analog and all-digital AM interference cases.”<sup>139</sup> NAB Labs contends that this scenario is likely a more accurate reflection of interference performance “in the real world where there is

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<sup>133</sup> Hershberger Comments at 1; Smith and Henry Reply Comments at 3. (“[N]o meaningful testing has been published on adjacent-channel interference of MA3 signals into analog, but we expect that the result will be similar to the results historically encountered with hybrid (MA1) into analog, since the total adjacent-channel power in full-rate MA3 is even higher than with MA1. Therefore, we suggest that more definitive testing is needed before any wholesale deployment of MA3, lest we have another negative scenario like was experienced with MA1, especially at night.”). We are not persuaded that additional testing is necessary to allow all-digital operation on a voluntary basis, because the reduction of signal energy in the adjacent channel frequencies in all-digital operation is likely to reduce adjacent-channel interference and in any case it will not exceed existing hybrid levels.

<sup>134</sup> Hubbard Comments at 7; Xperi Comments at 8.

<sup>135</sup> Hubbard Comments at 7; Xperi Comments at 8.

<sup>136</sup> NAB Labs All-digital AM Test Project I at 37; *see also* NAB Comments at 8, note 31 *supra*.

<sup>137</sup> Specifically, the NAB Labs testing showed an average all-digital signal-to-noise ratio degradation—in the absence of any other noise—of approximately 14.5 dB (individual results depended on the phase relationship between the carrier frequencies). NAB Labs All-digital AM Test Project II at 63.

<sup>138</sup> NAB Labs All-digital AM Test Project I at 41.

<sup>139</sup> NAB Labs All-digital AM Test Project II at 62; NAB Comments at 8; Hubbard Comments at 7-8 (“Hubbard concurs with the NAB Labs testing which found that impairment to analog co-channel stations was essentially equivalent whether a station is operating with an analog or an all-digital AM signal”); Carl T. Jones Comments at 2 (agreeing with NAB Labs’ conclusion that although the interference caused to an analog station by a co-channel all-digital station would be approximately 14.5 dB worse than by another analog station with equivalent power, this effect was essentially masked by real world environmental noise).

substantial RF noise in the AM band.”<sup>140</sup> We agree and therefore find that this noise-free environment concern is unlikely to be a practical issue in a real world environment and does not undermine the benefits of all-digital operation.

32. *Remediation procedure.* In the event that prohibited interference does occur, we adopt a streamlined resolution procedure based on the procedures currently applicable to hybrid stations.<sup>141</sup> It is our expectation that AM all-digital operators and complaining stations will work together to identify whether interference exists and to resolve interference complaints in a mutually acceptable fashion, including voluntary power reduction.<sup>142</sup> To facilitate this, we amend section 73.404(b) of the rules to allow up to 6 dB reduction of all-digital secondary or tertiary sidebands to avoid or resolve prohibited interference.<sup>143</sup> This change can be implemented by an all-digital AM station without further approval by the Commission, either unilaterally or as part of an agreement with another station. However, our main concern relates to changes to the primary sidebands because they transmit the main audio programming and thus a 6 dB reduction of the primary sidebands would significantly affect the station’s coverage area. For this reason, all-digital licensees seeking to reduce power in their primary sidebands must either apply for special temporary authorization or request a waiver of section 73.404(b), which will be considered on a case-by-case basis.<sup>144</sup> If the parties fail to reach an agreement that resolves the interference complained of, the affected station may file an interference complaint with the Commission, describing the technical means used to identify all-digital interference and fully documenting the source and extent of the interference. Although, as explained in paragraph 25, *supra*, we are not mandating compliance with the NRSC-5-D Standard, we strongly recommend that station engineers configure their systems according to industry best practices and the specifications set out in the voluntary industry standard NRSC-5-D and HD Radio Specifications.<sup>145</sup>

33. Due to the minimal interference detected in the all-digital testing environment, and the remediation procedures outlined above, we disagree with the commenters who ask that we delay authorization of all-digital AM radio pending additional testing or experimental operation.<sup>146</sup> We agree with commenters that contend that the record to date is sufficient to proceed with authorization of

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<sup>140</sup> NAB Labs All-digital AM Test Project II at 63.

<sup>141</sup> See *NPRM*, 34 FCC Rcd at 11570, para. 20 (seeking comment on the effectiveness of the hybrid remediation procedure and whether it should be applied to all-digital operation).

<sup>142</sup> Smith and Henry Reply Comments at 8 (suggesting that “any interference to existing analog stations by MA3 operations should be dealt with by the stations themselves; if no satisfactory resolution can be achieved, the Commission should be notified as under the current hybrid HD (MA1) rules.”).

<sup>143</sup> See Carl T. Jones Comments at 4; 47 CFR § 73.404(b) (“In situations where interference to other stations is anticipated or actually occurs, AM licensees may, upon notification to the Commission, reduce the power of the primary DAB sidebands by up to 6 dB. Any greater reduction of sideband power requires prior authority from the Commission via the filing of a request for special temporary authority or an informal letter request for modification of license.”); NAB Comments at 9.

<sup>144</sup> See 47 CFR § 73.24(i). Such requests should state, at a minimum, the technical reason for the request, the station’s proposed operating power, and the predicted signal strength coverage at that operating power (including a showing of community of license coverage as required by section 73.24(i) of the rules).

<sup>145</sup> As explained in paragraph 25, *supra*, however, we are not requiring conformity with the NRSC-5-D emissions limits, only with the Commission emissions mask set out in section 73.44.

<sup>146</sup> See, e.g., Smith and Henry Reply Comments at 5 (“We believe that the NAB/PILOT testing . . . is a good start, but more field and lab testing should be completed before a full rollout of MA3 transmissions is authorized. The use of Experimental licenses, and timely reporting therein, would go far to establish a solid engineering record before final Rules for all-digital AM broadcasting are adopted by the Commission.”); Carl T. Jones Comments at 3.

voluntary all-digital AM operation.<sup>147</sup> As stated by NAB, “The HD Radio MA3 all-digital operating mode is a proven technology . . . any lingering technical concerns with the MA3 mode are vastly outweighed by the consumer benefits of all-digital operation.”<sup>148</sup> The record demonstrates the technical feasibility of all-digital broadcasting, which is ready and available to be used voluntarily on a station-by-station basis. Based on the demonstrated benefits of all-digital broadcasting and the significant advantages it offers over either analog or hybrid operation, we do not believe that it is in the public interest to delay implementation by requiring additional tests, or require that stations undertake potentially expensive digital conversions under experimental licenses.<sup>149</sup> To the extent there may be prohibited interference, we believe, based on the relative signal strengths of the stations concerned, that the risk of such interference is very small; moreover, because stations will be converting to all-digital operation on a gradual basis as circumstances warrant, any immediate issues that may arise can be promptly resolved using existing rules and the remediation procedure established herein.

34. *Nighttime operation.* We agree with the many commenters that argue that all-digital operation should be permitted both day and night.<sup>150</sup> Restricting all-digital operations to daytime or reducing power levels “would insure that all-digital AM would not survive” and reduce incentives for stations to convert to all-digital.<sup>151</sup> Although some commenters express concern that skywave propagation characteristics will result in increased interference at night,<sup>152</sup> Xperi claims that the skywave behavior of a digitally-modulated signal will be comparable to that of an analog signal.<sup>153</sup> Similarly, NAB and others point out that WWFD has been “broadcasting all-digital nighttime service for 20 months [since July 2018] without any problems.”<sup>154</sup> However, we are cognizant of the possibility that the noise floor masking effect described in paragraph 31, *supra*, may not be applicable at night if the desired station’s nighttime signal is well above the environmental noise level.<sup>155</sup> Although we are confident that prohibited interference as defined in sections 73.37, 73.182 and 73.187 will not occur,<sup>156</sup> if signal degradation is not masked by the noise floor, and other interferers are not present, there is a possibility of signal degradation approaching the levels observed by NAB Labs during its testing. As discussed in

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<sup>147</sup> See, e.g., NAB Comments at 3-4; Xperi Comments at 8,14; CTA Comments at 1,4; Bryan Broadcasting Comments at 7; Hubbard Comments at 2; Puerto Rico Broadcasters Comments at 2; Carl T. Jones Comments at 2.

<sup>148</sup> NAB Reply Comments at 3-4.

<sup>149</sup> See Smith and Henry Reply Comments at 3 (suggesting that all-digital stations be authorized solely pursuant to experimental licenses until extended field evaluations of digital-to-analog interference are conducted).

<sup>150</sup> Winnekins Comments at 1 (arguing that nighttime noise is “already so severe that “our city of license cannot hear our station at low power.”); Crawford Comments at 3 (“While we realize that there is increased potential for interference through skywave propagation at night, because MA3 emissions are confined to the bandwidth of the analog signal, we do not believe that such transmissions will produce increased nighttime interference.”); NAB Comments at 3; Joint Commenters Comments at 3; Hubbard Comments at 8; see also *NPRM*, 34 FCC Rcd at 11571, para. 22 (seeking comment on all-digital nighttime operation).

<sup>151</sup> Joint Commenters Comments at 3.

<sup>152</sup> Joseph Talbot Comments at 1 (“All digital transmission does not work reliably under skywave conditions and the nature of any interference caused by it needs to be evaluated, considered, and mitigated.”); Carl T. Jones Comments at 3 (“[I]t is recommended that further tests be performed to ensure that existing nighttime analog operations are not adversely impacted by stations that convert to all-digital operation.”); REC Comments at 4.

<sup>153</sup> Xperi Comments at 24 (“when an all-digital signal is operated at the recommended level mimicking the perceived coverage of an analog signal, the skywave propagation is expected to affect the all-digital signal no more than an analog signal would be impacted.”).

<sup>154</sup> NAB Comments at 3; see also Joint Commenters Comments at 3; Hubbard Comments at 8.

<sup>155</sup> Carl T. Jones Comments at 3.

<sup>156</sup> See paragraph 27, *supra*.



paragraph 27, *supra*, we accept the possibility of this additional interference in view of the larger public interest benefits at stake. In the unlikely event that prohibited interference should occur despite the much higher undesired to desired (U/D) signal strength ratios within a station's protected service area, the interfering station must follow the remediation procedure set out in paragraph 32, *supra*, to promptly resolve the interference.

35. *Emergency preparedness.* As proposed in the *NPRM*, we confirm the existing obligation of all-digital AM licensees, like any digital audio broadcast provider, to participate in the national Emergency Alert System (EAS).<sup>157</sup> Commenters that support all-digital broadcasting agree that all-digital stations can and should provide emergency alerts.<sup>158</sup> The primary purpose of the EAS is to provide the President with “the capability to provide immediate communications and information to the general public at the national, state and local levels during periods of national emergency.”<sup>159</sup> Broadcast stations have always served as the primary mechanism for the over-the-air (legacy) transmission of the Presidential and all other EAS alerts.<sup>160</sup> Digital broadcast stations, like analog broadcast stations, play an integral part in the distribution of EAS alerts.<sup>161</sup> The EAS rules already apply generally to all Digital Audio Broadcasting (DAB) stations,<sup>162</sup> and the record does not provide any meritorious arguments for why all-digital AM stations should be carved out from EAS obligations. This obligation extends to ensuring that any “downstream” EAS participant stations are capable of receiving and decoding EAS

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<sup>157</sup> See *NPRM*, 34 FCC Rcd at 11574, para. 29; 47 CFR § 73.1250; see generally, Federal Communications Commission, “The Emergency Alert System (EAS),” <https://www.fcc.gov/emergency-alert-system> (last visited Sept. 21, 2020).

<sup>158</sup> Hubbard Comments at 11; see also NAB Comments at 4; Xperi Comments at 10-11; Crawford Comments at 3.

<sup>159</sup> 47 CFR § 11.1. National activation of the EAS for a Presidential alert message is initiated by the transmission of an Emergency Action Notification (EAN) event code and is designed to provide the President the capability to transmit an alert message (in particular, an audio alert message) to the public within ten minutes from any location at any time. See also Section 606(c) of the Communications Act (as amended), 47 USC § 606(c). The EAN must take priority over any other alert message and preempt other alert messages in progress. See, e.g., *Review of the Emergency Alert System*, EB Docket No. 04-296, First Report and Order and Further Notice of Proposed Rulemaking, 20 FCC Rcd 18625, 18628, para. 8 (2005) (*EAS First Report and Order*). See also, e.g., 47 CFR §§ 11.33(a)(11), 11.51(m), (n). The EAS also is used by state and local governments, as well as the National Weather Service (NWS), to distribute alerts. Whereas EAS participants are required to broadcast Presidential alerts; they participate in broadcasting state and local EAS alerts on a voluntary basis. See 47 CFR § 11.55(a). See also *EAS First Report and Order*, 20 FCC Rcd at 18628, para. 8.

<sup>160</sup> The EAS uses a broadcast-based, hierarchical alert message distribution architecture to deliver alerts to the public. Using this system, when the transmission of an alert encoded in the EAS protocol is received by the EAS equipment of EAS participants assigned to monitor the transmission of the originating broadcaster, the encoded EAS header code tones activate the EAS equipment, which then decodes the numeric codes in the original alert message, re-encodes that information, and broadcasts anew the EAS header code tones, attention signal and audio message to the public. This process is repeated as the alert is rebroadcast to other downstream monitoring EAS participants until all affected EAS participants have received the alert and delivered it to the public. This process of EAS alert distribution among EAS participants is often referred as the “daisy chain” distribution architecture. See, e.g., *Review of the Emergency Alert System*, EB Docket No. 04-296, Fifth Report and Order, 27 FCC Rcd 642, 646-47, paras. 6-7 (2012) (*EAS Fifth Report and Order*).

<sup>161</sup> In adopting rules for the Common Alerting Protocol (CAP) method of distributing EAS alerts, the Commission elected to maintain the over-the-air (legacy) system of distributing EAS alerts – complemented by CAP-based distribution – largely due to the robustness and survivability of broadcast-based radio. See *EAS Fifth Report and Order*, 27 FCC Rcd at 654-55, para. 27.

<sup>162</sup> See 47 CFR 11.11(a); see also, *EAS First Report and Order*, 20 FCC Rcd 18625, 18628, paras. 33-9.



alerts from the all-digital station or can adjust their monitoring assignments to receive EAS alerts from another nearby station.<sup>163</sup>

36. Further, in adopting the EAS requirement for DAB stations, the Commission explained that “fully informing the public of critical emergency information best serves the public interest and that this can be accomplished only if broadly applied.”<sup>164</sup> We find that the commercial incentive for broadcasters to reach a wide base of listeners dovetails with the public interest in ensuring that as many people as possible have access to EAS alert warning information. Therefore, we reject commenters’ suggestions that, because existing consumer analog receivers cannot receive EAS alerts from all-digital stations, we mandate continued analog service for dissemination of EAS alerts—particularly for people who “likely do not listen to that station on a regular basis during non-emergency periods.”<sup>165</sup> Such regulatory efforts are likely to be counterproductive, as over time they will reduce the audience size and weaken the viability of the stations providing the service.<sup>166</sup> Further, given the voluntary nature of all-digital operation, we anticipate a gradual transition, ensuring that EAS alerts will continue to be available on other AM and FM analog stations for the foreseeable future. Given this, analog listeners should have sufficient sources from which they can receive EAS alerts. Finally, in addition to EAS capabilities, we note that all-digital stations can transmit useful emergency information to listeners other than on the main audio stream, including, for example, text in multiple languages or images such as missing persons or evacuation routes.<sup>167</sup>

37. *Notification to the Commission of all-digital operations.* In response to concerns that: (1) potentially affected stations should be given a meaningful opportunity to collect baseline data on their current listenable coverage to support any subsequent interference claim;<sup>168</sup> and (2) consumers be given reasonable notice of changes in their service,<sup>169</sup> we adopt a modified version of the current digital notification procedure for all-digital stations by adding a 30-day waiting period for certain operational changes.<sup>170</sup> This conservative approach toward identifying and resolving interference as it occurs is appropriate given our emphasis throughout this *Report and Order* on the remediation procedure as a recourse for potentially affected stations. Specifically, we will require licensees to electronically file a

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<sup>163</sup> See REC Comments at 2-3. We leave it to the parties to negotiate the technical details of the EAS link but emphasize that the all-digital station may not go on air unless and until it can certify compliance with all of its EAS obligations. This may involve upgrading the downstream station’s facility to permit reception of digital alerts or making arrangements for them to be received from another station. We expect the downstream station to cooperate with this process.

<sup>164</sup> *EAS First Report and Order*, 20 FCC Rcd 18625, 18638-39, paras. 36-39.

<sup>165</sup> See REC Comments at 2; Mark W. Wells Comments at 1; Edward Thierbach Comments at 1.

<sup>166</sup> In this respect, we doubt that the ability of certain individuals to assemble a rudimentary analog receiver would be of widespread utility in an emergency. See Mark W. Wells Comments at 1. The approach adopted herein relies instead on the ongoing existence of financially viable AM stations broadcasting robust and clear signals to a wider audience.

<sup>167</sup> Xperi Comments at 10-11.

<sup>168</sup> See SBE Comments at 6 (recommending a 60-day period for collecting baseline data); REC Comments at 3 (suggesting that conversion application should be held for 30 days to allow for public participation).

<sup>169</sup> See *NPRM*, 34 FCC Rcd at 11577-78, para. 39.

<sup>170</sup> See Bryan Broadcasting Comments at 8 (urging the Commission to adopt a “straightforward procedure for stations to notify the Commission of a change to all-digital operations and, likewise, a notification of reversion to analog or hybrid operations”); California and Missouri Broadcasters Comments at 4 (recommending a simple notification procedure similar to Form 355-AM as there is “no justification for a costlier or cumbersome procedure”); Joint Commenters Comments at 4 (advocating for Form 355-AM notification procedure for conversion to or from all-digital operations, to maintain an accurate listing of the transmission modes of AM radio stations); Hubbard Comments at 10.

digital notification,<sup>171</sup> using the existing FCC Form 335-AM Digital Notification (or any successor notification), to notify the Commission of the following changes: (1) the commencement of new all-digital operation; (2) an increase in nominal power of an all-digital AM station; or (3) a transition from core-only to enhanced operating mode. All-digital AM notifications will be placed on a Commission public notice, and new operation may begin no sooner than 30 calendar days from the date of this public notice. This will minimize the paperwork required for all-digital AM conversions while giving local co-channel and adjacent channel stations time to gather baseline data on their existing coverage before the new all-digital operation begins. Digital notification must be submitted within ten days of implementing all other changes, namely: (1) any reduction in nominal power of an all-digital AM station; (2) a transition from enhanced to core-only operating mode; or (3) a reversion from all-digital to hybrid or analog operation.

38. Although we direct broadcasters to use the current Form 335-AM for all-digital notifications, additional information is required for notification of all-digital operations specifically. Therefore, until the Form 335-AM is updated to display all-digital operation requirements, we direct filers to select “N/A” as appropriate within the form and submit an attachment with the Form 335-AM containing the following information:

- (a) the type of notification (all-digital notification, increase in nominal power, reduction in nominal power, transition from core-only to enhanced, transition from enhanced to core-only, reversion from all-digital to hybrid or analog operation);
- (b) the date that new or modified all-digital operation will commence or has ceased;
- (c) a certification that the all-digital operations will conform to the relevant nominal power and spectral emissions limits;
- (d) the nominal power of the all-digital station;
- (e) a certification that the all-digital station complies with all EAS requirements; and
- (f) if a notification of commencement of new all-digital service or a nominal power change, whether the station is operating in core-only or enhanced mode.

39. *Notice to listeners.* During the 30-day period established above, we require an AM broadcaster commencing new all-digital operation to provide reasonable notice to its listeners that the station will be converting to all-digital operation and will no longer be available on analog receivers. In the *NPRM*, we sought comment on requiring broadcasters to notify listeners that there will be such a change to their service.<sup>172</sup> Because we agree with NAB that broadcasters have a strong incentive to promote such a change to their listeners,<sup>173</sup> we give broadcasters flexibility to use reasonable methods intended to reach their audience, including on-air and website announcements. However, in the event that the reasonableness of notice of conversion to all-digital operation is challenged, we would consider it presumptively sufficient if the broadcaster provided at least the same amount of notice as that set out in section 73.3580, our local public notice rule, with which broadcasters are already familiar.<sup>174</sup>

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<sup>171</sup> Currently, such notification would be submitted to the Bureau’s Consolidated Database System (CDBS). The Bureau is currently transitioning from use of the CDBS database to the Licensing and Management System (LMS) database. Therefore, this notification requirement will also apply to the LMS database once the transition is completed. There is no fee for filing a digital notification.

<sup>172</sup> See *NPRM*, 34 FCC Rcd at 11577, para. 39.

<sup>173</sup> NAB Comments at 10 (claiming that it would be “difficult to conceive of a broadcaster who would implement such a substantial change in service without enthusiastically promoting the change to listeners.”); *but see* REC Comments at 2 (“[T]he public notice rules of §73.3580 should apply to these conversions as they have a major impact and are of major importance to the public interest”).

<sup>174</sup> See 47 CFR § 73.3580 (requiring a combination of over-the-air announcements and online postings).

40. *Alternative technologies.* In the *NPRM*, we sought comment on the authorization of all-digital transmissions using the only digital technology approved by the Commission for AM radio in the United States today—HD Radio.<sup>175</sup> Many commenters agree that all-digital AM broadcasting should be allowed but object to HD Radio as the sole authorized transmission technology.<sup>176</sup> Specifically, commenters urge us to consider the Digital Radio Mondiale (DRM) all-digital transmission technology on the grounds that it: (1) offers equal or better sound quality to HD Radio at lower bitrates; (2) can transmit metadata as well as emergency alerts, multicast subchannels, and a data channel; (3) is energy- and spectrum-efficient; (4) uses a superior audio codec; (5) is not susceptible to interference; (6) is not owned or controlled by a single company; and (7) has been used successfully in other countries and is the approved technology for shortwave broadcasting in the United States.<sup>177</sup>

41. We find this request to be beyond the scope of this proceeding. In the *NPRM*, we sought comment on all-digital operations for the only digital technology approved by the Commission for AM radio in the United States today (HD Radio) as a means to improve AM service in an expeditious manner.<sup>178</sup> To the extent interested parties believe that we should re-evaluate HD Radio and consider alternative technologies, we would need to evaluate a fully developed proposal including data such as laboratory and field testing, similar to the petition for rulemaking that formed the basis of this proceeding.<sup>179</sup> In the absence of any data regarding DRM performance in the U.S. AM band, we cannot evaluate its merits based on the bare assertions of its proponents.<sup>180</sup>

42. In the present proceeding, we authorize all-digital HD Radio operations now for the same reasons the Commission authorized hybrid HD Radio operations in 2002: it is currently the only “feasible, near-term digital technology option” before us and the adoption will “provide regulatory clarity and [] compress the timeframe for finalizing the rules and policies that will affect the ultimate success of this service.”<sup>181</sup> Because it is in the public interest to provide an immediate path forward for AM stations

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<sup>175</sup> *NPRM*, 34 FCC Rcd at 11560, para. 1.

<sup>176</sup> See DRM Comments at 2-3; Hardis Comments at 10; Dolby Comments at 2; Dolby Ex Parte at 4-6; Hershberger Comments at 1-3; Smith and Henry Reply Comments at 7; Henry Comments at 1; Lebryk Comments at 1.

<sup>177</sup> See DRM Comments at 2-3; Hardis Comments at 10; Dolby Comments at 2; Dolby Ex Parte at 4-6; Hershberger Comments at 1-3; Smith and Henry Reply Comments at 7; Henry Comments at 1; Lebryk Comments at 1; see generally *Amendment of Parts 2, 25, and 73 of the Commission’s Rules to Implement Decisions from the World Radiocommunication Conference (Geneva, 2003) (WRC-03) Concerning Frequency Bands Between 5900 kHz and 27.5 GHz and to Otherwise Update the Rules in this Frequency Range*, Report and Order, 20 FCC Rcd 6570 (2005).

<sup>178</sup> *NPRM*, 34 FCC Rcd at 11560, para. 1.

<sup>179</sup> See Dolby Ex Parte at 6 (arguing that OMB-Circular A-119 requires standards incorporated in regulations to be re-evaluated and states a preference for the use of voluntary consensus standards, which includes DRM) (citing Office of Mgmt. & Budget, Exec. Office of the President (OMB), *OMB Circular A-119: Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities*, 81 Fed. Reg. 4673 (2016)). Because we decline to incorporate the NRSC-D standard for the reasons discussed above nor do we foreclose consideration of alternative digital radio technologies and applicable standards in the future if properly before us, we conclude that our actions are consistent with OMB-Circular A-119.

<sup>180</sup> In addition, parties interested in alternative digital technologies would need to address the Commission’s previous reasons for adopting a single digital radio technology. *Digital Radio First Report and Order*, 17 FCC Rcd at 19990, para. 1 (“We conclude that the adoption of a single IBOC transmission standard will facilitate the development and commercialization of digital services for terrestrial broadcasters . . . .”); *id.* at 20002, para. 35 (“it is necessary to define a single DAB standard to ensure the rapid and efficient development of DAB service”).

<sup>181</sup> *Digital Radio First Report and Order*, 17 FCC Rcd at 19999, 20006, paras. 26, 44; Dolby Comments at 2-3 (urging us to consider DRM and not “simply adopt[] the all-digital functionality of technology originally selected for its use in hybrid broadcasting”).

to broadcast in all-digital as their circumstances allow, we approve the HD Radio MA3 mode, but do not foreclose the future consideration of alternative transmission technologies.

43. *Outside the scope of this proceeding.* To the extent that commenters propose specific rule changes to or increased enforcement of Parts 15 or 18 to reduce noise floor levels caused by RF devices and other sources, we find those proposals beyond the scope of this proceeding.<sup>182</sup> For the same reason, we will not consider arguments relating to: (1) the sunset of AM translators;<sup>183</sup> (2) establishing a Low Power AM service;<sup>184</sup> (3) waiving regulatory fees for all-digital AM stations;<sup>185</sup> (4) allocating television spectrum for FM replacement facilities for AM broadcast stations on a primary basis;<sup>186</sup> (5) allowing translator rebroadcasting from an all-digital AM primary station to originate programming;<sup>187</sup> (6) disallowing use of HD Radio hybrid mode;<sup>188</sup> (7) authorizing AM programming on audio-only channels in ATSC 3.0 TV broadcasts;<sup>189</sup> (8) widening the FM band;<sup>190</sup> (9) other AM revitalization-related proposals, such as eliminating third-adjacent channel protections;<sup>191</sup> and (10) receiver standards.<sup>192</sup>

#### IV. CONCLUSION

44. In this *Report and Order*, we adopt rules to allow AM broadcasters to broadcast an all-digital signal. We find that a voluntary transition to all-digital broadcasting would significantly benefit AM stations and their listeners by providing better audio quality, improved resistance to noise and interference, and metadata information to accompany the primary audio programming. Therefore, this action will advance the Commission's goal of improving and modernizing the AM radio service.

#### V. PROCEDURAL MATTERS

45. *Paperwork Reduction Act Analysis.* This Report and Order contains new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. The requirements will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to

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<sup>182</sup> See SBE Comments at 4 (“[H]igh ambient noise levels at MF are not a ‘given’ . . . improvement in regulation of the RF environment in the AM Broadcast Band is possible and urgent”); Universal Stations Reply Comments at 3; Smith and Henry Reply Comments at 4 (“We strongly disagree with the rather fatalistic assertions by many other Commenters in this proceeding that the ambient noise problem for the AM band is beyond hope . . . with vigorous action by the Commission, including Part-15/18 enforcement actions and fines, the vast bulk of the Utility-related noise issues on the AM band could be resolved within about 2 years. . .”). We note that the appropriate vehicle for these concerns would be a petition for rulemaking or informal request for enforcement action submitted to the relevant bureau(s).

<sup>183</sup> See Wood Comments at 1.

<sup>184</sup> *Id.* at 1.

<sup>185</sup> See Schober Comments at 2.

<sup>186</sup> See REC Ex Parte at 3.

<sup>187</sup> See Schober Comments at 2.

<sup>188</sup> See *Id.* at 3.

<sup>189</sup> See Hershberger Comments at 3.

<sup>190</sup> See REC Comments at 6-8.

<sup>191</sup> See Universal Stations Reply Comments at 2.

<sup>192</sup> See Legate Comments at 3 (urging the Commission to create a receiver bandwidth specification); Puerto Rico Broadcasters Comments at 2 (suggesting that the Commission “require radio receiver manufacturers to include HD reception capabilities on every new radio sold in the United States”). We also dismiss as moot the suggestion that we allow analog station programming to be duplicated on digital stations. See Schober Comments at 2. On August 6, 2020, we eliminated the non-duplication rule. *Non-Duplication Order*, note 54, *supra*.

comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

46. *Congressional Review Act.* [The Commission will submit this draft Report and Order to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, for concurrence as to whether this rule is “major” or “non-major” under the Congressional Review Act, 5 U.S.C. § 804(2).] The Commission will send a copy of this Order on Reconsideration to Congress and the Government Accountability Office pursuant to the Congressional Review Act.<sup>193</sup>

47. *Final Regulatory Flexibility Certification.* As required by the Regulatory Flexibility Act of 1980 (RFA),<sup>194</sup> an Initial Regulatory Flexibility Certification was incorporated into the *NPRM*.<sup>195</sup> Pursuant to the Regulatory Flexibility Act of 1980, as amended,<sup>196</sup> the Commission’s Final Regulatory Flexibility Certification relating to this Report and Order is attached as Appendix C.

## VI. ORDERING CLAUSES

48. Accordingly, **IT IS ORDERED** that, pursuant to the authority contained in Sections 1, 4(i), 4(j), 301, 303, 307, 308, 309, 316, and 319 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 303, 307, 308, 309, 316, and 319, this *Report and Order* **IS ADOPTED** and **WILL BECOME EFFECTIVE** 30 days after publication in the Federal Register.

49. **IT IS FURTHER ORDERED** that Part 73 of the Commission’s Rules **IS AMENDED** as set forth in Appendix B and such rule amendments will become effective 30 days after publication in the Federal Register, except for new section 73.406, which contains new or modified information collection requirements that require approval by the Office of Management and Budget under the Paperwork Reduction Act and **WILL BECOME EFFECTIVE** after the Commission publishes a notice in the Federal Register announcing such approval and the relevant effective date.

50. **IT IS FURTHER ORDERED** that the Commission’s Consumer and Governmental Affairs Bureau, Reference Information Center, **SHALL SEND** a copy of this *Report and Order*, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

51. **IT IS FURTHER ORDERED** that the Commission **SHALL SEND** a copy of this *Report and Order* in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

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<sup>193</sup> *See* 5 U.S.C. § 801(a)(1)(A).

<sup>194</sup> *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601, *et. seq.*, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996). The SBREFA was enacted as Title II of the Contract with America Advancement Act of 1996 (CWAAA).

<sup>195</sup> *NPRM*, 33 FCC Rcd at 4744, para. 33, App. A.

<sup>196</sup> *See* 5 U.S.C. § 604.

**APPENDIX A**  
**List of Commenters**

Angela Weddle  
Brian J. Henry  
Brian Winnekins  
Broadcast Electronics, Elenos Group (Elenos)  
Bryan Broadcasting Corporation  
California Broadcasters Association and Missouri Broadcasters Association  
Carl T. Jones Corporation  
Consumer Technology Association (CTA)  
Crawford Broadcasting Company  
David Bowers  
David L. Hershberger  
Digital Radio Mondiale  
Dolby Laboratories, Inc.  
Edward A. Schober  
Edward Thierbach  
Hubbard Radio, LLC  
iHeartCommunications, Inc.  
Jacob Wood  
Jonathan E. Hardis  
Joseph Edward Talbot  
Kintronic Laboratories  
Kirk J Mazurek  
Mark E. Bohach and Arlene D. Bohach  
Mark W Wells  
Martin Minnicino  
Mount Wilson FM Broadcasters, Inc.  
National Association of Broadcasters (NAB)  
National Public Radio, Inc.  
Nautel Maine, Inc.  
Peter Laws  
Phillip Legate  
Puerto Rico Broadcasters Association  
REC Networks  
Society of Broadcast Engineers, Incorporated

Stephen F. Smith and Brian J. Henry

Taylor Laub

The Cromwell Group, Inc. of Illinois, Hancock Communications, Inc., WYCQ, Inc., GARK, LLC, Ackley Caribbean Enterprises, Inc., Centennial Licensing II, LLC, Nevada County Broadcasters, Inc., University of Massachusetts, Metroplex Communications, Inc., Georgia-Carolina Radiocasting Company, LLC, Sutton Radiocasting Corporation, Tugart Properties, LLC, Lake Hartwell Radio, Inc., Appalachian Broadcasting Company, Inc., GEOS Communications, Stone Canyon of Flagstaff, LLC, Central Baptist Theological Seminary of Minneapolis, Morgan County Broadcasting Co Inc., South Sound Broadcasting, LLC, Sunnylands Broadcasting, LLC, Spottswood Partners II, Ltd., East Texas Broadcasting, Inc., Aztec Capitol Partners, Inc., Kentucky Mountain Bible College, Phoenix Media Group, LLC (Joint Commenters)

Thomas Lebryk

Universal Stations LLC

Xperi Corporation



## APPENDIX B

## Final Rule Changes

Part 73 of Chapter 1 of Title 47 of the Code of Federal Regulations is amended as follows:

1. The authority citation for part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 155, 301, 303, 307, 309, 310, 334, 336, 339.

2. In § 73.402, add new paragraph (h) to read as follows:

**§ 73.402 Definitions.**

\* \* \* \* \*

(h) *All-digital AM station.* An AM station broadcasting an IBOC waveform that consists solely of digitally modulated subcarriers and the unmodulated AM carrier.

3. In § 73.403, revise paragraph (a) to read as follows:

**§ 73.403 Digital audio broadcasting service requirements**

(a) Broadcast radio stations using IBOC must transmit at least one over-the-air digital audio programming stream at no direct charge to listeners. In addition, a hybrid broadcast radio station must simulcast its analog audio programming on one of its digital audio programming streams. The DAB audio programming stream that is provided pursuant to this paragraph must be at least comparable in sound quality with a standard analog broadcast.

\* \* \* \* \*

4. In § 73.404, revise the section heading and paragraphs (a) – (b), and remove paragraph (e) to read as follows:

**§ 73.404 IBOC DAB operation.**

(a) The licensee of an AM or FM station, or the permittee of a new AM or FM station which has commenced program test operation pursuant to § 73.1620, may commence hybrid IBOC DAB operation with digital facilities which conform to the technical specifications specified for hybrid DAB operation in the (2002) *First Report and Order* in MM Docket No. 99–325, as revised in the Media Bureau's subsequent *Order* in MM Docket No. 99–325. In addition, the licensee of an AM station, or the permittee of a new AM station that has commenced program test authority pursuant to § 73.1620, may, with reasonable notice to listeners, commence all-digital IBOC operation with digital facilities that conform to the requirements set out in the (2020) *Report and Order* in MB Docket No. 19-311 and MB Docket No. 13-249. An AM or FM station may transmit IBOC signals during all hours for which the station is licensed to broadcast.

(b) In situations where interference to other stations is anticipated or actually occurs, hybrid AM licensees may, upon notification to the Commission, reduce the power of the primary DAB sidebands by up to 6 dB. All-digital AM licensees, may, upon notification to the Commission, reduce the power of the secondary and tertiary sidebands by up to 6 dB, even if doing so results in non-compliance with § 73.1560(a)(1). Any greater reduction of sideband power requires prior authority from the Commission via the filing of a request for special temporary authority or an informal letter request for modification of license.

\* \* \* \* \*

[Paragraph (e) has been deleted]

5. Add § 73.406 to subpart C to read as follows:

**§ 73.406 Notification**

Hybrid AM and FM licensees must electronically file a digital notification to the Commission in Washington, DC, within 10 days of commencing IBOC digital operation. All-digital licensees must file a digital notification within 10 days of the following changes: (1) any reduction in nominal power of an all-digital AM station; (2) a transition from enhanced to core-only operating mode; or (3) a reversion from all-digital to hybrid or analog operation. All-digital licensees will not be permitted to commence operation sooner than 30 calendar days from public notice of digital notification of the following changes: (1) the commencement of new all-digital operation; (2) an increase in nominal power of an all-digital AM station; or (2) a transition from core-only to enhanced operating mode.

(a) Every digital notification must include the following information:

- (1) The call sign and facility identification number of the station;
- (2) If applicable, the date on which the new or modified IBOC operation commenced or ceased;
- (3) The name and telephone number of a technical representative the Commission can call in the event of interference;
- (4) A certification that the operation will not cause human exposure to levels of radio frequency radiation in excess of the limits specified in § 1.1310 of this chapter and is therefore categorically excluded from environmental processing pursuant to § 1.1306(b) of this chapter. Any station that cannot certify compliance must submit an environmental assessment (“EA”) pursuant to § 1.1311 of this chapter and may not commence IBOC operation until such EA is ruled upon by the Commission.

(b) Each AM digital notification must also include the following information:

- (1) A certification that the IBOC DAB facilities conform to applicable nominal power limits and emissions mask limits;
- (2) The nominal power of the station; if separate analog and digital transmitters are used, the nominal power for each transmitter;
- (3) If applicable, the amount of any reduction in an AM station’s digital carriers;
- (4) For all-digital stations, the type of notification (all-digital notification, increase in nominal power, reduction in nominal power, transition from core-only to enhanced, transition from enhanced to core-only, reversion from all-digital to hybrid or analog operation);
- (5) For all-digital stations, if a notification of commencement of new all-digital service or a nominal power change, whether the station is operating in core-only or enhanced mode; and
- (6) For all-digital stations, a certification that the all-digital station complies with all EAS requirements.

(c) Each FM digital notification must also include the following information:

- (1) A certification that the IBOC DAB facilities conform to the HD Radio emissions mask limits;
- (2) FM digital effective radiated power used and certification that the FM analog effective radiated power remains as authorized;
- (3) If applicable, the geographic coordinates, elevation data, and license file number of the auxiliary antenna employed by an FM station as a separate digital antenna; and

(4) If applicable, for FM systems employing interleaved antenna bays, a certification that adequate filtering and/or isolation equipment has been installed to prevent spurious emissions in excess of the limits specified in § 73.317.

## APPENDIX C

## Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA)<sup>1</sup> an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rule Making (NPRM)* to this proceeding.<sup>2</sup> The Commission sought written public comment on the proposals in the *NPRM*, including comment on the IRFA. The Commission received no comments on the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.<sup>3</sup>

**A. Need For, and Objectives of, the Report and Order**

2. This *Report and Order* adopts several rule changes to allow AM stations to voluntarily broadcast an all-digital signal using the digital broadcasting technology known as HD Radio MA3. This action will improve the AM radio service by providing enhanced audio quality, increasing listenable reception areas, and allowing additional metadata textual information, such as song and artist identification, traffic services, and digital emergency alerts, to be transmitted along with the main audio programming. All-digital operation will increase the format choices that AM broadcasters can offer to their audiences, including the option of music programming. These greater capabilities will level the playing field between AM and FM signals from the listener's perspective, and help AM stations recapture audiences lost to FM radio, satellite radio, or online streaming services because of their higher sound fidelity and broader programming array. All-digital AM operation will also provide the full technological benefits of digital broadcasting while avoiding the shortcomings of the current analog or hybrid modes of transmission, which are more susceptible to noise and interference, more likely to cause interference to other stations, and place more demands on an AM station's transmission and antenna system.

3. All-digital operation provides greater usable signal coverage, is energy- and spectrum-efficient, and will be supported by an ever-increasing number of digital receivers. Since all-digital operation is completely voluntary, and the cost of conversion will vary from station to station, AM broadcasters will be able to decide whether conversion to all-digital meets their own needs and market demand. In the *Report and Order*, the Commission concludes that the public interest in the long-term viability of AM stations and the valuable services they provide, outweighs a possible loss of service to some current analog listeners as broadcasters and the listening public transition to an all-digital environment. All-digital service represents a significant and singular opportunity to preserve the AM service for future listeners. Any disruption to analog listeners will take place gradually, as AM stations individually decide their audience is ready to convert to all-digital, with full notice to consumers and ample opportunity to adjust to the new technology.

4. In the *Report and Order*, the Commission authorizes all-digital operations subject to the requirement that all-digital operations not cause prohibited interference to existing broadcast stations. In the unlikely event that such interference would occur, the Commission will apply current remediation procedures that encourage cooperation between the parties to resolve complaints and include an option to voluntarily reduce power. The Commission adopts the proposal in the *NPRM* that each all-digital station is obligated to provide at least one free over-the-air digital programming stream that is comparable to or better in audio quality than a standard analog broadcast. It also mandates that all-digital AM stations participate in the national Emergency Alert System (EAS).

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<sup>1</sup> See 5 U.S.C. § 603. The RFA, see 5 U.S.C. §§ 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996). The SBREFA was enacted as Title II of the Contract With America Advancement Act of 1996 (CWAAA).

<sup>2</sup> 34 FCC Rcd 11560 (2019).

<sup>3</sup> See 5 U.S.C. § 604.

5. Although all-digital conversion is a purely voluntary process for individual AM stations, the Commission strongly supports an all-digital future and affirms that the objective of the proceeding is a viable all-digital AM service. Supporting all-digital removes any regulatory uncertainty about the future of the AM HD Radio system and should give car companies and receiver manufacturers reassurance to invest in AM digital receivers. Thus, an all-digital environment will reduce the likelihood of interference while maximizing digital benefits such as an improved high-quality listener experience, signal robustness, reliable and listenable coverage, and superior audio quality.

**B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA**

6. There were no comments to the IRFA filed.

**C. Response to comments by the Chief Counsel for Advocacy of the Small Business Administration**

7. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.<sup>4</sup> The Chief Counsel did not file any comments in response to the proposed rule in this proceeding.

**D. Description and Estimate of the Number of Small Entities to Which the Rules Apply**

8. The RFA directs the Commission to provide a description of and, where feasible, an estimate of the number of small entities that will be affected by the rules adopted herein.<sup>5</sup> The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small government jurisdiction.”<sup>6</sup> In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.<sup>7</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>8</sup>

9. *Radio Stations.* Radio stations are an Economic Census category that “comprises establishments primarily engaged in broadcasting aural programs by radio to the public. Programming may originate in their own studio, from an affiliated network, or from external sources.”<sup>9</sup> The SBA has established a small business size standard for this category as firms having \$41.5 million or less in annual receipts.<sup>10</sup> Economic Census data for 2012 shows that 2,849 radio station firms operated during that

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<sup>4</sup> 5 U.S.C. § 604(a)(3).

<sup>5</sup> *Id.* § 603(b)(3).

<sup>6</sup> *Id.* § 601(6).

<sup>7</sup> *Id.* § 601(3) (incorporating by reference the definition of “small business concern” in 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

<sup>8</sup> 15 U.S.C. § 632.

<sup>9</sup> U.S. Census Bureau, 2012 NAICS Definitions, “515112 Radio Stations,” <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=515112&search=2017+NAICS+Search&search=2017>.

<sup>10</sup> 13 CFR § 121.201, NAICS code 515112 Radio Stations.

year.<sup>11</sup> Of that number, 2,806 operated with annual receipts of less than \$25 million per year, and 43 firms had annual receipts of \$25 million or more.<sup>12</sup> Because the Census has no additional classifications that could serve as a basis for determining the number of stations whose receipts exceeded \$41.5 million in that year, we conclude that the majority of radio broadcast stations were small entities under the applicable SBA size standard.

10. Apart from the U.S. Census, the Commission has estimated the number of licensed commercial AM stations to be 4,570 and the number of commercial FM stations to be 6,706 for a total of 11,276, along with 8,303 FM translator and booster stations.<sup>13</sup> According to BIA/Kelsey Publications, Inc.'s Media Access Pro Database, as of March 2020, 4,389 AM stations and 6,767 FM stations had revenues of \$41.5 million or less. In addition, the Commission has estimated the number of noncommercial educational FM radio stations to be 4,197.<sup>14</sup> NCE stations are non-profit, and therefore considered to be small entities. Accordingly, we estimate that the majority of radio broadcast stations are small entities. We note, however, that, in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations<sup>15</sup> must be included. Our estimate, therefore, likely overstates the number of small entities that might be affected by our action, because the revenue figure on which it is based does not include or aggregate revenues from affiliated companies.

11. Moreover, as noted above, an element of the definition of "small business" is that the entity not be dominant in its field of operation. The Commission is unable at this time to define or quantify the criteria that would establish whether a specific radio station is dominant in its field of operation. Accordingly, the estimate of small businesses to which rules may apply does not exclude any radio station from the definition of a small business on this basis and therefore may be over-inclusive to that extent. Also, as noted, an additional element of the definition of "small business" is that the entity must be independently owned and operated. The Commission notes that it is difficult at times to assess these criteria in the context of media entities and the estimates of small businesses to which they apply may be over-inclusive to this extent.

#### **E. Description of Projected Reporting, Record Keeping and Other Compliance Requirements**

12. The rules changes adopted in the *Report and Order* establish a straightforward procedure for stations to notify the Commission of a change to all-digital operations. The notification requirement for all-digital operations, is as follows: AM licensees must electronically file a digital notification, using the existing FCC Form 335-AM Digital Notification (or any successor notification form), to notify the Commission of the following proposed changes: (1) the commencement of new all-digital operation; (2) an increase in nominal power of an all-digital AM station; or (3) a transition from core-only to enhanced operating mode. All-digital AM notifications will be placed on an FCC public notice, and new operation may begin no sooner than 30 calendar days from the date of this public notice. This notification process will minimize the paperwork required for all-digital AM conversions, while giving local co-channel and adjacent channel stations time to gather baseline data on their existing coverage before the new all-digital operation begins. Digital notification must be submitted within ten days of implementing all other

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<sup>11</sup> U.S. Census Bureau, Table No. EC1251SSSZ4, *Information: Subject Series - Establishment and Firm Size: Receipts Size of Firms for the United States: 2012* (515112 Radio Stations) [https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012\\_US/51SSSZ4/naics~515112|515120](https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4/naics~515112|515120).

<sup>12</sup> *Id.*

<sup>13</sup> *Broadcast Station Totals as of June 30, 2020*, FCC News Release (rel. July 1, 2020) (*Broadcast Station Totals*), <https://www.fcc.gov/document/broadcast-station-totals-june-30-2020>.

<sup>14</sup> *Id.*

<sup>15</sup> "[Business concerns] are affiliates of each other when one concern controls or has the power to control the other or a third party or parties controls or has the power to control both." 13 CFR § 121.103(a)(1).

changes, namely: (1) any reduction in nominal power of an all-digital AM station; (2) a transition from enhanced to core-only operating mode; or (3) a reversion from all-digital to hybrid or analog operation. There is no fee for filing a digital notification.

13. The *Report and Order* does not adopt recordkeeping requirements. However, it does require licensees converting AM stations to all-digital operation to provide reasonable notice to its listeners that their station will be converting to all-digital operations and will no longer be available on analog receivers.

**F. Steps Taken to Minimize Significant Impact on Small Entities, and Significant Alternatives Considered**

14. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.<sup>16</sup>

15. Conversion to all-digital AM transmission (and then, consequent compliance with the rules governing all-digital operation) is completely voluntary and therefore flexible, based on an AM broadcaster's assessment of its individual financial and technical circumstances, including size. AM broadcasters overwhelmingly support the proposal to allow all-digital AM broadcasting, as do broadcast engineers, technology companies, and individual listeners. Of the technical requirements contemplated in the *NPRM*, the Commission evaluated several alternative options. The Commission originally considered imposing a (non-voluntary) stricter frequency tolerance standard of 1 Hz on all AM broadcasters, but decided that the benefits of doing so would not outweigh the associated burden of upgrading transmission equipment, particularly for smaller AM broadcasters, and declined to adopt the requirement. In addition, the Commission considered incorporating the NRSC-5-D Standard governing the technical implementation of HD Radio all-digital radio into the rules, but upon careful consideration of the record, decided that doing so would be unnecessary and could stifle industry innovation regarding the all-digital HD Radio technology. Therefore, in reaching the approach taken in the *Report and Order*, the Commission considered various alternatives and their effects on AM broadcasters, including small entities.

**G. Report to Congress**

16. The Commission will send a copy of this *Report and Order*, including this FRFA, in a report to Congress and the Government Accountability Office pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996.<sup>17</sup> In addition, the Commission will send a copy of the *Report and Order*, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration. A copy of the *Report and Order* and FRFA (or summaries thereof) will also be published in the *Federal Register*.<sup>18</sup>

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<sup>16</sup> 5 U.S.C. § 603(c)(1)-(c)(4).

<sup>17</sup> *See id.* § 801(a)(1)(A).

<sup>18</sup> *See id.* § 604(b).