

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

In the Matter of)	
)	
Amendment of Part 15 of the)	ET Docket No. 14-165
Commission's Rules for Unlicensed)	
Operations in the Television Bands,)	
Repurposed 600 MHz Band, 600 MHz)	
Guard Bands and Duplex Gap, and)	
Channel 37, and)	
)	
Amendment of Part 74 of the)	
Commission's Rules for Low Power)	
Auxiliary Stations in the Repurposed 600)	
MHz Band and 600 MHz Duplex Gap)	GN Docket No. 12-268
)	
Expanding the Economic and Innovation)	
Opportunities of Spectrum Through)	
Incentive Auctions)	

COMMENTS OF THE NATIONAL ASSOCIATION OF BROADCASTERS

February 4, 2015

Executive Summary

Unlicensed operation in the TV “white spaces” remains very much a nascent industry. The sluggish growth of unlicensed devices provides an opportunity for the Commission to properly and thoroughly address the clear threat of interference they pose to licensed operations already serving the public. Nothing in the record remotely suggests that it is essential the Commission moves at breakneck speed to put more pressure on a system that has yielded little over the past five years.

This *Notice* is driven by the concern that after the broadcast incentive auction fewer channels will be available for unlicensed operation in the TV band. That is undoubtedly true. Indeed, it is an inherent feature of Congress’s plan for a voluntary reallocation of spectrum for wireless providers for licensed use. But this fact does not change the physics of interference, and a carefully crafted balance achieved in 2010 that was nearly a decade in the making.

While NAB supports some of the proposals in the *Notice*, several of the proposals simply go too far. If adopted, they will significantly increase the potential for interference to DTV operations, especially after the incentive auction when broadcasters are packed together more tightly. In particular, the Commission should reject proposals to allow fixed operations in channels adjacent to occupied DTV channels and to allow unlicensed operation within two vacant channels instead of the three currently required. No real-world experience or technical analyses support the proposition that these operations can be allowed while avoiding harmful interference.

Broadcasters also remain concerned about the lack of a viable dedicated band for licensed wireless microphones. Based on interference concerns from Qualcomm and others, NAB recommends that the Commission allocate the duplex gap to licensed wireless microphones exclusively with appropriate guard bands to protect wireless services.

NAB believes strongly that there is a constructive way forward that benefits local television broadcasters, their viewers and unlicensed advocates, such as Google and Microsoft. But given the expectation that the repacking process following the incentive auction will not be completed until the end of the decade, the Commission should consider its proposals with all due care, including a comprehensive review of the

efficacy of the TV white spaces database. NAB looks forward to collaborating with the Commission during this process.

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COMMENTS OF THE NATIONAL ASSOCIATION OF BROADCASTERS

I. Introduction

The National Association of Broadcasters (“NAB”)¹ submits these comments in response to the Federal Communication Commission’s (“FCC” or “Commission”) *Notice of Proposed Rulemaking* that considers rule changes for unlicensed device operation in

¹ NAB is a nonprofit trade association that advocates on behalf of local radio and television stations and broadcast networks before Congress, the FCC and other federal agencies, and the courts.

the 600 MHz band.² The proposed changes – made in anticipation of the forthcoming broadcast incentive auction – would substantially relax many of the technical rules designed to ensure that unlicensed devices operating in the broadcast band do not cause harmful interference to broadcast and other existing operations.

As a general matter, NAB continues to support efforts to make efficient use of the broadcast band, including the responsible provision of unlicensed devices that do not cause interference to broadcast television. Broadcasters have been one of the leading spectrum sharers domestically, partnering with unlicensed devices in the 600 MHz band, public safety land mobile operations in the same band and with the Department of Defense in the BAS band. However, the very limited experience that the Commission, broadcasters and unlicensed device operators have had since unlicensed devices were first granted access to the broadcast band in 2010 does not support many of the *Notice's* more aggressive proposals.

While NAB can support those proposed changes in the *Notice* unlikely to cause increased interference, several other proposals fail to meet any standard of technical review and, if adopted, would result in unacceptable interference for TV viewers, as well as other licensed operations. In particular, NAB is concerned with efforts to permit low power operation of fixed devices on channels adjacent to occupied TV channels and proposals to allow unlicensed fixed devices to operate where there are only two vacant channels. NAB is also opposed to other proposals that could severely limit the ability of broadcasters to operate licensed wireless microphones, especially following the

² *Notice of Proposed Rulemaking* in ET Docket No. 14-165 and GN Docket No. 12-268 (rel. Sept. 30, 2014) (“*Notice*”).

Commission's surprising determination to eliminate the two channels it had just reserved for wireless microphone use in 2010.

The fundamental question in this proceeding is simple – how does the Commission modify its existing rules to allow for more efficient unlicensed operations in the television broadcast bands without diminishing the overall quality of the band for consumers? While we believe it can be done, the Commission should proceed cautiously. Even the best laid plans can fail when put into action in the real world. Thus far, with few devices operating, the implications of any failures have been minimal. But, after the incentive auction, when broadcasters are packed more tightly into a smaller band, the introduction of thousands, or perhaps even millions, of unlicensed devices based on revised service rules that cannot withstand technical scrutiny would severely diminish the usefulness of the 600 MHz band for every type of user – broadcast viewers, microphone operators, mobile broadband users and even those using the unlicensed devices themselves.

II. Many of the Proposed Rule Modifications Are Likely to Cause Unacceptable Levels of Interference

NAB has serious concerns about several of the proposed rule changes in the *Notice*. In particular, the two proposals discussed in detail below are highly problematic, and very likely to increase harmful interference to licensed services in the broadcast band. Experience thus far with the nascent TVWS system does not support these rule changes – each of which would allow unlicensed operations “closer” to occupied TV channels. For the reasons detailed below, NAB urges the Commission not to implement the following proposed changes.

A. The Commission Should Not Allow Fixed Devices Adjacent to Occupied TV Channels

The *Notice* proposes to alter existing rules so that fixed devices can operate adjacent to occupied TV channels (*i.e.*, within their service contour) if the operating power of those devices is reduced to 40 milliwatts EIRP – the same maximum power level currently permitted for personal/portable devices allowed to operate adjacent to occupied TV channels.³ This change would, according to the *Notice*, allow fixed devices “to operate in locations where the spectrum is highly congested.”⁴

NAB opposes this change. While, on its face, a proposal to synchronize rules and power limits between fixed and personal/portable devices might seem appealing, a fixed device, even one operating at reduced power, is for several reasons more likely than a personal/portable device to cause harmful interference when operating on an adjacent channel.

In approving TVWS operation and setting rules for personal/portable unlicensed operation on channels adjacent to DTV service, the Commission relied on assumptions that personal/portable operations would be wholly different than fixed operations, not just in terms of power, but also in terms of design, where and how the devices would be used, and how likely it would be for the devices to cause harmful interference.⁵ Although the Commission expressed concerns that the mobile nature of personal/portable devices could cause harmful interference, it nonetheless approved personal/portable

³ *Notice* at ¶35.

⁴ *Id.*

⁵ See *Second Report and Order and Memorandum Opinion and Order*, 23 FCC Rcd 16807 (2008) at ¶¶172-178.

devices for adjacent channel operation because a number of different characteristics unique to those devices would likely mitigate their interfering potential. At the same time, based on the unique characteristics of fixed devices, the Commission determined that adjacent channel operation should not be allowed.⁶ The present *Notice* completely ignores those critical differences.

In its 2008 analysis, for example, the Commission assumed that personal/portable white space devices would be transitory and intermittent (battery powered) with small self-contained, low gain antennas and that the devices would be operated close to the body and low to the ground, with significant wall and building penetration losses between the device and nearby television receivers.⁷ It assumed a polarization mismatch between the DTV receiving antenna and the white space device,⁸ and that free space propagation or an unobstructed path would not apply between a personal/portable device operated close to the ground and an outdoor DTV receiving antenna.⁹ According to the FCC's analysis, all of these factors – none of which would apply to a fixed white space device – would reduce by 15 dB or more the signal level received at the DTV antenna from a personal/portable device compared with free space conditions.¹⁰ Even considering these mitigating factors, the Commission found that a personal/portable device operating at 40 mW would provide only “*adequate* protection

⁶ *Id.*

⁷ *Second R&O* at ¶173.

⁸ *Id.* at ¶177.

⁹ *Id.* at ¶173.

¹⁰ *Id.* at ¶¶173-176.

for indoor DTV reception ... and *marginal* protection for outdoor DTV reception from such TVBD signals.”¹¹

Operation of fixed devices, in contrast, differs in a number of ways from personal/portable devices. As a result, even at 40 mW, fixed devices are more likely to cause harmful interference. For example, instead of being placed close to the body and low to the ground, a fixed white space device is more likely to be placed near a window or used in the upper floors of a home; indeed each of the present fixed devices is designed to have its antenna located outdoors, ensuring a direct unobstructed path between the white space device and an outdoor DTV receiving antenna. Instead of being transitory and intermittent, fixed devices are more likely to be operated for long durations and to be plugged into an outlet. Put simply, all of the factors that mitigated interference caused by a personal/portable device – low height, small antenna, building, wall or body attenuation – are absent from fixed devices. If a 40 mW personal/portable device was expected to provide only “adequate” or “marginal” protection of DTV services, a fixed device operating at the same power is much more likely to interfere with licensed operations. In fact, such a fixed device has the potential of causing interference to 80 percent of a typical TV station’s reception area.¹² The FCC should not permit such fixed device operations.

The proposal also fails to account for out-of-band emission requirements of fixed devices on immediately adjacent television channels, which are much less stringent

¹¹ *Id.* at ¶176 (emphasis added).

¹² See OET Report FCC/OET 07-TR-1003, “Interference Rejection Thresholds of Consumer Digital Television Receivers Available in 2005 and 2006,” (rel. March 30, 2006), at 2-12.

than those for personal/portable devices.¹³ In fact, out-of-band emissions for fixed devices are permitted to be 14 dB higher than portable devices on an immediately adjacent channel. The rules permit this less stringent value because they currently do not allow fixed devices to operate on adjacent channels. The less strict out-of-band emission limit is another reason the FCC should reject altering the rules to permit fixed devices adjacent to occupied TV channels.

Importantly, the Commission presently has no experience with consumers using personal/portable devices as no such devices have yet been approved for public use. Therefore, it is premature to assert that operation of personal/portable devices on adjacent channels, under the Commission's original calculations and assumptions, have not caused harmful interference to licensed services. No real-world evidence supports this conclusion. And it is certainly premature to liberalize the rules of adjacent channel operations before the industry or the Commission has any practical consumer experience with any devices operating on those channels. For all of these reasons, the Commission should reject proposals to allow fixed TVWS device operation on adjacent channels.

¹³ Section 15.709 sets forth the following general technical requirements for TV white spaces devices:

(c) *Emission limits for TVBDs.* (1) In the television channels immediately adjacent to the channel in which the TVBD is operating, emissions from the TVBD shall not exceed the following levels.

(i) Fixed devices: -42.8 dBm conducted power.

(ii) Personal/portable device operating adjacent to occupied TV channels: -56.8 dBm EIRP.

B. There is No Technical Support for the Proposition that Devices Operating within Two Empty Channels Instead of Three Can Avoid Harmful Interference

NAB also opposes allowing fixed devices to operate at locations where there are two contiguous vacant channels rather than three, which would reduce the “guard band” between TVWS and TV operations from 6 MHz to 3 MHz.¹⁴ This proposal would effectively permit TVWS operation on a channel immediately adjacent to a TV station and eliminate the requirement that the adjacent channel desired/undesired (D/U) signal protection ratio be met. There is no technical or scientific data – including the studies cited in the *Notice* – supporting the proposition that TVWS devices operating in this manner will not cause harmful interference to DTV operations. Accordingly, the FCC should reject this proposal.

The Commission’s proposals in its recent inter-service interference (“ISIX”) proceeding recognize the potential for interference from adjacent channel operation and apply the adjacent channel D/U ratio of -33 dB specified in ATSC Recommendation A/74¹⁵ for all interfering signals even when the signal is 5 MHz removed from the band edge.¹⁶ The ISIX approach is consistent with previous testing done by the FCC showing that a 1 MHz signal centered in the adjacent channel (*i.e.*, 2.5 MHz away) has the same interference potential as a wider band signal immediately adjacent or 0 MHz away from

¹⁴ *Notice* at ¶37.

¹⁵ See “ATSC Recommended Practice: Receiver Performance Guidelines,” April 7, 2010, at 15, available at: http://www.atsc.org/cms/standards/a_74-2010.pdf.

¹⁶ See *Second Report and Order and Further Notice of Proposed Rule Making* in ET Docket Nos. 13-26 and 14-14, Appendix A (rel. Oct. 17, 2014). Specifically, Table 12 of Appendix A show an adjacent channel protection ratio of -33 dB for the DTV receiver when any interfering signal is present within the 6 MHz band of the adjacent channel.

the desired channel.¹⁷ Nothing in this proposal or the studies it cites suggests that the interference rejection of an ATSC DTV receiver would dramatically improve with an additional frequency separation of 0.5 MHz (*i.e.*, from 2.5 MHz to 3.0 MHz) between a TV signal and an interfering signal as proposed. No tests or data demonstrate that the interference rejection of a TV receiver is the same whether the interfering signal is 3 MHz removed from the desired signal (*i.e.*, within the first adjacent channel) or 6 MHz away (*i.e.*, a second adjacent channel away) as required under the current rules. So, there is no technical basis to support effectively reducing the D/U ratio required to protect television receivers from adjacent channel white space operations.

To support its proposal, the Commission cites to a pair of studies purporting to show that unlicensed devices operating adjacent to occupied TV channels do not cause harmful interference to broadcast reception.¹⁸ These papers by white space proponents, which examined interference issues in foreign television markets that do not use the same broadcast television transmission standard as the U.S., are largely irrelevant. They do not support the assertion that unlicensed operations can operate in such close proximity to occupied DTV channels.

The Commission should not rely on this pair of inapposite foreign studies to support its proposal to allow TVWS operation within two open TV channels for several reasons. First, while the white space devices cited in these studies – one in South Africa and the other in Ghana – operated on channels adjacent to TV operations, in each case

¹⁷ See Figure 2-1 and Section 7 of OET Report FCC/OET 07-TR-1003, *Interference Rejection Thresholds of Consumer Digital Television Receivers Available in 2005 and 2006*, March 30, 2006, prepared by Stephan Martin of the Technical Research Branch of the Laboratory Division of OET.

¹⁸ *Notice* at fn. 59.

the adjacent broadcast operations were analog television, not digital operations.¹⁹ South Africa is scheduled to transition to digital this year and all of Ghana's television operations are currently analog. Therefore, neither of these studies examined actual TVWS operation on a channel adjacent to a DTV operation. Second, both South Africa and Ghana operate on 8 MHz channels and with different television systems (e.g., PAL) than the United States. Third, and perhaps most critically to the instant proposal, while the trial detected no interference, the unlicensed devices in the trial were limited and carefully engineered to ensure that there would be no television receivers in the potential interference area around the devices. In fact, the South African study found a potential for interference to television reception *within 200 meters (or 656 feet)* of the TVWS device. This equates to a potential for interference to television reception in a 1,352,636 square feet area around a TVWS device. No objective observer could conclude that creating a *31 acre area* of potential interference "will not increase the potential of interference to television reception."²⁰

According to NAB's analysis, with no interference present, a DTV receiver will operate with a DTV signal level down to about -83 dBm. The present TVWS rules assume that the minimum adjacent channel D/U ratio required to prevent interference is -33 dB. This means that the interfering signal on the adjacent channel can be 33 dB stronger than the desired DTV signal. In other words, if the DTV signal is at the

¹⁹ See, e.g., CSIR Report on Field measurements done on operational TVWS trial network in Tygerberg, Oct. 13, 2013. Page 3 of the report states, "(a) laboratory estimation of the protection ratio established the acceptable levels of WSD transmission signals on adjacent channels to *analogue* TV transmissions." (*Emphasis added.*) Page 4 of the report indicates that "co-existence with DVT-T2 was estimated but not tested during this trial."

²⁰ *Id.* at ¶37.

threshold level required (-83 dBm) for an error free picture, then the interfering signal can be -50 dBm.²¹ Since a fixed TV white space device can operate at 4 Watts or +36 dBm, assuming free space propagation between the fixed device and an outdoor DTV antenna, the TV white space device signal would have to travel approximately 800 meters before interference free DTV reception could be guaranteed. Permitting white space devices to operate where the potential for interference to TV reception and viewers stretches across hundreds of meters fails to ensure that the proposed Part 15 changes would not increase the risk of harmful interference to authorized users.²² The Commission should not adopt this proposed change.

III. The Commission Should Ensure the TVWS Database Works Before Relaxing Technical Rules Designed to Protect Incumbent Services

The essential characteristic of unlicensed white space devices is found in the term “white space devices” itself – these devices operate opportunistically on available, unused channels where their operation will not cause harmful interference to licensed services.²³ To ensure white spaces devices operate only on available channels, and to prevent interference to primary users, the Commission established a number of safeguards.

The TV band database is the cornerstone of the Commission’s framework for the coexistence of licensed and unlicensed services in the TV bands. To prevent interference to licensed services, the database provides white spaces devices with a list

²¹ These are negative numbers so -50 is bigger or less negative than -83.

²² See, e.g., *Notice* at ¶¶ 3 and 21.

²³ *Unlicensed Operation in the TV Broadcast Bands*, Second Memorandum Opinion and Order, 25 FCC Rcd 18661, ¶ 1 (2010) (Commission’s rules are intended “to make the unused spectrum in the TV bands available” for unlicensed use.)

of available channels that may be used at a particular location. Under the rules, before commencing operations, a fixed TVWS device must register with the database and provide the following information:

- FCC identifier (FCC ID) of the device;
- Manufacturer's serial number;
- Geographic coordinates;
- Antenna height above ground;
- Name of individual or business that owns the device;
- Name of a contact person responsible for the device's operation;
- Address of the contact person;
- E-mail address for contact person; and,
- Phone number of contact person.²⁴

Based on the information users enter, the database identifies the available TV channels at the TVWS device's location. Thus, as a tool for preventing harmful interference and allowing TVWS devices to coexist with licensed services, the database is only as good as its inputs.

Location information is the most important information users enter into the database. Because different channels are available in different areas, it is vital that users enter correct location information – otherwise they may operate on occupied channels. The rules attempt to ensure the accuracy of location information in the database through two options – either devices must have an incorporated geolocation capability, or a professional installer must determine the geographic coordinates of the

²⁴ 47 C.F.R. § 15.713

device.²⁵ Despite the low cost of incorporated geolocation capability, as evidenced by the widespread availability of such capability in smartphones and tablets, no approved white spaces devices have such capability – and thus all existing devices rely on “professional installation” for accurate location information. In reviewing the experience of TVWS operations, the Commission should include a review of the functioning of the database, and the FCC should be prepared to revisit its rules as needed, particularly if it envisions more widespread use of TVWS devices. The FCC should ensure its rules provide a sharing framework that functions for all operators in the TV bands.

Assuming the database functions as intended to prevent TVWS devices from operating on unavailable channels, NAB supports the following proposed changes to the rules:

- While it is preferable to reserve two vacant channels in each market for wireless microphone use, at the very least, NAB supports the proposal that would require TVWS devices to recheck the database every 20 minutes, which would eliminate Section 15.711(b)(3)(iii) of the rules allowing TVWS devices to continue operating until 11:59 p.m. the day following its inability to establish contact with the database.²⁶
- NAB is also in favor of the provision that would require database harmonization within 10 minutes.²⁷
- NAB does not oppose elimination of the prohibition of fixed TVWS devices on channels 3 and 4. However, given the continued, albeit diminishing, use of TV interface devices with channel 3 or 4 outputs, we recommend that the Commission delay elimination of the prohibition for three years.
- NAB does not oppose the proposed graduated scale for intermediate power levels and corresponding power levels.²⁸ The *Notice* includes a proposal that TVWS devices “be required to indicate to the white space database the power at

²⁵ 47 C.F.R. § 15.711(b).

²⁶ *Notice* at ¶190.

²⁷ *Id.*

²⁸ *Notice* at ¶39

which it will operate.”²⁹ NAB supports a requirement for an automatic communication between the device and database, coupled with a requirement that users be unable to alter the power level once communication is made. The rules should also include a requirement for the device to automatically supply its antenna height.

V. The Commission Should Allocate the Duplex Gap to Licensed Wireless Microphones Exclusively

The *Notice* includes a unique proposal to subdivide the 600 MHz duplex gap amongst licensed and unlicensed services, allotting 6 MHz for unlicensed services exclusively, 4 MHz for wireless microphones and a 1 MHz guard band between licensed microphone and wireless downlink services. While NAB appreciates the Commission’s effort to make efficient use of the duplex gap and also find an exclusive home for licensed wireless microphones, this proposal suffers from a number of problems.

First, the proposed division of the duplex gap wrongly gives more spectrum and exclusive access to unlicensed services. As a general matter, an established licensed service that provides a public service should be given priority – both in terms of allocation and access – over nascent and wholly unproven unlicensed services. With the elimination of two reserved channels (12 MHz) in the TV band, licensed wireless microphone operators, including those used for local news, sporting events and theater productions, need a permanent, interference-free allocation. And while the Commission is tackling the issue of alternative spectrum bands for wireless microphones in a separate proceeding,³⁰ it should in this proceeding addressing the duplex gap specifically allot more spectrum for licensed microphones – a service that would

²⁹ *Id.*

³⁰ *Notice of Proposed Rulemaking* in GN Docket Nos. 14-166 & 12-268 (rel. Sept. 30, 2014).

undoubtedly use the spectrum efficiently, consistently and in the public interest. In contrast, it is highly speculative, and therefore potentially wasteful, to allot duplex gap spectrum exclusively for unlicensed use. To date, it remains unclear whether a market for white space devices will develop and, in any event, unlicensed operations will be given multiple other allotments throughout the broadcast band that can be used on an opportunistic basis.

Second, as NAB and other parties, including Qualcomm, have made clear, the inclusion of unlicensed devices in the duplex gap will very likely cause interference with licensed services in adjacent bands.³¹ As NAB has previously explained, “licensed wireless microphones, because of their lower power, their unique operational characteristics, such as battery power, intermittent operation and likely body absorption, are a more appropriate sharing partner with wireless broadband than uncontrolled and unlicensed Part 15 devices.”³² There also is no evidence showing that unlicensed device operations immediately adjacent to a dedicated licensed wireless microphone band can avoid interference with microphones that, under the current proposal, would not be identifiable in the white spaces database. It is far more reasonable – and better engineering – to dedicate the middle portion of the duplex gap to licensed wireless microphones and include reasonable guard bands on either side of that allocation to

³¹ See Comments of The National Association of Broadcasters in GN Docket No. 12-268 (filed Nov. 12, 2014) at 12-15; see also Petition for Reconsideration of Qualcomm Incorporated in GN Docket No. 12-268 (filed Sept. 15, 2014) at 4-8 (Qualcomm’s analysis showed that “mobile phones cannot use the 600 MHz licensed spectrum adjacent to the duplex gap and guard bands if the mobile user is in the same room as an unlicensed device operating in the 600 MHz duplex gap or guard bands because the mobile devices would be blocked by the unlicensed device operation.”)

³² Comments of The National Association of Broadcasters in GN Docket No. 12-268 (filed Nov. 12, 2014) at 15.

protect wireless mobile receivers and base stations. Again, while NAB appreciates the Commission's attempt to make the most efficient use of the duplex gap, this proposal simply goes too far. There is nothing efficient about overstuffing the duplex gap with incompatible operations.

Of course, this proposal would be completely upset by the possible inclusion of TV stations in the duplex gap after the repacking, as suggested in a recent incentive auction public notice.³³ NAB strongly opposes this suggestion. Aside from the clear negative effect on those broadcasters stuck on an island between the uplink and downlink wireless operations, having full-powered broadcast stations in the duplex gap, especially in major markets, would completely eliminate the only dedicated spectrum available for licensed microphones used to cover breaking news and weather events, which was the entire point of providing such dedicated spectrum. Eliminating spectrum for wireless microphone use in some markets also would diminish wireless microphone manufacturers' incentive to build new devices because they would only be able to operate in certain portions of the country. Manufacturers, and the broadcasters that rely on their products, need both certainty and consistency as they transition into the post-incentive auction world. Inserting broadcasters into the duplex gap undermines that much-needed certainty.

³³ See Public Notice, "Comment Sought on Competitive Bidding Procedures for Broadcast Incentive Auction 1000, including Auction 1001 and 1002," in AU Docket No. 14-252 and GN Docket No. 12-268 (rel. Dec. 17, 2014) at ¶35.

VI. Conclusion

NAB continues to support the Commission's efforts to develop reasonable rules for unlicensed operation in the broadcast band, both before and after the incentive auction. Unfortunately, some of the proposals in this *Notice* simply go too far and are not supported by experience nor sound technical analysis. NAB encourages the Commission to exercise caution before it reformulates rules to benefit operations that are, at best, unproven and, at worst, could cause widespread interference throughout the 600 MHz band. There is a way forward that works for everyone. We remain committed to working with the Commission to develop rules and procedures that ensure both more efficient use of the TV band and an interference-free environment for all users.

Respectfully submitted,

**NATIONAL ASSOCIATION OF
BROADCASTERS**

A handwritten signature in black ink, appearing to read "Rick Kaplan", with a long horizontal flourish extending to the right.

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