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

In the Matter of	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	Docket No. 12-268
	)	
Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band	)	WT Docket No. 08-166
	)	
Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition	)	WT Docket No. 08-167
	)	
Amendment of Parts 15, 74 and 90 of the Commission's rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones	)	ET Docket No. 10-24

REPLY COMMENTS OF
THE PUBLIC INTEREST SPECTRUM COALITION

The Open Technology Institute at the New America Foundation, Public Knowledge, Consumer Federation of America and the National Hispanic Media Coalition (collectively, the "Public Interest Spectrum coalition" or "PISC") are pleased to submit these Reply Comments to supplement our response to the issues raised in the Notice of Proposed Rulemaking ("*NPRM*")[1] and Public Notice ("*Public Notice*")[2] in the above-captioned proceedings.

[1] *In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, FCC 12-118, Docket No. 12-268 (rel. Oct. 2, 2012)(hereinafter "*Incentive Auctions NPRM*" or "*NPRM*"). By *Order* dated November 29, 2012, the Commission extended the deadline for filing initial Comments to January 25, 2013. *See Order*, DA 12-1916, Docket No. 12-268 (rel. Nov. 29, 2012).

[2] Public Notice, *The Wireless Telecommunications Bureau and the Office of Engineering and Technology Seek to Update and Refresh the Record in the Wireless Microphones Proceeding*, DA 12-1570, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (rel. Oct. 5, 2012). By *Order* dated November 30, 2012, the Commission extended the

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deadline for filing initial Comments to January 25, 2013. *See Order*, DA 12-1926, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (rel. Nov. 30, 2012).

SUMMARY

The undersigned consumer and media reform groups of the Public Interest Spectrum Coalition ("PISC") firmly believe the Commission can best optimize TV band spectrum for broadband deployment, innovation, job creation, consumer welfare and economic growth more broadly only by ensuring the availability of a substantial number of 6 MHz blocks of *unlicensed* access to TV White Space spectrum in every local market, with a portion of that spectrum being contiguous nationwide.

PISC is pleased to find a clear consensus among commenters supporting the Commission's proposal to designate the guard bands for unlicensed use and to add to the guard bands any "remainder" spectrum that cannot be auctioned in standard 5 megahertz blocks. Allowing unlicensed use of the guard bands, subject to the same technical rules that currently govern white space devices in general, will yield compelling public interest benefits. Ensuring a substantial amount of unlicensed spectrum on a nationwide basis is critical for developing markets with scope and scale for new, innovative and affordable "Super WiFi" chips, devices, applications and services. The record to date exhibits a widespread consensus that Congress has granted the Commission wide discretion to determine what constitutes a "technically reasonable" guard band under the circumstances. And while the Spectrum Act may preclude a guard band that is wholly unrelated to the purpose of protecting licensed services from harmful interference, it is equally true that the Communications Act precludes any decision by the Commission to *minimize* the size of an otherwise technically reasonable guard band for the purpose of increasing overall auction revenue.

PISC believes there is a clear consensus in the record to date that both the guard band below the auctioned downlink band *and* the duplex gap between the auctioned uplink and downlink blocks (in the alternative, channel 51-down band plan) need to be 10 to 12 MHz or more to avoid interference among licensed users. There is strong support among major commenters for a duplex gap of at least 18 megahertz or more in width, which PISC supports. There is strong support in the record for the view that the duplex gap must be consistent across all geographic markets in order to facilitate the development of a single device filter, in addition to promoting at least a baseline supply of contiguous unlicensed access. There is also widespread agreement that the guard bands between the downlink bands and TV broadcast operations will need to be greater than the 6 MHz proposed in the NPRM.

Concerning wireless microphones, the comments filed by major parties suggest policy changes that can result in a "win-win" for both microphone operators and for ensuring that a sufficient number of 6 MHz unlicensed channels are available in every market nationwide, including the largest cities. First, the comments of a diverse set of interests strongly agree that the two current reserve channels for microphones should be maintained as at least a fallback for reservations by Part 74 licensees and/or major venues as needed. Second, there is a broad consensus that the Commission should expand and legitimize the already common practice of microphone operators relying on TV co-channels that are not available for unlicensed use by TVBDs. Third, since TV co-channels and most white space channels below channel 21 currently are not available for use by unlicensed TVBDs, PISC believes that both Part 74 and unlicensed microphones should be required to use and exhaust those channel slots (in 200 kHz increments) *as a precondition* to using the two current reserve channels or any other white space channels that can be used by unlicensed TVBDs. Finally, microphone use of any unlicensed TVWS

channel should be restricted to reservations requested from and assigned by a TV Bands Database administrator. PISC strongly opposes any expansion of Part 74 eligibility to the extent that it would allow any increase in the number of microphone users with the ability to block access to the very limited number of TV white space channels available for unlicensed use.

PISC also finds strong support among commenters for the Commission's proposal to make channel 37 available for unlicensed use, while protecting the Radio Astronomy Service (RAS) and wireless medical devices (WMTS) with protection zones that can readily be enforced using the TV Bands Database. Since both WMTS and RAS operations are fixed and static, there is no reason why protection zones enforced on an automated basis through a geolocation database system certified by the Commission would not be able to safeguard incumbents so that the remaining 95 percent or more of the band's capacity, which is currently unused, can be used on a largely contiguous basis nationwide. Because the TV Bands Database is designed and certified as an automated enforcement tool that does precisely what the WMTS industry claims it needs to avoid interference, there is no reason to leave 6 MHz of prime spectrum mostly unused in most parts of the country going forward.

PISC is pleased to find considerable support from diverse parties for its proposal that all new 600 MHz licenses should include a condition that permits unlicensed white space devices (TVBDs) to continue to operate on a localized basis until such time as the licensee notifies the Commission and/or a TV Bands Database administrator that the licensee intends to commence service. With clear ground rules and the TV Bands Database as an automatic enforcement mechanism, there is absolutely no downside or risk for licensees, who would maintain all of their rights to *use* the public resource; they would only lose the ability to warehouse it. In the case of the 600 MHz band, a "use it or share it" policy is the closest thing to a spectrum efficiency "free

lunch." It also is important to recognize that this proposal simply maintains the status quo. In effect, the Commission does not need to change its rules, but merely sustain the existing treatment of licensees in the 600 MHz band.

Finally, PISC concurs with the consensus in the record among non-dominant wireless carriers that the Commission should adopt, as a general licensing condition, a limit on total spectrum holdings below 1 GHz. The implementation of this condition would comply with both the language and intent of the Spectrum Act, as any acquisition of spectrum that exceeds the limit could be mitigated by a subsequent divestiture of spectrum once the auction is complete. PISC believes that a general condition limiting overall holdings below 1 GHz is most appropriate in this proceeding, rather than a limit focused only on the share of 600 MHz spectrum acquired in the auction. This cap should apply in particular to *paired* spectrum holdings below 1 GHz.

I. THE FORWARD AUCTION BAND PLAN SHOULD INCLUDE A DUPLEX GAP AND GUARD BANDS THAT BOTH PROTECT INCUMBENT SERVICES AND ENSURE SUBSTANTIAL NATIONWIDE AND CONTIGUOUS ACCESS TO UNLICENSED SPECTRUM

A. The Comments Suggest Widespread Consensus that the Commission Should Designate Guard Bands for Unlicensed Use

With the exception of a couple diehard opponents to the Commission's series of unanimous Orders making fallow TV band spectrum "white space" available for unlicensed use, the record demonstrates a widespread consensus across industries and among consumer groups in favor of designating any needed guard bands for low-power, unlicensed use. In addition to PISC,[3] a diverse range of interests that included Verizon, CTIA, Comcast, the Consumer Electronics Association (CEA), Google, Microsoft, WISPA, IEEE, the Computing Technology Industry Association (CompTIA), the National Cable Telecommunications Association (NCTA)

[3] Comments of the Public Interest Spectrum Coalition, Docket No. 12-268, *et al.* (Jan. 25, 2013) ("PISC Comments").

and Spectrum Bridge are among the many commenters expressing explicit support for unlicensed use of the guard bands and/or duplex gap (under the alternative 51-down band plan supported by these commenters and others).

On this issue, PISC agrees with CTIA, which states that "in accordance with the Spectrum Act, . . . spectrum in the guard bands should be identified for unlicensed use, to the extent technically feasible."[4] CTIA's support for complementary unlicensed use in the guard bands and duplex gap should not be surprising, since its comments highlight a projection by Alcatel-Lucent, which forecasts an increase of "87 times [the current] daily traffic on wireless networks" over the next five years, with 50 percent of that traffic on cellular networks "while the remaining 50 percent will be offloaded to Wi-Fi."[5] Similarly, Comcast observes that while "the growing demand for unlicensed spectrum appear[s] like a daunting problem, one part of the solution is clear: allocate sufficient contiguous spectrum in the 600 MHz band for unlicensed use."[6] Comcast goes on to argue that the Commission has the statutory authority and policy rationale to "designate at least a contiguous 20 MHz block as the duplex gap, and allocate that spectrum for unlicensed use."[7]

The Consumer Electronics Association (CEA) adds that "guard bands could effectively serve the dual purpose of protecting TV and licensed 600 MHz operations from interference,

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[4] Comments of CTIA – The Wireless Association, Docket No. 12-268 (Jan. 25, 2013) at 3, 11 ("Comments of CTIA"). *Accord*, Comments of Verizon and Verizon Wireless, Docket No. 12-268 (Jan. 25, 2013) at 20 ("Comments of Verizon") ("Appropriate low-power Part-15 type devices could operate in the guard band and the duplexer gap on a non-interfering basis provided they meet certain specification.").

[5] Comments of CTIA at 7, citing Sue Marek, "Mobile Broadband Usage Is Skyrocketing-and So Are the Number of Projections," FIERCEWIRELESS (Feb. 27, 2012), *available at* http://www.fiercewireless.com/story/mobile-broadband-usage-skyrocketing-and-so-are-number-projections/2012-02-27.

[6] Comments of Comcast Corporation and NBCUniversal Media, LLC, Docket No. 12-268 (Jan. 25, 2013) at 40, 44 ("Comments of Comcast and NBC/Universal").

[7] Comments of Comcast and NBC/Universal at 40. *Accord*, Comments of the Computing Technology Industry Association, Docket No. 12-268 (Jan. 25, 2013) ("Comments of CompTIA") at 2; Comments of White Space Alliance, ET Docket No. 12-268 (Jan. 25, 2013) at iii ("Comments of White Space Alliance") ("[The Commission] should allow unlicensed use of the guard bands and duplex gap…").

while permitting low-power, non-interfering unlicensed use."[8] Google and Microsoft, for their part, list a number of reasons why "a band plan that allows unlicensed devices access to a duplex gap that is large enough to support robust unlicensed operations will more effectively support innovation and investment . . .."[9]

One dissonant note was struck by Qualcomm, which offers the puzzling objection that "Qualcomm's preliminary analysis . . . indicates that an LTE mobile device will interfere with TV white space devices."[10] Although Qualcomm's opposition is expected (the company has been perhaps the single most persistent opponent of the Commission's decision to allow unlicensed use of the vacant white space channels since at least 2007), the relevance of its claim is puzzling since a key reason to designate the guard bands and duplex gap for low-power unlicensed use, rather than auction it for licensed use, is that Part 15 devices and users, which includes those utilizing TV white space devices, are required to accept any interference. Moreover, if unlicensed access to the guard bands is subject to the Part 15 rules governing access to the TV white space channels, then automated management by the TV Bands Database can deny access to a TVBD at any particular place or time where harmful interference to licensees in the adjacent band occurs. Unlicensed users of *any* TV band spectrum neither expect to operate without risk of interference, nor can they object or evade the loss of access to a particular channel if harmful interference into the protected licensed operation unexpectedly occurs.

[8] Comments of the Consumer Electronics Association, Docket No. 12-268 (Jan. 25, 2013) at 28 ("Comments of the Consumer Electronics Association").
[9] Comments of Google and Microsoft, Docket No. 12-268 (Jan. 25, 2013) at 32-33 ("Comments of Google and Microsoft").
[10] Comments of Qualcomm Incorporated, Docket 12-268 (Jan. 25, 2013) at 22 ("Comments of Qualcomm"). Another minority view was offered by the Telecommunications Industry Association (TIA), which stated that "while unlicensed uses in the TV 'white spaces' can and should continue, the Commission should keep an open mind about the possibility of licensing any new guard bands." Comments of Telecommunications Industry Association, Docket No. 12-268 (Jan. 25, 2013) at ii ("Comments of TIA").

B. The Comments Suggest Widespread Consensus that the Commission has Broad Authority to Designate a Duplex Gap and Guard Bands and Allow Unlicensed Use

PISC stated in its initial comments that in the Spectrum Act, Congress explicitly authorized the Commission's use of discretion to allocate any "technically reasonable" guard bands for unlicensed use.[11] Pursuant to this authorization, the Commission should do so absent compelling evidence that permitting low-power unlicensed operations would cause harmful interference to primary licensed services in adjacent or nearby bands. The record to date exhibits a widespread consensus that the Commission has the discretion to designate "technically reasonable" guard bands for unlicensed use.[12] PISC agrees fully with the extensive statutory analysis presented in the comments filed by Google and Microsoft and, separately, by Comcast, both of which conclude that Congress has granted the Commission wide discretion to determine what is "technically reasonable" under the circumstances.

Google and Microsoft, for example, correctly conclude that the Spectrum Act's admonition to define guard bands that are "no larger than technically reasonable to prevent harmful interference" is satisfied by "a frequency block of any size that the FCC, on the record before it, rationally finds appropriate to prevent harmful interference."[13] They note that the D.C. Circuit has concluded that in administrative law, "reasonable" means "not arbitrary and capricious."[14] Clearly "reasonable" does not mean "necessary" – and the fact that the House Commerce Committee chose to change draft legislative language from "technically necessary" to

[11] *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6407(b), 126 Stat. 156, 230 (2012) ("The Spectrum Act").

[12] Even Cisco Systems Inc., which has consistently advocated in Congress against unlicensed access to TV band spectrum, states in its statutory analysis that "the statute does not appear to create a presumption in favor of licensed guard bands. The only burden incurred by the Commission in choosing unlicensed would appear to be the requirement to explain why the Commission believes unlicensed use to be the best result in the public interest, including the fulfillment of the primary purpose of the guard bands as provided in Section 6407(b)." Comments of Cisco Systems, Inc., Docket No. 12-268 (Jan. 25, 2013) at 14 ("Comments of Cisco").

[13] Comments of Google and Microsoft at 35.

[14] *Id.* at 36, citing *DIRECTV, Inc. v. FCC*, 110 F.3d 816, 829 (D.C. Cir. 1997).

"technically reasonable" evidences the clearest possible Congressional intent to allow the expert agency wide discretion to determine both the appropriate size and licensing status of the guard bands established to protect licensed services from harmful interference.

PISC also concurs with the analysis presented by Comcast, which concludes that "the best possible construction of the [Spectrum] Act is that the Commission has the flexibility to develop a band plan that includes unlicensed guard band spectrum."[15] Moreover, Comcast adds the important point that this interpretation is also "consistent with the Commission's Title III authority because it allows the Commission to implement a band plan that achieves maximum utilization of the spectrum without raising interference concerns that would accompany any proposal to license and auction the spectrum."[16] As Comcast observes, Section 303(g) of the Communications Act directs the Commission to "generally encourage the larger and more effective use of radio in the public interest."[17] Section 309(j) additionally sets forth the appropriate "objectives" the Commission must promote to design an auction in the public interest, directs the Commission to, *inter alia*, "promot[e] economic opportunity and competition,"[18] while *forbidding* the Commission from "bas[ing] a finding of public interest, convenience and necessity on the expectation of Federal revenues."[19] In other words, while the Spectrum Act may preclude a guard band this is wholly unrelated to the purpose of protecting licensed services from harmful interference, it is equally true that the Communications Act precludes any decision by the Commission to *minimize* the size of an otherwise technically reasonable guard band for the purpose of increasing overall auction revenue.

[15] Comments of Comcast Corporation and NBC/Universal at 43.
[16] *Id.* at 43; *See Id*. at 43 n.126.
[17] *Id*. at 43 n.126, citing 47 U.S.C. § 309(g).
[18] *Id.*, citing 47 U.S.C. § 309(j)(3).
[19] *Id.*, citing 47 U.S.C. § 309(j)(7)(A).

C. There is Widespread Support for a Conservative Approach that Designates a Relatively Wide and Consistent Duplex Gap and/or Guard Bands

In its initial comments, PISC described the compelling public interest benefits likely to result from the availability of substantial and *contiguous* unlicensed spectrum access nationally, or at least regionally, in the 600 MHz band. [20] The discontinuous nature of unlicensed access to TV band spectrum is a disadvantage that will slow (but ultimately not stop) the deployment of rural broadband, machine-to-machine (M2M) innovation and other valuable deployments in the TV white spaces. Nonetheless, a substantial and contiguous block of unlicensed spectrum in the guard bands and/or duplex gap – particularly if each guard band contains at least two 6 MHz 'white space' channels accessible to TVBDs in every market – would spur deployment of unlicensed technologies, creating a multiplier effect with benefits for the industry, consumers and job creation in the broader economy.[21]

There is a clear consensus in the record to date that both the guard band below the auctioned downlink band *and* the duplex gap between the auctioned uplink and downlink blocks (in the alternative, channel 51-down band plan are supported as technically superior by virtually all major industry commenters) need to be 10 to 12 MHz or more to avoid interference among licensed users. If the Commission accepts the consensus in favor of a 51-down band plan with a duplex gap, PISC agrees with the many commenters proposing that a duplex gap in excess of 12 MHz is both technically reasonable and probably necessary to give auction bidders the certainty they need that harmful interference in the future is unlikely. The *NPRM* rightly raised concerns

[20] Comments of Public Interest Spectrum Coalition, Docket No. 12-268 (Jan. 25, 2013) at 22 ("Comments of PISC").
[21] *See generally* Comments of Google and Microsoft at 21-28.

that "[m]inimizing the duplex gap size . . . could have negative impact on mobile performance."[22]

With respect to the width of a technically reasonable duplex gap between high-power uplink and downlink LTE operations, there is strong support among major comments for a duplex gap of at least 18 megahertz or more in width. Motorola Mobility observes that the average 3GPP specification for an LTE duplex gap under 1 GHz is 19 megahertz, with a range of 10 to 30 megahertz.[23] The *NPRM* similarly recognized that the 3GPP bands with "duplex gaps of at least 28 megahertz and at least 1.4 times the pass band size" reduce harmful interference resulting from degraded receiver sensitivity to a far greater degree than do narrower duplex gaps.[24] Google and Microsoft conclude that based on this finding alone, "[a] band plan with a duplex gap of 28 MHz is technically reasonable."[25] Their comments also place into the record the declaration of a professor of engineering and former CTO of Motorola Inc., David Borth, who concludes that "[f]or a traditional FDD band plan, such as . . . Figure 12 in the *NPRM*, a duplex gap of greater than 20 MHz is technically reasonable to prevent harmful interference between licensed services."[26] Borth also noted that because "no amount of filtering" can prevent interference caused by intermodulation created by LTE transmissions, "[t]his intermodulation issue alone would justify a gap that—at an absolute minimum—exceeds the pass band size."[27]

Because a duplex gap exceeding 20 megahertz is consistent with the actual band plans adopted by 3GPP and the judgment of expert commenters such as David Borth and Motorola

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[22] *NPRM* at ¶ 178 & note 262.
[23] Comments of Motorola Mobility LLC, Docket No. 12-268 (Jan. 25, 2013) at 11 ("Comments of Motorola Mobility"). "[C]urrent 3GPP specifications for LTE frequency bands under 1 GHz provide for duplex gaps of varying sizes ranging from 10 MHz to 30 MHz, ***with an average separation of approximately 19 MHz*** between the base transmit and base receive bands for Frequency Division Duplex ("FDD") networks." *Ibid* (emphasis added).
[24] *NPRM* at ¶ 178 & n. 262.
[25] Comments of Google and Microsoft at 37.
[26] "Declaration of David Borth," appended to Comments of Google and Microsoft, at 2.
[27] *Id.* at 38, citing the "Declaration of David Borth" appended to the comments.

Mobility, PISC supports the view that a duplex gap of 20 megahertz would be technically reasonable. In addition to being needed to mitigate interference, a duplex gap of 20 megahertz or more would create a more technically-balanced ecosystem combining robust, small-cell unlicensed access immediately adjacent to wider-area licensed services. As Comcast states, "because current Wi-Fi standards utilize 20 MHz channels, the Commission should allocate at least 20 MHz of contiguous spectrum reclaimed using the reverse auction for unlicensed use."[28] At a minimum, if the Commission adopts a traditional FDD band plan along the lines of the 51-down plan in Figure 12 of the NPRM, the comments of Verizon, CTIA and others suggest that a duplex gap "of at least 10 MHz, and possibly more"[29] will be both reasonable and necessary to facilitate cost-effective quality of service without undue risk of harmful interference.

There is also strong support in the record for Verizon's view that the duplex gap "must line up across all geographic markets in order to facilitate the development of a single device filter."[30] PISC agrees in particular with the analysis and position of Motorola Mobility, which recommends a "fixed-size" duplex gap that is consistent nationwide.[31] The company states:

> It is important . . . that the Commission establish a fixed-sized duplex gap and avoid crafting the forward auction in a manner that would enable variably sized duplex gaps in different regions of the country. This would create significant challenges for equipment and chip-set design and negatively affect nationwide interoperability in the band.[32]

With respect to the size of the guard bands between the downlink bands and TV broadcast operations, there is widespread agreement in the comments filed that it will need to be

[28] Comments of Comcast and NBC/Universal at 41. *Accord* Comments of the White Spaces Alliance at iii ("[The Commission] should … set the guard bands at 10 – 12 MHz and the duplex gap at 18 – 24 MHz.").
[29] Comments of CTIA at 28; *see also* Comments of Verizon at 18-19 ("The gap must be at least 10 MHz (and possibly larger, depending on the overall band design). A larger duplex gap results in less insertion loss and also facilitates a larger pass band of 25 MHz or possibly more without impacting sensitivity in the mobile device.").
[30] Comments of Verizon at vi.
[31] Comments of Motorola Mobility at 11.
[32] *Id.*

greater than the 6 MHz proposed in the NPRM.[33] For example, Verizon "assumes[s] a minimal guard band of 10 MHz to protect downlink from adjacent high-power broadcast channels."[34] Qualcomm recommends "a separation of approximately 10 MHz between the highest full power TV station and any downlink block to avoid saturation of the receiver in the user device."[35] Motorola Mobility concurs and recounts the results of DTV receiver interference testing at the University of Kansas spectrum labs, which were submitted by the New America Foundation in the TV White Space proceeding in 2007.[36] The "KU Study" measured levels of interference into a number of different DTV receivers by a 6 MHz OFDM signal technically similar to an LTE signal. In his declaration for Motorola Mobility, David Borth concludes that based on the KU Study results, "the LTE transmitter could cause observable interference to the DTV receiver at distances less than approximately 2,000 feet away . . . even with a frequency separation of more than 6 MHz."[37]

D. It is Technically Reasonable to Dedicate Any Remainder Spectrum Resulting from Dividing the Band Plan into 6 MHz Blocks to Enlarging the Guard Bands

PISC, in its initial comments, strongly supported the Commission's proposal to designate the guard bands for unlicensed use and to add to the guard bands any "remainder" spectrum in any market that cannot be auctioned in standard 5 megahertz blocks.[38] Both the concept of uniform 5 MHz blocks and the *NPRM*'s proposed use of any remainder spectrum to enhance the interference protection capabilities of the guard bands and/or duplexer gap have widespread

[33] *See, e.g.,* Comments of Google and Microsoft at 39-40; Comments of Qualcomm at 21; Comments of Verizon at 19-20.
[34] Comments of Verizon at 19-20.
[35] Comments of Qualcomm at 21.
[36] "University of Kansas TV Band Interference Study," Comments of New America Foundation, ET Docket 04-186 (Jan. 31, 2007), *Unlicensed Operation in the Television Broadcast Bands* (2008) (hereinafter "KU Study").
[37] Comments of Motorola Mobility, Declaration of David Borth, appendix at 6.
[38] *See* Comments of PISC at 21; *see also Incentive Auction NPRM, at ¶ 234.*

support and little opposition in the record. For example, PISC concurs with Verizon's recommendation that "the only reasonable place to locate the remainder spectrum is in the guard band."[39] Similarly, Google and Microsoft concluded that "auctioning remainder spectrum is incompatible with the proposed 5 MHz 'building block' model for the forward auction" and would "introduce needless complexity to the auction process . . .."[40] CEA, WISPA, the White Space Alliance and Free Press are among other commenters, along with PISC, that supported the Commission's proposal to add remainder spectrum to the guard bands designated for unlicensed use.

E. The Commission Should Anticipate and Require Interoperability Across Licensed FDD Spectrum in the 600 MHz Band

As consumers and competitive carriers learned to their dismay after the 700 MHz band auctions of 2008, the time to decide on interoperability obligations in a new band is *before* and not after the auction. PISC strongly agrees with the Competitive Carriers Association that the Commission should protect the 600 MHz band from the anti-competitive harms inherent in the absence of interoperability "by implementing an interoperability mandate as part of its initial band plan and service rules, rather than waiting to attempt to resolve interoperability concerns that inevitably will arise in the future."[41]

Interoperability allows consumers to more easily switch carriers. Moreover, among LTE networks, interoperability is critical to ensure that roaming is technically possible. A clear obligation promotes competition and consumer choice by allowing smaller, competitive wireless

[39] Comments of Verizon at 20, note 28. "Tacking on an extra MHz or two to an otherwise-generic block of auctionable spectrum would not make sense. And from a device design point of view, dedicating remainder spectrum to guard band use is technically preferable to increasing the size of the duplex gap." *Ibid.*
[40] Comments of Google and Microsoft at 42.
[41] Comments of the Competitive Carriers Association, WT Docket No. 08-166 (Jan. 25, 2013), at 16 ("Comments of CCA"). *Accord*, Comments of T-Mobile USA, Inc., WT Docket No. 08-166 (Jan. 25, 2013), at 21 ("Comments of T-Mobile") ("The Commission should require interoperability across all paired 600 MHz band channels.").

carriers to provide the newest and most sought after devices on their networks. Interoperability can also promote an effective and efficient public safety network, which could be a factor here given the spectral proximity to the 700 MHz public safety bands. As PISC, CCA and others have documented in the pending proceeding on 700 MHz band interoperability, the balkanization of that band has resulted in a device ecosystem controlled by the two dominant carriers in a manner that has sharply impeded competition and has slowed deployment of LTE services to consumers.[42] PISC agrees as well with the recommendation of T-Mobile that, at a minimum, the Commission should require interoperability across all paired 600 MHz band channels. T-Mobile correctly observes that "[t]he benefits of requiring interoperability are great and cost little to nothing, especially at the outset of band development."[43]

II. THE COMMISSION SHOULD OPEN THE TWO RESERVED WIRELESS MICROPHONE CHANNELS FOR DUAL USE BY UNLICENSED DEVICES AND EXPLICITLY LEGITIMIZE MICROPHONE RELIANCE ON TV CO-CHANNELS

The comments filed by major parties directly impacted by the assignment of unused TV channel capacity for microphone operations suggests a set of policy changes which, taken together, would result in "win-win" for both microphone operators and for ensuring that a sufficient number of 6 MHz unlicensed channels are available in every market nationwide, including the largest cities. First, comments filed by a diverse set of interests in this proceeding express a widespread consensus that the two current reserve channels for microphones should be maintained as at least a fallback for reservations by Part 74 licensees and/or major venues as needed. Second, there is a widespread consensus that the Commission should expand and

[42] *See* Comments of Consumers Union, Public Knowledge, the New America Foundation and Free Press, *Promoting Interoperability in the 700 MHz Commercial Spectrum*, WT Docket No. 12-69 (filed June 1, 2012); Comments of RCA – The Competitive Carriers Association, *Promoting Interoperability in the 700 MHz Commercial Spectrum*, WT Docket No. 12-69 (filed June 1, 2012).
[43] *Ibid.*

legitimize the already common practice of microphone operators relying on TV co-channels that are not available for unlicensed use by TVBDs. Third, since TV co-channels and most white space channels below channel 21 currently are not available for use by unlicensed TVBDs, both Part 74 and unlicensed microphones should be required to use and exhaust those channel slots (in 200 kHz increments) *as a precondition* to using the two current reserve channels or any other white space channels that can be used by unlicensed TVBDs. Finally, although at least Part 74 licensees should have continued access to the two reserve channels *as needed*, microphone use of any unlicensed TVWS channel should be restricted to reservations requested from and assigned by a TV Bands Database administrator, since the TVBD process can ensure an efficient assignment and spacing of 200 kHz channels for microphone use that both protects them from TVBDs *and* simultaneously from other microphone operators proximate enough to raise interference concerns.

A. The Two Reserve Channels for Microphones Should be Maintained But Opened for Unlicensed Use When Not Reserved

The comments filed express a broad consensus that the two channels currently reserved for wireless microphone use should be maintained as at least a fallback for major venues that need to coordinate a substantial number of channels for special events and/or major venues. The disagreement among comments by parties with the most at stake is not whether or not two vacant TV channels should be designated for microphone use, but rather the terms of access and whether that spectrum should be made available for broader unlicensed use by TVBDs when and where it is not reserved for microphone use. For example, Shure Inc. advocates essentially the

status quo,[44] whereas the National Association of Broadcasters ("NAB") supports maintaining two reserve channels, but also proposes limiting microphone eligibility to a somewhat expanded universe of licensed Part 74 microphone operators.[45]

In contrast, advocates of ensuring a robust amount of unlicensed spectrum in every market nationwide generally support maintaining the two reserve channels for microphone reservation, *as needed*, but otherwise opening those two channels for opportunistic use by unlicensed TVBDs wherever and whenever that spectrum capacity would otherwise be fallow.[46] For example, Google and Microsoft propose that the two reserve channels for microphones should be retained, but that access should be broadened to dual use by both Part 74 operators and TVBDs obtaining permission through the TV bands database.[47] PISC concurs with this view. As Google and Microsoft observe, "[t]his approach will ensure that Part 74 wireless microphone users will always have two channels where they can be assured of primary rights through a white spaces database, and both non-Part-74 wireless microphone users and users of white space devices will have access to these channels on an unlicensed basis."[48]

Because expanded co-channel availability and coordination could greatly reduce the need for microphone use of these two reserve channels, PISC similarly proposed that the two microphone channels should be opened more generally for unlicensed TVBDs at any time and

[44] Comments of Shure Incorporated, WT Docket No. 08-166 (Jan. 25, 2013) at 16 ("Comments of Shure") ("Incentive auctions and repacking will inevitably lead to fewer White Space channels nationwide, thereby making the two reserve channels critical for *all* wireless microphone operators, regardless of license status.").
[45] *See* Comments of National Association of Broadcasters, WT Docket No. 08-166 (Jan. 25, 2013) at 2 ("Comments of NAB"). NAB implicitly limits the reserve channels to Part 74 licensees since it proposes that unlicensed microphones should not operate in the TV band except perhaps under the same very low-power Part 15 rules in effect for unlicensed TVBDs. *See* Comments of NAB at 7.
[46] *See, e.g.*, Comments of Google and Microsoft at 51-53; Comments of Spectrum Bridge, Inc., Docket No. 12-268 (Jan. 23, 2013) at 8-9 ("Comments of Spectrum Bridge"); Comments of White Space Alliance at 34; Comments of The Wireless Internet Service Providers Association, Docket No. 12-268 (Jan. 25, 2013) at 19 ("Comments of WISPA").
[47] Comments of Google and Microsoft, at 51-53. "Unlicensed devices and wireless microphones can share the two channels currently reserved for exclusive wireless microphone use if the FCC designates both channels for wireless microphone use as well as unlicensed use, rather than eliminating the current designation completely. " *Id.* at 51.
[48] Comments of Google and Microsoft at 51-52.

place microphone operators have not made a qualified reservation.[49] Microphone use of unlicensed TVWS, in turn, should be restricted to reservations on these two reserve channels *if but only if* the expanded number of useable TV co-channels and channels below 21 that are not available to TVBDs are insufficient to meet their needs at a particular time and venue.[50] Even if the Commission decides that unlicensed microphones should continue to receive preferential access to these two channels, it should be by reservation only so that the TV Bands Database can enable more widespread and efficient use of the other 99 percent of the capacity on the two channels. Particularly since there will be substantially less white space in a repacked TV band after the auction, it would be a needless waste of prime spectrum not to utilize the TV Bands Database to facilitate *dual use* of these channels for microphones, as needed, and TVBDs.

Moreover, PISC agrees that reservations on the two designated channels should be coordinated and assigned through a TV Bands Database administrator in order to ensure efficient use of unlicensed spectrum while also improving transparency and coordination among microphone users. Spectrum Bridge likewise proposed that this 12 MHz of spectrum can be utilized far more intensively and efficiently if microphones must receive assignment by TVBDs, with reservations in increments of no more than the 200 kilohertz of spectrum space they actually use rather than occupying a full 6 MHz TV channel.[51]

[49] Comments of PISC at 41.
[50] **[CHECK]** This requirement could be essentially the same as the Commission's existing requirement that unlicensed microphone users cannot make reservations unless they first "certify that they are making use of all TV channels not available to TV band devices and on which wireless microphones can practicably be used." FCC, "Office of Engineering and Technology and Wireless Telecommunications Bureau Announce the Initial Launch of Unlicensed Wireless Microphone Registration System," *Public Notice* in ET Docket No. 04-186, DA 12-1514 at 5 (released September 19, 2012).
[51] Comments of Spectrum Bridge at 9.

B. The Commission Should Explicitly Legitimize Wireless Microphone Use of TV Co-Channels and Allow Use of Unlicensed White Space Only if Needed

The record to date reflects widespread support for proposals that would both expand and legitimize the well-established practice of microphone operators that rely on out-of-market TV channels ("TV co-channels") that have very weak signals at the microphone venue, but which are nevertheless not permitted for use by unlicensed TVBDs. Clearing any TV channels of broadcasters to facilitate a reallocation of spectrum for auction will necessarily reduce the number of vacant channels available for both wireless microphones and unlicensed TVBDs. However, unlike unlicensed devices, wireless microphones have a long and proven history of being able to operate co-channel with TV stations that have a weak signal at or inside their venue. For example, Broadway theaters are considered one of the most important and deserving categories of professional microphone operators that are not eligible for a Part 74 license. Because their venues are generally behind thick walls – and frequently even below ground level – there seems to be no reason why at least these professional operators should not *rely first and foremost* on TV co-channels that will not displace other valuable uses, such as TVBDs on the far scarcer supply of TV band spectrum accessible under Part 15. Indeed, the Broadway League recognizes this reality in its comments: "[N]owhere are there fewer available channels than in the heart of the Broadway Theatre District and through skillful engineering and coordination, Broadway theatres have extracted use from every available slice of spectrum without causing interference."[52]

PISC's initial comments offered a detailed analysis, based on recent microphone reservations in the TV Bands Database and Shure's own wireless microphone channel finder database, showing that "even in the single most congested urban market, there appears to be no

[52] Comments of The Broadway League, WT Docket No. 08-166 (Jan. 25, 2013) at 12.

need for wireless microphones to occupy unlicensed TV White Space channels – or even the two vacant microphone reserve channels – except as a last resort for special events."[53] Spectrum Bridge, based on its experience as a TV Bands Database operator, noted that it "is already common practice" for wireless microphones to use co-channel TV spectrum.[54] Google and Microsoft, both provisionally certified as TV Bands Database operators, observed that "[c]o-channel operations are occurring, and are widespread," a "point amply illustrated during the field tests performed by the Office of Engineering and Technology in the white spaces proceeding."[55] Indeed, Google and Microsoft note that during OET's testing, "one of the channels used by wireless microphones at FedEx Field was the very channel used to carry the high definition broadcast of the football game taking place that day."[56] Of course, this should not be surprising, since FedEx Field did not need to worry that it would interfere with over-the-air viewers of the game broadcast.

Two leading microphone manufacturers, Shure and Sennheiser, proposed very straightforward changes in their comments that would legitimize and expand the number of TV co-channels available for microphones without increased risk of interference to television viewers and without cannibalizing the even more limited number of unlicensed white space channels available for TVBDs. Shure correctly observed that the TV Bands Database can be harnessed to ensure greater availability of TV co-channels without undue risk to broadcast licensees:

[53] Comments of PISC at 36.
[54] Spectrum Bridge Comments at 9; *see also* PISC Comments at 35 ("common practice" for microphones to use co-channel spectrum); Google/Microsoft Comments at 53 ("widespread" co-channel operations); Comments of White Space Alliance at 34.
[55] Comments of Google and Microsoft at 53, citing Letter from Edmond Thomas, Senior Technology policy Advisor, White Spaces Coalition, to Marlene H. Dortch, FCC, ET Docket No. 04-186 (filed Aug. 19, 2008).
[56] *Ibid.*

> [W]ireless microphones could operate on locally used co-channel TV frequencies within the TV station's contour without causing interference, such as inside buildings or other structures where over-the-air TV signals are not receivable or where no over-the-air receivers are in operation. ***The availability of White Space databases presents the possibility of allowing co-channel operation of licensed wireless microphones through database registration.*** In the event that any interference were to occur, the source could be identified through the database and turned off.[57]

Shure correctly noted that "to make the most efficient use of the spectrum, the Commission should consider defining the separation requirement on a more technically complete basis that includes the predicted contour of the TV station and the radiated power of the wireless microphone."[58]

Sennheiser concurred with this objective and endorsed "a simpler rule" that would allow wireless microphones "to operate at locations where a co-channel TV signal is below a specified threshold."[59] PISC made this same proposal in its initial comments.[60] Sennheiser stated:

> If a wireless microphone is to be operated indoors, as most are, the measurement can be taken indoors, giving the microphone system the benefit of any wall attenuation. This approach will be faster and easier for microphone users to implement than either database registration or full-scale frequency coordination.[61]

As Shure and Sennheiser note, current FCC rules specify a minimum spacing of 113 kilometers between wireless microphones and TV transmitters without regard to other relevant technical parameters.[62] PISC believes the Commission should offer at least Part 74 licensees a choice between a standard but far shorter separation distance *or*, as Sennheiser suggests, a signal strength threshold at the actual location of the microphone transmitter (*i.e*, inside the venue). At a

[57] Comments of Shure at 25 (emphasis added).
[58] *Id.*
[59] Comments of Sennheiser Electronic Corporation, Docket No. 12-268 (Jan.25, 2013) at 11; *see also* Comments of PISC at 38 (proposing choice of either simple geographic separation or actual received signal strength at the microphone location).
[60] Comments of PISC at 38.
[61] Comments of Sennheiser at 11.
[62] *See* 47 C.F.R. §74.802(b)(3).

minimum, the FCC should legitimize the status quo evident from Shure's own microphone channel look-up database and substantially shorten the TV co-channel separation distances for both Part 74 and unlicensed microphones.[63] Rather than waste spectrum capacity by over-protecting TV viewers with unnecessarily over-sized protection contours – when, in reality, most microphone use is at low power and attenuated by indoor operation – the Commission could require microphones to register in the database so that, as Shure proposes, "in the event that any interference were to occur, the source could be identified through the database and turned off."[64]

If the Commission enhances spectrum efficiency by reducing microphone co-channel separation distances, by requiring microphone registration and coordination to more intensely use these non-TVWS channels, and by maintaining the two microphone reserve channels on a non-exclusive basis (for reservation in the case of a special event or the unavailability of non-TVWS channels in a particular geography), then there should be no need or justification to permit or encourage microphones to displace additional unlicensed use of these bands.

Moreoever, as the White Space Alliance (WSA) has argued, the ability to use TV band spectrum most efficiently will depend upon widespread adoption of digital wireless microphone systems. The WSA thus recommends that "all wireless microphones authorized for licensed use become frequency agile, i.e., have the ability to dynamically select available spectrum on which to operate."[65] However, the National Association of Broadcasters argues that there are practical limits to the spectral efficiency of digital microphone systems -- namely that they rely on near-optimal conditions, and that error correction (in order to account for interference) can result in

[63] *See, e.g.,* Comments of WISPA at 17-20 and Comments of The Boeing Company, Docket No. 12-268 (Jan. 25, 2013) at 4 ("Boeing Comments") (recommending reduction of the distance separation criterion).
[64] Comments of Shure at 25.
65 Comments of White Space Alliance, Docket No. 12-268 (Jan.25, 2013) at 33.

losses to efficiency gains.[66] Further, Shure and Sennheiser claim that wireless microphones, owing to their unique and stringent quality of service demands[67], need "clean, interference-free spectrum"[68], and that there is no substitute for UHF spectrum as found in the reserve channels.[69]

While there is no argument that many wireless microphone services have high quality of service demands, this only justifies better coordination as offered by a database reservation system. Registering via a database is by far the best way to ensure access to "clean" spectrum. This protects operators from both TVBDs, and, most importantly, other wireless microphones competing for the same channels. It further allows for much more efficient use of available spectrum, where operators can register only as much as they need, rather than occupy an entire 6 MHz channel for only a few microphones.

C. Part 74 Eligibility Should be Broadened for Professional Operators in Major Venues Only If Unlicensed Microphones Operate Under Part 15 as TVBDs

Several comments by wireless microphone interests proposed expanding Part 74 eligibility to include a wide range of events, performances and other uses unrelated to broadcasting and video production. PISC strongly opposes any expansion of Part 74 eligibility to the extent that it would allow any increase in the number of microphone users with the ability to block access to the very limited number of TV white space channels available for unlicensed use. As we argue in the two sections above, although there are potentially non-TVWS channels on which wireless microphones can operate without displacing unlicensed access (which is scarce in major urban markets in particular), under the current rules Part 74 licensees have priority to

66 Comments of National Association of Broadcasters at 11.

67 Comments of Shure Inc. at 9.

68 Comments of Shure Inc. at 16.

69 According Sennheiser, wireless microphone signals must be able to pass through sets and performers' bodies, using small, inconspicuous antennas -- Comments of Sennheiser at 9.

reserve white space channels before using other vacant channels, to block a full 6 MHz channel even if they are actually using just 200 kHz, and to spread themselves out across the available unlicensed channels, potentially leaving none available for broadband, M2M and a myriad of other unlicensed uses by the rest of the population. Moreover, the potential categories of socially beneficial microphone users are endless – and it would be difficult to extend eligibility in a principled and clear manner that benefits some of the millions of microphone users while excluding others.

As a result, PISC believes the Commission should not even incrementally broaden eligibility for Part 74 licensing unless at least three conditions hold: (1) that the eligibility is limited to the sort of professional operation of multiple-microphone systems at major venues that was anticipated in the white space rules (with respect to the qualification for *unlicensed* microphone reservations on white space channels that would otherwise be available for TVBDs); (2) that TV co-channels must be fully utilized before any reservation can be made for access to the two "reserve" channels (which would be open for dual use when and where microphones do not make a reservation); and (3) that any reservation on a white space channel authorized for use by unlicensed TVBDs (including the two current reserve channels) must be requested and assigned by a certified TV Bands Database administrator for only the amount of spectrum actually needed (e.g., 200 kHz subchannels) and in a manner that minimizes the number of unlicensed channels occupied in a local market.[70]

Shure proposes that the Commission broaden the Part 74 eligibility rules incrementally to include "professional use of wireless microphones."[71] Shure suggests that the Commission could define a "professional" microphone operator similarly to the definition of "professional installer"

[70] *See* Comments of PISC at 41-42.
[71] Comments of Shure at 21.

in the White Space rules, as "an entity consisting of an individual or team of individuals with experience in installing radio communications equipment and that provides service on a fee basis – such an individual or team can generally be expected to be capable of ascertaining the geographic coordinates of a site and entering them into the device for communication to a database."[72] Subject to the three conditions stated just above – which would provide Part 74 licensees with sufficient spectrum capacity and protection while preserving as much white space as possible for unlicensed TVBDs and services – if the Commission does consider expanding Part 74 eligibility, an incremental expansion based on both the "professional" nature of the microphone operation and the size of the venue would strike a better balance than proposals to broaden eligibility to open-ended categories of users based on the nature of the institution using the microphone.

For example, the NAB proposes an expansion of Part 74 eligibility "subject to restricting *unlicensed* wireless microphone operations in the television band."[73] However, the NAB proposes four additional functional categories of users ("theaters, live music producers, government bodies, and houses of worship")[74] that potentially number in the hundreds of thousands and which defy any principled means of distinguishing among them on a cost-benefit basis. The NAB asserts that "their venues are typically located away from residential areas" and "generally have access to professional technicians . . . familiar with Part 74's frequency coordination requirements, mitigating the risk of interference."[75] To the contrary, while this rationale might have some relevance to Shure's more incremental suggestion of "professional" microphone operators in major venues, this would certainly not be the case for 99 percent of

[72] Comments of Shure at 21, citing *White Spaces Second Order* at ¶ 150.
[73] Comments of NAB at i.
[74] *Id.* at 4.
[75] Comments of NAB at 4.

"houses of worship" (which are most typically scattered throughout residential neighborhoods and, in fact, can include private residences under the First Amendment), or "theaters" (which include, for starters, virtually every K-12 elementary and high school in the country), or "live music producers" (which would potentially include every karaoke bar or any other place where music is played using a microphone). Even electronic news gathering, although somewhat more definable, has other spectrum available outside the TV bands above 600 MHz and thus there is no need to cripple the nascent market for unlicensed use of TV white spaces by giving microphone operators the authority and incentive to occupy all of a very limited number of channels available for unlicensed use.

III. CHANNEL 37 SHOULD BE OPENED FOR UNLICENSED USE SUBJECT TO MINIMAL PROTECTION ZONES FOR INCUMBENT LICENSEES ENFORCED BY THE TV BANDS GEOLOCATION DATABASE

Most comments addressing the issue support the Commission's proposal to allow unlicensed use of Channel 37 subject to exclusion from protection zones, enforced by the TV Bands Databases, where radioastronomy ("RAS") and wireless medical telemetry systems ("WMTS") can continue to operate free from interference. Since both WMTS and RAS operations are fixed and static, there is no reason why protection zones enforced on an automated basis through a geolocation database system certified by the Commission would not be able to safeguard incumbents so that the remaining 95 percent or more of the band's capacity, which is currently unused, can be used on a largely contiguous basis nationwide.

In addition to PISC,[76] a diverse number of parties supported unlicensed use of Channel 37 on a non-interfering basis. WISPA states that "there is no public policy reason to impose a

[76] *See* Comments of PISC at 27-32.

nationwide restriction on six megahertz of spectrum when incumbents are using that spectrum only in a limited number of clearly defined areas."[77] Spectrum Bridge, one of the two certified TV bands database administrators, agreed that "[t]he existing TV White Space database can handle the management of these facilities."[78] Boeing stated its belief that "well-considered protection areas" would protect WMTS from interference.[79] Neul Limited, a U.K.-based company developing innovative machine-to-machine technology that operates on TV white space channels, agreed that unlicensed access to Channel 37 spectrum "would be of enormous value to white space users."[80]

Contrary to this strong support for the Commission's proposal to promote more efficient band sharing are the comments of the WMTS industry, notably the WMTS Coalition and GE Healthcare, both of which advocate to maintain the status quo. GE Healthcare argues that unlicensed use should not be permitted because "large exclusion distances would be necessary to prevent the fundamental emissions of unlicensed devices in Channel 37 from causing harmful interference to WMTS operations."[81] The WMTS Coalition opposes unlicensed devices in the band unless the Commission can provide "absolute assurance" that (1) "the protection zones chosen would be more than large enough"; (2) the "mitigation techniques required in unlicensed devices . . . are sufficiently mature to be proven 100% reliable"; and (3) a process for frequency coordination to enforce the protection zones "has been proven to work with a high degree of accuracy."[82]

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[77] Comments of WISPA at 15. *Accord*, Comments of the White Space Alliance at 27-28.
[78] Comments of Spectrum Bridge, Inc., Docket No. 12-268 (Jan. 23, 2013) ("Spectrum Bridge Comments") at 9.
[79] Boeing Comments at 3.
[80] Comments of Neul Limited, Docket No. 12-268 (Jan. 25, 2013) ("Neul Comments") at 2-3.
[81] Comments of GE Healthcare, Docket No. 12-268 (Jan. 25, 2013) ("GE Healthcare Comments") at 32.
[82] Initial Comments of The WMTS Coalition, Docket No. 12-268 (Jan. 25, 2013) at 21 ("Comments of WMTS Coalition").

PISC believes that before this proceeding is completed, the TV Bands Database system will be proven to be reliable enough to establish and enforce protection zones around fixed site incumbents with the "high degree of accuracy" demanded by the WMTS Coalition. In fact, the WMTS industry appears to be demanding precisely what the Commission designed and certified the TV Bands Database administrators to do. PISC, WISPA and other commenters proposed that WMTS devices can and should be registered in the TV Bands Database, which can quite easily calculate a protection contour for each site just as the TVDBs do for similarly fixed-site TV transmitters and Part 74 wireless microphone reservations. The Commission will need to determine a reasonable protection radius based on objective propagation data, and the fact that the devices are licensed for indoor use, but this should be fairly straightforward. The WMTS Coalition notes that there are more than 2,200 hospitals with registered WMTS systems operating on Channel 37. This is a considerably smaller number of locations than the number of TV broadcast licensees. Moreover the fact that hospital use is indoors and frequently located on a campus separated from nearby residential neighborhoods also promises to give an extra margin of safety concerning interference protection.

The one legitimate concern raised by the industry is whether personal/portable TVBDs will refresh their channel permission frequently enough to avoid being carried into a hospital – and close to a WMTS system – while transmitting on Channel 37. Although there is a cost-benefit trade-off associated with more frequent connections and queries to a TV Bands Database, Spectrum Bridge and other TVDB administrators have indicated that more checking is technically feasible and should not increase costs more than marginally. It may also be possible for devices to be denied access to Channel 37 unless they have the ability to refresh at required frequency intervals or, alternatively, when the device moves more than a certain distance. If

much more frequent queries are needed for Channel 37, and that has a significant cost, it may be possible that this is an optional feature that manufacturers could decide to build into certain devices but not into others. In any event, there seems to be no reason why the Commission cannot customize and calibrate appropriate "rules of the road" to enforce necessary protection zones on an automated basis through the geolocation database.

The WMTS Coalition raises two other concerns that need not be a reason to maintain the status quo of a (mostly) fallow Channel 37. First, the WMTS Coalition asserts that "unlicensed devices may be authorized to transmit at higher power levels than the very low-power WMTS devices that are currently installed."[83] It is certainly true that fixed TVBDs are authorized to transmit at power levels up to 4 watts EIRP, which is a much higher level than the extremely low-power 40 milliwatt limit that applies to personal/portable TVBDs operating on a channel immediately adjacent to a TV station. However, that variation among TVBDs depending on frequency, location and proximity to a licensed incumbent is one of the great advantages of the geolocation database as an interference protection system.

In the case of WMTS licensees, the Commission is able to write the rules to generate a larger protection zone to separate fixed TVBDs and a smaller protection zone for low-power mobile TVBDs. Any variation – including potentially even the building materials that attenuate the signals from outside the hospital – could be included in the algorithms that determine what protection zones and "rules of the road" are adequate to protect the licensed use.

Second, the WMTS Coalition expresses concern that "[o]n a large hospital campus . . . the actual location of any given WMTS receiver could be a quarter-mile or more away from the 'protection location' identified in the WMTS registration."[84] This seems fairly easy to remedy.

[83] Comments of WMTS Coalition at 22.
[84] Comments of WMTS Coalition at 22.

During the inevitable transition period to incorporation in the TV Bands Databases, the Commission can give WMTS registrants an opportunity to update and correct the database with respect to the actual geospatial location of their eligible equipment. A large hospital campus might end up registering two or more different locations. All this seems more feasible in part because of the existing WMTS database, which can be updated and then synched with one or more of the certified TV Bands Databases. This will facilitate protection zones for any newly-licensed equipment, or when a licensee moves equipment between locations. In any event, since the TV Bands Database is designed and certified as an automated enforcement tool that does precisely what the WMTS industry claims it needs, there is no reason to leave 6 MHz of prime spectrum mostly unused in most parts of the country going forward.

IV. MAINTAINING THE STATUS QUO THAT PERMITS UNLICENSED USE OF 600 MHZ SPECTRUM WHERE LICENSEES ARE NOT OPERATING PROMOTES EFFICIENT USE OF THE BAND AND HAS NO NEGATIVE IMPACT ON LICENSED OPERATION

In its initial comments, PISC proposed that all new 600 MHz licenses should include a condition that permits unlicensed white space devices (TVBDs) to continue to operate on a localized basis until such time as the licensee notifies the Commission and/or a TV Bands Database administrator that the licensee intends to commence service. Although in the past auction delays and 10-year buildout requirements, however meritorious or unavoidable, have proven to be a recipe for leaving spectrum capacity fallow for extended periods. In this proceeding, however, the Commission has a governance mechanism in place to ensure that unused spectrum "white space" in the 600 MHz band is made available for use – or withdrawn from use – depending on the operations of a primary licensee. The TV Bands Databases certified by the Commission are designed precisely to govern opportunistic access by unlicensed devices

that must seek permission each 24-hour period to continue using a particular channel – a permission that the TV Bands Database can withhold when a primary licensee is ready to commence service.

It is important to recognize that this proposal simply maintains the status quo. In effect, the Commission does not need to change its rules, but merely sustain the existing treatment of licensees in the 600 MHz band. Currently, opportunistic access to fallow 600 MHz spectrum is the default: When a broadcast licensee vacates a channel, in that local geographic area the spectrum becomes available via the TV Bands Database for unlicensed use to the extent TVBDs will not interfere with another licensee. And if a new broadcaster is assigned a channel, or an existing licensee is relocated to a new channel, the TV Bands Database withholds permission for unlicensed use of that 6 MHz block within the broadcaster's service area (plus a buffer). All this is automated; consumers will typically not even be aware that frequency blocks are added to or subtracted from the list of available channels, depending on the status of the primary licensee, any more than they would be aware of the automated updating of available channels if their device moves from one media market to another.

A. The TV Bands Database Can Ensure that Temporary Use of Fallow Frequency Blocks are Cleared Immediately As Needed by Licensees

A number of commenters expressed strong support for this concept, with all parties emphasizing that it greatly increases the efficient use of spectrum without diminishing in any respect the license rights or flexibility of auction winners. Google and Microsoft assert that "the Commission can ensure the public benefits from access to extraordinarily valuable spectrum in the 600 MHz band from the outset ***with no burden on licensees***."[85] The companies observe that this policy may be especially critical in areas more likely to be underserved – since they are

[85] Comments of Google and Microsoft at 45 (emphasis added).

typically the last to be built out – and that there is no reason to wait many years and even possibly until after a drawn-out Part 27 re-licensing process to permit non-interfering use of fallow spectrum.[86]

Spectrum Bridge states that its experience as a spectrum broker and as the first fully authorized TV Bands Database administrator suggests that "a significant amount of spectrum is licensed but not being used," including "a number of un-built rural cellular licenses."[87] It notes that secondary markets for spectrum are not working well to make much of this fallow spectrum available. Spectrum Bridge states:

> The spectrum should only be removed once it has been demonstrated that it is actively being used for the intended purpose (Use it or Share it). It could take years for rural build out of auctioned spectrum to occur and it does not have to remain fallow during that period if white space rules are applied and managed by a [geolocation] database.[88]

The White Space Database Administrators likewise stated that while temporary or contingent use of fallow spectrum may not have been practical in the past, "the Commission's ongoing certification of databases to govern opportunistic and conditional access by frequency-hopping radios makes this approach entirely feasible and relatively inexpensive."[89]

WISPA similarly urges the Commission to "allow unlicensed use to continue in areas where 600 MHz spectrum has been auctioned but where mobile wireless services have not yet been deployed."[90] WISPA, like PISC, proposes a 30-day notification period during which a licensee can check and verify that the TV Bands Database has removed permission to use the

[86] *Id.*
[87] Comments of Spectrum Bridge at 5.
[88] *Id.*
[89] Comments of the White Space Database Administrators, Docket No. 12-268 (Jan. 25, 32013) at 3 (footnote omitted).
[90] Comments of WISPA at 27-28.

licensee's frequency block within the protected contour of any service area.[91] This should include the ability of licensees to notify the TVDB about periods during which it is testing even prior to commencing service.[92]

B. The Commission Should Fashion Build-Out Requirements so that Spectrum in Areas Not Built Out is Available for Opportunistic, Unlicensed Use

The supporting comments from WISPs, consumer advocates, mobile handset makers and Internet companies noted above should not be surprising because at least in the case of the 600 MHz band, a "use it or share it" policy is the closest thing to a spectrum efficiency "free lunch." Thanks to the automated enforcement mechanism of the TV Bands Database, there is absolutely no downside or risk for licensees, who would maintain all of their rights to *use* the public resource – they would only lose the ability to warehouse it. And yet, again not surprisingly, CTIA, the wireless industry association, struggled to find a reason to oppose it. CTIA argues that any "use it or share it" requirement "would interfere with a licensee's ability to test and build out its network" and "undermine or delay the provision of service in these areas," thereby "creating substantial uncertainty . . . as to whether it would be able to clear the band when needed."[93]

CTIA would have a valid point if the TV Bands Database was not capable of enforcing permissions to transmit based on a geographic exclusion zone, or if the TV Bands Database was not already set up to accept and enforce reservations for exclusive use of a frequency block by licensees (currently Part 74 wireless microphone operators) in a particular geographic area for a particular period of time. As PISC proposed in its initial comments, if a licensee needs the band clear for testing or any other legitimate purpose, the Commission should permit the licensee to make a reservation in the TV Bands Database, just as licensed wireless microphone operators

[91] Comments of WISPA at 27-28.
[92] *See* Comments of PISC at 59-60.
[93] Comments of CTIA at 40.

can do today, and immediately exclude opportunistic use at the places and times needed.[94] CTIA does not even mention the TV Bands Database, or explain why it could not enforce exclusion zones – whether during a testing period, or permanently upon commencement of service. CTIA does not explain why there would be any "substantial uncertainty" about clearing the frequency block whenever the licensee notifies a TVDB administrator (and/or the Commission), since the core purpose of the TV Bands Database is to record and enforce exclusion zones to protect the rights of licensees.

In sum, with clear ground rules and the TV Bands Database as an automatic enforcement mechanism, there is no basis for any objection by future 600 MHz licensees. Their spectrum rights would not be diminished in the slightest and their "burden" (to notify a TVDB administrator) would be *de minimus* and not involve collecting any data they did not already have readily at hand for their own purposes (since certainly the carriers know their own buildout and customer service rollout some period in advance).

V. THE COMMISSION SHOULD PROMOTE MOBILE BROADBAND COMPETITION BY ADOPTING A GENERAL LICENSING CONDITION THAT LIMITS TOTAL SPECTRUM HOLDINGS BELOW 1 GHZ

In order to ensure that competitive harms in the wireless market are not exacerbated by spectrum allocations in this proceeding, the Commission should adopt a general licensing condition that limits total spectrum holdings below 1 GHz. The implementation of this condition would comply with both the language and intent of the Spectrum Act, as any acquisition of spectrum that exceeds the limit could be mitigated by a subsequent divestiture of spectrum once the auction is complete. PISC believes that a general condition limiting overall holdings below 1 GHz is most appropriate in this proceeding, rather than a limit focused only on the share of 600

[94] *See* Comments of PISC at 60.

MHz spectrum acquired in the forward auction. This cap should apply in particular to *paired* spectrum holdings below 1 GHz. In addition, we believe this limit would be particularly necessary in the absence of the broader spectrum screen under consideration in the Commission's ongoing spectrum screen proceeding.

A. The Commission has the Authority to Implement an Overall Cap or Aggregation Limit on Spectrum Holdings Below 1 GHz

As PISC and others noted in initial comments, a spectrum cap or aggregation limit in this proceeding on spectrum holdings below 1 GHz complies with both the language and the intent of the Spectrum Act. The Spectrum Act confirms that nothing in Section 6404 "affects any authority the Commission has to adopt and enforce rules of general applicability, including rules concerning spectrum aggregation that promotes competition."[95] Nothing in the Spectrum Act nullifies other longstanding policy directives in Title III of the Communications Act. And, as the Competitive Carriers Association notes, Section 309(j)(3)(B) of the Communications Act specifically directs the Commission to design and implement spectrum auctions in a manner that will "promote economic opportunity and competition …."[96]

The Congressional Record reflects additional support for the idea that the Commission's authority is preserved in the protection or furtherance of competition in the mobile service network. As Representative Waxman notes, "Congress intends for the FCC to continue to promote competition through its spectrum policies. The FCC can adopt and enforce, for example, a spectrum cap through a rule that applies either to all licenses, or to spectrum offered in a particular auction, as long as such rules are not party-specific."[97] He further explains that the Act additionally "preserves the FCC's ability to require, among other things, the divestiture of

[95] The Spectrum Act at § 6404.
[96] Comments of the Competitive Carriers Association, Docket No. 12-268 (Jan. 25, 2013) at 4 ("CCA Comments").
[97] 158 CONG. REC. E265, E266 (daily ed. Feb. 28, 2012) (speech of Hon. Henry A. Waxman).

specific spectrum, such as spectrum below 1 GHz, in order to promote competition."[98] In the event that an entity would hold more than a certain capped level of spectrum below 1 GHz at the conclusion of the auction, that entity would not be ineligible to participate in the auction, but rather it may simply need to divest a portion of its sub-1 GHz holdings at the conclusion of the auction.

As PISC explains more fully below, without a mechanism in this proceeding to limit spectrum holdings below 1 GHz, the already-concentrated holdings of that beachfront spectrum would increase, and competition would be further hindered.

B. Evidence in This Record and Elsewhere Supports the Assertion that Spectrum Holdings Below 1 GHz are Highly Concentrated

As many, including the Commission, have noted in this proceeding and in others,[99] spectrum below 1 GHz is uniquely valuable because of a variety of factors, including its propagation characteristics.[100] In addition, entities that wish to compete on a national level with the two largest carriers will be foreclosed from doing so without access to at least a portion of this spectrum.[101] As the Commission itself has noted, "[t]he more favorable propagation characteristics of lower frequency spectrum (*i.e.*, spectrum below 1 GHz) allow for better coverage across larger geographic areas and inside buildings," and that access to such spectrum is "important for other competitors to meaningfully expand their provision of mobile broadband

[98] *Id.*
[99] *See, e.g.*, CCA Comments at 2: "The spectrum consolidation by the two largest incumbents is most notable in the low-frequency band "beachfront" spectrum below 1 GHz. The superior propagation characteristics of spectrum below 1 GHz provide the network economics essential to building coverage in light suburban and rural markets."
[100] CCA Comments at 7: "…this spectrum is ideal for wide area coverage and has strong propagation characteristics."
[101] Comments of T-Mobile USA, Inc., Docket No. 12-268 (Jan 25, 2013) at 25 ("T-Mobile Comments"): "Despite the Commission's efforts to implement policies and safeguards to promote widespread access to spectrum resources, spectrum best suited for advanced mobile broadband applications – particular below 1 GHz, which is ideal for nationwide, wide-area regional and rural coverage with superior propagation characteristics – has become increasingly concentrated in the hands of the largest U.S. wireless carriers.

services or for new entrants to have a potentially significant impact on competition."[102] The record in this proceeding contains both independent support and support to outside documents that highlights the concentration of spectrum holdings below 1 GHz.

For example, Sprint notes that AT&T and Verizon hold 75% of sub-1GHz spectrum, "including 86% of it in the top 10 U.S. markets and over 80% in the top 50 markets."[103] In addition, CCA points to the Mobile Spectrum Holdings NPRM, which "recognizes the decline in the number of nationwide wireless carriers from six to four since 2003, and that several "regional and rural facilities-based providers have exited the marketplace through mergers and acquisitions."[104] Moreover, the Herfindahl-Hirschman Index ("HHI"), measuring consolidation in the wireless industry, "increased from 2,151 in 2003 to an alarming 2,848 in 2010 (where an HHI of greater than 2,500 indicates a 'highly concentrated' market)."[105] Comparing these data points demonstrates that spectrum holdings below 1 GHz are even more concentrated than the standard measure of market share, which suggests even less "effective competition" in a future marketplace dominated by revenue from LTE and other data services.

C. For the Purpose of Allocating Spectrum in this Auction, the Commission Should Impose a Cap on Total Holdings Below 1 GHz

Competitive carriers, their industry association and consumer advocacy groups are in agreement that spectrum holdings below 1 GHz require particular attention in determining precisely how much spectrum could be acquired in this auction. Several commenters, including T-Mobile, note the necessity for a cap on total holdings below 1 GHz in the particular context of

[102] Application of AT&T Inc. and Qualcomm Incorporated For Consent to Assign Licenses and Authorizations, Order, 26 FCC Rcd 17589 ¶¶ 49-51 (2011).
[103] Comments of Sprint Nextel Corporation, Docket No. 12-268 (Jan. 25, 2013) at 2 ("Sprint Comments"); *see also* T-Mobile Comments at 25.
[104] CCA Comments at 6, citing Mobile Spectrum Holdings NPRM ¶ 14.
[105] CCA Comments at 6. CCA also notes that "in recent years, the 850 MHz cellular band has seen significant consolidation to Verizon Wireless through the Alltel transaction and AT&T through a variety of small transactions."

this proceeding.[106] Others, in the context of a broader spectrum screen (or screens), note the particular importance of this spectrum and call for a limit on sub-1 GHz holdings as a component of the broader screen or an assessment of 1 GHz holdings as a mechanism for determining how much and which spectrum could be acquired in this proceeding.[107]

While members of the Public Interest Spectrum Coalition also support the adoption of a more general-purpose screen or rule in the Commission's separate proceeding on spectrum aggregation limits, it is critical that, for this auction of uniquely valuable spectrum below 1 GHz, that there is some mechanism in place to prevent the competitive harms outlined in the previous section. Thus, PISC recommends that, for this auction, the Commission impose a cap on total spectrum holdings below 1 GHz as a general condition on licenses in this auction. This cap should apply in particular to *paired* spectrum holdings below 1 GHz, inasmuch as *unpaired* supplemental downlink spectrum is not particularly valuable to competitive carriers or to new entrants that lack uplink spectrum in the 700 MHz band.

PISC does not have a recommendation for a specific percentage cap, although we believe the Commission should refer to the comments of Free Press for an example of what could be the upper limit (40 percent),[108] while also pointing out that the limit recommended in that proceeding is made in the context of a broader screen that takes market share and other measures of market power and consolidation into account.[109]

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[106] T-Mobile Comments at 23; *See also* Comments of Public Interest Spectrum Coalition, Docket No. 12-268 (Jan. 25, 2013) at 66 ("PISC Comments") (calling for an auction-specific aggregation limit) and CCA Comments at 8 (asking the Commission to "adjust its approach to evaluating spectrum aggregation in today's wireless industry by applying three independent thresholds to spectrum aggregation," including "one targeted specifically at local spectrum holdings below 1 GHz…").
[107] Sprint Comments at 9.
[108] Comments of Free Press, WT Docket 12-269 (Nov. 28, 2012) at 11.
[109] *Id.*

CONCLUSION

The undersigned members of the Public Interest Spectrum Coalition (PISC) support the Commission's efforts to reallocate fallow TV band spectrum for flexible use on a licensed and unlicensed basis. PISC also believes the Commission can best optimize TV band spectrum for broadband deployment, job creation, consumer welfare and economic growth more broadly only by ensuring that *unlicensed* access to substantial amounts of TV White Space spectrum will continue to be available in every local market and nationwide, with a portion of that spectrum being contiguous nationwide. We therefore appreciate this opportunity to share our views once again on a number of the important issues raised by this proposed rulemaking.

Respectfully Submitted,

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