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

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules	)	ET Docket No. 14-165
For Unlicensed Operations in the Television Bands,	)	
Repurposed 600 MHz Band, 600 MHz Guard	)	
Bands and Duplex Gaps, 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	)	
	)	
Promoting Spectrum Access for Wireless	)	GN Docket No. 14-166
Microphone Operations	)	
	)	
Expanding the Economic and Innovation	)	GN Docket No. 12-268
Opportunities of Spectrum Through Incentive	)	
Auctions	)	

To: The Commission

REPLY COMMENTS OF
OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA
AND PUBLIC KNOWLEDGE

February 25, 2015

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I. INTRODUCTION AND SUMMARY

The Open Technology Institute at New America ("OTI") and Public Knowledge ("PK") hereby reply to certain of the Comments regarding proposed changes to certain of the Commission's Part 15 rules.[1] OTI and PK commend the Commission for opening this proceeding as a means of implementing the agency's decision in last May's *Incentive Auction Report & Order* to allow unlicensed operations in the 600 MHz duplex gap and other guard bands, Channel 37, a set-aside channel for sharing with microphones in every market, as well as the opportunity to update the current white space rules to reflect new realities and the proven effectiveness of the TV Bands Database system.[2] As our groups and others have explained in previous filings, the emergence of a mass market for unlicensed chips, devices and services in this unique low-band spectrum – including the integration of the 802.11af standard into Wi-Fi chipsets – is wholly dependent on access to three or more 40 mW, 6 MHz channels in *every* market nationwide. OTI and PK applaud the Commission for its thoughtful proposals which, taken together and with some minor improvements, can fulfill that promise.

OTI and PK strongly support the Commission's efforts to ensure that at least three to four 6 MHz channels will be available for unlicensed WSDs in every market. The record clearly supports the Commission's tentative conclusion that the duplex gap, as well as a lower guard band of 9 or 11 MHz, can provide a contiguous 6 MHz channel for unlicensed WSDs at a power level of 40 mW or more without undue risk of harmful interference to Part 27 services. Technical studies using real-world assumptions about filtering and propagation loss, such as

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[1] *Amendment of Part 15 of the Commission's Rules For Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gaps, and Channel 37*, Notice of Proposed Rulemaking, 29 FCC Rcd 12248 (2014) ("*NPRM*"). The Office of Engineering and Technology extended the deadlines for filing Comments and Reply Comments to February 4, 2015 and February 25, 2015, respectively.

[2] *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, FCC 14-50, 29 FCC Rcd. 6567 (2014) ("*Incentive Auction R&O*").

Broadcom has filed and reprised in its comments, suggest that the power limits for unlicensed WSDs in the duplex gap could be at least 100 mW with a 4 MHz separation form LTE downlink. We are heartened the Commission appears to have learned from its first effort to placate the hyper-inflated interference concerns of broadcast industry licensees concerning WSDs that *overly restrictive* rules can deter and suffocate the tremendous potential of low-band unlicensed technologies.

OTI and PK strongly support the 4-6-1 duplex gap band plan proposed in comments filed by other leading parties in the unlicensed community. Broadcom's analysis and the Commission's own proposal to permit a 6 MHz unlicensed channel at 40 mW in the 9 MHz guard bands indicates a recognition that 3 MHz of separation is sufficient to protect LTE downlink operations from harmful interference.

OTI and PK question whether licensed microphones should operate in the duplex gap at all. If there is a single point of agreement among all major parties in this proceeding, it is that Part 74 microphone operations and unlicensed WSDs cannot productively cohabit the duplex gap *and* sufficiently protect licensed Part 27 operations. While public interest groups and other unlicensed advocates support a compromise around a 4-6-1 plan as the best balance between the needs of the various stakeholders, the microphone and wireless industries are divided on this question in a way that strongly suggests the Commission should move Part 74 microphones out of the duplex gap entirely.

On the issue of unlicensed microphone operations in the duplex gap, OTI and PK agree with Microsoft that the Commission's proposal to "require" wireless microphone users to check a database manually to obtain a list of available frequencies is *not* "[u]nlicensed use . . . rely[ing] on a database" in the sense that Congress intended. OTI and PK also oppose any increase in the

Commission's proposed 20 mW power limit for wireless microphones operating in the duplex gap or other guard bands.

Channel 37 represents one of the three or four channels that will make or break the emergence of robust national markets for unlicensed WSDs. OTI and PK therefore strongly support the consensus among commenters that the Commission should permit all three types of WSDs (fixed, Mode I and Mode II) to operate subject to protection zones that are based on *real world* assumptions about propagation and interference risk. By neglecting to factor in real world assumptions about terrain concerning RAS and the fact that WMTS operates indoors, the Commission risks a reversion to the same over-protective, one-size-fits-all problem that plagued the original set of white space rules in 2008 and which the Commission is, ironically, proposing to remedy in other portions of this same *NPRM*.

OTI and PK concur with the overwhelmingly support among commenters for the Commission's proposal to relax the stringent out-of-band emission limits that inhibit the use of Channels 35-39. These restrictions are unnecessary since under the Commission's proposal to open Channel 37 for shared use, any necessary separation can be more effectively enforced by the TV Bands Database.

OTI and PK strongly support and Commission's proposal to help offset the incentive auction's huge reduction in the number of channels available for unlicensed WSDs by removing the prohibition on personal/portable device operation on channels 7 to 20. Similarly, our groups agree with the clear consensus among commenters that the Commission should adopt its proposal to allow fixed WSDs to use Channels 3 and 4. OTI and PK see little if any justification to delay making these channels available.

Finally, OTI and PK strongly support the Commission's proposal to permit WSDs to continue operating in the 600 MHz band post-auction until the licensee gives notice that it will "commence operations" in a local area. The Commission's proposal simply maintains the status quo since today the majority of 600 MHz spectrum is available for opportunistic unlicensed use, subject to permission enforced by the TV Bands Database. Contrary to CTIA's efforts to maintain its members' ability to warehouse vacant spectrum, PEAs should not be used as the geographic foundation for excluding WSDs from access to underutilized spectrum. PEAs can be larger than states and even Cellular Market Areas can extend hundreds of miles beyond a single urban area where a carrier may initially provide service. No standardized licensing area comes close to replicating what the TV Bands Database can do given very straightforward data points that are readily available to licensed carriers that, before they deploy, carefully planned out the coverage areas and link budgets for each and every base station and cell site. In reality, the reporting "burden" on licensees (to notify a TV Bands Database administrator) would be *de minimus* and not involve collecting any data the operator does not already have readily at hand for their own purposes.

II. THE RECORD SUPPORTS COMMISSION PROPOSALS TO MAKE ADDITIONAL 6 MHZ CHANNELS AVAILABLE FOR UNLICENSED USE

OTI and PK once again commend the Commission for its decision last May to allow unlicensed operations in the 600 MHz duplex gap and other guard bands, Channel 37, a set-aside channel for sharing with microphones in every market, as well as the initiation of this proceeding to update the current white space rules to reflect new realities and the proven effectiveness of the TV Bands Database system. Our groups and others have explained in previous filings that the emergence of a mass market for unlicensed chips, devices and services– including the integration of the 802.11af standard into Wi-Fi chipsets – is wholly dependent on access to three or more 40

mW, 6 MHz channels in *every* market nationwide. The promise of the *Incentive Auction R&O* is that the duplex gap and Channel 37 will provide at least two of those channels in nearly every market, while an updating of the current white space rules can also open new channels for both fixed and personal/portable use in most markets as well.

A. Duplex Gap, Guard Bands and Wireless Microphones

Whether the balanced outcome the Commission adopted in the *Incentive Auction R&O* actually comes to pass will depend on whether the technical rules adopted in this proceeding enable widespread and flexible operations that also protect incumbent licensees from harmful interference. Nowhere is this more important than in the duplex gap and lower guard bands, where competing interests (licensed microphones, mobile industry interests) are waging a full-court press to deny unlicensed users the access they need. OTI and PK believe the record clearly supports a conclusion that the Commission can ensure that the duplex gap, as well as a guard band of 9 or 11 MHz, provides a dedicated, contiguous 6 MHz channel at a power level of 40 milliwatts or more without undue risk of interference to new Part 27 services as they deploy post-auction.

1. Duplex Gap Interference and Separation from LTE Downlink

OTI and PK strongly support the Commission's proposal to adopt rules that allow fixed and portable WSDs to operate in a 6 MHz channel at 40 milliwatts, in both the duplex gap and any guard bands that are at least 9 MHz wide, while protecting LTE downlink by requiring at least a 3 MHz buffer.[3] As several leading commenters have observed, the technical studies submitted in this proceeding both support the Commission's proposal and suggest that the Commission is being overly conservative, particularly with respect to the power levels and

[3] *NPRM* ¶¶ 86-88, 93.

separation distance for unlicensed operations in the duplex gap.[4] Technical studies using real-world assumptions about filtering and propagation loss, such as Broadcom has filed and reprised in its comments,[5] suggest that the power limits for unlicensed WSDs in the duplex gap could be at least 100 mW with a 4 MHz separation form LTE downlink. Broadcom's findings further suggest that particularly at a lower power level (40 or 50 mW), the 1 MHz buffer proposed for the bottom of the duplex gap (creating a total 5 MHz of separation) is not needed and could be moved to separate unlicensed from LTE uplink.

Admittedly, OTI and PK are not currently in a position to independently confirm either the Commission's tentative technical conclusions in the *NPRM* or the competing assumptions relied on in the conflicting studies filed by Broadcom, Qualcomm and, most recently, CTIA.[6] Nonetheless, we are heartened that the Commission appears to have learned from its first effort to placate the hyper-inflated interference concerns of broadcast industry licensees concerning unlicensed and spectrum sharing that *overly restrictive* rules can deter and suffocate the tremendous potential of low-band unlicensed technologies. What former Chairman Julius Genachowski dubbed "Super Wi-Fi" – and especially the addition of IEEE 802.11af to the Wi-Fi family – hangs in the balance. Once again, a critical mass of investment and the scale needed

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[4] *See, e.g.*, Comments of Broadcom Corporation, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of Broadcom") at 2, 7-19; Comments of Google Inc, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of Google") at 4-16; Comments of Microsoft Corporation, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of Microsoft") at 5-9 (concluding from testing data that a maximum power limit of 100 mW would still protect LTE downlink in the duplex gap); Comments of Wi-Fi Alliance, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of Wi-Fi Alliance") at 24-27; Comments of WhiteSpace Alliance, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of WSA") at 20-22.

[5] Comments of Broadcom at 18-19. "Unlicensed devices can safely operate at both higher power levels, and at a smaller spectral separation from LTE uplink, than the Commission has proposed. At 4 MHz separation, an unlicensed device can conservatively operate at a power level as high as 112.5 mW before the odds of interference with LTE uplink becomes significant." *Id.*

[6] *NPRM* ¶¶ 83-85; Comments of CTIA-The Wireless Association, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of CTIA") at 7-27.

to further magnify the tremendous economic and social benefits of mass-market Wi-Fi and other unlicensed innovation will fail to materialize if the Commission does not follow through on the promise of the *Incentive Auction R&O* to ensure the minimum of three or four 6 MHz channels for unlicensed WSDs in *every* market nationwide. The duplex gap and guard bands will be essential to fulfill the balanced policy the Commission voted to adopt last May.

Because by law unlicensed WSDs in the repurposed 600 MHz spectrum will be required to constantly recheck and renew permission to transmit in each of these frequencies – possibly as often as every 20 minutes – if years from now it turns out that harmful interference results, it will be easy enough to withdraw a particular channel from use until an appropriate fix is found. In contrast, a repeat of the failings of the 2008 rules, which attempted to placate politically powerful broadcasters with overly-restrictive rules that the Commission is only now beginning to repair in this NPRM, would be far harder to remedy. It would create a massive opportunity loss for spectrum efficiency and for consumer welfare – and yet it would be very difficult to quantify that loss or revisit overly-conservative conclusions about how well different services can coexist in practice.

OTI and PK therefore urge the Commission to err on the side of testing the outer limits of spectrum sharing, efficiency, innovation and the evolution of radio systems to coexist – and not to "split the baby" to placate self-interested lobbies (e.g., Qualcomm, CTIA) that have demonstrated for nearly a decade that they are willing to say or do almost anything to kill or cripple what they perceive as competition from unlicensed services and innovation.

2. Duplex Gap Band Plan and Licensed Microphones

OTI and PK strongly support the 4-6-1 duplex gap band plan proposed in comments filed by other leading parties in the unlicensed community.[7] As noted above, the technical findings that the Commission relies on in the *NPRM* suggest that the additional 1 MHz buffer at the bottom of the proposed 1-4-6 duplex gap plan is not necessary to protect LTE downlink operations from WSDs operating at a maximum power of 40 milliwatts. Broadcom's testing demonstrates that there is no need for 5 MHz of separation between LTE downlink and unlicensed WSDs; and the Commission's own proposal to permit a 6 MHz unlicensed channel at 40 mW in the 9 MHz guard bands indicates recognition that 3 MHz of separation is sufficient to protect LTE downlink operations from harmful interference.[8] Broadcom concluded:

> Importantly, these results also demonstrate that the Commission can ensure sufficient protection for LTE while improving the efficiency of duplex gap operations by adopting a different partitioning scheme for the duplex gap than the one it has proposed. Specifically, by placing the 1 MHz buffer at the top of the duplex gap (between LTE uplink and the unlicensed channel) rather than at the bottom (between LTE downlink and the 4 MHz channel set aside for wireless microphones), the Commission can significantly enhance the value of the unlicensed channel while maintaining extremely robust protective margins for LTE.[9]

Locating the 1 MHz buffer at the top of the duplex gap, thereby providing some separation between unlicensed WSDs and LTE uplink transmissions, "will effectively protect licensees while maximizing the value of the entire duplex gap."[10] OTI and PK agree with Wi-Fi Alliance that "creating a one-megahertz buffer between white space devices and LTE uplink will help to ensure that unlicensed operations can flourish in the duplex gap without suffering excessive interference, while at the same time providing an added layer of protection for LTE

[7] *See, e.g.* Comments of Google at 16-18; Comments of Microsoft at 12-14; Comments of Wi-Fi Alliance at 27-28; Comments of Broadcom at 19.
[8] *NPRM* at ¶ 88. *See also* Comments of Google at 17.
[9] Comments of Broadcom at 19.
[10] Comments of Microsoft at 12.

operations."[11] If the Commission concludes that the 1 MHz buffer is needed to better separate wireless microphones from LTE downlink, then we agree with Wi-Fi Alliance that wireless microphones should be required to locate their 200 kilohertz transmissions in the upper 3 megahertz of their portion of the duplex gap.[12]

Another salient issue for the Commission is whether licensed microphones should operate in the duplex gap at all. If there is a single point of agreement among all major parties in this proceeding, it is that Part 74 microphone operations and unlicensed WSDs cannot both productively cohabit the duplex gap *and* sufficiently protect licensed Part 27 operations. While our groups and other unlicensed advocates support a compromise around a 4-6-1 plan as the best balance between the needs of the various stakeholders, the microphone industry and mobile carriers are divided on this question in a way that strongly suggests the Commission should move Part 74 microphones out of the duplex gap entirely.

For example, microphone manufacturer Sennheiser stated in its pending Petition for Reconsideration of the *Incentive Auction R&O* that the duplex gap and guard bands are inadequate for microphone fidelity. It cites – and attaches to its comments in this proceeding – the results of studies the company conducted in Europe "that demonstrates the detrimental effects on wireless microphone operations by the high noise floor in the duplex gap."[13] Sennheiser's comments in this proceeding reinforce its belief that the proposed 4 MHz share of the duplex gap is unworkable, stating: "[T]he reality is that the limited bandwidth, coupled with

[11] Comments of Wi-Fi Alliance at 26-27.
[12] *Id*. at 27.
[13] Comments of Sennheiser Electronic Corporation, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of at Sennheiser") at 15 n. 39. *See also* Sennheiser Petition at 6.

the likelihood of a high noise floor and out-of-band emissions from adjacent wireless services, will diminish likely use."[14]

Similarly, Shure has opined that the duplex gap "will not provide a suitable spectrum environment for professional wireless microphones that require reliable clean spectrum due to the out-of-band emissions ('OOBE') from the immediately adjacent 600 MHz uplink band."[15] The opinions of the two leading microphone makers strongly suggest that the Commission should not be sacrificing the utility of the one contiguous unlicensed channel to make room for microphone interests who *insist* that the duplex gap is unreliable in relation to the quality of service they need.

At the other extreme, CTIA reports testing results that lead it to the conclusion that wireless microphones in the duplex gap (or in any but perhaps 2 megahertz of an 11 MHz guard band, if there is one) are incompatible with protecting licensed LTE operations. CTIA objects to the *NPRM*'s proposed 1-4-6 duplex gap plan and recommends that the Commission should adopt a 5-6 allocation that limits use of the duplex gap to low-power unlicensed WSDs, separated from LTE downlink by a "true" 5 megahertz guard band.[16] The Consumer Electronics Association (CEA) similarly argues that "the *NPRM* provides no support, evidence, or analysis showing that such operations [licensed microphones in the duplex gap] could operate without causing harmful interference to [licensed] mobile broadband operations."[17]

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[14] Comments of Sennheiser at 9. Sennheiser further asserts that the *NPRM*'s proposed 20 mW power limit "will make wireless microphone operations, which generally operate at 50 mW, unreliable on these frequencies. The guard bands are likely to have high noise floors and out-of-band emissions from adjacent services." *Id.* at 15. However, if the power limit for narrow-band microphones is 50 mW, then because anywhere between 12 and 16 microphones can operate on 6 MHz, the aggregate power output on the 6 MHz duplex gap could be as high as 600 to 800 milliwatts.

[15] Reply Comments of Shure Inc., GN Docket No. 12-268 (filed March 12, 2013) at 9-10.

[16] Comments of CTIA at 16-20.

[17] Comments of Consumer Electronics Association, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) at 6-7.

For its part, the National Association of Broadcasters (NAB) similarly insists that the Commission must make a stark choice: Exclude unlicensed WSDs from the duplex gap so that microphones have both the bandwidth they need and the enormous separation distance from LTE that the wireless industry demands.[18] However, NAB's demand for an all-or-nothing outcome ignores the fact that its proposal asks the Commission to reverse its adherence to Congressional intent, clearly expressed in the Spectrum Act, to allocate the 600 MHz guard bands for unlicensed TV white space (TVWS) operations without causing harmful interference to licensed LTE operations post-auction.[19] As the Commission stated in the *Incentive Auction R&O,* "Section 6407(c) was a compromise intended by the conferees to 'create a nationwide band of spectrum that can be used for innovative unlicensed applications.'"[20] Congress never even considered the possibility that the duplex gap or guard bands would be given over to a *licensed* service, let alone one that has not paid for spectrum and that would leave 99.9 percent of the spectrum capacity unused.

The NAB/Sennheiser/Shure rationale for setting aside the entire duplex gap (11 MHz!) for a smattering of occasional narrow-band microphone users is that Part 74 licensees are somehow losing their two clean, reserved channels above and below Channel 37. However, the implication that Part 74 operations are somehow losing two reserved channels is a canard. The two set-aside TV channels for microphones were always intended primarily for the far more numerous population of *unlicensed* microphone users and venues, since unlike Part 74 licensees, unlicensed microphones are not permitted to reserve locally-vacant TV channels in the TV Bands Database.

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[18] Comments of National Association of Broadcasters, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of NAB") at 14-16.
[19] *See* Spectrum Act, § 6407(c).
[20] *Report & Order* ¶ 271, note 815, citing 158 Cong. Rec. H915 (daily ed. Feb. 17, 2012) (remarks of Rep. Waxman).

Moreover, as OTI and PK have detailed in previous filings in this docket (12-268), whereas a decision not to give unlicensed WSDs use of 6 megahertz in the duplex gap would almost certainly strangle the market for low-band Wi-Fi innovation in its crib, the tiny club of Part 74 wireless microphone operators have far more spectrum relative to their needs than do unlicensed users, particularly in congested markets like New York City. Part 74 microphones have historically operated co-channel to broadcast stations in neighboring media markets that are *not* available for use by unlicensed devices.[21] Part 74 users have and will continue to have access both to vacant channels available for use by WSDs and, *in addition*, access to other vacant channels *not available* to unlicensed devices.[22] Indeed, the *Incentive Auction R&O* greatly expanded the areas where wireless microphones can operate co-channel to TV broadcasters, a change that OTI and PK supported.[23]

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[21] *See, e.g., Ex Parte* Letter from Michael Calabrese, GN Docket 12-268 (filed May 6, 2014), at 3. For example, PISC documented in its initial comments in this proceeding that at the Rockefeller Center in New York City (home to TV production facilities for NBC Universal), the Shure Inc. microphone user look-up database shows that in addition to channels 22 and 42, which are reserved exclusively for microphones, there are ten (10) non-TVWS channels available with no broadcaster operating within 70 miles (the FCC separation distance); plus an additional six channels with no broadcaster operating within 50 miles; and yet another four channels with no broadcaster operating within ten miles. Comments of the Public Interest Spectrum Coalition, Docket No. 12-268, *et al*, at 32-37 (Jan. 25, 2013) ("PISC Comments"), referencing Shure Inc., Wireless Frequency Finder, available at http://www.shure.com/americas/support/tools/wireless-frequency-finder;

[22] 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 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. PISC Comments at 36. Spectrum Bridge, based on its experience as a TV Bands Database operator, noted that it "is already common practice" for Part 74 microphones to use and even reserve co-channel TV spectrum not available for use by WSDs in cities like New York. Comments of Spectrum Bridge Docket No. 12-268, *et al.* at 9 (Jan. 25, 2013); *see also* PISC Comments at 35 ("common practice" for microphones to use co-channel spectrum). Google and Microsoft, both certified as TV Bands Database administrators, reported 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." Comments of Google/Microsoft, Docket No. 12-268, *et al.* at 53 (Jan. 25, 2013), 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).

[23] The Commission amended Section 74.802(b) to permit wireless microphones to operate as close as four kilometers from the protected contour of co-channel TV stations. *See Incentive Auction R&O* ¶¶ 304-307.

3. Unlicensed Microphones Must Rely on an Automated Database

The Spectrum Act clearly requires that all unlicensed devices operating in the duplex gap or other guard bands in the repurposed 600 MHz spectrum must "rely on a database" or "subsequent methodology."[24] OTI and PK agree with Microsoft that the Commission's proposal to "require" wireless microphone users to check a database manually to obtain a list of available frequencies is *not* "[u]nlicensed use . . . rely[ing] on a database" in the sense that Congress intended.[25]

Congress was obviously aware that the automated geolocation database system already certified by the Commission to govern unlicensed access to vacant TV band spectrum – and the necessity of re-checking it periodically for permission to transmit – provides reliable protection for licensed incumbents. In contrast, adopting a requirement that hundreds of thousands of both professional and off-the-shelf microphone users should regularly go online (with a separate device) and check the database manually is at best wishful thinking and at worst an empty gesture. It seems doubly unrealistic to expect microphone users to stop a meeting, performance or church service every 20 minutes to recheck the database. Moreover, as Microsoft also explains, the Commission's stated goal "[t]o ensure that wireless microphones used in applications such as electronic newsgathering receive protection in a timely manner" will not be achieved unless *all* unlicensed devices, including unlicensed microphones, incorporate automated database communication capability.[26]

OTI and PK also oppose any increase in the Commission's proposed 20 mW power limit for wireless microphones operating in the duplex gap or other guard bands. Sennheiser asserts that the *NPRM*'s proposed 20 mW power limit "will make wireless microphone operations,

[24] *See* 47 U.S.C. § 1454(d).
[25] Comments of Microsoft at 36.
[26] Comments of Microsoft at 38.

which generally operate at 50 mW, unreliable on these frequencies."[1] However, if the power limit for narrow-band microphones is 50 mW, then because anywhere between 12 and 16 microphones can operate on 6 MHz, the aggregate power output on the 6 MHz duplex gap could be as high as 600 to 800 milliwatts. Even aside from the potential impact on Part 27 licensees, this creates a legitimate concern about whether microphone operations could undermine the expected benefit of this single, contiguous nationwide channel for unlicensed WSDs. OTI and PK therefore agree with Microsoft that "the Commission should, as it initially proposed, limit eligibility for licensed Part 74 operations in the duplex gap to ENG users only."[27]

B. Both Fixed and Personal/Portable WSDs Should Share Channel 37 Subject to Exclusion Zones Based on Real World Assumptions

OTI and PK commend the Commission for recognizing that using geolocation database technology as an enforcement mechanism, the FCC can enable unlicensed operations while protecting wireless medical telemetry services (WMTS) and radio astronomy services (RAS) incumbents from harmful interference. Across the United States, Channel 37 spectrum is barely used, a situation that Google correctly points out is increasingly "unacceptable in a spectrum-constrained environment."[28] Channel 37 offers the advantage of providing a rare contiguous frequency that will benefit unlicensed innovation. More critically, Channel 37 represents one of the three or four channels that will make or break the emergence of robust national markets for unlicensed WSDs, as the Commission implicitly acknowledged in its balanced *Incentive Auction R&O* last year.

OTI and PK therefore strongly support the consensus among commenters – or at least those that are not incumbent users of Channel 37 – that the Commission should permit all three

[27] Comments of Microsoft at 11 [citations omitted].
[28] Comments of Google at 18.

types of WSDs (fixed, Mode I and Mode II) to operate subject to protection zones that are based on *real world* assumptions about propagation and interference risk. Wi-Fi Alliance correctly observes that "because access will be controlled by a [geolocation] database that will know the device's operating parameters, there is no need for a distinction between fixed and personal/portable devices."[29]

Although we support the Commission's proposal to open Channel 37 for unlicensed sharing, like other leading voices in the unlicensed community OTI and PK believe the proposed exclusion zones to protect both WMTS and RAS incumbents are unnecessarily restrictive – "a needless impairment of consumer broadband."[30] The separation distances proposed will exclude critical portions of cities and even certain rural areas where there is no substantial risk of harmful interference to incumbent operations. By neglecting to factor in real world assumptions about terrain and the fact that WMTS operates indoors, the Commission's staff risks a reversion to the same over-protective, one-size-fits-all problem that plagued the original set of white space rules in 2008 and which the Commission is, ironically, proposing to remedy in other portions of this same *NPRM*. OTI and PK urge the Commission to adjust the proposed exclusion zones for both WMTS and RAS based on real-world interference protection needs.

1. Sharing with WMTS Incumbents:

The *NPRM* proposes co-channel separation distances as great as 2.8 km from WMTS for WSDs operating at 40 milliwatts. As Microsoft observes, even the smallest separation distance (300 meters at 40 mW if the antenna height is less than 3 meters) "is significantly larger than necessary to protect incumbents" based on the technical analysis done by Broadcom.[31] While OTI and PK acknowledge a lack of independent technical research or expertise on this point, we

[29] Comments of Wi-Fi Alliance at 28.
[30] Comments of Microsoft at 19.
[31] *Id.* at 20.

nevertheless agree with Broadcom, Google, Microsoft, Wi-Fi Alliance and others that it is unrealistic to assume free space propagation loss, as the Commission apparently does, when every WMTS device is indoors and separated from WSDs by *at least* one exterior wall.[32]

As Google observes, "taking walls into account leads to greatly reduced separation distances" – and not to do so seems particularly inapt in urban areas where additional propagation loss is likely at the edge of even a modest exclusion zone. For example, Broadcom's analysis accepted the building penetration loss assumption of 20 dB put forth by GE Healthcare ("GEHC"), as well as GEHC's assumed noise floor of -110 dBm/10 KHz.[33] Even so, Broadcom arrived at far smaller separation distances than the *NPRM* proposes.

OTI and PK urge the Commission to go the extra mile and recalculate separation distances based on real-world conditions. Between the WMTS industry database (ASHE) and the TV Bands Database, it should be possible to use less conservative exclusion zones as a baseline and then tailor them according to the specific terrain or other factors implicating the vulnerability of medical deployments. Specifically, we support Google's recommendation that "the Commission should authorize WMTS users to collaborate with white space database providers to take account of line-of-sight and non-line-of-sight propagation effects from the *actual* boundaries of each WMTS site."[34]

2. Sharing with RAS Incumbents

OTI and PK support the Commission's commitment to protecting RAS sites from interference. However, based on the comments in the record, it appears that the exclusion areas proposed in the *NPRM* are in many instances unjustifiably larger than necessary because they fail

[32] *See, e.g.*, Comments of Wi-Fi Alliance at 30 ("the FCC should not rely on the TM-91-1 propagation model . . . [which] underestimates building penetration loss, fails to adequately account for antenna heights, and fails to account for urban clutter loss.").
[33] *See* Comments of Microsoft at 20-22.
[34] Comments of Google at 19, referencing *NPRM* ¶ 112.

to take terrain blockage into account – even when there are mountains between RAS and potential unlicensed users. OTI and PK urge the Commission to revisit its approach to exclusion zones for RAS and adopt instead a terrain-aware model that also takes time of operation into account.

In several cases the failure to use a terrain-aware model results in the unnecessary loss of one of only three or four possible white space channels in unlicensed-constrained urban markets that include New York City, Boston and Seattle.[35] This leads to a number of dramatically untenable outcomes. For example, Microsoft points out that the citizens of Seattle would find themselves inside the exclusion zone of the VLBA station in Brewster, Washington. Not only is that station 200 km distant – but the Cascade mountain range lies between these two locations.[36] Google describes how New York City and a number of other major cities would also lose access to Channel 37 unnecessarily, at least for certain WSD operations.[37]

Unlike WMTS, a failure to take terrain into account in fashioning exclusion zones for RAS is not a question of arguable technical assumptions, but rather a failure to take a data-driven approach to better policy outcomes. OTI and PK support the strong consensus among commenters that the Commission should make every effort to use real-world assumptions and not constrain public access to the benefits of unlicensed broadband connectivity unless absolutely necessary to protect an incumbent from harmful interference.

[35] *See* Comments of Google at 27-28 ("the Commission's proposed fixed separation distances instead of a terrain-aware model would unnecessarily forelose white space operations at 4 W in several major population center . . . including New York City").
[36] Comments of Microsoft at 26.
[37] Comments of Google at 27-28.

C. Both Fixed and Personal/Portable WSDs Should Operate Without Restrictions on the Two Channels Above and Below Channel 37

Comments in the record overwhelmingly support the Commission's proposal to relax the stringent out-of-band emission limits that inhibit the use of Channels 35-39 and instead require WSDs "to meet either the current adjacent channel or the Section 15.209 emission limits as appropriate."[38] OTI and PK strongly support this approach, as well as the related proposal to permit unlicensed WSDs to operate on the nearest vacant TV channels above and below channel 37 that were previously reserved for the exclusive use of wireless microphones.[39] As Microsoft aptly states, "because the old rules that restricted operation on Channels 35-36 and 38-39 are no longer necessary to protect other authorized operations, these changes are low-hanging fruit that have the potential to make an immediate impact on the development of 600 MHz unlicensed operations."[40]

As the Commission and a number of commenters have recognized, the very stringent out-of-band emission limit that currently applies to WSD emissions into Channel 37 severely handicap the use of Channels 35, 36, 38 and 39 in every area nationwide even though WMTS and RAS incumbents need protection in only a relative handful of locations.[41] OTI and PK agree with the *NPRM* and the clear consensus among commenters that the Commission should expeditiously replace this over-protective one-size-fits-all approach and instead rely on the

[38] *NPRM* ¶ 128. *See, e.g.,* Comments of Broadcom at 21-22; Comments of Wireless Internet Service Providers Association, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of WISPA") at 6; Comments of Google at 36-37; Comments of Microsoft at 29-30; Comments of Wi-Fi Alliance at 7-8, 34; Comments of WSA at 7.
[39] *NPRM* ¶ 25.
[40] Comments of Microsoft at 29.
[41] *NPRM* ¶¶ 126-128. *See also* Comments of Broadcom at 21-22.

proven ability of the TV Bands Database to enforce a prescribed separation distance between unlicensed operations and Channel 37 incumbent licensees.[42]

D. Personal/Portable WSDs Should Operate on Unused Channels 7 to 20

OTI and PK strongly support and Commission's proposal to help offset the incentive auction's huge reduction in the number of channels available for unlicensed WSDs by removing the prohibition on personal/portable device operation on channels 14-20.[43] There appears to be virtually unanimous support in the record for this sensible proposal.[44]

Like the *NPRM*'s proposal to remove the overly-protective OOBE restrictions on Channels 35-39, discussed just above, OTI and PK applaud the Commission's recognition that reliance on the more fine-grained protection afforded by the geolocation database (TV Bands Database) is superior to a one-size-fits-all restriction that is not needed in most areas across the country. In this instance, public safety and certain other land mobile operations make use of Channels 14-20 in just eleven cities. The record shoes widespread agreement that incumbent licensees operating in certain markets below Channel 21, including PLMRS/CMRS, "will receive adequate protection through the databases, which can easily enforce keep-out zones" on an as-needed basis.[45] Spectrum Bridge concurs, stating its belief that no rule changes would be required for the TV Bands Database it administers "to protect PLMRS/CMRS or other authorized services from harmful interference."[46] At the same time, as Google observes in its

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[42] *See* Comments of Broadcom at 21.
[43] *NPRM* ¶ 30.
[44] *See, e.g.*, Comments of Microsoft at 40-41; Comments of Wi-Fi Alliance at 9-11; Comments of Google at 37-38; Comments of Spectrum Bridge, Inc., ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of Spectrum Bridge") at 3. An exception is the WhiteSpace Alliance, which focuses on promoting fixed wireless uses of the band and the IEEE 802.22 standard. Comments of WSA at 9-10.
[45] Comments of Microsoft at 40.
[46] Comments of Spectrum Bridge at 3.

comments, since the Spectrum Act requires the Commission to reallocate and auction Channels 14-20 by 2021, "opening these channels for use by personal/portable devices is not a long-term solution for white space operations."[47]

The *NPRM* also seeks comment on allowing personal/portable operations on VHF Channels 7 to 13 in addition.[48] Once again, there appears to be a clear consensus in the record in favor of making these additional channels available for both fixed and personal/portable unlicensed use.[49] OTI and PK likewise agree there is no good reason not to do so. Fixed white space operations at higher power levels already have access to these channels, depending on the location of broadcast licensees. And personal/portable use will remain at the same low power levels that apply to UHF channels. Opening Channels 7-13 potentially adds an additional 42 MHz of spectrum for unlicensed use and operations on a mobile basis, helping further to offset the great reduction in unlicensed access to low-band spectrum due to the incentive auction reallocation.

It is true that the value of this VHF spectrum (174-216 MHz) is less immediately evident for mobile devices, such as smartphones and tablets, since extremely low-band frequencies require larger antennas based on current technologies. However, as Google observes, "opening this spectrum for additional unlicensed uses could spur development of technologies to make more effective use of these channels."[50]

E. Fixed WSDs Should be Allowed to Operate on Unused Channels 3 and 4

OTI and PK agree with the clear consensus among commenters that the Commission should adopt its proposal to allow fixed WSDs to use Channels 3 and 4. Several commenters

[47] Comments of Google at 38; *see generally* 47 U.S.C. § 1413.
[48] *NPRM* ¶ 32.
[49] *See, e.g.*, Comments of Google at 39; Comments of Microsoft at 41; Comments of Wi-Fi Alliance at 12-13.
[50] Comments of Google at 39.

note that opening the channels can help spur additional unlicensed innovation. For example, Spectrum Bridge states that in combination with Channel 2, which is already available for fixed use, Channels 3 and 4 "are capable of supporting innovative fixed VHF applications, such as long range telemetry."[51] WhiteSpace Alliance, for its part, notes that the propagation characteristics of these channels (2, 3, 4) would benefit rural deployment and public safety communications.[52] More generally, OTI and PK agree with Wi-Fi Alliance's observation that opening up these channels will "encourage innovation on the part of device manufacturers to the ultimate benefit of consumers."[53]

As Microsoft observes, the exclusion of Channels 3 and 4 back in 2008 was designed "to protect analog television devices and will no longer be necessary once the transition is completed for all classes of television service."[54] In contrast, NAB acknowledges that consumer use of TV interface devices relying on Channels 3 and 4 are "diminishing," yet it nevertheless recommends that the Commission defer unlicensed use.[55]

OTI and PK see little if any justification to delay making these channels available. As Spectrum Bridge suggests, the most likely near-term use for fixed WSDs in this spectrum is outdoor operations that in any event are not likely to proliferate for a number of years as manufacturers develop products for this new opportunity. OTI and PK recommend that the Commission adopt its proposal and pave the runway for future innovation that can more productively use what is now the rapidly disappearing issue of TV peripherals that *might be* vulnerable to interference.

[51] Comments of Spectrum Bridge at 3.
[52] Comments of WSA at 9.
[53] Comments of Wi-Fi Alliance at 9.
[54] Comments of Microsoft at 46.
[55] Comments of NAB at 13.

III. THE COMMISSION CAN PERMIT CONTINUED UNLICENSED USE OF VACANT 600 MHZ SPECTRUM WHERE CARRIERS HAVE NOT COMMENCED OPERATIONS WITHOUT RISK OF HARMFUL INTERFERENCE OR IMPOSING UNDUE BURDENS ON LICENSEES

OTI and PK strongly support the Commission's specific proposal to permit WSDs to continue operating in the 600 MHz band post-auction until the licensee gives notice that it will "commence operations" in that local area.[56] As the Commission has recognized in this proceeding, due to the repurposing of broadcast spectrum for auction and the repacking of broadcast licensees, there will be precious little spectrum left to nurture a national market for low-band unlicensed devices and services – particularly connectivity for personal/portable devices (e.g., the 802.11af standard) that require a minimum of 18 to 24 MHz in *every* market nationwide. Ongoing, temporary access to unused 600 MHz spectrum on a localized basis is not only the most efficient spectrum policy – and does no harm to licensees, thanks to the TV Bands Database system – but it also may prove essential to the viability of unlicensed operations.

In the past, auction delays and 10-year buildout requirements based on population, however meritorious or unavoidable, have proven to be a recipe for leaving spectrum capacity fallow for extended periods – and particularly so in rural and other underserved areas. In this proceeding, however, the Commission correctly acknowledged there is a governance mechanism in place to ensure that unused spectrum "white space" in the 600 MHz band remains available for use – or withdrawn from use – depending on the actual operations of the 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.

[56] *Incentive Auction Order* at ¶ 680; *Part 15 NPRM* at ¶¶ 131-144.

It is important to recognize that the Commission's proposal simply maintains the status quo. Today the majority of 600 MHz spectrum is not used by licensees and is available for unlicensed use. Opportunistic access to fallow 600 MHz spectrum is the default: When a broadcast licensee is not operating on a channel, in that local area the spectrum becomes available for unlicensed use to the extent WSDs 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.

In short, the Commission's proposal to permit continued, temporary use of unused 600 MHz spectrum post-auction is the closest thing imaginable 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. The reporting "burden" on licensed carriers is also minimal considering that they obviously have the required information readily at hand as part of their process of preparing link budgets, deploying base stations and determining when they can commence commercial service.

OTI and PK also agree with Wi-Fi Alliance, and Microsoft that the Commission should authorize both Mode I and Mode II personal/portable devices in the repurposed 600 MHz band.[57] Wi-Fi Alliance correctly states that the TV Bands Database "can specify appropriate operating

[57] Comments of Wi-Fi Alliance at 34-35; Comments of Microsoft at 17-19.

parameters (including power) for both fixed and personal/portable devices based on the spectrum landscape. There is therefore no reason to distinguish between the two types of devices."[58]

The record in this proceeding shows strong support for the Commission's proposal.[59] And yet, not surprisingly, CTIA, the wireless industry association, and Qualcomm, the industry's proprietary chip vendor, struggled to find a reason to oppose it. We address those concerns below.

A. Proposals to Bar Unlicensed Use of Vacant Spectrum if a Licensee Commences Service Anywhere in a Partial Economic Area Would Undermine Spectrum Efficiency, Rural Broadband and a Robust Market for WSDs

CTIA and Telecommunications Industry Association (TIA) do not dispute the basic concept of permitting unlicensed operations to continue using the "repurposed" 600 MHz band on a temporary basis until such time as a licensee commences commercial service. However, in a transparent attempt to kill the concept – and to give carriers the option to keep virtually any or all of their licensed spectrum fallow at its discretion – CTIA suggests that when a licensee initiates commercial operations *anywhere* in the license area, the TV Bands Databases must deny permission for use of fallow spectrum *everywhere* in the license area.[60] Specifically, CTIA suggests that "white space device operations should cease in a PEA [Partial Economic Area] as soon as the commercial licensee has initiated service anywhere in the market."[61]

PEAs should not be used as the geographic foundation for excluding WSDs from access to underutilized spectrum. There are only 416 PEAs in the entire United States, including U.S. island territories and one for the Gulf of Mexico. According to the map of PEAs available on the

[58] Comments of Wi-Fi Alliance at 34;
[59] *See* Comments of WISPA at 16-17; Comments of Wi-Fi Alliance at 34-35; Comments of Microsoft at 48-49; Comments of Spectrum Bridge at 6.
[60] Comments of CTIA at 36-39. *Accord* Comments of Telecommunications Industry Association, ET Docket No. 14-165 and GN Docket No. 12-268 (filed Feb. 4, 2015) ("Comments of TIA") at 17. *See also* Comments of Qualcomm at 19-20.
[61] Comments of CTIA at 38.

Office of Engineering and Technology's website, PEAs can be larger than entire states.[62] Large bodies of water or mountains can separate portions of a single PEA. In many cases cities well over 100 miles apart are located in the same PEA. . For example:

- Bangor, ME and Caribou, ME are over 145 miles apart – and in the same PEA.
- Hartford, CT and Manhattan, NY are nearly 100 miles apart – and in the same PEA.
- Monterey, CA is 84 miles south of San Francisco and Petaluma, CA is 33 miles north of San Francisco – and yet all are in the same PEA.

The requirement to prohibit WSDs throughout a PEA simply because a licensee has commenced service in a portion of it [i.e. "*anywhere*"] would unnecessarily restrict opportunistic access to unused spectrum in instances where there is clearly no chance of harmful interference *even if* the TV Bands Database malfunctioned. Indeed, allowing WSDs to continue using the repurposed 600 MHz spectrum post-auction – based on a rationale of spectrum efficiency and the ability of the TV Bands Database to protect licensees from interference – but then making the protection zone the size of a PEA is at best arbitrary overkill. It also creates a moral hazard, since licensed carriers will have a strong incentive to throw up a base station or two, whether in the most profitable downtown area or at the edge of the PEA, and by doing so pull the plug on Wireless Internet Service Providers (WISPs) and any other opportunistic public access to the vacant spectrum.

OTI and PK strongly believe that the proposal in the *NPRM* strikes the right balance between simplicity for the parties and not denying access to unlicensed devices located far beyond the licensee's actual service area. There may be no standardized licensing area that comes close to replicating what the TV Bands Database can do given very straightforward data points that are readily available to licensed carriers that, before they deploy, have carefully planned out the coverage areas and link budgets of each and every base station and cell site. In

[62] "FCC Areas," Office of Engineering and Technology, available at http://transition.fcc.gov/oet/info/maps/areas/.

certain states even Cellular Market Areas can extend hundreds of miles beyond a single urban area where a carrier may initially provide service. Any standard geographic unit would be arbitrary, since it would not take into account the location of the carrier's base station within the area – and therefore is inferior to the protection zone that carrier itself can determine under the Commission's well-balanced proposal.

Large portions of 600 MHz band spectrum will remain unused in large portions of the country for many years following the incentive auctions – and, if the experience is similar to past auctions, many rural and small town areas may not be built out even at the end of the initial 10-year license term. The policy proposed by the Commission is especially critical in rural and small market areas more likely to be underserved – since they are typically the last to be built out. 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.

The Commission's proposal and rationale here is also consistent with the rules adopted to encourage more efficient spectrum use in the 2.5 GHz band. Under Section 27.55(a)(4) of the Commission's rules, licensees in the 2.5 GHz band may exceed the signal strength at the border of their licensed areas without consent where the neighboring licensee is not providing service. When the neighboring licensee commences service, the user is required to comply with the applicable power and emissions limits at the boundary and can exceed these limits if the licensee consents. In adopting the approach, the Commission recognized "the importance of ensuring the ubiquitous availability of broadband services."[63] The same rationale applies here, although with

[63] *See* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, WT Docket No. 03-66, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 14165, ¶¶ 109 (2004).

even less potential risk for any licensee since the TV Bands Database provides automatic exclusion of the unlicensed devices at any time that the licensee chooses to commence service.

B. Spectrum Licenses Do Not Confer 'Exclusive' Rights on Any User and the Commission Has the Authority at Any Time to Condition Licenses with Obligations to Facilitate Full and Efficient Use

CTIA argues that the use-it-or-share-it requirement proposed by the Commission "is wholly inconsistent with the 'exclusive license' provided to bidders in the incentive auction and impermissibly elevates the rights of unlicensed services."[64] Qualcomm likewise argues that "licensees will have purchased exclusive spectrum rights via an auction to use all of the spectrum within service area [and] without having to share those rights with unlicensed users."[65]

Carriers and their suppliers never seem to tire in their effort to relitigate this well-settled issue. The Powell Commission confronted this question squarely in its order approving ultra-wideband (UWB) operations as an underlay on PCS and other licensed bands. The Commission's 2002 UWB Report & Order made it clear that incumbent licensees do not have the right to exclude other authorized users from emitting energy into their assigned bands, provided that there is an acceptably minimal risk of harmful interference.[66] In that proceeding, Sprint similarly "objected to the basic concept of UWB operation, stating that the Commission does not have a legal right to convert Sprint's licenses into non-exclusive licenses and to require Sprint PCS to share its spectrum with others, much less share it for free."[67] Sprint's argument was

[64] Comments of CTIA at 39.
[65] Comments of Qualcomm at 19-20.
[66] In Re Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, First Report and Order, 17 F.C.C. R. 10505 (2002) ("UWB First R&O"). *See also* In Re Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 18 F.C.C.R. 3857 (2003) (responding to several petitions for reconsideration and largely leaving the First Report and Order's decisions and reasoning in place).
[67] *Id.* ¶ 271. For an excellent summary of this issue in relation to the Commission's effort to balance auctioned but non-exclusive licensing rights with a desire to permit efficiency-enhancing, low-power

that it had "spent over $3 billion for exclusive" spectrum rights, and that "Commission authorization of new users constitutes breach of contract and an unlawful modification of licenses for which the Government would be liable for damages."[68] The Commission firmly rejected Sprint's argument for "exclusive" use, stating:

> [S]pectrum is not, and has never been, exclusive to Sprint or to any other licensee or user. While Sprint PCS has been provided some exclusivity in operating licensed PCS systems within specified geographic areas, Part 15 transmitters [such as personal computers and electric drills] currently are permitted to operate within the PCS and cellular frequency bands . . . [and] there are countless other devices that emit radio emissions within these bands.[69]

The Commission concluded that "[o]ur analysis of the record . . . indicates that UWB devices can be permitted to operate without causing harmful interference if appropriate technical standards and operational restrictions are applied to their use."[70] Similarly, in this proceeding the Commission has correctly determined it is that the TV Bands Database system can ensure that once a licensee reports it will commence service, all WSDs will be denied permission to transmit within a distance that could conceivably cause harmful interference.

Of course, the Commission's authority to impose conditions on licensees in the public interest has deeper roots than the Communications Act truism that licenses confer no exhaustive or permanent rights. The Supreme Court and recent precedents have affirmed that Title III delegates "expansive powers" to the Commission, including a "comprehensive mandate to 'encourage the larger and more effective use of radio in the public interest.'"[71] Section 303(b) of

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UWB underlays, see Paul Margie, *Can You Hear Me Now? Getting Better Reception from the FCC's Spectrum Policy*, 2003 Stan. Tech. L. Rev. 5.

[68] *Id*.

[69] *Id.*

[70] *Id*. ¶ 18.

[71] *CNBC v. United States*, 319 U.S. 190, 219 (1943) (quoting 47 U.S.C. § 303(g)); *see also Cellco Partnership*, 700 F.3d 534, 542 (D.C. Cir. 2012) (upholding the Commission's authority to require licensees to offer data roaming agreements on commercially reasonable terms and conditions).

the Act specifically gives the Commission wide-ranging authority to "[p]rescribe the nature of the service to be rendered" by a licensee."[72]

Reinforcing this authority, section 303(r) empowers the Commission to "[m]ake such rules and regulations and prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out the provisions of this chapter."[73] And although the Commission's authority to condition a license may be most clear where, as here, it is defining obligations on a newly-allocated band for the first time and prior to an auction, even after licenses are granted Section 316 of the Act authorizes "new conditions on existing licensees" "if in the judgment of the Commission such action will promote the public interest, convenience, and necessity."[74] The outcome of the UWB proceeding was likewise premised on this basic principle.

CTIA and Qualcomm, perhaps recognizing the Commission clearly has the general authority to permit non-harmful sharing of any licensed band, argues that the proposal is unlawful in this instance because the 2012 Spectrum Act only permits unlicensed use of the 600 MHz duplex gap and guard bands.[75] But although there is no language in the Spectrum Act that explicitly permits the Commission to allow continued and productive use of fallow spectrum post-auction[76] – neither is there any language that suggests the contrary. There is, however, language expressly stating that the Spectrum Act in no way diminishes the FCC's pre-existing authority. The Spectrum Act confirms that nothing in Section 6404 "affects any authority the Commission has ***to adopt and enforce rules of general applicability*** . . . ."[77]

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[72] 47 U.S.C. § 303(b). *See also Cellco Partnership v. FCC*, 700 F.3d at 542.
[73] 47 U.S.C. § 303(r). *See also Cellco Partnership v. FCC*, 700 F.3d at 542.
[74] 47 U.S.C. § 316.
[75] Comments of Qualcomm at 19.
[76] Comments of CTIA at 39 ("There is no language in the Spectrum Act that envisions or compels access to licensed 600 MHz spectrum by unlicensed white space devices.").
[77] Spectrum Act § 6404.

The Congressional purpose underlying the Spectrum Act focused on authorizing an incentive auction that would shift low-band spectrum into the hands of mobile providers for licensed use – and nothing in the Commission's proposal impedes unfettered licensed use of the 600 MHz band post-auction. A worst case is that potential licensees can factor in the modest reporting costs when they bid for 600 MHz licenses or purchase it on secondary markets. Although CTIA's members would understandably rather not have any "burdensome" reporting requirements that serves to facilitate enhanced Wi-Fi and other low-cost connectivity that potentially competes with mobile carrier offerings, whether the "burden" of such a licensing condition is justified by the public interest benefit is squarely within the Commission discretion.

C. The Commission's Proposed Reporting Obligations are Minimally Burdensome and Justified to Promote Spectrum Efficiency, Public Access and Innovation

CTIA writes that being "required to provide detailed information to TV bands database administrators… imposes impermissible burdens on 600 MHz licensees…"[78] They go on to state that "[b]ecause commercial wireless licensees are constantly modifying their base stations – including the frequencies used – to meet consumer demands, a wireless licensee would need to constantly update the TV bands databases to ensure that unlicensed devices would not harmfully interfere with their operations."[79] Qualcomm complains that a requirement to update the TV Bands Databases is "particularly burdensome as mobile carriers are always modifying, densifying, extending, and upgrading their networks to meet consumer needs."[80]

[78] Comments of CTIA at 36-37; see also Comments of TIA at 16-17.
[79] Comments of CTIA at 38
[80] Comments of Qualcomm at 20. *See also* CTIA Comments at 38. TIA blithely opines that "CMRS licensees usually have the privilege (and often, the obligation) to provide service throughout their license area." TIA Comments at 16. Even a cursory review of the Commission's service-specific "substantial service" standards shows this statement to be a total fallacy. Licensees are generally required to meet population-based benchmarks that are most easily satisfied by building out in densely populated areas, creating a disincentive to serve rural areas.

In reality, the "burden" on licensees (to notify a TV Bands Database administrator) would be *de minimus* and not involve collecting any data the operator does not already have readily at hand for their own purposes. The reporting "burden" on licensed carriers is also minimal considering that they obviously have the required information readily at hand as part of their process of preparing link budgets, siting and deploying base stations, and determining when they can commence commercial service. And clearly the carriers know their own buildout and commercial rollout some period in advance.

Spectrum Bridge, a certified TV Bands Database administrator, explains that "a 600 MHz Licensee can use readily available GIS tools to generate a polygon, which would then be uploaded to the database as part of the registration process. This will allow the Licensee to incorporate whatever details are necessary, such as its licensed PEA boundary, without involving the database administrator in the specifics."[81] Mobile Future also endorses the Commission's approach, provided that the TV Bands Database is accurate and accounts for carrier needs for protection "during the initial and testing phases of operations. [82]

The Commission's proposal here – a reporting requirement enforced by an FCC-certified geolocation database system – is also consistent with the approach the Commission appears likely to adopt in the 3550-3650 MHz band. The new Citizens' Broadband Radio Service would allow General Authorized Access (unlicensed or license-by-rule) to operate on vacant licensed spectrum in the band, on a very localized basis, until such time as Priority Access License (PAL)

[81] Comments of Spectrum Bridge at 6.
[82] Comments of Mobile Future, ET Docket No. 14-165 and GN Docket No. 12-268 at 5 (Feb. 4, 2015) ("Comments of Mobile Future") ("administrators should update the white spaces database when carriers begin operating on particular frequencies in particular PEAs to inform unlicensed operators that white spaces devices may no longer operate on that spectrum").

holders notify the geolocation database administrator (in this case, the Spectrum Access System) the date on which they will commence operations.[83]

OTI and PK have previously proposed a 30-day notification period during which a licensee can check and verify that the TV Bands Database has removed permission to use the licensee's frequency block within the protected contour of any service area. A substantial notification period benefits both licensees and unlicensed operators, since the former will have time to verify the band is clear and the latter (mainly fixed wireless operators, such as WISPs) may need time to reconfigure their networks to use alternative channels.

At the same time, OTI and PK recommend that the Commission accord licensees the ability to notify a TV Bands Database, even on short notice, about specific periods of time the licensee needs to operate prior to commencing regular, ongoing commercial operations.[84] If a licensee needs the band clear in a local area 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 can do today, and immediately exclude opportunistic use at the places and times needed.[85]

In sum, with clear ground rules and the TV Bands Database as an automatic enforcement mechanism, the operations of licensed carriers would not be impacted in the slightest. The licensees' "burden" (to notify a TV Bands Database administrator) would be *de minimus* and not involve collecting any data carriers do not already have readily at hand. The admonition in the 2012 report and recommendations of the President's Council of Advisors on Science and

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[83] *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, FCC 14-49 (rel. Apr. 23, 2014).
[84] *See* Comments of the Public Interest Spectrum Coalition, Docket No. 12-268, *et al.* (Jan. 25, 2013) ("Comments of PISC"), at 59-60.
[85] *See* Comments of PISC at 60. *Accord* Comments of Mobile Future at 5 ("Commission must adopt a definition of 'commences operations' that protects licensees from harmful interference during the initial and testing phases of operations").

Technology (PCAST) is as relevant for the 600 MHz band as it is for unused Federal spectrum, to wit: "The incongruity between concern about a 'looming spectrum crisis' and the reality that only a fraction of the Nation's prime spectrum capacity is actually in use suggests the need for a new policy framework to unlock fallow bandwidth in all bands, as long as it can be done without compromising the missions of Federal users and ideally by improving spectrum availability for Federal users."[86]

IV. CONCLUSION

OTI and PK strongly commend and support the Commission's efforts to ensure that at least three to four 6 MHz channels will be available for unlicensed WSDs in every market. The thoughtful proposals in the *NPRM*, taken together and with some modest improvements, hold true to the balanced policy adopted in last May's *Incentive Auction R&O* and have the potential to facilitate a robust national market for low-band unlicensed innovation and consumer welfare. Our groups look forward to working with the Commission to complete these rules quickly so that both the incentive auction and further investment in unlicensed devices and deployments can proceed without undue delay.

Respectfully Submitted,

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[86] President's Council of Advisors on Science and Technology, *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth* (July 2012), at 16.