

**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
)	

COMMENTS OF PUBLIC INTEREST SPECTRUM COALITION

The Open Technology Institute at the New America Foundation, Consumer Federation of America, Public Knowledge and the National Hispanic Media Coalition (collectively, the “Public Interest Spectrum Coalition” or “PISC”) are pleased to submit these comments in response to a number of 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

Contents

SUMMARY..... Error! Bookmark not defined.

I. ENSURING ACCESS TO SUBSTANTIAL AND CONTIGUOUS SPECTRUM FOR UNLICENSED DEVICES AND SERVICES WILL YIELD COMPELLING PUBLIC INTEREST BENEFITS TO CONSUMERS AND THE ECONOMY 8

A. The Unlicensed Economy is Thriving, Creating Jobs, Delivering Broadband to Unserved Areas, Addressing the Explosion of Consumer Wireless Data Demand with Spectrum Re-Use.....8

B. Unlicensed Access to TV White Space is a Complementary Platform for Innovation, Economic Growth and Spectrum Efficiency that Requires a Minimum Amount of Spectrum in Every Market Nationwide18

II. DESIGNATING SUBSTANTIAL GUARD BANDS FOR CONTIGUOUS UNLICENSED USE NATIONWIDE IS BOTH NECESSARY TO PROTECT LICENSED SERVICES AND SERVES THE PUBLIC INTEREST IN ENSURING NATIONAL MARKETS AND SPURRING UNLICENSED INNOVATION..... 21

A. Any Guard Bands Between Licensed Services Should be Designated for Unlicensed Use Only on a Contiguous, Nationwide Basis.....23

B. Current Technical Rules for White Space Devices Should Apply to the Unlicensed Guard Bands to Help Spur National Markets by Ensuring a Sufficient Amount of Compatible Shared Spectrum in Every Market.....26

III. ALLOWING SHARED, UNLICENSED USE OF CHANNEL 37 OUTSIDE PROTECTION ZONES PROMOTES SPECTRUM EFFICIENCY AND NATIONAL MARKETS FOR UNLICENSED DEVICES AND SERVICES 27

A. Channel 37 Should be Made Available for General Unlicensed Use in Areas and at Times not Specifically Reserved to Protect Incumbent Services Vulnerable to Interference.....28

B. Protection Zones for Radio Astronomy Services (RAS) Can be Enforced Through the TV Bands Database and Also Permit Parties to Negotiate Additional Use29

C. Wireless Medical Telemetry Devices Should Transition Off the Band and Can be Protected Through the TV Bands Database During any Necessary Transition and Relocation Period.....30

IV. WIRELESS MICROPHONES SHOULD RELY WHEREVER POSSIBLE ON NON-WHITE SPACE CHANNELS AND THE TWO CHANNELS RESERVED FOR UNLICENSED MICROPHONES SHOULD BE AVAILABLE FOR GENERAL UNLICENSED USE WHEN NOT RESERVED 32

A. Wireless Microphone Operations Currently Do Rely and Should Rely Primarily on the Many Unused Local TV Channels *Not* Available for Use by Unlicensed White Space Devices32

B. The Commission Should Expand the Number of Co-Channels Available for Wireless Microphone Reservation and Require Operation on Non-White Space Channels Except Where That Will Not be Sufficient for a Particular Time, Place and Venue37

the 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).

C. The Two Channels Currently Reserved for Microphones Should be Open for General Unlicensed Use and Available for Microphone Reservation Only as Needed and Based on Coordination Through the TV Bands Database	41
V. THE COMMISSION SHOULD REPACK AND RELOCATE FULL POWER AND SECONDARY BROADCAST LICENSEES IN A MANNER THAT ENSURES SUFFICIENT UNLICENSED SPECTRUM IN EVERY MARKET AND OPTIMIZES THE UTILITY OF UNLICENSED WHITE SPACE OVERALL	45
A. Channel Relocations Should Optimize Total White Space Above Channel 20 and the Number of Channels Available for Fixed Unlicensed Use for Rural Broadband Access	46
B. Secondary Broadcast Licensees Should Maintain Actual, Substantial Service and Strict Adherence to the 2015 DTV Transition Deadline or Lose Protection in the TV Bands Database	49
C. Low Power Broadcast Licensees Should be Required as a Condition of Relocation or Reassignment to Share a Channel Wherever Feasible.....	53
VI. ALL UNOCCUPIED SPECTRUM IN THE CURRENT UHF BAND SHOULD REMAIN AVAILABLE FOR UNLICENSED USE THROUGH THE TV BANDS DATABASE UNTIL NEW 600 MHZ LICENSEES COMMENCE SERVICE WITHIN INTERFERENCE RANGE.....	55
A. Maintaining Access to Vacant UHF Spectrum Until Needed by a Licensee Protects Licensees and Promotes Spectrum Efficiency and Emerging Markets for Unlicensed TV White Space Services	57
B. The Commission Should Include a License Condition that Requires New 600 MHz Licensees to Notify a TV Bands Database Administrator 30 Days Prior to Commencing Commercial Service in a Local Area	59
VII. PERSONAL/PORTABLE UNLICENSED DEVICES SHOULD BE PERMITTED TO OPERATE ON CHANNELS 14 TO 20 SINCE THE TV BANDS DATABASE CAN PROTECT PUBLIC SAFETY OPERATIONS DURING THE T-BAND TRANSITION .	61
VIII. THE COMMISSION SHOULD INCLUDE AN AUCTION-SPECIFIC SPECTRUM AGGREGATION LIMIT AS A GENERAL CONDITION OF LICENSES AWARDED IN THE FORWARD AUCTION	63
A. The Commission has authority to implement an auction-specific spectrum screen as a general license condition that applies equally to all bidders	63
B. The Commission should adopt an auction-specific aggregation limit that reflects the different characteristics of different spectrum bands.	66
C. Additionally, the Commission should impose wholesale access conditions on any acquisition of 600 MHz spectrum above the threshold.	68
CONCLUSION	Error! Bookmark not defined.

SUMMARY

The undersigned consumer and media reform groups of the Public Interest Spectrum Coalition (“PISC”) generally support the Commission’s effort to reallocate fallow broadcast band spectrum for flexible use on a licensed and unlicensed basis. We realize that conducting the world’s first spectrum incentive auction and reorganizing the band to promote a variety of important current and future uses is a complex task under conditions of uncertainty – not the least of which is how many UHF channels can be cleared for reallocation on a cost-effective basis. We applaud the staff’s clearly diligent and creative effort and offer these comments in response to a number of issues and questions raised in the *NPRM*.

In addition to incentive auctions for exclusively-licensed spectrum, PISC believes the Commission can best optimize TV band spectrum for broadband deployment, job creation and economic growth 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. To a far greater degree than was perhaps imaginable when the Commission initially approved unlicensed use of the TV white space channels, the unlicensed economy is thriving, creating jobs, delivering broadband to unserved areas, and meeting the explosion of consumer wireless data demand with low-cost and small cell spectrum re-use. Unlicensed spectrum increasingly serves as an incubator of wireless innovation.

PISC therefore strongly supports 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. Allowing unlicensed use of the guard bands, subject to the same technical rules that currently govern white space devices in general, will yield additional and compelling public interest benefits. PISC also strongly supports

contiguous guard bands and therefore favors the Commission's proposal to "keep the downlink spectrum band consistent nationwide."

PISC strongly supports the Commission's proposal to make channel 37 available for unlicensed use, while protecting the Radio Astronomy Service and wireless medical devices (WMTS) with protection zones that can readily be enforced using the TV Bands Database. Whether or not the Commission ultimately determines that one or both of the incumbent services can transition out of channel 37 in the future, PISC agrees that the TV Bands Database is capable of fully protecting these fixed-location incumbent operations, subject to the same rules that already protect broadcasters and licensed wireless microphone reservations.

The Commission's current rules governing wireless microphone operations encourage inefficient spectrum use and will undermine the emergence of a robust market for unlicensed consumer devices and services in the TV bands unless modified. Although many professional and multi-microphone operations have long been operating on non-local broadcast TV co-channels and other non-TVWS channels that otherwise lie fallow, the Commission's rules allow and encourage microphone users to block off the considerably smaller number of channels that are available to unlicensed devices in the nation's largest urban markets. The Commission can instead promote greater spectrum efficiency and innovation if it both authorizes and requires microphone users to use non-TVWS channels first, to use TVWS channels only as needed, and to coordinate that use to ensure efficient channel placement and geographic spectrum re-use. PISC believes the Commission should reduce the separation distance for co-channel microphone operation to reflect real-world interference risk and to maximize co-channel spectrum available at most locations. Because expanded co-channel availability and coordination will greatly reduce the need for microphone operations on the channels now reserved for microphone use, we

propose that the two reserve channels be opened more generally for unlicensed TVBDs at any time and place microphone operators have not made a qualified reservation. Microphone use of unlicensed TVWS, in turn, should be restricted to reservations on these two reserve channels.

Broadcast station repacking and relocation will have an enormous impact on the future of the unlicensed economy. PISC recommends that the Commission adopt a policy of vigorously enforcing its rules to ensure that LPTV, translator and booster stations that are not entitled to interference protection also do not have protected status in the TV Bands Database. PISC recommends that the Commission establish objective guidelines to determine if LPTVs are providing “substantial broadcast services” to the relevant community and also strictly enforce the September 2015 DTV transition deadline for low power stations. PISC strongly supports the Commission’s proposal to allow LPTV and translator stations to share channels with one another or with full-power TV stations. However, PISC recommends that the Commission go further and require secondary broadcast licensees to co-locate and share a single 6 Mhz channel where feasible without reducing their free over-the-air broadcast service to the community.

Even after the forward incentive auction is completed, large portions of 600 MHz band spectrum will remain unused in large portions of the country for many years – 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. PISC therefore proposes 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 a TV Bands Database administrator that the licensee intends to commence service. Licensees lose no rights whatsoever and bear a *de minimus* burden to simply inform the Commission and one of the TV Bands Database administrators 30 days prior to commencing

substantial service in a particular local area, so that all unlicensed devices can be immediately denied permission to operate on that frequency band.

PISC recommends that the Commission propose permitting the operation of personal/portable white space devices on channels 14 to 20 in the markets and on the channels where they are *not* being used by Private Land Mobile Radio Service (PLMRS) or Commercial Mobile Radio Service (CMRS) licensees. Since public safety typically occupies only two T-Band channels in a small and finite number of cities, it should be possible to rely on the TV Bands Database to deny white space devices permission to transmit on channels registered for use by PLMRS or CMRS operations in those 11 metropolitan markets.

Finally, PISC recommends that the Commission adopt, as a general license condition applicable to all forward auction bidders, a separate aggregation limit for the 600 MHz auction that accounts for the entirety of an entity's holdings below 1 GHz. The harsh reality for potential wireless entrants and competitive carriers is that not all spectrum is created equal. At present, the two dominant carriers already control more than four-fifths of the available spectrum below 1 GHz. Coverage is most important for potential market entrants and existing competitive carriers trying to establish a national or regional LTE network – these entities are coverage limited, not primarily capacity limited. PISC therefore strongly recommends a separate aggregation limit in this auction for holdings below 1 GHz overall or, alternatively, a very low cap on the share of 600 MHz spectrum that can be acquired by a single entity. PISC also believes that an auction-specific cap allowing a carrier to acquire as much as one-third of the spectrum in the auction is too high considering the unique propagation characteristics of 600 MHz spectrum and its potential to either enable or undermine the ability of competitive carriers to establish a national or even a regional LTE network.

I. ENSURING ACCESS TO SUBSTANTIAL AND CONTIGUOUS SPECTRUM FOR UNLICENSED DEVICES AND SERVICES WILL YIELD COMPELLING PUBLIC INTEREST BENEFITS TO CONSUMERS AND THE ECONOMY

In addition to incentive auctions for exclusively-licensed spectrum, PISC believes the Commission can best optimize TV band spectrum for broadband deployment, job creation and economic growth 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. PISC believes that advancing a national goal of not merely affordable broadband access, but of truly pervasive connectivity – seamless mobile connectivity anywhere and anytime – will require an enormous increase in available spectrum capacity, both licensed and unlicensed.

A. The Unlicensed Economy is Thriving, Creating Jobs, Delivering Broadband to Unserved Areas, and Addressing the Explosion of Consumer Wireless Data Demand with Spectrum Re-Use

Since the Commission initially adopted its policy permitting unlicensed use of vacant TV channel spectrum (the “TV White Spaces”), the unlicensed economy has become central to the positive impact of both wireless and wired Internet access on innovation, job creation and economic growth more broadly. The most obvious benefit of unlicensed spectrum has been Wi-Fi networks that permit many different users – at home, at work, in a coffee shop or other “hot spot” – to share the same wired Internet connection. Because Wi-Fi operates at very low power and is open to all users, there can be many homes, employees, or customers of a retail establishment sharing the same 2.4 GHz band in a relatively small area with little or no interference. Unlicensed Wi-Fi routers, chips and services are a rapidly-growing, multi-billion-dollar industry, but more important for the economy, for education and for other purposes is the

tremendous *multiplier effect* that Wi-Fi has on the use and utility of the Internet by making a single wired connection available for shared use on a very low-cost, do-it-yourself basis. This generates enormous consumer welfare.

A 2009 study by economist Richard Thanki, commissioned by Microsoft, estimated that just three unlicensed applications – Wi-Fi routers in homes, Wi-Fi in hospitals, and RFID tracking inventory in clothing retail stores – together would generate between \$16 and \$37 billion each year in economic value for the U.S. economy over the next 15 years.³ The Thanki study also estimated that Wi-Fi has increased the adoption of broadband by anywhere between 4.3 and 9.8 million households by making it more economical. A follow-up study conducted in 2012 found that Wi-Fi carries more internet traffic to end users' terminals than cellular or wired connections combined.⁴ Of 82 million broadband connections in the US, 70 million use Wi-Fi. Setting aside other uses (like M2M and smart grid), Thanki estimates that Wi-Fi access points deliver a total annual economic benefit of \$15.45 billion.⁵

Thanki also notes the exceptional cost-savings to industry from bolstering their networks with Wi-Fi offloading:

"For example a cellular picocell costs from \$7,500 to \$15,000 whereas a much higher capacity carrier-grade Wi-Fi access point costs around \$2,000. The cost of a Wi-Fi chipset for a consumer device is around \$5, whereas 3G cellular chipsets costs around \$30."⁶

Over the past two years, a series of additional economic studies have documented the steadily increasing economic benefits of unlicensed spectrum use for both personal and business productivity, as well as its complementary integration with carrier networks as the primary

³ See Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum* (Sept. 2009), at p. 19; <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020039036>.

⁴ *Id.*, at 33.

⁵ See *Id.*, at 111.

⁶ See *Id.* at 32.

means of meeting exploding consumer demand for data services on mobile devices. In their 2011 study, Stanford economists Milgrom, Levin and Eilat estimate the economic value of Wi-Fi to be at least \$25 billion annually, citing the value of Wi-Fi's superior speed alone to be worth \$12 billion.⁷ Milgrom, *et al.*, also conclude that the greatest value of unlicensed spectrum may be its role as a reliable platform for innovation for as yet unanticipated uses. In other words, the story of WiFi may yet gain another chapter with what Chairman Genachowski has called the "Super WiFi" of unlicensed technology using UHF spectrum. Milgrom observes as well that allocating spectrum between licensed and unlicensed is not a zero-sum game. Rather than representing a loss to auction revenues, designating blocks of unlicensed spectrum will naturally increase the value of the licensed blocks being sold.⁸ At the least, setting aside unlicensed bands will likely have no negative effect on auction revenues.⁹

In fact, it's increasingly clear that unlicensed spectrum is not in competition with – but rather complementary to – licensed services. In his 2012 study for the Consumer Federation of America, Mark Cooper notes the crucial role that the "expansion and nimble integration of unlicensed use technologies with exclusive licensed models" has played in the development of wireless broadband.¹⁰ That offloading to WiFi hotspots has been embraced by industry is obvious: since AT&T began reporting, the number of hot spot connections has increased by 270% compounded annually, to more than 30,000.¹¹ This year Comcast will reportedly exceed this number – which, in turn, are small in comparison to unlicensed hot spot deployments by Asian carriers in China, Japan and South Korea in particular. Given that roughly 37% of traffic

⁷ See Paul Milgrom *et al.*, *The Case for Unlicensed Spectrum* (Oct. 2011), at 19

⁸ See *Id.*, at 2-3.

⁹ See *Id.*, at at 3

¹⁰ See Mark Cooper, *Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves* (January 2012), at 38

¹¹ See *Id.*, at 12.

is offloaded to Wi-Fi, Cooper calculates that the revenues for AT&T and Verizon from access to unlicensed spectrum are enhanced through cost reductions due to thousands of towers and access points that never need to be built is in excess of \$20 billion (of their \$55 billion total in wireless data revenue).¹² Further, Cooper notes the explosive growth in the number of Wi-Fi hotspots available, estimating the value of hot spot connectivity alone to be an “extremely conservative... \$10 billion per year and growing.”¹³

In fact, the benefits of unlicensed spectrum extend far beyond wireless broadband. Open wireless strategies (Wi-Fi and other unlicensed technologies) are dominant in a number of wireless services, making up 80% of wireless healthcare solutions and 70% of smart grid communications.¹⁴ Using unlicensed spectrum, companies are able to deploy advanced smart grid solutions without vying for their own piece of spectrum – a cost prohibitive to most innovators. In fact, thanks to the availability of unlicensed channels at 900MHz and 2.4GHz, only 1% of the US smart grid market runs over licensed spectrum.¹⁵ In contrast, Europe’s lack of an equivalent open wireless alternative to 900 MHz has resulted in only 15% wireless deployment (the rest uses wireline) – a situation that has stagnated the deployment of smart grid technology in European markets.¹⁶

Unlicensed Spectrum Carries an Increasing Share of Mobile Data Traffic

One of the many proven benefits of unlicensed spectrum is that it facilitates spectrum frequency re-use over very small areas (a home, business, or school). Because of its efficiency and low cost, unlicensed spectrum will soon carry more data traffic than either wired lines or licensed carrier bands. Cisco’s widely-cited Visual Networking Index (VNI), which projects

¹² See *Id.*, at 19

¹³ See *Id.* 19.

¹⁴ See Yochai Benkler, *Open Wireless vs. Licensed Spectrum* (November 2011), at 1..

¹⁵ See *Id.*, at 4.

¹⁶ See *Id.*, at 9.

growth in mobile data demand, concluded in its June 1 forecast that by 2015 Wi-Fi devices will actually use more bandwidth than all wired devices combined.¹⁷ Cisco predicts Wi-Fi devices will consume 37.2 exabytes of data worldwide per month in 2015, carrying more than six times as much total data traffic over the airwaves as commercial mobile networks (with 6.3 exabytes per month).¹⁸

The more recent development driving this trend is the rapidly rising use of unlicensed spectrum by consumers to offload surging mobile device data traffic, as well as to boost the speed of mobile broadband applications. Wi-Fi has been essential to the growth in popularity of smartphones such as the iPhone and is shouldering an increasing share of the capacity load on often under-provisioned licensed wireless networks. Since most video and other high-bandwidth applications on mobile devices are used indoors and within range of a wired local area network, widespread availability of unlicensed spectrum is the single most important factor in mitigating the “spectrum crunch.” More than half of the page views on Apple iPhones come through a Wi-Fi network, as does 92% of iPad web browsing, according to Nielsen research.¹⁹ Cisco's Internet Business Solutions Group (IBSG) found in a 2011 study that only 35 percent of mobile data use was “on the move” (truly mobile), while the remainder was nomadic – either at home (40%) or in the workplace (25%).²⁰ The Cisco study shows that “80 percent of the time, people connect

¹⁷ Janko Roettgers, “Wi-Fi to Overtake Wired Network Traffic by 2015,” GigaOm, June 1, 2011, available at <http://gigaom.com/broadband/cisco-Wi-Fi-vni-report/>.

¹⁸ Cisco Visual Networking Index: Forecast and Methodology 2010-2015, June 1, 2011; available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360.pdf.

¹⁹ Kevin C. Tofel, “iPhones, iPads thrive on Wi-Fi, Androids on 3G and 4G,” GigaOm, June 23, 2011, available at <http://gigaom.com/mobile/iphones-ipads-thrive-on-wi-fi-androids-on-3g-and-4g/>.

²⁰ Cisco, VISUAL NETWORKING INDEX: FORECAST AND METHODOLOGY 2010-2015, June 2011 at 10, available http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html.

to the mobile Internet from their home, office, or other indoor location – all areas that are sufficiently addressed by Wi-Fi.”²¹

Of course, the ability to access sufficient amounts of unlicensed spectrum – in homes, businesses, in rapidly proliferating public hot spots and across hot zones – is a complement and cost saving to both commercial wireless carriers and to wireline ISPs seeking to give their customers the ability to access content away from their home wired connections. The Cisco IBSG study suggested that, “mobile operators can reduce their radio access costs by at least 25 percent (in most cases) by selectively incorporating Wi-Fi into their network architectures and operations.”²² Overall, Cisco’s VNI estimates that roughly 20% of mobile data traffic was routed over unlicensed Wi-Fi in 2010, a share projected to increase to 30% by 2015.²³ Another study by Juniper Research projects that 63% of the data traffic generated by smartphones, tablets and feature phones will be transferred onto the fixed network via Wi-Fi and femtocells by 2015.²⁴ Currently Wi-Fi accounts for over 98% of the mobile data offloaded, a proportion that will remain above 90% even assuming a higher take-up rate for femtocells, which re-use carrier frequencies at low power.

The growing importance of unlicensed spectrum for reducing network congestion and boosting consumer welfare is evident in the recent surge in carriers embracing Wi-Fi:

- AT&T Wireless gives its customers access to at least 30,000 Wi-Fi hotspots and an increasing number of Wi-Fi “hot zones” in congested areas including Times Square and

²¹ *Connected Life Market Watch*, Cisco IBSG, at 5 (2011).

²² *New Chapter for Mobile*, Cisco IBSG, at 5 (2011).

²³ John Leibovitz and Robert Alderfer, “Demand for Mobile Broadband,” FCC Blog, Feb. 10, 2011.

²⁴ Juniper Research, “Relief Ahead for Mobile Data Networks as 63% of Traffic to Move Onto Fixed Networks via Wi-Fi and Femtocells by 2015,” April 19, 2011; available at <http://www.marketwire.com/press-release/relief-ahead-mobile-data-networks-as-63-traffic-move-onto-fixed-networks-via-Wi-Fi-femtocells-1503808.htm>

stadiums such as Chicago's Wrigley Field. Consumers made 107 million connections of AT&T's Wi-Fi network just in the third quarter of 2010, more than in all of 2009.²⁵

- A consortium of major cable companies – Comcast, Cablevision and Time Warner Cable – have blanketed the New York City area with a shared Wi-Fi network and are extending the model in other congested areas along the East Coast and beyond.
- Towerstream deployed a Wi-Fi network of more than 1,000 base stations, covering seven square miles of New York City, and leasing access to wireless carriers and other companies seeking more ubiquitous bandwidth.²⁶
- Japanese telco KDDI is building out a Wi-Fi network of 100,000 hot spots that will integrate seamlessly with its licensed 4G network to proactively reduce congestion and improve speeds for consumers.²⁷

Enabling Innovation and the 'Internet of Things'

Unlicensed spectrum as a public resource increasingly serves as an incubator of wireless innovation. In their 2011 study, Stanford economists Milgrom, Levin and Eilat observed that “the primary benefits of unlicensed spectrum may very well come from innovations that cannot yet be foreseen. The reason is ... that unlicensed spectrum is an enabling resource. It provides a platform for innovation upon which innovators may face lower barriers to bringing new wireless products to market.”²⁸ One of the primary areas where unlicensed, particularly TV white space spectrum, will have a huge positive impact on many sectors of the economy as an innovation

²⁵ PR Newswire, “Third-Quarter Wi-Fi Connections on AT&T Network Exceed Total Connections for 2009,” Press Release (2010, October 22), available at <http://www.prnewswire.com/news-releases/third-quarter-wi-fi-connections-on-attnetwork-exceed-total-connections-for-2009-105520733.html>

²⁶ Alan Weissberger, “Metro Wi-Fi Reborn: City Wide Mega-Hot Spot for Mobile Data Offload,” IEEE, May 29, 2011, available at <http://community.comsoc.org/blogs/ajwdct/metro-Wi-Fi-reborn-city-wide-mega-hot-spot-mobile-data-offload>

²⁷ Stacey Higginbotham, “Wi-Fi: it's the other cell network,” GigaOm, July 1, 2011; available at <http://gigaom.com/broadband/wi-fi-its-the-other-cell-network/>

²⁸ See Paul Milgrom et al, *The Case for Unlicensed Spectrum* (Oct. 2011), at p. 2

platform is wireless machine-to-machine communication. Energy monitoring, environmental monitoring and controls, mobile health care monitoring, industrial automation, intelligent transportation networks, control systems (for agricultural machinery, toll booths, traffic lights) are all rapidly gaining users as costs decline.²⁹ Ericsson has estimated there will be 50 billion connected devices by 2020, leading increasingly to what some already call an “Internet of Things.”³⁰ As the as the President’s Council of Advisors on Science and Technology (PCAST) observed in their recent report and recommendations, by 2020 “the connected device market is expected to be dominated not by mobile phones, as it is today, but by machine to machine (M2M) devices – as many as 50 billion of them by some estimates.”³¹

One reflection of how open, unlicensed access to spectrum lowers the barriers to entry and innovation is the proliferation of new device certifications on these bands – a trend that could mushroom once the Commission establishes more certainty about the availability of substantial unlicensed 600 MHz spectrum in every market nationwide. Far more devices have been certified to use the 2.4 GHz unlicensed band (20,339 by one recent count) than in any other band (the FM band was second with 7,275 devices certified). From wireless local area networks (WLAN) to metro area Wi-Fi networks, Wi-Fi chips have ended up in everything from smartphones and laptops, to portable media players, TVs and cameras,³² and even bathroom scales.³³ From 2005 to 2008, nearly 1 billion Wi-Fi chipsets were sold.³⁴ By 2010, Wi-Fi

²⁹ See Richard Thanki, *The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet* (June 2012), at p. 65

³⁰ Hans Vestberg, President and CEO, Ericsson, Address to Shareholders, April 13, 2010, available at <http://www.ericsson.com/thecompany/press/releases/2010/04/1403231>.

³¹ President Council of Advisers on Science and Technology, *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, Report to the President, July 2012, at 41.

³² Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum* (Sept. 2009), at p. 19; <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020039036>.

³³ <http://nexus404.com/Blog/2009/07/28/withings-wiscale-wi-fi-bathroom-scale-monitor-your-weight-loss-and-body-fat-using-iphone-app/>.

³⁴ Represent an estimate based on Wi-Fi chipsets sales reported by Wi-Fi Alliance.

shipments grew to 761 million products – a 29 percent increase from 2009.³⁵ This growth is likely to continue, with sales likely to exceed 1.5 billion devices a year by 2014.³⁶ Unleashing an abundance of spectrum and driving down its cost as an input for all things mobile is therefore the single best means by which Congress, the Administration and the Commission can promote innovation and consumer welfare in wireless.

A policy that attempts to meet this surging demand by relying *solely* on clearing and auctioning exclusive licenses that fit the current business model of commercial wireless carriers would be shortsighted and sacrifice future U.S. innovation and competitiveness. Despite the overall abundance of unused spectrum capacity,³⁷ even in major cities, there is a looming limit to the number of frequency bands below 3 GHz that can be reallocated, by auction or otherwise, to exclusively licensed use. As a result, while the traditional carrier business model will demand more and more exclusive-use spectrum in the short-run to meet surging mobile data demand, it should be equally clear that this model is not sustainable longer term, just as the PCAST concluded with respect to already-occupied Federal spectrum.³⁸

Martin Cooper, leader of the team at Motorola that invented the first mobile phone, has calculated that frequency re-use is responsible for roughly 64 times more improvement in total wireless utilization over the past 45 years than any improvement attributable to making more

³⁵ Wi-Fi Alliance, “Wi-Fi® expands as the center of leading-edge technologies in 2011,” Press Release, Jan. 6, 2011; available at http://www.wi-fi.org/news_articles.php?f=media_news&news_id=1035.

³⁶ Thanki, *supra* note 9, at p. 18.

³⁷ Actual spectrum measurement studies have demonstrated that even in the most valuable “beachfront” frequencies below 3 GHz, the vast majority of frequency bands are not being used in most locations and at most times. Spectrum measurement studies by the New America Foundation, by Shared Spectrum Company, the Illinois Institute of Technology and others show that even in Manhattan and in Washington near the White House, less than 20 percent of the frequency bands below 3 GHz are in use over the course of a business day. Spectrum usage rates are, of course, far lower in suburban and rural areas.

³⁸ “PCAST finds that clearing and reallocation of Federal spectrum is not a sustainable basis for spectrum policy due to the high cost, lengthy time to implement, and disruption to the Federal mission.” President Council of Advisers on Science and Technology, *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, Report to the President, July 2012, at vi.

spectrum available.³⁹ While the FCC estimates that “mobile data demand is expected to grow between 25 and 50 times current levels within 5 years,” the total number of wireless industry cell sites grew only 14% over a recent two-year period.⁴⁰ There are practical limits to how close carriers can bring their owned infrastructure (transmitters and backhaul) to the individual consumer. As demand for mobile data increases, the industry’s cell site bottleneck is a very real constraint and cost that limits the spectrum efficiency of the dwindling number of prime frequency bands that can be auctioned for exclusive use.

Rural WISPs need unlicensed White Space spectrum to expand coverage

The nation’s more than 2,000 WISPs serve more than two million mostly rural and small-town homes, businesses and first responders throughout the country. WISPs, as well as hundreds of Rural Local Exchange Carriers (RLECs), rely primarily on unlicensed spectrum to extend Internet connectivity to unserved and underserved areas – and have long advocated access to the TV White Space because the unique propagation qualities allow it to cover far larger rural areas at lower cost. The ability of WISPs to access unlicensed spectrum without competitive bidding eliminates a significant barrier to entry, thereby benefiting consumers who would not otherwise have access to fixed broadband services.

Unfortunately, according to WISP operators, the uncertainty stemming from incentive auction legislation is already deterring investments and deployments by WISPs in unserved rural areas. For example, a WISP called RCorn applied for and received an experimental license to deploy on TV white space channels in Kearney and Grand Island, Nebraska, where it already has 3,500 customers for fixed wireless broadband service over unlicensed (using the 2.4 GHz and 5

³⁹ Martin Cooper, “Cooper’s Law,” ArrayComm, available at <http://www.arraycomm.com/serve.php?page=Cooper>

⁴⁰ According to CTIA data collected by the Commission, during a two-year period after June 2007, total cell sites increased just 14% (from approximately 210,000 to 246,000). See Federal Communications Commission, *Mobile Broadband: The Benefits of Additional Spectrum*, Omnibus Broadband Initiative, Technical Paper No. 6, at pp. 2, 5 (Oct. 2010) (“OBI Paper”), at 12-13, Exh. 8.

GHz bands). RCom's CEO, Russ Hillard, told the FCC that the 900 MHz unlicensed band is fully occupied by farmers, who use it to control tractors, combines and irrigation systems; and the 2.4 GHz unlicensed band is increasingly noisy due to heavy residential use. RCom tries to make due with 5 GHz unlicensed, but with its superior propagation for rural areas, the TV white space spectrum would both reduce the cost of rural broadband service and greatly improve the quality. Despite receiving an experimental license for the wide-open TV bands, RCom put a hold on any further investment until TV white space unlicensed gear is available.

B. Unlicensed Access to TV White Space is a Complementary Platform for Innovation, Economic Growth and Spectrum Efficiency that Requires a Minimum Amount of Spectrum in Every Market Nationwide

Despite the uncertainties surrounding incentive auction legislation, investments in a wide variety of unlicensed devices and services on the TV White Space spectrum has been advancing since the FCC's initial Order in November, 2008, with substantial fixed broadband deployments and mass marketing of devices expected early this year. The sort of fixed, higher-power base stations used by WISPs in rural areas are going into large-scale production and available soon from several start-up manufacturers. In addition, a variety of standards setting groups are completing new variations of the IEEE 802.11 Wi-Fi standard to take advantage of the superior TV band propagation characteristics. For example, the 802.22 standard has been finalized and supports the sort of higher-power wide area network deployments in demand by WISPs, whereas the 802.11af standard, expected to be finalized by next year, enables low-power personal/portable devices and may be the most widely adopted standard as it is built into smartphones, tablets and other mobile computing devices.

After the Commission unanimously adopted the White Space Order in 2008 and again in 2010, a number of technology companies, cities, universities, utilities, hospitals and other innovators sought experimental licenses to begin testing and demonstrating how “Super Wi-Fi” using the low-frequency spectrum in the TV bands could take unlicensed technologies to the next level. These demonstrations have included:⁴¹

- 1) **Fort Pickett National Guard Base** – Last September, 2012, Nottoway County, Virginia became the first FCC certified TVWS rural broadband deployment. One of the nation’s small business WISPs is using TVWS to extend connectivity to this heavily forested and mostly unserved area, including at the Fort Pickett Army National Guard base.
- 2) **Smart City Deployment: Wilmington, North Carolina** - The city is currently relying on white space technology for its "Smart City" initiative, the nation’s first FCC-certified TV white space deployment. The permanent deployment provide Wi-Fi access for public safety and citizens in public areas, as well as taking advantage of the propagation characteristics of TV band spectrum for applications that include remote monitoring and management of wetland areas; real-time traffic monitoring to reduce congestion, fuel consumption and travel time; to remotely monitor and manage public facilities; and to support local law enforcement during emergency situations.⁴²
- 3) **Rural Unserved Area Deployment: Claudeville, Virginia (population 916)** – Remote Claudeville, in southern Virginia, never had a broadband connection until Dell, Microsoft and Spectrum Bridge teamed up, using an experimental license on vacant TV channels. A white space backhaul solution has effectively brought broadband access for the first time ever to this town where only dial-up Internet access existed until 2009.⁴³
- 4) **Smartgrid Deployment: Plumas California** – The Plumas-Sierra Rural Electric Cooperative launched the nation’s first “Smart Grid” wireless network trial while simultaneously providing broadband access to the local communities. The Plumas “Smart Grid” wireless network delivers real-time broadband connectivity allowing

⁴¹ More on these and other examples are on the website of the Wireless Innovation Alliance (WIA), a consumer and high-tech company coalition, at <http://wirelessinnovationalliance.com/>; and were previously included in testimony by Harold Feld, House Subcommittee on Communications, Technology and the Internet, June 1, 2011.

⁴² Nate Anderson, *Wilmington, NC Takes White Spaces to Swamp, Ballparks*, *Ars Technica*, Feb. 24, 2010, available at <http://arstechnica.com/tech-policy/news/2010/02/wilmington-nc-takes-white-spaces-to-swamp-ballparks.ars>.

⁴³ Nate Anderson, (2009, October 21) *First White Space Broadband Deployment in Small Virginia Town*, *Ars Technica* (Oct. 21, 2009); retrieved May 28, 2011 from <http://arstechnica.com/tech-policy/news/2009/10/first-white-space-broadband-deployment-in-small-virginia-town.ars>.

system operators to manage the electrical system remotely, request critical data from the substations, manage directed power flow, and protect the systems and employees while maintaining the local grid.⁴⁴

- 5) **Connectivity for Rural College Communities** – Last June, 2012, AIR.U (Advanced Internet Regions University), a coalition of higher education associations representing over 500 colleges and universities, announced an initiative using TV white space spectrum that would bring high-speed broadband to colleges and universities with limited existing service. An initial deployment at West Virginia University is scheduled for installation in February 2013.
- 6) **Hospital Campus Deployment: Logan, Ohio (population 6,704)** - The world's first white space broadband network trial for healthcare providers was launched here, enabling broadband access throughout the hospital, including patient rooms, waiting areas, cafeteria, and meeting rooms.⁴⁵
- 7) **Public Safety and Tribal Deployment: Yurok Reservation, California** – Until recently the Yurok Reservation in Arcata – California's largest Native American tribe – made due with a single T1 line and connections slower than dial-up. The reservation spans 44-miles of mountainous, heavily forested land presenting many signal obstacles, terrain tailor-made for TV band spectrum, which covers larger areas and penetrates foliage far better than obstructs Wi-Fi at 2.4 GHz. By leveraging its primary public safety use, 70 to 80% of the tribal community now has access to plug and play broadband over White Space spectrum.⁴⁶
- 8) **Low-Income Housing Deployment: Houston, Texas** – Rice University researchers, with a grant from the National Science Foundation, were able to modify an off-the-shelf Wi-Fi card to use TV white space spectrum to achieve point-to-point transmission distance of one mile (compared to its original 400 to 500 feet), allowing affordable broadband connectivity to low-income residents who previously had no broadband.⁴⁷

44 Spectrum Bridge (2010, June 23) *Nation's First "Smart Grid" White Spaces Network Trial* [Press release]. Retrieved from http://www.spectrumbridge.com/news/pressreleases/10-06-23/Nation_s_First_%E2%80%9CSmart_Grid%E2%80%9D_White_Spaces_Network_Trial.aspx.

45 Business Wire, *TV White Spaces Delivering Enhanced Broadband Access and Telemedicine Applications to Healthcare Providers*, Press Release, Sept 14, 2010, available at <http://www.businesswire.com/news/home/20100914005980/en>

46 Carlson Wireless, "California's Largest Tribe Deploys First White Space Broadband for Remote Public Safety Environment," Press Release (June 10, 2011), available at http://www.carlsonwireless.com/about/press-release.php?subaction=showfull&id=1307731549&archive=&start_from=&ucat=1

47 Nate Anderson, *Extending Wi-Fi to one mile, thanks to empty TV channels*, Ars Technica, April 26, 2011, available at <http://arstechnica.com/tech-policy/news/2011/04/extending-Wi-Fi-to-one-mile-thanks-to-empty-tv-channels.ars>

- 9) **Super Wi-Fi Network Trials: Cambridge, England** – Over a year-long period (2011-12) Microsoft led a consortium of 14 firms, including the BBC, British Sky Broadcasting, BT, Nokia, and Samsung, to begin trials on a wireless hotspot network using the freed-up TV channels that the UK, following the U.S. lead, is reallocating for unlicensed use.⁴⁸

II. DESIGNATING SUBSTANTIAL GUARD BANDS FOR CONTIGUOUS UNLICENSED USE NATIONWIDE IS BOTH NECESSARY TO PROTECT LICENSED SERVICES AND SERVES THE PUBLIC INTEREST IN ENSURING NATIONAL MARKETS AND SPURRING UNLICENSED INNOVATION

PISC strongly supports 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.⁴⁹ Since Congress in the Spectrum Act explicitly authorized the Commission’s discretion to allocate any “technically reasonable” guard bands for unlicensed use,⁵⁰ the Commission should do so absent any compelling evidence why permitting low-power unlicensed operations in all or any feasible portion of the guard bands would cause harmful interference to primary licensed services in adjacent or nearby bands. Very substantial guard bands (including possible need for a duplex gap⁵¹) are clearly and objectively necessary to avoid interference between the contemplated high-power uses – and adding remainder spectrum to the guard bands to further reduce the risks of interference (and to reduce handset costs for consumers) is clearly in the public interest. Allowing unlicensed use of the guard bands, subject to the same technical rules that currently govern white space devices in general, will yield additional and compelling public interest benefits.

⁴⁸ Andrew Parker and Paul Taylor, “Microsoft steps into the spectrum space race,” *Financial Times*, June 26, 2011, available at <http://www.ft.com/cms/s/0/09864858-a02a-11e0-a115-00144feabdc0.html#ixzz1QQ2BjS7V>

⁴⁹ *Incentive Auction NPRM*, at ¶ 234.

⁵⁰ See Spectrum Act § 6407(b).

⁵¹ For the remainder of this section, we use the term “guard bands” to mean any protection zone between high-power licensed services in the band, including both guard bands and a potential duplex gap between uplink and downlink channels, which the *NPRM* discuss separately.

First, since unlicensed guard band channels would be available in every DMA, the very largest metropolitan markets that now have few if any white space channels available for unlicensed use (*viz.*, Los Angeles, New York City) would have some guaranteed availability (assuming that no other service, such as wireless microphones, is permitted to block or interfere with low-power unlicensed use). Ensuring a substantial amount of unlicensed spectrum on a nationwide basis will prove critical for developing markets with scope and scale for new, innovative and affordable “Super WiFi” chips, devices, applications and services. The WiFi standard has proven an unparalleled economic boon to both the wireless and wired broadband ecosystems, but it never would have flourished without availability of a substantial and predictable amount of bandwidth in every market nationwide (and, increasingly, worldwide). As the Commission concludes in Section VIII of the *NPRM*, by ensuring that a substantial amount of unlicensed spectrum “will be available on a nationwide basis,” this “will help to create certainty for the unlicensed industry and promote greater innovation in new services, including increased access for broadband services across the country.”⁵²

A second compelling public interest benefit is the opportunity to have *contiguous* and ideally wide-channel unlicensed spectrum available nationally, or at least regionally, in the 600 MHz band. Unlike other unlicensed bands, no current TV white space channel is contiguous on either a national or regional basis. 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, M2M and other valuable deployments. Nonetheless, a contiguous block of unlicensed spectrum could – together with substantial availability in every DMA – spur deployment of unlicensed technologies. For example, many widely-dispersed M2M networks

⁵² *Incentive Auctions NPRM*, at ¶ 239.

(smartgrids, health monitoring, farm management networks) would be far more cost-effective to deploy if they could rely on a consistent frequency network in every location they are deployed.

A third compelling public interest benefit is the opportunity for easier data offloading from LTE networks to “Super WiFi” links with longer-distance and more reliable connections to wireline backhaul. As noted in the section above, WiFi operating primarily on the 2.4 GHz band is offloading a rapidly increasing share of total wireless data traffic *despite* capacity and propagation constraints. The integration of WiFi with access to more spectrum with diverse propagation characteristics (600 MHz, 2.4 GHz, 5 GHz) offers – because of intensive small cell spectrum re-use – the potential to carry far more mobile device data traffic than the spectrum that will be auctioned in the 600 MHz band. The benefits of unlicensed small cell access as complements to licensed networks and to enhance the speed and bandwidth of consumer use are likely to be enhanced further if the Commission’s ultimate band plan puts unlicensed spectrum in a wide duplex gap between LTE uplink and downlink channels, as the *NPRM* describes as part of its alternative band plan in section VI.⁵³

A. Any Guard Bands Between Licensed Services Should be Designated for Unlicensed Use on a Contiguous, Nationwide Basis

As noted just above, PISC believes that the compelling public interest benefits of ensuring substantial access to unlicensed spectrum in the 600 MHz band nationwide will be magnified to the degree that the guard band (and/or duplex gap) spectrum is contiguous nationwide. PISC therefore strongly supports the Commission’s proposal to “keep the downlink spectrum band consistent nationwide” which, under the 600 MHz band plan tentatively proposed in the *NPRM*, would result in a uniform unlicensed guard band of 6 to 10 MHz between the

⁵³ *Incentive Auctions NPRM*, at ¶¶ 166-167.

auctioned uplink band and remaining television stations lower in the current UHF band.⁵⁴

However, PISC strongly opposes the Commission's proposed band plan to the extent that it "allow[s] variations in the amount of uplink spectrum available in any geographic area."⁵⁵ In general, consumers, wireless market competition and the public interest will benefit more from *contiguous* unlicensed guard bands reflecting a nationally uniform band plan that promotes device interoperability. The Commission's proposal to squeeze out odd lots of extra unpaired uplink spectrum that varies market-by-market across the country appears to be an attempt to raise an extra increment of revenue at the expense of undermining the potential long-term value of the band *as an ecosystem* for consumers and innovators alike.

There are several reasons why the Commission's band plan should define nationally uniform downlink *and* uplink bands for auction that avoid interference with guard bands that are designated for low power unlicensed use and *contiguous nationwide*:

First, contiguous guard bands will magnify the value of unlicensed services for all consumers and for a wide array of businesses that will take advantage of this spectrum not only for broadband, but for an unimaginable array of new machine-to-machine innovation and productivity enhancement. Substantial guard bands will help to ensure that a sufficient amount of spectrum is available for unlicensed use nationwide, which is critical to sustaining markets for chips, devices, applications and services with the scope and scale to spur investment in widespread deployment and availability of "Super WiFi." In addition to the benefits of substantial but discontinuous access, predictable access to the equivalent of four, five or six *contiguous* unlicensed channels nationwide will stimulate innovation and investment in the unlicensed economy to a considerably greater degree. Although presently discontinuous white

⁵⁴ *Id.*, at ¶ 124.

⁵⁵ *Id.*

space will be used productively, an entirely different level of innovation and cost-effective services could be enabled by the ability to build devices (particularly a wide variety of low-cost M2M devices and networks) that could operate on a few pre-set channels – or have consistent access to 12 or 18 MHz of contiguous spectrum – almost everywhere. PISC believes that a thriving unlicensed economy energized by substantial and contiguous spectrum below 1 GHz nationwide will yield a far larger and longer-lived benefit for consumers than some odd-lot uplink spectrum that will only be attractive to supplement the capacity of the two or three largest carriers with established paired-block networks.

Second, as the *NPRM* concedes, the industry’s need to “support multiple band plans would increase the cost, size, and/or complexity of these devices.”⁵⁶ The Commission notes that “each band plan requires a different design of the filters and/or duplexers in user equipment, such as mobile devices.”⁵⁷ Thus, “manufacturers would need to create separate duplexers for different markets or risk interference in areas where we cleared less spectrum for wireless use.”⁵⁸ What this means in practice is a more severe repeat of what has already occurred post-auction in the 700 MHz band: a lack of device interoperability that is leveraged by the two dominant wireless carriers to kill competition and consumer choice. The Commission’s penny-wise notion of squeezing out odd lots of broadcast spectrum for auction will in all likelihood harm consumers and the public interest by ensuring that potential market entrants and competitive carriers lacking national scope and scale will lack access to the latest, best and most cost-effective chips and devices (just as they lack them now) since those will be prioritized for the distinct band plan families acquired by the two dominant carriers.

⁵⁶ *Incentive Auctions NPRM*, at ¶ 161.

⁵⁷ *Id.*

⁵⁸ *Id.*

Finally, we note that the *NPRM* includes no analysis of the interference impact on broadcasting and television reception if high-power wireless operations and high-power broadcasters are interleaved and operate co-channel on a market-by-market basis. The success of the incentive auction to optimize the current TV band spectrum for all three services – for television, cellular mobile services and unlicensed use – will depend on a considerable degree of predictability and trust. Unlicensed operations are in their infancy on TV white space frequencies, and the sort of uncertainty generated by contingent and discontinuous band plans (which the *NPRM* describes charitably as “flexible”) could undermine the enormous consumer and public interest benefits of this new service. Although we do not have the technical information we would need to conclude that discontinuous band plans by local market could work or not work, it certainly suggests the need for early and extensive interference testing to ensure that the proposed band plans are viable in practice.

B. Current Technical Rules for White Space Devices Should Apply to the Unlicensed Guard Bands to Help Spur National Markets by Ensuring a Sufficient Amount of Compatible Shared Spectrum in Every Market

The Commission requests comment on whether the existing power and emission limits that govern white space devices operating on vacant TV channels “are appropriate for unlicensed operation in the guard band spectrum to protect licensed operations” and also whether the TV Bands Database can be used to govern unlicensed access to the guard bands.⁵⁹ Although we do not claim to have sufficient information at this time about the interaction at the boundaries between very low-power white space TVBDs and high-power LTE operations, PISC urges the Commission to impose power, emission and other technical requirements on unlicensed use of the guard bands that are as consistent as possible with the rules that apply to operation in vacant

⁵⁹ *Id.* at ¶¶ 235-236.

TV channels. For example, if a guard band is 8 MHz (consistent with the Commission’s proposal to enhance 6 MHz guard bands with remainder spectrum), then it could well be better to permit unlicensed operation in the middle 6 MHz of the guard band at 100 milliwatts (or even at 40 milliwatts) rather than impose a lower power limit across the entire 8 MHz (e.g., 30 mW) that would be inconsistent with unlicensed operation in the remaining TV band spectrum (and channel 37). As explained above, a large portion of the public interest benefit of designating the guard bands for unlicensed access is to achieve a critical mass of unlicensed bandwidth in the largest urban markets that currently have an insufficient number of white space channels.

III. ALLOWING SHARED, UNLICENSED USE OF CHANNEL 37 OUTSIDE PROTECTION ZONES PROMOTES SPECTRUM EFFICIENCY AND NATIONAL MARKETS FOR UNLICENSED DEVICES AND SERVICES

The Commission “propose[s] to make channel 37 available for unlicensed use, while protecting WMTS and the Radio Astronomy Service.”⁶⁰ PISC strongly supports this proposal. As the *NPRM* observes, “there are relatively few radio astronomy operations, all at specified locations,” and, as required under existing rules, the “locations of WMTS operations [are] registered with the American Society for Healthcare Engineering (ASHE).”⁶¹ As a result, whether or not the Commission ultimately determines that one or both of these incumbent services can transition out of channel 37 in the future, PISC agrees that with the TV Bands Database already certified and capable of fully protecting these fixed primary incumbent operations, there is no reason why the unused portions of channel 37 should not be made available for unlicensed use, subject to the same TV White Space rules that already protect broadcasters and licensed wireless microphone reservations.

⁶⁰ *Incentive Auctions NPRM*, at ¶ 237.

⁶¹ *Ibid.* “ASHE is the Commission’s designated frequency coordinator for WMTS and maintains the database of registered devices.” *Id.*

A. Channel 37 Should be Made Available for General Unlicensed Use in Areas and at Times not Specifically Reserved to Protect Incumbent Services Vulnerable to Interference

Protecting incumbent RAS and WMTS operations through registration in the TV Bands Database will impose no additional burden or risk on these licensees, but will put fallow spectrum to productive use and create tremendous potential benefits for unlicensed services. As the *NPRM* confirms, the 13 radio astronomy sites making RAS observatories on channel 37 are fixed and well-defined with respect to the exclusion zones that would need to be enforced through the TV Bands Database. Protection zones for RAS observatories are already defined as limits on unauthorized WMTS operation within a certain distance of RAS observatories and, through the TV Bands Database, “unlicensed white space device operation is prohibited within 2.4 km of protected radio observatories.”⁶² Similarly, WMTS operations are restricted to fixed indoor use and are required to register their location with the ASHE coordination database, which reports 2,739 locations registered for operations in channel 37 as of March 2012.⁶³ The registrations already collected and coordinated by ASHE can simply be made available to one or more of the TV Bands Database administrators.

Because both RAS observatories and WMTS devices are fixed and static, it should be straightforward to define and enforce exclusion zones using the TV Bands Database. PISC notes that just last month the Commission proposed a rulemaking that would extend the TV Bands Database concept to govern opportunistic access to the 3550-3650 band,⁶⁴ expressing confidence

⁶² *Incentive Auction NPRM*, at ¶ 203. (“Our rules protect RAS in three ways from harmful interference caused by these services. First, our rules prohibit transmission by unlicensed white space devices on channel 37.³⁰³ Second, in addition to the general out-of-band emission (OOBE) limits for unlicensed white space devices, our rules prescribe stricter field strength limits in the 602-620 MHz band.³⁰⁴ Third, unlicensed white space device operation is prohibited within 2.4 km of protected radio observatories.”)

⁶³ *Incentive Auction NPRM*, at ¶ 210.

⁶⁴ *In the Matter of Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, GN Docket 12-354 (rel. Dec. 12, 2012) (“Small Cell Use in the 3.5 GHz Band NPRM”).

that geolocation database technology is currently capable of enforcing exclusion zones not only for Fixed Satellite Service earth stations, but also for non-fixed military radar systems. The Commission's *Small Cell Use in the 3.5 GHz Band* NPRM states:

We believe that current database technology can be used to achieve dynamic frequency assignment while mitigating interference between devices in the same frequency band. . . . We propose that Citizens Broadband Service devices would be required to utilize integrated geo-location technology and be able to access a database that identifies incumbent users entitled to interference protection, including DoD radar and FSS earth stations.⁶⁵

While opportunistic unlicensed access to the unused portions of channel 37 appears to have no substantial downside for incumbents, there are important public interest benefits to putting this currently fallow spectrum to work. As discussed above with respect to the unique value of unlicensed guard bands, the potential value of unlicensed innovation and services in the current UHF band will be magnified if the Commission ensures a substantial amount of white space in every market and particularly if a number of these channels are contiguous nationwide. Unlicensed access to channel 37 greatly advances both of these compelling needs, since at least personal/portable devices would have access to that channel in every urban area. In New York City, where the public look-up function on the TV Bands Database administered by Spectrum Bridge indicates the availability of only a single channel in Manhattan (channel 49), even temporary exclusion zones around certain medical facilities would permit operation on one additional channel (channel 37) in most areas.

B. Protection Zones for Radio Astronomy Services (RAS) Can be Enforced Through the TV Bands Database and Also Permit Parties to Negotiate Additional Use

⁶⁵ *Ibid.* at ¶¶ 58, 96.

As noted above, the 13 fixed and relatively remote sites dedicated to RAS observatories can be protected from interference by defining protection zones enforced by the TV Bands Database. This would be little different than current rules, which already rely on the TV Bands Database to deny permission to white space devices to operate in channel 37 – or to operate at all within 2.4 km of protected radio observatories.⁶⁶ In addition, as the *NPRM* notes, white space devices must observe stricter field strength limits in the 602-620 MHz band to provide RAS with additional protection.⁶⁷

PISC also proposes that the Commission adopt the same flexibility for potential authorized access to the RAS protection zones, for individual unlicensed operations, that currently apply to the separation distances that restrict WMTS operations in the band. As the *NPRM* notes, a WMTS operator can seek and receive written permission from the director of an affected observatory to operate inside an RAS protection zone.⁶⁸ We suggest that this coordination option be available to unlicensed operators as well, since there could well be certain fixed unlicensed services within the protection contour (e.g., a nearby WISP or very low-power machine-to-machine network on a farm or ranch) that could demonstrate they pose no threat to the observatory's mission but do provide valuable benefits to its surrounding community.

C. Wireless Medical Telemetry Devices Should Transition Off the Band and Can be Protected Through the TV Bands Database During any Necessary Transition and Relocation Period

Although PISC is not able to offer any technical insight into the appropriate time frame and process for relocation of WMTS operations off of channel 37, we believe that a generous transition period (e.g., three to five years) should be adequate to both reduce the cost and any

⁶⁶ *Incentive Auction NPRM*, at ¶ 203, citing § 15.707(a) and § 15.712.

⁶⁷ *Ibid.*, citing § 15.709(c)(4).

⁶⁸ *Id.*, citing § 95.1119 (requiring written concurrence by the director of the affected observatory before operating WMTS within the vicinity of radio astronomy observatories in the 608-614 MHz band).

potential disruption concerning the retuning or replacement of equipment that would still have a substantial useful life at the end of the transition period. Although the Spectrum Act limits total reimbursements to \$300 million –less than the current replacement cost estimated by ASHE of registered WMTS equipment in service in channel 37 – at the end of a relatively long transition period today’s devices will likely have depreciated to the point that reimbursement will be feasible.

At a minimum, PISC supports the suggestion that new WMTS registrations for use of channel 37 should be frozen immediately – and required to rely in the future on the other two WMTS bands, as well as on the many unlicensed and other bands used by medical radio devices today.⁶⁹ The Commission has frozen new incumbent assignments in similar circumstances where a reallocation is being considered to accommodate more intensive or efficient use of a band.⁷⁰ Whether or not the Commission determines that it is feasible to use the Spectrum Act reimbursement fund to set a deadline for a near-term WMTS transition off channel 37, a freeze on new registrations is essential both to reduce the potential cost of transition and to ensure the viability of any potential long-term transition of WMTS. A freeze on new registrations would give the Commission time to determine, perhaps through a separate public notice, whether 1395-1400 MHz and 1427-1432 MHz bands already assigned to WMTS on a protected basis would

⁶⁹ In its recent Order allocating dedicated spectrum for Medical Body Area Networks, the Commission observed that its rules permit medical radio devices to operate unlicensed on many other frequencies. *See In the Matter of Amendment of the Commission’s Rules to Provide Spectrum for the Operation of Medical Body Area Networks*, First Report and Order and Further NPRM, ET Docket 08-59, adopted May 24, 2012, at 6464, n. 9 (“Among the frequencies used by medical radio devices on an unlicensed basis under Part 15 of our rules are the 9-315 kHz, 13.553-13.556 MHz (13 MHz ISM band), 174-216 MHz (TV channels 7-13), 218-222 MHz, 293-320 MHz, 410-450 MHz, 512-608 MHz (TV channels 14-36), 614-668 MHz (TV channels 38-46), 902-928 MHz (915 MHz ISM band), and 2400-2483.5 MHz (2.45 GHz ISM band) bands. Certain medical devices also operate on an unlicensed basis using inductive techniques at low frequencies. *See* 47 C.F.R. §§ 15.241 and 15.242.”).

⁷⁰ *See, e.g., In the Matter of Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, FCC 12-148, GN Docket No. 12-354 (rel. Dec. 12, 2012 (imposing freeze on new earth stations in the 3600-3650 MHz band); Public Notice, *Wireless Telecommunications Bureau and Public Safety and Homeland Security Bureau Suspend the Acceptance and Processing of Certain Part 22 and 90 Applications for 470-512 MHz (T-Band) Spectrum*, DA 12-643 (rel. Apr. 26, 2012) (“T-Band Freeze Notice”).

meet the industry’s needs, especially as the industry shifts more toward other options that allow or require the use of spectrum outside channel 37, such as Medical Body-Area Networks (MBANs). More broadly, a freeze on new registrations within channel 37 would also minimize the amount of unlicensed spectrum that would be blocked off due to the enforcement of WMTS protection contours, which will be critically important in alleviating the increasing congestion in urban areas around registered hospitals and other medical facilities.

Finally, with respect to the ability of the TV Bands Database to protect WMTS operations in channel 37, the *NPRM* notes that ASHE believes there are additional WMTS devices and locations that have not registered.⁷¹ However, it should not be considered burdensome to require that they come into compliance with the Commission’s rules if they believe they need greater certainty with respect to interference protection.

IV. WIRELESS MICROPHONES SHOULD RELY WHEREVER POSSIBLE ON NON-WHITE SPACE CHANNELS AND THE TWO CHANNELS RESERVED FOR UNLICENSED MICROPHONES SHOULD BE AVAILABLE FOR GENERAL UNLICENSED USE WHEN NOT RESERVED

A. Wireless Microphone Operations Currently Do Rely and Should Rely Primarily on the Many Unused Local TV Channels *Not* Available for Use by Unlicensed White Space Devices

In the television White Spaces proceeding, the Commission sought to ensure that “a limited but substantial number of wireless microphones can be operated on any basis without the potential for interference from TV bands devices.”⁷² In an abundance of caution, the Commission ensured that both licensed and unlicensed microphones had multiple TV channels

⁷¹ *Incentive Auction NPRM*, at ¶ 210 n.318.

⁷² *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket Nos. 04-186 and 02-380, Second Memorandum Opinion and Order, 25 FCC Rcd 18661, 18671-18677, ¶ 12 (2010) (“*TV White Spaces Second MO&O*”).

available at their venue that could accommodate dozens of microphones (which operate on far narrower, 200 khz channels). Two TV channels were reserved exclusively for use by unlicensed microphones, as well as for the far smaller number of microphone operations licensed under Part 74.⁷³ In addition, licensed microphones are authorized to register any available channel at the location of their venue – including any unlicensed White Space channel (“TVWS channels”) – for protection in the TV Bands Database. Unlicensed microphones are authorized under Part 15 to operate on TVWS channels without interference protection. However, unlike licensed microphones, unlicensed microphones can request registration for exclusive use of a TVWS channel only by “certify[ing] that they are using the reserved channels and all other available channels from 7-51 (except channel 37) that are not available for use by TV band devices and are practicable for use by wireless microphones.”⁷⁴

Although the two exclusive channels and the option to reserve additional TVWS channels provide considerable space for microphones to operate without risk of interference from unlicensed broadband devices (TVBDs), microphones have effective access to a considerably larger number of non-TVWS channels that would more than meet their needs. The *TV White Spaces Second MO&O* made general reference to these additional channels several times:

The two reserved TV channels will accommodate a minimum of at least 16 wireless microphones, and the additional channels that are not available for TVBDs at most locations will accommodate many additional wireless microphones. . . . Such entities may consult with a TV bands database to identify the reserved channels at their location, as well as the TV channels that may not be available for TV band devices.⁷⁵

⁷³ *TV White Spaces Second MO&O* , at ¶ 14-15. See 47 C.F.R. §15.707(a) (prohibiting white space devices on the first channel above and the first channel below channel 37 that are available, or if a channel is not available above and below channel 37, prohibiting white space devices on the first two channels nearest to channel 37). See also 47 C.F.R. § 15.712(f)(2).

⁷⁴ *TV White Spaces Second MO&O* , at ¶ 15.

⁷⁵ *TV White Spaces Second MO&O* , at ¶ 14-15.

These “additional channels that are not available to TVBDs at most locations” are of two types: One category is the unoccupied TV channels below Channel 21 that are not available at all to mobile TVBDs and are available to fixed TVBDs (e.g., fixed wireless base stations and CPE) only in the rare (and mostly very rural) locations where three consecutive channels are vacant. For example, in New York City, the TV Bands Database indicates that at New York University only channel 49 is available for unlicensed white space devices.⁷⁶ In contrast, wireless microphones have exclusive use of channels 22 and 42. In addition, channels 5, 9 and 10 are “white space” channels that are available to microphones but are not available to unlicensed TVBDs (because personal/portable devices are prohibited below channel 21).

The second and far larger category of channels are those where wireless microphones have historically operated co-channel to broadcast stations in distant media markets. For example, in New York City a video production facility or Broadway theater should have little concern about receiving interference from over-the-air TV signals originating in Bridgeport, Connecticut (60 miles away) or possibly even Newark, New Jersey (11 miles). Indoor venues are particularly shielded from distant TV signals because of attenuation due to the structure – and even more so if the venue is at ground level (or effectively underground, in the case of most Broadway theaters). As noted in the *NPRM*, under current rules co-channel wireless microphone operations must be separated by a distance of at least 113 kilometers (70 miles) from the television transmitter,⁷⁷ although it appears that in practice (as noted below) many indoor microphone operators feel comfortable operating at considerably shorter separation distances.

While many of these broadcast co-channels regularly accommodate microphone operations, unlicensed white space devices are not permitted to transmit on these frequencies if

⁷⁶ Query made January 19, 2013 to live look-up function on the TV Bands Database administered by Spectrum Bridge (“Show My White Space”), available at <http://whitespaces.spectrumbridge.com/whitespaces/home.aspx>.

⁷⁷ *Incentive Auctions NPRM*, at ¶ 223, citing 47 C.F.R. § 74.802(b)(3).

they are within the artificial F(50,90) protection contours of the licensed TV stations. Indeed, the fact that unlicensed broadband devices are prohibited from using these co-channels appears to be one reason they are desirable to many professional microphone operators.

The microphone industry has recognized the utility of these distant-market co-channels and already facilitates their use. Shure Inc., the major wireless microphone manufacturer based in Chicago, maintains a public channel look-up database for its customers that identifies all the TV channels that are not occupied by local broadcasters. It also identifies the non-local broadcast co-channels, permitting a microphone user to sort these channels by separation distance. This allows a microphone venue to identify a channel that may be in use in distant Bridgeport, for example, but which is safe for local microphone operations *and* not available for use by any other unlicensed devices.

For example, at the Rockefeller Center in New York City (home to TV production facilities for NBC Universal), Shure look-up database shows that in addition to channels 22 and 42, which are reserved exclusively for microphones, there are 10 non-TVWS channels available with no broadcaster operating within 70 miles (the FCC separation distance); plus an additional 6 channels with no broadcaster operating within 50 miles; and yet another 4 channels with no broadcaster operating within 10 miles.⁷⁸ As noted on the summary table just below, these 22 channels are capable of accommodating as many as 374 microphones in a single location – although Shure’s look-up database recommends the use of about 7 or 8 per channel.

Reservations in the TV Bands Databases maintained by Spectrum Bridge and Telcordia show that use of both non-local and even local TV co-channels is indeed common practice. TV

⁷⁸ <http://www.shure.com/americas/support/tools/wireless-frequency-finder>

production facilities at the Rockefeller Center regularly reserve non-TVWS channels that are co-channel to distant (and not so distant) TV stations.⁷⁹ These reservations recently included:

- Channel 29 -- WFME -- West Milford, NJ (14 miles away)
- Channel 51 -- WNJN -- Montclair, NJ (13 miles away)
- Channel 30 -- WFUT -- Newark, NJ (11 miles away)
- Channel 44 -- WNYW -- New York, NY (0 miles away)
- Channel 31 -- WPXN -- New York, NY (0 miles away)

In fact, although the TV Bands Database shows only a single vacant TV channel available in Manhattan for unlicensed white space use, wireless microphone operators enjoy a vast array of choices – including, in practice, 22 television channels, enough to potentially operate more than 300 microphones in a single venue. As described just above, the table below is derived from searching Shure's microphone channel search database at the Rockefeller Center in Manhattan (zip code 10112). It indicates that even in the single most congested urban market, there appears to be no need for wireless microphone operators to occupy unlicensed TV White Space channels – or even the two vacant microphone reserve channels – except as a last resort for special events.

Available Channels in NYC

Rockefeller Center (10112)

Type of Channel	Number of available channels	Potential Microphones*	Total Microphones
Non-TVWS Channels below 21	3 (17, 19, 20)	51	51
Non-TVWS Channels above 21	7 (25, 26, 34, 39, 45, 46, 50)	119	170
TV Co-Channels (50-70 miles distant)	6 (23, 27, 41, 47, 48, 61)	102	272
TV Co-Channels (10-50 miles distant)	4 (18, 21, 29, 51)	68	340
Reserve Channels	2 (22, 42)	34	374

Similarly, NBC Universal's reservations⁸⁰ in Washington, D.C. for President Obama's second inauguration (January 21, 2013) included a number of out-of-market TV co-channels that are not available for use by unlicensed devices:

⁷⁹ Compiled based on publicly available microphone reservation data in the TVDB hosted by SBI, accessed Jan. 21, 2013.

- Channel 21 -- WVPY -- Front Royal, VA (69 miles away)
- Channel 29 -- WMPB -- Baltimore, MD (40 miles away)
- Channel 41 -- WUTB -- Baltimore, MD (30 miles away)
- Channel 28 -- WFPT -- Frederick, MD (29 miles away)

It's also telling that the default search setting for TV broadcasters in Shure's microphone channel search database is a 50-mile radius (20 miles less than the FCC rules technically permit). That is, Shure's database does not seem to consider any broadcaster operating more than 50 miles away to represent any risk of interference to even its older (and discontinued) wireless microphone products. Moreover, since Shure's channel look-up feature is designed to identify microphone channels that operate co-channel with TV stations at *any distance*, it seems to confirm that at least professional microphone operators are comfortable operating without fear of interference on a wide variety of even quite proximate TV co-channels, depending on their location, needs and local interference situation.

B. The Commission Should Expand the Number of Co-Channels Available for Wireless Microphone Reservation and Require Operation on Non-White Space Channels Except Where That Will Not be Sufficient for a Particular Time, Place and Venue

The Commission's current rules governing wireless microphone operations encourage inefficient spectrum use and will certainly undermine the emergence of a robust market for unlicensed consumer devices and services in the TV bands. Although many professional and multi-microphone operations have long been operating on non-local broadcast co-channels and other non-TVWS channels that otherwise lie fallow, the Commission's rules allow and encourage microphone users to block off the considerably smaller number of channels that are available to unlicensed devices in the nation's largest urban markets. The Commission can

⁸⁰ Compiled based on publicly available microphone reservation data in the TVDB hosted by SBI, accessed Jan. 21, 2013.

instead promote greater spectrum efficiency and innovation if it both authorizes and requires microphone users to use non-TVWS channels first, to use TVWS channels only as needed, and to coordinate that use to ensure efficient channel placement and geographic spectrum re-use.

1. The Commission should reduce the separation distance for wireless microphones operating co-channel with TV stations, with an alternative test based on actual received broadcast signal strength at the venue

As noted just above, current rules governing the operation of wireless microphones on a co-channel basis with UHF band broadcasters require a separation distance of 70 miles.⁸¹ PISC agrees with each of the three suggested changes in the NPRM that could “enable more intensive use by wireless microphones of the broadcast television spectrum that is not available for white space devices.”⁸² Most importantly, PISC believes the Commission should reduce the separation distance for co-channel wireless microphone operation in a manner that reflects real-world interference risk and that will tend to maximize co-channel spectrum available at most locations. A 70-mile separation requirement is technologically outdated since it pre-dates both digital microphone technology and the digital television transition. A single command-and-control separation distance ignores both topography (e.g., the broadcast station may not even be visible due to intervening terrain) and the microphone user’s location (which may be shielded by other buildings, or behind the thick walls of an indoor theater or stadium).

PISC proposes that the Commission amend its Part 74 rules (and the comparable Part 15 rules that apply to unlicensed microphones), to give microphone users a choice between relying on a simple geographic separation (e.g., 30 miles) or, alternatively, relying on the actual received signal strength of the co-channel broadcast signal at the venue’s location, factoring in real-world interference conditions.

⁸¹ 47 C.F.R. § 74.802(b)(3).

⁸² *Incentive Auction NPRM*, at ¶ 225.

2. The Commission should require unlicensed and Part 74 microphones to first use non-TVWS channels and to coordinate co-channel assignments through Database registrations that account for real-world interference conditions and geographic spectrum re-use

PISC agrees that the TV Bands Database or, alternatively, a separate Commission-certified database could coordinate microphone registrations and requests for channels in a manner that both conserves scarce TV white space and improves the level of interference protection for microphone operations. For example, we note that the TV Bands Database operated by Spectrum Bridge already offers a free *Wireless Microphone Frequency Locator* application that “provides users with up-to-date wireless microphone channel availability for any U.S. location,” including a green/yellow/red light ranking of available channels based on “noise floor values.”⁸³

It is both technically feasible and beneficial for efficient use of TV band spectrum for both licensed and unlicensed microphone operators seeking interference protection to register and coordinate through the TV Bands Database. As the Commission observes in the NPRM, “[w]ireless microphones operate in a relatively narrow bandwidth and are technically capable of choosing different frequencies among multiple vacant channels available for operation.”⁸⁴

Today nearly all professional and multi-microphone venues are employing digital microphone systems, such as the Shure system cited in the *NPRM*, that can support up to 14 or 15 microphone channels on a single 6 MHz TV channel.⁸⁵ Further, as advances in wireless microphone technology continue to generate greater spectrum efficiencies, the need for microphone operators to access whitespace should lessen. In fact, modern digital microphones, such as Shure's ULX-D system, allow up to 17 wireless microphones to operate simultaneously

⁸³ See Spectrum Bridge at <http://whitespaces.spectrumbridge.com/WhiteSpacesSolutions/WirelessMics.aspx>.

⁸⁴ *Incentive Auction NPRM*, at ¶ 223.

⁸⁵ *Id.*, at note 353.

within a single 6 MHz TV channel. These devices also support a "high density mode," which can support up to 47 *microphones* in one 6 MHz channel, and they are considerably more tolerant of interference.⁸⁶

The Commission notes in the *Public Notice* that analog microphones in particular actually use only a fraction of a six megahertz channel “while the remainder is effectively left fallow. This constitutes a very inefficient use of valuable spectrum.”⁸⁷ With coordination and greater authorized access to non-TVWS channels, even performance venues in close geographic proximity could be assigned microphone subchannels to make full use of otherwise fallow spectrum. And, in the vast majority of cases, venues that are more than 200 or 300 meters distant from each other can re-use the same channels, making it possible for each venue conceivably to coordinate the use of 30, 40 or 50 microphones on 4, 5 or 6 non-TVWS channels.

Since wireless microphones operate at a power comparable to a WiFi router, the Commission should assume that coordination will pay dividends for the public interest in the form of both less microphone interference and also tremendously more spectrum re-use on broadcast co-channels and other non-TVWS channels that would otherwise lie fallow. Because neither licensed nor unlicensed wireless microphones have paid for their spectrum – and because both receive “priority access” to the TV band in relation to WISPs and other unlicensed broadband use of the white spaces – a requirement that microphones register, coordinate and request efficient assignments is a modest and minimal condition for free spectrum with interference protection.

⁸⁶ www.shure.com/americas/products/wireless-systems/ulxd-systems

⁸⁷ 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), at 6. *See also Incentive Auction NPRM*, at ¶ 223, note 353.

C. The Two Channels Currently Reserved for Microphones Should be Open for General Unlicensed Use and Available for Microphone Reservation Only as Needed and Based on Coordination Through the TV Bands Database

If the Commission authorizes and requires coordinated microphone operation on an expanded number of non-local broadcast co-channels, we believe that together with other unoccupied frequencies below channel 21 that are not available to unlicensed TVBDs, wireless microphone operators should only need to make reservations on unlicensed TVWS channels for occasional special events – and that therefore their access to TVWS should be limited to the two channels currently reserved exclusively for microphone use. Moreover, because expanded co-channel availability and coordination could greatly reduce the need for microphone use of these two reserve channels, we propose that the two microphone channels should be opened more generally for unlicensed TVBDs at any time and place microphone operators have not made a qualified reservation. Microphone use of unlicensed TVWS, in turn, should be restricted to reservations on these two reserve channels. Moreover, 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.

1. Microphone operators should request the reservation of subchannels through the TV Bands Database to coordinate non-interfering use and maximize efficient use of unlicensed spectrum

In addition to opening the two microphone reserve channels for general unlicensed use at times and places where microphones have not made a reservation, the public interest would benefit from additional efficiencies if microphones are required to register and request an assignment of microphone subchannels whenever the non-TVWS channels available at their location are inadequate for a particular event or need. The Commission should approve a

standardized process, developed jointly by the TV Bands Database administrators and the microphone industry, to streamline requests certifying that non-TVWS channels are insufficient and requesting that a specific number of microphone subchannels be reserved for a particular discrete period of time. PISC proposes that any TV Bands administrator authorized by the Commission to process such a request must, within a definite time frame, assign the requesting party reserved use of specific microphone subchannels in a manner that both minimizes the amount of unlicensed spectrum removed from general use, while also coordinating the request to avoid any potential interference with any other nearby microphone operators making similar requests.

This coordination and assignment requirement for microphone reservations should be mutually beneficial for microphone operators (who will be assured reserved channels and coordination to mitigate interference) and for the general public (who will maintain access to a maximum amount of unlicensed spectrum capacity). In the absence of such a requirement, microphone operators will be more likely to inadvertently interfere with one another and will also unnecessarily spread out across both designated unlicensed channels when one might well accommodate their needs. For example, since two indoor microphone venues located more than 300 meters apart could quite easily re-use the same single reserve channel, in the absence of required coordination and assignment, they may either inadvertently or purposely reserve and occupy two otherwise vacant TV channels, thereby leaving most of the potential capacity fallow in that area and potentially denying service to unlicensed white space device users in certain very congested urban areas.

Although PISC believes this coordination and assignment system could apply as well to microphone operators seeking reserved subchannels on *non-TVWS* spectrum, with similar public

interest benefits, we assert here that at a minimum the requirement should apply to any ability of microphones to occupy channels that could be available for unlicensed devices in general (including the two current reserve channels).

2. Microphone operations in other unlicensed TVWS channels and in the guard bands should be prohibited except to the extent their operations conform to the technical requirements that apply to unlicensed TVBDs

The *NPRM* requests comment on the extent to which microphone operations should be accommodated on unlicensed channels that are open to white space devices, including the guard bands designated to mitigate interference with new licensed broadband services. PISC believes that if the Commission adopts the proposals described above, there should be no need for microphones to have any preferred access to other unlicensed spectrum in the ongoing TV band or in the guard bands. Specifically, 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.

As the *NPRM* observes, unlicensed devices “are an important part of this nation’s communications capabilities,” yet “[c]urrently, some urban markets do not have channels available for white space use.”⁸⁸ The *NPRM* further observes the benefits “of providing for additional spectrum, ideally on a nationwide basis, for unlicensed use in these bands.”⁸⁹ Our proposals here would contribute to these critical public policy goals while continuing to

⁸⁸ *Incentive Auction NPRM*, at ¶¶ 228, 231.

⁸⁹ *Id.* at ¶ 227.

accommodate the ability of microphone venues to access and even to reserve a very large number of television frequency subchannels to meet their needs. On the other hand, permitting microphones to reserve or even to operate on any unlicensed channel, or in the guard bands, without conforming to the power, emissions and other technical requirements of the TV White Space rules would unnecessarily undermine the unlicensed economy.

In sum, PISC believes that maintaining two unlicensed white space channels designated for microphone reservations on a strictly *as needed* basis strikes the appropriate balance between current microphone operations and the great potential for unlicensed innovation *if* a sufficient number of unlicensed channels are accessible at all times in every market nationwide.

3. If the microphone channel above Channel 37 is reallocated, then a second reserve channel below and closest to Channel 37 should be designated

As the Commission observes in the *NPRM*, white space devices are currently excluded from two of the unused UHF channels nearest to channel 37, which are reserved for both unlicensed and licensed wireless microphone operations.⁹⁰ Due to the repacking and reallocation of UHF channels either above or below channel 37, depending on the band plan adopted, it is possible that microphones could lose one or even both of their existing reserve channels. Although PISC has argued that these two microphone channels could be safely opened for general unlicensed use (subject to microphone reservations when needed), since we also believe that these should be the only TV white space available for microphone use, we urge the Commission to maintain two channels in each market for potential microphone reservations on an *as-needed* basis. Since one or both of the current reserve channels could unpredictably be lost due to the rebanding, PISC urges the Commission to adopt rules specifying that wherever feasible, a priority in the

⁹⁰ *Incentive Auction NPRM*, at ¶ 222 citing 47 C.F.R. §15.707(a) (prohibiting white space devices on the first channel above and the first channel below channel 37 that are available, or if a channel is not available above and below channel 37, prohibiting white space devices on the first two channels nearest to channel 37).

repacking process will be maintaining two designated unlicensed channels nearest to channel 37, as a backup for microphone reservations as needed, in every market nationwide.

V. THE COMMISSION SHOULD REPACK AND RELOCATE FULL POWER AND SECONDARY BROADCAST LICENSEES IN A MANNER THAT ENSURES SUFFICIENT UNLICENSED SPECTRUM IN EVERY MARKET AND OPTIMIZES THE UTILITY OF UNLICENSED WHITE SPACE OVERALL

Broadcast station repacking and relocation will have an enormous impact on the future of the unlicensed economy, since it will largely determine whether the Commission preserves sufficient access to unlicensed spectrum in every market nationwide, including both for personal/portable devices and for the fixed wireless broadband services that are so critical to rural and other underserved communities. Although most broadcast stations choosing to remain on the air will be accommodated with either an existing or new channel assignment, the specific channels that the Commission assigns (or chooses not to assign) will heavily impact whether there is a robust future for what Chairman Genachowski has called “Super WiFi” in the TV band spectrum. As PISC notes below, it is critical that the Commission protects not only ongoing broadcast operations, but also makes channel reassignments with a goal of maximizing the number of white space channels available for unlicensed use above channel 20 while simultaneously striving to maintain as many consecutive white space channels as possible to facilitate rural broadband (since fixed wireless services can operate only on the middle of three consecutive white space channels).

The policies that govern this repacking and reassignment process will be most critical concerning secondary broadcast licensees (LPTV, translator and booster stations) that are not eligible to participate in the incentive auction – but which are roughly twice as numerous as

primary full power and Class A stations that are eligible. Although these stations serve many fewer people – and in most cases use only 1 or 2 MHz of actual capacity to broadcast a standard definition stream of content – they will under the current rules continue to occupy a full 6 MHz channel of TV band spectrum. In many cases this will well serve the public interest. As the Commission points out in the *NPRM*, low power television stations “are a source of diverse and local television programming, and television translator stations are an important free, over-the-air resource in rural and remote locations.”⁹¹ The consumer and media reform groups that comprise PISC have long advocated for more localism in broadcasting and on behalf of stations that serve minority language communities and other public needs. Many LPTVs clearly fit this description, providing vital and useful services to local minority communities and to the general public that would not be provided by network affiliates and other full power commercial stations. At the same time, there are many LPTVs that are barely broadcasting, that will not in the end make the digital TV transition, or which are occupying far more spectrum capacity than they actually need to fulfill their mission – and, cumulatively, blocking access to fallow spectrum that the Commission should attempt to reallocate for unlicensed use to benefit everyone in these same communities.

A. Channel Relocations Should Optimize Total White Space Above Channel 20 and the Number of Channels Available for Fixed Unlicensed Use for Rural Broadband Access

The *NPRM* makes a number of proposals designed “to best preserve and improve the use of the unused spectrum in the broadcast television bands for unlicensed operations.”⁹² While PISC applauds the Commission for focusing these proposals on the vital public interest in ensuring there will be substantial unlicensed spectrum access nationwide, the *NPRM* is less

⁹¹ *Ibid.*, at ¶ 358.

⁹² *Incentive Auction NPRM*, at ¶ 227.

explicit about the critical importance of broadcast station repacking and relocation to the future of the unlicensed economy.

The public interest in the process that repacks and relocates both primary and secondary broadcast stations extends far beyond preserving broadcast service for the over-the-air viewing public. The share of households relying on over-the-air broadcasting has dwindled to 10 percent (10.7 million households).⁹³ In contrast, more than 60% of U.S. households now use unlicensed home WiFi networks to efficiently share a single Internet access point – and an even larger number of individual Americans make use of unlicensed WiFi broadband services on mobile devices.⁹⁴ While broadcasters struggle to find a business model to make use of their surplus spectrum, the capacity and propagation limits of WiFi that rely on the 2.4 GHz band are becoming problematic, despite the efficient small cell re-use of unlicensed spectrum. The 2.4 GHz unlicensed band is not only becoming congested in many urban locations, but – conversely – it does not propagate well enough to provide economical coverage in many unserved and underserved areas where hundreds of enterprising Wireless Internet Service Providers (WISPs) are eager to deploy on TV White Space frequencies.

These very important public interest implications of a robust market for unlicensed white space devices, networks and services make it critical for the Commission to adopt priorities and policies for TV band repacking and relocation intended to optimize *both* broadcast TV *and* the aggregate utility of unlicensed access to white space spectrum. It is troubling that the *Incentive Auction NPRM* does not explicitly anticipate and request comment on potential trade-offs

⁹³ *Incentive Auction NPRM*, at ¶ 14, citing Nielsen National Universe Estimates (January 1, 2012). “[D]uring the 2011-2012 television season, the Nielsen Company estimates that only 10.7 million television households, or approximately 10 percent of the total, rely solely on over-the-air broadcast television service.” *Ibid*.

⁹⁴ See Strategy Analytics, *Broadband and Wi-Fi Households Global Forecast 2012*, a summary of which is available at <http://www.strategyanalytics.com/default.aspx?mod=reportabstractviewer&a0=7215>. This study also reports that the U.S., with 61% of broadband households relying on WiFi, is actually lagging behind seven other countries in WiFi household penetration. In a mid-2011 study, ComScore.com estimated there were 116 million Wi-Fi users.

between accommodating the needs of ongoing broadcasters and the needs of the general public for emerging unlicensed innovation and services that will depend on robust unlicensed access in every market.

PISC believes that at least two trade-offs are particularly important to anticipate. First, the relocation of broadcast stations should result in the largest possible number of unlicensed white space channels *above channel 20*. The viability of both fixed and personal/portable white space devices will depend in large part on the number of white space channels located above channel 20. The majority of ‘white space’ channels below channel 21 are unusable for unlicensed broadband services: Personal/portable unlicensed devices are not permitted to operate below channel 21; and fixed white space devices, so vital for rural broadband and other underserved areas, rarely find channels available below 21 since they are restricted to using the middle of three consecutive vacant channels. Moreover, both types of white space channels – particularly fixed, higher-power channels – are disproportionately located today in the 600 MHz band above channel 37 that is most likely to be reallocated for auction to licensed services. As a result, locating the maximum available number of white space channels above channel 20 will put more spectrum into operation since “stranded” white space below channel 21 will lie fallow.

A second critical and related trade-off is the number of consecutive white space channels in a market. As noted just above, rural broadband and other uses of fixed unlicensed devices in the TV band are completely dependent on the availability of “triples” – that is, on three consecutive white space channels. Similarly, personal/portable devices can operate at significantly higher power (100 milliwatts rather than 40 milliwatts) on these second adjacent channels. Moreover, both types of white space channels – particularly fixed, higher-power channels – are disproportionately located today in the 600 MHz band above channel 37 that is

most likely to be reallocated for auction to licensed services. Since the ongoing TV Band will inevitably be compressed – with many fewer white space channels for unlicensed use overall – it becomes particularly important for the Commission to adopt an explicit policy that it will seek to relocate broadcasters to channels that have the effect of optimizing the white space that remains for both fixed and personal/portable unlicensed services.

As the remainder of this section emphasizes, although the *NPRM* focuses primarily on the relocation of primary broadcast licensees, tradeoffs involving the spectrum occupied by *secondary* licensees will have an equal if not greater impact on the future of the unlicensed economy.

B. Secondary Broadcast Licensees Should Maintain Actual, Substantial Service and Strict Adherence to the 2015 DTV Transition Deadline or Lose Protection in the TV Bands Database

In its discussion of eligibility for the reverse auction, the *NPRM* proposes to make full power and Class A licensees “with expired, cancelled or revoked licenses” ineligible to participate.⁹⁵ The *NPRM* then proposes that ineligibility could result for a number of reasons including “when a station ceases operations for longer than one year” and “when the licensee has failed to timely construct a post-DTV transition facility.”⁹⁶ Similarly, PISC recommends that the Commission adopt a policy of vigorously enforcing these and related rules to ensure that LPTV, translator, and booster stations that are not entitled to interference protection also do not have protected status in the TV Bands Database. The Commission should strictly and affirmatively enforce its existing rules so that secondary broadcast stations are able to block public access to channels *only* to the extent they are actually in use to provide a substantial service in the public interest.

⁹⁵ See *Incentive Auction NPRM*, ¶ 78.

⁹⁶ *Ibid.*

1. Channels Not in Use for Substantial Broadcast Service Should be Available for Unlicensed Use Through the TV Bands Database

Under the Commission’s Part 15 rules governing unlicensed access to white space, the TV Bands Database must block access to channels based on “only TV station information from station license or license application records.” Although a station’s license “will expire as a matter of law . . . if the station fails to transmit broadcast signals for any consecutive 12-month period,”⁹⁷ the spectrum occupied by a station that goes “dark” remains unavailable through the TV Bands Database during those 12 months – and possibly longer – if the Commission does not exercise its discretion to cancel the license. The Commission may act on a “dark” station at its discretion once the station has failed to operate for 30 days.⁹⁸ In addition, a failure “to transmit broadcast signals” is a far lower (and less meaningful) threshold than would be one based on providing “substantial broadcast services’ to the local community.

PISC recommends that the Commission establish objective guidelines for providing “substantial broadcast services” to the relevant community. We recognize that LPTV licensees are not subject to the criteria that determines eligibility for Class A status under the Community Broadcasters Protection Act of 1999 (CBPA).⁹⁹ Nevertheless, the *NPRM* requests comment on whether “the public interest would be served by establishing a set of ‘selection priorities’ to choose among [displacement] applications when necessary.”¹⁰⁰ Although the Commission is referring to the selection of competing displacement applications where the number of channels available to accommodate LPTV and translator stations may be insufficient, PISC proposes that

⁹⁷ Section 74.763(c) of the Commission’s rules.

⁹⁸ *See Id.*

⁹⁹ *See 47 U.S.C. § 336(f)(2)(A)(i).* The CBPA provides that to qualify for Class A status, during the 90 days preceding enactment of that statute an LPTV station must have: (1) broadcast a minimum of 18 hours per day; (2) broadcast an average of at least three hours per week of programming produced within the market area served by the station; and (3) been in compliance with the Commission’s rules for low power television stations. *See* § 336(f)(2)(A)(i) of the Act. Class A stations are also required to comply with certain full power television rules to maintain their Class A status. *Id.* § 336(f)(2)(A)(ii).”

¹⁰⁰ *Incentive Auction NPRM*, at ¶ 361.

some minimal “substantial service” criteria should be established to determine whether such stations should be relocated or eligible for license renewal at all. For example, the CPBA requires that Class A low power stations broadcast a minimum of 18 hours a day. While we concede that many LPTVs provide important services to minority language communities and for other purposes while broadcasting less than 18 hours a day, it seems entirely reasonable for the Commission to require some minimum number of hours of broadcasting each week – and also some smaller but meaningful number of hours of locally-originated programming. Stations that are ‘dark’ at most times, or that are merely rebroadcast canned commercial content that originates in distant markets, for viewing by a relative handful of people, should not be displacing either bona fide LPTV stations or the public’s access to the frequency band for unlicensed services.

At a minimum, PISC recommends that the Commission require secondary broadcasters to report any failure to operate for a period of 30 days or more to the Commission and to a TV Bands Database administrator so that the currently unused channel can be made available for unlicensed use until such time as the licensee can report its immediate intention to commence (or restore) substantial service. Section 74.763(c) of the Commission rules already provides that the “[f]ailure of a low power TV, TV translator, or TV booster station to operate for a period of 30 days or more . . . *shall be deemed evidence of discontinuation of operation* and the license . . . may be cancelled at the discretion of the FCC” (*emphasis added*). Since going “dark” for 30 days is deemed evidence of discontinuation of operation – and a possible basis for license cancellation – PISC recommends that the Commission adopt a policy that stations are required to report going “dark” and lose protection in the TV Bands Database until such time as substantial service resumes. Section 74.763(b) already requires similar notification in the event that causes

beyond the control of the licensee make operation impossible to operate for a period of 30 days.¹⁰¹ Since unlicensed white space devices must renew their authorization to use a particular channel at least once every 24 hours (by rechecking the TV Bands Database), this requirement would have no impact at all on the ability of a broadcast station to renew its service without fear of harmful interference.

PISC also agrees that the Commission should strictly enforce its policy to downgrade the status of Class A stations that fail to meet the eligibility requirements of the CPBA. The *NPRM* correctly observes that “Class A television stations must continue to meet the [CPBA’s] eligibility criteria in order to retain Class A status, or else they are subject to modification of their license to low power television status.”¹⁰² The Commission enforced the CPBA to downgrade a number of Class A stations during 2012¹⁰³ and should continue to do so as warranted.

2. The Commission Should Strictly Enforce the 2015 DTV Transition Deadline and Immediately Open Non-Conforming Channels for Unlicensed Use Through the TV Bands Database

In its 2011 Second Report and Order adopting rules for the digital transition of LPTV, translator and booster station licensees, the Commission emphasized that the September 1, 2015 deadline to cease analog transmissions is a “hard” deadline and that any extensions for construction of digital facilities will in no case extend past March 1, 2016.¹⁰⁴ PISC supports

¹⁰¹ See 47 C.F.R. § 74.763(b).

¹⁰² *Incentive Auction NPRM*, at ¶ 75.

¹⁰³ See e.g., *Reclassification of License of Class A Television Station WBVT-CA Burlington, Vermont*, Order, 27 FCC Rcd 13550 (MB 2012); *Reclassification of License of Class A Television Station KGLR-LP Lubbock, Texas*, Order, 27 FCC Rcd 10917 (MB 2012) .

¹⁰⁴ See *Amendment of Parts 73 and 74 of the Commission’s Rules to Establish Rules for Digital Low Power Television, Television Translator, and Television Booster Stations and to Amend Rules for Digital Class A Television Stations*, Second Report and Order, MB Docket No. 03-185 (rel. July 15, 2011), at ¶ 13. “We reiterate that the September 1, 2015 transition date is a ‘hard’ deadline and that all low power television stations, including those that obtain a last-minute extension, will be required to cease analog operations on September 1, 2015, and

strict adherence to these deadlines, which are already long overdue considering that full power stations completed their transition more than six years prior to this 2015 deadline – and fewer and fewer households are actually viewing analog over-the-air signals. We also suspect that a large share of the LPTV and translator stations that have not yet built digital facilities will not make that investment now that it is clear they are not eligible to profit directly from the incentive auction process. We therefore urge the Commission to enforce its rules and ensure that non-compliant stations are removed from the TV Bands Database at the earliest possible date so that the spectrum capacity is put to productive use for wireless broadband and other unlicensed innovation. We also urge that extension requests to delay digital service beyond the September 2015 deadline be denied absent compelling justifications.¹⁰⁵

C. Low Power Broadcast Licensees Should be Required as a Condition of Relocation or Reassignment to Share a Channel Wherever Feasible

The TV Bands incentive auction will result in a public policy paradox: public auction revenue will be paid to *full power* stations willing to give up 3 MHz and share a channel with another station, but *low power* stations (LPTVs) that are ineligible to participate can in most cases continue to occupy 6 MHz even if they are using only 1 or 2 MHz of capacity. In large urban markets, this paradox suggests that the Commission is willing to pay tens of millions of taxpayer dollars to recover 3 MHz from a full power station – but will then permit low power stations to warehouse 3 MHz or more that is not being used to provide substantial broadcast service (such as multicasting original content). Moreover, many LPTVs have also been authorized to occupy two 6 Mhz channels until the September 15, 2015 digital transition

those with unbuilt digital facilities will have to remain silent while they complete construction.” *Second Report and Order* at ¶¶ 15-16, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-110A1.pdf.

¹⁰⁵ See 47 C.F.R. § 74.788(c)(1) stating that the Chief, Media Bureau can grant an extension of up to six months beyond Sept. 1, 2015 under certain circumstances.

deadline. Although LPTV and translator licensees have secondary status – and although the *NPRM* warns that they cannot be guaranteed a channel assignment, subject to accommodating full power and Class A stations during the repack¹⁰⁶ – they nonetheless have rights superior to unlicensed users and will in many cases be relocated into some of the few remaining TV White Space channels in the largest DMAs.

The D.C. market provides an example. A search using the Commission’s Low Power Television Station Search Tool¹⁰⁷ shows four LPTV stations.¹⁰⁸ According to their Wikipedia profiles, all four broadcast a single stream of standard definition digital content – except for WDCN-LP, which is audio only and appears to be rebroadcasting the content of an FM radio station.¹⁰⁹ Since these stations are not multicasting, they could in theory all be co-located and broadcast the same content on a single 6 MHz channel.¹¹⁰ More practically, it seems possible that at least two of these stations could share a channel. Although none appear to be co-located on the same tower at present, sharing a channel might also yield cost reductions over time assuming that each one is currently renting tower space and maintaining separate transmission facilities. Even if the power level and coverage area of a co-located pair of LPTVs was

¹⁰⁶ See *Incentive Auction NPRM*, ¶¶ 74, 118 (“we do not propose to extend protection in the repacking process to low power television and translator stations. Such stations have always had secondary status for interference purposes, and . . . the Spectrum Act’s mandate with respect to preservation of coverage in the repacking process does not extend to them”).

¹⁰⁷ The online search tool generates a list of Low Power, Class A and TV Translator television stations within 20 miles of an entered zip code. See <http://fjallfoss.fcc.gov/cgi-bin/zipsrch/srchzip>.

¹⁰⁸ The four are WDDN-LP (channel 23), WWTD-LP (14), WDCN-LP (6, audio only) and WIAV-LP (44). According to the station data provided by the FCC’s LPTV Search Tool, each station has been granted a second 6 MHz channel – a Digital Companion Channel – allowing each one “to operate a second digital station simultaneously with its analog channel until the low power station digital transition ends.” This companion channel grant may not apply in practice to WIAV-LP, since its analog channel assignment is 58, on 700 MHz spectrum that has already been reallocated. See Low Power Television Station Search Tool, at <http://fjallfoss.fcc.gov/cgi-bin/zipsrch/srchzip>.

¹⁰⁹ See <http://en.wikipedia.org/wiki/WDCN-LP>. According to the Wikipedia profile, “87.75 MHz FM is the center frequency of channel 6’s audio signal, which can be received on most [FM radios](#) and thus makes a music format viable.”

¹¹⁰ One technical exception is WWTD-LP, which “currently broadcasts color bars on channel 49.1 and [New Tang Dynasty Television](#) on channel 49.2,” according to its Wikipedia profile, available at <http://en.wikipedia.org/wiki/WWTD-LD>.

increased – so that they each cover at least the same population they did prior to sharing – this would have the benefit of freeing up an additional channel that would otherwise be fallow spectrum.

PISC strongly supports the Commission’s proposal to allow LPTV and translator stations to share channels with one another or with full-power TV stations.¹¹¹ The Commission has already authorized channel sharing among full power stations eligible to participate in the incentive auctions, and so extending this as part of the overall repacking plan should be a given.¹¹²

However, merely allowing voluntary channel sharing does not go far enough considering the value and current waste of broadcast spectrum capacity. PISC proposes that as part of the channel repacking and relocation process, that the Commission require secondary broadcast licensees to co-locate and share a single 6 Mhz channel where that is feasible without reducing their broadcast service to the community. We suggest that initially the Commission should analyze the rationale and feasibility of such a requirement in at least the 30 largest DMAs and, if it appears technically feasible for a substantial number of stations and markets, we recommend that the Commission seek further comment on the nature of such a requirement, its potential impact, and the least burdensome means of implementing it.

VI. ALL UNOCCUPIED SPECTRUM IN THE CURRENT UHF BAND SHOULD REMAIN AVAILABLE FOR UNLICENSED USE THROUGH THE TV BANDS DATABASE UNTIL NEW 600 MHZ LICENSEES COMMENCE SERVICE WITHIN INTERFERENCE RANGE

As the Commission states in the *NPRM*, “implementing the results of the broadcast television spectrum incentive auction will be a complex and challenging undertaking for

¹¹¹ See *NPRM* at ¶ 359.

¹¹² See *Innovation in the Broadcast Television Bands: Allocations, Channel Sharing and Improvements to the VHF*, 27 FCC Rcd 4616, 4621-24 (2012).

broadcasters.”¹¹³ The channel repacking and broadcaster relocation process will in all likelihood take between 18 months (the period the *NPRM* poses as a potentially “reasonable transition deadline”) and the three-year deadline for reimbursement of relocation costs imposed by the Spectrum Act. Even if broadcasters cease operations on auctioned channels soon after the forward auction is completed, the *NPRM* contemplates buildout requirements that may have interim benchmarks for substantial service to portions of the covered population after three or four years, yet are still not likely to require the provision of service to 100 percent of the covered population even by the end of the proposed 10-year licensing period.¹¹⁴ In short, 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.

Although in the past this situation would be a recipe for leaving spectrum capacity fallow for extended periods, fortunately the Commission has already put a governance mechanism in place to ensure that unused spectrum “white space” in the upper UHF 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.

¹¹³ *Incentive Auctions NPRM*, at ¶ 308.

¹¹⁴ For example, most recently, in its Order defining AWS-4 licensing buildout requirements for the S Band spectrum acquired by DISH Network, the Commission required buildout to 70 percent of the *population* in each license area within seven years, it is quite likely that the vast majority of the nation’s geography – and most rural communities – will remain without AWS-4 service for at least seven years. *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, Report and Order and Order of Proposed Modification, WT Docket No. 12-70, ET Docket No. 10-142, WT Docket No. 04-356 (rel. Dec. 17, 2012)(“AWS-4 *NPRM*”).

PISC therefore proposes 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. In practice this would mean that even after a portion of the upper UHF band is reallocated and auctioned for advanced wireless broadband service, until the spectrum is actually put into service in a local area it should be available for non-interfering use by devices and/or systems that are multi-band, equipped with GPS, required to regularly check the TV Bands database, and on notice that they will be denied permission to continue using frequencies in a local area once the licensee notifies the Commission and a TV Bands Database operator of the geographic areas where actual service will commence. Licensees lose no rights whatsoever and bear a *de minimus* burden to simply inform the Commission and one of the TV Bands Database administrators prior to commencing substantial service in a particular local area, so that all unlicensed devices can be immediately denied permission to operate on that frequency band.¹¹⁵

A. Maintaining Access to Vacant UHF Spectrum Until Needed by a Licensee Protects Licensees and Promotes Spectrum Efficiency and Emerging Markets for Unlicensed TV White Space Services

The FCC-certified TV Bands Databases are designed for these frequencies and for this purpose. It should make no difference whether 600 MHz spectrum in a local area is fallow because no broadcaster has been assigned a license or, in the future, because a new wireless broadband licensee has yet to build out and commence service in that area. The admonition in

¹¹⁵ PISC has proposed versions of this concept in other proceedings, noting that it can also serve as a productive alternative to more draconian “use it or lose it” buildout requirements that are difficult to enforce in practice – and which yield no utility of the fallow spectrum in the meantime. *See* Comments of New America Foundation, Consumers Union, Public Knowledge, WT Docket No. 12-70, ET Docket No. 10-142, WT Docket No. 04-356 (filed May 17, 2012). *See also* Comments of the Public Interest Spectrum Coalition, In the Matter of Promoting More Efficient Use of Spectrum Through Dynamic Spectrum Use Technologies, ET Docket No. 10-237 (Feb. 28, 2011); Michael Calabrese, “Use it or Share it: Unlocking the Vast Wasteland of Fallow Spectrum,” Working Paper, presented at 39th Research Conference on Communication, Information and Internet Policy, September 25, 2011.

the recent report and recommendations of the President’s Council of Advisors on Science and 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.”¹¹⁶ PCAST proposed building on the TV Bands Database concept to enable shared access to underutilized bands without harming licensed primary operations. The Commission has already proposed applying the PCAST framework of opportunistic access governed by a geolocation database to a military radar band in its recently adopted NPRM to permit opportunistic and database-controlled sharing of the 3550-3650 MHz band.¹¹⁷ If a geolocation database mechanism can be relied upon to protect television broadcasting and Navy radars, it is certainly feasible to rely on the database permission system to limit unlicensed devices to the 600 MHz channels that are not in use.

PISC further proposes that any ongoing unlicensed or other FCC-approved access to licensed but unused 600 MHz spectrum should be explicitly subject to the presumption that use of fallow MSS spectrum is contingent and temporary. The Commission should further require that only devices and/or systems that are multi-band, equipped with GPS and capable of periodically checking the database may operate on these frequencies post-auction. With these 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

¹¹⁶ 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.

¹¹⁷ *In the Matter of Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, GN Docket No. 12-354 (rel. Dec. 12, 2012).

diminished in the slightest; and, as discussed further below, 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).

The Commission adopted a similar approach 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.”¹¹⁸ The same rationale applies here, although with 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. The Commission Should Include a License Condition that Requires New 600 MHz Licensees to Notify a TV Bands Database Administrator 30 Days Prior to Commencing Commercial Service in a Local Area

Just as licensed wireless microphone operators can make reservations in the database to block unlicensed access to TV white space channels as they need it, PISC believes that during the years following the 600 MHz incentive auction, new licensees can simply notify an FCC-certified TV Bands Database administrator in advance of the commercial operation of a base station or other transmitter. We propose that licensees notify a TVDB administrator 30 days in advance of its intention to commence substantial service. Although unlicensed white space

¹¹⁸ *In the Matter of 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*, Report and Order and Further Notice of Proposed Rulemaking, WT Docket No. 03-66, para.109.

devices must renew their permission to transmit on a channel in a local area each 24 hours, a 30-day notice period would give the TVDB administrator time to implement removal of the frequency band from the list available in that area – and also give the licensee ample time to confirm through its own queries to the TVDB (which is public and transparent) that the frequency channel has indeed been removed. Moreover, PISC proposes that even prior to the 30-day period, 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 can do today, to exclude use at the places and times needed.

Our proposal here is broadly consistent with the “use it until needed” approach and 30-day notice period proposed by the Commission itself in the *NPRM* with respect to fixed Broadcast Auxiliary Stations: “Consistent with past practice, we propose that secondary fixed BAS stations operating in the UHF band . . . cease operating and relocate, at their own expense . . . when a new 600 MHz wireless broadband licensee intends to turn on a system within interference range of the incumbent.”¹¹⁹ The *NPRM* goes on to propose, “[a]lso consistent with past practice, . . . to require broadcast television or new licensees to provide thirty days’ notice to all incumbent fixed BAS operations within interference range that they must cease operations . . .”¹²⁰ Unlike the *NPRM*’s proposal for fixed BAS systems, which require 600 MHz licensees to notify incumbent operators and face potential risks of delay with respect to the physical relocation of the BAS systems, the simple notification to a TV Bands Database provider (or the Commission) proposed here would be both minimally burdensome and foolproof. The TVDB

¹¹⁹ *Incentive Auctions NPRM*, at ¶ 218, citing 47 C.F.R. § 101.79(a) (an Emerging Technology (ET) licensee may require the incumbent to cease operations, provided that the ET licensee intends to turn on a system within the interference range of the incumbent as determined by TIA TSB 10-F or any successor standard).

¹²⁰ *Incentive Auctions NPRM*, at ¶ 219.

administrator would have the authority and responsibility to deny future access to the frequency band prior to the commencement of service – a denial of service that is enforced automatically by the ordinary operation of white space devices under the Commission’s existing rules.

Finally, PISC recommends that the Commission define a standardized local protection area that would be removed from availability through the TV Bands Database whenever the licensee is within 30 days of commencing substantial service in any part of the area. In this respect, it is important to strike a balance between simplicity for the parties and not denying access to unlicensed devices located far beyond the licensee’s actual service area. With this in mind, we recommend that the Commission adopt areas no larger than Cellular Market Areas. However, because in certain states CMAs can extend hundreds of miles beyond a single urban area where a carrier may initially provide service, the Commission should also consider the feasibility of the licensee providing more specific information, such as the shape file of the protection contour that is needed to give the licensee protection from harmful interference, or at least the data that would be needed by the TV Bands Database administrator to generate an interference protection contour (just as the TVDBs calculate for broadcast station based on transmitter location, height, power and other objectively known variables).

VII. PERSONAL/PORTABLE UNLICENSED DEVICES SHOULD BE PERMITTED TO OPERATE ON CHANNELS 14 TO 20 SINCE THE TV BANDS DATABASE CAN PROTECT PUBLIC SAFETY OPERATIONS DURING THE T-BAND TRANSITION

The *Incentive Auctions NPRM* states that although Section 6103 of the Spectrum Act requires reallocation of the channels between 14 and 20 (the “T-Band”) licensed to local public safety agencies in 11 large metropolitan markets by 2021, the Commission intends to address

public safety's T-Band transition in a separate Public Notice.¹²¹ While consideration of the T-Band transition in a separate proceeding may be appropriate, PISC believes there is one related issue that the Commission should consider in the incentive auction rulemaking unless it will be included in the forthcoming T-Band Notice.

Specifically, PISC recommends that the Commission propose permitting the operation of personal/portable white space devices on channels 14 to 20 in the markets and on the channels where they are *not* being used by Private Land Mobile Radio Service (PLMRS) or Commercial Mobile Radio Service (CMRS) licensees. Since public safety typically occupies only two T-Band channels in a small and finite number of cities, it should be possible to rely on the TV Bands Database to deny white space devices permission to transmit on channels registered for use by PLMRS or CMRS operations in those 11 metropolitan markets. In fact, since fixed unlicensed white space devices are authorized to operate on the T-Band (where there are three consecutive white space channels available), and at far higher power levels, there is no apparent reason why the TV Bands Database cannot also protect public safety operations during the T-Band transition from very low-power unlicensed devices (typically 40 milliwatts), particularly since a conservative protection contour could account for any added risk that the devices are mobile. And since, unlike fixed devices, personal/portable TVBDs devices can operate on any white space channel, T-Band white space that is now fallow in every market across the nation can be put to productive use for unlicensed innovation and services.

¹²¹ *Incentive Auctions NPRM*, at ¶ 19. See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, §§ 6402, 6403, 125 Stat. 156 (2012) (Spectrum Act).

VIII. THE COMMISSION SHOULD INCLUDE AN AUCTION-SPECIFIC SPECTRUM AGGREGATION LIMIT AS A GENERAL CONDITION OF LICENSES AWARDED IN THE FORWARD AUCTION

The Commission is correct to consider the application of a spectrum screen concurrent to and as part of this rulemaking proceeding, given the unique value of the spectrum being reallocated. Below, we highlight two important considerations in evaluating a screen in this context: 1) that the Commission recognize the unique value of 600 MHz spectrum, particularly as it relates to the coverage needed by potential market entrants and competitive carriers seeking to establish an LTE network; and 2) that the Commission incorporate that value in an auction-specific aggregation limit that reflects that inherent weight. We examine three frameworks under which the Commission might structure an aggregation limit to incorporate these considerations. Ultimately, PISC recommends a separate aggregation limit for this auction that focuses on a bidder's overall holdings below 1 GHz.

A. The Commission has authority to implement an auction-specific spectrum screen as a general license condition that applies equally to all bidders

As an initial matter, the imposition of a spectrum cap or screen in this proceeding would not run afoul of section 6404 of the Spectrum Act. We recognize that section 6404 of the Spectrum Act “provides that the Commission may not prevent a person from participating in a system of competitive bidding, provided that the person complies with all procedures and other requirements established to protect the auction process.”¹²² Nonetheless, the Act specifically retains FCC's authority to impose licensing conditions of general applicability based on the public interest standard.¹²³ The imposition of a spectrum limit and any related conditions for exceeding the screen's threshold would therefore not violate the Act. Moreover, since the

¹²² *Incentive Auctions NPRM*, at ¶381.

¹²³ 47 U.S.C. 309(j)(17)(B): “Nothing in subparagraph (A) affects any authority the Commission has to adopt and enforce rules of general applicability, including rules concerning spectrum aggregation that promote competition.”

Commission would still have to approve any transfers after the auction concludes, there would in any case be no ineligibility at the auction stage, as an entity surpassing the threshold would decide what spectrum and how much to divest post-auction in each local market.¹²⁴

PISC recommends that the limit imposed here should be auction specific. The harsh reality for wireless markets is that not all spectrum is created equal. As others have rightly noted, different bands of spectrum offer different value to carriers, and the Commission's current practice of weighing all spectrum equally does not adequately reflect the nuances of these varying value propositions or their impact on competition and consumer choice. Indeed, "this simplistic method ignores the large differences in value and utility between bands like 700 MHz and BRS," and "[t]he Commission should not expect robust national competition, particularly in suburban, exurban and rural markets, if its policies let the Baby Bell carriers control more than four-fifths of the available spectrum below 1 GHz."¹²⁵ The reasons for this variance in value comes from a variety of factors:

"Commercial spectrum bands differ from one another in numerous technical, operational, and regulatory aspects, including signal propagation, availability of network equipment and consumer handsets, size and contiguity of spectrum blocks, availability of paired bands for uplink and downlink transmissions, technical restrictions (*e.g.* guard bands, power limits), cost of clearing incumbents, and need for coordination or other complex negotiations with other licensees."¹²⁶

¹²⁴ *Incentive Auctions NPRM*, at ¶ 384.

¹²⁵ Comments of Free Press, WT Docket No. 12-269 (Nov. 28, 2012) at 11 (Free Press Comments). *See also* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, including Commercial Mobile Services, WT Docket No. 10-133, *Fifteenth Mobile Wireless Report*, 26 FCC Rcd 9664, 9837 ¶ 298-299 (2011) (*Fifteenth Annual Competition Report*): "Of the sub-1 GHz spectrum, Verizon Wireless and AT&T each hold a significant amount of the available Cellular and 700 MHz spectrum, which is well suited for the provision of mobile broadband. Specifically, when measured on a licensed MHz-POP basis, Verizon Wireless holds 47.7 percent of the Cellular spectrum and 42.8 percent of the 700 MHz spectrum, while AT&T holds 43.6 percent of the Cellular spectrum and 24.4 percent of the 700 MHz band spectrum. Adding these two bands together, Verizon Wireless holds 45 percent of the licensed MHz-POPs of the combined Cellular and 700 MHz band spectrum, AT&T holds approximately 33 percent."

¹²⁶ Comments of Sprint Nextel Corporation WT Docket No. 12-269 (Nov. 28, 2012) at 6 (Sprint Comments). *See also Fifteenth Mobile Wireless Report* at ¶ 292.

From these factors emerges a particularly valuable class of spectrum below 1 GHz. And, as a corollary, control of a large share of this highly valuable spectrum affords the controlling entity with significant advantages within mobile service markets. This spectrum has “better intrinsic spectrum propagation than spectrum in higher bands and therefore provides signal coverage over larger geographic areas,”¹²⁷ and allows for “superior penetration of buildings, vehicles, and other physical obstacles, thereby typically requiring fewer cells in urban areas to achieve sufficient signal strength.”¹²⁸

In addition, the Commission should consider the related issue of coverage versus capacity. Coverage is most important for potential market entrants and existing competitive carriers trying to establish a national or regional LTE network – these entities are coverage limited, not primarily capacity limited. Capacity can be a constraint on established LTE networks, as they add customers and enhance bandwidth intensive services. But initially, potential entrants and competitive carriers need to establish a critical mass of coverage in a reasonable time at a reasonable cost. Spectrum below 1 GHz is uniquely suited for coverage and yet it is overwhelmingly controlled by the two largest carriers with nationwide coverage. These concerns make 600 MHz auction unique and ideally suited to advance a competition policy that is concerned with encouraging more than two or three serious national or regional LTE carriers competing in every market.

¹²⁷ Sprint Comments at 7; *see also* Reply Comments of T-Mobile USA, Inc. WT Docket No. 12-269 (Jan. 7, 2013) at 10 (T-Mobile Reply Comments): “Certain propagation characteristics of low-band spectrum, such as in-building penetration and efficient coverage of rural areas, simply cannot be replicated at higher bands even if carriers are willing to make the additional investments required to deploy systems in those bands.

¹²⁸ Sprint Comments at 7.

B. The Commission should adopt an auction-specific aggregation limit that reflects the different characteristics of different spectrum bands.

The Commission asks specifically asks for comment on a rule “that permits any single participant in the auction to acquire no more than one-third of all 600 MHz spectrum being auctioned in a given licensed area...”¹²⁹ and “whether [the Commission] should adopt a threshold that recognizes the different characterizations of different spectrum bands...”¹³⁰ Given the variance in spectrum value noted above – and the nature of the challenge for competition policy, which is access to the best spectrum to establish a competitive LTE network – PISC strongly recommends a separate aggregation limit for this auction or, alternatively, for holdings below 1 GHz overall.

On one hand, the Commission could, in recognition of the value of the spectrum at issue in this proceeding, adopt an auction-specific threshold in this proceeding that reflects that value. In this context, we believe the Commission’s proposed one-third limit to be too high considering the unique propagation characteristics of 600 MHz spectrum and its potential to either enable or undermine the ability of competitive carriers to establish a national or even a regional LTE network. Indeed, because only the two dominant carriers currently have sufficient spectrum under 1 GHz for national or widespread regional coverage, there is a risk that, if those carriers were to acquire two-thirds of the paired spectrum available in this auction, there would be limited remaining spectrum available to establish or sustain any improvement in wireless competition. If that risk were realized, there may be insufficient 600 MHz spectrum available for even one other carrier to establish a substantial LTE network on spectrum under 1 GHz.

This issue is exacerbated by the lack of interoperability on the 700 Mhz band. As others have noted, “the lack of interoperability has severely hindered deployment of 4G services in the

¹²⁹ *Incentive Auctions NPRM*, at ¶ 384.

¹³⁰ *Id.*, at ¶ 384.

band by smaller carriers, and has significantly impaired competition and innovation.”¹³¹ As a result of the absence of interoperability and the subsequent access to interoperable devices, smaller carriers lack the economies of scale to compete nationwide. As a result, access to valuable spectrum below 1 GHz is one necessary component for competitive carriers and new entrants to acquire sufficient coverage in the absence of interoperability.¹³²

One way to mitigate these problems and permit carriers to acquire the spectrum they need to obtain the coverage for a substantial, competitive LTE network would be to impose an aggregation limit that caps spectrum based on a share of the available *paired bands*. The most valuable spectrum to a new entrant seeking to establish widespread coverage is paired spectrum, and remaining lots of supplemental spectrum could be useful to carriers looking to augment capacity on existing networks. However, incumbent carriers have an incentive to acquire paired spectrum not just to increase capacity, but also to foreclose new entrants. By separating paired from unpaired, supplemental uplink and downlink spectrum within the denominator of the aggregation-limit equation and preserving sufficient paired spectrum for competitive providers, the Commission could therefore prevent the two largest carriers from foreclosing new entrants into the market.

In addition, a more meaningful aggregation limit might instead examine the aggregate of holdings of carriers of spectrum in bands below 1 GHz, as proposed by various carriers in the related spectrum aggregation proceeding.¹³³ As Sprint explains, “the Commission should establish a cap for spectrum below 1 GHz,” and “[t]he cap should be applied on a prospective basis only.” This approach would ensure that one or two carriers do not dominate within a

¹³¹ Comments of RCA – The Competitive Carriers Association WT Docket No. 12-69 (June 1, 2012) at 9 (Comments of RCA).

¹³² Another, noted below, is a condition for wholesale access for those entities exceeding a set aggregation limit.

¹³³ Reply Comments of Sprint Nextel Corporation WT Docket 12-269 (Jan. 7, 2013) at 16-17 (Sprint Reply Comments); Reply Comments of T-Mobile at 5.

valuable class of spectrum, and would further mitigate the problem of, for example, the two dominant carriers acquiring two-thirds of spectrum on top of the 80%+ of the 700 MHz band and their legacy 800 MHz grants, which would leave too little left for all other potential carriers, including potential new entrants.

Finally, if the Commission decides to apply a broader screen, it should consider a “weighted approach” that factors the greater value of spectrum holdings below 1 GHz into the overall screen.¹³⁴ If it chooses to apply such a screen here, the Commission should, at the very least, weight spectrum holdings below 1 GHz in proportion to either the capex differential (treating this as coverage spectrum) or the market value differential, based on recent auctions and secondary market transactions, or incorporate an explicit cap on those holdings in accordance with the recommendations noted above as part of a function of the screen.

C. Additionally, the Commission should impose wholesale access conditions on any acquisition of 600 MHz spectrum above the threshold.

Finally, the Commission asks “whether [it] should adopt a threshold that would allow a licensee to acquire additional 600 MHz spectrum above that threshold so long as the licensee agrees to comply with certain conditions such as spectrum sharing through roaming and/or resale obligations, infrastructure sharing, or accelerated buildout requirements.”¹³⁵ We agree that, depending on how the Commission structures and applies the aggregation limit, any acquisition above that limit should include pro-competitive conditions. The list of conditions included in the NPRM are not objectionable, although PISC emphasizes particularly the need for a wholesale access requirement.

¹³⁴ See, e.g. ,Comments of Free Press at 14-20 for an example how such a screen might be implemented.

¹³⁵ *Incentive Auctions NPRM*, at ¶ 384.

Specifically, the Commission should condition auction awardees that exceed the threshold to make a certain percentage of capacity available in each Economic Area for open wholesale leasing by any qualified entity, or for roaming by other carriers, on a non-discriminatory basis.¹³⁶ As PISC has noted previously, “[i]t is becoming increasingly clear that wireless connectivity on a nationwide basis is both essential to the survival of rural and regional carriers – who have always relied on roaming – and also a fuel for innovation among a rising tide of mobile equipment makers, application developers and mobile service providers, all of which are dependent on the terms of access to wireless networks.”¹³⁷

As to the survival of rural and regional carriers, small carriers have repeatedly asserted in the context of the debate over 700 MHz band interoperability that “roaming is of critical importance to smaller carriers because customers are increasingly dependent upon roaming agreements for seamless data services when they are traveling or working outside their home service areas.”¹³⁸ Just as competitive cell phone carriers could not have survived without cellular voice roaming, it’s unlikely that competitive mobile broadband carriers can survive for long in an LTE world without the ability to procure connectivity for their customers outside their home service area on fair and reasonable terms nationwide.¹³⁹ Providers and consumers of current and future devices, applications and services that bundle wireless connectivity and are sold independently from incumbent national carriers will also benefit from a partial wholesale access requirement. Since few carriers are likely to emerge from this auction with sufficient spectrum

¹³⁶ See Comments of New America Foundation, Public Knowledge and Consumers Union WT Docket No. 12-70, ET Docket No. 10-142, WT Docket No. 04-356 (May 7, 2012) at 11 (PISC AWS-4 Comments).

¹³⁷ PISC AWS-4 Comments at 10.

¹³⁸ Comments of Rural Cellular Association, In the Matter of 700 MHz Mobile Equipment Capability, RM No. 11592 (March 31, 2010), at 9.

¹³⁹ PISC AWS-4 Comments at 11.

below 1 GHz that aligns with their coverage areas, this condition would promote competition and consumer choice if the customers on those carriers could roam easily where needed.

This condition should apply for at least the initial license period (e.g., 10 years) and could be revisited as part of the renewal process. However, it is important that the condition be in place for a substantial number of years so as not to deter competitive carriers and especially innovative new business models or start-ups that may not have alternative spectrum available.

CONCLUSION

The undersigned members of the Public Interest Spectrum Coalition (PISC) support the Commission's efforts to reallocate fallow broadcast band spectrum for flexible use on a licensed and unlicensed basis. At the same time, PISC 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 on many of the particular components of this ambitious proceeding.

Respectfully Submitted,

Open Technology Institute at the New America Foundation
Consumer Federation of America
Public Knowledge
National Hispanic Media Coalition

/s/ Michael Calabrese

Michael Calabrese

Sarah Morris

Grady Johnson

Sean Vitka

Wireless Future Project/Open Technology Institute

New America Foundation

1899 L Street, NW – 4th Floor

Washington, DC 20036

January 25, 2013