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March 17, 2014

Ms. Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: GN Docket No. 12-268 (Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions); GN Docket No. 12-354 (Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band); ET Docket No. 13-49 (Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band)

Dear Ms. Dortch:

The Dynamic Spectrum Alliance applauds the Commission's groundbreaking efforts to enable greater use of spectrum resources in the TV white spaces below 700 MHz, in the 3.5 GHz bands, and in the 5 GHz bands. The Dynamic Spectrum Alliance is a newly formed global organization advocating for more efficient and effective spectrum use. Although still less than a year old, the Dynamic Spectrum Alliance membership already spans 34 multinational companies, small-and-medium-sized enterprises, and academic, research, and other organizations from around the world, all working to create innovative solutions that will increase the utilization of available spectrum to the benefit of consumers and businesses alike.¹

Members of the Dynamic Spectrum Alliance are investing in the future – a future in which more spectrum is dynamically shared globally, across a variety of complementary bands and under an increasing array of licensed, unlicensed, and other regulatory regimes. The Dynamic Spectrum

¹ The Dynamic Spectrum Alliance's members are: 6Harmonics Inc.; Adaptrum, Inc.; Aviacomm, Inc.; Botswana Innovation Hub; British Sky Broadcasting Limited; Canadian Spectrum Policy Research; Carlson Wireless Technologies Inc.; Communication Research Center of National Taiwan University; Council for Scientific and Industrial Research (CSIR); CTVR, Trinity College, University of Dublin; RelayServices; Facebook; Gigabit Libraries Network; Google Inc.; Institute for Infocomm Research (I2R); Institute for Information Industry; InterDigital Communications, Inc.; Mediatek Inc.; Microsoft Corporation; Mid-Atlantic Broadband Communities Corporation; MyDigitalBridge Foundation; National Institute of Information and Communications Technology; Neul Ltd.; Panaftel Wireless Limited; Selcom Broadband Limited / UhuruOne; Shared Spectrum Company; SpectraLink Wireless, Ltd.; Tanzania Commission for Science and Technology; Texas Instruments Inc.; University of Strathclyde - Centre for White Space Communications; University of York; and WaveTek Nigeria Limited. For more information, please visit www.dynamicspectrumalliance.org.

Alliance's members greatly appreciate the Commission's efforts to ensure the most productive use of radio spectrum and offer the following suggestions for the Commission's consideration as it develops spectrum sharing plans for the 600 MHz, 3.5 GHz, and 5 GHz bands.

The Commission Should Enable Robust Access to Licensed and Unlicensed Spectrum Above and Below 1 GHz

Enabling access to both licensed and unlicensed spectrum is key to meeting increasing spectrum demands. In the past, such a balanced approach has fueled the wireless economy, benefiting consumers, innovators, and investors alike. Exclusive access to licensed spectrum has enabled wireless carriers to make large-scale, long-term investments in their networks and to strengthen their competitive positions. Shared access to unlicensed spectrum has enabled wireless carriers to offload both traffic and costs onto Wi-Fi networks, massively increasing available bandwidth and productivity. More critically, complementary licensed and unlicensed access has enabled consumers to improve the quality and reduce the cost of their own broadband access. It is hard to imagine the typical wireless consumer in the U.S. not relying on both licensed and unlicensed spectrum during any given day.

Open and shared access to unlicensed spectrum has also fostered widespread contributions to innovation, competition, and fast-paced investment in emerging technologies. For instance, because unlicensed devices are “free from the burden of normal delays associated with the licensing process,” manufacturers can design equipment to “fill a unique need [that can] be introduced into the market quickly.”² Thousands of new unlicensed devices are certified each year. Wi-Fi devices are the best known, but Bluetooth,³ Zigbee,⁴ and RFID⁵ devices have all also experienced rapid growth in the last several years. Machine-to-machine technologies, which most often rely on unlicensed spectrum, represent a large and growing market as well.⁶

Spectrum regimes that rely on licensing alone can create uncertainty about spectrum availability and limit new investments in the sector, preventing countries from capturing the full economic rewards of broadband and wireless connectivity. This is significant because, as Richard Thanki notes in a recent economic paper, “the success of the [unlicensed] bands has been the most

² Kenneth R. Carter, Ahmed Lahjouji, & Neal McNeil, FCC, *Unlicensed and Unshackled: A Joint OSP-OET White Paper on Unlicensed Devices and Their Regulatory Issues*, OSP Working Paper Series at 5 (May 2003).

³ Bluetooth is a standard facilitating hands-free operation of music players, mobile phones, and other devices.

⁴ Zigbee powers technologies that benefit from ad hoc and mesh networking solutions, such as home automation.

⁵ Radio Frequency Identification (RFID) technologies are used in a variety of industries to track inventory or other objects.

⁶ Analysys Mason, *M2M Is Already a USD 10 Billion Sector*, Sept. 9, 2013, available at <http://www.analysismason.com/About-Us/News/Insight/M2M-growth-opportunities-Sep2013/> (last visited Dec. 26, 2013).

surprising and consequential change in the previous 15 years in spectrum management. The attendant economic benefits from [unlicensed] technologies are substantial, widely dispersed, and likely to exceed \$270 billion per annum globally.”⁷ Thanki further observes that the spectrum bands authorized for unlicensed access now account for the majority of innovation in wireless communications, the majority of wireless devices manufactured, and the majority of Internet data traffic delivered to consumers.⁸

The Wi-Fi experience also makes clear that greater availability of unlicensed spectrum increases demand for, and the utility of, licensed spectrum. Wi-Fi connectivity has enabled consumers to use their mobile phones, tablets, laptops, and other devices more intensively to access a variety of online content and services. For example, about 57% of all mobile data traffic in North America is currently carried by Wi-Fi, and by 2018 that figure is expected to increase to 64%, according to Cisco.⁹ Use and development of these online services in turn drives demand for licensed and unlicensed network access, creating a virtuous cycle of investment in content, as well as both licensed and unlicensed access.

Because licensed and unlicensed uses provide distinct opportunities and benefits that complement each other, the FCC should make more spectrum available for both licensed and unlicensed uses at a variety of frequencies.¹⁰ A spectrum policy that balances licensed and unlicensed approaches will maximize innovation and investment.

Sufficient Usable Unlicensed Spectrum Must Remain Available in 600 MHz Bands

The Commission’s 600 MHz proceeding, in which it will conduct a reverse and a forward auction to make television broadcast frequencies available for wireless broadband use, “is an important component of the Commission’s unprecedented commitment and efforts to make

⁷ See Richard Thanki, *Making the case for permissive dynamic access to the radio spectrum*, at 16 (August 2013) (Thanki 2013), available at http://research.microsoft.com/en-us/projects/spectrum/case-for-permissive-rule-based-dynamic-spectrum-access_thanki.pdf (last visited Feb. 8, 2014).

⁸ Thanki 2013 at 2.

⁹ See Tech Companies Push for Greater Wi-Fi Access, available at <http://www.wififorward.org/tech-companies-push-for-greater-wi-fi-access/> (last visited Feb. 17, 2014).

¹⁰ Although Wi-Fi technology is highly efficient, the 2.4 GHz spectrum is becoming congested in major metropolitan markets. See Richard Thanki, *The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet*, at 6, 14 (June 2012) (Thanki 2012), available at http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report_thanki.pdf (last visited Dec. 26, 2013); see also Comments of Comcast Corporation at 14, *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, FCC Docket No. ET 13-49 (filed May 28, 2013), available at <http://apps.fcc.gov/ecfs/document/view?id=7022418913>.

additional licensed and unlicensed spectrum available for broadband.”¹¹ The *600 MHz NPRM* recognizes the importance of and “burgeoning demand” for unlicensed spectrum.¹² Accordingly, the *600 MHz NPRM* correctly seeks to determine “how to best preserve and improve the use of the unused spectrum in the broadcast television bands for unlicensed operations, including the possibility of providing for additional spectrum, ideally on a nationwide basis, for unlicensed use in these bands.”¹³ As the Commission previously explained, unlicensed operations in these bands could create networks with “extended range, fewer dead spots, and improved individual speeds” that “are expected to spur investment and innovation,” thereby enabling “potential uses ... limited only by the imagination.”¹⁴

This change is already happening. The Dynamic Spectrum Alliance’s members are involved in deployments of TV white spaces technologies – currently spanning four continents – encompassing devices, databases, and networks. Many of these projects are commercial deployments combining different unlicensed and licensed wireless technologies, including TV white spaces, in places ranging from the densest urban environments to rural areas lacking even electricity and encompassing both broadband and machine-to-machine communications.¹⁵ These deployments are helping address key policy challenges around digital and social inclusion and are improving citizen access to education, healthcare, and government services. These projects are increasing available bandwidth and are helping to make wireless connectivity more ubiquitous and affordable. They are having real impact on people’s lives.

Meanwhile, after substantial investment, the building blocks are falling into place for a globally scalable marketplace for devices capable of dynamically accessing unused white space spectrum. Numerous standards have been developed including the IEEE’s 802.11af standard for Wi-Fi in the television white space spectrum, the IEEE 802.22 standard for wide area networks, and the Weightless standard for machine-to-machine (M2M) communication. Each of these advances is creating opportunities for vendors to begin product development. Moreover, the IETF PAWS standardized protocol for device to database communication is now stable, with devices and databases now deploying to meet the draft standard. And, the TV white space database providers have developed a specification for database-to-database communication, which is being extended to countries beyond the United States. In Europe, the ETSI BRAN has completed and approved EN 301 598, which could become the European (and by default African) standard for TV white space devices.

¹¹ See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 27 FCC Rcd. 12,357 ¶ 4 (2012) (“*600 MHz NPRM*”).

¹² See *600 MHz NPRM* ¶¶ 228-29.

¹³ *Id.* ¶ 227.

¹⁴ *Unlicensed Operation in the TV Broadcast Bands*, Second Memorandum Opinion and Order, 25 FCC Rcd. 18661, 18662 (¶ 1) (2010).

¹⁵ See, e.g., <http://research.microsoft.com/en-us/projects/spectrum/pilots.aspx>.

Even with all this progress, and despite the overall beneficial goals of the 600 MHz proceeding, the uncertainty about continued TV white spaces availability that surrounds that proceeding is hampering further investment in TV and other white space. To date, the United States has demonstrated technical and policy leadership in its efforts to enable unlicensed access to the TV white spaces. It is critical, therefore, that when allocating the spectrum made available as a result of the digital television transition and repacking the 600 MHz broadcast bands, the Commission strikes the right balance between exclusive-use licensed access and non-exclusive, open, unlicensed access.

The Dynamic Spectrum Alliance agrees with the Wi-Fi Alliance that there needs to be at least the equivalent of 24 MHz of usable unlicensed spectrum nationwide below 700 MHz, which may be supplemented in some locations by conventional TV white space access to unassigned broadcast frequencies. The spectrum for the four nationwide 6 MHz channels could come from the following sources: (1) The guard band(s) needed to separate broadcast transmissions from mobile broadband reception; (2) The duplex gap between the bands to be licensed for mobile wireless use; (3) Channel 37 in areas where unlicensed devices can coexist with medical telemetry and radio astronomy devices; and (4) Any channels reserved for wireless microphones when licensed users are not making use of them. On a market-specific basis, unlicensed devices should be permitted to continue using unassigned channels in the repacked UHF spectrum under the FCC's TV white spaces rules.

To ensure that guard bands and duplex gaps are usable for unlicensed devices, the Commission should keep current TVWS in-band power and out-of-band emission rules for personal/portable devices. Likewise, the duplex gap between uplink and downlink licensed operations must be 12 MHz at an absolute bare minimum to create one usable 6 MHz unlicensed channel and ensure that licensed devices are protected from harmful interference. The guard band between uplink licensed operations and broadcast television should be 11 MHz at a minimum to accommodate a usable unlicensed channel in that gap. The Commission can make these accommodations (indeed could adopt an even larger guard band and duplex gap), while adhering to the Spectrum Act's "technically reasonable" standard, which empowers the Commission to determine the appropriate amount of spectrum needed to prevent harmful interference between licensed services outside the guard bands.¹⁶

The Dynamic Spectrum Alliance prefers a 600 MHz band plan that limits market variability and instead provides access to uniform, nationwide spectrum for unlicensed and licensed uses. Regardless of the band plan that the Commission ultimately adopts, the Commission should enable unlicensed spectrum access in geographic areas where the licensee has yet to build out a network or has ceased operations. The Commission should also make available for unlicensed use any unassigned spectrum remaining after the auction of the LTE uplink and downlink channels. By allowing unlicensed use in areas where spectrum remains unauctioned or where new licensees have yet to deploy, the Commission will ensure that otherwise fallow spectrum is being put to valuable use.

¹⁶ Middle Class Tax Relief and Job Creation Act, Pub. L. 112-96, 126 Stat. 156 ("Spectrum Act").

The Commission Must Ensure Meaningful Unlicensed Access to the 3.5 GHz Spectrum

The Dynamic Spectrum Alliance supports the Commission's proposal to create a new Citizens Broadband Radio Service in the 3550-3650 MHz band, which would be managed by a spectrum access system (SAS) incorporating a dynamic database and/or, potentially, other interference mitigation techniques, such as sensing, beacons, and other methods. Just as Wi-Fi transformed access over the past decade, opportunistic and dynamic small-cell devices in the 3.5 GHz band can deliver speed, quality, and agility that consumers and businesses have never before seen. Dynamic access in the 3.5 GHz could also be used to narrow the gap for last mile access.

In general, the Dynamic Spectrum Alliance supports the Commission's proposed three-tiered approach with ascending rights for General Authorized Access (GAA), Priority Access, and Incumbent Access tiers. To ensure the most effective deployment of new opportunistic technologies in the 3.5 GHz band, the Commission should reserve sufficient nationwide spectrum for robust, unlicensed General Authorized Access ("GAA"). A guaranteed minimum amount of GAA spectrum would encourage the Dynamic Spectrum Alliance's members -- and other service providers and manufacturers -- to research, develop, and deploy new technologies that could connect opportunistically on the 3.5 GHz band. The Commission also should provide regulatory flexibility to developers and users of GAA products and services.

The Dynamic Spectrum Alliance believes that the regulatory framework for the SAS should ensure that Citizens Broadband Service users, whether Priority Access or GAA, operate only in areas where they would not cause harmful interference to the federal incumbents. SAS should also be permitted to suggest power levels to devices. Specifying a reduced power level may, in some circumstances, allow a device to operate closer to a protected contour in order to maximize spectrum use while avoiding the production of harmful interference. As with the TV white space databases, SAS services should be competitively differentiated consistent with baseline standards.

The FCC initially proposed that the Priority Access tier provide an alternative to traditional dedicated spectrum for users with strict quality-of-service needs such as hospitals, utilities, and state and local governments. The DSA believes that it can also enable both commercial and non-commercial network operators -- such as Wi-Fi aggregators and enterprise networks -- to offer a better grade of service to their customers. At the same time, the Commission should ensure that this spectrum is efficiently used. The DSA believes that, in order to maximize spectrum utilization, the Commission should ensure that the TTL (Time to Live) of Priority Access Licenses are short in duration, and that spectrum can be dynamically opened up for GAA use if it is not being used by the licensee.

The Commission Should Expand Unlicensed Access to the 5 GHz Bands

The Dynamic Spectrum Alliance supports the Commission's proposals to amend Part 15 of its rules governing the operation of Unlicensed National Information Infrastructure (U-NII) devices in the 5 GHz band. Access to additional 5 GHz spectrum could markedly increase available

bandwidth for Wi-Fi and other wireless devices, enabling Gigabit connectivity over short ranges, indoors and outdoors, and complementing both licensed and unlicensed connectivity available at other frequencies.

The Dynamic Spectrum Alliance encourages the Commission to move forward quickly to designate the U-NII-2A band and the U-NII-4 band for unlicensed use and to update its technical rules, including harmonizing service rules, for the existing U-NII bands so as to allow more intensive use while protecting incumbents. The Commission should authorize outdoor as well as indoor use, allow devices to operate at increased power levels, and harmonize service rules across the various U-NII bands, insofar as possible. For example, the maximum power limit in the U-NII-1 band is 50 mW, whereas standard Wi-Fi devices can typically operate at up to 100 mW. Harmonization will make it easier for chip manufacturers to standardize equipment across the bands. It will also allow increased use of the 802.11ac standard, along with other technical enhancements, to provide gigabit speeds over short ranges.

As part of this process, the Commission should consider sharing techniques, including geolocation database technologies, whether standalone or integrated with sensing, beacons, and other technology, as an option for unlicensed devices in the 5 GHz bands, to accommodate more users, allow more efficient use of the band, and facilitate enforcement of sharing rules.

The Commission Should Immediately Endorse the ‘Use it or Share it’ Principles for Licensed Spectrum

As previously stated, the Dynamic Spectrum Alliance recognizes the need for both licensed and unlicensed spectrum to ensure access for all users. Establishing the optimal balance between the two is a critical challenge for the Commission and will have far reaching effects to our economy.

In exploring the range of possible solutions which would maximize the spectrum utilization, the Commission proposed the principle of “Use it or Share it” in its *600 MHz NPRM*.¹⁷ The DSA supports establishing this policy in the 600 MHz and considering its expansion to other bands. In particular, establishing this policy before conducting auctions for additional licensed use provides fair notice to all parties; discourages the licensing of spectrum for speculative future value; and signals to the market that more unlicensed spectrum will be available in regions where there otherwise are limited business cases for licensed deployments.

Moreover, this policy can easily be implemented using the same IETF PAWS model developed for TV White Spaces or could be implemented in the SAS model proposed for the 3.5 GHz band. This approach allows a database to continue to protect incumbent licensees in these new bands while at the same time enabling vast amounts of underutilized spectrum for unlicensed access.

¹⁷ *600 MHz NPRM* ¶ 405; see also Michael Calabrese, *Use It or Share It: Unlocking the Vast Wasteland of Fallow Spectrum* (2011), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1992421

The Dynamic Spectrum Alliance is eager to work with the Commission to ensure the most efficient and effective use of spectrum across a range of complementary frequencies, and would be happy to provide the Commission with additional information as it develops its spectrum-sharing plans. Should you have any questions about this submission, please do hesitate to contact the undersigned at 425-704-9269 or 202-641-7615.

Sincerely,

/s/ Paul Garnett

Paul Garnett, Director Technology Policy
Microsoft Corp.

On behalf of
The Dynamic Spectrum Alliance