

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of

Revision of Part 15 of the Commission's  
Rules to Permit Unlicensed National  
Information Infrastructure (U-NII) Devices  
in the 5 GHz Band

ET Docket No. 13-49

**COMMENTS OF GOOGLE INC. AND MICROSOFT CORPORATION**

Aparna Sridhar  
Policy Counsel  
**GOOGLE INC.**  
1101 New York Avenue NW  
2nd Floor  
Washington, DC 20005  
(202) 346-1261

*Counsel for Google Inc.*

Staci Pies  
Director, Government and Regulatory  
Affairs  
**MICROSOFT CORPORATION**  
901 K Street NW, 11th Floor  
Washington, DC 20001  
(202) 263-5947

*Counsel for Microsoft Corporation*

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## INTRODUCTION AND SUMMARY

Freeing up additional spectrum resources for unlicensed access will help drive economic growth and innovation and increase the availability and bandwidth of broadband connections throughout the United States.<sup>1</sup> As the Commission states in its Notice of Proposed Rulemaking, unlicensed access to the 5 GHz band “hold[s] significant promise for helping to accommodate the needs of businesses and consumers for fixed and mobile communications.”<sup>2</sup> Users of Google and Microsoft products and services depend on access to robust broadband connections, including broadband over both licensed and unlicensed wireless networks.

Spectrum allocations for unlicensed use across a variety of frequencies, including TV white spaces and the 2.4 GHz band, will complement consumers’ reliance on exclusively licensed spectrum and diversify consumers’ connectivity options. Additional 5 GHz allocations, with large blocks of available spectrum, offer particular potential for high-capacity, short-range connections. Different spectrum bands and licensing models will help address different consumer needs.

Microsoft and Google, therefore, strongly support the Commission’s proposals to expand commercial and public access to the 5 GHz band on a shared basis, as well as the FCC’s other efforts to increase spectrum sharing across a variety of frequencies. The Commission should move forward quickly to designate the U-NII-2A band and the U-NII-4 band for unlicensed use and to update and harmonize its technical rules for the existing U-NII bands so as to allow more intensive use while protecting incumbents. As

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<sup>1</sup> See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat.

<sup>2</sup> Throughout these comments, the terms “5 GHz band” and “U-NII bands” refer to the spectrum between 5150 and 5925 GHz.

part of this process, the Commission should consider sharing techniques—including authorizing geolocation database technologies as an optional alternative for unlicensed users—to accommodate more users, allow more efficient use of the band, and facilitate enforcement of sharing rules.

## DISCUSSION

### I. **EXPANDING UNLICENSED ACCESS TO THE 5 GHZ BAND WILL DRIVE ECONOMIC GROWTH AND INCREASE BROADBAND CONNECTIVITY FOR CONSUMERS.**

The benefits of expanding unlicensed access to spectrum are widely known and beyond dispute. The unlicensed technology sector is large and growing rapidly, with unlicensed technologies contributing many billions of dollars to the U.S. economy.<sup>3</sup> Unlicensed access provides a means of innovating in wireless with lesser financial burdens and fewer regulatory restrictions than those attendant to licensed spectrum. Market forces are better able to shape investment and deployment decisions on an ongoing basis. While licensed access provides network operators the certainty they may need to invest, unlicensed access allows a larger number of participants individually to make smaller investments, and to introduce new products and services quickly and affordably.

Just as licensed and unlicensed uses are complementary, a balance of licensed and unlicensed access, both above and below 1 GHz, will best accommodate the

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<sup>3</sup> Mark Cooper, *Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves*, at 7 (Jan. 2012), <http://www.markcooperresearch.com/SharedSpectrumAnalysis.pdf>; Comments of Google Inc. and Microsoft Corporation, *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Docket No. 12-268 (Jan. 25, 2013), at 2-21; Comments of the National Cable & Telecommunications Association, *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Docket No. 12-268 (Jan. 25, 2013), at 2-4.

nation's spectrum needs. Consumers need unlicensed access to both high-frequency and lower-frequency spectrum to address their growing demand for diverse wireless devices and applications with different ranges and capabilities.

Unlicensed networks and users, moreover, face a congestion challenge akin to the network congestion experienced by licensed network operators and their customers. The same need for additional spectrum resources exists for unlicensed and licensed devices. Further, peak cellular and Wi-Fi traffic occurs during different time periods—meaning there are times of the day when consumers will overburden one form of access even while the other has available capacity.<sup>4</sup> So, it is critically important that the FCC designate additional spectrum for both licensed and unlicensed networks.

In particular, although 2.4 GHz unlicensed spectrum is being used very efficiently,<sup>5</sup> it has become saturated during certain times of day in heavily trafficked areas such as city centers, apartment buildings, and public venues.<sup>6</sup> This congestion imposes a large cost on consumers because Wi-Fi is the most heavily used method of wireless broadband connectivity and the 2.4 GHz band is the core Wi-Fi band today. Improved unlicensed access to the 5 GHz band, as recommended in the 5 GHz NPRM, has notable potential to help address the need for additional unlicensed spectrum.

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<sup>4</sup> See, e.g., Richard Thanki, *The Economic Significance of License-Exempt Spectrum to the Future of the Internet*, at 37 Figure 15 (June 2012), <http://www.wirelessinnovationalliance.org/index.cfm?objectid=DC8708C0-D1D2-11E1-96E9000C296BA163> (providing smartphone traffic data for UK).

<sup>5</sup> See *id.* at 14 (concluding that “a small-cell architecture is remarkably spectrally efficient; the aggregate spectral efficiency of the 2.4GHz band is at least 30 times greater than the overall efficiency of any cellular band.”).

<sup>6</sup> See Comments of the National Cable & Telecommunications Association, GN Dkt. 12-354, at 7 (Feb. 20, 2013) (noting congestion in 2.4 GHz band, particularly in urban areas).

Timely Commission action in the 5 GHz band would thereby speed innovation and economic growth, especially by increasing the bandwidth of Wi-Fi connections in the home.

Wi-Fi is already used in some of the 5 GHz bands designated for unlicensed use. Even assuming ongoing advances in Wi-Fi technology, however, the 5 GHz bands currently available for unlicensed technologies will not be able to support growing consumer demand. Expanding existing unlicensed designations to the U-NII-2B and U-NII-4 bands, and revising the Commission's rules for the U-NII-1, U-NII-2A, U-NII-2C, and U-NII-3 bands, will provide additional capacity for Wi-Fi connections (especially at short range) and thereby help manage congestion in the 2.4 GHz band.

Indeed, industry has developed a Wi-Fi standard specifically for the 5 GHz band. This standard, IEEE 802.11ac, uses 80 MHz and 160 MHz channels to provide significantly increased bandwidth and data rates, enabling transfers of larger amounts of data over the same spectrum. Innovators will use this standard to improve short-range video streaming and two-way, real-time video delivery, as well as other high-bandwidth consumer applications—if the FCC designates sufficiently wide unlicensed channels.

Unlicensed access to additional 5 GHz spectrum and updated rules also will enable increases in the aggregate capacity of outdoor wireless networks that operate in multiple bands, such as the networks cable operators are deploying to supplement their wireline offerings. Within a Wi-Fi network, higher frequencies such as 5 GHz can provide greater short-range capacity, while the lower frequencies such as TV band spectrum will enable greater range.

Finally, increased access to unlicensed spectrum has the potential to improve broadband access in rural areas. Rural wireless Internet service providers already make use of the 5 GHz band in the core of their base station coverage, and expanding access to this band will provide flexibility to supplement other capacity (such as capacity in the 2.4 GHz band, the 900 MHz band, and potentially the TV white spaces) at the edge of coverage.

## **II. RULES FOR THE 5 GHZ BAND SHOULD SUPPORT WIDESPREAD COMMERCIAL AND PUBLIC USE.**

In light of rapidly increasing consumer demand for unlicensed services, the contribution of unlicensed technology to the national economy, and the growing exhaustion of 2.4 GHz spectrum, the Commission should designate the U-NII-2B and U-NII-4 bands for unlicensed use and adopt technical rules for the 5 GHz band that enable more intensive use. Two steps are particularly important.

First, the Commission should authorize outdoor as well as indoor use to the fullest extent possible, across all segments of the band. Because unlicensed 5 GHz spectrum can be used as a substitute for some outdoor applications occurring in lower-frequency bands, increasing unlicensed access to the 5 GHz band for outdoor use will ease spectrum congestion in lower-frequency bands such as 2.4 GHz and LTE. Conversely, maintaining the indoor-only restriction on the U-NII-1 band would dramatically limit the types of uses that the band can support. Critical uses, such as increasing the capacity of wide area networks, would be hampered significantly. The Commission must protect incumbent users as it expands use of the 5 GHz band. But as discussed below, sharing techniques that are less onerous than an indoor-only restriction will accomplish this goal.

Second, the Commission should increase power levels and harmonize service rules across the various U-NII bands, insofar as possible. Higher power levels will allow commercial users to deploy services more effectively and to reach more consumers from a single base station. For example, the maximum power limit in the U-NII-1 band is 50 mW, whereas Wi-Fi operating power is typically as high as 100 mW for indoor use and up to 1 W for outdoor applications. 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, which are necessary to provide gigabit Wi-Fi.

**III. THE COMMISSION SHOULD CONSIDER AUTHORIZING OPTIONAL SHARING TECHNIQUES THAT MAY FURTHER INCREASE THE UTILITY OF THE 5 GHz BAND, INCLUDING GEOLOCATION DATABASE TECHNOLOGIES.**

Enforceable protections for incumbent users are essential to successful sharing of the 5 GHz band. The Commission has identified rule modifications that should improve the utility and reliability of Dynamic Frequency Selection (DFS) as a sharing tool.<sup>7</sup> In addition, however, the Commission should consider giving users of unlicensed 5 GHz spectrum flexibility to utilize alternative sharing technologies, such as geolocation database solutions. Such alternatives may be less costly than DFS to implement, and could avoid the service delays associated with DFS channel availability checks.<sup>8</sup> If

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<sup>7</sup> See *NPRM* ¶¶ 68-70.

<sup>8</sup> DFS systems require nomadic applications to wait 60 seconds to determine if there is an active radar in the area, and then, if a radar is detected, to wait 30 minutes before re-checking the spectrum. A network access point or device could more quickly query a database (using a different unlicensed frequency or communications method) and receive a signal indicating whether the 5 GHz U-NII bands are available for use at that location.

allowed as optional alternatives, they might further increase utility of the 5 GHz band while protecting incumbent users.

Below, we suggest how geolocation database technologies, as an illustrative example, might be employed in the 5 GHz band as an optional alternative to DFS, or otherwise to allow greater operating flexibility for unlicensed users.

**A. Alternatives to DFS in the U-NII-2A and U-NII-2C Bands.**

Database technologies may have a role in enabling use of particular classes of unlicensed devices, as an alternative sharing approach if the Commission finds that DFS protection is insufficient to allow those particular devices. Beyond that, and to the extent that the Commission continues to rely on DFS to protect incumbent users in any U-NII band, it should consider whether other technologies could be less burdensome alternatives to DFS.

For example, geolocation database approaches might provide a useful alternative approach to facilitating sharing with the Earth Exploration Satellite Service and similar services. These synthetic aperture radar (SAR) systems “perform space-based observations and measurements of surface topography, soil moisture, and sea surface height,” as well as “the higher resolution necessary for commercial applications, such as high-resolution surface mapping.”<sup>9</sup> To the extent unlicensed terrestrial use might interfere with these systems, a database approach, voluntarily used by unlicensed operators as an optional alternative to DFS, could provide protection either on a temporal basis when SAR satellites are overhead, or on a geographic basis to restrict unlicensed use in areas that are currently subject to SAR measurements.

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<sup>9</sup> NPRM ¶¶ 82, 85.

Similarly, database-controlled sharing may provide advantages over DFS in protecting incumbent Terminal Doppler Weather Radar (TDWR) systems. TDWR systems are in known fixed geographic locations<sup>10</sup> that a geolocation database could readily identify and protect. To the extent 5 GHz band radiolocation equipment is used at permanently fixed locations (such as federal installations) or locations known in advance (such as the sites of major public or government events), geolocation databases could be useful to prevent interference to that incumbent use, as well. Optional database solutions should be easy to implement for sharing applications such as these. Many, if not most, unlicensed devices have location awareness capabilities already. Growing experience in the TV white space context, moreover, is showing that the costs of device-based query software and establishing a database system are minimal.

#### **B. Other Optional Uses of Alternative Sharing Technologies.**

Geolocation databases and other alternative sharing technologies might be allowed, on an optional basis, to increase the utility of the 5 GHz band in other contexts as well.

##### *1. Satellite Feeder Links in the U-NII-1 Band.*

The Commission, for instance, currently prohibits outdoor unlicensed use of the U-NII-1 band and limits the power levels in that band to 50 mW.<sup>11</sup> The FCC established these restrictions more than a decade ago, based on assumptions that it now recognizes may need to be updated.<sup>12</sup> The Commission should ease these restrictions

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<sup>10</sup> NPRM ¶ 54.

<sup>11</sup> See NPRM ¶¶ 16, 36.

<sup>12</sup> NPRM ¶ 37.

nationwide to the extent possible. In addition, it should consider alternative approaches that would effectively protect the incumbent satellite links while simultaneously permitting more flexible unlicensed use of the band.

With access to the characteristics of the Mobile Satellite Service (MSS) feeder link signals and the location of the links, a geolocation database could calculate protection contours for these operations. Unlicensed devices could ping the database with their locations to receive information about channel availability and permitted power levels. Outside of the protection contours, unlicensed users that choose to employ database technology could increase power levels above what otherwise would be permitted, and operate outdoors (with qualified installations) even if the indoor-only restriction otherwise would continue to apply.

Similar technology has been deployed successfully in the white spaces of the television broadcast bands to protect incumbent television stations while allowing productive use of otherwise-fallow spectrum.<sup>13</sup> Like television broadcast stations, MSS feeder links are at fixed locations and have predictable transmission characteristics, suggesting that the database framework could be readily translated to the U-NII-1 band.

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<sup>13</sup> See generally *Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, First Report and Order and Further Notice of Proposed Rulemaking, 21 FCC Rcd. 12266 (2006); *Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16807 (2008); *Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Third Memorandum Opinion and Order, 27 FCC Rcd. 3692 (2012); Elizabeth Woyke, *World's First Commercial White Spaces Network Launching Today in North Carolina*, Forbes.com (Jan. 26, 2012), <http://www.forbes.com/sites/elizabethwoyke/2012/01/26/worlds-first-commercial-white-spaces-network-launching-today-in-north-carolina/> (last visited May 24, 2013).

2. *Fixed Satellite and Intelligent Transportation Applications in the U-NII-4 Band.*

Earth stations in the U-NII-4 band Fixed Satellite Service are likewise at known, stationary locations that could be protected using geolocation database technology.<sup>14</sup>

Also in the U-NII-4 band, the Commission has allocated 75 MHz for non-federal use by Dedicated Short Range Communications Service (DSRC) systems. These intelligent transport systems will enable vehicle-to-vehicle communications once they are developed. DSRC systems have not yet become operational, however, and it may be many years before they are widely adopted.<sup>15</sup> In the interim, the Commission could allow other uses of the band subject to sharing technology. Requiring U-NII-4 devices to query a geolocation database, for example, would provide a mechanism for registering licensees and managing general unlicensed use as DSRC becomes operational over time, or as alternative sharing mechanisms are deployed.

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<sup>14</sup> See NPRM ¶ 90.

<sup>15</sup> Doug Newcomb, *Why Your Next Car Should—And Shouldn't—Be a Wi-Fi Hotspot*, *Popular Mechanics* (Oct. 18, 2012), <http://www.popularmechanics.com/cars/news/industry/why-your-next-car-should-and-shouldnt-be-a-wi-fi-hotspot-13852868> (last visited May 24, 2013) (discussing analyst views that '[t]he reality is that adoption of [this] technology is at least 10 years away and will require investments that federal and local governments may be unwilling to make').

## CONCLUSION

In conjunction with greater unlicensed and licensed access to other bands, expanded commercial and public access to the 5 GHz band can promote wireless broadband and feed innovation in Wi-Fi and other technologies. Sharing rules consistent with the approaches suggested above, that allow maximum flexibility to employ suitable sharing technologies such as dynamic frequency selection and database access, will maximize utility of the band and encourage robust investment.

Respectfully submitted,



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Aparna Sridhar  
Policy Counsel  
**GOOGLE INC.**  
1101 New York Avenue NW  
2nd Floor  
Washington, DC 20005  
(202) 346-1261

*Counsel for Google Inc.*



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Staci Pies  
Director, Government and Regulatory  
Affairs  
**MICROSOFT CORPORATION**  
901 K Street NW, 11th Floor  
Washington, DC 20001  
(202) 263-5947

*Counsel for Microsoft Corporation*

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