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April 7, 2014

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

Re: *GN Docket No. 12-354*-- Ex parte meetings

Dear Ms. Dortch:

On April 3, 2014 and April 4, 2014, Scott Blue, Ranveer Chandra, Michael Daum, and Anoop Gupta, of Microsoft Corp., and the undersigned, met separately with Brendan Carr, legal advisor to Commissioner Pai; Renee Gregory, legal advisor to Chairman Wheeler and Gigi B. Sohn, special counsel for external affairs to Chairman Wheeler; Louis Peraertz, legal advisor to Commissioner Clyburn; Erin McGrath, legal advisor to Commissioner O'Rielly; David Goldman, senior legal advisor to Commissioner Rosenworcel; and John S. Leibovitz, Paul Powell, and Richard Arsenault of the Wireless Bureau.[1] The purpose of the meetings was to discuss the Commission's pending Further Notice of Proposed Rulemaking to amend its rules regarding commercial operation in the 3.5 GHz band. After thanking each Office for the recent item that allows for greater use of unlicensed spectrum in the 5.0 GHz band, Microsoft restated its support for the President's Council of Advisors on Science and Technology's ("PCAST") three tiers of access framework for spectrum sharing, praised the Commission's efforts to expeditiously allocate this valuable spectrum, and emphasized that for successful commercial development, above all, there needs to be sufficient spectrum reserved for unlicensed General Authorized Access ("GAA") devices across a national footprint that includes all major markets.

Microsoft described its Spectrum Observatory (http://observatory.microsoftspectrum.com), which collects frequency usage data from

[1] Mr. Chandra only attended the meetings with Mr. Carr, Ms. Gregory, Ms. Sohn, and Mr. Peraertz. Mr. Kosseff only attended the meetings with Ms. McGrath, Mr. Goldman, Mr. Leibovitz, Mr. Powell, and Mr. Arsenault.

sensor base stations around the world. At each location, monitoring stations record data and send the data up to the Microsoft Azure cloud to be stored and processed for visualization. Users can then go online to the observatory website to generate detailed reports and graphs showing spectrum usage in each location. The Microsoft Spectrum Observatory is a non-commercial venture that is designed to provide industry, academia, and government with insight about how spectrum is used globally. All of the source code for the Microsoft Spectrum Observatory is under an open source software license at http://spectrumobservatory.codeplex.com. While the Microsoft Spectrum Observatory has shown good progress, Microsoft is looking for feedback and looks forward to working with more partners in government, academia, and industry to increase the quantity and improve the quality of spectrum measurements, which will better inform conversations about how spectrum can be used more efficiently over time. Microsoft distributed a Spectrum Observatory fact sheet, which is attached to this filing.

Microsoft explained the tremendous potential for dynamic, unlicensed broadband connectivity.[2] The company supports the PCAST's vision of a shared spectrum superhighway between 2.7 – 3.7 GHz and can envision the highway extending towards the 5.0 GHz band. As seen with the overwhelming success of Wi-Fi, opportunistic connectivity helps to meet the burgeoning consumer demand for mobile and nomadic broadband access. To encourage sufficient investment in new opportunistic technology, the Commission should commit to the allocation of a minimum of five 10-MHz channels for unlicensed use between 3.55 – 3.65 GHz on a nationwide basis. If that is not feasible at this time, the Commission should identify additional spectrum between 2.4 GHz and 5 GHz available on a nationwide basis for the balance of the five unlicensed channels.

It is essential that this new wireless broadband superhighway have a national footprint. Of particular concern to Microsoft are the large exclusion zones that are currently deemed necessary in order to protect incumbents in the 3.5 GHz band. These zones cover densely populated areas such as New York City and Los Angeles, the very areas that have the greatest need for additional unlicensed spectrum, and would therefore discourage companies from investing in new opportunistic technology in the band. In order to foster the development of GAA technology in this band, the Spectrum Access System ("SAS") must allow GAA devices to operate when the band is not being used by incumbent users and Priority Access licensees. In densely populated areas in which

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[2] Richard Thanki, THE ECONOMIC SIGNIFICANCE OF LICENSE-EXEMPT SPECTRUM TO THE FUTURE OF THE INTERNET (2012), *available at* http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report_thanki.pdf, at 2.1 (estimating that connecting devices to license-exempt, dynamic Internet technology would add between $560 billion to $870 billion annually in economic value).

incumbents are unlikely to be able unable to share, additional spectrum between 2.7 and 3.5 GHz should be identified.

In the event that more dynamic spectrum sharing with incumbents will be delayed, and the exclusion zones remain fixed lines on a map, the Commission should allow for a much simpler sharing method in this band. For example, a GAA device that can confirm its location, either using GPS or through professional installation, should not be required to connect to an SAS. Priority Access licensees could then intermittently transmit a beacon signal that informs GAA devices that they are currently operating on a given frequency and that the GAA devices must vacate the channel. Such a scheme is relatively inexpensive, efficient, agile, and secure, and is similar to technology used in Wi-Fi today.

Microsoft reiterated the importance of allowing GAA devices to be unlicensed under Parts 2 and 15 of the Commission's rules. As seen with other opportunistic technology, the unlicensed framework provides nascent devices with the necessary agility and flexibility to meet consumers' changing needs. Microsoft sees no reason to depart from the longstanding practice of allowing companies to develop unlicensed, opportunistic technology. Microsoft presented a hypothetical situation of a portable device in which a 3.5 GHz radio is on the same chip as a 2.4 GHz Wi-Fi radio. As a standalone, the 2.4 GHz Wi-Fi device is unlicensed. If it is combined with a 3.5 GHz radio, does the previously unlicensed device now fall under the new "license-by-rule"?

Microsoft also stressed the need for GAA device manufacturers and service providers to follow proper spectrum etiquette that would allow various types of devices to coexist on the spectrum that is reserved for GAA and minimize interference between devices. Small cells, 802.11 Wi-Fi, LTE, and other technology should co-exist on the band, and a single technology should not crowd out the others. Microsoft believes that requiring all GAA devices to employ listen-before-talk is the preferred method for coexistence.

Finally, Microsoft reiterated its support for a simple and fair Priority Access licensing system that allows both established and new entrants to obtain licenses. Additionally, Microsoft urged the Commission to ensure that educational facilities and mission-critical users, such as public safety agencies, also can obtain Priority Access licenses, as envisioned in the Notice of Proposed Rulemaking in this proceeding.[3] Microsoft is concerned that the potential licensees originally identified in this proceeding will be unable to compete for licenses against the commercial operators that are now also

[3] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, Docket No. 12-354, *Notice of Proposed Rulemaking* (Dec. 12, 2012) at ¶ 70.

being identified as potential bidders for this band. Given that no priority should be given to any GAA devices, the users originally identified for priority access should not be forced to operate in the spectrum that the Commission reserves for opportunistic, GAA use.

Please direct any questions to the undersigned.

Sincerely,

Gerard J. Waldron
Jeff Kosseff
Counsel for Microsoft Corp.

cc: Mr. Brendan Carr
Ms. Renee Gregory
Ms. Gigi Sohn
Mr. Louis Peraertz
Ms. Erin McGrath
Mr. David Goldman
Mr. John S. Leibovitz
Mr. Paul Powell
Mr. Richard Arsenault

Microsoft SPECTRUM OBSERVATORY

http://observatory.microsoftspectrum.com

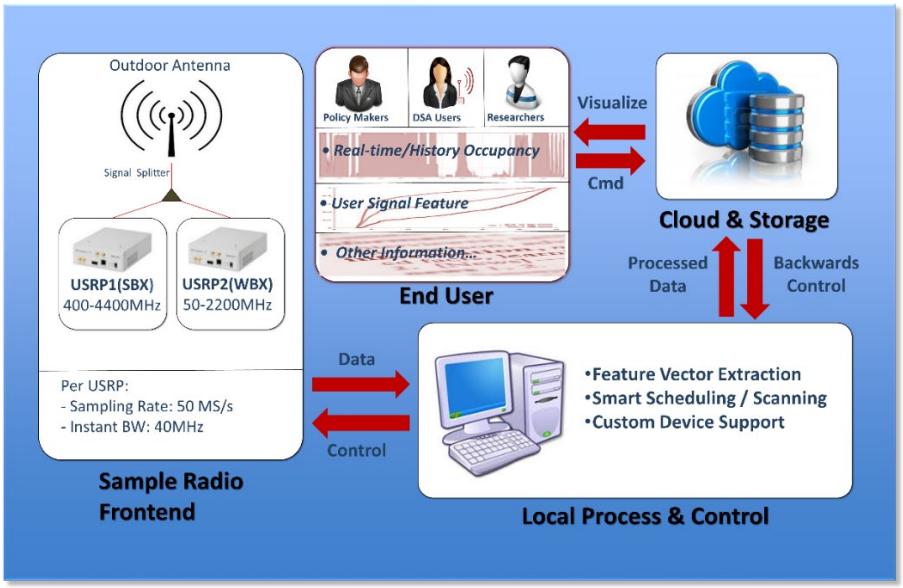
Overview

The Microsoft Spectrum Observatory was created with the purpose of providing an intuitive presentation of the usage of the wireless spectrum. The project is sponsored by Microsoft's Technical Policy Group and the data is made freely available to the public. Data is recorded through monitoring stations and is stored and processed for visualization through the Windows Azure cloud.

Microsoft believes that the data gathered on spectrum utilization will help inform policy discussions and decisions implicating various forms of spectrum management – ranging from methods such as the reallocation of spectrum for exclusive use licensing or unlicensed dynamic access to allocated but unassigned spectrum.

To support this effort, measurement units collecting spectrum usage data have been installed by Microsoft and partners in various locations around the world. Microsoft philosophy in developing this program has been to keep costs low and to keep the solution flexible and open to others.

Measurement Stations



Each measurement station consists of a radio frequency spectrum measurement device that is connected to an antenna and mounted in a public space (typically at the top of a building). The device continually takes power spectral density measurements within the range of the RF sensor using a FFT (Fast Fourier Transform) processing technique. The device is programmed to record measurements for a number of frequency bands about every 3 seconds. These power spectral density measurements are stored locally on a computer connected to the base station and then aggregated to determine the average, minimum, and maximum values for 1-minute time intervals. The aggregated data is then automatically transferred to a cloud repository for storage and further processing.

Data Processing

As new data is uploaded, it is then processed even further. First, the data is normalized in both time and frequency. For time normalization, this means that measured data is grouped by hour into 60-minute segments and any minutes which do not have any measured data are encoded with a special value to represent NaN (not a number, or "no measurement"). For frequency normalization, this means that the power spectral density values at associated frequency points on a linear scale are interpolated on a logarithmic scale with a spacing of 200 points/decade. This allows more efficient data storage that is optimized for fast query and presentation.

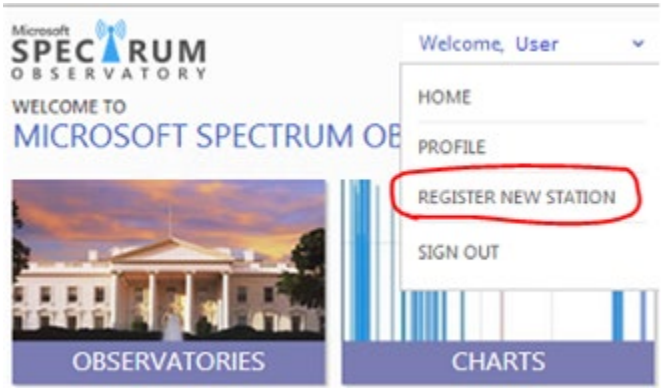
After normalization is performed, multiple aggregations are computed. Daily, weekly, and monthly values are calculated as available. The values for average, minimum, maximum versus frequency are aggregated over time.

Source Code Released Under OSS License

All of the source code for the Microsoft Spectrum Observatory is released under an Apache 2.0 license to CodePlex (https://spectrumobservatory.codeplex.com). This will allow contributions to this project from organizations including academics, governments, and others. Microsoft will continue to develop this code base, and release new features as open source. The public obtains real value out of having the data available, but by making all of the collection methods public and available for comment, the value of this data increases since it can be verified by third parties. Microsoft wants to see spectrum used efficiently, and the Spectrum Observatory increases the likelihood of that happening by providing data to everyone. By making the project open source, other partners in the community can also build on this work and take it further.

How to Set Up Your Own Monitoring Station

The detailed specifications as well as step by step instructions on how to register your stations is located in our hardware and software setup guide on our website at *http://observatory.microsoftspectrum.com*. Just sign-in to the site, click on the Register New Station dropdown, and follow the instructions presented.



Monitoring Station Hardware Costs

You can now set up your own Spectrum Observatory Monitoring Station for as little as $1300 in hardware. Here is a list of the hardware that you need and the estimated costs for it.

Component Type	Estimated Cost
Host PC	$300
RF Sensors	$3,990 - $20,000 **(***Coming soon, support for RF sensors that retail for $675)**
Antenna	$200
Network Switch	$20
Cabling, Connectors and Splitter	$100

Contact Us

For more information, you can contact us at spectrum_obs@microsoft.com