



July 15, 2019

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Expanding Flexible Use of the 3.7 GHz Band
GN Docket No. 18-122
Joint Ex Parte Presentation

The Wireless Internet Service Providers Association (“WISPA”), Google LLC and Microsoft Corp. share the goal of bringing better broadband to more consumers, especially those millions of Americans that lack adequate fixed broadband in their homes, small businesses, farms, ranches, and other locations. To help achieve these objectives, each of us has participated in this proceeding asking that the Commission make the 3700-4200 MHz band available for Part 101 frequency coordinated point-to-multipoint (“P2MP”) operations.

Previously, the Broadband Access Coalition, in conjunction with Google, conducted initial technical inquiries to determine if P2MP systems could offer fixed wireless broadband access services on a shared basis in 300 megahertz of the C-band, while not causing harmful interference to incumbent fixed-satellite service (“FSS”) earth stations in the band. Our inquiry focused on *co-channel* sharing, and therefore did not assume any frequency separation between fixed services and FSS. Instead, the concept relied upon a combination of geographic separation and FSS-aware network planning of the P2MP systems such that any fixed wireless signals reaching FSS sites were below harmful interference thresholds. The results of this initial inquiry were shared with the Commission.¹

To confirm and demonstrate the possibility and opportunity of shared access to the C-band by both FSS and P2MP users, WISPA, Microsoft, and Google commissioned a third-party technical study to expand the scope of the original inquiry to include the new registrations, and to independently verify the technical results of that inquiry. The Joint Commenters engaged Professor Jeff Reed, the Willis G. Worcester Professor of Electrical and Computer Engineering at Virginia Tech and the founding director of Wireless @ Virginia Tech, to perform an independent analysis of the feasibility of *co-channel* sharing between FWA and FSS earth stations in C-band. The results of that study conducted by Professor Reed and his colleagues are summarized in the presentation attached to this filing. This report, which relies on conservative estimates and standards-based assumptions, shows that earth stations can be coordinated and

¹ See Letter from Stephen E. Coran to Marlene H. Dortch, FCC Secretary, RM-11791 (filed March 28, 2018).

protected within a geographic exclusion zone of less than 10 km. In turn, this means that more than 80 million Americans and 78% of the geographic area of the country will have the ability to access currently fallow spectrum for P2MP services. The greatest availability will be in rural areas where earth stations are less prevalent and widely dispersed. The complete report is attached.

With a sufficient amount of new mid-band spectrum, broadband providers can deploy networks capable of offering gigabit or near-gigabit broadband service. Significantly, this opportunity is complementary to proposals to reallocate some of the C-band for flexible use. In sum, the Commission can clear 200 megahertz for flexible use, re-pack earth stations from that band in the upper 300 megahertz, and allow shared, coordinated use of the upper 300 megahertz among FSS and P2MP.

The following conclusions of the study, and related points, deserve particular emphasis.

- 1. P2MP in shared C-band spectrum can provide gigabit broadband access for more than 80 million Americans.** The C-band Alliance supports clearing and auctioning up to 200 megahertz out of 500 megahertz of C-band spectrum for flexible use.² At least 300 megahertz of spectrum would be used by C-band earth stations repacked into the remaining spectrum. Assuming a conservative overall average of 4 bits/second/hertz spectral efficiency, 300 megahertz of C-band spectrum would allow gross throughput rates of approximately 1.2 gigabits per second for P2MP systems. For comparison, 300 megahertz of spectrum is some *six times* greater than the maximum amount of spectrum currently available for wireless ISPs in the 3.65 GHz band today, and twice as much spectrum than is available in the entire CBRN band.
- 2. P2MP will not cause harmful interference to co-channel FSS.** As the attached study shows, P2MP systems can operate *co-channel* with all existing C-band earth stations (including the ~14,000 additional earth stations that were recently registered), without causing harmful interference. This is the result of employing reasonably-sized exclusion zones surrounding earth stations, combined with siting and pointing of P2MP nodes such that no signals exceeding Commission-declared interference criteria are received at any FSS earth station. Part 101 coordination would calculate and determine actual co-channel geographic exclusion zones.
- 3. Repacking C-band will have no effect on the results of the study.** The coexistence study already assumes that the P2MP systems are operating *co-channel* with FSS. Repacking FSS to a smaller portion of the original C-band results in greater concentration of earth station use in the repacked frequencies, but such concentration does not matter to the results of the study. Co-channel sharing with all 18,000+ earth stations has *already been assumed*. The only criterion that matters to the results of the study is the location of the earth stations.³

² https://c-bandalliance.com/?utm_campaign=marketing

³ We note, however, that if the study had considered *non-co-channel* use, the results would likely be even more dramatic. If the Commission agrees to prohibit “full-band, full-arc” registrations for the vast

4. **All C-band registrations have been taken into account, including those that have yet to be accepted by the Commission.** The study assumes that all 18,000+ registrations in the International Bureau Filing System (IBFS) as of the close of the registration window are legitimate registrations, although a large number have yet to be accepted by the Commission. Among the many conservative assumptions in the study, coexistence registrations that are not accompanied by coordination reports, which are not afforded interference protection from co-primary fixed services,⁴ are included in the analysis.
5. **The study utilizes conservative assumptions.** In addition to the assumption of co-channel operations and the protection of all earth stations currently in IBFS regardless of protection status, the study includes additional conservative assumptions. These include, but are not limited to, a propagation model that takes clutter and terrain into account on a statistical basis rather than the use of actual buildings, trees, berms, hills, and mountains that afford greater protection; using a height for Customer Premise Equipment (CPE) of 7-10 m, which exceeds typical CPE height of ~5-7 m for actual installations; and assuming 100% duty cycle of P2MP transmissions in both directions.
6. **P2MP will better protect adjacent-band radio altimeter operations.** Concern has been expressed regarding the impact of C-band transmissions on the proper operation of radio altimeters for aeronautical navigation, which are employed in the central 100 MHz of the adjoining 4200-4400 MHz band.⁵ Because radio altimeters are primarily used at elevations of 5000 feet or less on approach to airports, the same methods used by P2MP systems to avoid beaming energy toward FSS can be employed to avoid deploying P2MP near approach paths or beaming P2MP signals toward airport facilities. Further, P2MP base and CPE antennas are specifically designed with narrow vertical beams, and the base transmissions are often downtilted toward surrounding service areas, so that P2MP systems by design suppress emissions in the upward direction. Flexible use systems, on the other hand, include mobile stations, which typically involve omnidirectional antennas with no control over the orientation of the antenna, thereby increasing the risk that interfering signals may be sent upward toward aircraft. In fact, the band that is adjacent to the upper end of the radio altimeter band, i.e., the 4400-4500 MHz band, is a federal band that is used for fixed service transmissions,⁶ underscoring the ability of the radio altimeter stations in 4200-4400 MHz to coexist peacefully with fixed systems in the adjoining band.

majority of C-band earth stations that don't require it, we can re-do the study to show even greater broadband penetration.

⁴ *Public Notice*, GN Docket No. 18-122, RM-11791, RM-11778, DA 19-385 (rel. May 3, 2019) at 4 (“Registrations or licenses granted for applications filed during the window without the coordination report will include a condition noting that the license or registration does not afford interference protection from fixed service transmissions.”)

⁵ See Letter from Aviation Associations to Marlene H. Dortch, FCC Secretary, GN Docket No. 18-122 (filed June 19, 2019).

⁶ There are 882 federal fixed (point-to-point) systems in this band compared to only 16 federal mobile systems. See the National Telecommunications and Information Administration Band Use Report for this band, available at https://www.ntia.doc.gov/files/ntia/publications/compendium/4400.00-4500.00_01DEC15.pdf.

7. P2MP will have no effect on flexible use operations in the lower part of the band.

The same guard band that will protect earth stations from flexible use operations in the lower part of the 3700-4200 MHz band will also work as a guard band between those flexible use systems and P2MP systems in the upper portion of the band. In fact, it's likely that no guard band is actually needed to protect flexible use and P2MP use, given that there will be no guard band at all between flexible use systems operating within the lower 200 megahertz of the band. If flexible use systems can co-exist with themselves with 0 MHz of guard band given that they will include mobile systems operating with no constraints on antenna orientation, then they should co-exist perfectly with P2MP systems, which employ only fixed and carefully-pointed antennas, without any guard band.

As noted in the study, the analysis is based on a statistical average and is intended for the baseline performance and for estimating the national coverage. In practice, each P2MP system would be designed and coordinated on a site-specific basis, taking all surrounding earth stations into account, and fully protecting those operations.

Based on the foregoing findings and conclusions, FSS earth stations operating in the 3700-4200 MHz band should be entitled to coordinated protection from harmful interference predicted to be caused by co-primary, co-channel terrestrial fixed operations, such as P2MP broadband services, operating in the same band. As the attached coexistence report demonstrates, such protections are possible even when FSS operations are re-packed in the upper portion of C-band. P2MP systems in this band operating on a shared basis with FSS earth stations will provide gigabit-class broadband services to more than 80 million Americans, without causing harmful interference to FSS. As part of the C-band proceeding, and as proposed in the NPRM, the Commission should authorize shared use of the band for this important national objective.

Respectfully submitted,

**WIRELESS INTERNET SERVICE
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Attachment: Technical Study by Professor Reed and colleagues, Reed Engineering