

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Amendment Of The Commission's Rules To
Establish A Next-Generation Air-Ground
Communications Service On A Secondary
Licensed Basis In The 14.0 to 14.5 GHz Band

RM -11640

COMMENTS OF QUALCOMM INCORPORATED

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QUALCOMM Incorporated is pleased to file these comments on its Petition for Rulemaking to establish a Next Generation Air-Ground ("Next-Gen AG") terrestrial-based communications service to provide multi-gigabit-per-second broadband connectivity to airplane passengers flying above the continental United States ("CONUS").¹ As detailed in the Petition for Rulemaking ("Next-Gen AG Petition" or "Petition"), American consumers' rapid adoption and increasing usage of smartphones, tablets, and other mobile broadband enabled devices necessitate prompt FCC action to establish this new mobile broadband service so airborne travelers can have the same level of connectivity that they currently enjoy when on land in their homes, offices, parks, cars, trains, and buses.

INTRODUCTION & SUMMARY

The Next-Gen AG service presented in the Petition would operate on a secondary licensed basis in the 14.0 to 14.5 GHz band and successfully share spectrum with incumbent satellite operators and other users through use of innovative equipment designs and interference

¹ See FCC Public Notice, Consumer & Governmental Affairs Bureau Reference Information Center Petition For Rulemakings Filed, Report No. 2933 (Aug. 30, 2011).

mitigation techniques. In the Petition, Qualcomm proposes that the Commission would conduct an auction of two 250 MHz licenses at 14.00 to 14.25 GHz and 14.25 to 14.50 GHz to enable two separate systems, but not restrict a single entity from purchasing both licenses to construct a more robust 500 MHz system. The proposed system would operate in a similar manner to the air-ground system currently operated by Gogo (formerly Aircell), which uses a network of terrestrial ground stations to communicate with in-flight aircraft. The Next-Gen AG system, however, would offer significantly greater capacity (*i.e.*, 300 Gigabits per second (“Gb/s”) service on a combined basis) in a significantly larger swath of spectrum (*i.e.*, 250 MHz or more versus 3 MHz used by Gogo’s current air-ground system) to support the ever-increasing demands of mobile users who need to maintain full access while they are traveling in a plane for hours at a time above the CONUS.

There is no question that multi-Gb/s capacity will soon be essential to supporting the growing broadband connectivity needs of airplane travelers who are bringing smartphones, tablets, e-readers, and other mobile broadband enabled devices on-board aircraft. These travelers expect an in-flight broadband experience fully equivalent to what they have available on the ground. This is exactly what the proposed Next-Gen AG mobile communications service can provide.

The Petition explains, in intricate detail in Appendix A, how the proposed Next-Gen AG service can operate in successful coexistence with the other users of the 14.0 to 14.5 GHz band, which include the Geosynchronous Orbit (“GSO”) satellite systems that provide a variety of services including Qualcomm’s own OmniTRACS service, future Non-Geosynchronous Orbit (“NGSO”) satellite systems, NASA’s Tracking and Data Relay Satellite System (“TDRSS”), and radio astronomy users. As an incumbent user of the band itself, Qualcomm thus has a direct

interest in fully protecting existing operations. The Next-Gen AG service will use advanced hardware and software designs, tightly-focused Ground Station (“GS”) communications beams that point away from the geostationary orbit, low transmit power from aircraft, and seamless hand-offs to successive GSs that track the flight path.

DISCUSSION

I. A Next-Generation Air-Ground Communications Service Is Needed Now To Fully Support Airline Travelers’ Ever-Increasing Use Of Mobile Broadband Devices

The FCC needs to act now to establish a Next-Gen AG service so that U.S. travelers will be able to maintain full broadband connectivity while they are flying above the CONUS. As detailed in the Next-Gen AG Petition, mobile broadband-enabled devices have become integral to the personal and business lives of millions of American workers and consumers who require full-time broadband access to access their office emails and documents, communicate via videoconference, log on to social networking sites, watch entertainment programming, and create, review, and upload/download files containing documents, photos, videos, music, lectures to/from the cloud.²

The trends that illustrate the rapidly growing use of mobile broadband-enabled devices are staggering.³ By 2015, more U.S.-based users will access the Internet through mobile devices than through PCs and other wireline devices.⁴ The International Data Corporation thus has forecasted that, between 2010 and 2015, the number of mobile Internet users will grow by a compound annual growth rate (“CAGR”) of 16.6%.⁵ This year, the worldwide sales of

² See Next-Gen AG Petition at 6-11.

³ See Next-Gen AG Petition at 3-6.

⁴ See International Data Corporation Worldwide New Media Market Model Forecast (Sept. 12, 2011) available at <http://www.idc.com/getdoc.jsp?containerId=prUS23028711>.

⁵ See *id.*

smartphones, tablets, and netbooks combined will exceed 400 million units, overtaking by many millions traditional PC sales.⁶ Users will want these devices to continue to perform fully on-board aircraft.

A. Mobile Broadband-Enabled Device Sales Are Exploding Because They Are Improving Consumers' Personal Lives And Facilitating Countless Business Efficiencies

As the Commission well knows, American travelers are using more and more of the data-hungry applications or “apps” on their mobile broadband-enabled smartphones and tablets. These apps provide quick access to torrents of data in the form of email, weather, news, art, literature, games, social networking sites, photos, videos, TV shows, and movies via Facebook, Google+, Flickr, dotPhoto, Shutterfly, Snapfish, Blockbuster, Netflix, HBO GO, Hulu, CBS, NBC, ABC, CNN, YouTube, and the list goes on. Without question, these engaging apps are leading smartphone and tablet users to consume significantly more data than they were consuming just one year ago.⁷ Users not only are using their devices more often, but the apps with which they regularly interact are becoming increasingly sophisticated with greater data needs.⁸ For example, highly popular social networking applications are routinely adding new features that take advantage of the increasing data capacity of today’s 3G and 4G mobile broadband networks.

⁶ See Next-Gen AG Petition at 3 (citing Deloitte’s Technology, Media and Telecommunication Predictions report).

⁷ See Next-Gen AG Petition at 6 n.15.

⁸ See John Letzing, “Facebook Unveils New Features Amid Growing Competition,” WALL STREET JOURNAL (Sept. 22, 2011) available at <http://online.wsj.com/article/SB10001424053111903703604576586992144487316.html>; see also Next-Gen AG Petition at 8 n.22 (noting that Facebook will be adding features that allow users to share music and entertainment programming with friends much like they share news stories, photos, and videos today).

Smartphones and tablets have become integral to our daily lives. One of the more remarkable statistics cited in the Next Gen AG Petition is that 35% of U.S. smartphone users interact with at least one non-voice smartphone application before they even get out of bed.⁹ The Petition also notes that the increasing reliance on cloud-based computing platforms will lead U.S. travelers to rely on broadband access for common office tasks such as reading and writing emails, preparing and reviewing documents, charts, and presentations.¹⁰ There is no question that consumers want to – and increasingly need to – maintain full broadband connectivity while in-flight.

B. Airline Passengers Want A High-Quality In-Flight Broadband Experience

The need to support high-capacity in-flight mobile broadband connectivity is illustrated by the recent announcement that American Airlines and Samsung will be equipping the premium cabins of 600 aircraft with Wi-Fi enabled Samsung Galaxy tablets.¹¹ Airline passengers will use the tablets to access email, entertainment, social networking, and gaming applications, and to review and edit documents, presentations, photos, and audiovisual material. Given that these tablets ostensibly will be supported by Gogo’s current bandwidth-limited air-ground service, it won’t be long until the much-higher capacity Next-Gen AG system proposed in the Petition becomes absolutely essential.

The success of Gogo’s in-flight Internet service demonstrates the technical viability and cost-effectiveness of an air-ground solution. Gogo currently partners with nine major airlines to

⁹ See Next-Gen AG Petition at 7 n.16 (consumers could not wait to get out of bed to check social networking, news, weather, and classified ad apps).

¹⁰ See Next-Gen AG Petition at 9-11.

¹¹ See Chloe Albanesius, “American Airlines Adding Samsung Galaxy Tab 10.1 Tablets to Flights,” PC MAGAZINE (June 14, 2011) *available at* <http://www.pcmag.com/article2/0,2817,2386894,00.asp>

provide mobile broadband connectivity on-board 1,166 commercial aircraft.¹² The company provides mobile broadband service to many more private jets.¹³

Not surprisingly, Gogo expects mobile broadband usage on-board aircraft to continue to skyrocket as the number of mobile broadband enabled devices and usage of data-rich applications proliferate. As a result, the company is taking steps to increase the capacity of its bandwidth-limited service.¹⁴ But given that the upgrade will operate in the same 3 MHz band as the current system it is, at best, a temporary means of addressing the inevitable exponential growth in mobile broadband data demand on-board aircraft. A high-capacity, low-latency, and low-cost air-ground network, as proposed in the Next-Gen AG Petition, is needed.

C. The FCC Should Enable The Proposed Service As Part Of Its Broader Effort To Expand The Amount Of Available Mobile Broadband Spectrum

In order to address the impending terrestrial mobile broadband spectrum crunch, we all agree that the FCC needs to continue to work closely and quickly with the Administration and Congress to identify and auction additional spectrum within the next few years. In conjunction with these important efforts, the Commission should also establish the proposed Next-Gen AG service to enable a full broadband experience on-board aircraft that is equivalent to the level of service available on the ground today. The United States can lead the way globally and become the first country to authorize such a mobile service so Americans and other U.S.-based travelers can have a full in-flight broadband experience.

¹² See Participating Airlines available at <http://www.gogoair.com/gogo/cms/airlines.do>.

¹³ See Aircell Press Release, “Aircell Announces Technology Roadmap,” (Mar. 9, 2011) available at <http://www.aircell.com/press-room/aircell-announces-technology-roadmap>.

¹⁴ See Virgin America Press Release, “Virgin America Becomes First Airline To Launch Gogo’s ATG-4 Technology, New Even Higher Speed WiFi Connection to Launch on First Virgin America Aircraft in Early 2012” (Sept. 14, 2011) available at <http://www.virginamerica.com/press-release/2011/virgin-america-becomes-first-airline-to-launch-gogos-atg-4-technology.html>.

II. Qualcomm Has Designed A Next-Generation Air-Ground Mobile Broadband Communications System That Will Provide High-Speed Connectivity To Airborne Travelers Without Impacting Existing Operations At 14.0 To 14.5 GHz

Qualcomm has engineered the Next-Gen AG mobile broadband communications system so that it will operate on a secondary licensed basis at 14.0 to 14.5 GHz and coexist successfully with GSO satellite systems, future NGSO satellite systems, NASA's TDRSS, radio astronomy users, and other secondary users of the band. As Qualcomm noted previously, given that it uses this same band for its own successful GSO satellite-based OmniTRACS mobile communications and information service, the company has a direct interest in fully protecting primary GSO satellite operations.

A. The Terrestrial Component of the Next-Gen AG System Will Include A Network Of A Few Hundred Highly-Sophisticated Ground Stations

The Next-Gen AG Petition explains that the terrestrial component of the Next-Gen AG system is comprised of an arrangement of a few hundred GS service areas that take the form of hexagonal regions and cover the CONUS.¹⁵ Each GS is located in the southern corner of a hexagonal service area and radiates northward – typically $\pm 60^\circ$ from true north and generally with a low elevation angle such as 10° or less. This arrangement allows the Next-Gen AG system to avoid interference to GSO satellite receivers on the geostationary arc. Each of the GSs will operate with a maximum of four beams in a given swath of spectrum to track up to 600 in-flight aircraft above the CONUS. In addition,, the GS-to-aircraft links would use a Time-Division-Duplex communications scheme to provide a two-way backhaul connection to aircraft equipped with on-board Wi-Fi access points to interface wirelessly with passenger smartphones, tablets, laptops, gaming devices, and other Wi-Fi capable devices.

¹⁵ See Next-Gen AG Petition at 15, Figure 1.

As designed, a single 500 MHz system could support an aggregate throughput of 300 Gigabits per second (“Gb/s”). However, if the Commission allocates, auctions, and licenses the spectrum in two 250 MHz blocks, the combined throughput for each system would be halved, to approximately 150 Gb/s.

B. The Next-Gen AG Service Will Feature A Number Of Innovative Interference Protection Techniques

Appendix A to the Next-Gen AG Petition explains in great detail how the proposed system will protect all other operations in the 14.0 to 14.5 GHz band from harmful interference through use of highly advanced RF equipment and antenna designs, tightly-focused GS communications beams that point away from GSO satellites as explained above, low transmit power from aircraft transceivers, and seamless hand-offs to successive GSs that track the flight path in a similar manner to how terrestrial cellular networks operate. The hand-off process will allow the system to use the least amount of transmit power to maintain a desired Carrier-to-Noise (“C/N”) interference ratio and a negligible $\Delta T/T$ (also referred to as Rise over Thermal) level into GSO satellite operations that is well below 1% in all scenarios. In this way, the proposed system will provide millions of airplane travelers with high-speed in-flight broadband connectivity, fully protect primary users, and successfully coexist with other secondary users of the 14.0 to 14.5 GHz band.

CONCLUSION

Given the rapidly increasing usage of mobile broadband enabled devices and the desire of American travelers to remain fully connected while traveling, Qualcomm respectfully requests that the FCC promptly issue a Notice of Proposed Rulemaking to establish a Next Generation Air-Ground service in accordance with the system design and interference protection principles set out in the Petition. Qualcomm looks forward to continuing to work with the Commission and interested stakeholders to enable high-speed broadband connectivity for the exploding population of airborne travelers with mobile broadband devices and applications.

Respectfully submitted,

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