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

In the Matter of	)	
	)	
Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands	)	WT Docket No. 12-70
	)	
Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz	)	ET Docket No. 10-142
	)	
Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands	)	WT Docket No. 04-356

COMMENTS OF DISH NETWORK CORPORATION

May 17, 2012

TABLE OF CONTENTS

EXHIBITS

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COMMENTS OF DISH NETWORK CORPORATION

DISH Network Corporation ("DISH") submits these comments in response to the *Notice of Proposed Rulemaking* ("*NPRM*") and *Notice of Inquiry* ("*NOI*") in the above-captioned proceeding.[1] Through wholly owned subsidiaries,[2] DISH holds Mobile-Satellite Service ("MSS") and Ancillary Terrestrial Component ("ATC") licenses in the 2000-2020 MHz and

[1] Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, WT Docket No. 12-70, Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz, ET Docket No. 10-142, Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, WT Docket No. 04-356, *Notice of Proposed Rulemaking and Notice of Inquiry*, FCC 12-32 (rel. Mar. 21, 2012) ("*2 GHz NPRM*" and "*2 GHz NOI*").

[2] DISH subsidiaries Gamma Acquisition L.L.C. and New DBSD Satellite Services G.P. hold the MSS and ATC authorizations.

2180-2200 MHz bands ("2 GHz MSS band" or "S-Band").[3] As it embarks on an effort to bring a new and vibrant mobile broadband and satellite service to American consumers, DISH supports the Commission's initiative in this rulemaking proceeding to "remov[e] unnecessary barriers to flexible use" of S-Band spectrum.[4]

Providing additional spectrum for wireless broadband, while simultaneously bolstering competition in the wireless marketplace, is critical. The Commission's proposed actions—with some prudent changes and expeditious implementation—will usher in a new, dynamic competitor and unleash an additional 40 MHz of spectrum for mobile broadband, while preserving important MSS services.

I. INTRODUCTION AND SUMMARY

DISH's planned entry into the wireless market could not come at a better time for American consumers. America's need for mobile broadband services, and the spectrum required to sustain and grow those services, will increase significantly during the next several years. The Commission has estimated that demand for mobile data will "grow between 25 to 50 times" its

[3] On March 2, 2012, the International Bureau approved the transfer of the authorizations held by TerreStar License Inc. ("TerreStar") to DISH's subsidiary, Gamma Acquisitions L.L.C. ("Gamma"), and DISH's acquisition of New DBSD Satellite Services G.P. ("DBSD"). *See* DBSD North America, Inc., Debtor-in-Possession; New DBSD Satellite Services G.P., Debtor-in-Possession; Pendrell Corporation, Transferor; and TerreStar License Inc., Debtor-in-Possession; Assignor, and DISH Network Corporation, Transferee; and Gamma Acquisition L.L.C.; Assignee Applications for Consent to Assign/Transfer Control of Licenses and Authorizations of New DBSD Satellite Services G.P., Debtor-in-Possession and TerreStar License Inc., Debtor-in-Possession, *Order*, 27 FCC Rcd. 2250 (2012) ("*DBSD and TerreStar Transactions Order*").

[4] *2 GHz NPRM* ¶ 1.

2010 levels by 2015.[5] President Obama and policymakers from across the political spectrum have urged the Commission to increase the supply of available spectrum to satisfy the demand for mobile broadband.[6] Providing additional spectrum to meet that demand has a well-documented direct effect on employment and the American economy. According to a recent study, every 10 MHz of additional licensed spectrum made available for mobile broadband increases the U.S. Gross Domestic Product ("GDP") by $1.739 billion, employment by at least 7,000 jobs, and government revenues by $468 million.[7] By this metric, unleashing the 40 MHz of S-Band spectrum would increase GDP by almost $7 billion, create 28,000 jobs, and increase government revenues by over $1.87 billion.

To help meet this growing demand, the Commission has set a goal of making "more spectrum available on a flexible basis."[8] This includes taking "actions that will optimize license[e] flexibility sufficient to increase terrestrial broadband use of MSS spectrum."[9] But

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[5] Federal Communications Commission, Mobile Broadband: The Benefits of Additional Spectrum 5 (Oct. 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-302324A1.pdf.

[6] *See, e.g.*, Memorandum of June 28, 2010 – Unleashing the Wireless Broadband Revolution, 75 Fed. Reg. 38387 (July 1, 2010); Press Release, Committee on Energy and Commerce, Ranking Members Waxman and Eshoo Applaud Spectrum Provisions in Payroll Tax Conference Report (Feb. 16, 2012), *available at* http://democrats.energycommerce.house.gov/index.php?q=news/ranking-members-waxman-and-eshoo-applaud-spectrum-provisions-in-payroll-tax-conference-report; Rep. Greg Walden, Jumpstarting Opportunity with Broadband Spectrum, The Hill's Congress Blog (Nov. 29, 2011), *available at* http://thehill.com/blogs/congress-blog/technology/195891-jumpstarting-opportunity-with-broadband-spectrum.

[7] Recon Analytics, The Wireless Industry: The Essential Engine of U.S. Economic Growth 1 (visited May 14, 2012), *available at* http://reconanalytics.com/wp-content/uploads/2012/04/Wireless-The-Ubiquitous-Engine-by-Recon-Analytics-1.pdf.

[8] Federal Communications Commission, Connecting America: The National Broadband Plan 75 (2010) ("National Broadband Plan").

[9] *Id*. at 87.

simply increasing spectrum availability is not enough. As Chairman Genachowski has said, the Commission must also "ensur[e] a competitive mobile marketplace that drives innovation and investment, creates jobs and benefits consumers."[10]

The Commission can achieve both goals in this proceeding by moving forward with its proposal to grant exclusive terrestrial authority to the current 2 GHz MSS licensee to operate in the newly designated AWS-4 band. The Commission has correctly found that the 2 GHz band cannot be shared by satellite and terrestrial services controlled by different operators. Neither MSS nor ATC operations can coexist with separately licensed, terrestrial-only operations across the same 40 MHz of spectrum because the services will interfere with each other. These interference issues can be overcome if (and only if) the MSS and the terrestrial operations are under common control. No two independent operators can succeed in organizing and managing the highly complex coordination process required between the MSS and the terrestrial services at the same time, in the same band, and in the same region. Thus, the Commission correctly proposes that the only way to realize the full potential of the 2 GHz band for terrestrial use while preserving a satellite service is to have the same operator (or affiliated operators) control both the satellite and terrestrial systems.

None of the band plan or licensing alternatives mentioned in the *NPRM* and the *NOI* presents viable alternatives to the Commission's proposal. Any one of these options would lessen the band's potential, delay putting the spectrum to use, and improperly curtail DISH's rights as a licensee without any countervailing public benefit. Rather, to maximize the full

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[10] Press Release, Federal Communications Commission, Statement from Chairman Julius Genachowski Regarding AT&T Inc.'s Abandonment of Its Proposed Acquisition of T-Mobile USA Inc. (Dec. 19, 2011), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-311592A1.pdf.

broadband potential of the S-Band, the Commission should adopt prudent modifications to the proposed AWS-4 rules and expeditiously give DISH the regulatory certainty it needs to plan and develop its terrestrial network. With these adjustments, the Commission's proposed AWS-4 rules for terrestrial use of the 2 GHz MSS spectrum will promote competition, drive innovation and investment, create jobs, and benefit consumers. These rules would allow DISH to drive competition in the mobile broadband market as it has been doing for years in the video distribution market.

First, the Commission should adopt its proposed performance requirements with targeted modifications. The Commission's proposed performance requirements and penalties are arguably more stringent than those adopted for all other terrestrial services, and may hinder scalable, efficient long-term investment in technologies and infrastructure. Nonetheless, as a demonstration of its commitment to put the spectrum to use for the benefit of the public, DISH supports a final, seven-year buildout deadline, but suggests the following adjustments to the milestone schedule:

- Extend the interim milestone from three to four years, and simplify it to require coverage to 60 million people ("POPs");
- Permit Commission consideration of a range of enforcement actions other than automatic license forfeiture for non-compliance with either the interim or final milestone (*e.g.*, monetary penalties or other enforcement action); and
- Revise the final milestone to require coverage to 200 million POPs, consistent with the recommended national scope of the license.

Second, the Commission should adopt the proposed AWS-4 technical rules, provided that it makes the minor adjustments described below in Section V. These adjustments will ensure full terrestrial use of the spectrum while protecting spectrum users from harmful interference.

Third, the Commission should ensure DISH has the regulatory flexibility to tailor its terrestrial and satellite services to consumers' needs by allowing for a paired single block option.

Fourth, the Commission should license AWS-4 spectrum on a nationwide basis. The small Economic Area ("EA") licenses proposed by the Commission are difficult to administer and are inconsistent with the need for broad geographic spectrum assignments.

Fifth, The Commission should also remove the outdated gating requirements that have inhibited MSS/ATC licensees from realizing the broadband potential of this spectrum, while declining to adopt proposals that could unduly delay or increase the cost of new broadband deployment in the AWS-4 band.

Finally, the Commission should reject the *NOI*'s 2 GHz Extension Band Concept, which raises substantial legal and operational challenges. This proposal would only deny American consumers additional broadband services for the foreseeable future.

II. BACKGROUND

DISH has a long history of implementing innovative approaches to its businesses and acting as a disruptive, dynamic force that promotes vibrant, competitive markets. In the video marketplace, DISH has built and maintained a reputation for providing high-quality programming at prices below those of its competitors. DISH and its affiliate, EchoStar Corporation ("EchoStar"), have been at the forefront of numerous technological breakthroughs in the satellite and wireless markets: the first to develop a UHF remote control; the first to offer a satellite receiver for less than $200; the first to offer an integrated receiver descrambler for C-Band satellite television; the first to offer satellite television receivers with built-in digital video recorders ("DVRs"); the first to offer HD programming in 1080p; and the first to offer a multi-room HD and DVR satellite receiver. And EchoStar's Slingbox, with its "placeshifting" technology, complements DISH's service by enabling subscribers to access their programming wherever they are via an encrypted Internet connection.

This same disruptive force is evident in a number of recent transactions. Through its purchase of most of the assets of Blockbuster, for example, DISH has augmented its television and streaming offerings with additional content and delivery methods, including more than 100,000 movies, television shows, and games available via digital delivery as well as through the mail. Likewise, EchoStar's acquisition of Hughes, a leading provider of fixed satellite broadband and network management solutions to the consumer and business markets, will enable EchoStar to improve the effectiveness and availability of fixed satellite broadband nationwide.

DISH is ready to bring this same competitive energy to the mobile broadband marketplace. To succeed over the long term, DISH must expand beyond offering "linear" video distribution services and provide consumers with bundles that include fixed as well as mobile video, voice, and data. DISH's assets position it favorably to make this move. Its existing satellites and DBS service network give it a leading position in fixed "linear" video. Its knowledge and expertise in the satellite industry will allow it to further maximize the potential of the MSS assets it has acquired from DBSD and TerreStar. And the Commission's proposal to modify DISH's 2 GHz licenses to allow terrestrial use under new AWS-4 rules will help DISH efficiently and competitively enter the market to maximize the use of the S-Band for mobile video, voice, and broadband services for American consumers.

The Commission's proposal, moreover, is consistent with its recent recognition that "significant public interest benefits" arise from DISH's control of the 2 GHz spectrum, including "efficient use of the 2 GHz spectrum by a financially sound licensee that has the requisite capital and capability to deploy 2 GHz" services to consumers.[11] DISH has invested approximately $3 billion in the 2 GHz band, including tens of millions of dollars toward the cost of clearing the S-

[11] *See DBSD and TerreStar Transactions Order*, 27 FCC Rcd. at 2260 ¶ 26.

Band of incumbent Broadcast Auxiliary Service licensees. To deploy and operate a full-fledged terrestrial broadband wireless network in the S-Band, DISH is prepared to spend billions of dollars more on infrastructure and employ tens of thousands of Americans.

Furthermore, DISH can take advantage of the most advanced wireless technology without being captive to a legacy technology. If the Commission acts quickly, DISH is poised to enter the market at a time when mobile broadband technology is leaping to significantly superior capabilities. In particular, DISH's work with the 3rd Generation Partnership Project ("3GPP")[12] will allow the 2 GHz spectrum to be ready for an LTE-Advanced rollout, once the S-Band is fully integrated into the new standard. The 3GPP group is expected to complete the S-Band specifications for LTE-Advanced by December 2012. Any delay in commencing buildout beyond that time is a delay in a new entrant capturing the substantial increase in data throughput and quality-of-service capabilities that the new standard will make possible, underscoring the importance of expeditious Commission action here.

III. THE COMMISSION SHOULD ASSIGN THE AWS-4 LICENSE THROUGH MODIFICATION OF EXISTING MSS/ATC AUTHORIZATIONS

The Commission's proposed grant of AWS-4 authority through modification of DISH's existing MSS/ATC authorizations serves the public interest by offering the only reasonable and realistic means of expediting new broadband deployment in the band. It is also consistent with sound engineering, law, and policy. Moreover, alternative licensing and band plan proposals would unduly complicate and delay, if not foreclose, deployment of new broadband services.

[12] 3GPP unites multiple telecommunications standards bodies and provides their members with a stable environment to produce reports and specifications that define 3GPP technologies. *See* 3rd Generation Partnership Project (3GPP), About 3GPP (visited May 14, 2012), http://www.3gpp.org/About-3GPP.

A. Modification of DISH's Existing Authority Is the Only Reasonable Means of Promoting Full Terrestrial Use of the S-Band

The Commission's proposal to grant terrestrial authority to operate in the AWS-4 band to DISH, by modifying its 2 GHz authorizations to include Part 27 terrestrial authority and obligations, will promote the rapid deployment of the spectrum. And it will do so without raising harmful interference problems or encountering legal pitfalls that would accompany any alternative method of facilitating terrestrial use of the S-Band.

1. The Commission's Proposed Conclusion Regarding MSS and Terrestrial Service Coexistence Is Supported by Commission Precedent

The Commission's proposal to grant terrestrial authority to operate in the AWS-4 band to "the current 2 GHz MSS licensee" is consistent with its determination in 2003 that MSS and ATC operations cannot coexist in the same band with separately licensed terrestrial operations.[13] As the Commission correctly recognized, "same-band, separate operator sharing is impractical and ill-advised," and it is unclear how the operators "could overcome the technical hurdles to workable sharing arrangements between two mobile services."[14] In reaching that conclusion, the Commission considered many factors, including the propagation characteristics of the frequency band, service and network ubiquity, the limited geographic separation between users, the anticipated operating power, the need for protection of adjacent spectrum users, and the extent of system deployment.[15]

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[13] *Compare 2 GHz NPRM* ¶¶ 71, 74, *with* Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, *Report and Order and Notice of Proposed Rulemaking*, 18 FCC Rcd. 1962, 1991-92 ¶ 49 (2003) ("*ATC Order*").

[14] *ATC Order*, 18 FCC Rcd. at 1991-92 ¶ 49.

[15] *Id*.

Indeed, as the Commission also observed, "[s]ame-band satellite and terrestrial operations have created technical problems in other bands."[16] In the case of Local Multipoint Distribution Service ("LMDS"), for example, the Commission found that two widely deployed services, one satellite and one terrestrial, cannot share the same spectrum even if they are both fixed.[17] Although certain fixed services have been able to coexist with other mobile and fixed services, "the problems grow more complex where, as here, both the proposed satellite service and the proposed terrestrial service are planned as mobile services with widespread deployments."[18] Taken together, these concerns offer "strong reasons"[19] to assign AWS-4 terrestrial authority to DISH as the incumbent 2 GHz MSS license holder. Indeed, nothing has changed since 2003 that would alter these conclusions.

2. The Commission's Proposed Conclusion Regarding MSS and Terrestrial Service Coexistence Is Also Supported by Engineering Analysis

Technical analysis of today's MSS and terrestrial networks further confirms the Commission's 2003 findings. A report commissioned by DISH and prepared by two prominent electrical engineering experts, Dr. Richard Barnett of Telecomm Strategies, Inc. and Dr. Michael Dellomo of Radyn, Inc. (the "Barnett/Dellomo Report"), underscores the continued validity of

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[16] *Id*. at 1994-95 ¶ 54.

[17] *See* Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, *First Report and Order and Fourth Notice of Proposed Rulemaking*, 11 FCC Rcd. 19005, 19015-16 ¶ 27 (1996).

[18] *ATC Order*, 18 FCC Rcd. at 1991-92 ¶ 49.

[19] *2 GHz NPRM* ¶ 71.

the conclusion that MSS operators cannot share spectrum with unaffiliated terrestrial providers.[20] The Barnett/Dellomo Report thus confirms the soundness of existing Commission policy, and demonstrates that the Commission's proposal is the only workable means by which a robust terrestrial mobile broadband provider can share the 2 GHz Band with an MSS/ATC service.

Specifically, Drs. Barnett and Dellomo first conclude that the only means to avoid harmful interference between terrestrial and satellite services using the same frequencies is to have both systems run by the same operator. Second, they conclude that co-frequency sharing between two separate operators—one providing MSS (satellite only) and the other providing AWS (terrestrial)—is not feasible today and cannot be mitigated by the use of the LTE architecture. Third, they find that the co-frequency sharing interference environment between separately controlled MSS/ATC (satellite with an ancillary terrestrial service) and AWS terrestrial systems presents even more serious problems. Finally, they confirm and quantify the harmful interference impact.

a. MSS and Terrestrial Operations Are Possible When Performed by the Same Operator in the Same Band

As Drs. Barnett and Dellomo point out, the only way to manage the frequency usage of terrestrial (*e.g.*, ATC or AWS-4) and satellite systems in the same band is to have the same operator (or commonly affiliated operators) operate and coordinate the systems. The terrestrial portion must be operated in a manner that controls the terminal-to-MSS uplink interference while providing terrestrial service. The Commission has found that this is achievable, despite the

[20] *See* Report of Dr. Richard Barnett, Telecomm Strategies, Inc., and Dr. Michael Dellomo, Radyn, Inc., The Technical Basis for Requiring Control of Satellite and Terrestrial Operations in the 2 GHz Band by the Same Operator (May 2012) ("Barnett/Dellomo Report") (attached as Exhibit 1).

operational challenge that the single operator might face.[21] Adding another unaffiliated operator, on the other hand, would make achieving this type of coordination much more difficult, if not practically impossible.[22] The core challenge is that sharing the S-Band between MSS and terrestrial systems requires real-time resource management of the communications links operating in both the satellite and terrestrial systems.[23]

b. Co-frequency Sharing Between Separately Owned MSS/ATC and Terrestrial Operations Is Not Feasible

As Drs. Barnett and Dellomo explain, co-frequency sharing between MSS and AWS implicates at least four interference scenarios: (1) AWS-4 mobile terminals into MSS satellite receivers in the 2000-2020 MHz band; (2) AWS-4 base station transmitters into MSS mobile terminals in the 2180-2200 MHz band; (3) MSS mobile terminals into AWS-4 base station receivers in the 2000-2020 MHz band; and (4) MSS satellite transmissions into AWS-4 mobile terminals in the 2180-2200 MHz band. Drs. Barnett and Dellomo examine each scenario in turn, finding the following:

- AWS handset transmissions directly endanger reception at MSS satellite receivers, especially in light of two factors: (1) the significantly larger satellite receive antenna gain compared to the gain of a typical base station receive antenna; and (2) the large number of co-frequency mobile terminals simultaneously operating within the satellite beam's footprint.[24] These two factors produce as much as 70 dB higher noise/interference levels; this additional noise is not offset by the distance between the satellite and the terrestrial network. The end result would be harmful interference to the MSS satellite receiver.[25]

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[21] *See ATC Order*, 18 FCC Rcd. at 1993 ¶ 52.

[22] *Id*.

[23] Barnett/Dellomo Report § 3.1.

[24] *Id*. § 1.3(a).

[25] *Id*.

- MSS handsets on the ground are susceptible to co-frequency interference from nearby AWS base stations. This is due to the relatively weak signal strength of the MSS satellite downlink and the omnidirectional receiving antenna of the MSS handset.[26]

- AWS base station receivers are susceptible to interference from nearby transmitters on MSS handsets. This is due to the MSS handsets' use of omnidirectional antennas as well as the relatively higher power levels required to establish the earth-to-satellite communication.[27]

- AWS handsets are vulnerable to interference from MSS downlink transmissions, because AWS handsets also employ omnidirectional antennas.[28] As a result, the AWS handset will detect the unwanted satellite downlink signal at a comparable level to the wanted signal from the AWS base station and be unable in many instances to differentiate between the two.[29]

Furthermore, Drs. Barnett and Dellomo conclude that LTE technology cannot overcome these interference problems. One of the advantages of LTE is that it allows operators to dynamically reassign subcarriers (and, hence, spectrum) amongst various nodes and users. This reassignment capability depends heavily on the system's ability to dynamically control subcarrier usage. While there are several ways to implement this reassignment in an integrated environment, it would be impossible to accomplish this without integration of the terrestrial and satellite service providers.[30]

c. ATC and Separately Licensed Terrestrial Operations Cannot Coexist in the Same Band

DISH's existing authority to conduct ATC operations in the same frequencies further precludes the possibility of separately licensed, terrestrial operations.[31] There are, again, four

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[26] *Id*. § 1.3(b).

[27] *Id*. § 1.3(c).

[28] *Id*. § 1.3(d).

[29] *Id*.

[30] *Id*. §§ 3.1-3.2.

[31] *Id*. § 2.

potential interference scenarios between DISH's licensed ATC operations and an AWS-4 service provided in the same frequency: (1) AWS handsets into ATC base stations in the 2000-2020 MHz band; (2) ATC handsets into AWS base stations in the 2000-2020 MHz band; (3) AWS base stations into ATC handsets in the 2180-2200 MHz band; and (4) ATC base stations into AWS handsets in the 2180-2200 MHz band. Drs. Barnett and Dellomo conclude that sharing would raise intractable operational and interference issues that cannot be practically mitigated.[32] Indeed, no two competing operators are likely to succeed in organizing and managing the highly complex coordination process required between both the ATC and terrestrial services at the same time, in the same band, and in the same region. It is no surprise, therefore, that no terrestrial mobile wireless operator shares the same frequencies with a separate mobile wireless operator, as coexistence of competing services in the same area and band is not feasible with current (or proposed) technology.[33] Thus, sharing between ATC operations and a separately licensed terrestrial network is not possible.

d. Interference Computations Confirm that Non-integrated Co-frequency Sharing Is Not Feasible

Drs. Barnett and Dellomo also quantified the threat of interference from co-frequency sharing between different operators by using software developed to capture the Commission's interference calculation model.[34] For example, they calculated interference from AWS-4 base stations into MSS receivers in the downlink band, and found that MSS handsets on the ground

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[32] *Id*.

[33] *Id*.

[34] *See* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Ninth Report and Order and Order*, 21 FCC Rcd. 4473 (2006).

would have a negative interference margin and be severely affected within 140 km of a different operator's AWS base station for non-integrated operations.[35] In short, computations based on the Commission's model confirm that non-integrated co-frequency sharing is not feasible.

B. License Modification Is Consistent with the Communications Act and Commission Precedent

The Commission's proposed use of Section 316 of the Communications Act to modify DISH's authority to operate in the 2 GHz MSS band is consistent with the plain language of the statute. Section 316 confers expansive authority to modify licenses when the Commission believes that such action "will promote the public interest, convenience, and necessity."[36] As the D.C. Circuit has held, "Section 316 grants the Commission broad power to modify licenses."[37] Here, the proposed modification will expeditiously make 40 MHz of spectrum available for terrestrial mobile broadband use by consumers while increasing competition and protecting existing services and licensees from harmful interference, consistent with the Commission's public interest mandate under Section 316.

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[35] Barnett/Dellomo Report § 4.2. In the case of integrated operations, by contrast, the operator will be able to achieve maximum throughput capacity at a shorter distance—50 km from the base station—and will be able to operate at lower throughput levels everywhere within the 50 km area. *Id.* § 4.3. Thus, while interference will be an issue even in the case of integrated operations, it is far less debilitating than in the non-integrated scenario.

[36] 47 U.S.C. § 316; *California Metro Mobile Commc'ns v. FCC*, 365 F.3d 38, 45 (D.C. Cir. 2004). Naturally, in the extremely unlikely event that the Commission's modifications were later overturned by the courts, licensing in that band should return to the *status quo ante*.

[37] *California Metro*, 365 F.3d at 45; *see also Cmty. TV, Inc. v. FCC*, 216 F.3d 1133, 1140 (D.C. Cir. 2000); *Rainbow Broadcasting v. FCC*, 949 F.2d 405, 410 (D.C. Cir. 1991); Improving Public Safety Communications in the 800 MHz Band, *Report and Order*, 19 FCC Rcd. 14969, 15013 ¶ 69 (2004) (finding that the *Ashbacker* doctrine does not prevent the Commission "from adopting licensing mechanisms through its rulemaking process that foreclose competing applications").

The Commission's proposal is also supported by Commission precedent. For example, the Commission has used its Section 316 authority to enhance licensee flexibility by adding ATC authority to MSS licenses;[38] to expand the 2 GHz MSS spectrum assignments of the former S-Band licensees so that they could provide beneficial services to the public and enhance competition;[39] and to give Sprint Nextel access to 10 MHz of the 1.9 GHz band to resolve issues of interference and inefficiency impacting public safety services.[40] The same core public interest values—expanded flexibility and improved and more competitive services—are served here by use of Section 316 authority to modify DISH's existing 2 GHz MSS/ATC authority.

C. License Modification Is the Most Realistic, Timely Solution to Rapid Deployment and Best Serves the Public Interest

The proposed Section 316 license modification best serves the public interest by facilitating more expeditious and efficient use of the spectrum for mobile broadband than other Commission tools.[41] If, on the other hand, the Commission considers a fundamental change in the licensing and allocation of AWS-4,[42] the spectrum is likely to remain fallow for years—tied

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[38] Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands, *Second Order on Reconsideration, Second Report and Order, and Notice of Proposed Rulemaking*, 22 FCC Rcd. 19733, 19752 ¶ 43 (2007); *see also* Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands, *Report and Order and Order Proposing Modification*, 23 FCC Rcd. 7210, 7210 ¶ 1 (2008).

[39] Use of Returned Spectrum in the 2 GHz Mobile Satellite Service Frequency Bands, *Order*, 20 FCC Rcd. 19696, 19705-06 ¶¶ 21-22 (2005).

[40] Improving Public Safety Communications in the 800 MHz Band, *Memorandum Opinion and Order*, 20 FCC Rcd. 16015, 16045 ¶ 69 (2005) ("We reaffirm our conclusion that the grant to Nextel of access to 1.9 GHz spectrum was well within the scope of the Commission's Section 316 license modification authority and past precedent, and that the Commission was not precluded from granting such rights by license modification . . . .").

[41] *See 2 GHz NPRM* ¶¶ 76-79. The proposed license modification also will remove outdated regulatory barriers to mobile broadband deployment, increase the supply of available spectrum for mobile broadband use, and avoid harmful interference. *Id.*

[42] *See id.* ¶ 80.

up in regulatory procedures, potential litigation, and other hurdles. Moreover, any new licensees would have to coordinate with DISH's MSS and ATC operations, which, as discussed above, is not feasible. This would greatly delay, if not outright preclude, the roll-out of a competitive mobile broadband service and discourage entry.

As detailed in the National Broadband Plan, repurposing spectrum to wholly new uses and licensees takes substantial time:

Figure 1: Time Historically Required to Reallocate and License Spectrum[43]

BAND	FIRST PROPOSAL	LICENSES ISSUED	APPROXIMATE LAG TIME
PCS	1989	1995	6 years
BRS/EBS	1996	2006	10 years
700 MHz	1996	2009	13 years
AWS-1	2000	2006	6 years

Consistent with these challenges, efforts to make available the AWS-2 and AWS-3 bands have been languishing since the Commission first proposed service rules in 2004 and 2007, respectively, with no timetable yet established to auction the bands.[44] Even with the incentive

[43] National Broadband Plan at 79, Exhibit 5-C. This does not include the amount of time for a licensee to build out and begin providing service.

[44] *See* Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd. 19263 (2004); Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band, *Notice of Proposed Rulemaking*, 22 FCC Rcd. 17035 (2007).

auctions recently authorized by Congress, the most optimistic industry estimates predict that it will take one to three years before the first auction occurs.[45]

IV. THE COMMISSION SHOULD ADOPT ITS PROPOSED PERFORMANCE REQUIREMENTS WITH TARGETED MODIFICATIONS

If DISH receives terrestrial authority to operate in the AWS-4 band as proposed, it will aggressively build out a broadband network to provide competitive choice and innovative offerings to American consumers. While DISH supports the cornerstone of the Commission's proposed seven-year buildout requirements, it recommends the following adjustments to the performance requirements to ensure they are commercially reasonable and achievable.

A. A Seven-Year Buildout Schedule Is Achievable

Although DISH supports the proposal, the contemplated AWS-4 seven-year buildout schedule is among the shortest in the Commercial Mobile Radio Services ("CMRS"). By way of example, AWS-1 licensees holding licenses issued before December 31, 2009, are required to provide "substantial service" within 15 years,[46] and 700 MHz C Block licensees have 10 years to cover 75 percent of the population in each license area.[47] Additionally, the Wireless Communications Service ("WCS") licensees effectively have been afforded a 19-year buildout schedule as a result of the Commission's extension and modification of their substantial service

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[45] *See, e.g.*, John Eggerton, CTIA Offers Own Timetable for FCC Auction Action, Broadcasting & Cable (Mar. 22, 2012), *available at* http://www.broadcastingcable.com/article/482207-CTIA_Offers_Own_Timetable_for_FCC_Auction_Action.php?rssid=20065 ("CTIA wants the first auction—in which broadcasters offer up spectrum and the FCC chooses the lowest bidder—to be completed by Jan. 7, 2014, and the second auction, in which that reclaimed spectrum is sold to the highest bidder, to be completed by Oct. 14, 2014.").

[46] 47 C.F.R. §§ 27.13(g), 27.14(a).

[47] 47 C.F.R. § 27.14(h), (i).

requirements.[48] While precedent supports a longer timeline for construction, the Commission understandably hopes to push full terrestrial deployment of the S-Band as rapidly as commercially reasonable. As detailed below, a seven-year buildout is achievable with some adjustments.

B. Modifications to the Proposed Interim Milestone Requirement Are Warranted

Four-Year Interim Milestone. A four-year interim buildout period is necessary to allow sufficient time to build a new facilities-based network.[49] At the same time, it will ensure that the spectrum is put to use as expeditiously as possible. Indeed, even with the extra year, a more stringent interim buildout requirement on new licensees has never been imposed by the Commission and successfully met by new CMRS licensees.[50] Unduly stringent buildout conditions can foreclose desirable spectrum uses and leave the spectrum fallow for a longer

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[48] *See* Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, *Report and Order and Second Report and Order*, 25 FCC Rcd. 11710, 11718 ¶ 15 (2010) ("*WCS Order*"). Originally, WCS licensees were required to make a showing of substantial service in their license areas by the end of their initial 10-year license term, which commenced on July 21, 1997. This deadline was subsequently extended by three years before being replaced with the current schedule, which requires WCS licensees to cover 40% of the population within 3.5 years and 75% of the population within six years. *See id*.; 47 C.F.R. § 27.14(p).

[49] *See* Declaration of David Zufall, Vice President for Wireless Development, DISH Network Corporation, ¶ 3 ("Zufall Declaration") (attached as Exhibit 2).

[50] The Commission did require LightSquared to construct a terrestrial network covering at least 100 million people by December 31, 2012 (approximately 33 months after order). *See* SkyTerra Communications, Inc., Transferor, and Harbinger Capital Partners Funds, Transferee, Application for Consent to Transfer of Control of SkyTerra Subsidiary, LLC, *Memorandum Opinion and Order and Declaratory Ruling*, 25 FCC Rcd. 3059, 3085 ¶ 56 (2010). LightSquared is not expected to meet this milestone, however. In the WCS context, as noted, licensees held their licenses for years after an original 10-year buildout period was extended before being replaced by the current requirements. *See WCS Order*, 25 FCC Rcd. at 11718 ¶ 15; Table of Buildout Requirements in Other Proceedings (attached as Exhibit 4). In addition, the four-year milestone period for 700 MHz licenses, which commenced at the end of the DTV transition in 2009, has not yet occurred. *See* 27 C.F.R. § 27.14(g)-(i).

period of time than with more reasonable buildout requirements. One concern is that a truncated interim milestone of three years as proposed in the *NPRM* may require inefficient use of technology or infrastructure to satisfy a regulatory requirement as opposed to the more scalable and long-term investments needed to launch a robust, competitive offering.

To enter the market as a new and vibrant competitor in a field of powerful incumbents, DISH must focus on the future of cellular technology—LTE-Advanced. Developing and implementing a new LTE-Advanced network in the S-Band will take time. Although DISH has been diligently working with 3GPP to ensure that the standard is updated to account for harmonization of the band for single-operator use, this process is not expected to be completed until December 2012. Only then can equipment vendors fully engage in development of LTE-Advanced equipment.[51] And this equipment cannot be designed for the S-Band in particular until the AWS-4 service rules and 3GPP S-Band specifications are completed.[52]

To move forward with the network infrastructure, chipsets, and devices required to deploy its network, DISH will need to issue requests for proposals ("RFPs") based on the LTE-Advanced standard and AWS-4 service rules, receive and evaluate responses to the RFPs, negotiate and execute contracts, and assist the manufacturers with the design and production of the network equipment. In addition, DISH will need to upgrade its customer service and billing systems to support new mobile broadband services as well as develop support systems for regulatory requirements such as the Communications Assistance for Law Enforcement Act ("CALEA") and E-911. During this period, DISH will also complete construction of network operations centers ("NOCs"), deploy new S-Band cell sites in trial markets, negotiate

[51] Zufall Declaration ¶¶ 4-5.

[52] *Id*.

interconnection and backhaul agreements, and obtain IP addresses and telephone numbers. Due to the complexity of creating a new, differentiated product, in a new and technically constrained band, and the requirement for sequential development of chipsets and commercial devices, these activities are expected to require approximately 30 months from when the AWS-4 service rules and 3GPP S-Band specifications are completed.[53]

Further, to develop a facilities-based retail service, DISH must not only build the necessary network and personal devices, but also undertake the engineering and planning necessary to put those devices to effective use.[54] Once all the equipment and systems have been developed, they must be certified to meet technical specifications, fully integrated with DISH retail business operations systems, and tested as a complete network. DISH will need to train support staff and test operational procedures. DISH will also need to test billing and customer care systems and procedures. DISH may also enter into roaming arrangements, which will require extensive certification testing of roaming devices with roaming partners as well as integration with their billing, customer care, and operations support systems. This process is expected to require approximately nine months, for a total of 39 months from when the AWS-4 service rules and 3GPP S-Band specifications are completed.[55]

DISH will then need to complete all launch-related work including full deployment of S-Band cell sites in launch markets and construction of backhaul facilities. DISH will complete establishment of a broad geographic retail presence for the products and services. Finally, DISH will complete full market trials of the complete service. Work will begin in all of these areas as

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[53] *Id*. ¶ 5.

[54] *See* DISH Network Corporation, Notice of Ex Parte, IB Docket Nos. 11-149, 11-150, at 4 (filed Feb. 2, 2012); Zufall Declaration ¶¶ 5-7.

[55] *Id*. ¶ 6.

soon as possible after the Commission's new AWS-4 rules are finalized, but many of these activities must be performed sequentially—one must be either complete or substantially underway before the other commences. In general, development, testing, certification, and deployment must follow each other. This entire process is expected to last 48 months from when the AWS-4 service rules and 3GPP S-Band specifications are completed.[56]

In short, based on an ambitious buildout schedule and barring unforeseen circumstances,[57] DISH believes it can deploy its network to 60 million POPs within four years.[58] A three-year interim milestone is unrealistic for a new mobile broadband service provider and a new band, especially one that lacks a global ecosystem for LTE-Advanced equipment.

Adjusted and Simplified Interim Coverage Requirement. Given DISH's status as a prospective new entrant in the mobile broadband marketplace and its lack of existing wireless infrastructure, the coverage requirement associated with the interim milestone should be adjusted to provide DISH with sufficient flexibility as it begins the challenging process of building a new facilities-based network. Even at four years, a 30 percent POPs coverage requirement is

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[56] *Id*. ¶ 7. After initial launch, DISH will continue to deploy cell sites, backhaul and operational support systems throughout the country. DISH will launch additional markets as they are deployed and tested, and DISH will also continue to develop new products and services to ensure ongoing competitiveness of the products. This process will continue through completion of the final milestone. *Id.* ¶ 8.

[57] *Id*. ¶ 9. Unforeseen circumstances are always a possibility, especially with new technologies. The Commission should, consistent with its general rules and precedent, entertain extension and waiver requests to the extent unforeseen circumstances frustrate compliance with a milestone. *See* 47 C.F.R. § 1.3 (providing for waivers of Commission rules for good cause shown).

[58] Zufall Declaration ¶¶ 3, 7.

aggressive and likely unrealistic. As noted above, the Commission has not imposed similarly stringent interim buildout requirements that have been met by CMRS licensees.[59]

Moreover, for a nationwide license, using an absolute population number is preferable to using a percentage of the total population—a figure potentially subject to interpretation. For these reasons, the Commission should adopt a four-year milestone that requires coverage and service to 60 million POPs, which is approximately 20 percent of the current U.S. population based on the 2010 U.S. Census.

C. Modification to the Proposed Final Milestone Is Warranted

The final buildout requirement should also be modified to be more consistent with comparable requirements for most CMRS licenses and to reflect the recommended nationwide scope of the license. The proposed 70 percent coverage requirement is excessive here, compared to buildout requirements imposed on, and satisfied by, other CMRS licensees.[60] For example, the Commission required broadband PCS licensees of 30 MHz blocks to cover two-thirds of the population of their license areas and gave them ten years to do so.[61]

The final milestone should be set at 200 million POPs, which is approximately 65 percent of the current U.S. population based on the 2010 U.S. Census. This proposal compares favorably to buildout requirements imposed on other CMRS licensees, such as 700 MHz licensees that were allowed 10 years—three additional years—to provide coverage to 70 to 75 percent of the

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[59] *See supra* note 50. Although Clearwire met a four-year milestone requirement originally imposed on Sprint, that milestone required coverage to only 15 million POPs. *See* Applications of Nextel Communications, Inc., and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *Memorandum Opinion and Order*, 20 FCC Rcd. 13967, 14028 ¶ 164 (2005) ("*Sprint/Nextel Order*"); Exhibit 4.

[60] *See* Exhibit 4.

[61] *See* 47 C.F.R. § 24.203(a).

population of their licensed areas.[62] A 200 million POP milestone would reflect the shortened seven-year schedule, and the reality of the costs and delays associated with a new service in a new band without an existing global ecosystem. Such a requirement also substantially exceeds the Commission-approved commitments made by Sprint-Nextel and Sprint-Clearwire in their transactions: 30 million and 140 million POPs, respectively.[63]

D. The Commission Should Adopt a System of Flexible Sanctions for Buildout Noncompliance

Rather than requiring a draconian outcome such as automatic license termination for failure to meet a milestone, the Commission should adopt a flexible enforcement approach that allows for case-by-case consideration of a range of enforcement actions, including monetary penalties or other enforcement options. Automatic license termination is the harshest available remedy and should not be required in the event of a failure to meet a milestone.

A system of flexible sanctions is consistent with the regime that applies to 700 MHz licenses. There, failure to meet interim milestones results in a two-year reduction in the license term, as well as possible enforcement action and possible reduction in size of the licensed area, but only after a determination that the licensee failed to undertake meaningful efforts to put the spectrum to use.[64]

Under this system of flexible sanctions, the maximum penalty to be considered for failure to meet the milestones should be termination of AWS-4 authority only for those areas where the

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[62] *See* Service Rules for the 698-746, 747-762, and 777-792 MHz Bands, *Second Report and Order*, 22 FCC Rcd. 15289, 15293 ¶ 6 (2007) ("*700 MHz Second Report and Order*"); Exhibit 4.

[63] *See Sprint/Nextel Order*, 20 FCC Rcd. at 14028 ¶ 165; Sprint Nextel Corporation and Clearwire Corporation Applications for Consent to Transfer Control of Licenses, Leases, and Authorizations, *Memorandum Opinion and Order*, 23 FCC Rcd. 17570, 17617 ¶ 119 (2008).

[64] *See 700 MHz Second Report and Order*, 22 FCC Rcd. at 15348 ¶ 153.

licensee has not provided coverage. This approach is fully consistent with Commission precedent,[65] reflects the substantial and risky investment in new technologies and new competitive offerings contemplated by the Commission's proposed rules, and also avoids stranding consumers to whom DISH is providing service.

These approaches are more reasonable than automatic cancellation and are consistent with the Commission's 700 MHz licensing regime. The proposed automatic termination of authorizations upon failure to meet the buildout requirements is both impractical and inequitable, and will ultimately disenfranchise consumers.[66] Indeed, the question of whether the licensee has missed the requirements can be fact-intensive. Accordingly, the rules should provide for imposition of penalties only after a Commission determination that the licensee has not met the requirement.

V. THE COMMISSION SHOULD ADOPT THE PROPOSED AWS-4 TECHNICAL RULES WITH MINOR MODIFICATIONS

The Commission should adopt AWS-4 technical rules based upon existing ATC and AWS-1 rules, with minor modifications that will both maximize flexible use of the spectrum and protect incumbent operations in adjacent bands. These modifications include changes to generally conform the AWS-4 rules to the ATC waivers previously granted to DBSD.[67]

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[65] *See, e.g.*, 47 C.F.R. § 27.14(g)(2) (providing that if a 700 MHz A, B or E Block licensee fails to meet the final milestone, "that licensee's authorization will terminate automatically without Commission action for those geographic portions of its license in which the licensee is not providing service, and those unserved areas will become available for reassignment by the Commission").

[66] *See id.* ¶ 95.

[67] *See* New ICO Satellite Service G.P. Application for Blanket Authority to Operate Ancillary Terrestrial Component Base Stations and Dual-Mode MSS-ATC Mobile Terminals in the 2 GHz MSS Bands, *Order and Authorization*, 24 FCC Rcd. 171, 183-95 ¶¶ 35-65 (2009) ("*DBSD Waiver Order*").

Protection of MSS Operators. The Commission proposes to ensure that 2 GHz MSS systems do not suffer harmful interference as a result of AWS-4 terrestrial operations in the 2 GHz band.[68] This is critical to protect existing MSS services and the integrity of the co-primary MSS allocation at 2 GHz, especially given the global nature of MSS in the 2 GHz band. As noted above, and consistent with previous Commission findings and engineering analysis, the only practical means to provide this protection is to ensure that any terrestrial use of the S-Band is undertaken by the MSS provider.[69]

Protection of Operations Below 1995 MHz. The proposed out-of-band emissions ("OOBE") attenuation from mobile stations transmitting in the 2000-2020 MHz band of $70+10*\log_{10}(P)$ dB below 1995 MHz is sufficient to protect PCS receivers from harmful interference in the 1930-1995 MHz band, which is allocated to PCS downlinks.[70] This level is actually more protective than the $60+10*\log_{10}(P)$ dB level that the Commission has in the past found sufficient to protect neighboring band operations that are not harmonized but rather place uplinks in the neighborhood of downlinks. In addition, through the 3GPP process, G Block and S-Band operators have determined that the $70+10*\log_{10}(P)$ dB limit provides sufficient OOBE protection.[71] This was reiterated by Sprint in a letter filed on November 17, 2011, with the Commission:

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[68] *2 GHz NPRM* ¶ 17.

[69] *See* discussion *supra* Section III.A; *ATC Order*, 18 FCC Rcd. at 1991-95 ¶¶ 49-54; Barnett/Dellomo Report §§ 1.5, 4.

[70] Declaration of Mariam Sorond, Vice President for Technology Development, DISH Network Corporation, ¶ 3 ("Sorond Declaration") (attached as Exhibit 3).

[71] *See* 3rd Generation Partnership Project, Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Ratio Transmission and Reception (Release 10), 3GPP TS 36.101 V10.6.0 (2012-03), *available at* http://www.3gpp.org/ftp/Specs/archive/36_series/36.101/36101-a60.zip.

> Sprint has concluded that the protections set forth in the applicable Commission rules and policies, and in the final and pending specifications set forth by the 3rd Generation Partnership Project, in addition to DISH's and Sprint's mutual willingness to engage in good faith coordination, are sufficient to address harmful interference from MSS/Ancillary Terrestrial Component Services operations in the 2000-2020 MHz band into current or planned Personal Communications Services ("PCS") operations in the G Block and other PCS bands . . . .[72]

The measurement procedure specified in 47 C.F.R. § 27.53(h) is the correct procedure to assess this limit.[73]

Protection of Operations in 1995-2000 MHz. The Commission proposes three alternatives for OOBE attenuation between 1995 and 2000 MHz.[74] Of the three alternatives, imposing a limit of $43+10*\log_{10}(P)$ dB at 2000 MHz along with linear interpolation to $70+10*\log_{10}(P)$ dB at 1995 MHz is an appropriate OOBE limit in the AWS H Block (1995-2000 MHz). On the other hand, requiring attenuation of $70+10*\log_{10}(P)$ dB below 2000 MHz would have a significant adverse impact on operations in the AWS-4 uplink band. Such an attenuation requirement would likely: (1) increase the cost of mobile units; (2) require a significant reduction in power, affecting both uplink throughput and cell coverage; and (3) require a roll-off region to meet such a limit, which would result in unusable spectrum. In addition, the linear interpolation requirements of S-Band mobile terminals, which are intended to protect the AWS H

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[72] Letter from Marc S. Martin, Counsel for Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket Nos. 11-149, 11-150, at 2 (Nov. 17, 2011), *available at* http://ecfsdocs.fcc.gov/filings/2011/11/17/6016875873.html.

[73] Sorond Declaration ¶ 3.

[74] *2 GHz NPRM* ¶¶ 36-41. The Commission's three proposals are: (1) maintain the existing linear interpolation at $43+10*\log_{10}(P)$ dB at 2000 MHz; (2) require fixed and mobile transmitters in 2000-2020 MHz to attenuate below 2000 MHz by $70+10*\log_{10}(P)$ dB; or (3) require that fixed and mobile transmitters operating in 2000-2020 MHz attenuate emissions below 2000 MHz by 43+10*log10(P) dB, symmetric with existing limits for PCS emissions in 2000-2020 MHz. *Id.* ¶¶ 37-39.

Block, should be clarified as being measured in watts rather than dBs (the current rule does not specify the scale). Measuring in dBs would increase the cost of the device, impair the ability of the S-Band to deploy higher bandwidth carriers, and reduce uplink capacity.[75]

A shift by 5 or 10 MHz of the uplink spectrum for AWS-4 is not required to protect G Block operations, because an attenuation requirement of $70+10*\log_{10}(P)$ at 1995 MHz is sufficient. Moreover, in view of the dramatic increases in U.S. mobile broadband demand, guard bands are generally wasteful as a matter of spectrum policy—especially a 5 MHz guard band that otherwise could be used for new mobile broadband services.[76]

Protection of the S-Band Uplink. In order to protect S-Band uplink base station receive operations, H Block operations need to attenuate to a $70+10*\log_{10}(P)$ dB level at 2000 MHz. This would be aligned with the level of protection that is being provided from S-Band into the PCS band. Without this protection, S-Band base stations would receive harmful interference from H Block base stations. The power of downlink H Block operations also needs to be attenuated to prevent blocking to the S-Band base stations and harmful interference to the satellite receiver. In addition, OOBE limits from operations in the 1930-1995 MHz band at 2000 MHz should be set at $60+10*\log_{10}(P)$ dB, consistent with levels that were agreed among operators and vendors during the 3GPP process.[77]

Protection at the Upper Edge of the Uplink Band, Lower Edge of the Downlink Band. The Commission's proposed attenuation requirement of $43+10*\log_{10}(P)$ dB for emissions above

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[75] Sorond Declaration ¶ 4.

[76] *Id.*

[77] *Id.* ¶ 5; *see* 3rd Generation Partnership Project, Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Ration Transmission and Reception (Release 10), 3GPP TS 36.101 V10.6.0 (2012-03), *available at* http://www.3gpp.org/ftp/Specs/archive/36_series/36.101/36101-a60.zip.

2020 MHz from mobile units operating in the 2000-2020 MHz band is sufficient to protect operations in the AWS-2 J Block (2020-2025 MHz) and 2025-2110 MHz bands.[78] The proposed attenuation of $43+10*\log_{10}(P)$ dB for emissions below 2180 MHz from base stations operating in the 2180-2200 MHz band is also sufficient to protect operations in the AWS-2 J Block (2175-2180 MHz) and AWS-3 band (2155-2175 MHz).[79] As the Commission has previously found, the $43+10*\log_{10}(P)$ dB level is sufficient to protect adjacent band systems operating in a harmonized manner (*i.e.*, uplink next to uplink and downlink next to downlink). An attenuation of $43+10*\log_{10}(P)$ dB at the 2020 MHz boundary provides even further protection for the operations at 5 MHz away in the 2025-2110 MHz band.[80]

***Intraband Protection Issues*.** Attenuations applied outside of the uplink and downlink blocks provide appropriate protection from interference between AWS-4 and adjacent bands. With unified operations in the band, however, operator-to-operator interference within the AWS-4 band becomes moot. Thus, intraband base and mobile emission limits are unnecessary.[81]

Measurement Procedures for AWS-4 Mobile and Base Stations. The Commission has proposed that measurement procedures for AWS-1 for both mobile and base stations be applied to AWS-4.[82] DISH agrees that the measurement procedures specified in Section 25.252(c)(4)[83]

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[78] *2 GHz NPRM* ¶ 44.

[79] *Id*. ¶ 45.

[80] Sorond Declaration ¶ 6.

[81] *See 2 GHz NPRM* ¶¶ 32-33 (proposing to apply Section 27.53(h) of the Commission's rules, which includes OOBE attenuation of $43+10*\log_{10}(P)$ dB and the associated measurement procedure, to mobile and base transmissions in the AWS-4 band).

[82] *2 GHz NPRM* ¶ 57.

[83] 47 C.F.R. § 25.252(c)(4).

(as clarified by the technical waivers granted to DBSD) should apply to both mobile and base stations.[84]

Mobile Station Power Limits. The propagation characteristics of the AWS-4 uplink spectrum are more similar to the PCS bands, which allow for 2 watts EIRP, than they are to AWS-1.[85] As a result, the PCS power limit and its Part 27 counterpart, the 2 watt limit applicable to BRS/EBS, are more appropriate references for AWS-4. Therefore, the Commission should limit AWS-4 mobile terminals to 2 watts EIRP and fixed terminals to 2 watts output power.[86] Adopting these power limits for AWS-4 would also align with the current mobile power definitions for the 2 GHz band, which allow 1dBW/1.23 MHz, as the Commission already clarified in the previously granted DBSD waivers.[87] In granting the DBSD technical waivers, the Commission noted that the ATC rules allow higher power levels across larger bandwidths, such as 3 dBW EIRP across a 5 MHz bandwidth.[88] The BRS/EBS power limits are actually lower than the current power allocations in the 2 GHz band for higher bandwidths, and, therefore, are more protective of adjacent operations than the current ATC regime.[89]

Antenna Height Restrictions. DISH supports the proposal that general height restrictions for base stations are sufficient, and no further limitation is necessary.[90] But with

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[84] Sorond Declaration ¶ 7.

[85] *See 2 GHz NPRM* ¶ 61.

[86] 47 C.F.R. § 27.50(h).

[87] *See DBSD Waiver Order*, 24 FCC Rcd. at 191 ¶ 55.

[88] *Id*.

[89] Sorond Declaration ¶ 8.

[90] *2 GHz NPRM* ¶¶ 62-63.

respect to fixed stations, a 10-meter height restriction[91] is not necessary. As noted above, AWS-4 uplink operations at 2 GHz have characteristics more aligned with the BRS/EBS band than they do with AWS-1 uplink operations, which take place at 1.7 GHz. In the BRS/EBS context, the Commission has found that height restrictions for fixed stations are unnecessary.[92]

Transfer of Other Part 25 MSS/ATC Rules. Additional Part 25 MSS/ATC technical rules (other than those discussed above) need not and should not be incorporated into the AWS-4 technical rules, as they were intended to protect operations and deployment scenarios that will no longer exist under the Commission's proposed 2 GHz band plan.[93] These unnecessary and restrictive rules would place a significant burden on an LTE-Advanced network and reduce DISH's ability to use the spectrum efficiently.[94]

VI. THE COMMISSION SHOULD ADDRESS REGULATORY AND OTHER ISSUES

The Commission should adopt additional AWS-4 rules that provide regulatory flexibility, including allowing for a paired single block option and nationwide licensing, while eliminating unduly restrictive ATC rules. The Commission should not, however, adopt proposals that could unduly delay or increase the cost of new broadband deployment in the AWS-4 band.

A. Regulatory Flexibility Is Appropriate and Should Allow for a Paired Single Block AWS-4 License Option

The regulatory flexibility proposed in the *NPRM* is appropriate and will allow DISH to tailor its services to consumer demand and technological innovation. The Commission should permit the use of fixed and portable stations in addition to mobile terminals, consistent with

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[91] *Id*. ¶ 64.

[92] Sorond Declaration ¶ 9.

[93] *See 2 GHz NPRM* ¶ 136.

[94] Sorond Declaration ¶ 10.

existing service allocations.[95] The Commission should also adopt a flexible paired single block option for AWS-4 spectrum that would allow DISH to combine its existing two paired 10 MHz x 10 MHz blocks into a single paired 20 MHz x 20 MHz block, which will give DISH the flexibility to design its network and respond effectively to its business and technical needs.[96]

B. The AWS-4 License Area Should Mirror the MSS Licensing Regime

The Commission should license AWS-4 spectrum on a nationwide basis, rather than on a smaller geographic area basis. Small EA licenses are more difficult to administer and do not serve the demand for broad geographic service coverage.

C. The Commission Should Eliminate ATC Gating Requirements in the 2 GHz Band

As proposed in the *NPRM*, the Commission should eliminate the ATC restrictions in the 2 GHz band.[97] These restrictions have made it difficult to economically deploy 2 GHz terrestrial operations. As the Commission found, "the ATC gating criteria have made it difficult for MSS providers to deploy ancillary terrestrial networks, as well as to establish partnerships with wireless providers or other well-capitalized potential entrants."[98]

The ATC gating requirements no longer advance the public interest, as evidenced by the multiple bankruptcy filings from prior licensees. For example, the requirement of maintaining a

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[95] *Id.* ¶ 100. Part 27 rules for BRS and EBS already permit "[m]obile and other user stations." 47 C.F.R. § 27.50(h)(2). But Commission precedent suggests that fixed service in the MSS bands may require a waiver. *See* Motorola Satellite Communications, Inc. for Modification of License, *Order and Authorization*, 11 FCC Rcd. 13952, 13955-56 ¶¶ 10-11 (1996). Given the Commission's intent to make this band more like CMRS, the Commission should adopt its proposal to clarify that service to fixed stations is allowed.

[96] *See 2 GHz NPRM* ¶ 24.

[97] *Id*. ¶ 136.

[98] National Broadband Plan at 88.

spare satellite diverts substantial resources away from network deployment.[99] In addition, the integrated service requirement effectively limits the devices a provider can offer—regardless of what individual consumers actually want.[100] Finally, the ATC rules place procedural requirements on ATC operators that are not imposed on any other wireless carrier.[101]

D. Current Relocation Obligations Should Be Allowed to Sunset

The Commission proposes applying the cost-sharing obligation of ATC operators to the AWS-4 licensee and extending the period for 10 years after issuance of the AWS-4 license.[102] Current MSS/ATC relocation obligations to Fixed-Service ("FS") microwave licensees in the 2180-2200 MHz band will sunset in December 2013.[103] FS microwave licensees in the 2180-2200 MHz band have been on notice for nearly 20 years, however, that they would likely need to relocate their services.[104] Accordingly, the Commission should allow these FS operations to end naturally in 2013, which will not prejudice these licensees in any way.

E. Moving the MSS/AWS-4 Uplink Band Would Delay and Complicate Market Introduction of Mobile Services

The *NPRM* seeks comment on, but does not propose, either moving the MSS/AWS-4 uplink band to 2005-2025 MHz or moving and reducing the uplink band to 2010-2025 MHz.[105] Neither option furthers the Commission's goal of facilitating the timely buildout of this spectrum

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[99] *See* 47 C.F.R. § 25.149(b)(2).

[100] *See* 47 C.F.R. § 25.149(b)(4).

[101] *See* 47 C.F.R. § 25.117(f).

[102] *2 GHz NPRM* ¶¶ 134-35.

[103] *Id*. ¶ 134.

[104] *See* Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, *First Report and Order and Third Notice of Proposed Rulemaking*, 7 FCC Rcd. 6886 (1992).

[105] *2 GHz NPRM* ¶ 42.

nor is needed to solve interference issues. As detailed above, interference issues between the 2000-2020 MHz and 1995-2000 MHz bands can be resolved without any restructuring of the band plan. Rather, both alternatives would only cause significant delays, greatly complicate putting the new AWS allocation to use, and substantially increase the cost and complexity of operating the MSS/AWS-4 network.

As an initial matter, the alternatives would improperly curtail some of DISH's spectrum rights.[106] Because DISH's MSS satellites cannot operate above 2020 MHz, any upward migration above that frequency would effectively result in the partial revocation of DISH's MSS/ATC licenses, and would reduce the viability of MSS services. The diminution of the uplink spectrum to 15 MHz would further leave 5 MHz of downlink spectrum unpaired. This too would amount to partial revocation of DISH's license.[107] Given that interference issues can be resolved without restructuring the band plan and DISH's MSS satellites cannot operate above 2020 MHz, moving and/or reducing the uplink band would not serve the public interest.

In addition, because DISH's MSS satellites cannot operate above 2020 MHz, any upward migration will increase the cost and complexity of operating the MSS and terrestrial networks because the spectrum allocations will not entirely align. This misalignment would create the need for different components in the device. For example, there would need to be two duplexers (rather than one duplexer) associated with the terrestrial and satellite paths used in the device, which would increase costs.

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[106] *Cf. id.* ¶ 74 (acknowledging the need to be "mindful of the 2 GHz MSS license holder's existing rights to operate MSS in the AWS-4 band").

[107] Notably, DISH's acquisition of DBSD and of TerreStar's licenses was not subject to any divestiture or set-aside condition, since the Commission found no anti-competitive effects in need of a remedy.

Indeed, in either scenario, a move would cause delay by slowing the development of devices. The 3GPP S-Band (Band 23) specifications are based on the current spectrum allocation, so any move of the uplink band would require DISH to begin the time-consuming process of getting a new band plan approved by 3GPP.

VII. THE COMMISSION SHOULD REJECT THE 2 GHZ EXTENSION BAND CONCEPT

Separate and apart from its detailed proposal to expand terrestrial mobile broadband use in the 2 GHz Band, the Commission also issued an *NOI* inviting comment on a radically different plan—the "2 GHz Extension Band Concept."[108] This concept faces significant legal and operational hurdles that would inject uncertainty and delay into the proposed AWS-4 structure, and ultimately frustrate the Commission's objective to expeditiously provide additional spectrum for mobile broadband use. Given the clear viability of the *NPRM*'s proposal and its consistency with the Commission's goals, the Commission should reject the 2 GHz Extension Band Concept.

A. The 2 GHz Extension Band Concept Would Undermine 2 GHz Service Offerings and Unduly Delay Service to Consumers

The 2 GHz Extension Band Concept would both shrink and move the uplink portion of DISH's spectrum to the 1695-1710 MHz block.[109] As depicted below, the plan calls for two new blocks of spectrum, the PCS-Extension Block and the AWS-Extension Block.

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[108] *2 GHz NOI* ¶ 139.

[109] *Id*. ¶ 141.

Figure 2: Existing Band Plan

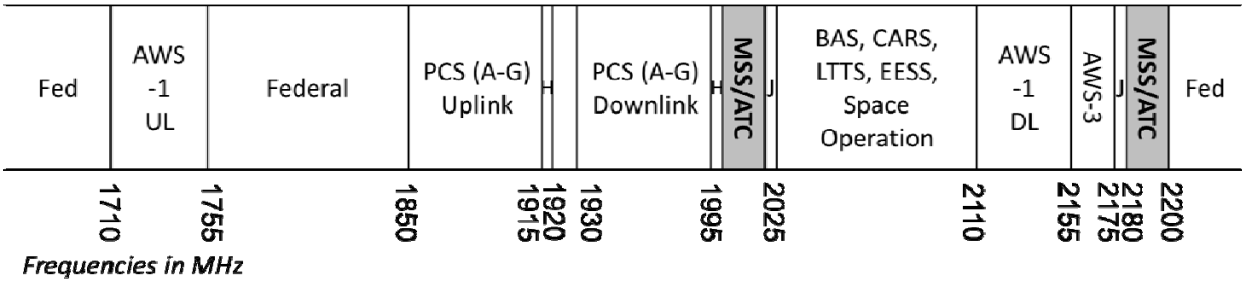
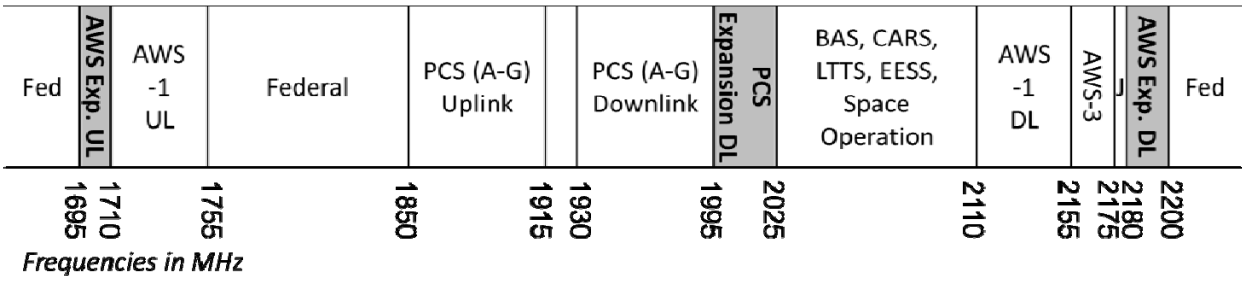


Figure 3: 2 GHz Extension Band Concept



If the alternative band plan were adopted, DISH's MSS offering would be critically harmed, reduced to a one-way (downlink-only) service using the 2180-2200 MHz downlink the satellites currently are designed for, which would deprive existing and future MSS customers of two-way services. Since there is no MSS allocation at 1695-1710 MHz, this problem could not be solved even if DISH were to build and launch additional MSS satellites to replace its two in-orbit MSS satellites, valued at more than $900 million. The likely result is that the potential of 2 GHz MSS and its public interest benefits would be lost. DISH would also lose five MHz of uplink spectrum for terrestrial use, needlessly limiting its already spectrum-constrained ability to serve its future terrestrial customers. Worse, the *NOI* does not propose any mechanism through which DISH would be compensated for this involuntary relocation and diminution of its rights—or explain why the company would invest the time and resources into building out a broadband MSS and terrestrial network at 2000-2020 MHz and 2180-2200 MHz only to see that investment diminished or even stranded if the Commission were to ultimately adopt this alternative plan.

Further, the 1695-1710 MHz band is far from becoming available in the foreseeable future. The band remains allocated for National Oceanic and Atmosphere Administration satellite use. According to the National Telecommunications and Information Administration ("NTIA"), the steps required to reallocate the 1695-1710 MHz band include satellite and technology redesigns, and the next World Radiocommunication Conference (probably in 2016) is slated to consider the addition of a mobile service allocation to the 1695-1710 MHz band for Region 2.[110] NTIA also notes that "[t]hese planning requirements and conversion of operations to alternative means will require resources to implement."[111] Accordingly, the 2 GHz Extension Band Concept would cause an unreasonable, protracted, and potentially fatal delay to the buildout of DISH's broadband network.

B. The 2 GHz Extension Band Concept Is Unsustainable

Aside from creating practical difficulties, the 2 GHz Extension Band Concept faces significant legal difficulties, due to recent passage of the Middle Class Tax Relief and Job Creation Act of 2012 ("Act").[112] The Act specifically requires the Commission to "auction" the 1695-1710 MHz band.[113] While the Act does not prevent the Commission's proposal to reallocate DISH's S-Band spectrum for terrestrial use, it could well preclude the Commission from conducting a "spectrum swap" with DISH for the spectrum that Congress specifically designated for auction.

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[110] National Telecommunications and Information Administration, An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, and 4200-4220 MHz, 4380-4400 MHz Bands, at 1-6 (Oct. 2010), *available at* http://www.ntia.doc.gov/report/2010/assessment-near-term-viability-accommodating-wireless-broadband-systems-1675-1710-mhz-17.

[111] *Id.*

[112] Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96.

[113] *Id.* § 6401(a)(3).

The Act's auction requirement cannot be circumvented by using an incentive auction to reclaim the 2000-2020 MHz block from DISH, and then providing DISH with equal bidding credits to be used in the auction of the 1695-1710 MHz band. The Act specifically requires the participation of two competing licensees in any incentive auction, which the Commission acknowledges would not be the case here.[114] And, in any event, DISH would first have to agree to put its licenses up for auction—which DISH has no intention of doing.

VIII. CONCLUSION

The Commission's proposal to modify DISH's MSS/ATC authority represents an important step toward putting 40 MHz of wireless broadband spectrum to use for American consumers as quickly as possible. It is critical, however, that the Commission act expeditiously so that the spectrum can actually be deployed and new competitive services can be provided to the American people.

[114] *Id*. § 6402.

Respectfully submitted,

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May 17, 2012

EXHIBIT 1: THE TECHNICAL BASIS FOR REQUIRING CONTROL OF SATELLITE AND TERRESTRIAL OPERATIONS IN THE 2 GHZ BAND BY THE SAME OPERATOR

THE TECHNICAL BASIS FOR REQUIRING CONTROL OF SATELLITE AND TERRESTRIAL OPERATIONS IN THE 2 GHz BAND BY THE SAME OPERATOR

An Engineering Analysis by Dr. Richard Barnett, Telecomm Strategies, Inc. and Dr. Michael Dellomo, Radyn, Inc.

Introduction

This report analyzes the potential interference issues that could arise if terrestrial Advanced Wireless Service-4 ("AWS-4") operations were permitted to coexist with authorized Mobile-Satellite Service ("MSS") and Ancillary Terrestrial Component ("ATC") operations in the 2000-2020 MHz and 2180-2200 MHz bands ("2 GHz band"). Specifically, this report analyzes the potential interference scenarios that result from satellite and terrestrial operations sharing the same frequencies, and examines the impact of using the Long-Term Evolution ("LTE") architecture technology in both an "integrated" manner (*i.e.*, same operator or affiliated operators) and "non-integrated" manner (*i.e.*, two separate, unaffiliated operators—MSS/ATC and AWS-4).

These analyses lead to the conclusion that co-frequency sharing of the band between separately controlled MSS and AWS systems is not feasible today. Moreover, co-frequency sharing between separately controlled ATC and AWS systems presents even more serious problems. Separate, unaffiliated operators are unlikely to succeed in organizing and managing the highly complex coordination process required between both satellite and terrestrial systems at the same time, in the same band, and in the same region. Rather, the only means to avoid harmful interference between satellite and terrestrial systems is to have both systems run by the same operator (or affiliated operators).

Section 1 analyzes the four interference scenarios involved in co-frequency sharing between MSS and AWS-4. Section 2 discusses the additional complications presented by ATC and AWS-4 sharing. Section 3 examines whether the harmful interference resulting from co-frequency sharing can be mitigated by the use of the LTE architecture. Section 4 explains that the harmful interference problems discussed in Section 1 have been confirmed through computations using software developed by Radyn, Inc. ("Radyn"). Section 4 also sets forth the calculations and interference results in the cases of non-integrated, co-frequency sharing and integrated co-frequency sharing.

Section 1 – Interference Between Terrestrial and Satellite Operations in the 2 GHz Band

1.1 Background

The 2 GHz band or "S-Band" is allocated on a primary basis for MSS in both the U.S. and international tables of frequency allocations.[1] Therefore, MSS provided in these bands must be protected from interference from other services. Specifically, interference protection must be provided to MSS "uplinks" (transmissions from mobile terminals to satellites) in the 2000-2020 MHz band and to "downlinks" (transmissions from satellites to mobile terminals) in the 2180-2200 MHz band. The existing MSS licensee in the 2 GHz band is also licensed to provide ATC services in the same band—specifically, ATC "uplinks" (mobile terminals to base stations) in the 2000-2020 MHz band and ATC "downlinks" (base stations to mobile terminals) in the 2180-2200 MHz band.

1.2 Terrestrial Operations in the 2 GHz Band

MSS operators have developed a variety of sophisticated techniques that permit additional terrestrial usage without taking spectrum away from their MSS operations. This is possible in part because MSS systems employ multiple small spot beams across the overall service area of the system, as discussed in more detail below. All of the techniques for implementing terrestrial operations rely on the MSS operator's ability to optimize the spectrum used for terrestrial operations so as to minimize interference with the MSS system—specifically, the ability to assign and reassign, on an ongoing basis, the spectrum used for both satellite and terrestrial components, based on the overall communications requirements of the combined MSS plus terrestrial system. It is important that this relative assignment of spectrum between the MSS and terrestrial components of the system remain dynamic—rapidly changeable between two points in geographic space, as well as between two points in time. In addition, the way in which the spectrum is used terrestrially by the MSS operator (*e.g.*, the power levels of the mobile terminals or base stations and the base station antenna characteristics) will be constrained in order to minimize interference to and from the MSS system.

A spot-beam MSS system cannot simultaneously use the entire licensed spectrum in all its spot beams. To do so would cause harmful interference between the adjacent spot beams of the system. Therefore the total available spectrum is divided up (not necessarily equally or in a

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[1] Fixed and Mobile allocations are co-primary with MSS in the 2 GHz band. In adding the Fixed and Mobile co-primary allocations, the Commission determined that the new allocations would not result in harmful interference to MSS operations because any Fixed and Mobile licensees would be required to "protect the 2 GHz MSS licensee from harmful interference." Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, WT Docket No. 12-70, Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz, ET Docket No. 10-142, Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, WT Docket No. 04-356, *Notice of Proposed Rulemaking and Notice of Inquiry*, FCC 12-32 ¶ 68 (rel. Mar. 21, 2012).

manner fixed over time) such that no two adjacent spot beams use precisely the same frequency at the same time.

MSS operators may implement a technique that exploits this feature of multi-spot beam MSS systems and provides terrestrial service in certain frequencies and certain geographic areas where the MSS system is not using those frequencies at that time. Great care must be taken in determining exactly where such terrestrial usage can occur, taking account of the detailed and instantaneous operating parameters of the MSS system.

The implementation of this technique differs between the MSS operators, depending on the type of satellite orbit (geostationary, medium earth, or low earth orbit), the frequency band in question, and the beam-forming capabilities of the specific satellite being used. Common to all such schemes is the need for flexible frequency assignment between the satellite and terrestrial portions of the systems, on a beam-by-beam or frequency-by-frequency basis and as a function of the precise geographic locations of the terrestrial mobile and base stations. This requires that the terrestrial system be optimally designed so that it does not cause or receive harmful interference into or from the MSS system, and so that it uses a common network control facility and an integrated system architecture that prescribe both the terrestrial and satellite usage of frequencies in a time-varying and location-dependent way. This facility must be capable of controlling and monitoring the detailed links operating in both systems.

An independent terrestrial AWS-4 system that uses the same MSS spectrum cannot possibly operate in the way described above. Therefore, it would be certain to cause and receive harmful interference to and from the MSS system.

1.3 Interference Between Separate MSS and AWS-4 Operations

The fact that harmful interference will occur between co-frequency, co-coverage, independently operated communications networks is no surprise. This is why terrestrial systems, for example, are licensed on a frequency band basis.

Harmful interference between licensed MSS/ATC systems and separate, unaffiliated terrestrial AWS-4 systems would certainly occur, unless some of the available resource (either in terms of spectrum or geographic coverage) was taken away from the MSS/ATC licensee and given to the AWS-4 operator, so that the MSS/ATC and AWS-4 systems no longer would operate on a co-frequency and co-coverage basis. The interference situation between MSS and a terrestrial AWS-4 service is no different.

As with MSS and ATC, the proposed AWS-4 service would also have uplinks in the 2000-2020 MHz band and downlinks in the 2180-2200 MHz band. This means, in turn, that co-frequency sharing implicates at least four interference scenarios:

- AWS-4 mobile terminals into MSS satellite receivers;
- AWS-4 base station transmitters into MSS mobile terminals;
- MSS mobile terminals into AWS-4 base station receivers; and
- MSS satellite transmissions into AWS-4 mobile terminals.

(a) AWS-4 Mobile Terminals into MSS Satellite Receivers

On the surface it might seem that interference from AWS-4 mobile terminals to MSS satellite receivers would not be very significant, due to the vastly large distance from the AWS-4 mobile terminal to the satellite. However, the following two factors more than compensate for this difference in distance, as follows:

(i) The satellite receive antenna gain is significantly larger than the gain of a typical base station receive antenna. Typically, the difference would be on the order of 40 dB.
(ii) There will be a large number of co-frequency mobile terminals simultaneously operating within the footprint of the satellite beam, which covers many thousands of square miles. For example, 1,000 mobile terminals would result in a 30 dB (i.e., 10*log1000) increase in interference compared to a single terminal.

The two factors above amount to a noise/interference level of approximately 70 dB or greater (assuming at least 1,000 mobile terminals simultaneously operating within a satellite beam footprint), which is comparable to the difference in spreading loss between the path to the base station (*e.g.*, 12 km) and the distance to the satellite (*e.g.*, 40,000 km). Because the distance from AWS-4 mobile terminals to MSS satellite receivers is effectively eliminated as an interference mitigation factor, harmful interference is likely to occur.

This conclusion is supported by the analysis presented in 2002 by Comsearch, concluding that a *single* transmitting mobile terminal will result in a carrier-to-interference ratio ("C/I") at the satellite receiver of either 25.4 or 32.0 dB, depending on whether the mobile system operates Code Division Multiple Access ("CDMA") or Universal Mobile Telecommunications System ("UMTS"), respectively.[2] If the total number of such mobile terminals within the footprint of the satellite receive beam are taken into account, then these C/I levels will be quickly eroded to the point where harmful interference occurs.

Geographic separation of service areas between terrestrial AWS-4 and MSS systems (for example, by allowing AWS-4 to serve urban areas and MSS to serve rural areas) does not solve the interference problem because the satellite beams are too large to be tailored to rural areas only or to reject terrestrial AWS-4 transmissions from the urban and suburban areas. Therefore, the satellite beams will also cover the urban areas. This means the AWS-4 mobile transmissions in the urban areas will interfere with the satellite receive beams, as described above, unless special measures are taken regarding the characteristics of the AWS-4 mobile transmissions and the aggregation of traffic from these mobile terminals. The constraints placed on these urban mobile transmissions may also vary with time and frequency, depending on the traffic loading requirements of the MSS system. Special measures can be implemented successfully only if the same operator (or affiliated operators) controls both MSS and AWS-4 systems.

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[2] *See* AT&T Wireless Services, Inc., Further Comments, IB Docket No. 01-185, Attachment A (filed Apr. 1, 2002) ("Comsearch Report").

(b) AWS-4 Base Station Transmitters into MSS Mobile Terminals

As expected, interference from AWS-4 base stations to MSS mobile terminals will be significant. The MSS mobile terminals must use omnidirectional receiving antennas to receive relatively weak signals from the MSS satellite. Therefore they are susceptible to co-frequency transmissions from nearby AWS-4 base station transmitters. This conclusion is supported by the Comsearch Report, which concluded that a terrestrial base station must be very far away or well-shielded from an MSS mobile terminal to avoid harmful interference.[3]

For this interference scenario, a very significant interference problem arises in the "transition regions" between the urban and rural areas. In these transition regions, serious interference from AWS-4 base stations to MSS mobiles will occur, unless very careful measures are taken with the design and traffic loading of the AWS-4 component of the system. Only when both the AWS-4 and MSS systems are under the control of the same operator or affiliated operators can such measures be successfully implemented.

(c) MSS Mobile Terminals into AWS-4 Base Station Receivers

Interference from MSS mobile terminals to AWS-4 base stations also will be significant. MSS mobile terminals must use omnidirectional antennas to transmit to the MSS satellite using relatively high EIRP levels compared to a typical AWS-4 mobile terminal. However, they also may be near AWS-4 base stations and thus may cause harmful interference, particularly as they get closer to the AWS-4 base stations. This conclusion is supported by the Comsearch Report, which concluded that, to avoid unacceptable interference, the MSS mobile terminal cannot communicate with the satellite using the same frequency as the terrestrial base station receiver, absent substantial blockage.[4]

This interference scenario would occur in the "transition regions" between the urban and rural service areas. There will be serious interference from MSS mobiles to AWS-4 base stations in these areas, unless operators implement very careful measures, such as shutting down the satellite mobile transmit when operating in the coverage of AWS-4 base stations. Again, such measures require integrated control of the two systems.

(d) MSS Satellite Transmissions into AWS-4 Mobile Terminals

Because both MSS and AWS-4 mobile terminals employ omnidirectional antennas, the downlink power flux density from the satellite may be comparable in level to the radiated power required for the link from an AWS-4 base station to its associated mobile receivers. Therefore, the AWS-4 mobile terminals may detect the unwanted satellite downlink signal at a comparable level to the wanted signal from the AWS-4 base station, and may receive harmful interference as a result. Again, this conclusion is supported by the analysis presented by the Comsearch Report, which

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[3] *Id.* at 2-3.

[4] *Id.* at 1-2.

concluded that this interference could be a problem, at least in the case of a CDMA mobile terminal.[5]

This interference scenario exists regardless of any segregation of the service areas between the AWS-4 and MSS networks. As explained in Section 1.3(a) above, the MSS satellite beam inevitably covers urban areas and thus potentially interferes with the AWS-4 mobile terminals in those urban service areas. The best means for preventing this interference from degrading the performance of the AWS-4 system is to place control of both the AWS-4 and MSS systems under the same operator or affiliated operators.

1.4 Alternative Transmission Requirements to Prevent Harmful Interference Between Separate AWS-4 and MSS Operations

In this section we consider whether any alternative transmission requirements could be implemented to prevent harmful interference between separate MSS and AWS-4 operations.

The Commission's proposal is to authorize AWS-4 operations co-directionally with MSS, thus allowing use of the same frequency band (*i.e.*, 2180-2200 MHz) for both satellite and AWS-4 downlinks, as well as the same spectrum (*i.e.*, 2000-2020 MHz) for both MSS and AWS-4 uplinks. This is the assumption used in Section 1.3 above (discussing interference between MSS and AWS-4 operations) and Section 2 below (discussing interference between ATC and AWS-4 operations).

If the transmission requirements for AWS-4 were reversed (*i.e.*, AWS-4 downlink at 2000-2020 MHz and AWS-4 uplink at 2180-2200 MHz), the following four interference scenarios would occur:

(i) MSS satellite transmissions into AWS-4 base station receivers in the 2180-2200 MHz band;
(ii) AWS-4 base station transmissions into MSS satellite receivers in the 2000-2020 MHz band;
(iii) AWS-4 mobile terminal transmitters into MSS mobile receivers in the 2180-2200 MHz band; and
(iv) MSS mobile terminal transmitters into AWS-4 mobile receivers in the 2000-2020 MHz band.

Certain restrictions on the design of AWS-4 base station antennas could mitigate some, but not all, of the interference described above. For example, designing the AWS-4 base station antenna to focus its high-gain region horizontally where AWS-4 mobile subscribers generally are located (rather than up toward the MSS satellite) could achieve some isolation of the signal path between the AWS-4 base station and the MSS satellite. These design restrictions, however, would limit the geographic reach of the AWS-4 system and thus significantly compromise performance and capacity of the system, which will have to support expanding broadband service requirements. Moreover, these design restrictions would not mitigate the interference described in (iii) and (iv)

[5] *Id.* at 2.

above, both of which occur directly between the AWS-4 and MSS mobile terminals. Thus, the reverse-band transmission alternative would preclude co-coverage, co-frequency operation between AWS-4 and MSS.

1.5 Same Operator for AWS-4 and MSS—An Essential Prerequisite

The only way to ensure spectrally efficient AWS-4 operations in the 2 GHz band, without taking spectrum away from authorized MSS operations in this band, is to allow the same operator (or affiliated operators) to control both AWS-4 and MSS operations, using an integrated system architecture and, ideally, a single overall AWS-4/MSS network control facility.

Section 2 - Additional Complications Presented by ATC and AWS-4 Sharing

Severe complications arise if an AWS-4 operator attempts to deploy in the same area where a separate, unaffiliated MSS operator has deployed an ATC system. This is equivalent to attempting to deploy two separate, but similar terrestrial systems in the same area and band. There are four potential interference scenarios: (1) AWS handsets into ATC base towers in the 2000-2020 MHz band; (2) ATC handsets into AWS base towers in the 2000-2020 MHz band; (3) AWS base towers into ATC handsets in the 2180-2200 MHz band; and (4) ATC base towers into AWS handsets in the 2180-2200 MHz band.

Since the AWS-4 and ATC mobiles will have similar technical characteristics, both the AWS-4 and ATC base stations will receive high levels of interference on the uplink. Additionally, both the AWS-4 and ATC base stations have similar technical characteristics and thus will generate high interference levels into each other's mobiles.

Shared use of the same spectrum by two separate terrestrial services in the same area is simply an unrealistic scenario. If that were possible, no FCC licensing to grant exclusive use of the spectrum would be required. Considerable efforts on the part of the FCC, the Telecommunications Industry Association ("TIA"), the National Spectrum Managers Association ("NSMA"), and the cellular and communications companies have been expended to define and control interference between co-frequency services in nearby areas. If such services could coexist in the same area, these efforts would be superfluous.

For completeness, we consider the special case of LTE technology below. Even so, the conclusion is the same: coexistence of separate services in the same area and band is not feasible with current (or even proposed) technology.

Section 3 – Integrated and Non-integrated Use of LTE

LTE technology is rapidly becoming a dominant means of establishing 4G mobile connectivity. Developed by the 3rd Generation Partnership Project ("3GPP"), it provides enhanced data rates and features over existing 3G wideband technologies such as Wideband Code Division Multiple Access ("WCDMA") and High Speed Packet Access ("HSPA"). Its use of Orthogonal Frequency Division Multiple Access ("OFDMA") on the downlink and the related Single Carrier

Frequency Division Multiple Access ("SC-FDMA") on the uplink provide capability for significant data throughput speeds far beyond the theoretical limit of 3G technologies.[6]

One of the advantages of LTE is that it allows operators to dynamically reassign subcarriers (and, hence, spectrum) amongst various nodes and users. The result is a greater ability to serve a changing customer environment. The reassignment capability depends heavily on the system's ability to dynamically and almost instantaneously control subcarrier usage. While there are several ways to implement this reassignment in an integrated environment, it would be impossible to accomplish this without integration.

An example of integrated LTE usage is the case of an MSS provider that also operates a terrestrial LTE service. An example of non-integrated LTE usage would be an AWS-4 operator attempting to use the same spectrum in the same area to provide terrestrial service separate and apart from the MSS provider.

3.1 LTE in an Integrated Environment

As mentioned above, LTE uses OFDMA for downlink data delivery to the mobile station. The transmitter divides a data stream among several very narrowband subcarriers (2048 of them in a 20 MHz band). The transmitter then performs an Inverse Fast Fourier Transform ("IFFT") to create the 20 MHz signal.[7] Here, the transmitter could be a terrestrial base station or a satellite transmitter, depending upon implementation. Depending upon the location of the mobile and data requirements of the transmission, a subset of the subcarriers is chosen to deliver the data and transmit power, and signal coding is varied to enable maximum data throughput. As an individual user's demand fluctuates, subcarriers can be reassigned to other users, and the power levels can be adjusted.

Using a feature of LTE Advanced called Cooperative MultiPoint ("CoMP"), two cooperative LTE transmitters in nearby areas can potentially allocate available subcarriers so as to provide the best service to their customers. The Heterogeneous Networks ("HetNet") feature of LTE Advanced also enables spectrum to be aggressively reused in overlapping cells to increase capacity within a single operator's network.

Consider the case of satellite spot beam usage in an MSS system with AWS-4 and satellite transmitters similar to the description in Section 1.2. Here we assume the same operator (or affiliated operators) manages both MSS and AWS-4 systems. Using LTE, subcarriers assigned to terrestrially covered areas could be dynamically reassigned or block-reassigned as the operator sees fit. Satellite and terrestrial base station equipment, if properly configured by a single operator, could dynamically assign channels, power levels, and signal coding to manage inter-

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[6] Erik Dahlman, Stefan Parkvall & Johan Skold, LTE/LTE-Advanced for Mobile Broadband (Oxford, UK, Academic Press (Elsevier)) (2011); 3rd Generation Partnership Project (3GPP), LTE (visited May 14, 2012), http://www.3gpp.org/lte.

[7] Erik Dahlman, Stefan Parkvall & Johan Skold, LTE/LTE-Advanced for Mobile Broadband (Oxford, UK, Academic Press (Elsevier)) (2011).

system inference. The goal is to provide optimal resource usage to its customers in all areas. There is less risk of conflict here because the operator will manage an equitable distribution of spectrum.

3.2 Non-integrated Usage Failure

Now consider the same case as above, but with an independent second operator managing the terrestrial AWS-4 system. Several problems arise. First, in order to have any sort of dynamic carrier management, each operator will need to have control of the other's system. This is not reasonable or even technically feasible if the two systems are competing or operating independently. Within a single integrated LTE network, base stations and mobility management servers and the devices themselves communicate directly with each other to coordinate their transmissions and mitigate interference. This is not possible between two independent, non-integrated systems.

Second, there is no common metric for measuring good service: in periods of high utilization, each operator will seek to maximize the share of resources allocated to its system, regardless of the deleterious effects on the other. In fact, it would be advantageous for one system to waste resources rather than allow its competitor to improve service.

The only solution in this scenario would be to segregate spectral usage in a non-dynamic fashion. This, however, would not enable stable, independent operation of the satellite and terrestrial systems due the spot beam spectrum allocation challenges described above and in Section 1.2. For the MSS system to operate competitively, the MSS operator must be allowed to determine the parameters for spectral segregation flexibly as its business plan demands. Otherwise, the AWS-4 system is not actually cooperating, but simply co-opting use of the spectrum at the MSS system's expense. It is important to note that the reallocation of surplus spectrum for other purposes must be at the discretion of the MSS operator, since only the MSS operator can optimize its implementation to ensure users receive satisfactory and consistent service. For that matter, only the MSS operator can determine the system parameters (*e.g.*, spot beam allocations), which will allow its business case to succeed in the first place.

Section 4 – Interference Computations Confirm Harmful Interference Between Separate MSS/ATC and AWS-4 Operations

In this Section, we perform interference computations, which confirm the threat of harmful interference from co-sharing between separate, unaffiliated operators.[8] We consider two cases:

[8] The interference computations were calculated along the same guidelines as for fixed transmitter into mobile receivers, and using software developed by Radyn for the purpose of assessing the prospect of harmful interference from and into CMRS carriers. Embedded in the software are the Commission's instructions for computation of interference. *See* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Ninth Report and Order and Order*, 21 FCC Rcd. 4473 (2006).

(a) non-integrated use of 2 GHz spectrum by a separate AWS system; and (b) integrated use of 2 GHz spectrum by the same operator (or affiliated operators). The results show that non-integrated use of 2 GHz spectrum results in unacceptable interference levels across a large area, while integrated use can efficiently utilize spectrum with relatively minor capacity loss at the edge of the AWS-4 service areas.

These computations are meant to be illustrative. We make standard assumptions for signal strength, acceptable interference levels, etc. We note here that computations using specific equipment and configurations will likely yield different numerical results. We also note that only one location is being studied. However, we emphasize that the essential results should remain unchanged: non-integrated AWS use will deny MSS operations in large areas, while integrated MSS/terrestrial use will permit MSS operations everywhere with full capacity in most places.

4.1 Interference Computation Setup

For both scenarios (*i.e.*, integrated and non-integrated use), we assume a single terrestrial base station is located in Ft. Myers, Florida. We assume an omnidirectional antenna, since for traditional 3 or 4 sector designs, the effective signal level at a given distance will not vary by much more than 3 dB. We examine interference into MSS handsets located at varying distances from the terrestrial transmitter. The MSS handsets are assumed to be communicating with the satellite using the 2180-2200 MHz band for downlink, and the terrestrial transmitter is assumed to be communicating with its mobiles in the same band. Reversing bands, as considered above in this report, results in mobile-to-mobile interference issues that are difficult to predict and impossible to manage or control, let alone mitigate.

The MSS mobile handset is assumed to be operating with a receiver threshold of -98 dBm, consistent with the LTE specification.[9] The AWS-4 terrestrial transmitter is assumed to use an EIRP of 63 dBm. Path loss from the terrestrial transmitter to the victim mobile is computed using the NSMA Over-the-Horizon Loss ("OHLoss") model. NSMA OHLoss is the standard

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[9] 3rd Generation Partnership Project (3GPP), LTE (visited May 14, 2012), http://www.3gpp.org/lte; The 3rd Generation Partnership Project (3GPP), LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Radio Transmission and Reception (3GPP TS 36.101 Version 10.6.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136100_136199/136101/10.06.00_60/ts_136101v100600p.pdf; The 3rd Generation Partnership Project (3GPP), LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) Radio Transmission and Reception (3GPP TS 36.104 version 10.6.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136100_136199/136104/10.06.00_60/ts_136104v100600p.pdf ; The 3rd Generation Partnership Project, LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (3GPP TS 36.211 Version 10.4.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136200_136299/136211/10.04.00_60/ts_136211v100400p.pdf.

model for predicting interference between services in most bands between 1 and 30 GHz. We set the confidence margin for NSMA OHLoss at 80%, though an argument could be made for considering 99.99% or 50%. Results obtained this way would be somewhat more conservative or liberal, but will be analogous with the 80% results except for scale. We do not consider these cases here.[10]

Parameters for the transmitters and receivers were based on numbers obtained from LTE specifications.[11] We assume, for peak performance, the transmitters are using 64QAM. The receiver reliability was set to a Bit Error Rate ("BER") of 10^{-6}. As with the confidence margin, other BER values could be specified but, for modern radios, this should not change the results by more than a few dB.[12]

4.2 Non-integrated Analysis

For the non-integrated analysis, we assume co-channel operation across the 20 MHz of MSS downlink spectrum, and we investigate in detail one of four interference scenarios—AWS-4 base stations into MSS receivers in the downlink band. Table 1 shows the computed interference margin values for the MSS mobile receiver. Beyond a 180 km distance, interference is negligible and MSS operation should be unimpeded. In fact, between 160 and 180 km, MSS operation should be only slightly impaired; users would experience only a minor elevation in bit error rate. However, MSS operations will be severely impacted within 140 km of the AWS-4 station. Figure 1 illustrates this situation. The yellow shaded area will have reduced but acceptable performance. The red shaded area will be denied MSS service because of the AWS-4 base station transmitter. Note that actual computations were only produced for the northern

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[10] National Spectrum Managers Association, OHLOSS Path Loss Computation with OHLOSS Tutorial (October 2000), *available at* http://www.nsma.org/recommendation/WG2-99-052.pdf.

[11] 3rd Generation Partnership Project (3GPP), LTE (visited May 14, 2012), http://www.3gpp.org/lte; The 3rd Generation Partnership Project (3GPP), LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Radio Transmission and Reception (3GPP TS 36.101 Version 10.6.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136100_136199/136101/10.06.00_60/ts_136101v100600p.pdf; The 3rd Generation Partnership Project (3GPP), LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) Radio Transmission and Reception (3GPP TS 36.104 version 10.6.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136100_136199/136104/10.06.00_60/ts_136104v100600p.pdf ; The 3rd Generation Partnership Project, LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (3GPP TS 36.211 Version 10.4.0 Release 10) (visited May 14, 2012), *available at* http://www.etsi.org/deliver/etsi_ts/136200_136299/136211/10.04.00_60/ts_136211v100400p.pdf.

[12] Trevor Manning, Microwave Radio Transmission Design Guide (Artech House) (2nd ed. 2009).

direction. However, since the terrain in central Florida is essentially flat, the circular depiction is likely to be accurate, at least over the land area.

Table 1: Interference Margin by Distance, Non-integrated Case

Distance (km)	Margin (dB)
120	-11.06
160	-2.17
180	-0.6
200	3.61

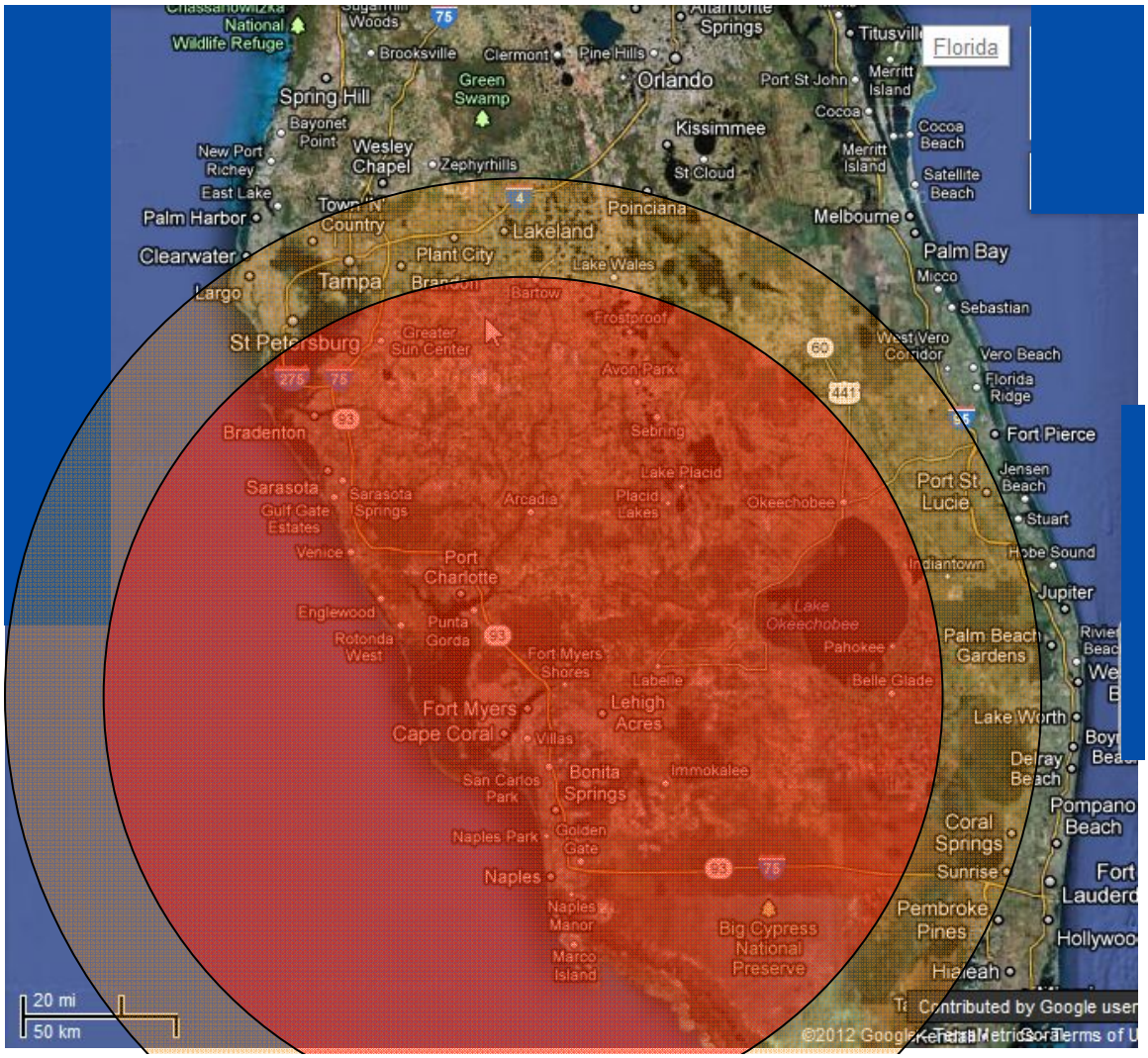

Figure 1: Non-integrated Service Disruption Area

4.3 Integrated Analysis

For the integrated analysis, we assume the MSS and terrestrial systems have a common operator. If, for example, a single user requires extensive bandwidth, the operator can accommodate the need by dynamically reallocating spectrum between the MSS and terrestrial subsystems. We consider the effect of the terrestrial system on the satellite's ability to communicate with a mobile MSS handset. Specifically, we consider a mobile receiver sufficiently far from the AWS-4 base station to require satellite service.

Table 2 shows the computed interference margin values for the MSS mobile receiver if we attempt to achieve maximum throughput without regard for quality of service. Within 50 km of the terrestrial transmitter, the MSS mobile will not be able to achieve maximum throughput while terrestrial users occupy part of the spectrum. However, it is possible to operate at lower throughput levels everywhere within the 50 km area. In fact, even just 1 km from the terrestrial station, the reduced capacity analysis has an interference margin greater than 17 dB. Thus, the operator is always able to operate at reduced capacity. While interference will be an issue even in the case of integrated operations, it is far less debilitating than in the non-integrated scenario.

Table 2 assumes a worst-case mix of MSS and terrestrial users. In most cases, the operator is free to adjust apportionment of the available spectrum to provide the best bandwidth to the most customers and will be able to minimize capacity loss.

Table 2: Interference Margin by Distance, Integrated Case

Capacity	Distance (km)	Margin (dB)
Maximum	30	-14.16
Maximum	40	-15.93
Maximum	50	2.85
Maximum	60	3.33
Maximum	70	4.46
Reduced	1 km	17.2

These computations do not take into account the coverage provided by the terrestrial system. Indeed, using the extended COST-231 model adjusted for the 2180-2200 MHz band and assuming light suburban/rural propagation, we find that the terrestrial transmitter will only cover users out to between 7 and 12 km, depending on the environment.[13] Figure 2 illustrates this situation.

In Figure 2, the green circle is the area covered by the integrated terrestrial service base station, while the yellow annulus is the area where accommodations will need to be made by the MSS/terrestrial integrated operator to account for lower capacity. Actual computations were only produced for the northern direction as in Section 4.2. We note that the size of the annulus

[13] Theodore Rappaport, Wireless Communications Principles and Practice (Prentice Hall PTR) (2nd ed. 2002).

will be reduced in areas where terrain is rougher or where the MSS operator accepts a higher bit error rate in exchange for higher capacity. This is contingent upon the business case of the MSS operator.

Similar techniques can be used to mitigate interference for the MSS mobile transmitting to the satellite.

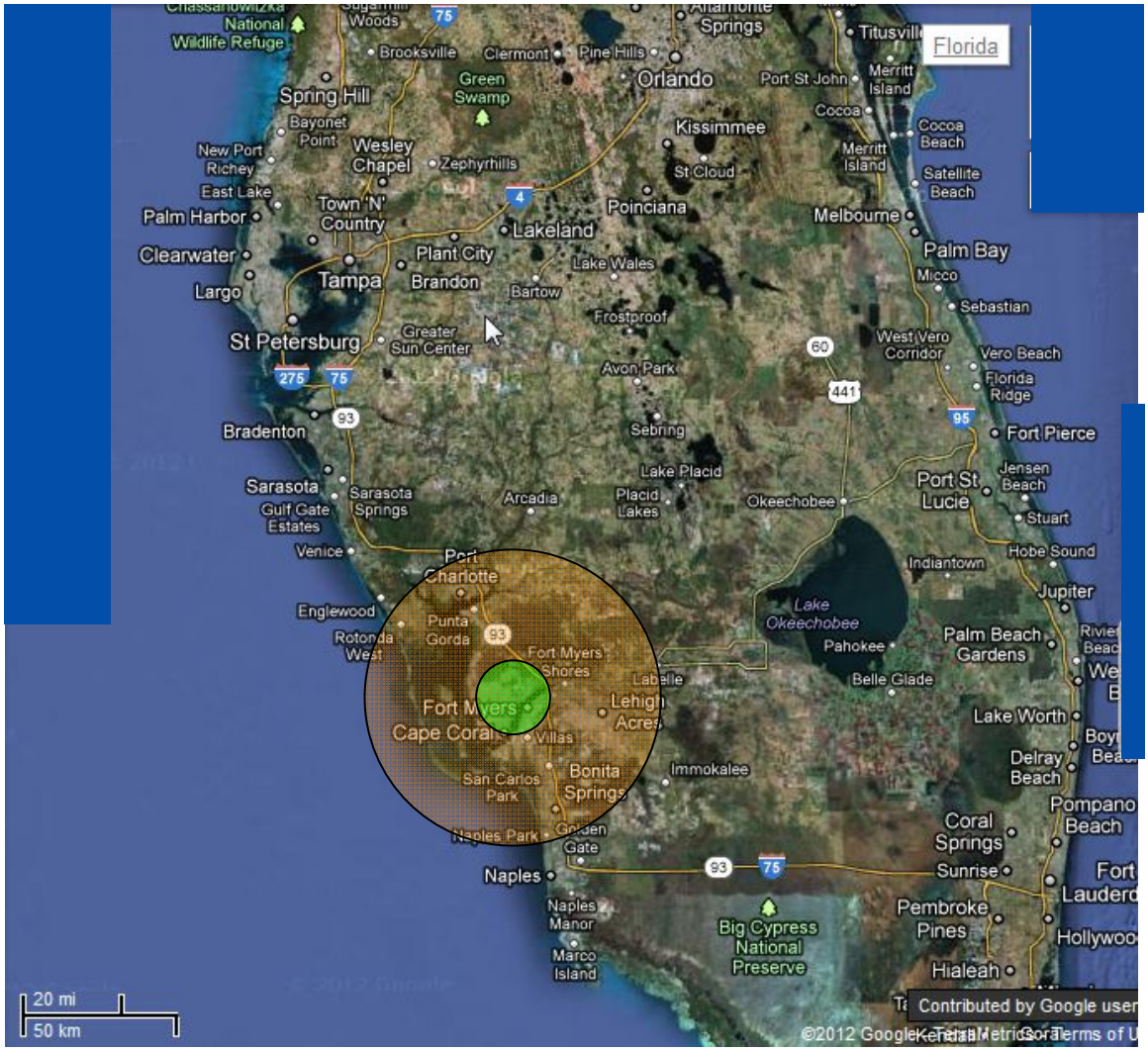

Figure 2: Integrated Service Area

Conclusions

The complexities of the various interference scenarios between AWS-4 and MSS operations in the 2 GHz band is such that only deployment of satellite and terrestrial operations by the same operator (or affiliated operators) can avoid harmful interference to both satellite and terrestrial operations. In the particular case of MSS systems, we find that the tight coordination required between the satellite component and the terrestrial component precludes the possibility of non-integrated AWS-4 usage. Indeed, we show that any significant AWS-4 deployment in the MSS band would seriously disrupt the satellite link. We also show that a combined integrated

MSS/terrestrial system with a single operator could maximize efficient use of the spectrum, with relatively minor loss of capacity under adverse conditions in some areas.

ENGINEERING CERTIFICATION

We hereby certify under penalty of perjury that we are the technically qualified persons responsible for the preparation of the engineering information contained in the foregoing report; that the foregoing has been prepared using facts of which we have personal knowledge or belief or upon information provided to us; and that the foregoing is true and correct to the best of our information, knowledge, and belief. Executed on May 17, 2012.

Richard Barnett

Dr. Richard Barnett
Telecomm Strategies Inc.

Michael Dellomo

Dr. Michael Dellomo
Radyn Corporation

EXHIBIT 2: DECLARATION OF DAVID ZUFALL

DECLARATION OF DAVID ZUFALL

I, David Zufall, being over 18 years of age, swear and affirm as follows:

1. I make this declaration in support of the comments of DISH Network Corporation ("DISH") filed in response to the *Notice of Proposed Rulemaking* ("*NPRM*") issued by the Federal Communications Commission ("Commission") in WT Docket Nos. 12-70 and 04-356 and ET Docket No. 10-142 (FCC 12-32). This declaration will focus on issues related to the buildout requirements for a terrestrial network using 2 GHz spectrum.

2. I am Vice President for Wireless Development for DISH Network L.L.C. In this role, I am overseeing the development and planning of a terrestrial wireless network system in the 2 GHz band. Before DBSD North America, Inc. ("DBSD") was acquired by DISH, I was a Senior Vice President for Technology Development at DBSD and oversaw its network systems. I am an engineer by training.

3. DISH is committed to expeditiously building a new terrestrial mobile broadband network in the 2000-2020 and 2180-2200 MHz bands using the LTE-Advanced standard. Based on an ambitious buildout schedule, DISH believes it can deploy its network to 60 million people ("POPs") within four years.

4. As a threshold matter, DISH cannot begin the process of building its network until the S-Band specifications for LTE-Advanced are finalized by the 3rd Generation Partnership Project ("3GPP"). That process is not expected to be concluded until December 2012. And, of course, the process also cannot begin until the Commission adopts AWS-4 service rules for S-Band terrestrial use in this proceeding. Until the LTE-Advanced standard and AWS-4 rules are finalized, DISH will not know the network parameters, frequency bands, emission limits, interference protections, and other technical details that are crucial inputs for its network design.

5. Once the LTE-Advanced standard and the AWS-4 services rules are finalized, DISH can begin obtaining the network infrastructure, chipsets, and devices required to deploy its network. To move forward with its network infrastructure, DISH will need to issue requests for proposals ("RFPs") based on the LTE-Advanced standard and AWS-4 service rules, receive and evaluate responses to the RFPs, negotiate and execute contracts, and assist manufacturers with design and production of the network equipment. In addition, DISH will need to upgrade its customer service and billing systems to support new mobile broadband services as well as develop support systems for regulatory requirements such as the Communications Assistance for Law Enforcement Act ("CALEA") and E-911. During this period, DISH will also complete construction of network operations centers ("NOCs"), deploy new S-Band cell sites in trial markets, negotiate interconnection and backhaul agreements, and obtain IP addresses and telephone numbers. Due to the complexity of creating a new, differentiated product, in a new and technically constrained band, and the requirement for sequential development of chipsets and commercial devices, these activities are expected to require approximately 30 months from when from when the AWS-4 service rules and 3GPP S-Band specifications are completed.

6. Once all the equipment and systems have been developed, they must be certified to meet technical specifications, fully integrated with DISH retail business operations systems, and tested as a complete network. DISH will need to train support staff and test operational procedures. DISH will also need to test billing and customer care systems and procedures. DISH also may enter into roaming arrangements, which will require extensive certification testing of roaming devices with roaming partners as well as integration with their billing, customer care, and operations support systems. This process is expected to require

approximately nine months for a total of 39 months from when the AWS-4 service rules and 3GPP S-Band specifications are completed.

7. DISH will then need to complete all launch-related work including full deployment of S-Band cell sites in launch markets and construction of backhaul facilities. DISH will complete establishment of a broad geographic retail presence for the products and services. Finally, DISH will complete full market trials of the complete service. Work will begin in all of these areas as soon as possible after the Commission's new AWS-4 rules are finalized, but many of these activities must be performed sequentially—one must be either complete or substantially underway before the other commences. In general, development, testing, certification, and deployment must follow each other. This entire process is expected to last 48 months from when the AWS-4 service rules and 3GPP S-Band specifications are completed.

8. After initial launch, DISH will continue to deploy cell sites, backhaul and operational support systems throughout the country. DISH will launch additional markets as they are deployed and tested, and DISH will also continue to develop new products and services to ensure ongoing competitiveness of the products. This process will continue through completion of the final milestone.

9. The timeframes estimated above are aggressive and do not include lag times for unforeseen circumstances. When deploying a new technology like LTE-Advanced and pioneering the development of S-Band infrastructure, there is always the potential for unforeseen circumstances, since DISH cannot know all the potential variables affecting the new technology.

The foregoing declaration has been prepared using facts of which I have personal knowledge or belief or upon information provided to me. I declare under penalty of perjury that the foregoing is true and correct to the best of my information, knowledge, and belief.

David Zufall
Vice President, Wireless Development
DISH Network L.L.C.

May 17, 2012

EXHIBIT 3: DECLARATION OF MARIAM SOROND

DECLARATION OF MARIAM SOROND

I, Mariam Sorond, being over 18 years of age, swear and affirm as follows:

1. I make this declaration in support of the comments of DISH Network Corporation ("DISH") filed in response to the *Notice of Proposed Rulemaking* ("*NPRM*") issued by the Federal Communications Commission ("Commission") in WT Docket Nos. 12-70 and 04-356 and ET Docket No. 10-142 (FCC 12-32). This declaration will focus on issues related to the technical rules proposed in the *NPRM*.

2. I am Vice President for Technology Development for DISH Network L.L.C. In this role, I am overseeing the technical analysis of operations in the 2 GHz band. Before DBSD North America, Inc. ("DBSD") was acquired by DISH, I was a Vice President for Technology Development at DBSD and oversaw its systems technology development. I am an engineer by training.

3. *Protection of Operations Below 1995 MHz.* The proposed out-of-band emissions ("OOBE") attenuation from mobile stations transmitting in the 2000-2020 MHz band of $70+10*\log_{10}(P)$ dB below 1995 MHz is sufficient to protect PCS receivers from harmful interference in the 1930-1995 MHz band, which is allocated to PCS downlink. This level is actually more protective than the $60+10*\log_{10}(P)$ dB level that the Commission has in the past found sufficient to protect neighboring band operations that are not harmonized but rather place uplinks in the neighborhood of downlinks. In addition, through the 3rd Generation Partnership Project ("3GPP") process, G Block and S-Band operators have determined that the $70+10*\log_{10}(P)$ dB limit provides sufficient OOBE protection. The measurement procedure specified in 47 C.F.R. § 27.53(h) is the correct procedure to measure this limit.

4. *Protection of Operations in 1995-2000 MHz.* Imposing a limit of $43+10*\log_{10}(P)$ dB at 2000 MHz along with linear interpolation to $70+10*\log_{10}(P)$ dB at 1995 MHz is an appropriate OOBE limit in the AWS H Block (1995-2000 MHz). On the other hand, requiring attenuation of $70+10*\log_{10}(P)$ dB below 2000 MHz would have a significant adverse impact on operations in the AWS-4 uplink band. Such an attenuation requirement would likely: (1) increase the cost of mobile units; (2) require a significant reduction in power, affecting both uplink throughput and cell coverage; and (3) require a roll-off region to meet such a limit, which would result in unusable spectrum. In addition, the linear interpolation requirements of S-Band mobile terminals, which are intended to protect the AWS H Block, should be clarified as being measured in watts rather than dBs (the current rule does not specify the scale). Measuring in dBs would increase the cost of the device, impair the ability of the S-Band to deploy higher-bandwidth carriers, and reduce uplink capacity. A shift by 5 or 10 MHz of the uplink spectrum for AWS-4 is not required to protect G Block operations, because an attenuation requirement of $70+10*\log_{10}(P)$ at 1995 MHz is sufficient. Moreover, in view of the dramatic increases in U.S. mobile broadband demand, guard bands are generally wasteful as a matter of spectrum policy—especially a 5 MHz guard band that otherwise could be used for new mobile broadband services.

5. *Protection of the S-Band Uplink.* In order to protect S-Band uplink base station receive operations, H Block operations need to attenuate to a $70+10*\log_{10}(P)$ dB level at 2000 MHz. This would be aligned with the level of protection that is being provided from S-Band into the PCS band. Without this protection, S-Band base stations would receive harmful interference from H Block base stations. The power of downlink H Block operations also needs to be attenuated to prevent blocking to the S-Band base stations and harmful interference to the satellite receiver. In addition, OOBE limits from operations in the 1930-1995 MHz band at 2000

MHz should be set at $60+10*\log_{10}(P)$ dB, consistent with the levels that were agreed among operators and vendors during the 3GPP process.

6. *Protection at the Upper Edge of the Uplink Band, Lower Edge of the Downlink Band*. The Commission's proposed attenuation requirement of $43+10*\log_{10}(P)$ dB for emissions above 2020 MHz from mobile units operating in the 2000-2020 MHz band is sufficient to protect operations in the AWS-2 J Block (2020-2025 MHz) and 2025-2110 MHz bands. The proposed attenuation of $43+10*\log_{10}(P)$ dB for emissions below 2180 MHz from base stations operating in the 2180-2200 MHz band is also sufficient to protect operations in the AWS-2 J Block (2175-2180 MHz) and AWS-3 band (2155-2175 MHz). As the Commission has previously found, the $43+10*\log_{10}(P)$ dB level is sufficient to protect adjacent band systems operating in a harmonized manner (*i.e.*, uplink next to uplink and downlink next to downlink). An attenuation of $43+10*\log_{10}(P)$ dB at the 2020 MHz boundary provides even further protection for the operations 5 MHz away in the 2025-2110 MHz band.

7. *Measurement Procedures for AWS-4 Mobile and Base Stations.* The measurement procedures specified in Section 25.252(c)(4) (as clarified by the technical waivers granted to DBSD) should apply to both mobile and base stations.

8. *Mobile Station Power Limits*. The propagation characteristics of the AWS-4 uplink spectrum are more similar to the PCS bands, which allow for 2 watts EIRP, than they are to AWS-1.[1] As a result the PCS power limit of 2 watts and its Part 27 counterpart, the 2 watt limit applicable to BRS/EBS, are more appropriate references for AWS-4. Therefore, the Commission should limit AWS-4 mobile terminals to 2 watts EIRP and fixed terminals to 2 watts output power. Adopting these power limits for AWS-4 would also align with the current

[1] *See 2 GHz NPRM* ¶ 61.

mobile power definitions for the 2 GHz band, which allow 1dBW/1.23 MHz, as the Commission already clarified in the previously granted DBSD waivers. In granting the DBSD technical waivers, the Commission noted that the ATC rules allow higher power levels across larger bandwidths, such as 3 dBW EIRP across a 5 MHz bandwidth. The BRS/EBS power limits are actually lower than the current power allocations in the 2 GHz band for higher bandwidths, and, therefore, are more protective of adjacent operations than the current ATC regime.

9. *Antenna Height Restrictions.* The proposed general height restrictions for base stations are sufficient, and no further limitation is necessary. But with respect to fixed stations, a 10 meter height restriction is not necessary. As noted above, AWS-4 uplink operations at 2 GHz have characteristics more aligned with the BRS/EBS band than they do with AWS-1 uplink operations, which take place at 1.7 GHz. In the BRS/EBS context, the Commission has found that height restrictions for fixed stations are unnecessary.

10. *Transfer of Other Rules of Part 25 MSS/ATC Rules.* Additional Part 25 MSS/ATC technical rules (other than those discussed above) should not be incorporated into the AWS-4 technical rules, as they were intended to protect operations and deployment scenarios that will no longer exist under the Commission's proposed 2 GHz band plan. These unnecessary and restrictive rules would place a significant burden on an LTE-Advanced network and reduce DISH's ability to use the spectrum efficiently.

The foregoing declaration has been prepared using facts of which I have personal knowledge or belief or upon information provided to me. I declare under penalty of perjury that the foregoing is true and correct to the best of my information, knowledge, and belief.

Mariam Sorond

Mariam Sorond
Vice President, Technology Development
DISH Network L.L.C.

May 17, 2012

EXHIBIT 4: PREVIOUS FCC BUILDOUT REQUIREMENTS

TABLE OF BUILDOUT REQUIREMENTS IN OTHER PROCEEDINGS

Precedent	First Milestone	Additional Milestones	Penalty	Notes
Applications of Nextel Communications, Inc., and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *Memorandum Opinion and Order*, 20 FCC Rcd. 13967 (2005); Sprint Nextel Corporation and Clearwire Corporation Applications for Consent to Transfer Control of Licenses, Leases, and Authorizations, *Memorandum Opinion and Order*, 23 FCC Rcd. 17570 (2008)	Within four years, Sprint must offer service to 15 million population nationwide (±5.3% of 2000 Census), but also must cover 1/3 of the population within a minimum of nine of the nation's most populous 100 BTAs and at least one BTA less populous than the nation's 200th most populous BTA.	Within six years, Sprint must offer service to at least an additional 15 million population nationwide, including 1/3 population coverage in nine additional BTAs in the 100 most populous BTAs, and at least one additional BTA less populous than the nation's 200th most populous BTA.	Enforcement action, such as monetary forfeitures, mandatory divestiture, or forfeiture of Sprint's 2.5 GHz band licenses.	Clearwire assumed and met Sprint's milestone obligations.
AT&T Inc. and BellSouth Corporation Application for Transfer of Control, *Memorandum Opinion and Order*, 22 FCC Rcd. 5662 (2007)	Within three years, AT&T must offer mobile or fixed point-to-multipoint service to 25% of the population in the service area of 2.3 GHz WCS licenses. Alaska licenses were exempt.	None	In the event AT&T failed to meet the service requirement, AT&T agreed to forfeit the unconstructed portion of the individual WCS licenses.	Requirement was superseded by new industry-wide performance requirements adopted in 2010.
Applications for Consent to Transfer of Control of SkyTerra Subsidiary, LLC,	LightSquared must construct a terrestrial network to provide coverage to at least 100	LightSquared must construct a terrestrial network to provide coverage to at least 145	Violation of any element would render authorizations null and void without any further action required by	Milestones to date have not been met. FCC has proposed to suspend the ATC authorization

Precedent	First Milestone	Additional Milestones	Penalty	Notes
Memorandum Opinion and Order and Declaratory Ruling, 25 FCC Rcd. 3059 (2010)	million people (±32.5% of 2010 Census) by December 31, 2012 (approximately 33 months after order).	million (±47.1%) by December 31, 2013 (about 45 months), and to at least 260 million people (±84.4%) by December 31, 2015 (about 69 months).	the Commission.	indefinitely based upon GPS interference concerns.
Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, *Report and Order and Second Report and Order*, 25 FCC Rcd. 11710 (2010)	Licensee must cover and serve at least 40% of the license area's population within 42 months.	Licensee must cover and serve at least 75% of the license area's population within 72 months.	Failure to satisfy either benchmark results in a loss of the entire license.	These requirements replaced the "substantial service" requirement with which WCS licensees had previously been given 13 years to comply.
Service Rules for the 698-746, 747-762, and 777-792 MHz Bands, *Second Report and Order*, 22 FCC Rcd. 15289 (2007)	For CMA and EA licenses (A, B, and E Blocks) sold in first auction, network must cover at least 35% of geographic area within 4 years of end of DTV transition. For CMA and EA licenses sold after first auction, network must cover at least 40% of population within 4 years of license term. For REAG licensees (C Block), network must cover at least 40% of	For CMA and EA licenses sold in first auction, network must cover at least 70% of geographic area by end of 10-year license term. For CMA and EA licenses sold after first auction, network must cover at least 75% of population by end of 10-year license term. For REAG licenses, network must cover at least 75% population coverage	Failure to meet interim requirement results in a two-year reduction in license term, as well as possible enforcement action and possible reduction in size of licensed area. FCC staff subsequently clarified that it will use its discretion to pursue enforcement action only where a licensee failed to undertake meaningful efforts to put this spectrum to use, such as engaging in system planning, exploring sites and site leases, pursuing network engineering planning, or	The four-year milestone period for 700 MHz licenses, tied to the end of the DTV transition in 2009, has not yet occurred.

Precedent	First Milestone	Additional Milestones	Penalty	Notes
	population within four years of license term.	within each EA in REAG by end of license term.	engaging in efforts to procure equipment.	
Amendment of the Commission's Rules to Establish New Personal Communications Services, *Memorandum Opinion and Order*, 9 FCC Rcd. 4957 (1994); Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies to Provide Spectrum-Based Services, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd. 19078 (2004)	Licensees of 30 MHz blocks must provide service with 33% population coverage or "substantial service" in license area within 5 years. Licensees of 10 MHz blocks must provide service with 25% population coverage or "substantial service" showing within five years.	Licensees of 30 MHz blocks must provide service to 67% population coverage or "substantial service" in license area within 10 years. For licensees of 10 MHz blocks, no additional requirements.	Failure to meet either requirement results in forfeiture or nonrenewal of license and the licensee's ineligibility to regain the license.	
Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Report and Order*, 18 FCC Rcd. 25162 (2003)	None	Licensee must provide "substantial service" at expiration of license term (10 or 15 years).	Failure to meet substantial service requirement bars licensee from obtaining license renewal.	