**DBSD Services Limited, Gamma Acquisition L.L.C., and Manifest Wireless L.L.C.'s Consolidated Interim Construction Notification for AWS-4 and Lower 700 MHz E Block Licenses**

Pursuant to 27.14(k) of the Commission's rules, DBSD Services Limited ("DBSD"), Gamma Acquisition L.L.C. ("Gamma"), and Manifest Wireless L.L.C. ("Manifest"), all of which are indirect, wholly-owned subsidiaries of DISH Network Corporation (together, "DISH," the "company" or "we/us"), file this consolidated Interim Construction Notification ("Interim Notification") for DISH's spectrum licenses in the AWS-4 Band and Lower 700 MHz E Block (the "Spectrum Licenses").[1] As explained below, DISH plans to efficiently deploy a next-generation 5G-capable network, focused on supporting the Internet of Things ("IoT"), and anticipates meeting the applicable final FCC construction milestones for the Spectrum Licenses by March 2020.

## I. THE PUBLIC INTEREST WILL BE BEST SERVED BY FUTURE WIRELESS NETWORKS SUPPORTING NEXT-GENERATION 5G AND IoT SERVICES

### A. The Paradigm Shift to 5G and IoT

The forthcoming 5G evolution represents a paradigm shift to a new era of communications and connectivity. 5G will meet the increasing demand for broadband communications by offering dramatically higher data speeds and capacity, while also addressing the needs of a networked society by enabling massive connectivity and ultra-low latency for mission critical services. 5G will usher in a new era of economic growth and innovation by connecting billions of new consumer and industrial devices.

Over the next few years, standards will be developed to implement the global vision and timelines for 5G. Full 5G standardization is expected to be complete by 2020,[2] with trials expected later this year and in 2018.[3] The promise of 5G is the culmination of the mobile

[1] Gamma owns 176 licenses in the AWS-4 band, channel Block A (2000-2010 MHz/2180-2190 MHz); DBSD owns 176 licenses in the AWS-4 band, channel Block B (2010-2020 MHz/2190-2200 MHz); and Manifest owns 168 licenses in the Lower 700 MHz E Block (722-728 MHz).

[2] *See* "ITU towards 'IMT for 2020 and Beyond,'" ITU (last accessed Mar. 2, 2017), *available at* http://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Pages/default.aspx.

[3] *See* Diana Goovaerts, "Verizon Announces 5G Customer Trials in 11 Cities with 5G Forum," WIRELESS WEEK (Feb. 22, 2017), *available at* https://www.wirelessweek.com/news/2017/02/verizon-

communications innovations that preceded it.[4] Analysts predict that by 2035, 5G will enable $12.3 trillion in global economic output and support 22 million jobs.[5]

One of the key benefits of 5G lies in networks capable of unleashing massive connectivity to support IoT. With IoT, "[t]he new rule for the future is going to be, '[a]nything that can be connected, will be connected.'"[6] As illustrated in Table 1, demand for IoT connectivity is already in the billions of devices and is growing rapidly.[7]

---

announces-5g-customer-trials-11-cities-5g-forum-partner. In addition, KT, a South Korean mobile operator, has announced plans to debut a pilot 5G network at the 2018 Winter Olympics in PyeongChang. *See* Stephen Lawson, "Korea's Working on A Cool Combination: 5G and the Winter Olympics," PC WORLD (Apr. 7, 2016), *available at* http://www.pcworld.com/article/3053620/koreas-working-on-a-cool-combination-5g-and-the-winter-olympics.html.

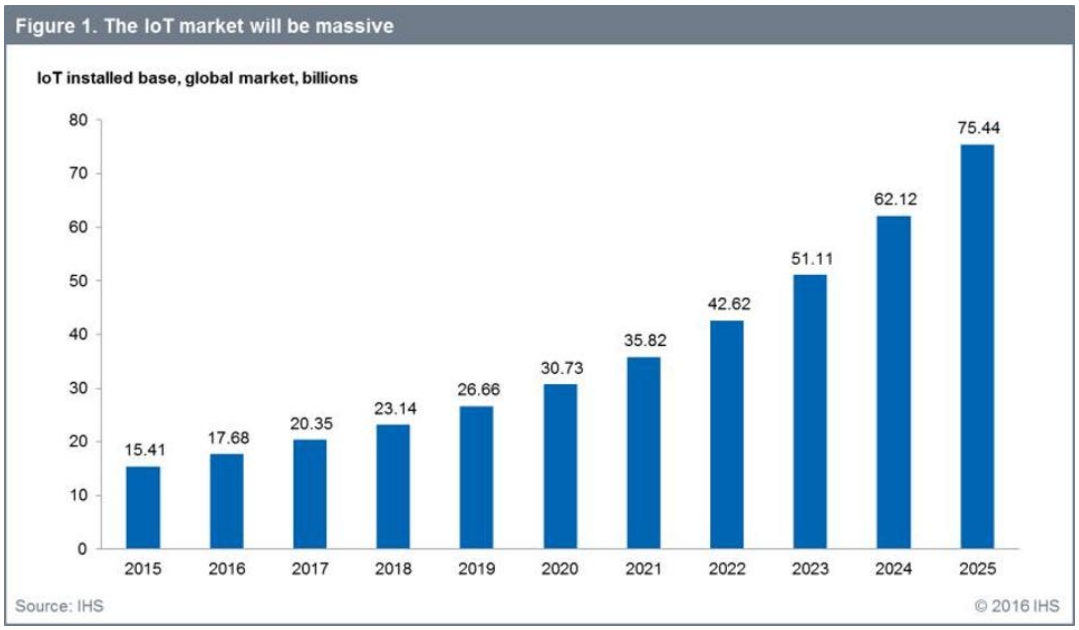
[4] "5G will leverage and extend the research and development (R&D) and capital investments made in prior mobile technologies to advance mobile to a platform that delivers the much needed ubiquity, low latency, and adaptability required for future uses. 5G will make possible new classes of advanced applications, foster business innovation and spur economic growth. The emergence of 5G is a fulcrum in the evolution of mobile technology." Karen Campbell, et al., "The 5G Economy: How 5G Technology Will Contribute to the Global Economy," IHS ECONOMICS/IHS TECHNOLOGY, at 5 (Jan. 2017), *available at* https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study.pdf.

[5] *Id*. at 4.

[6] Jacob Morgan, "A Simple Explanation of 'The Internet of Things,'" FORBES (May 13, 2014), *available at* http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/#6de58b066828.

[7] *See* Sam Lucero, "IoT platforms: Enabling the Internet of Things," IHS TECHNOLOGY, at 5 (Mar. 2016), *available at* https://cdn.ihs.com/www/pdf/enabling-IOT.pdf ("*IHS IoT Report*"). "IHS forecasts that the IoT market will grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025." *Id.*

**TABLE 1: Projected IoT Connectivity**[8]




With respect to connectivity, the IoT market encompasses at least two emerging segments: massive and critical.[9] Massive IoT connections include smart buildings and homes, transportation logistics, smart meters/agriculture, and other connections characterized by "high connection volumes, low cost, requirements on low energy consumption and small data traffic volumes."[10] Critical IoT connections, on the other hand, include autonomous cars, healthcare, and other connections characterized by "requirements for ultra-reliability and availability, with very low latency."[11]

Given the promise of IoT to revolutionize innovation and productivity in a variety of industries that traditionally fall outside the telecommunications sector, IoT will enable new use cases and services platforms that will drive efficiencies across diverse industries and produce

[8] *Id.*

[9] *See* "Ericsson Mobility Report On the Pulse of the Networked Society," ERICSSON, at 11 (Jun. 2016), *available at* https://www.ericsson.com/res/docs/2016/ericsson-mobility-report-2016.pdf ("*Ericsson Mobility Report*").

[10] *Id.*

[11] *Id.*

transformative societal benefits for the public.[12] The agriculture, manufacturing, biotechnology, transportation, education, energy and health sectors, among others, will demand substantial IoT connectivity in the coming years.

### B. 5G and IoT Have Expanded DISH's Deployment Options and Market Opportunities for New Wireless Services

Under the Commission's rules, DISH has two buildout paths for its Spectrum Licenses: meet an interim milestone in March 2017 and a final milestone in March 2021; or, meet an accelerated final milestone by a March 2020 deadline.[13] Pursuant to Section 27.14(k), DISH certifies that it is pursuing the latter path. We do not believe that it serves the public interest or makes business sense to build out a 4G/LTE network now that would duplicate networks already offered by the wireless incumbents, and subsequently require an almost immediate upgrade in order to be competitive. Instead, DISH plans to deploy a 5G-capable network, focused on supporting IoT – the first to be deployed in these bands anywhere in the world – that will meet

---

[12] *See* IHS *IoT Report* at 3.

[13] Pursuant to Section 27.14(q)(1)-(2), an AWS-4 licensee shall "provide terrestrial signal coverage and offer terrestrial service" to at least forty percent of its total AWS-4 population by March 7, 2017 (the "AWS-4 Interim Milestone"), and to at least 70 percent of the population in each of its license areas by March 7, 2020 (which was subsequently extended to March 7, 2021) (the "AWS-4 Final Milestone"). *See* Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, *Report and Order and Order of Proposed Modification*, WT Docket Nos. 12-70, 04-356; ET Docket No. 10-142, 27 FCC Rcd. 16102, 16174 ¶ 187 (2012) ("*AWS-4 Order*"); DISH Network Corporation, Petition for Waiver of Sections 27.5(j) and 27.53(h)(2)(ii) of the Commission's Rules and Request for Extension of Time, *Memorandum Opinion and Order*, 28 FCC Rcd. 16787, 16787-78 ¶ 1, 16804-05 ¶ 43 (2013) ("*AWS-4 Waiver Order*"). If an AWS-4 licensee does not meet the AWS-4 Interim Milestone, the AWS-4 Final Milestone is accelerated by one year, meaning the AWS-4 Final Milestone must be met by March 7, 2020 (the "Accelerated AWS-4 Final Milestone"). *See AWS-4 Order*, 27 FCC Rcd. at 16174 ¶ 188; 47 C.F.R. § 27.14(q)(3); *see also AWS-4 Waiver Order*, 28 FCC Rcd. at 16787-88 ¶ 1, 16804-05 ¶ 43.

Pursuant to Section 27.14(g), as subsequently waived by the Commission, a Lower 700 MHz E Block licensee may meet the interim construction benchmark by providing signal coverage and offering service to at least forty percent of its total E Block population by March 7, 2017 ("E Block Interim Milestone"), and providing signal coverage to at least seventy percent of the population in each of its license areas by March 7, 2021 ("E Block Final Milestone"). *See* Promoting Interoperability in the 700 MHz Commercial Spectrum, *Report and Order and Order of Proposed Modification*, 28 FCC Rcd 15122, 15148 ¶¶ 56-57 (2013) ("*700 MHz Interoperability Order*"). If an E Block licensee does not meet the E Block Interim Milestone, the E Block Final Milestone is accelerated by one year, meaning the E Block Final Milestone must be met by March 7, 2020 (the "Accelerated E Block Final Milestone"). *Id*. ¶ 58. The Accelerated AWS-4 Final Milestone and the Accelerated E Block Final Milestone will be collectively referred to as the "Accelerated Final Milestone."

the Accelerated Final Milestone in March 2020 for all of the Spectrum Licenses. This network will not be burdened with a requirement to be backward compatible with legacy services.

While we will continue to explore partnership opportunities, the current plan is to deploy a network on our own, or in possible cooperation with Northstar Wireless ("Northstar") and SNR Wireless ("SNR"), two entities in which DISH subsidiaries made non-controlling investments in connection with the AWS-3 auction. We also are open to exploring joint build partnerships that could reduce overall network deployments costs for DISH and other operators who may be upgrading or deploying their own networks in the same time frame.

DISH has been actively working to acquire, standardize, test and plan deployment of the Spectrum Licenses. Among other things, DISH:

- Purchased for $2.8 billion and restructured two bankrupt satellite companies (DBSD and TerreStar), and then successfully petitioned the Commission to repurpose that fallow spectrum for terrestrial service (which became AWS-4);
- Participated in several FCC spectrum auctions, spending more than $700 million to acquire the Lower 700 MHz E Block licenses, $1.6 billion to acquire the H Block licenses, and making approximately $10 billion in non-controlling investments in entities that won licenses in the AWS-3 Auction;
- In cooperation with the Commission, transformed the severely impaired AWS-4 uplink spectrum (2000-2020 MHz) into unimpaired downlink;
- Participated in the 3rd Generation Partnership Project ("3GPP") and other international forums that resulted in DISH's spectrum assets and investments being successfully and efficiently specified, standardized, and configured;
- Spent considerable resources to conduct tests to determine viable uses for the Spectrum Licenses, including trials for high power broadcast services in the 700 MHz E Block and fixed wireless broadband; and
- Made several offers, one in excess of $25 billion, to buy existing wireless companies in order to leverage their networks to help commercialize the Spectrum Licenses, only to be outbid by other wireless carriers.[14]

[14] In the midst of these various efforts, the company also had to work around the limitations imposed by the Commission's public spectrum auctions since 2013. These auctions have brought valuable spectrum

Based on these experiences, among other reasons, we now plan to deploy a 5G-capable network focused on supporting IoT by March 2020. As the 5G standards work continues apace, we anticipate continuously expanding the capabilities of the network.

### C. DISH Plans to Efficiently Deploy a Network Using Its Spectrum Licenses

DISH plans to deploy a flexible network using the Spectrum Licenses that can accommodate the increasing proliferation of IoT devices and services, with the objectives of providing low cost, extended coverage, long battery life, and increased connectivity solutions to the market. We believe that this approach will accommodate potential new partnerships and sharing models, including the potential to serve as an open source or neutral host to other service providers.

At this time, the company plans to utilize IoT technology, standardized at 3GPP, to support the emerging IoT market. For example, NB-IoT was standardized in June 2016 as part of 3GPP Release 13.[15] NB-IoT's coverage characteristics are substantially superior to LTE; an NB-IoT tower can cover over ten times the geographic area compared to the coverage of a typical LTE tower.[16] Use of narrowband technologies enables the deployment of an efficient network with a broad coverage and service footprint. As a result, we anticipate being able to bring innovative services to the market.

In the fourth quarter 2016, the company issued a technology selection Request for Information ("RFI") to facilitate the technology and infrastructure selection process. The RFI

---

to the industry, and raised billions for the United States Treasury, but they have also resulted in back-to-back anti-collusion periods that have hampered our ability to engage in discussions with outside parties and among potential partners in furtherance of our buildout objectives. Unlike incumbent operators who are able to add auctioned spectrum to an existing network, DISH, as a new entrant, has been uniquely impacted by the Commission's anti-collusions rules. Given our willingness to participate in FCC auctions, we have been subject to the Commission's quiet period for nearly *half* of the duration of the AWS-4 interim construction milestone period. Specifically, the company has been subject to the Commission's anti-collusion rules for over *660* days since 2013 – during the H Block auction (beginning in November 2013 and lasting through March 2014); the AWS-3 auction (beginning September 2014 and lasting through February 2015); and the 600 MHz incentive auction, ongoing since February 2016.

[15] *See* "Standardization of NB-IOT Completed," 3GPP (Jun. 22, 2016), *available at* http://www.3gpp.org/news-events/3gpp-news/1785-nb_iot_complete.

[16] Assuming an NB-IoT link budget advantage of 20 dB over LTE and using a COST-231 propagation model. *See* "NB-IoT: A Sustainable Technology for Connecting Billions of Devices," ERICSSON (2016), *available at* https://www.ericsson.com/publications/ericsson-technology-review/archive/2016/nb-iot-a-sustainable-technology-for-connecting-billions-of-devices.

was sent to dozens of vendors, including the four primary infrastructure vendors, and DISH received responses in February 2017, which are under review. The RFI encompassed several configurations and technologies,[17] and covered the Spectrum Licenses and other DISH-licensed spectrum. Additionally, in the case of certain configurations, the RFI asked about possible combinations with the AWS-3 unpaired uplink spectrum held by Northstar and SNR.[18]

In the coming months, DISH will work with infrastructure, device, and services vendors to select suitable equipment, product roadmaps and services offerings. Once the technology details are known, various follow-on deployment decisions can be made, with expected deployment to be completed by March 2020, consistent with the Accelerated Final Milestone. The company has spent years acquiring and standardizing its spectrum assets to ready itself to meet this challenge.

## II. THE SPECTRUM LICENSES ARE AN ESSENTIAL RESOURCE FOR DISH'S PLANNED ENTRY INTO THE WIRELESS MARKET

DISH has long aspired to enter the wireless market, and began acquiring spectrum licenses in 2008, when it successfully bid on 168 Lower 700 MHz E block licenses during Auction 73. Since then, we have acquired additional spectrum assets through both auctions and acquisitions. The company spent nearly $3.5 billion in acquiring the Spectrum Licenses that are the subject of this Interim Notification, and the focus during this time has been to position our spectrum and investments to anticipate and support future use cases and next generation technology.

We also attempted a series of acquisitions in an effort to deploy the Spectrum Licenses by leveraging existing network infrastructures, each time being outbid by an established incumbent competitor. For example, in March 2012, DISH began discussions with MetroPCS regarding a possible acquisition, which culminated in an offer for MetroPCS in August 2012 that totaled approximately $4 billion. Ultimately, T-Mobile acquired MetroPCS in 2013. In the second half of 2012, we began contemplating a purchase of Clearwire, and made a number of bids for Clearwire from January to June 2013, with our final bid amounting to approximately

[17] The RFI included requests for low powered wireless access (NB-IoT, LoRa, others), broadcast and multicast (eMBMS and Digital Video Broadcast), and Enhanced Mobile Broadband ("eMBB").

[18] Northstar and SNR will each make the selection of vendors, equipment, product roadmaps and service offerings related to the AWS-3 spectrum they hold.

$6.5 billion. During the same time period, we began analyzing an acquisition of Sprint. In April 2013, we submitted a merger proposal to Sprint for total cash and stock consideration of $25.5 billion. Both companies were ultimately purchased by Softbank in 2013.

Despite these setbacks in finding an established wireless partner, we have continued to pursue opportunities that could support our wireless entry. Below is a summary of these efforts, including responses to developments such as the evolution of service rules, industry composition, and technology, among other things, that have resulted in the company adjusting its plans.

### A. Lower 700 MHz E Block Licenses (722-728 MHz)

DISH's 168 licenses in the Lower 700 MHz E Block were granted (to a subsidiary company, Manifest) on February 20, 2009. The E Block licenses were acquired at auction in 2008 for more than $700 million, and in the years that followed, we studied and tested the spectrum to offer high-power broadcast mobile video services. At the time the E Block licenses were auctioned, the rules allowed for high-power broadcast operations.

Based on those rules, DISH conducted substantial testing to determine a business case for the spectrum.[19] Those studies included the testing of various high-powered broadcast mobile video technologies, including Advanced Television Systems Committee – Mobile/Handheld ("ATSC M/H"), among others.[20] DISH explained in the 2013 docket to explore interoperability solutions in the Lower 700 MHz band[21] that lowering the power levels for the E Block licenses would effectively preclude DISH's planned uses for the E Block.[22]

Nonetheless, the Commission in 2013, working with DISH and other stakeholders, did lower the authorized power levels for E Block operators as part of a larger effort to increase

[19] *See* Request for Extension and/or Waiver of Interim Construction Benchmark, Manifest Wireless L.L.C., Lead Call Sign WQJY944 (Jun. 12, 2013).

[20] *Id.* at 4.

[21] *See* Promoting Interoperability in the 700 MHz Commercial Spectrum, *Notice of Proposed Rulemaking*, 27 FCC Rcd 3521 (2012).

[22] *See* DISH Network Corporation Comments, WT Docket No. 12-69, p. 8-9 (Jun. 1, 2012); Letter from Jeffrey H. Blum, DISH, to Marlene H. Dortch, FCC, WT Docket No. 12-69 (Mar. 21, 2013); Letter from Jeffrey H. Blum, DISH, to Marlene H. Dortch, FCC, WT Docket Nos. 12-69, 12-357 & GN Docket Nos. 12-268, 13-186 (Aug. 2, 2013).

interoperability across the Lower 700 MHz band.[23] The reduction in power levels for the E Block licenses resulted in the company restarting technology and business case planning for those licenses.

### B. AWS-4 Licenses

In 2012, DISH spent $2.8 billion to acquire 40 MHz of fallow S-Band spectrum (2000-2020 MHz and 2180-2200 MHz) from two bankrupt satellite companies that had been unable to commercialize a network, among other reasons, because of the technology requirements limiting that band. After nearly a year of advocacy and related regulatory efforts, we were successful in repurposing that spectrum, which was designated "AWS-4," for terrestrial use.[24] But, technical rules imposed by the Commission in the 2012 *AWS-4 Order* rendered a portion of the AWS-4 uplink unusable, and impaired the remainder.[25] We analyzed the technical challenges associated with the band and issued a RFI seeking input from vendors to determine if they could be overcome. The vendor responses highlighted the challenges that would be faced in achieving competitive scale in equipment and devices due to the technical rules set for the band. These challenges injected delay in the ultimate standardization of the band.

In the hope of increasing the utility of the band, in September 2013, we petitioned the Commission for a waiver of certain AWS-4 technical rules to provide greater flexibility in the use and deployment of the AWS-4 band, including the ability to elect to use all 40 MHz of AWS-4 as downlink spectrum and additional time to meet the final milestone.[26] The Commission granted the request in December 2013, but required that DISH elect to designate the entire AWS-4 uplink band (2000-2020 MHz) either for downlink or uplink operations within 30

---

[23] In particular, the Commission revised its Part 27 rules to, among other things, limit E Block base stations transmitting a signal to no more than 1 kW effective radiated power ("ERP")/MHz in non-rural areas or 2 kW ERP/MHz in rural areas. *See 700 MHz Interoperability Order,* 28 FCC Rcd. at 15131 ¶ 21. Under the original rules, E Block licensees were allowed up to 50 kW ERP.

[24] *See AWS-4 Order*, 27 FCC Rcd. at 16103 ¶¶ 1-2.

[25] The FCC's Order imposed certain limitations on the use of a portion of this spectrum, including interference protections for other spectrum users and power and emission limits that we believed could render 5 MHz of our uplink spectrum (2000-2005 MHz) effectively unusable for terrestrial services and limit our ability to fully utilize the remaining 15 MHz of our uplink spectrum (2005-2020 MHz) for terrestrial services. *See id.* at 27 FCC Rcd. 16135-16146 ¶¶ 79-97.

[26] *See* DISH Network Corporation Petition for Waiver of Sections 27.5(j) and 27.53(h)(2)(ii) and Request for Extension of Time, WT Docket No. 13-225 (Sept. 9, 2013).

months, and that DISH bid the reserve price set for the H Block auction of $1.56 billion.[27] Having evaluated the ongoing evolution of wireless technology and market conditions, the determination was made in June 2016 to elect to use the AWS-4 uplink spectrum for downlink.[28]

### C. H Block

On April 29, 2014, DISH successfully bid for all 176 wireless spectrum licenses in the H Block auction, and paid $1.672 billion to acquire these licenses, including clearing costs associated with the lower H Block spectrum. The company's decision to acquire the H Block licenses was motivated, among other reasons, by the previously mentioned impairments to operations in the lower AWS-4 segment (2000-2020 MHz) that resulted from service rules the FCC adopted for the H Block.[29]

### D. Investments in Certain AWS-3 Licensees

DISH, through two wholly-owned subsidiaries, made non-controlling investments in Northstar Spectrum, LLC, the parent company of Northstar Wireless, LLC, and SNR Wireless HoldCo, LLC, the parent company of SNR Wireless LicenseCo, LLC, respectively. Both Northstar and SNR applied for designated entity status in the AWS-3 Auction (Auction 97).[30] On October 27, 2015, the Commission granted certain AWS-3 spectrum licenses (the "AWS-3 Licenses") to Northstar and SNR, respectively. The AWS-3 Licenses cover unpaired spectrum at 1695-1710 MHz, designated for uplink operations, as well as paired spectrum at 1755-1780 MHz and 2155-2180 MHz. The AWS-3 unpaired spectrum, however, requires coordination agreements with the Federal government before commercial operations in 27 coordination zones can commence. The 1695-1710 MHz band is shared with the federal meteorological satellite

[27] *See AWS-4 Waiver Order*, 28 FCC Rcd. at 16787-88 ¶ 1-2.

[28] *See* Letter from Jeffrey H. Blum, DISH, to Marlene H. Dortch, WT Docket No. 13-225 (Jun. 1, 2016).

[29] *See AWS-4 Order,* 27 FCC Rcd. at 16135-46 ¶¶ 79-97.

[30] The FCC denied the bidding credits claimed by SNR and Northstar in the auction. *See* Northstar Wireless, LLC, SNR Wireless LicenseCo, LLC Applications for New Licenses in the 1695-1710 MHz, and 1755-1780 MHz and 2155-2180 MHz Bands, *Memorandum Opinion and Order*, FCC 15-104, 30 FCC Rcd 8887 (2015). SNR and Northstar's appeals (Petitions for Review) of this decision are pending before the United States Court of Appeals of the District of Columbia Circuit.

("MetSat") service identified in a joint FCC/NTIA Public Notice.[31] To be able to operate in this band, Northstar, SNR and several federal agencies must agree on a coordination agreement to protect MetSat operations. Through Management Services Agreements with Northstar and SNR, DISH is assisting in the technology and engineering aspects of the potential coordination agreements. Northstar, SNR, DISH, and the federal agencies have held over thirty meetings and conference calls since August 2015, and the coordination process remains ongoing.

Currently, DISH is in discussions with each of Northstar and SNR to negotiate commercial terms to potentially enable the deployment of their respective AWS-3 uplink spectrum, which has also been standardized (as discussed below).

## III. DISH HAS BEEN WORKING DILIGENTLY TO STANDARDIZE, CONFIGURE AND TEST THE SPECTRUM LICENSES

The standardization process is critical to the deployment of wireless spectrum. In general, before a spectrum band is deployed, the wireless industry (such as through the 3GPP standards body) agrees to technical standards for such spectrum band(s). Standardization does not happen overnight, and can take months and even years of technical analysis, submissions and meetings.

DISH has been an active participant in the global standards process since 2012, driving forward the standardization of several bands and being involved in other related activities. The regulatory challenges impacting the Spectrum Licenses, described above, created obstacles to the company's efforts to standardize its spectrum, causing us to delay, and often restart, our work on standardization. For example, we not only had to create additional work items to ensure the AWS-4 downlink spectrum could be used in light of the impaired AWS-4 uplink, but also had to shepherd an entirely new band – incorporating AWS-1 and AWS-3 spectrum – through 3GPP when we were granted the AWS-4 Downlink Waiver. The process alone for this new band took more than one year. Similarly, we had to restart work on standardization to find new use cases for the 700 MHz E Block (standardized as Band 29 in 2012) following the *2013 Interoperability Order*. The company has participated in every related 3GPP meeting since 2012, and, while the

[31] *See* The Federal Communication Commission and the National Telecommunications and Information Administration: Coordination Procedures in the 1695-1710 MHz and 1755-1780 MHz Bands, *Public Notice*, DA-14-1023, GN Docket No. 13-185 (Jul. 18, 2014), *available at* https://apps.fcc.gov/edocs_public/attachmatch/DA-14-1023A1.pdf.

contributions it has authored are too many to list, the count exceeds 300. As a result, 3GPP approved key bands incorporating our Spectrum Licenses, including Bands 66 and 70, among others, as explained below.

DISH's standardization work goes beyond 3GPP; the company has worked with other domestic and global bodies to ensure that the Spectrum Licenses can be efficiently deployed. Among other things, we participate in working groups and device certification bodies to ensure that standardized bands incorporating the Spectrum Licenses are properly implemented and tested. And, the company has also been active at the ITU to ensure that the Spectrum Licenses are included in global frequency arrangements identified for terrestrial systems. Because of these efforts, spectrum will be able to be deployed for the benefit of the public, including through our plan to deploy a 5G-capable network, focused on supporting IoT, that will help meet the needs of our increasingly connected society.

### A. DISH has Been Actively Involved in 3GPP to Standardize the Spectrum Licenses

DISH has undertaken substantial efforts to standardize the Spectrum Licenses at 3GPP, which unites a group of seven telecommunications standard development organizations globally to produce the specifications that define technologies covering cellular networks. Standardization at 3GPP is critical to commercializing spectrum and putting it to use. The vast majority of mobile wireless networks deployed around the world follow 3GPP standards. One major benefit of 3GPP standards is the economies of scale brought about by global adoption, allowing hardware and software vendors to invest in creating infrastructure and device products, which can be sold in volume and can inter-operate with products from other vendors. The spectrum-related work at 3GPP involves RAN 4, where band plan requirements are specified, and RAN 5, where device testing requirements are specified.

#### i. RAN 4

DISH has taken a key role in the standards setting process for bands incorporating its Spectrum Licenses, which have resulted in the standardization of Band 23, Band 66 and Band 70, as described below:

***700 MHz E Block.*** The Lower 700 MHz E Block, along with adjacent D Block, was standardized by 3GPP in 2012 and is designated as Band 29.[32] Following the Commission's 2013 *700 MHz Interoperability Order*,[33] the company expanded its focus at 3GPP to include standard-based use cases and technologies appropriate for the E Block, given the power level limitations imposed by the *Order*. As part of this effort, we have been researching and supporting 3GPP for potential E Block applications, including Enhanced Multimedia Broadcast Multicast Services ("eMBMS"). The current eMBMS specification is limited to utilizing only 60 percent of the radio resources in a carrier, meaning the full utilization of the E Block spectrum under current 3GPP specifications would be severely limited in an eMBMS deployment.[34] At 3GPP, we are advocating to remove this limitation so that the band may be used for further eMBMS related initiatives, such as a standalone eMBMS carrier and enhanced broadcast/multicasting. 3GPP has standardized carrier aggregation support combining Band 29 with AWS-3 and AWS-4 spectrum.[35] Band 29 carrier aggregation results in a better experience for consumers and introduces additional capacity to the network.[36]

***AWS-4.*** While the AWS-4 licenses were acquired by DISH in 2012, the process of standardizing the AWS-4 band[37] at 3GPP (designated as Band 23) began in 2010. The two-year process of standardizing Band 23 proved complex because of co-existence problems stemming from the adjacency of the AWS-4 uplink blocks (2000-2020 MHz) to the PCS G & H downlink blocks. As explained above, the technical rules imposed by the Commission in the 2012 *AWS-4*

---

[32] *See* 3GPP Active Work Programme, 3GPP, UID 510028 (2012), *available at* http://www.3gpp.org/DynaReport/FeatureOrStudyItemFile-510028.htm.

[33] *See 700 MHz Interoperability Order*, 28 FCC Rcd. at 15131 ¶ 21.

[34] *See* Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol Specification (Release 13), 3GPP (2016), *available at* http://www.3gpp.org/ftp//Specs/archive/36_series/36.331/36331-d40.zip.

[35] *See* "Core part: LTE Advanced inter-band Carrier Aggregation Rel-14 for 2DL/1UL," WI # 700170, 3GPP (2015), *available at* https://portal.3gpp.org/desktopmodules/WorkItem/WorkItemDetails.aspx?workitemId=700170.

[36] Band 29 is defined as a supplementary downlink band ("SDL") whose capacity is 100% dedicated to carrier aggregation.

[37] *See* Active Work Programme, 3GPP, UID 470009, *available at* http://www.3gpp.org/DynaReport/FeatureOrStudyItemFile-470009.htm.

*Order* left the Band 23 uplink limited in its power and emissions.[38] The Band 23 uplink also posed an interference risk to the neighboring H Block (1995-2000), given that the H Block was un-auctioned at the time of Band 23 standardization.

Following the standardization of Band 23, the company moved forward with efforts to commercialize the AWS-4 band, and in early 2013, issued a network RFI soliciting vendor input on Band 23 infrastructure and network build costs. These discussions with vendors, however, confirmed the uplink impairments associated with the Band 23 arrangement. As a result, we initiated and completed Band 23 intra-band carrier aggregation work items[39] at 3GPP in late 2013 so that the AWS-4 downlink (2180-2200 MHz) could be utilized, even with the limited AWS-4 uplink allocations.

Following Commission grant of the AWS-4 Downlink Waiver in 2013, we began studying how the reconfigured AWS-4 blocks could better serve the public and consumer demand. At the same time, the Commission was contemplating service rules for the AWS-3 bands, in which the AWS-3 paired downlink (2155-2180 MHz) was adjacent to the upper AWS-4 blocks at 2180-2200 MHz. We believed that by creating a new asymmetric 3GPP band including the AWS-1 (Band 4), paired AWS-3, and the upper AWS-4 blocks, then the AWS-4 blocks could be aggregated with the AWS-1 and AWS-3 blocks to provide additional downlink capacity to the users of that band. We proposed the concept to the Commission,[40] which, in turn,

---

[38] *See AWS-4 Order* at 27 FCC Rcd. at 16135-16144 ¶¶ 78-93. *See also* DISH Network Corporation Comments, WT Docket No. 12-357, p. 1-12 (Feb. 6, 2013); DISH Network Corporation Reply Comments, WT Docket No. 12-357, p. 6-13 (Mar. 7, 2013); Letter from Jeffrey H. Blum, DISH Network Corporation, to Marlene H. Dortch, GN Docket Nos. 12-268 and 13-185; WT Docket No. 12-357 (Aug. 6, 2013); Letter from Jeffrey H. Blum, DISH Network Corporation, to Marlene H. Dortch, GN Docket Nos. 12-268 and 13-185; WT Docket Nos. 12-357 and 12-69 (Aug. 2, 2013).

[39] *See* Evolved Universal Terrestrial Radio Access (E-UTRA); LTE-Advanced Intra-Band Non-Contiguous Carrier Aggregation (CA) in Band 23, Release 12, Spec # 36.833-2-23, 3GPP (Jan. 22, 2015), *available at* https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2525, Evolved Universal Terrestrial Radio Access (E-UTRA); LTE-Advanced Intra-Band Contiguous Carrier Aggregation (CA) in Band 23, Release 12, Specification # 36.833-1-23, 3GPP (Jan. 22, 2015), *available at* https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2515.

[40] *See* Letter from Jeffrey H. Blum, DISH, to Marlene H. Dortch, FCC, GN Docket No. 13-185 (Mar. 7, 2014).

encouraged the industry and standard bodies to work together towards a technically feasible interoperable solution in its *AWS-3 Report & Order*.[41]

3GPP work for a new AWS extension band plan, which would add the soon-to-be auctioned AWS-3 spectrum to the existing Band 4, started in June 2014 as a study item[42] with the objective of selecting a basic band plan configuration. The study item introduced at 3GPP presented three different band plans, including an iteration that did *not* incorporate the upper AWS-4 blocks. This meant that, if selected, the AWS-4 spectrum would be left out of devices that supported this new band. DISH was an active participant in the 3GPP study item for the extension band and, among other things, provided data showing that the inclusion of AWS-4 in the new band plan was technically feasible.[43]

In December 2014, the study item concluded by recommending a 70+90 MHz band plan, which included the upper AWS-4 blocks.[44] The follow-on work item for the band (designated as Band 66), in which the specific requirements for the band were defined and standardized, began in March 2015.[45] Because the AWS-4 portion of the band is unpaired downlink, Band 66 devices would need to support carrier aggregation to fully utilize the entire 90 MHz downlink in the band. The company, along with other 3GPP stakeholders, agreed on a requirement to ensure that carrier aggregation is a feature that will be widely available for future Band 66 devices.[46]

---

[41] *See* Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands, *Report and Order*, GN Docket No. 13-185, 29 FCC Rcd. 4610, 4694- 701 ¶¶ 225-31 ("*AWS-3 Report & Order*").

[42] *See* "New Study Item Proposal: AWS-Extension Band for LTE," RP-141037, RAN #64, 3GPP (Jun. 2014).

[43] *See* "Band Plan Proposal for AWS Extension Band," R4-147330, RAN #73, 3GPP (Nov. 2014).

[44] *See* "Technical Specification Group Radio Access Network; Study on Advanced Wireless Services (AWS) extension band for LTE (Release 13)," TR 36.849, RAN #66, 3GPP (Jan. 2015).

[45] *See* "New WI: AWS-Extension Band for LTE," RP-150428, RAN #67, 3GPP (Mar. 2015).

[46] *See* "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception," TS 36.101, Table TS 36.101 v14.2.1, Table 5.5-1, 3GPP (Jan. 2017).

3GPP officially standardized Band 66 in December 2015,[47] and NB-IoT support was added in June 2016.[48]

***H Block.*** After winning the H Block licenses in 2014, we began studying how the newly acquired H Block and the lower AWS-4 spectrum could be standardized as a 3GPP band. A number of options for potential introduction and standardization by 3GPP were explored, but each presented technical challenges. For example, creating a new band that extended the existing PCS band (Band 25) to include the H Block and the lower AWS-4 spectrum was analyzed, but feedback from device and filter component suppliers confirmed that building duplexers supporting the new band configuration would be challenging due to a very wide downlink passband (90 MHz) and a small gap (10 MHz) between the uplink and downlink bands. After ongoing analysis and discussions with vendors, it was determined that it did not make sense to select a suboptimal band plan option for the H Block.

***AWS-3.*** Following the AWS-3 auction, Northstar, SNR, and DISH sought to create additional utility for the unpaired AWS-3 uplink (1695-1710 MHz) by pairing it with the lower AWS-4 band at 3GPP. By packaging unpaired spectrum together (in conjunction with the H Block downlink), DISH, a 3GPP member, sought to create a new 15+25 MHz asymmetric band similar to Band 66. This new band plan was introduced to 3GPP in September 2015 as a study item.[49] The study item concluded with approval of the 15+25 asymmetrical pairing for the new band[50] and the subsequent formal work item was introduced in December 2015.[51] The new band, designated as Band 70, was formally approved in June 2016.[52] In June 2016, DISH formally declared its intention to the Commission to use the lower AWS-4 band for downlink, thus aligning with the band plan promulgated for Band 70.

---

[47] *See* "Advanced Wireless Services (AWS) Extension Band for LTE," TR 36.869, RAN #72, 3GPP (Dec. 2015).

[48] *See* "RAN 4 CRs to Narrowband Internet of Things (IOT)," RP-161126, 3GPP (Jun. 2016), *available at* http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_72/Docs/RP-161126.zip.

[49] *See* "New SI: New AWS-3/4 Band Plan," RP-151626, RAN #69, 3GPP (Sept. 2015).

[50] *See* "Study on New Advanced Wireless Services (AWS)-3/4 Band for LTE," TR 36.870, RAN #70, 3GPP (Jan. 2016).

[51] *See* "New WI: New AWS-3/4 Band for LTE," RP-151731, RAN #70, 3GPP (Dec. 2015).

[52] *See* "Evolved Universal Terrestrial Radio Access (E-UTRA); New AWS Band for LTE," TR 36.749, RAN # 72, 3GPP (Jun. 2016).

***Other Ongoing 3GPP RAN 4 Activities.*** The company is continuing its 3GPP efforts to introduce additional features and flexibilities for Bands 29, 66, and 70. For example, additional carrier aggregation configurations and related device testing requirements for combining Bands 29, 66, 70 and 46 (the License Assisted Access "LAA" band) are being considered.[53] In December 2016, 3GPP approved the addition of NB-IoT support for Band 70,[54] enhancing service options for that band. The company is also proposing a 5G band plan framework which ensures a smooth transition of existing LTE bands to 5G bands, and requesting additional band flexibilities, such as asymmetric uplink/downlink pairings.[55]

**ii. RAN 5**

DISH has also been actively involved in 3GPP RAN 5 working group through which end user device conformance testing requirements are specified. This RAN 5 participation is important to ensure that device test requirements are properly specified and in conformance with the core requirements drafted in RAN 4. The RAN 5 work items for Band 66 and Band 70 were completed in September 2016[56] and December 2016,[57] respectively.

**B. Industry Working Group Participation**

Outside of 3GPP, the company participates in a number of working groups and device certification bodies to ensure that standardized bands that incorporate the Spectrum Licenses are

---

[53] *See* "Core part: LTE Advanced inter-band Carrier Aggregation Rel-14 for 2DL/1UL," WI # 700170, 3GPP (2015) *available at* https://portal.3gpp.org/desktopmodules/WorkItem/WorkItemDetails.aspx?workitemId=700170; "Core part: LTE Advanced inter-band Carrier Aggregation Rel-14 for 3DL/1UL," WI # 700176, 3GPP (2015), *available at* https://portal.3gpp.org/desktopmodules/WorkItem/WorkItemDetails.aspx?workitemId=700176: "Core part: LTE Advanced inter-band Carrier Aggregation Rel-14 for 4DL/1UL," WI # 700174, 3GPP (2015), *available at* https://portal.3gpp.org/desktopmodules/WorkItem/WorkItemDetails.aspx?workitemId=700174; "Core part: LTE Advanced inter-band Carrier Aggregation Rel-14 for 5DL/1UL," WI # 700169, 3GPP (2015), *available at* https://portal.3gpp.org/desktopmodules/WorkItem/WorkItemDetails.aspx?workitemId=700169. As noted above, DISH's work on standardization and subsequent testing and development of equipment related to the AWS-3 spectrum held by Northstar and SNR is being conducted at their request.

[54] *See* "RAN4 CRs to New band support for Rel-14 Narrowband Internet of Things (NB-IOT)," RP-162407, RAN # 74, 3GPP (Dec. 2016).

[55] *See* "Aspects to defining NR bands below 6 GHz," R4-1701495, RAN #82, 3GPP (Feb. 2017)

[56] *See* "Status Report for WI UE Conformance Test Aspects - AWS-Extension Band for LTE (Band 66)," RP-161523, RAN #73, 3GPP (Sept. 2016).

[57] *See* "Status Report of WI UE Conformance Test Aspects - AWS-3/4 Band for LTE (Band 70)," RP-162010, 3GPP (Dec. 2016).

properly implemented. For example, we participate in CTIA's over-the-air ("OTA") testing working group to ensure Bands 29, 66, and 70 are properly introduced in their respective test specifications. The company is also a member of two major device certification group, PTCRB (https://www.ptcrb.com) and GCF (http://www.globalcertificationforum.org). These device certification programs are important to ensure device performance and interoperability. These efforts also directly tie in with 3GPP and CTIA testing activities, as certification is mainly based on 3GPP RAN5 and CTIA OTA requirements. Band 66 certification work started in the second half of 2016; it is currently a certifiable band by both PTCRB and GCF. Band 70 certification requirements are still being developed.

### C. International Telecommunications Union ("ITU") Coordination

DISH has also been involved in the ITU process to ensure that its spectrum frequency arrangements are included within the ITU's recommendations. We took an active role within the Working Party 5D ("WP 5D") and Study Group 5 ("SG 5") of the International Telecommunications Union's Radiocommunication Sector ("ITU-R") to advocate and help formulate the U.S. position and to ensure that DISH's frequency arrangements were included within the Recommendation ITU-R M.1036.[58] The year-long effort successfully culminated in approval of frequency arrangements B6 (1980-2010 MHz, 2170-2200 MHz) and B7 (2000–2020

[58] *See* WP 5D Document No. 888: Finalization of the Draft Revision of Recommendation ITU-R M.1036-4, "Frequency Arrangements for Implementation of the Terrestrial Component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)" submitted by United States of America (Jan. 2015), *available at* https://www.itu.int/md/R12-WP5D-C/en?psizefield=500; WP 5D Document No. 978: Finalization of the Draft Revision of Recommendation ITU-R M.1036-4, "Frequency Arrangements for Implementation of the Terrestrial Component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)" submitted by United States of America (June. 2015), *available at* https://www.itu.int/md/R12-WP5D-C/en?psizefield=500; SG 5 Document No. 241: Progression of the Draft Revision of Recommendation ITU-R M.1036-4 - Frequency Arrangements for Implementation of the Terrestrial Component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR), submitted by United States of America (Jul. 2015), *available at* https://www.itu.int/md/R12-SG05-C/en; RA-15 Document No. 26: Approval of the Draft Revision of Recommendation ITU-R M.1036-4, "Frequency Arrangements for Implementation of the Terrestrial Component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)" submitted by United States of America (Oct. 2015), *available at* https://www.itu.int/md/R15-RA15-C/en.

MHz, 2180-2200 MHz) for the 1710-2200 MHz band within the Recommendation ITU-R M.1036.

### D. DISH Has Been Involved in Trials and Testing of its Spectrum Licenses

DISH has also been actively testing technologies to best utilize the Spectrum Licenses. Following the grant of the 700 MHz E Block licenses, as explained above, we began evaluating the feasibility of launching a one-way broadcast mobile video service using technologies such as ATSC M/H, Digital Video Broadcasting - Handheld ("DVB-H"), Digital Video Broadcasting - Satellite Services to Handhelds ("DVB-SH") and China Mobile Multimedia Broadcasting ("CMMB"). Field testing for a broadcast mobile video service based on the ATSC M/H standard was conducted in the Atlanta area, taking advantage of the maximum allowed power level of 50 kW ERP at the time. This testing was stopped in 2013, following the Commission's *700 MHz Interoperability Order*, which lowered the allowed power levels.

In 2013, in order to better understand the product and business aspects related to fixed wireless broadband, the company also conducted market trials in two markets. Given that equipment for Band 23 did not exist, we decided to partner with other operators (nTelos and Sprint) to conduct the trial using their 2.5 GHz spectrum. The parties worked closely together to design the trials in which the operators would provide the capacity and DISH would sell, install, and support the service. One trial objective was to create a service that addressed in-home consumer requirements, with the potential to serve as a model for how spectrum could be utilized more effectively while creating differentiated consumer offerings. As DISH explained, "[t]he trial differentiate[d] itself from prior fixed broadband services by relying on professionally installed rooftop devices at customers' homes that are intended to deliver significant gain and throughput advantages over inside-the-home antenna solutions."[59] The trial deployed ruggedized outdoor routers with built-in high-gain antennas to receive the 2.5 GHz LTE signal.[60] These trials provided an opportunity to understand both network economics and market dynamics.

[59] *See* DISH and nTelos Launch Fixed Wireless Broadband Pilot, DISH (Jun. 13, 2013), *available at* http://dish.client.shareholder.com/releasedetail.cfm?ReleaseID=771316.

[60] *Id*.

## IV. DISH'S SPECTRUM ACQUISITIONS AND STANDARDS EFFORTS WILL CULMINATE IN A NETWORK OPTIMIZED FOR 5G AND IoT

As 5G became the focus of the wireless industry in 2015 and 2016, we undertook efforts to identify options to leverage 5G technologies for our planned deployment, and have been active in the 5G standardization process since it began. Among other things, we have been working to ensure that 5G specifications include an option for a new wireless entrant to deploy a 5G network without needing a 4G network as its anchor.

The company has already taken significant steps at 3GPP in furtherance of its planned deployment. With the standardization of Band 66 in December 2015 and Band 70 in June 2016, we turned to the industry effort of implementing the two main requirements for 5G wireless networks; ultra high-speed data (10's of gigabits per second), and massive connectivity (up to a million devices per square km). 3GPP has aligned its standardization plan to support these requirements with Release 15 and beyond.

We believe 5G will be a platform that will enable a variety of partnerships by creating network-sharing opportunities among existing and new operators and shared infrastructure providers, including support for IoT. In September 2015, 3GPP held its first RAN 5G workshop inviting companies to present their view on 5G and its requirements. At this workshop, the company presented its perspective on 5G that included requirements to "offer flexibility to deploy a completely new network" and "allow new types of partnerships and sharing arrangements…" in addition to traditional network and spectrum sharing methods.[61] We are unique in that we have satellite capability in the same frequencies as AWS-4 that offer 100 percent geographic coverage and therefore can complement terrestrial networks. Active engagement in the 3GPP process continues in order to introduce integrated satellite and terrestrial specifications for 5G.[62]

---

[61] "DISH's Perspective on 5G," 3GPP RAN Workshop on 5G," RWS-150015, 3GPP (Sept. 2015), *available at* ftp://ftp.3gpp.org/workshop/2015-09-17_18_RAN_5G/Docs/RWS-150015.zip.

[62] *See* "SMARTER Use Case on 5G Connectivity using satellites," S1-153093, TSG-SA WG1 Meeting #71 ad hoc on SMARTER (5G), 3GPP (Oct. 2015), *available at* http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153093.zip;

Additionally, the company has contributed to the development of 5G use cases and deployment scenarios within various working groups at 3GPP.[63] The development of the 5G specifications for Enhanced Mobile Broadband ("eMBB") is expected to begin in April 2017, starting with Phase 1.[64] We, along with other members, have urged 3GPP to support both "Stand-Alone 5G" and "Non-Stand-Alone 5G" and to avoid the bifurcation of the 5G specifications. The company is also one of the leaders in encouraging 3GPP to consider broadcast/multicast support of the 5G specification, rather than an add-on (as was done for previous technologies).

---

[63] *See* "SMARTER Use Case on Multi-Connectivity and Service Sharing across operators," 3GPP S1-153062, TSG-SA WG1 Meeting #71 ad hoc on SMARTER (5G), 3GPP (Oct. 2015), *available at* http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153062.zip; "New SMARTER Use Case on support for broadcast service," S1-153056, TSG-SA WG1 Meeting #71 ad hoc on SMARTER (5G), 3GPP (Oct. 2015), *available at* http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153056.zip; "New SMARTER Use Case on support for flexible broadcast content caching in 3GPP system," S1-153057, TSG-SA WG1 Meeting #71 ad hoc on SMARTER (5G), 3GPP (Oct. 2015), *available at* http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153057.zip.http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153057.zip; "SMARTER Use Case on 5G Connectivity using satellites," 3GPP S1-153093, TSG-SA WG1 Meeting #71 ad hoc on SMARTER (5G), 3GPP (Oct. 2015), *available at* http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_71bis_adhoc_5G_Vancouver/docs/S1-153093.zip; "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Feasibility Study on New Services and Markets Technology Enablers; Stage 1 (Release 14)", TR22.891, 3GPP (2016), *available at* http://www.3gpp.org/ftp/Specs/archive/22_series/22.891/22891-e20.zip; "Considerations of Satellite system requirement for Next Generation Access," RP-160139, TSG-RAN Meeting #71, 3GPP (2016), *available at* http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_71/Docs/RP-160139.zip; "Requirements for Next Generation Access Technologies," RP-160030, TSG RAN ad hoc on Next Generation Access, 3GPP (2016), *available at* http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_AHs/2016_01_Next_Generation_Access/Docs/RPa160030.zip; "Satellite in New Radio Access Technologies," RP-161100, TSG-RAN Meeting #72, 3GPP (2016), *available at* http://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_72/Docs/RP-161100.zip; "Forward Compatibility Consideration for NR Channel Coding," RP-1612304, TSG-RAN 1 Meeting #87, 3GPP (2016), *available at* http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_87/Docs/R1-1612304.zip; "Satellite Aspects- Forward Compatibility Consideration," RP-1609781, TSG-RAN 1 Meeting #86 bis, 3GPP (2016) *available at* http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_86b/Docs/R1-1609781.zip.

[64] *See* 3GPP Release 15, *available at* http://www.3gpp.org/release-15, (last accessed Feb. 12, 2017) ("By the second half of 2017 the focus of our work will shift to Release 15, to deliver the first set of 5G standards - including new work as well as the maturing of the LTE-Advanced Pro specifications").

## V. CONCLUSION

The wireless industry is in the midst of a technological paradigm shift from legacy technology to a connected world, driven by 5G and IoT. DISH plans to meet the Accelerated Final Milestone for the Spectrum Licenses by March 2020 with an efficient and innovative network focused on these new technologies.