Jeffrey H. Blum
Senior Vice President,
Public Policy & Government Affairs
Jeffrey.Blum@dish.com
(202) 463-3703

September 21, 2018

SUBMITTED TO FCC UNIVERSAL LICENSING SYSTEM (ULS)

Donald Stockdale
Chief, Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: DBSD Corporation, AWS-4, Lead Call Sign T070272001; Gamma Acquisition L.L.C., AWS-4, Lead Call Sign T060430001; Manifest Wireless L.L.C., Lower 700 MHz E Block, Lead Call Sign WQJY944; American H Block Wireless L.L.C., H Block, Lead Call Sign WQTX200

Dear Mr. Stockdale:

DISH Network Corporation, along with its subsidiaries American H Block Wireless L.L.C., DBSD Corporation, Gamma Acquisition L.L.C., and Manifest Wireless L.L.C. (collectively, "DISH," "we" or "us") submit this response to your letter ("Letter"), dated July 9, 2018, requesting "updates and more detailed information on [our] buildout plans"[1] with respect to DISH's AWS-4 A Block (2000-2010 MHz/2180-2190 MHz) licenses, AWS-4 B Block (2010-2020 MHz/2190-2200 MHz) licenses (together, "AWS-4"), Lower 700 MHz E Block (722-728 MHz) licenses ("E Block"), and AWS H Block licenses (1915-1920/1995-2000 MHz) ("H Block"). DISH holds 176 Economic Area ("EA") licenses of AWS-4 and H Block (totaling 528 licenses), and 168 EA licenses of E Block (collectively, the "696 Licenses"). As the Letter states, the buildout obligation for our AWS-4 licenses is to "provide signal coverage and offer service to 70 percent of the population of each license's service area by March 7, 2020."[2] The buildout obligation for our E Block licenses is to "provide signal coverage and offer service to 70 percent of the geographic area of each license or 70 percent of the population of each license's area by March 7, 2020."[3] For H Block, our obligation is "to provide signal coverage and offer service to 75 percent of the population of each license's service area by April 29, 2022."[4] We currently anticipate meeting these buildout obligations.

[1] Letter from Donald K. Stockdale, Jr., Chief, Wireless Telecommunications Bureau, to Jeffrey H. Blum, DISH Network L.L.C., at 2 (Jul. 9, 2018).

[2] *Id.*

[3] *Id.*

[4] *Id.*

Our overall plans are already a matter of public record and were most recently updated in the Interim Construction Notification for our H Block licenses filed with the Commission on May 14, 2018.[5] We plan to deploy the 696 Licenses to support our next-generation network in two phases. In Phase 1, as we first explained in March 2017,[6] we plan to deploy a narrowband Internet of Things ("NB-IoT") network. NB-IoT was first standardized in June 2016 as part of 3GPP Release 13.[7] Our planned NB-IoT network presents the most efficient and promising technology to fulfill a growing demand for IoT connectivity in the near term and serve as a bridge to a 5G rollout in Phase 2, in part because NB-IoT is being considered as the 3GPP candidate for the massive connectivity requirement of 5G. Such a bridge to a 5G deployment is necessary because, among other things, equipment/installation availability for full standalone 5G (3GPP Release 16) will only be available after the March 2020 buildout milestones for our AWS-4 and E Block licenses, making it impractical for us to deploy 5G before such date. In any event, DISH's planned deployment is consistent with the Commission's goals in establishing a "'broad and flexible regulatory framework for licensing' … to 'enable the provision of stand-alone terrestrial services'" in the AWS bands.[8]

For our NB-IoT network, we have entered into contracts with dozens of vendors for base stations, chipsets, modules, tower leases, the core network, Radio Frequency ("RF") design, and deployment services (including: site acquisition, architectural and engineering, and construction and installation services). Among other things, initial RF design for Phase 1 is now complete, and we are in the process of identifying and securing tower sites. The core network has been installed and commissioned. Based on our vendors' current forecast, we plan to install the first base stations on sites later this year, and to continue deployment until complete.

---

[5] *See* American H Block Wireless L.L.C. Interim Construction Notification for H Block Licenses (filed May 14, 2018).

[6] *See* 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 (filed Mar. 7, 2017).

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

[8] Opposition of the Federal Communications Commission to Petition for a Writ of Mandamus, *In re NTCH*, United States Court of Appeals for the District of Columbia Circuit, No. 18-1121, at 6 (filed. Aug. 13, 2018) (*quoting* Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, *Report and Order and Order of Proposed Modification*, 27 FCC Rcd. 16102, 16103, 16189 ¶¶ 1, 228 (2012) ("*AWS-4 Report and Order*")). *See also* Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands, *Order on Reconsideration*, WT Docket Nos. 12-70, 04-356; ET Docket No. 10-142, FCC 18-121, ¶ 18 (rel. Aug. 16, 2018) ("[T]he Commission determined that modifying DISH's licenses was the 'most efficient and quickest path to enabling flexible terrestrial use of this band while ensuring compliance with the MSS protection rule.'") (*quoting AWS-4 Report and Order*, 27 FCC Rcd. at 16164, ¶ 162). These flexible use policies also apply to the current rules for the Lower 700 MHz band, which were adopted as the result of "a voluntary industry solution that would resolve the lack of interoperability in this band while allowing flexibility in responding to evolving consumer needs and dynamic and fast-paced technological developments." Promoting Interoperability in the 700 MHz Commercial Spectrum, *Report and Order and Order of Proposed Modification*, 28 FCC Rcd. 15122, 15123 ¶ 1 (2013).

In Phase 2, which we expect will follow after 3GPP Release 16 is standardized (which is expected to occur in December 2019), and as DISH's plans for its other spectrum holdings develop (including the full clearing of our nationwide 600 MHz licenses, which the broadcasters are required – by Commission mandate – to vacate by July 2020), we plan to aggressively upgrade and expand our network to support new use cases made possible through 5G technology. As a new entrant, we believe such a standalone 5G deployment can give us a competitive edge and enable the provision of a variety of 5G services, in particular massive connectivity and low-latency services. We believe that this approach will accommodate new partnerships and sharing models, including the potential to serve as a highly secure neutral host network to support various industry verticals (including but not limited to logistics, healthcare, agriculture, smart cities, and other connectivity use cases).

DISH's responses to the questions in the Letter are below. The questions are reproduced in bold text, with DISH's response following underneath. DISH's responses do not name specific vendors or provide greater detail on some issues due to the competitively sensitive nature of such information. We note that DISH cannot respond to some of the Bureau's specific questions because the information is not currently available and depends on the pace and manner of the business and technical development of our Phase 1 network. And, given that our buildout milestone is not until March 2020, it is likely that our plans may change. We cannot be certain whether our current deployment plans will progress in the manner we currently anticipate, and, among other things, events beyond our control may impact our responses.

What are the most significant challenges you face in constructing the intended network by 2020, and how do you intend to overcome those challenges?

DISH Response:

Unlike established wireless operators, DISH is building a new network from the ground up based on innovative NB-IoT technology and in preparation for a transition to 5G. As explained below, DISH only has 5 MHz of nationwide uplink available to deploy today. Moreover, as the only licensee of the AWS-4 and H Block spectrum, DISH has funded and driven the development of an ecosystem around these bands. As such, we face multiple challenges in, among other things, receiving equipment in a timely fashion and getting some of the larger vendors sufficiently motivated to do business with us.

For example, although we have already standardized some of our frequency bands at 3GPP, larger chipset vendors have yet to incorporate some of our frequencies into their development roadmaps. When we sought to have chipsets developed for our network, the favorable responses we received were generally from smaller chipset providers or those less-established in the U.S. market. DISH ended up contracting with several of these chipset providers to develop an ecosystem around DISH's frequency bands. It is important that these providers deliver the required chipsets in a timely manner, and we are closely monitoring their progress.

We also face challenges with vendor selection regarding the radios for our network. In December 2016, DISH sent out an RFI soliciting proposals to develop radios for our network. As a result of this process, in the fall of 2017, DISH contracted with one primary radio vendor and two secondary radio vendors. All three are global suppliers of radios. But, our primary vendor – based in China – is a world leader in IoT solutions and was able to customize its NB-IoT equipment for DISH's frequency bands

earlier than the other vendors. In July 2018, the FCC lab certified the radios developed for DISH by the Chinese vendor. We have received delivery of radios from this vendor, which we used for testing, and have completed performance validation. However, given recent developments regarding Chinese telecommunications vendors in Congress, at the FCC, and within the Administration, we are electing, at this time, to deploy radios solely provided by our two non-Chinese vendors. We decided to take this step even though this decision could cause, among other things, delay in our deployment timelines, additional costs, and increase our deployment risks. As for our other vendors: one has obtained FCC certification, but we have not completed performance validation of its radios; we are still awaiting commercial delivery of radios from the other vendor.

There is also no assurance that the performance of the radios from our vendors as validated in a lab will perform the same in the field. This is critical because NB-IoT is a new technology and the standalone version, which DISH is deploying, has not been deployed in the United States to date. Furthermore, we face challenges in getting appropriate RF tools and test tools that support NB-IoT for DISH's frequency bands. We are actively working with test equipment vendors to develop the requisite tools.

In addition to the challenges DISH faces as a new entrant, we also face recognized challenges related to infrastructure deployment. For instance, now that the initial RF design is complete, there are ongoing challenges and obstacles related to site acquisition from the tower companies (*i.e.*, "fallouts" – towers that we thought were available when the RF design was done, but subsequently turn out not to be available for a variety of reasons). For example, a site may require extensive structural work. These fallouts require further RF design to identify alternate towers, and that, in turn, results in additional site acquisition activity and challenges. To mitigate this, we have, among other things, added additional RF engineers and site acquisition expertise to accelerate the process.

In addition, we are experiencing challenges related to the zoning and permitting of candidate tower sites, which could delay our deployment timelines. There are also potential challenges regarding the availability of sufficient construction crews to meet our requirements in a timely manner. In addition to crew availability, the actual construction timelines could be affected by weather and other factors beyond our control. To mitigate these risks, we have, among other things, adapted our RF design and candidate site selection/acquisition procedures to identify and work in parallel on multiple candidates simultaneously, and to contract with multiple companies that offer construction services. We plan to prioritize construction by region, taking into account weather and other factors.

Please describe the timing of critical milestones leading up to your previously-stated goal of completing deployment by March 2020, including technology selection, vendor(s) selection, equipment selection/acquisition, system engineering, site acquisition, equipment testing, and advertisement of service and deployment to customers.

DISH Response:

As DISH is in the midst of deployment and may encounter additional unforeseen challenges, all future dates are subject to change as we continue to work to deploy our network by March 2020.

Technology Selection: We evaluated and researched various technologies, not limited to NB-IoT and LTE, that could be deployed on the 696 Licenses. Among other things, we evaluated the state of technology, various network deployment options, progress being made on the standardization of 5G specifications, the wireless ecosystem, and our overall business strategy to select the technology for our Phase 1 deployment. An important factor in our technology selection was the amount of nationwide uplink that we have available at this time to deploy – only 5 MHz at 1915-1920 MHz. This is the result of, among other things, an arrangement we made with the Commission and industry stakeholders in 2013 to help the agency solve the interoperability problem in the Lower 700 MHz band. At the request of the Commission, DISH voluntarily agreed to a substantial reduction in the power levels authorized for its 700 MHz E Block licenses. As DISH explained at the time, we offered this commitment "in the spirit of compromise to help the Commission deliver on its important public interest objective of unlocking additional spectrum"[9] despite that it required us to "fundamentally alter network design and deployment strategies[.]"[10] As part of this compromise, we sought, among other things, Commission action to increase the spectrum utility of the AWS-4 band (through granting DISH's AWS-4 downlink waiver) and pledged to bid the reserve price set for the H Block auction of $1.56 billion (which we ultimately paid). In cooperation with the Commission, in June 2016, DISH elected to transform the severely impaired AWS-4 uplink spectrum (2000-2020 MHz) into unimpaired downlink, leaving us with limited available uplink to deploy today. We believe that this was the right decision for many reasons and was, as the Commission found, in the public interest.

As a result of this process, DISH released an RFI outlining several deployment scenarios to potential vendors in December 2016.

Vendor Selection and Equipment Selection/Acquisition: DISH worked with a number of infrastructure and chipset vendors throughout 2016, 2017 and 2018. And, as explained above, we signed radio development contracts with three infrastructure vendors in the fall of 2017, as well as chipset development contracts in 2017 and 2018. Though the technology is based on 3GPP standards, the contracts require the vendors to customize their NB-IoT equipment to support DISH's deployment configuration, which requires use of the H Block uplink paired with the AWS-4 and E Block downlink.

DISH has also been working with core network equipment vendors. We issued an RFP for this equipment in December 2017, and signed a contract in March 2018. This equipment has been delivered and installed. Basic interoperability testing of this equipment has been completed, and the first NB-IoT session was successfully established in May 2018.

RF Design: Given that NB-IoT is an emerging technology, we sent an RFI for the nationwide RF design to several firms. In early 2018, we signed a contract with a leading RF services provider with extensive coverage planning expertise to assist in the RF design. As explained above, the nominal designs have been completed for all EAs and released to the site acquisition team. Site redesign activities will continue throughout the deployment process as necessitated by site acquisition and coverage.

---

[9] Letter from Jeffrey H. Blum, DISH Network Corporation, to Mignon Clyburn, Chairwoman, FCC, WT Docket No. 12-69, at 4 (Sept. 10, 2013).

[10] *Id.* at 2.

Site Acquisition: DISH has negotiated master lease agreements (MLAs) with over a dozen tower companies, both regional and national. We also signed multiple contracts for deployment services, including: site acquisition, architectural and engineering, and construction and installation services. We expect to have the first sites ready for equipment installation prior to the end of the year.

Marketing of Services: We plan to market NB-IoT services by March 2020, but we have not finalized those plans.

Please describe the service DISH intends to provide with respect to each spectrum band that has an upcoming construction deadline. Do you intend to include other licensed bands in the phase 1 deployment? If not, why? It has been reported that DISH began testing ATSC 3.0 in Dallas, TX, on the 700 MHz E block spectrum earlier this year. What role will this technology play in meeting the upcoming construction requirements for this spectrum?

DISH Response:

DISH intends to deploy an NB-IoT network supporting several services. The services for the Phase 1 NB-IoT network will be designed to operate on each of the 696 Licenses in their respective EAs. We currently plan for the services envisioned for our NB-IoT network to work on the three spectrum bands covering the 696 Licenses (AWS-4, E Block, and H Block), and we do not, at this time, expect to restrict a particular service on the network to a specific spectrum band. This decision is subject to change as we add more services to our portfolio.

In terms of other spectrums bands, we expect that our Phase 1 NB-IoT network will be built out using the 696 Licenses. We are not planning to commercially deploy our 600 MHz licenses to support Phase 1 of the network because, among other things, these licenses will not be entirely cleared of broadcaster operations until July 2020 (and this date assumes no extensions or waivers will be granted to any broadcasters).[11] We may test NB-IoT on some of our 600 MHz licenses; and, once we have results, we can make decisions regarding potential deployment. We anticipate that DISH's 600 MHz spectrum will be an important part of our Phase 2 deployment focused on 5G.

With respect to technology choice, DISH has been investigating and evaluating a number of technologies, not only NB-IoT, but also broadband, fixed wireless, ATSC 3.0, and LoRa (paired with licensed spectrum), among others, and will continue to do so.

That said, DISH believes that an NB-IoT network is the most efficient and promising network architecture to fulfill a growing demand for IoT connectivity in the near term and prepare us for 5G in Phase 2. Indeed, after DISH announced its NB-IoT plans in March 2017, existing wireless carriers in the

[11] *See* Incentive Auction Task Force and Media Bureau Remind Repacked Stations of Certain Post-Auction Transition Requirements and Deadlines, *Public Notice*, MB Docket No. 16-306; GN Docket No. 12-268, DA 18-884, at 2 (rel. Aug. 27, 2018).

United States – including AT&T,[12] Verizon[13] and T-Mobile[14] – also announced plans to deploy NB-IoT. Like us, existing carriers recognize the advantages of NB-IoT.[15] Because other carriers are moving forward with NB-IoT networks (layered onto their existing networks), there likely will be significant competition in the market for NB-IoT services. And, while NB-IoT may become the IoT solution for 5G, we believe that there will be a sustainable market for low-cost IoT devices with long-battery life that NB-IoT is particularly suited to support even outside of the 5G context.

We plan for our Phase 1 deployment to have three paired NB-IoT channels:

(1) downlink in AWS-4 Block A paired with H Block uplink;
(2) downlink in AWS-4 Block B paired with H Block uplink; and
(3) downlink in 700 MHz E Block paired with H Block uplink.

Finally, we have been testing broadcast mobile service in the 700 MHz E Block for a number of years, and our previous studies have included technical evaluation and testing of various high-powered broadcast mobile video technologies including Advanced Television Systems Committee - Mobile/Handheld (ATSC M/H), as well as the following orthogonal frequency-division multiplexing-(OFDM) based technologies: Digital Video Broadcasting - Handheld (DVB-H), and Digital Video Broadcasting - Satellite Services to Handhelds (DVB-SH). DISH also actively studied technical developments for Evolved Multimedia Broadcast Multicast Service (eMBMS), which optimizes broadcast and multicast delivery within data networks. We also leased some of our 700 MHz spectrum in certain markets for use by Fanvision, a mobile sports content provider. Fanvision used the spectrum to broadcast in-venue content to fans at various live sports arenas via its Fanvision device.

We view ATSC 3.0 as a promising and innovative technology for interactive video and data services. Among other things, we see potential in ATSC 3.0's innovations in delivering video, including improved over-the-air reception, immersive audio, mobile reception, targeted programming/advertising, automotive services, and advance emergency alerting. In April 2018, DISH participated in an ATSC 3.0 trial as part of the Spectrum Consortium "Next Gen" deployment in Dallas, Texas. DISH's 700 MHz

---

[12] *See* "AT&T to Launch NarrowBand IoT Network in U.S. and Mexico," AT&T Newsroom (Jun. 20, 2018), *available at* http://about.att.com/story/narrowband_iot_launches_us_and_mexico.html ("*AT&T Jun. 20 Press Release*").

[13] *See* "Verizon Carries Successful Data Session on New NB-IoT Guard Band Network," Verizon Newsroom (Feb. 1, 2018), *available at* https://www.verizon.com/about/news/verizon-carries-successful-data-session-new-nb-iot-guard-band-network ("*Verizon Feb. 1 Press Release*").

[14] *See* "T-Mobile Launches Nation's First Plan for Narrowband IoT," T-Mobile Newsroom (Jan. 9, 2018), *available at* https://newsroom.t-mobile.com/news-and-blogs/narrowband-iot.htm ("*T-Mobile Jan. 9 Press Release*").

[15] *See AT&T Jun. 20 Press Release* ("Adding NB-IoT to our portfolio will expand our LPWA capabilities, help drive investment in our evolution to 5G and support our customers as they deploy IoT solutions across the U.S. and Mexico."); *Verizon Feb. 1 Press Release* ("We are committed to providing more customer options to the IoT ecosystem by leading with new technologies and capabilities such as NB-IoT Guard band that efficiently use dedicated spectrum and target different customer requirements for throughput and battery life."); *T-Mobile Jan. 9 Press Release* ("T-Mobile's new NB-IoT plan takes advantage of narrowband technology, and the efficiency it provides, to significantly lower the costs of connecting things and unleash the next wave of IoT innovation.").

spectrum was used in transmitting on multiple towers in the Dallas metropolitan area to be able to form a Single Frequency Network (SFN).[16] DISH plans to continue participating in the Spectrum Consortium, as well as testing ATSC 3.0 in various other environments. The ATSC 3.0 ecosystem is in its infancy, and the equipment necessary to offer a service may not be available prior to our March 2020 buildout milestones, but we plan to continue to test deployment of ATSC 3.0.

How will each spectrum license independently be constructed to meet the service requirement? Will each and every spectrum band be deployed at each base station? If not, how do you plan to demonstrate that you have met the buildout requirement for each license in each band??

DISH Response:

We intend to construct each of the 696 Licenses to meet the applicable buildout requirement. We currently anticipate that every base station will include at least one downlink carrier in the AWS-4 A Block, at least one downlink carrier in the AWS-4 B Block, and uplink carriers placed in the H Block at 1915-1920 MHz. We also plan for at least one base station in each EA (apart from the eight EAs where DISH does not hold a 700 MHz E Block license) to include at least one downlink carrier in 722-728 MHz and at least one uplink carrier in 1915-1920 MHz. We anticipate adding additional NB-IoT carriers as needed based on marketplace conditions, consumer demand, changes in technology, and industry partnerships.

If an industry standard technology will be used, what is the standard and what is its status? Has DISH decided to not move forward given the current state of the standard? If so, please provide an explanation of the actions DISH chose to delay due to the pace of standards development.

DISH Response:

DISH currently plans to deploy NB-IoT based on 3GPP Release 14, which was standardized in June 2017.[17] We may choose to upgrade to future releases as our vendors make them available. Although compliant with the standard NB-IoT protocol, DISH's specific uplink/downlink band combinations have not yet been standardized by 3GPP. As stated above, NB-IoT is being considered as the 3GPP Radio Interface Technology (RIT) candidate[18] for the massive connectivity requirement of

---

[16] *See* "DISH Successfully Trials 'Next Gen' Broadcast Standard in Spectrum Co.'s Dallas SFN Project," DISH Newsroom (Apr. 8, 2018), *available at* http://about.dish.com/2018-04-08-DISH-Successfully-Trials-Next-Gen-Broadcast-Standard-in-Spectrum-Co-s-Dallas-SFN-Project ("Spectrum Co., LLC, is the ATSC 3.0 development consortium founded by Sinclair Broadcast Group, Inc. and Nexstar Media Group, Inc. (Nasdaq: NXST). Univision Local Media, Inc. has signed an MOU to join Spectrum Co. Its mission is promoting spectrum utilization, innovation and monetization by advancing the adoption of the ATSC 3.0 transmission standard across the broadcast industry. Spectrum Co. is pursuing advanced nationwide business opportunities made available by the NextGen standard and aggregation of ATSC 3.0 data capacity.").

[17] *See* "Releases," 3GPP, *available at* http://www.3gpp.org/specifications/67-releases (last accessed Sept. 21, 2018).

[18] *See* "Draft LTI on 3GPP 5G Initial Description Template," 3GPP, *available at* http://www.3gpp.org/ftp/PCG/PCG_40/docs/PCG40_11.zip (last accessed Sept. 21, 2018).

IMT-2020, as defined by the ITU. The minimum requirement for connection density for 5G is expected to be 1,000,000 connections per square kilometer.[19]

Please describe the architecture of the network DISH is constructing for its phase 1 network (including how base stations, repeaters, and end-user devices will interact) and the IOT services/applications it plans to provide?

DISH Response:

DISH intends to deploy a 3GPP NB-IoT architecture. The current plan is for the base stations to be backhauled to an enhanced packet core ("EPC") through a variety of connectivity options. Initially, we anticipate that the core will be centralized and will be based on a virtualized EPC platform, containing functions providing Home Subscriber Server (HSS), Mobility Management Entity (MME), Serving Gateway (S-GW), and Packet Data Network Gateway (P-GW) capabilities, and interfacing to DISH systems for billing, provisioning, reporting, and network monitoring.

The core architecture we plan to deploy is flexible and scalable. We plan for the NB-IoT services to detect the network, register/attach, and transmit and receive data through the NB-IoT protocols defined by 3GPP. At this time, we are evaluating various IoT services for our NB-IoT network, but have not finalized them.

Describe the coverage area you expect to achieve from each base station in phase 1. What are the technical parameters that are assumed in arriving at the expected coverage—such as data rate, receive signal level, frequency of transmissions (how often and how long does the base station communicate with subscriber units or an individual subscriber unit), and link budget? Also, describe the amount of bandwidth that you expect to use for each band (AWS-4, 700 MHz E Block, and H Block) for the phase 1 network.

DISH Response:

We intend to deploy a sufficient number of base stations in each EA to meet the applicable buildout requirement for each of the 696 Licenses. Our current plan is for the initial deployment to have at least one NB-IoT downlink or uplink carrier (200 kHz) for each of the 696 Licenses. We believe that this deployment will be able to potentially support millions of IoT connections. But, as noted above, we may add NB-IoT carriers as needed based on marketplace conditions, consumer demand, changes in technology, and industry partnerships.

In the RF design provided by our vendor, the geographic area predicted for each site varies over a wide range (between approximately 10km and 100km) due to the site configuration, terrain, and propagation model. This predicted range is based on a proprietary solution from our vendors for 3GPP Release 14. 3GPP has also approved specifications for NB-IoT that supports coverage of up to 120km as part of Release 15, and we may have the ability to upgrade to this extended range. The predicted

[19] *See* "Minimum Requirements Related to Technical Performance for IMT-2020 Radio Interface(s)," ITU-R M. 2410-0, Section 4.8 at 6 (Nov. 2017), *available at* https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2410-2017-PDF-E.pdf.

coverage for our network is based on an industry standard tool that is model tuned and calibrated for DISH's frequencies.

The system link budget is set by the equipment vendors based on their system capability, and the RF design vendor is using that link budget to design the network. The link budget is based on the 3GPP standard to support a maximum coupling loss (MCL) of 164 dB for standalone NB-IoT.[20] We anticipate that the signal strength of our network will provide reliable NB-IoT services, which generally require a low data rate with infrequent transmissions. The network architecture that we plan to deploy is flexible and scalable to support additional demand through additional NB-IoT carriers and core network server deployments.

Additionally, we plan to deploy base stations that employ link adaptation and power control mechanisms to support data rates for the services as needed.

Please clarify whether any portion of a narrowband IoT network using DISH's AWS-4, 700 MHz E Block, and H Block licenses in phase 1 will consist of one-way base stations that transmit to subscriber units that do not communicate with a base station. If the network will support two-way communications between base stations and customer equipment, how do you intend to deploy each band to support two-way communication?

DISH Response:

We currently plan for the NB-IoT network deployments using the 696 Licenses to be two-way. As noted above, we anticipate that our Phase 1 deployment will have three paired NB-IoT channels in each EA, except in the EAs where 700 MHz E Block is not licensed to DISH. In those EAs, only the first two pairs will be present. In parallel, we will continue to explore one-way testing on our various frequencies potentially using, among other technologies, ATSC 3.0, NB-IoT and LoRa, and may add one-way services to our deployment plans.

Describe the end-user devices you intend to deploy in order to meet the construction requirements for these spectrum bands (e.g., types of devices and their intended applications, locations and heights above ground where they would be installed, frequency bands available in the devices, how frequently they would interact with base stations). Also, please indicate when you expect these devices to become available.

DISH Response:

At this stage, we are still in the process of evaluating and developing services to be supported by our Phase 1 NB-IoT network (and, the disclosure of the specific services under development is competitively sensitive). But, we anticipate that some services potentially will be geared to the consumer market, while others potentially will be focused on the needs of businesses and cities. We also plan to have the network act as a neutral host platform to encourage the development of creative NB-IoT use cases by third-parties to complement our own NB-IoT offerings. The frequency with which the services

[20] *See* Dino Flore, "3GPP Standards for the Internet-of-Things," at 3 (Feb. 2016), *available at* http://www.3gpp.org/images/presentations/3GPP_Standards_for_IoT.pdf.

will interact with base stations likely will depend on the individual needs of the customer in question. For example, one service may need to send data more frequently in order to provide useful information, whereas another service may need to send data only once or twice a day, resulting in extended battery life. Some services potentially may also be capable of connecting using Wi-Fi and/or Bluetooth to complement the NB-IoT offerings. We anticipate that our NB-IoT offerings will be available to customers by March 2020.

When you previously stated that you expect to deploy by March 2020, did you mean that network coverage and equipment would be available to customers as of that date? Do you expect to be marketing and providing service to customers in each licensed area as of that date? How do you intend to market the service to customers in each licensed area?

DISH Response:

We anticipate that the Phase 1 NB-IoT network will be operating and providing coverage to 70 percent or more of the population in each EA, on each of the 696 Licenses, by March 2020. We expect to start marketing NB-IoT services to customers by that date.

For the H Block licenses, do you anticipate having chip sets and developer kits that support the band available in time to offer customer equipment by April 29, 2022?

DISH Response:

Yes.

Do you anticipate that the contemplated construction will require any rule waivers from the Commission (excluding any waivers already filed), including an extension of the construction deadline, waiver of the substantive construction requirement, or waiver of any service rules?

DISH Response:

Because we are a new wireless entrant and subject to several challenges and obstacles, as described above, we do not know whether any waivers or extensions for Phase 1 may become necessary to file at a later date. That said, we are focused on timely meeting our buildout milestones so that we are in a position to aggressively upgrade and expand the network to 5G in Phase 2. We share the Commission's goal of winning the race to 5G and believe we can be an important participant in that race.

/s/ Jeffrey H. Blum
Jeffrey H. Blum

cc: Matthew Pearl