STARRY™

FCC Progress Report III
February 15, 2019

Federal Communications Commission
Experimental Licensing Branch
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I. Introduction

In December 2017, Starry, Inc. ("Starry") filed its second Progress Report with the Federal Communications Commission ("FCC" or "Commission") updating the Commission on Starry's progress in developing, deploying and testing its fixed 5G wireless broadband access network. This third Progress Report contains additional updated information related to Starry's deployment efforts in the markets in which it holds experimental test authority licenses.

Today, more than 24 million Americans lack access to a high-speed internet broadband connection and among lower-income Americans, nearly half do not have an internet connection at home.[1] The benefits of broadband access in the home are well-known: increased job and educational opportunities, increased access to healthcare and expansion of broader economic opportunities for whole communities.[2] Ubiquitous, reliable internet is a critical part of our nation's infrastructure and a key driver of economic growth.

The Commission, recognizing that reliable and affordable broadband is critical to communities both large and small, has undertaken several rulemakings that address barriers to broadband expansion and has already begun to implement policies designed to encourage deployment of new access networks and spur broadband adoption across diverse geographies and demographics.[3] From adoption of diverse and flexible spectrum access policies to easing deployment barriers, the Commission via its *5G FAST* initiative is providing new entrants –

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[1] *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, 2018 Broadband Deployment Report, 33 FCC Rcd 1660 (2018) (*2018 Broadband Deployment Report*); Monica Anderson, *Digital Divide Persists Even as Lower-Income Americans Make Gains in Tech Adoption*, PEW RESEARCH CENTER (Mar. 22, 2017); http://www.pewresearch.org/fact-tank/2017/03/22/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption/.

[2] *See* U.S. Counsel of Economic Advisers Issue Brief, *The Digital Divide and Economic Benefits of Broadband Access* (Mar. 2016), https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160308_broadband_cea_issue_brief.pdf ; Intel World Ahead, *Realizing the Benefits of Broadband* (2010), https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/world-ahead-broadband-paper.pdf.

[3] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, GN Docket No. 14-177, 33 FCC Rcd 5576 (2018); *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket 17-79, Second Report and Order, FCC 18-30 (rel. Mar. 22, 2018).

utilizing innovative new technologies like Starry's – the opportunity to successfully compete with well-entrenched incumbents.

Emerging "5G" technologies – the term "5G" referring to a broader set of access technologies, both fixed wireless and mobile, that enable high-capacity, low-latency networks – offer a new set of opportunities help bridge the digital divide. Starry's success in raising venture financing, building and deploying fixed wireless technology, and providing competitive choice to consumers is one clear and tangible example of how consumers are *today* directly benefiting from the policies adopted by the Commission. However, even with this forward progress, the Commission recognizes that there is much work still to do to enable this success,[4] and we include herein some examples of areas that continue to be pressure points in the advancement of 5G technologies and services.

II. Company Background & Technological Approach

Starry is a Boston-based technology company that is using millimeter waves to re-imagine last-mile broadband access as an alternative to fixed-wireline broadband. Starry has developed and deployed proprietary pre-standard fixed 5G wireless technology that utilizes millimeter wave spectrum to connect consumers to affordable, high speed, gigabit-capable wireless broadband.[5] Starry provides wireless last-mile connectivity at a fraction of the cost of fixed wireline providers, creating a scalable and competitive broadband alternative in markets that are often dominated by one or two players. To date, Starry has invested more than $163 million in technology research and development, network deployment, network service, and customer care and will invest additional significant financial resources over the next year.

[4] Remarks of FCC Chairman Ajit Pai, Federalist Society 2018 National Lawyers Convention, "The current landscape of telecommunications law," (Nov.16, 2018), https://docs.fcc.gov/public/attachments/DOC-355136A1.pdf FCC 2018 Broadband Deployment Report: https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2018-broadband-deployment-report.

[5] Starry defines its technology as "pre-standard 5G" because Starry does not utilize 3GPP 5G NR radio technology in its base stations and more broadly, believes that for the average consumer the term "5G" represents a wider basket of access technologies that enable high-capacity, low-latency connections. Starry is not utilizing the 3GPP ecosystem, but rather is utilizing the more diverse 802.11 (WiFi) radio ecosystem governed by IEEE standards body for our baseband technology.

Starry was founded in late 2014 by a team of talented hardware, software, and RF engineers who set out to develop millimeter wave technology that could deliver reliable, gigabit-capable connections in dense and cluttered urban environments. Starry created and built a full-stack technology consisting of a network-node ("Starry Beam"), a home receiver ("Starry Point") suitable for single family homes or multiple-dwellings ("MDUs"), and an in-home, touchscreen Wi-Fi access hub ("Starry Station"). In 2017, the FCC renewed Starry's experimental market test authority licenses for the 37.0 to 38.6 GHz band in 22 markets.

Starry has performed extensive tests to characterize the performance of these bands, testing weather, foliage, and seasonality impacts in both urban and suburban environments in multiple cities. Starry is now testing various business models for last-mile broadband in buildings and neighborhoods across several major U.S. cities, and is developing plans for extending its reach into less dense suburban areas.

As required by the grant of this license, Starry submits this third progress report, which provides the Commission a significant update on our learnings over the past 30 months.

Starry's Technological Approach

KEY TECHNOLOGY INNOVATIONS
• Innovative approach to baseband radios in infrastructure: utilization of 802.11ac radios, transitioning to 802.11ax in 2019. • Capacity of 5 Gbps per beam sector with MU-MIMO (15-20 Gbps per site), improving to 10 Gbps per beam sector (40-50 Gbps per site), covering approximately 3 km in near-line-of-sight conditions and 1 km in non-direct-line-of-sight conditions.
• Deployment of active phased array for consumer internet.
• Hybrid multi-beamformed Rx & Tx.
• Starry Beams cover 60, 90-degree or 120-degree sectors with an effective range of nearly 3 km, after taking into account rain fade, foliage and reflections. • Free space range in line-of-sight conditions is more than 10 km.

Starry's technical architecture includes three key components: Starry Beam, the network-node, which communicates using millimeter wave spectrum to Starry Point, the at-premise transceiver, which connects to Starry Station, the in-home WiFi hub. In addition to these network building blocks, Starry has also developed a low-cost relay system to add network coverage in extreme non-line-of-sight conditions.

Starry Beam utilizes an active phased array for Point-to-Multipoint delivery of last-mile fixed broadband to consumer premises. By taking the innovative approach of utilizing available 802.11ac and 802.11ax baseband technology in our infrastructure, which facilitates 4x4 and 8x8 Multi-User MIMO, Starry marries these two technological approaches to create a highly efficient, extremely low-cost, high-capacity internet delivery system using millimeter waves. This unique hybrid approach to beamforming is especially efficient and practical for millimeter waves due to the small sizes of the antennas.

In addition, Starry's full-stack technology approach provides it greater transparency and control over the performance and stability of the Starry internet service, from node to home, ensuring a better overall customer experience.

In early 2019, Starry will begin to deploy its second-generation technology base station and at-premise transceiver, which dramatically decreases the cost of both pieces of equipment and increases capacity, further driving down passing costs and increasing the efficiency of Starry's total technology stack. The second-generation consumer equipment incorporates Starry's own Active Electronically Steered (Phased) Array ("AESA") and transceiver ICs. The next iteration of our second-generation base station equipment also incorporates 802.11ax technology with OFDMA and additional MU-MIMO functionality, further increasing capacity and throughput of each base station.

Additionally, new design iterations for Starry's second-generation transceivers for single family homes and MDUs significantly shrink the form factor of the consumer premise equipment ("CPE"), making it easier to deploy and more community-friendly for challenging sites, such as in historic districts. In Q1 2019, Starry is deploying an intermediate-range base station called Relay, which has an even smaller visual impact at 9 inches x 11 inches, smaller than the already zoning-friendly, 18 inch x 18 inch design of Starry's full range base station. This new, high efficiency base station is powered by power over Ethernet.

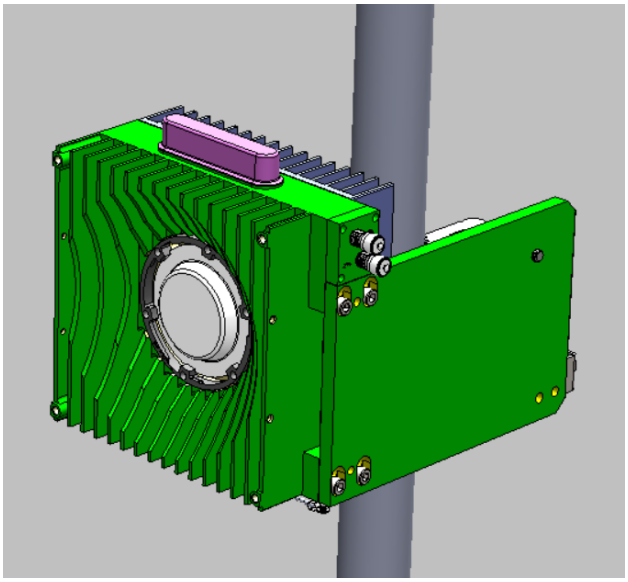

Figure 1. Starry's Relay, an Intermediate Base Station

Starry's ability to drive down the cost of both the base station and the CPE is a critical factor in Starry's success and makes the deployment of scalable 5G fixed wireless networks not just an aspiration, but a reality.

At today's economics, considering the relatively low-volume of equipment we currently manufacture, Starry's passing costs for areas with densities of 1,000 homes or more per square mile are less than $20 per home passed. With the advances in our second-generation technology, we are confident that we can lower the passing costs to below $12 per home passed by the end of 2019. In comparison, the cost of building a fixed-wireline fiber network is approximately $2,000 per home passed (depending on the type of deployment).

A single second-generation Starry Beam utilizing 802.11ac/ax technology with OFDMA and additional MU-MIMO functionality can serve approximately 3,000 subscribers. Each deployed site typically contains 3 to 6 base stations (each its own sector); in aggregate, each site can serve about 15,000 households with approximately 40-50 Gbps of capacity per site. Even with our rapid decline in costs through 2018, we expect CPE costs to continue to decline in 2019-2021, enabling an even more robust business case in both multi-family and single-family residences with as little as 4% market penetration.

The FCC's experimental market test authority license has served exactly as intended: we took an early and significant risk to develop a new technology, deployed stable but early

versions for real-world testing, iterated and troubleshot over a live network, built a theoretical business model, and have tested parts of that business model in an operational environment. We have also gathered critical technical data on how millimeter wave bands behave in a variety of real world conditions (weather, foliage, urban clutter). Additionally, Starry has gained valuable insight from consumers to better understand market appetite for new products, and the barriers to adoption and deployment across a variety of geographies.

Continuing to develop a better understanding of these dynamics – and what strategies are most successful at enabling next generation fixed wireless networks – will lay the groundwork for future network providers to emerge and help inform better, more efficient spectrum sharing strategies, while simultaneously increasing broadband competition and access, focused on real customer demands. This critical data will ultimately be foundational in helping create a robust and more competitive broadband marketplace for consumers.

Starry: Field Tests & Results

Starry has gathered significant data on the operation of our millimeter wave technology across multiple cities and operating environments, along with broadband consumer usage patterns. This is invaluable data that can only be gleaned from operating a network with customers in a real-world deployment. Below we summarize just some of this data – specifically the average consumption in Boston and Los Angeles over a recent and randomly-selected three-day period, and our validated link budget.

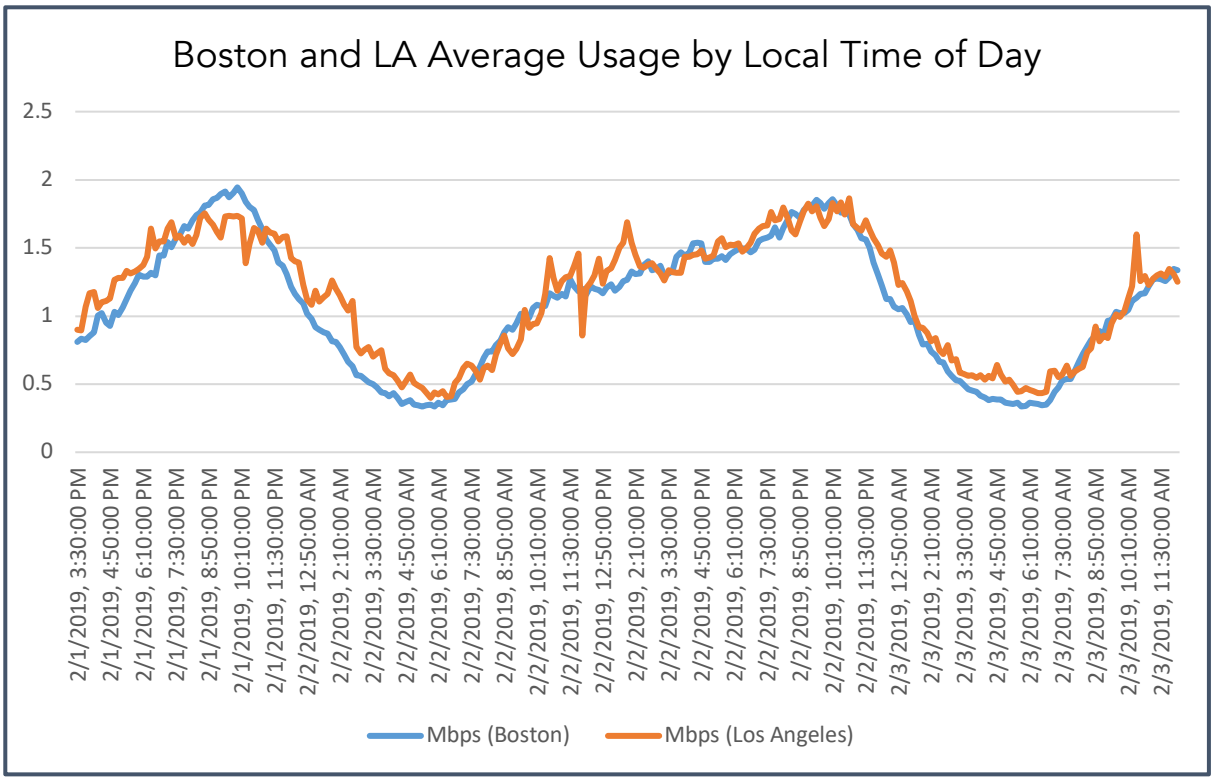

Figure 2 Typical Time of Day Usage in Boston and Los Angeles (per subscriber)

Sample Link Budget (from Beam to Second Generation End-Point)

Parameter	Typical	Unit
Transmit EiRP (average over Az)	+56	dBm
Receiver Sensitivity (256 QAM as example, 5/6 LDPC, 1700 Mbps PHY rate/2SS)	-60	dBm
Rx Antenna Gain	38	dB
System Gain	154	dB
Path Loss (2000 m)	130	dB
Margin	24	dB

III. Starry's Network Deployment

a. Opportunities & Obstacles

In Starry's second Progress Report, we detailed our extensive efforts to plan for and reduce barriers to deployment of our network. From shrinking the size of our base stations to designing a diverse array of CPE form factors to be compact, concealable and responsive to historic districts, Starry has taken a progressive and aggressive posture to ensure swift and timely deployments.

However, even with those efforts and investment of time and resources (human and financial), deployment barriers continue to be one of the most significant challenges to growing Starry's network footprint.

Deployment Background

Starry typically deploys its base stations on vertical assets – either managed rooftops or towers – that are 100 feet or higher in elevation. Starry's baseline architecture does not make use of rights-of-way, such as pole attachments or municipal furniture to site our base station equipment. And because of Starry's base station propagation characteristics, Starry only needs to deploy tens of sites in order to provide citywide coverage – not deploy hundreds or thousands of small cells, as envisioned by other providers.

Minimizing equipment size is key in speeding deployment of network equipment. Starry purpose-built our base stations to be compact in size to reduce barriers to siting that often plague larger equipment installations and to avail ourselves of recent small cell regulations that have been enacted at the federal and state levels to speed deployment. Additionally, by developing a variety of form factors for the Starry Point (transceiver) and making it small, compact and highly concealable, we can meet the requirements under Over-the-Air-Reception-Devices ("OTARD") rules to reduce deployment time further.[6] The design of our hardware is critical to enable a rapid and easily scalable deployment strategy and we will continue to innovate on design in order to utilize every regulatory streamlining tool available to us.

[6] 47 C.F.R. § 1.4000.

As Starry stated in its last Progress Report, there is one clear truth in infrastructure deployment: time is money. Any delay in any part of the chain of deployment increases costs at every step in the process. Even with the most thoughtful planning process, siting and deployment delays are inevitable. Those costs are compounded the longer the delay. Unexpected delays also wreak havoc on deployment timelines and equipment supply chain. An unexpected delay in this process of 30 days can translate to a delay of 45-60 days or more for our business, due to this domino effect. And for every month that a site deployment is delayed, it costs us thousands of dollars in site rental fees and other related costs. Multiply that over multiple sites in multiple cities and delay costs can become a significant financial drag, an added "tax" on companies, not to mention a detriment to our customers who must wait longer for service.

In many municipalities, the permitting process is estimated to be 30-60 days. However, the reality is that the permitting process can take up to 90 days or greater to complete.[7] The reasons are varied. Some municipalities lack the personnel to deal with the sheer volume of applications received, while other municipalities' personnel are not up to speed on new small cell regulations or how to permit new, unfamiliar technologies that are smaller in size and footprint than traditional, larger cellular installations. And still others are concerned about the threat of thousands or tens of thousands of new small cells entering their cities as new "5G" deployments, and we are unfortunately caught in the middle (even though this is not our deployment strategy).

Starry invests in a tremendous amount of contingency planning upfront to head off unexpected delays and enable us to switch to "plan B" when our first course of action is delayed, all of which also carries substantial costs. We understand that this is a cost of doing business in infrastructure deployment, but those resources ideally would be invested in technology development, not diverted to risk managing site acquisition and deployment. We welcome the Commission's efforts in reducing barriers to deployment and appreciate the

[7] While Starry's base stations are afforded a 60-day review period, local governments will simply deny the application within the period or request alterations to an application, and we are then required to re-start from square one.

Commission's focus on a critical, but often overlooked area. We believe that continuing to modernize existing rules, such as the OTARD rule, will add more tools to the toolbox and help speed deployment of competitive broadband services to consumers.

b. Market Deployment Status

In late summer 2016, Starry launched its initial beta service in the Boston area to test its very early equipment in the field providing service to consumer households. Starry targeted areas where the population density is a minimum of 1,000 homes per square mile. Starry's beta sought to build on and further confirm the results of the data gathered in controlled tests the previous months. Since that time, we have tested a variety of weather and foliage conditions in a variety of neighborhoods throughout Boston, Somerville and Cambridge. Starry's network has been stress tested against hurricane force winds, nor'easters and the severe snow, hail, sleet and freezing conditions that are typical to a northeast winter. Our network is durable and resilient even in these difficult conditions.

In 2017, Starry service was launched on a wide-scale test basis to customers in Boston. Today, Starry is passing 350,000 homes in metro Boston with coverage in Back Bay, Beacon Hill, the North End, South End, Brookline, Brighton, Allston, Charlestown, Cambridge and Somerville. In 2018, Starry launched four additional markets and today is serving customers in the Los Angeles, New York City, Washington, DC and Denver markets. In total, Starry's network passes nearly 1.5 million homes across these five markets.

Consumers in all markets are offered a monthly, no contract, no installation fee, no data cap plan of 200 Mbps down/up for a flat rate of $50 per month, inclusive of all equipment, and installation. In 2019, Starry will test additional speed plans and pricing in existing and new markets, including both higher and lower speed tiers at varying prices.

Starry's typical penetration rate across deployed neighborhoods in Boston is between 5% and 30%. In some MDUs, Starry's penetration rate exceeds 60%. Starry has experienced the most success in buildings and areas where there was previously only one choice in internet providers, but has found success even in areas where Starry is the third provider. We have found a strong consumer appetite for broadband-only service that does not require bundled services, like television and phone, or long-term contracts.

Starry also continues to prioritize the customer experience as part of its market test. In all of our markets, Starry takes a white-glove approach to installations and customer care, with the aim of reducing customer frustration and increasing customer happiness. Today, Starry has a 4.95-Star Rating (out of 5 highest possible) for all installations and our overall Net Promoter Score is 71.[8] Starry continues to refine and improve its customer installation process with a goal of maintaining 100% customer satisfaction.

Market Status

Updated February 3, 2019

Market	Status
Boston, MA	Customer operations. Continuing to expand network footprint across the metro area.
Los Angeles, CA	Customer operations. Continuing to expand network footprint across metro area.
Washington, DC	Customer operations. Continuing to expand network footprint across metro area.
New York Metro	Customer operations. Continuing to expand network footprint across metro area.
Denver, CO	Customer operations. Continuing to expand network footprint across metro area.
Cleveland, OH	Base station site construction complete.
Chicago, IL	Base station site acquisition in progress.
Houston, TX	Base station site construction complete.
Dallas, TX	Base station site construction complete.
Seattle, WA	Base station site construction complete.
Detroit, MI	Base station site construction complete.
Atlanta, GA	Base station site construction complete.
Indianapolis	Base station site construction complete.
San Francisco, CA	Base station site acquisition in progress.
Philadelphia, PA	Base station site construction complete.
Miami, FL	Base station site construction complete.
Minneapolis, MN	Base station site construction complete.
Memphis, TN	Base station site acquisition in progress.
Sioux Falls, SD	Base station site acquisition in progress.
Manchester, NH	Base station site acquisition in progress.
Portland, OR	Base station site acquisition in progress.
Phoenix, AZ	Base station site acquisition in progress.

[8] Net Promoter Score is a measure on a scale -100 to 100 of customers' willingness to recommend a product or service. One of the largest publicly available sources puts the Net Promoter Score for ISPs on average at 0. *See* https://npsbenchmarks.com/industry/telecommunications/internet-service-provider.

In Starry's previous Progress Report, we detailed three critical data points that have emerged about the Starry subscriber:

1. Consumers increasingly demand affordable broadband-only services without unnecessary bundles.
2. Data consumption is rapidly increasing with consumption driven by the continued rise of streaming television options and the mass adoption of 4K televisions.
3. Customers do not exhibit a strong demand for gigabit broadband, and instead are more conscious of price and received broadband speeds.

While these three data points continue to be consistent among our growing customer base, we also observe the following themes:

1. **Data consumption is rising even faster than we anticipated.** Starry's customer base is comprised primarily of "cord cutters" – consumers who have actively decided they do not want bundled services from their incumbent provider. As such, they tend to be heavy consumers of over-the-top video and other streaming services. However, the increase in data consumption has outpaced even our expectations. The average Starry customer consumes more than 350 GB/month, the top 5% consumes more than 750 GB/month and the top 1% consume more than 1.2TB/month. We see the impact of 4K TVs and other data-hungry, high-consumption applications increasing usage every quarter and expect it will only accelerate. This rate of data consumption makes our no-data caps policy relevant to consumers, particularly as incumbent providers implement data caps nationwide. Further, it highlights the importance of Fixed Wireless versus the de-minimis high-speed data caps offered by mobile operators in their "unlimited" plans.
2. **Symmetry and latency are increasingly important to consumers.** A large survey of our customers revealed that *more than two-thirds* "sometimes or always" work from home, and that symmetrical, low-latency connections are important to support seamless video conferencing and other applications that require robust download and upload capacity. We expect this to increase in importance as the overall workforce trend continues to evolve towards more flexible work arrangements.

3. **Privacy protections are important to our users.** Privacy has arisen as a key concern of our users. Starry has taken a proactive and aggressive approach to privacy, creating clear and easy-to-understand policies for our customers. We make clear that: we do not sell data to any third-party about our users; we do not perform deep packet inspection and we do not look at or keep user browsing data; and we only collect the data we need in order to provide our customers with excellent service. These three simple tenets have strong resonance with our customer base.
4. **Broadband remains financially out of reach for many and we have found real estate partners eager to help close the digital gap.** Affordable broadband options for residents of affordable housing (housing subsidized by city, state or federal funding) are few and are often burdened with complex eligibility requirements that make adoption near impossible. We have found private owners of affordable housing willing to help bridge that divide by partnering with Starry to provide low-cost access in bulk (via Starry Connect, see section IV) to their residents. By providing 'always on' broadband access in an apartment, as they would water or electricity, our real estate partners are removing a critical barrier to broadband adoption for their residents. Starry has agreements with several large affordable housing portfolio owners to rollout bulk service to their residents. Starry is taking a unique and innovative approach to addressing the digital divide that incentivizes the landlord, not the internet service provider, to expand broadband adoption to underserved communities.

c. MDU Market: Challenges and Opportunities

As Starry expands its network presence across multiple cities under its experimental license, we continue to learn firsthand the challenges and opportunities in a broadband marketplace that has long been dominated by few incumbent providers. In our second Progress Report, we noted that individual consumers and property owners/managers overwhelmingly crave broadband choice. Starry is championed by residents and landlords who see the value in having an alternative internet provider in their MDU building. And, property owners increasingly view having multiple broadband providers as a value-add to their

buildings, and they market it as an amenity to prospective tenants. We also noted that building owners/managers are often intimidated by incumbent providers into blocking new service providers from entering their buildings. And lastly, that the use of "exclusive marketing agreements" is widespread and today, in practice, act like exclusive access agreements, significantly hindering the ability for new entrants to provide broadband service to residents of MDUs, to detriment of residents.

Much of what was detailed in our prior Progress Reports remains true. Gaining access to MDUs is not impossible, but it is challenging when incumbent building service agreements are designed to incentivize building owners/managers to keep out competition and/or make serving the building cost-prohibitive for new entrants. Starry has found the key blockers to serving MDUs to be:

1. **Exclusive marketing agreements, revenue share and "door fee" arrangements.** Starry has found that 100% of MDUs with 50 or more rental units have exclusive marketing agreements and/or revenue sharing or door fee agreements in place with an incumbent internet access provider. Exclusive marketing agreements are often coupled with revenue sharing schemes or a "door fee" arrangement and together, significantly hinder new entrants from serving these buildings. Exclusive marketing agreements, in practice, act like the exclusive access agreements that are prohibited by the FCC in the 2007 *Exclusive Service Contracts Order* and the 2008 *Competitive Networks Order*.[9] Many of these agreements contain overly restrictive language that often leaves building owners and managers with the impression that they cannot enable competitive services in their buildings, and if they do, they will face litigation from the incumbent.
2. **Exclusive wiring agreements.** In new construction communities, Starry is encountering MDUs that have entered into exclusive wiring agreements with the incumbent service provider. These agreements enable the incumbent provider

[9] *Exclusive Service Contracts for Provision of Video Services in Multiple Dwelling Units and Other Real Estate Developments*, MB Docket No. 07-51, Report and order and Further Notice of Proposed Rulemaking, FCC 07-189 (rel. Nov. 13, 2007); *Promotion of Competitive Networks in Local Telecommunications Markets*, WT Docket No. 99-217, Report and Order, FCC 08-87 (rel. Mar., 21 2008).

exclusive use of 'homerun' lines in the building (for terms of 10-15 years or more) if the incumbent assumes the cost of pulling and wiring fiber or coax through the building. The property developer often does not make provisions for neutral wiring; the net result is effectively an exclusive service agreement for the incumbent provider and a captive consumer base that has no say in who provides their internet access.

3. General lack of understanding of prohibition on exclusive service agreements. In many cases, the incumbent provider may smartly not sign an exclusive service agreement, but will leave the building owner/manager under the impression that they do in fact have the exclusive right to serve the building. In our experience, many building managers do not understand that exclusive service agreements are prohibited by the FCC and become intimidated when they receive cease and desist letters from incumbent providers that overstate the legal restrictions in the marketing or revenue share agreements. The mere threat of litigation or potential for litigation is an effective deterrent for building owners/managers from aggressively pursuing broadband alternatives for their residents. Additionally, building owners/managers have raised concerns about potential retaliation or decrease in service quality from incumbents, should they enable competitive services into their buildings. All of this in the aggregate creates a challenging environment not just for Starry, but for any provider wishing to enter the market and compete head-to-head with incumbents.

Starry is fortunate to have an experienced sales and operations team, and the resources to invest to meet these challenges head on. And while these conditions pose significant challenges to expanding our deployment, our teams continue to find creative ways to engage residents and MDU owners and managers. Starry has also struck partnerships with large national real estate owners who understand the value of offering their residents competitive broadband alternatives. However, in some cases, our teams cannot overcome the challenges posed by these exclusive marketing or wiring agreements and a building may go unserved.

IV. Starry Connect: Addressing the Digital Divide

The FCC has identified closing the digital divide as one of its top priorities.[10] By implementing policies that will encourage the deployment of competitive broadband networks, the Commission has rightly posited that it will result in an increase in broadband adoption in communities where adoption today is low. Starry has made a commitment to find creative and innovative ways to address the digital divide in communities where we have a presence.

Launched in August 2018, Starry Connect is a program aimed at providing a variety of free and low-cost internet access solutions for public and affordable housing communities. From building common area WiFi access to monthly, low-cost access plans, Starry Connect offers simple, easy-to-understand and use plans for residents in public or subsidized affordable housing, through partnerships with cities, states and owners of affordable housing properties.

Today, incumbents offer affordable internet access plans to low-income communities, but those plans often don't offer fast enough speeds to qualify as broadband,[11] and as a result can exacerbate digital inequities. These plans also have a complicated web of eligibility requirements that make it difficult for low-income families to apply for and utilize existing affordable internet offers. All require participation in a patchwork quilt of federal programs and households can become ineligible for affordable plans if they stop receiving certain federal benefits or if the qualifying child receiving benefits ages out of a program. These plans also require that the subscriber not be a prior customer of the incumbent provider (which is virtually impossible in single-provider markets) and some require mandatory credit checks. The barriers to accessing these low-cost offers are impossibly high for most families.

Starry Connect takes a different approach. Last year, Starry announced a partnership with Related Companies, the nation's largest private owner of affordable housing, and our plans to serve their portfolio of 45,000 affordable units nationwide. In spring 2019, we will be launching the first of Related's affordable communities and offering their residents a

[10] *See 2018 Broadband Deployment Report.*

[11] *EveryoneOn*, *Low-Cost Internet Service and Devices,* https://www.everyoneon.org/lowcost-offers

$15/month broadband plan for 30 mbps download/upload speeds with no data caps, no additional equipment fees and no arduous eligibility requirements. The only eligibility requirement is to live in a building being served by Starry Connect. Starry is working with Related and other affordable housing owners to provide broadband access on a bulk basis to residents – erasing the most significant barrier to broadband adoption, the connection to the home.

Starry also recently launched a pilot program with the Boston Housing Authority to provide their communities with free common-area WiFi and desktop computers for resident computer labs. Both programs have been eagerly and warmly received by tenants and we look forward to expanding our partnerships as we grow our footprint across markets.

V. Looking Ahead: 2019 and 2020

Starry's work developing next generation, pre-standard 5G technologies has been groundbreaking to date, but we believe that the technology will benefit from additional iteration, testing, and innovation and we will continue to devote resources to research and development over the next two years.

Starry has taken a thoughtful and considered approach to security around our supply and manufacturing chain. The issue of 5G technology security has risen into the public discourse recently. However, Starry has been contemplating these issues for the past three years and has made critical manufacturing and supply chain decisions, all with an eye to protecting not just our intellectual property, but the security and integrity of our telecommunications stack. Starry has taken the following approach:

- We do not use networking equipment or software from Chinese sources as a matter of policy.
- We have never had all of the components of our telecommunications stack manufactured in one location. Rather, we utilize multiple overseas vendors (that do not share ownership) to manufacture the components of our system. We then ship those components to the United States and use American manufacturers to complete the final process.

- We do not buy any radio technology from Chinese manufacturers. (We work with U.S. companies such as Quantenna, Marvell, Qualcomm and Broadcom.)

Protecting the integrity of our telecommunications technology is critical to Starry and we will continually evaluate and invest resources to ensure we do everything possible to protect our intellectual property and the security of our systems.

In 2019, Starry will also focus our engineers and deployment teams on how to best provide coverage away from the urban core and deeper into suburban environments. That is, to provide high-quality, reliable service to both single family homes and also very small multi-dwelling units (2-3 units) in suburban areas, in particular areas that may be constrained by less availability of high sites (vertical assets) and more below vegetation canopy coverage.

VI. Conclusion

Millimeter wave spectrum offers enormous opportunity to expand broadband access and competition, and Starry continues to prove, through its innovative technology approach and ability to deploy a working network, the great promise of these bands. The opportunity to continue to test, characterize and provide service in these bands through the FCC's market test authority license provides valuable data and the validation necessary to continue our investment in developing the next generation of 5G communications technology. It also provides market confidence in the for further development and capital investment in building the 5G networks of the future. We thank the Commission for its continued support in enabling innovation to flourish in the public interest.