Broadband Mapping: Challenges and Solutions

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Chairman Wicker, Ranking Member Cantwell, and Members of the Committee, thank you for the opportunity to testify about how to base policy decisions to close the digital divide on reliable broadband mapping data.

I am testifying on behalf of Competitive Carriers Association ("CCA"), the nation's leading association for competitive wireless providers. CCA is composed of nearly 100 carrier members ranging from small, rural providers serving fewer than 5,000 customers to regional and nationwide providers serving millions of customers, as well as vendors and suppliers that provide products and services throughout the wireless communications ecosystem.

It is an exciting time in the wireless industry, as mobile connections are powering new technologies to revolutionize entire industries and improve consumers' quality of life across the United States. Specifically, wireless technologies enable telemedicine services and remote patient monitoring, which increases patients' access to medical care, particularly in rural areas. Precision agriculture enables farmers to increase yields while conserving resources. Distance learning brings the latest lessons and training programs to students, allowing them to access educational opportunities previously unimaginable. Today's wireless services also enhance public safety, economic growth, and opportunities for all Americans.

As impressive as existing wireless networks can be, 5G will supercharge existing services like telehealth and precision agriculture and enable new services, such as augmented and virtual reality, autonomous vehicles, and other innovations not yet invented. As these technologies develop, it is imperative to provide access and expand wireless services, or rural areas will be left behind, on the wrong side of the digital divide.

Today's hearing is both important and timely: we cannot close the digital divide if we do not know the size and location of our country's existing coverage gaps. Reliable data is necessary to

determine where mobile broadband coverage does and does not exist. It also is important to understand that measuring fixed wireline broadband availability is a separate and distinct challenge from reliably measuring mobile coverage.

CCA commends this Committee for its steadfast, bipartisan work to create reliable mobile broadband coverage maps. These efforts include not only statements and hearings, but also a steady flow of letters expressing concern to the Federal Communications Commission ("FCC") and enacting laws to take steps to improve data, including the Rural Wireless Access Act and the Precision Agriculture Connectivity Act.

Members of Congress know from hearing from your constituents and travelling across your states that the representation of coverage in your states is overstated - and, in some cases, substantially so. While significant efforts to update coverage maps will take place at the FCC, agencies across the government should work in coordination to produce the most reliable coverage maps possible. For example, the Department of Commerce's National Telecommunications and Information Administration should continue its ongoing efforts to refresh the national broadband map and the Department of Agriculture should base rural broadband funding programs on improved data.

CCA and our members stand ready to work with Congress, the FCC, the Administration, and all stakeholders to create reliable coverage maps to appropriately guide policymakers as work continues to preserve and expand mobile broadband coverage. With our nation on the precipice of a major technological change, the stakes are too high for anything less than our best efforts.

From Form 477 to the Mobility Fund Phase II Data Collection

Historically, the FCC's Form 477 has served as the principal tool to determine the availability of communications services and to guide the FCC's policymaking, and is intended to represent where consumers should expect to receive mobile broadband services at the minimum speeds advertised by

providers. The FCC has an ongoing proceeding to update the Form 477 to improve the data and to eliminate unnecessary filing requirements. As recently as last December, the FCC used Form 477 data to report that "approximately 100% of the American population lives in geographical areas covered by mobile LTE with a minimum advertised speed of 5Mbps/1Mbps." This figure does not match Congress' or consumers' on-the-ground experience. Once work is complete to develop reliable maps to determine eligible areas for Mobility Fund Phase II ("MF II"), lessons learned from the MF II experience can guide ongoing updates to Form 477.

MF II is proposed to disburse $4.53 billion over ten years to preserve and expand 4G LTE service in areas without an unsubsidized LTE provider. Acknowledging that using Form 477 to determine eligible areas for MF II would prolong any challenge process, the FCC decided to undertake a new, one-time data collection to determine areas initially eligible for MF II support. To the FCC's credit, this one-time data collection included specific parameters, namely requiring carriers to report where they provide 4G LTE service with download speeds of 5 Mbps with 80% cell edge probability and a 30% loading factor. But evidence supporting final determinations for areas eligible to receive MF II support must be clear, rigorous, and above all, reliable. While any steps to standardize the data should be commended, we now know that the parameters selected did not sufficiently improve the accuracy or credibility of the resulting coverage maps, which continue to dramatically overstate coverage in several states – especially in rural states. Areas where coverage was overstated, absent a successful challenge, would be ineligible for support to preserve and expand mobile broadband for a decade.

The MF II Challenge Process Is Overly Burdensome and Insufficient to Correct Flaws

On February 27, 2018, the FCC released a 53-page public notice explaining how the MF II challenge map would be generated, the procedures for filing a challenge, and how the FCC would process challenges. With the benefit of hindsight, it is now apparent that the complicated process

prevented the FCC from substantially improving its initial map of eligible areas. As a bipartisan group of eleven Senators wrote to the FCC last month, "The Challenge Process for MF-II was aptly named because collecting and submitting information for the FCC maps was, indeed, a challenge." Here are the basic steps a challenger was expected to undertake:

- Download mapping data from the FCC's portal;
- Compare the FCC's data to all available information about every carrier offering service in an area. If that research leads a challenger to conclude that the FCC's map is inaccurate because of other evidence, then it must conduct drive tests and submit the results to the FCC for consideration;
- A challenger may challenge the FCC's map, one square kilometer at a time. In other words, a challenger must demonstrate the absence of coverage in each one square kilometer block throughout an area. To provide some perspective, many rural areas that could be challenged have thousands of square kilometer blocks that must be separately analyzed to determine whether any carrier is providing service;
- For each individual square kilometer block, speed tests must be conducted no further than 800 meters apart from one another, and done between 6:00 AM and 12:00 AM local time;
- The tests must include all unsubsidized wireless companies claiming coverage inside that block;
- Only certain handsets, specified by and purchased from each operator claiming coverage in the area, may be used;
- A challenger must subscribe to rate plans and constantly monitor usage to ensure service is not throttled or subject to data caps, which could bias the tests and collect unusable test results;

- A challenger must purchase, mount and calibrate test equipment on one or more test vehicles, or hire a testing company to perform the tests;
- If a challenger does the testing, it must train up testing teams and take them away from their work building and maintaining a network for two or more months;
- GPS tracking equipment must be purchased so that the testers understand where the vehicle is in relation to the one square kilometer blocks eligible to be challenged, and so tests get conducted at the required locations inside the blocks, that is, at the minimum distance separation of 800 meters;
- Since the FCC's rules require a challenger to demonstrate lack of coverage in 75% of the grid being challenged, only grids with accessible roads that can be driven by a normal vehicle can be challenged. Vehicle-based drive testing must be done on drivable roads, which in rural areas can be far apart or otherwise inaccessible due to private or public restrictions, seasonal closures, or other factors. This is a significant limitation; indeed, some CCA members report that up to half of the rural blocks do not have enough drivable roads to meet the FCC's 75% benchmark. So, if a carrier claims coverage, there can be no challenge;
- For each test, a challenger was required to submit: (i) all speed test measurements collected during the relevant time frame, (ii) signal strength and latency, (iii) the service provider's identity, (iv) the make and model of the device used (which must be from that provider's list of pre-approved handsets), (v) the international mobile equipment identity (IMEI) of the tested device, (vi) the method of the test (i.e., hardware- or software-based drive test or non-drive test app-based test), (vii) if an app was used to conduct the measurement, the identity and version of the app, (viii) the identity and location of the server used for speed and latency testing;

- While challengers bear the burden of proof, challenged carriers do not need to provide drive tests to rebut. In lieu of drive testing, challenged carriers may submit data from transmitter monitoring software that could show geolocated, device-specific throughput measurements and other device-specific information, along with certifications from an engineer. Producing this level of rebuttal evidence is easier to do than drive testing.

To provide some perspective on how daunting this challenge process was, one of CCA's small carrier members undertook to analyze 165,000 separate square kilometer blocks within its service area that it believed could possibly be incorrectly labeled as "covered." That company tested several thousand blocks, but had nowhere near the resources needed to test a substantial portion of the blocks that appeared to be worth a challenge. One of our larger members spent over $2 million to hire a testing firm that completed tests in 20 states and challenged 37,000 one square kilometer blocks. Even with this resource allocation, the member completed testing in less than 5% of the carrier's overall rural footprint.

The takeaways from this process for challengers are: (i) the process was so complicated and expensive that challengers large and small were never able to challenge all of the areas they wanted to, and (ii) in any area where the FCC ***incorrectly*** showed unsubsidized coverage; absent a successful challenge, there could be no investment of universal service support. Without eligibility for support, unserved people living in those areas could wait over a decade or more before having another opportunity to access mobile broadband services that are reasonably equivalent to services found in the nation's more densely-populated regions.

FCC Investigation

Despite these problems, entities provided the FCC with 20,809,503 speed tests to challenge claimed coverage. In December 2018, FCC Chairman Pai announced that a preliminary review of the data filed through the challenge process suggested that the preliminary maps were an inadequate basis to distribute MF II support, and launched an investigation into the data while suspending the next step of the challenge process. CCA appreciates the FCC's continued focus on ensuring that it has reliable data before allocating limited support resources. The FCC should use the investigation to understand and rectify overstated coverage figures, and take steps to improve the next mobile coverage data collection. While the investigation may uncover additional concerns, various stakeholders confirm that the lack of a more robust standardization of parameters for the one-time data collection was a critical error that should be addressed.

Improved Standards Produce More Reliable Data

Policymakers should apply a specific set of factors to standardize data collection, better understand carriers' broadband coverage, and produce more reliable maps. It is important to keep in mind that no model will 100 percent reflect on-the-ground coverage. That said, steps should be taken to further standardize modeled coverage. At a minimum, a detailed Radio Frequency Link Budget submission should include the following:

- Signal Strength. Standardizing the Reference Signal Received Power ("RSRP") will base measurements on the same real-world measurements that wireless networks use to determine cell selection and handover, among other network functions. As current Form 477 filings show, these results can be subjective and vary by equipment vendor and network design. A weaker RSRP means that the coverage area is larger but that the actual coverage is less reliable at the cell edge. Also, a weaker RSRP threshold translates to more path loss allowed between the base station and the mobile. It is therefore imperative that all carriers

report a standard RSRP level. In rural areas where sites are isolated, the coverage area doubles with a 5 dB increase in the Maximum Allowed Path Loss for a single site. For 4G LTE specifically, a -85 dBm RSRP level per 5 MHz channel would reflect excellent coverage, while a signal strength of no lower than -105 dBm per 5 MHz channel would reflect the type of reliable signal strength that consumers expect. In contrast, a -120 dBm level per 5 MHz channel could register that a consumers' device is connected to LTE service, but in reality, provide for a poor connection that fails to support many applications or functions.

- Cell Edge Probability. Cell edge probability determines the likelihood that the minimum speed will be possible at the furthest point from the base station. From data collected during the ongoing MF II process, it is evident that an 80 percent cell edge probability drastically overstates coverage capabilities. The FCC should revisit this parameter and adopt a cell edge probability of 90 percent or higher, as proposed by several industry stakeholders, including those representing the largest nationwide wireless carriers as well as those providing service across rural and regional areas of the United States. It is worth noting that the industry standard for commercial operators is to design their networks for at least 90% cell edge probability, and public safety typically designs to 95%. In a rural site, using 80% extends the cell radius by about 27% and increases the "covered" area by about 60%. This additional 60% could represent hundreds of square kilometers of additional "coverage" per site that is mostly insufficient to support reliable service.
- Cell Loading. Cell loading determines the extent to which available resources from a given base station may be used by consumers while providing minimum coverage speeds. In the MF II proceeding, the FCC directed reporting providers to evidence a 30% load factor, which failed to accurately reflect network use in rural areas. As Verizon has previously highlighted,

network loading in at least one rural region in Oklahoma often exceeds 30 percent. In fact, because rural Americans are often more dependent on mobile broadband service for internet access than their urban counterparts, one CCA carrier member reports that its rural sites utilizing high-quality, low-band spectrum routinely experience average cell loading well in excess of 50 percent in the evening hours. In rural areas, coverage is typically provided by low-band spectrum, which has limited capacity compared to higher frequencies, and as a result, these sites are often prone to being heavily loaded. The FCC should revisit this parameter and adopt a cell loading factor of at least 50 percent on the downlink, or higher, to reflect the reality that consumers in rural areas are more likely to rely on their mobile connection for their primary or only internet connection.

- Clutter Factors. Clutter factors include environmental features such as structures, trees, vegetation, topography, or other objects that affect propagation of a signal from a base station. With varied geographic features across the country, clutter factors should match local environments but also must be appropriately standardized across reported coverage areas. Submissions for clutter factors also should include clear indications of the precise loss values assigned to the clutter and feeder type.

A variety of other factors also form the foundation upon which a robust Link Budget is based; however, standardizing the bottom-line factors listed above will produce substantially more reliable maps and reduce the need to expend additional resources to correct data collection flaws.

Connectivity for millions of Americans living in rural areas depends on policy decisions that are based on reliable, real-world coverage data. Armed with improved and more reliable broadband mapping, policymakers can connect all Americans and lay the groundwork for the expansive impact that

the latest broadband technologies promise for all consumers. And if designed correctly, a robust data collection will promote the inclusion of rural and Tribal communities in today's digital economy. Thank you for your ongoing leadership on this critical issue and for holding today's important hearing. I welcome any questions you may have.