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The Honorable Anna Eshoo

1. **You stated in your testimony that "the overwhelming advantage of AT&T and Verizon" in having spectrum located below 1 GHz means a "long, slow slide to duopoly." Can you elaborate on what you mean by that?**

Lowband spectrum provides unique advantages. In particular, lowband spectrum penetrates buildings and other natural obstacles. In densely populated urban areas, lowband spectrum allows carriers to reach subscribers inside buildings and deep in the "concrete arroyos" of modern streets. In more rural areas, the ability lowband spectrum to penetrate foliage and curve around terrain makes the cost of rural deployment significantly lower and enables the carrier to remain in contact with the subscriber.

In the absence of lowband spectrum, competitors are unable to provide reliable "always on" service in urban and rural areas comparable to that of AT&T and Verizon. In addition, the lack of lowband spectrum drives up the cost of network depoloyment. While there are some technical tricks that can help to compensate for this disadvantage, they require both significantly more higher band spectrum, combined with significant and expensive changes in network architecture. Even then, however, the advantages of lowband spectrum cannot be entirely overcome.

Because competing carriers cannot offer a network as reliable as that of AT&T and Verizon with their abundance of lowband spectrum, the competing carriers must offer their service at a lower price. But the absence of lowband spectrum actually increases the cost of deployment. This creates an inherently unsustainable situation, which must result in AT&T and Verizon steadily buying out their competitors and further increasing their advantage until no competitors remain.

2. **In July, West Virginia University became the first university in the country to use "TV White Spaces" to deliver wireless broadband service across their campus. Without a nationwide block of unlicensed spectrum under 1 GHz, do you believe universities in dense urban areas like San Francisco or New York could offer such innovative services to their students and faculty?**

I do not believe it is possible for colleges and universities to offer such innovative services without a nationwide block of unlicensed spectrum under 1 GHz. As discussed above in response to Q1, lowband spectrum has unique physical properties that make it ideally suited to mobile broadband, particularly in urban areas. The limited range and

inferior propogation characteristics of other unlicensed bands – including the 5 GHz now under consideration for unlicensed – do not enable services such as these in urban areas because these frequencies cannot penetrate buildings.

Even in rural areas, higher frequency would make it difficult or impossible for colleges and universities to offer such services. Higher frequencies experience "tree fade," degradation of the signal when passing through foliage. For the same reasons that lowband spectrum is critical to competition in the licensed space, lowband spectrum is equally critical for innovation and affordable service in the unlicensed space.

In addition, what is critically important about "unlicensed spectrum," as opposed to spectrum licensed for exclusive use, is that it is open for innovation by anyone, and free for anyone to deploy whatever equipment is certified by the FCC, for any purpose. By contrast, licensed spectrum is under the exclusive control of the licensee.

The result is that unlicensed allows for innovation, particularly of general use technology like WiFi and TVWS. Once these become available to the public, economies of scale make the equipment for deployment increasingly affordable, driving further innovation.

What is critical, however, is that the spectrum be available on a ***national*** basis to enable economies of scale. If unlicensed spectrum is not available on a national basis, particularly in urban areas where most potential customers live, it is impossible to develop economies of scale. Indeed, in the absence of urban markets, it may be practically impossible to attract development at all. But even if development occurs for specific uses, the limited number of markets assures that equipment would be far too expensive for colleges and universities to deploy innovative services.

The evolution of traditional Wi-Fi illustrates both the evolution of a general purpose application on unlicensed spectrum and the need for a national band to promote economies of scale. The FCC opened the first unlicensed bands in 1989, primarily for devices such as garage door openers and remote control devices. As the Internet revolution grew in the 1990s, it became clear that wireless networking would have enormous benefits. Because unlicensed spectrum was available for use without permission on a national basis, the IEEE developed the protocos for Wi-Fi on these bands. Chip manufacturers began incorporating the new Wi-Fi into devices for wireless networking at a time when in the licensed space economic factors drove carriers – and therefore wireless equipment makers – to focus exclusively on voice. The proliferation of chips for laptops and printers drove down the price, making Wi-Fi affordable for home use. As chips became ever cheaper because of the economies of scale, people found more innovative uses for them. This virtuous cycle was only possible because the national availability of a block of unlicensed spectrum allowed manufacturers to make products they could sell anywhere in the country to anyone.

Contrast this to the more limited 3.65 GHz band, the "licensed lite" band used primarily by wireless Internet service providers (WISPs). It had been hoped that in addition to higher-power equipment for WISP use, manufacturers would put lower-power chips in

laptops to repeat the virtuous cycle of Wi-Fi. But the 3.65 GHz band has large exclusion zones to protect certain users. As a result, no one can use 3.65 GHz in the Northeast, along the West coast, or in the Great Lakes region. Without access to the largest markets in the United States, device manufacturers have had no interest in developing chips for lower-power mobile 3.65 GHz use. Rather than evolve as a general purpose technology, the 3.65 GHz band has remained limited primarily to rural WISPs.

The future of the TVWS in the United States, for colleges and universities and everyone else, depends on the availability of a sufficient national spectrum block open for TVWS. Happily, with proper planning, this can be achieved.

<u>The Honorable Henry Waxman</u>

1. **The FCC has been criticized by NAB and AT&T for putting out a public notice seeking additional comment on band plans because it seemed to be ignoring an "industry consensus" on what the band should look like. Do you agree that there is a consensus band plan?**

There is no consensus plan. To the contrary, while many commenters have expressed criticism of certain proposed plans, there is no consensus around an actual band plan. This criticism of the FCC is entirely unjust and seems to derive from some confusion over the FCC's proper steps to comply with Administrative Procedure Act and develop a more complete record.

In the Public Notice seeking further comment on the Band Plan ("Band Plan Public Notice") issued by the Wireless Bureau on May 17,[1] the Bureau noted certain limited points of common agreement among the majority of commenters. Specifically, as the Public Notice clearly stated, there was widespread criticism of the initial plan proposed in the Notice of Proposed Rulemaking.

The Band Plan Public Notice then observed that while there had been widespread criticism of some aspects of the initial plan, there was no consensus around a specific plan. The Band Plan Notice described certain positions from different commenters, including those of NAB, those of AT&T and Verizon, and those of competitive carriers such as Sprint and T-Mobile, rural carriers, and others. The Band Plan Notice also recited certain concerns on the part of staff in light of certain physical characteristics of the spectrum. The Band Plan Notice therefore sought comment on several new proposals.

[1] Public Notice, "Wireless Telecommunications Bureau Seeks to Supplement The Record On 600 MHz Band Plan," GN Docket No. 12-268 (May 17, 2013) available at: http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0517/DA-13-1157A1.pdf

NAB, AT&T and others criticizing the Notice appear to have either mistaken this for an effort to rehabilitate the original proposal in the Notice of Proposed Rulemaking – which it clearly was not – or were seeking to browbeat staff into accepting their proposed band plan. But to claim that staff ignored a "consensus band plan" is simply false to fact.

Consensus around what elements of the initial proposed band plan the majority of carriers *reject* is not the same thing as consensus *for* a specific band plan. The Band Plan Public Notice clearly acknowledged the negative consensus, and also properly acknowledged there was no affirmative consensus for a specific band plan.