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**The FCC Is Poised to Achieve a Major Milestone Advancing 5G Wireless Services**

by

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**Introduction and Summary**

Summer in Washington, D.C. in a presidential election year can be a slow time, at least with regard to communications policy. But this summer is an exception. For instance, Federal Communications Commission Chairman Wheeler has scheduled a Commission vote to allocate so-called millimeter wave or high band spectrum for 5G wireless. If actually adopted, the item would be an important milestone in the United States' efforts to plan for and implement 5G services, which is expected to be offered as early as 2020.

Chairman Wheeler decided to propose proceeding to an allocation of additional spectrum without further study on how 5G is to be deployed in the U.S. This is a wise market-oriented decision that is somewhat uncharacteristic of the current Administration and FCC. So, it is a decision to be heartily applauded. The FCC should be cautious, however, that its efforts are not undermined by (1) failing to move rapidly to an auction and actual deployment; (2) maintaining unworkable spectrum sharing arrangements; or (3) manipulating the auction procedures or spectrum screens that skew competition.

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CTIA President Meredith Baker in June [identified](#) the many varied benefits that 5G wireless can provide to the nation. CTIA has indicated that 5G wireless networks can speed up mobile broadband, increase capacity for billions of new Internet of Things (IoT) devices, and reduce latency, or the time it takes for Internet messages to be received and responded to. Given the exploding consumer demand for wireless capacity documented in the body of this paper, CTIA appears to be correct that it is urgent for our government to begin the process of finding and reallocating more spectrum for 5G services, not only to accommodate projected demand, but also to maintain the U.S.'s substantial lead in wireless deployment and innovation. If sufficient high band spectrum is made available, the expansion of 5G promises to produce massive consumer welfare improvements as well as economic growth in terms of GDP, jobs, and investment.

Although the FCC would be meeting an important 5G milestone by allocating high band spectrum to meet the documented projected demand, to date the Administration has been lagging in its progress of meeting the Administration's goal of deploying 500 MHz of wireless spectrum below 6 MHz. NTIA claims that "substantial progress" has been made. But two important spectrum initiatives, making available 3.5GHz spectrum and completing a successful broadcast incentive auction, still have too many uncertainties associated with them to be categorized as part of the "substantial progress." What is more, the Brattle Group last summer concluded that with increasing mobile demand, the U.S. is now about 350 MHz short of the need for more below-6-MHz spectrum.

The Senate's bipartisan MOBILE NOW Act also advances the 5G effort. Its main provisions include: (1) a mandate that the Administration's wireless spectrum allocation goals be met by the end of 2020; (2) a feasibility study for reallocating six specified bands above 24 GHz by the end of 2017, (3) a feasibility study for commercial-government sharing of spectrum between 3.1 and 3.5 GHz and between 3.7 and 4.2 GHz; (3) provisions to speed deployment of communications infrastructure on federal property; and (4) an NTIA report making recommendations to Congress that would provide incentives to federal agencies to relinquish or share the spectrum they use.

Despite these laudable efforts, however, the Senate may be settling for less than is desirable, perhaps because of demands from either the Administration or congressional Democrats. The legislation, hopefully through the amendment process, can be improved in at least the following respects: (1) by imposing a deadline on actual reallocation of millimeter wave spectrum; (2) by establishing effective incentives for government to vacate unneeded spectrum and ensuring the use of modern technology; and (3) by imposing a firm deadline for federal agencies to grant access to government lands for building out infrastructure.

All this said, Chairman Wheeler's efforts to have the FCC allocate additional high band spectrum for wireless broadband use should be applauded. Hopefully, both Congress and the Administration can build upon the FCC's achievement by enacting a rare bipartisan success story with MOBILE NOW.

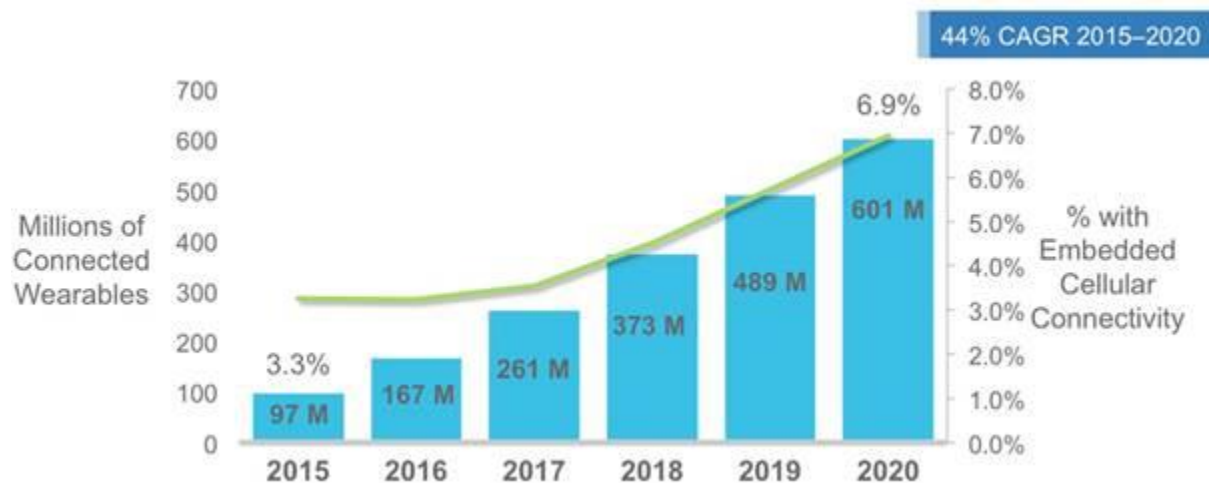
## More Spectrum Is Needed for Wireless Services

This year, interest surrounding 5G services has become a frequent topic of conversation. Ms. Baker rightly indicates that government must focus on allocating spectrum for 5G so that the United States can maintain its global lead in developing wireless services.

A June [White Paper](#) released by CTIA is just one of many studies that describe the growing interest in the IoT. The paper points out that 5G will enable faster broadband, produce more capacity, and decrease latency. 5G promises to make mobile broadband networks have greater throughput, up to 100 Mbps at peak rates. These 5G networks will be able to support more devices than before, which is what the IoT is all about, perhaps 100 times as many as are supported now. They will provide from five to ten times lower latency, or the time it takes for an Internet message to be sent and a response received, than the current approximately 50 millisecond latency today, increasing the types of uses to which mobile services can be put.

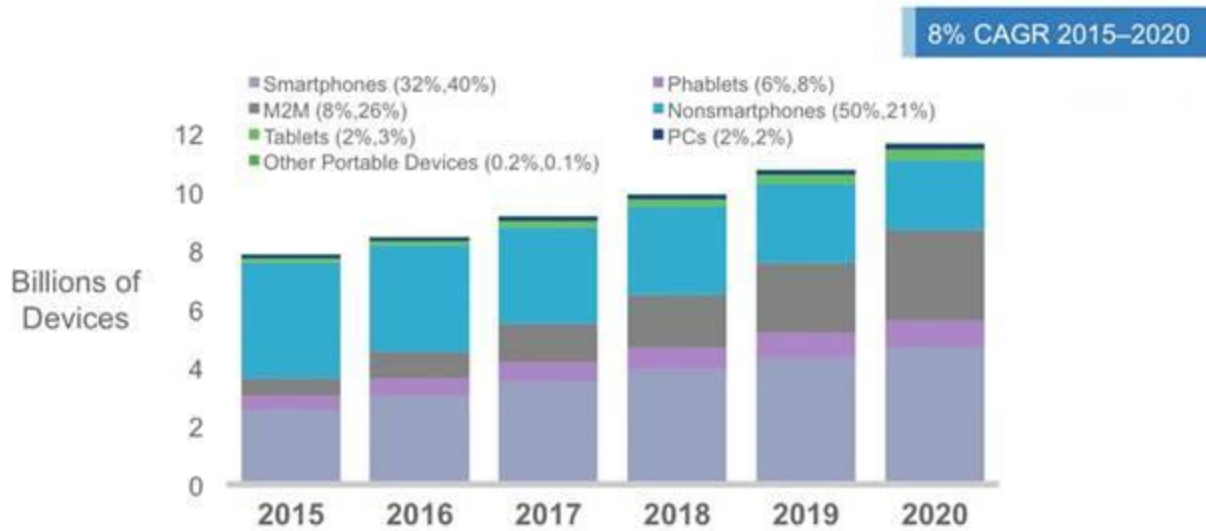
The white paper expands on the types of services that could be supported by 5G, such as vast improvements in remote medical diagnostics and health management, access to video, even at higher future qualities of 4K and 8K video, infrastructure monitoring such as transportation information, energy consumption, public safety, wearables, as well as real-time videoconferencing. This is not even to mention the numerous business and manufacturing uses that have yet to be specifically conceived.

Consumer demand for wireless broadband use has been exploding. For instance, in February 2016 Cisco, in one of its respected mobile service [reports, projects](#) that wearable devices are estimated to increase to 600 million by 2020:



Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020 White Paper, Figure 17 (Feb. 2, 2016).

DHL and Cisco's current [estimate](#) is that there will be 50 billion connected devices worldwide by 2020. Even the wireless communications devices that Cisco currently tracks will increase substantially:



Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020 White Paper, Figure 4 (Feb. 2, 2016).

In Senate testimony delivered in February 2015, Mercatus Center Senior Research Fellow Adam Thierer [estimated](#) that up to 35 billion devices will be connected to the Internet by 2019, a large number of these through wireless services, at least in part.

Global wireless traffic continues to grow exponentially. North America saw a 55 percent growth rate in 2015, compared to 74 percent globally. Cisco projects worldwide growth as follows:



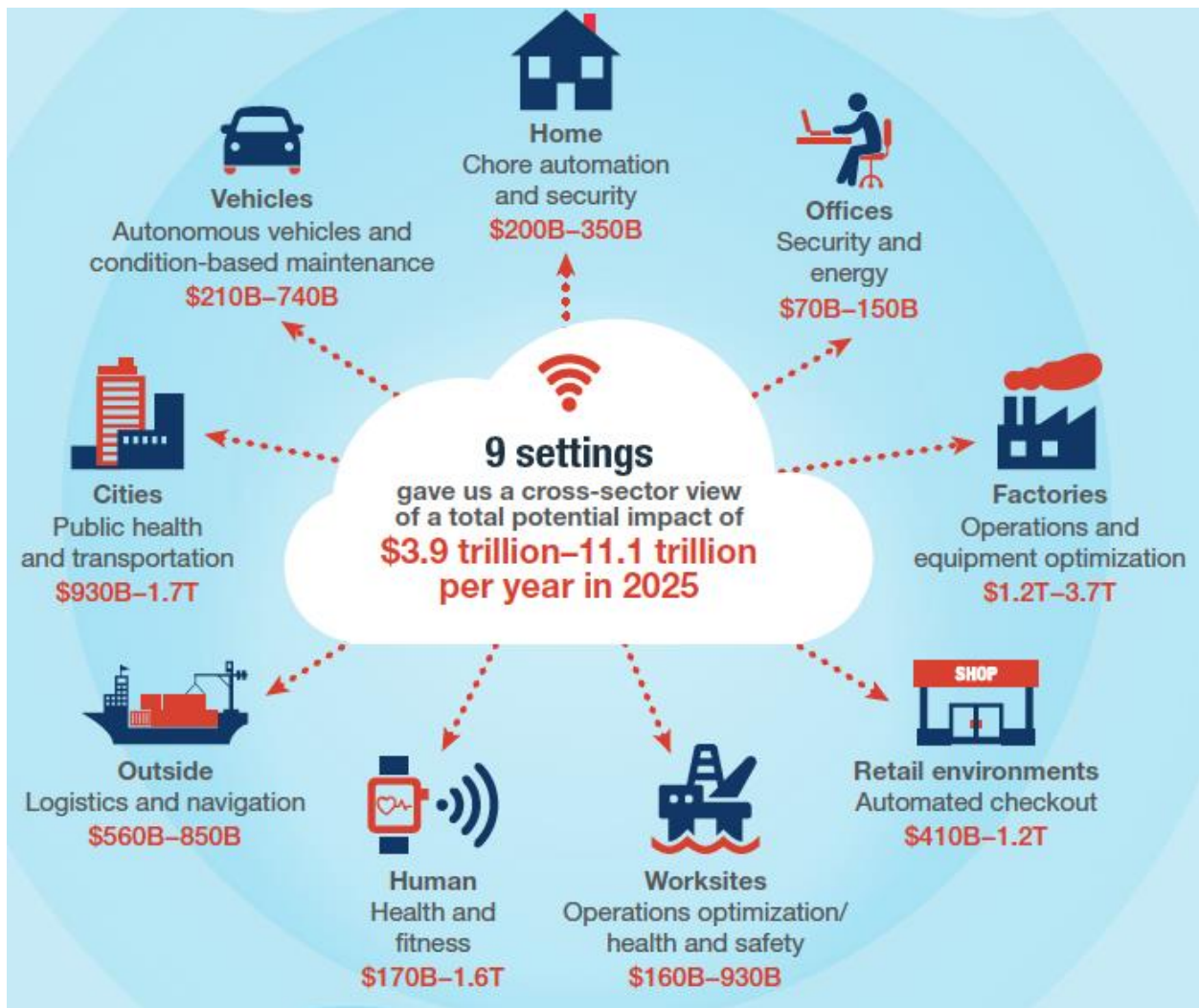
Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020 White Paper, Figure 3 (Feb. 2, 2016).

Given these facts, I agree with CTIA’s assessment that it is urgent that government start the process of finding and reallocating more spectrum for 5G services, not only to accommodate demand, but also to maintain the U.S.’s substantial lead in wireless deployment and innovation.

## Mobile Spectrum Will Produce Enormous Consumer Welfare Benefits

A number of econometric studies have demonstrated the huge enhanced consumer welfare value associated with wireless services. In a May 2015 report, the Brattle Group [estimated](#) that every dollar spent on wireless service contributes to \$2.32 of total spending in the U.S. economy. Wireless added approximately \$200 billion in GDP in 2013. For every one person employed in the wireless market segment, an additional 6.5 people find employment. In another study, Recon Analytics [reported](#) in December 2015 that for every 100 MHz of spectrum allocated for wireless use, \$3.1 billion is added to the GDP and over 100,000 jobs are added to the U.S. economy.

CTIA's Meredith Baker in June estimated that 5G and IoT can add \$2.7 trillion to the U.S. economy over the next 15 years. In June 2015 the McKinsey Global Institute [estimated](#) that the added global value associated with IoT in nine specific sectors, leveraged by IoT developments, could be as much as \$11.1 trillion:



McKinsey Global Institute, The Internet of Things: Mapping the Value Beyond the Hype, In Brief, page 2 (June 2015).



Even these reports fail to quantify the difficult-to-quantify revolutionary value of changing the way we interact with and communicate with each other, or the way wireless improves the efficiency in our business and lives. No longer are we Americans chained to our homes and offices in order to communicate, but we can interact, take care of business, and find entertainment options, wherever we happen to be.

### **FCC Chairman Wheeler Promotes High Band Spectrum for 5G**

Because of these enormous potential consumer welfare benefits, it is heartening that the FCC remains dedicated to searching for sufficient spectrum to reallocate for broadband mobile use. As one step in this process, Chairman Wheeler in June [announced](#) that he is ready to move forward on locating more spectrum for 5G wireless. Specifically, he plans for the Federal Communications Commission on July 14, 2016, to vote on a final order that, according to an agency [fact sheet](#), will allocate approximately 10.8 GHz of millimeter wave or high band spectrum for mobile broadband use. This so-called “Spectrum Frontiers Proceeding” would allocate certain bands above 24 GHz, 3.85 GHz of licensed spectrum and 7 GHz of unlicensed use. If adopted, the item would be an important milestone in the United States’ efforts to plan for and implement 5G services, which is expected to be offered as early as 2020.

The item for consideration also includes a Further Notice of Proposed Rulemaking that proposes to allocate additional high band spectrum for flexible wireless use which, if adopted, could further aid 5G in America.

Chairman Wheeler wisely proposes to proceed to an allocation of additional spectrum without further study on how 5G is to be deployed in the U.S., concluding that the need was adequately demonstrated, the potential uses were adequately described, palpable, and numerous. In fact potential uses are possibly transformative, promising revolutionary positive societal and economic benefits. He thus proposes leaving it to the market to make decisions to use the spectrum wisely. This market-oriented decision is refreshing in this Administration and this FCC, which are not always of a market-oriented disposition.

Although it is too soon for congratulations since nothing has been adopted yet, and many details remain vague, it nonetheless is appropriate to praise Chairman Wheeler’s proposal for identifying the need for more 5G spectrum, and for the relative speed that he proposes to reach a decision on high band spectrum. From the Notice of Inquiry’s adoption in October 2014 to a July 2016 Report and Order is a fairly quick turnaround for the FCC.

Notwithstanding this, there are still potential clouds on the horizon. First, the FCC has to follow through promptly on the reallocation decision to auction and deploy the spectrum. Second, the amount of sharing between commercial users, and between commercial and government users, is potentially extensive in some spectrum bands, thereby possibly limiting the allocation’s usefulness. Third, the fact sheet accompanying the Chairman’s announcement notes that the Order will include an “ex ante spectrum holdings limit” and “spectrum threshold” in secondary market transaction reviews, which could undermine the speed and market efficiency of deploying the spectrum. These issues are discussed in the following sections.

*The Government Needs to Get More Spectrum into the Pipeline.* The importance of the Spectrum Frontiers Proceeding is that additional spectrum must be placed into the pipeline because of the historically long time frame from conception to actual spectrum deployment. Historically, the government has been agonizingly slow assigning spectrum to a licensee or other authorized user, taking an average of roughly 13 years. A July 2015 study commissioned by CTIA [demonstrates](#) this stark fact in the following table:

SPECTRUM	BANDS	FIRST STEP	AVAILABLE FOR USE	FIRST DEPLOYMENT	APPROXIMATE TIME LAG
Cellular	824-849; 869-894 MHz	1970	1981	1983	13 years
PCS	1850-1920; 1930-2000 MHz	1989	1995	1995	6 years
EBS/BRS	2496-2690 MHz	1996	2006	2009	13 years
SMR	817-824; 862-869 MHz	1995	2012	2013	18 years
700 MHz	698-748; 746-806 MHz	1996	2009	2010	14 years
AWS-1	1710-1755; 2110-2155 MHz	2000	2006	2008	8 years
WCS	2305-2315; 2345-2355 MHz	1997	2012	2015	18 years
AWS-3	1695-1710, 1755-1780; 2155-2180 MHz	2002	2015	2017 (estimated)	15 years
AWS-4	2000-2020; 2180-2200 MHz	2003	2012	2017 (estimated)	14 years
600 MHz	TBD	2014	2016 (estimated)	TBD	TBD

Thomas K. Sawanobori, Dr. Robert Roche, From Proposal to Deployment: The History of Spectrum Allocation Timelines (Jul. 20, 2015).

In its Spectrum Frontiers Proceeding, the FCC already has taken almost two years of this time frame and auction rules. And the auction itself and eventual deployment dates are unknown. As part of the spectrum to be placed in the pipeline, the need for speed in achieving deployment of high band spectrum is obvious. Provisions of the MOBILE NOW Act, described later in this perspective, could help to enforce this speed-of-deployment issue.

*Sharing Spectrum is More Difficult Than the Government Admits.* The biggest potential downside of the high band spectrum is the amount of sharing that may be required. I have indicated [here](#) the problems with sharing spectrum between commercial and government users. Inevitably, sharing reduces the available usable spectrum and the flexibility and reliability that commercial users need to deploy services that consumers want. A number of these sharing problems also can exist among commercial users.

The government's 2012 [PCAST Report](#) has thrown in the towel and concluded that sharing is the only way for further under-utilized government spectrum to be made available for commercial use. There are five serious problems with sharing.

First, sharing is inherently inefficient. Shared spectrum by definition reduces capacity available for broadband use. Some [are concerned](#) that government is utilizing inefficient, outdated technology. Although the PCAST report includes some efficiency improvement proposals, no concrete steps in this direction have yet been taken.

Second, sharing spectrum undermines investment incentives by increasing costs and potentially reducing reliability. Some [have noted](#) that sharing inevitably increases carrier costs through ongoing coordination and operational work-arounds, costs that ultimately must be borne by consumers. Ongoing coordination obligations inevitably reduce available capacity, and sometimes on infrequent and unpredictable occasions, thus raising potential mobile broadband reliability concerns.

Third, sharing techniques are not sufficiently advanced to produce efficient results. Although modern dynamic sharing technologies, with more refinement, show some promise to aid in real time sharing of spectrum, such as with white spaces microphone usage, such systems are designed for relatively fixed users and involve a significant amount of manual coordination, as some [have noted](#).

Fourth, sharing reduces potential auction revenues because the market will devalue spectrum saddled with significant limitation, as I detailed [here](#). The coordination requirements contained in both the AWS-3 auction and proposed 3.5 GHz allocation are particularly significant given that government uses and coordination obligations are likely to remain murky even at the time of an auction.

Fifth, ongoing sharing between sensitive national security and law enforcement systems and commercial operations pose continuing security concerns to government operations, a concern expressed in the Administration's [memo](#) promoting sharing.

Sharing difficulties occur not just between commercial and government users, but can be among private users as well. Just three examples demonstrate this issue. First, Globalstar sought to modify its satellite license to provide terrestrial service. This proposal, which the FCC included in a 2013 [Notice of Proposed Rulemaking](#), is designed to preserve satellite spectrum while finding additional terrestrial mobile uses. After years of delay and testing, the proposal is still mired in a potential-interference controversy mostly among commercial competitors, slowing progress on a decision. Second, Ligado Networks, formerly known as LightSquared, has for years been seeking to modify its satellite license for terrestrial wireless use. The latest controversy out for [public comment](#) involves Ligado's proposed access to the 1675 to 1680 MHz band that would be shared with meteorological and oceanographic satellites. Third, the FCC is seeking [comment](#) regarding the reallocation of a portion of the 5.9 GHz band for unlicensed mobile use, 75 MHz of which is currently allocated primarily to short-range wireless communications links for vehicular use, called Dedicated Short Range Communications (DSRC). Although spectrum for DSRC initially was made in the late 1990s, the industry has been slow to develop technologies using this spectrum, and other technologies have been developed, such as radar, to increase vehicular safety functions such as collision avoidance systems.



I do not take a position on the merits of any of these three proceedings or the potential interference issues raised in them by opposing parties. I cite them only as a warning sign about the lengthy delays and problems associated with sharing that more readily could be solved by dedicated reallocation of spectrum for wireless use.

*Auction Manipulation and Uneconomic Spectrum Screens Slow Down the Reallocation Process.* The brief statements in the Spectrum Frontiers Proceeding fact sheet regarding new spectrum allocation limitations harkens back to the unwise regulations that the FCC adopted to govern spectrum allocation in the forward portion of the broadcaster incentive auction. I've said before, [here](#) and [here](#), that creation of skewed bidding rules, such as creation of "reserve spectrum" available only to favored bidders, poses unacceptable risks that the incentive auction will fail. And these same policies have led to questionable spectrum screen policies based on the type of wireless spectrum, which delays both deployment and post-auction transactions. Although these brief phrases in a fact sheet are hard to interpret, I fear that the Commission may be set to do the wrong thing again, this time in the Spectrum Frontiers Proceeding.

Of course, the Commission is now in the middle of the incentive auction of the over-the-air broadcast spectrum reallocation process. No one knows at this point the robustness of bidding in the "forward auction" by mobile providers, the degree of impairment in nationwide spectrum channels, the timing of eventual deployment, or indeed the amount of spectrum that will eventually be reallocated for wireless use. Notwithstanding, the FCC should not repeat the incentive auction errors by tipping the scale in favor of certain potential wireless licensees, artificially depriving certain players of needed spectrum. The Commission should let the market decide on spectrum assignment and deployment.

### **The Administration Is Lagging in Its Efforts to Reallocate 500 MHz of Spectrum Below 6 MHz**

As I describe more fully [here](#), the Administration itself seems to be lagging in evaluating and reallocating spectrum in accordance with the President's [policy goal](#) of allocating 500 MHz of spectrum for wireless broadband, which at the time was generally believed to include only spectrum below 6 GHz. That policy is now six years old. To date, the Administration has actually only auctioned off about 145 MHz of this 500 MHz that reliably can be used for dedicated wireless broadband usage. It is unclear the impact of the Spectrum Frontiers Proceeding reallocation will have on the Administration's 500 MHz goal. Regardless how one views this 500 MHz progress issue, given the historical delays in allocating spectrum identified above, it would be wise for NTIA to turn its "promise" of additional below 6 GHz spectrum into a reality.

### **The Administration's Plan Is Already Outdated**

A June 2015 [report](#) published by the Brattle Group estimated that by 2019 the United States will need to reallocate an additional 350 MHz of spectrum for high power dedicated mobile broadband use, which would not include high band spectrum. The report noted that the FCC is lagging in addressing its 2010 prediction that there would be a 300 MHz deficit of spectrum for mobile broadband use by 2014. Based on these two separate assessments according to the Brattle

Group report, by 2019 the U.S. will need about 650 MHz total of spectrum for high powered mobile broadband use.

The Brattle Group based its additional 350 MHz estimate on the same methodology the FCC used to make its own 300 MHz prediction in 2010. The estimate includes assumptions based on both increased efficiency of technology and off-loading of traffic to Wi-Fi. The Brattle Group's estimation notes that in hindsight, the FCC estimates were fairly accurate as an historical trend, even though certain peaks and troughs occurred within the timeline. Although all estimates are going to be off to some extent, on the whole there is a good basis on which to rely on the reasonableness of these predictions. Introduction of the IoT, or harnessing the technological capabilities of mobility and the Internet to a whole host of different machinery and appliance applications, along with the ever-increasing demand for video applications, is only going to accelerate these existing demand curves.

### **The Senate's MOBILE NOW Initiative**

As I describe fully [here](#), Senators Thune and Nelson have introduced bipartisan legislation, the [MOBILE NOW Act](#), S. 2555, on February 11, 2016, that would address this need to identify and allocate for spectrum for wireless broadband use, including 5G. The bill would obligate the Administration to fulfill the 500 MHz spectrum goal, improve timetables for FCC spectrum action, require NTIA to evaluate mechanisms to give government the incentive to give up spectrum, and enact other wireless infrastructure improvements. I applaud Senators Thune and Nelson for their bipartisan efforts to speed up the process of spectrum reallocation usable for 5G, although I noted weaknesses in my perspective that should be addressed. And MOBILE NOW has been mired in Senate politics for four months, to the detriment of the good substance behind the bill. I hope that Congress can get beyond politics to enact needed reforms to promote 5G spectrum availability and progress.

### **Conclusion**

Chairman Wheeler should be applauded for proposing to move forward on the allocation of high band spectrum for 5G use. Burgeoning wireless demand and the promise of transformative services justify such a move – and a quick one at that. The Administration should do more to address its lagging implementation of the President's original 2010 plan to allocate 500 MHz of below-6 GHz spectrum for mobile broadband use. The Senate's MOBILE NOW Act can address some of these concerns and be improved upon if it includes action-forcing requirements that force regulators to get the job done.

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