Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the matter of	)	
	)	
Spectrum Task Force Requests Information on Frequency Bands Identified by NTIA as Potential Broadband Spectrum	)))	ET Docket No. 10–123

To: Chiefs, Office of Engineering and Technology and Wireless Telecommunications Bureau

COMMENTS OF ERICSSON

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EXECUTIVE SUMMARY

Ericsson expects that the future wireless network will be a heterogeneous one, where macro coverage is augmented by smaller embedded cells in areas with high population density and that this progression will continue into large public gathering areas and within enterprises and homes. *This diversity in deployment environments requires a variety of suitable and sufficient spectrum allocations.*

Ericsson's primary focus is pairing of *licensed* spectrum expanding the existing AWS–1 band from 2×45 MHz to an additional 2×60 MHz by (1) reallocating spectrum in the 1675–1710 MHz and 2075–2110 MHz bands and pairing this spectrum, and (2) pairing AWS–3 with reallocated federal spectrum in the 1755–1780 MHz band.

Ericsson submits that the NTIA *Fast Track* analysis of bands and future spectrum band analysis should be informed and overlaid by the principles relied upon by the Telecommunications Industry Association and Ericsson in their comments on dynamic spectrum sharing and by 4G Americas in its blueprint for determining suitable mobile broadband spectrum. The general policy principles that emerge include the following:

- Consider how federal users can use commercial off-the-shelf equipment ("COTS") and commercial wireless services to increase efficiency while repurposing spectrum.
- Licensed commercial mobile spectrum below 3GHz is needed to support the mobile broadband vision in the *NBP* and the Presidential memo.
- Auctions of licensed spectrum have fueled innovation and investment in wide-area, commercial mobile broadband technology and services.
- A shared spectrum environment is considered a complement to exclusive-use spectrum, unless support for on-demand, real-time, mission-critical services can be guaranteed.
- The commercial suitability of various spectrum sharing models depends on the appropriate balance among economic, technical, operational and regulatory realities.
- Shared spectrum becomes viable at much lower layers in the network where transmit powers are limited, mobility may be constrained, communication is over shorter ranges and traffic requirements are dynamically varying.
- Diversity in deployment environments requires a variety of spectrum allocations.

1675–1710 MHz. Ericsson supports reallocation of the full 1675–1710 MHz band for commercial mobile broadband; it should be joined to the adjacent AWS–1 band and paired with 2075-2110 MHz. Unfortunately, NTIA proposes reallocation only of 1695–1710 MHz, with large exclusion zones. This will not address the need to support wider bandwidth services.

1755–1850 MHz. This band should be strongly considered for reallocation for licensed mobile broadband. Specifically the 1755-1780 MHz band paired with 2155–2180 MHz (AWS–

3), is a high priority band that would provide 2×25 MHz of contiguous spectrum for mobile broadband. This band has been globally harmonized and standards are in place. This spectrum would permit faster rollout of more affordable broadband and devices.

2700–2900 MHz. This band is globally harmonized and its proximity to the BRS band and the 3GPP Band 7 makes it worthy of consideration. Numerous other countries are already considering bands including this spectrum for potential reallocation to mobile broadband service. The Commission and NTIA should consider whether this band could be segmented and repacked so as to permit the upper portion to be used for radar while the lower portion is used for mobile broadband.

3410–3800 MHz. Spectrum from this band should be reallocated in accordance with globally harmonized wireless broadband. NTIA has proposed reallocating 3550–3650 MHz, subject to extensive exclusion zones, based on certain transmitter characteristics. Ericsson has suggested changes to these parameters that may affect the exclusion zone distances. Based on the size and location of the exclusion zones and other factors, the shared use of 3550–3650 MHz for commercial service does not appear feasible, but repacking and segmenting the band could potentially free up spectrum for mobile broadband. In the longer term, it would be best to relocate services from the 3410–3800 MHz band to the 2950–3400 MHz band.

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Ericsson hereby submits its comments in response to the Commission's March 8 *Public Notice*[1] seeking information concerning certain frequency bands that the National Telecommunications and Information Administration ("NTIA") has identified as potential candidates for broadband reallocation.

I. INTRODUCTION

The *Public Notice* notes that NTIA, at the direction of the President, has undertaken a process of reexamining government spectrum usage with the objective of making additional spectrum available for non-government broadband usage,[2] consistent with the National Broadband Plan ("NBP").[3] Specifically, NTIA identified the 1675–1710 MHz, 1755–1780

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[1] *Spectrum Task Force Requests Information on Frequency Bands Identified by NTIA as Potential Broadband Spectrum,* ET Docket 10–123, *Public Notice,* 26 F.C.C.R. 3486 (2011).

[2] *Id.* at 3486-87 & nn.2-6; *see* NTIA, *Plan and Timetable to Make Available 500 Megahertz of Spectrum for Wireless Broadband* (Oct. 2010) ("*Ten-Year Plan*"), *available at* http://www.ntia.doc.gov/reports/2010/TenYearPlan_11152010.pdf; NTIA, *An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675–1710 MHz, 1755–1780 MHz, 3500–3650 MHz, and 4200–4220 MHz, 4380–4400 MHz Bands* (Oct. 2010) ("*Fast-Track Report*"), *available at* http://www.ntia.doc.gov/reports/2010/FastTrackEvaluation_11152010.pdf.

[3] *Connecting America: The National Broadband Plan,* at 84, Recommendation 5.8 (2010) (*NBP*), *available at* http://www.broadband.gov/plan/.

MHz, 3550–3650 MHz, 4200–4220 MHz, and 4380–4400 MHz bands as fast-track candidates for commercial use last October. In November, NTIA recommended reallocation of the 1695–1710 MHz and 3550–3650 MHz bands. In January, NTIA asked the Commission to begin proceedings to make those two bands available for shared usage and also began evaluating the 1755–1850 MHz band.[4] The *Public Notice* seeks comment on the suitability of each of these bands and also asks for information about other bands that may be worthy of consideration.

Ericsson supports the Commission's and NTIA's actions to conduct a comprehensive and coordinated approach in identifying, allocating, and licensing new mobile broadband spectrum. In these Comments, Ericsson addresses whether and to what extent these bands could be made available for broadband deployment. We examine the assumptions on which NTIA based its analysis, including the band selection factors used by NTIA and the wireless broadband parameters used in the compatibility studies. We also suggest additional criteria that may be worthy of further consideration and discuss other bands for further review and analysis. We also briefly touch on spectrum sharing and which bands should be prioritized.

II. DISCUSSION

A. PRIMARY OBJECTIVE

Ericsson's primary focus is the bandplan set forth in Figure 1 below, illustrating the priority pairing of *licensed* spectrum expanding the existing AWS–1 band from 2×45 MHz to an additional 2×60 MHz by 1) reallocating spectrum in the 1675–1710 MHz and 2075–2110 MHz bands and pairing this spectrum as indicated in Block A, and 2) pairing AWS3 with reallocated federal spectrum in the 1755–1780 MHz band as shown as Block B.

[4] *See Public Notice*, 26 F.C.C.R. at 3486-87.

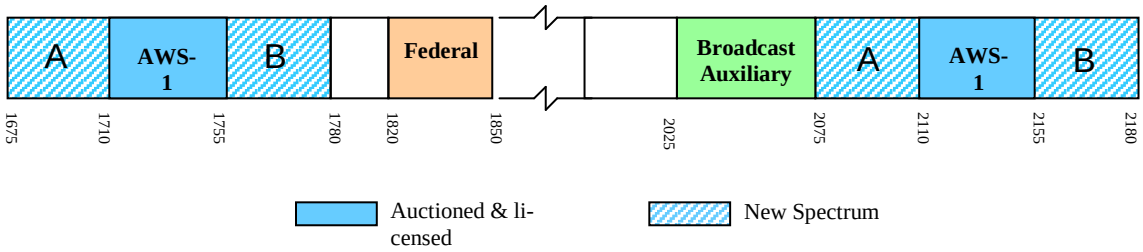

Figure 1. Priority Spectrum Allocations

In addition, Ericsson suggests the following:

- Segmentation or sharing in the shorter-term in the 2700–2900 MHz band should be considered with a longer-term vision to relocate radars from the 2.7–2.9 GHz band to the 2950–3400 MHz band.

- The suggested extension of the C-Band to 3550–3650 MHz does not provide an optimal solution for mobile broadband services, considering among other constraints, highly restrictive exclusion zones across many dense urban populations. Ericsson recommends relocating services in C-Band (3410–3800 MHz) to 2950–3400 MHz for the longer term considering segmentation in the shorter term. The band plan for the range 3410–3800 MHz is very much still under discussion within 3GPP, CEPT and ITU. While options for the band 3410–3600 MHz are being debated within 3GPP, member companies would generally agree with the creation of an unpaired allocation for mobile services in the band 3600–3800 MHz. Ericsson would very much like national allocations to be aligned with that view.

- Move satellite, including the Fixed Satellite Service (FSS) usages to above 4GHz in the longer term.

- Conduct additional analysis to determine suitability of 1300–1390 MHz, given its proximity to GPS.

B. SUITABLE SPECTRUM

1. INTRODUCTION

In the past few years, mobile broadband use has created a new engine of economic growth for the country. For instance:

- CTIA lists 96 percent penetration for wireless service with 302.9 million mobile subscriptions as of December of 2010. This is an increase of 796 percent since 1995.[5]

[5] CTIA Quick Facts, *Year-End 2010 Top-Line Survey Results* (summary of the results of CTIA's semiannual survey), available at http://www.ctia.org/advocacy/research/index.cfm/aid/10323.

- Around 30 percent, or 78 million, of those U.S. mobile subscribers carry one or more smartphones capable of handling broadband data connections that allow users to connect to information services, workplace environments and entertainment throughout the day. That number is increasing at an annual growth rate of 57 percent.[6]

- In 2011, U.S. smartphone sales are expected to reach 95 million units.[7]

- Today, 26.6% of mobile phone users have no fixed phone line, whereas there were no such subscribers just ten years ago.[8] It is very clear that such a fixed line replacement is possible for many wireless data subscribers on 3G or 4G data plans.[9]

As subscribers replace their data connectivity with wireless subscriptions, their expectations of the service will be no different from what they expect from a wireline broadband connection, such as cable, DSL, or fiber. Where computers were previously tethered to a DSL line, many will soon be tethered to a wireless modem.[10] Indeed, many laptops and tablets may be tethered to smartphones and have integrated wide area wireless connectivity, making a distinction between devices and the bandwidth they consume quite ambiguous. This will create a new expansion in data traffic, and change the way people view TV and get their entertainment, all of which will require outlays of additional *suitable* spectrum.

Some of the factors that have contributed to this expansion:

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[6] Maisie Ramsay,*U.S. Traffic Doubles; Smartphone Growth Up 57%, says CTIA* (Mar. 22, 2001), http://www.wirelessweek.com/News/2011/03/Devices-Data-Traffic-Doubles-CTIA-Smartphones/; Nielsenwire, *U.S. Smartphone Battle Heats Up: Which is the "Most Desired" Operating System?* (Dec. 1, 2010), http://blog.nielsen.com/nielsenwire/online_mobile/us-smartphone-battle-heats-up/.

[7] Telecompaper, *Smartphones to be Most Sought-After Devices in US in 2011* (Feb. 17, 2011) (based on Gartner Group projection), http://www.telecompaper.com/news/smartphones-to-be-most-sought-after-devices-in-us-in-2011.

[8] CTIA Quick Facts.

[9] *See generally NBP* at 76-78.

[10] *See, e.g.*, John Biggs, Gadgetwise, *The Newcomer's Guide to Wireless Tethering* (April 6, 2011), http://gadgetwise.blogs.nytimes.com/2011/04/06/the-newcomers-guide-to-wireless-tethering/.

- The rapid advancement in semiconductor technology has put huge amounts of computational power into subscribers' hands. This has produced smartphones that can handle tasks that were carried out in desktop computers just a couple of years ago.

- The development of new mobile broadband technologies such as LTE has made it possible for operators to realize huge gains in spectral efficiency out of their limited spectrum resources.

- Over-the-top information and content providers such as Facebook and Google have revolutionized the way people keep in touch with each other and access information, providing even better experience in many ways within mobile environments than was possible from the desktop.

This expansive growth of mobile broadband use has been supported by the evolution of wireless networks and technology. Table 1 below illustrates a generational classification of commercial wireless telecommunication systems that is reflective of the strides that have been made. The table shows an improvement in three metrics over every generation: the bandwidth used for a link between a user terminal and the network, the order of data rates that can be handled by a typical cell, and the frequency bands over which the technology is capable of operating over. Note that the data rates that may be expected by a single user have been improving to the same extent as the peak cell data rates.

ITU Classification Generation	1G	IMT–2000		IMT–Advanced
		2G	3G	4G
Technology	AMPS/NMT	GSM/EDGE EIA/TIA–136 EIA/TIA–95	GSM/WCDMA/HSPA/EDGE CDMA2000/evDO 3GPP LTE Rel. 8	3GPP LTE Rel. 10
Type	Analog	Digital	Digital	Digital
Channelization	Up to 100 KHz	Up to 1 MHz	Up to 10 MHz	Up to 100 MHz
Frequency Band	400–1000 MHz	400–2000 MHz	400–3000 MHz	200–5000 MHz
Data rates[11]	Up to 10 kb/s /user	Up to 1 Mb/s/cell	Up to 100 Mb/s/cell	Up to 1 Gb/s/cell
Services	Voice telephony	Voice/data	Voice/Data	Data (voice included)
Lifecycle Timeline	1985–1999	1992–present	2002–present	2009–present

Table 1. Evolution of Wireless Networks and Technology

[11] The data rates are in orders of magnitude.

The future undoubtedly will lead to further improvements in the technological tools available. Indeed, techniques such as network centralization will allow greater coordination between infrastructure nodes such as base stations, even allowing for centralized signal processing architectures that can manage the interference environment more effectively over multiple cells. Advances in radio technology will make base stations much more energy efficient, while the availability of greater backhaul bandwidth, much of it based on fiber deployments will enable higher density base stations deployments.

However, the ability to support deployment density alone will not meet the needs of the future. While the industry supports 5 billion subscriptions worldwide in 2010, there is likely to be a need to support 50 billion connected devices by the year 2020.[12] While most of today's bandwidth usage is meant for personal connectivity, the network expansion of the future will be fueled by machines in addition to the needs of individuals. The Machine-to-machine ("M2M") connectivity requirements are quite diverse, ranging over traffic from low-powered sensor networks, actuators to control the smart grid, intelligent transportation applications, video surveillance, mobile health, *etc.* Some machine devices will be very low power and low bandwidth, while others will handle high data rates. Some machines will have very low latency requirements, while others will be able to live with significantly delayed communication abilities. Some machines will need always-on connectivity, while others may be able to use excess capacity overnight. Finally, some use cases such as sensor networks in homes and buildings will thrive with short range wireless links, while some others such as sensors used in

[12] *See* Arpit Joshipura, Ericsson, *Infrastructure Innovation: Can the Challenge Be Met?* (Sept. 2010), *available at* http://www.gsaglobal.org/expo/2010/attendees/docs/20100916_expo_keynote03.pdf; *see also* Alan Weissberger, The Viodi View, *Exponential Growth in M2M Market Dependent on Important Network Enhancements* (Oct. 2010), http://viodi.com/2010/10/07/exponential-growth-in-m2m-market-dependent-on-important-network-enhancements/.

forestry and agriculture might require longer range communication at frequency bands below 1 GHz to be cost effective. As a result, there is a need for spectrum allocations with diverse characteristics.

Experts agree that notwithstanding the innovation that has led to increasingly efficient spectrum use, existing allocations are not sufficient to meet demand.[13] Suitable and sufficient additional spectrum is critical to meet the growing demand for mobile broadband. The 4G Americas organization recently stated:

> The implementation of future networks must support access to communications anywhere, anytime. Therefore these networks will rely on multiple access technologies supported by a variety of spectrum bands to address both coverage and capacity needs. This will require suitable lower frequencies to support mobility in macro deployments as well as sparsely populated areas, in addition to higher bands supporting capacity objectives through a mix of macro, micro and pico cell deployments.[14]

2. THE NETWORKED SOCIETY

Ericsson expects that the future wireless network will be a heterogeneous one, where macro coverage is augmented by smaller embedded cells in areas with high population density and that this progression will continue into large public gathering areas and within enterprises and homes. *This diversity in deployment environments requires a variety of spectrum allocations.* Frequency bands up to 2.5 GHz are, for the most part, particularly suited for good coverage in most environments, with coverage properties improving at lower frequencies. Dense urban deployments at the next level of the cellular network can use the region between 1 GHz

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[13] *See NBP* at 77 ("The growth of wireless broadband will be constrained if government does not make spectrum available to enable network expansion and technology upgrades.").

[14] 4G Americas, *Sustaining the Mobile Miracle: A 4G Americas Blueprint for Securing Mobile Broadband Spectrum in This Decade,* at 32 (March 2011) ("*4G Americas Blueprint*"), *available at* http://www.4gamericas.org/UserFiles/file/White%20Papers/4G%20Americas%20 Mobile%20Broadband%20Spectrum%20Requirements%20March%202011.pdf

and 3 GHz for smaller cell diameters, while picocellular deployments can benefit from frequency bands between 1 and 4 GHz. Deployments in enterprises and other public areas can span the frequency range 2 GHz to 5 GHz, while homes would benefit from deployments that span between 3 GHz and 5 GHz as well. The cellular industry is additionally interested in frequency bands above 3 GHz for wireless backhaul connectivity in non-line-of-sight deployments, while frequency bands from 10 GHz onwards hold potential for microwave backhaul.

In general, it is expected that the higher layers of this hierarchy of cells will need dedicated spectrum with exclusive use arrangements, especially in mobility domains where users are moving through the network and need a constant and reliable environment to communicate within. Depending on the traffic requirements, picocellular environments would likely need a combination of dedicated and dynamically provisioned spectrum, but Ericsson believes that network efficiency requirements will still need exclusive allocation to operators. Shared spectrum becomes viable at much lower layers in the network where transmit powers are limited, mobility may be constrained, communication is over shorter ranges and traffic requirements vary dynamically. Still, sharing in the cellular context should be treated in conjunction with ownership rights. While indoor environments in some businesses and within homes can use a greater diversity of allocations including unlicensed spectrum, larger cellular deployments in enterprises, public areas, certain picocellular environments and even home networks may benefit from the ability to coordinate use of spectrum even if such coordination is carried out in a distributed manner, thus allowing controlled network deployments that are able to provide better bandwidth efficiency. Such networks are defined in opposition to uncoordinated networks where radios may aggressively coexist with each other as in ISM bands. The ability of some network

operators to be able to secure spectrum more dynamically can create new business models and newer competitive environments for purpose-built networks.

3. APPROPRIATE SELECTION FACTORS

Ericsson submits that the following factors should be given significant weight in selecting and prioritizing bands for non-government broadband allocations, based in large part on the work of 4G Americas:

- **Configure Licenses With Wider Bandwidth.**

  - "Technologies that support ever more supple mobile broadband capability, such as LTE, will increasingly require wider bandwidth channels to meet consumer demand for bandwidth intensive and content-rich services. Wider spectrum blocks maximize spectrum use by accommodating more bits and allowing more resources to be pooled (the "trunking efficiency" effect) for sharing among users. Spectrum allocations should therefore be in sufficiently large, contiguous blocks to accommodate the future development of mobile broadband networks. Allocations should focus, at a minimum, on 2×10 MHz blocks," in spectrum bands below 3 GHz.[15] Indeed, if there is an intent for mobile broadband to serve as a true complement to fixed network deployment, contiguous allocations of the order of *2×40 MHz* would be ideal.

- **Group Like Services Together.**

  - "The grouping of like services can reduce complexity and cost, and allow more flexibility in the form factor of the subscriber equipment. For example, allocating additional spectrum adjacent to similar services and with similar duplex distances[16] reduces the number of bands that a device must support. Standards development would as a result be accelerated, and existing user equipment would be more easily modified rather than

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[15] *4G Americas Blueprint* at 27 (emphasis in original; footnote omitted concerning why "carrier aggregation cannot be considered a substitute for wider channels in the first instance").

[16] *Id.* at 28. Allocating additional spectrum adjacent to similar services and with similar duplex distances does more than to reduce the number of bands that a device must support; it also furthers and accelerates standardization by simplifying radio requirements specification. Existing equipment can subsequently be modified, thus speeding the market availability of the devices, since the use of adjacent spectrum does not increase the number of bands to be supported in a multiband device. As discussed below, an example of this selection is the pairing of 1755–1780 MHz with 2155–2180 MHz, which would be adjacent to the AWS–1 band. As a result of placing these bands together, the complexity is minimized and the cost will be comparably less than if non-contiguous spectrum were used.

requiring new technology developments, which accelerates the market availability of those devices."[17]

- **Be Mindful of Global Standards.**

  - "Technical standards are the foundation for service providers and manufacturers to develop competitive products and services. Further, standards help facilitate regulatory compliance, establish patent policies for use of essential technologies, provide a platform for third party supplier solutions, and serve to energize investment. Finally, standards allow companies to take advantage of economies of scale that lower costs and promote growth, maximizing opportunities for innovation."[18]

- **Pursue Global Spectrum Allocations.**

  - "Ensuring that spectrum allocations are, to the greatest extent possible, in accord with international allocations promotes innovation and investment by creating critical economies of scale. This facilitates global roaming and helps countries that share borders manage cross-border interference."[19] Ericsson notes that globally uniform frequency plans also reduces complexity and cost and allows more flexibility in the form factor of the subscriber equipment.

  - Without frequency plan coordination, "new technologies and services can be difficult to export to other markets, and internal markets will fail to benefit from developments in international markets."[20] "Fragmented spectrum allocations hamper innovation and require companies to dedicate resources to developing new or adapting existing products or technologies for a single market, rather than sharing those development costs globally. This, in turn, increases the costs and limits the potential availability of products and services for the [American] consumer."[21] "Moreover, new/modified technology takes time . . . , delaying the availability of services and devices to serve the market and meet demand."[22]

- **Place Primary Reliance on Exclusively Licensed Spectrum.**

  - As Ericsson recently commented in the Dynamic Spectrum Use proceeding, "Licensed spectrum allows the network operator to provide emergency and real-time services that

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[17] *Id.*

[18] *Id.* at 28.

[19] *Id.* at 29.

[20] *4G Americas Blueprint* at 29. As a result, without such harmonization it would be more difficult to export from the U.S. to other markets, and U.S. markets would not benefit from developments in other international markets.

[21] *Id.*

[22] *Id.*

require reliably managed access to spectrum. Services such as E–911, telephone relay service, and communications relied upon by first responders and other public safety personnel are inherently real-time services requiring protection from interference and assurance of spectrum resources. Reliably managed spectrum access also enables "always-on" connectivity for email and web browsing while supporting services that are sensitive to delays and latency, such as streaming video, high-quality voice telephony, and on-line games, as well as a wide variety of applications such as telemedicine. These services require a managed network using licensed spectrum, not one with opportunistic access to spectrum where priority services would compete equally with secondary services for spectrum access. Moreover, the provision of broadband service that will be relied upon for these services entails a large number of users, most or all of whom are mobile. As a result, intra-system interference can come from many constantly moving locations in the network. If the system uses licensed spectrum, this constantly changing interference can be managed dynamically and in a coordinated manner, minimizing its effects on users and causing no harmful interference to others. A large-scale mobile network employing spectrum opportunistically would face a many-fold increase in the complexity of this task."[23]

- **Ensure Appropriate Propagation Characteristics.**

  - "[T]he ability to provide services more efficiently is enhanced using spectrum with appropriate propagation characteristics, which are characteristic of the lower radio frequencies."[24] For instance, frequency bands up to 2.5 GHz are for the most part particularly well suited for good mobile coverage in most environments, with coverage properties improving at lower frequencies. That is, these bands provide adequate service across a broadly defined geographic area, including rural and isolated areas where the population density is low.[25] "There are also specific needs for capacity in which greater bandwidth is needed across a smaller area, but by a number of interests contending for limited spectral resources."[26]

  - Some general guidelines for appropriate spectrum are:

    - Frequency bands up to 2.5 GHz are best suited for coverage with a concentration on lower frequencies for best performance.
    - Between 1 GHz and 3 GHz is very useful for smaller cell diameters.
    - Picocellular deployments can benefit from frequency bands between 1.5 and 4 GHz.

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[23] Comments of Ericsson Inc, ET Docket 10–237, at 5 (filed Feb. 28, 2011) ("Ericsson Dynamic Sharing Comments").

[24] *4G Americas Blueprint* at 30.

[25] *See, e.g.*, *NBP* at 86-89, 94; GSM Association, *Spectrum: Digital Dividend*, http://www.gsmamobilebroadband.com/spectrum/digital_dividend/list.aspx

[26] *4G Americas Blueprint* at 30-31.

- Deployments in enterprises and other public areas can span the frequency range 2 GHz to 5 GHz
- Homes would benefit from deployments that span between 3 GHz and 5 GHz.
- Above 3 GHz for wireless backhaul connectivity in non-line-of-sight deployments
- Frequency bands from 10 GHz and up may be useful for microwave backhaul.

Ø **Consider Impact of Adding New Spectrum Bands.**

- *Impact on Device Design:* "A critical consequence of spectrum fragmentation relates to the feasibility of manufacturing devices with increasingly more sophisticated antennae technology. . . . In practice, this means multiple antennas must be implemented in the mobile device for these bands, meaning not only additional antenna elements but also front end components."[27] This, in turn, requires consideration of factors including frequency band, signal to noise ratio, interference mitigation, form factor, and the inclusion of other radios, such as Wi-Fi, GPS, Bluetooth, and FM. These factors can make "the design equation . . . dramatically more complex."[28] As a result, there are "growing challenges associated with finding the additional real estate within the device for additional front end components and antennas. The additional front elements do not 'scale' to quite the same degree as baseband units, due partly to their dependence on physical layout and space constraints."[29]

- *Impact on Towers*: More bands mean more antennas on towers, and more towers needed.

C. NTIA'S SELECTION FACTORS

The *Public Notice* seeks feedback on how the technical assumptions upon which NTIA based its analyses affect how broadband services could be deployed in each band, and whether readily available equipment can meet the technical assumptions in NTIA's analyses.[30]

NTIA identified spectrum for long-term potential for reallocation in the *Ten-Year Plan* based on a set of Band Prioritization and Selection Factors:

- "the amount of useable bandwidth to support wireless broadband and the degree to which that spectrum is contiguous;

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[27] *Id.* at 36-37.

[28] *Id.* at 37.

[29] *Id.*

[30] *See* 26 F.C.C.R. at 3487.

- "industry interest in the band and the expected auction revenue, if applicable, that the band will yield;
- "indirect benefits to the economy of making the band available for wireless broadband; the availability of comparable spectrum (or other alternative arrangements) if relocation of incumbent users is necessary;
- "the estimated costs of relocating Federal incumbents to another band;
- "the impact to services using global allocations that would require international negotiations to bring about reallocation;
- "and the likelihood that the band can be repurposed within ten years."[31]

NTIA's *Fast-Track Report* also evaluated some of the bands thus identified to determine the extent to which they could be made available for sharing with non-government broadband operators within five years, based on factors such as number of assignments, type of operations, function, location, and strong industry interest.[32]

While these are necessary factors for consideration, Ericsson believes that they should be informed and overlaid by the principles relied upon by the Telecommunications Industry Association ("TIA") and Ericsson in their comments on dynamic spectrum sharing and by 4G Americas in its blueprint for determining the suitability mobile broadband spectrum.[33] The general policy principles that emerge from these filings include the following:

- Consider how federal users can use commercial off-the-shelf equipment ("COTS") and commercial wireless services to increase efficiency while repurposing spectrum.
- Licensed commercial mobile spectrum below 3GHz is needed to support the mobile broadband vision in the *NBP* and the Presidential memo.

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[31] *Ten-Year Plan* at 10.

[32] *Fast-Track Report* at 1-4.

[33] *See generally* Comments of TIA, ET Docket 10–237 (filed Feb. 28, 2011); Ericsson Dynamic Sharing Comments; *4G Americas Blueprint*; *see also* Comments of Ericsson Inc, WT Docket 10–123 (June 28, 2010) ("Ericsson 1675–1710 MHz Comments").

- Decisions about sharing spectrum should not compromise the spectrum needs of the commercial mobile broadband industry.

- Auctions of licensed spectrum have fueled innovation and investment in wide-area, commercial mobile broadband technology and services.

- The constraints imposed on commercial mobile broadband by sharing will affect whether Commission mandates and emergency and real-time services can be supported.

- A shared spectrum environment is only a complement to exclusive-use spectrum, not a substitute for it, because dynamic, opportunistic sharing cannot support on-demand, real-time, mission-critical services.

- The commercial suitability of various spectrum sharing models depends on the appropriate balance among economic, technical, operational and regulatory realities.

- There are substantial uncertainties about the regulatory and business aspects of models involving sharing.

- A successful sharing environment will require developing an appropriate method for determining spectrum availability tailored to each specific band and its authorized uses, both primary and opportunistic.

- Shared spectrum becomes viable at much lower layers in the network where transmit powers are limited, mobility may be constrained, communication is over shorter ranges and traffic requirements are dynamically varying.

- Diversity in deployment environments requires a variety of spectrum allocations.

The *Fast-Track Report* recommends that various portions of the candidate bands totaling 115 MHz be made available for geographic sharing with fixed and/or mobile wireless broadband use within five years, based on an analysis assuming equipment characteristics for LTE FDD transmitters and receivers.[34] The report assumes peak transmit output power of 40 dBm for a channel bandwidth of 5 MHz and 43 dBm for a channel bandwidth of 10 MHz; no other power levels or bandwidths were considered. The choice of LTE FDD is appropriate, but based on the possible uses of the spectrum analyzed in the *Fast-Track Report*, it is likely that channel bandwidths of at least 2×20 MHz would be used — and rather than *peak* power, the *average*

[34] Tables B-3 and B-4, *Fast-Track Report*, Appendix B, at B-5, B-6

transmit output power for channel bandwidths used in the analysis should be 46 dBm for the LTE FDD Base station on a per carrier and antenna basis.

The *Public Notice* also seeks comment on whether the error detection and correction techniques employed in modern digital receivers can reduce the effects of pulsed interference from radar signals, and whether commercial users would be willing to accept receiver standards to allow better sharing with such high-powered adjacent-band Federal systems.[35] Ericsson submits that it is too early to determine the benefit of techniques such as forward error correction ("FEC") in reducing the effects of pulsed interference. Currently this topic is being studied for the EC by the European Conference of Postal and Telecommunications Administrations ("CEPT") regarding compatibility studies between radars in the adjacent band to the 2.5–2.69 GHz band.[36] Part of the study is looking at preliminary results that show radar pulse interference may have a wider impact on system performance than just what is hit by the radar pulse. Therefore, additional study is required to understand the implications of operating commercial mobile systems in the proximity of pulse radar interference.[37]

D. SPECIFIC COMMENT ON NTIA SPECTRUM BANDS

Ericsson is very supportive of the actions that the Commission and NTIA have taken in developing these proposals on specific spectrum bands. However, we are concerned that the

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[35] 26 F.C.C.R. at 3488.

[36] *See, e.g.*, EC Radio Spectrum Committee, *EC Decision 2008/477/EC on the 2.5–2.69 GHz Band – Contribution from Belgium (BIPT) about Potential Interference with 2.7 GHz Aeronautical Radars*, RSCOM10-33 (June 22, 2010), *available at* http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/rsc/rsc32_public_docs/rscom10_33.pdf; CEPT Electronic Communications Committee, *Report from the Working Group Spectrum Engineering, Cluj Napoca*, CEPT/ECC/083SE(10) § 7.13, at 12 (Sept. 13-17, 2010), *available at* http://goo.gl/XxDY4.

[37] *See* CEPT/ECC/083SE(10) § 7.13.

main focus of the proposals consists of spectrum-sharing scenarios, which ignores the need for exclusively licensed spectrum and creates substantial uncertainties that spectrum-sharing entails.

In particular scenarios, some sharing practices may greatly enhance the ability to use spectrum and may provide efficient ways of repurposing spectrum for specific uses. However, accomplishing successful sharing can be cumbersome and time-consuming and the process can create substantial uncertainties that may hamper innovation and investment. The mobile wireless, or "cellular,"[38] industry is best positioned to drive the adoption of, and to satisfy the mass-market demand for, mobile broadband service. The full potential of industry and consumer satisfaction depends on the adoption of appropriate spectrum policies. These policies more often than not depend on the guarantee of clear regulatory conditions and access to licensed spectrum.

Spectrum that is available over most of the nation, with at most limited exclusion zones, is far more valuable to mass-market applications, such as cellular systems, than spectrum that is excluded from use in metropolitan areas and solely available for rural deployment. And a sharing environment must be well defined, commercially feasible, and suitable for the provision of the envisioned services. Ultimately, the value of shared spectrum access in a mass-market, wide-area coverage network is dependent on the extent to which mandated, real-time, and mission-critical services can be supported. This, in turn, is dependent on the ability of a service provider to exert "ownership" of the spectrum, in the sense of exclusivity, with implicit guarantees of quality. The constraints imposed by the sharing environment will determine whether real-time services can be supported or whether, instead, the spectrum is only suitable for less critical communications.

[38] The term "cellular" will be used herein to refer to wireless mobile service and systems generally, not limited to 850 MHz Part 22 cellular systems.

1. 1675–1710 MHz

Ericsson has previously commented on the use of the 1675–1710 MHz band[39] in response to a 2010 public notice,[40] stating that reallocating the band could provide additional spectrum for commercial broadband services as envisioned by the National Broadband Plan. And there are certain characteristics of the 1675–1710 MHz band that supported further consideration of this spectrum for commercial use. For example, it is adjacent to the AWS–1 band, which creates some synergies that would make it suitable for mobile broadband services. Specifically, service providers and equipment manufacturers may be able to use or adapt existing AWS–1 band equipment for spectrum that effectively could be an extension of that band. Further, placing "like" services in adjacent spectrum bands reduces the risk of harmful interference between licensees.

Unfortunately, the current assessment is critically constrained to the portion of the band identified in NTIA's January 2011 letter, namely 1695–1710 MHz.[41] This reduces the proposed spectrum by 20 MHz, down to 15 MHz. In addition, NTIA recommended that the Commission allocate the band to the non-Federal mobile service and establish large exclusion zones, 72 to 121 km in radius and covering over 12 percent of the population, to protect 18 Federal earth stations from potential harmful interference from mobile service transmitters.[42] Some of the

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[39] Ericsson 1675–1710 MHz Comments

[40] See *Office of Engineering and Technology Requests Information on Use of 1675–1710 MHz Band,* ET Docket 10–123, *Public Notice,* 25 F.C.C.R. 7285 (2010) ("OET Public Notice").

[41] Letter from Associate Administrator, Office of Spectrum Management, NTIA, to Chief, Office of Engineering and Technology, FCC, dated Jan. 19, 2011, available at http://www.ntia.doc.gov/filings/2011/NTIA_FCC_Letter_115%20MHz_01192011.pdf.

[42] *See Fast-Track Report* at 1-6, table 4-68, and App. H. The exclusion zones encompass areas in which approximately 12.65 percent of the U.S. population resides (based on 2000 U.S. Census data).

areas identified are in dense urban areas where spectrum capacity is needed. Even the synergies resulting from association with AWS–1 cannot overcome the significant shortcomings of such a small sliver of unpaired spectrum that will not be capable of nationwide deployment.

Ericsson submits that there are numerous other complications with reallocating only the 1695–1710 MHz band. First, allocating the spectrum for time division duplex ("TDD") broadband usage is not acceptable, given its adjacency to the AWS–1 band, TDD operations would inevitably introduce sources of harmful interference into the AWS–1 band. Second, principles of global spectrum harmonization contradict creating a unique U.S. allocation using only 15 megahertz of the 1675–1710 MHz band for wireless broadband use, because such an allocation would suffer from a lack of manufacturing scale.

Finally, the proposed 15 MHz of spectrum — less than half of the 1675–1710 MHz band — does not address the need to support wider bandwidth services. By contrast, the reallocation of the entire 1675–1710 MHz on a licensed basis, on the other hand, could provide additional spectrum for commercial broadband services, given that this spectrum could be paired with the 2075–2110 MHz band. Suitable and sufficient additional spectrum is critical to meet the growing demand for mobile broadband. The reallocation of the 35 MHz of spectrum in the 1675–1710 MHz band, as set forth in Ericsson's proposal in Section II.A above, fulfills many of the spectrum selection principles discussed in Section II.B.3 above, with the added benefit of having the same duplex spacing as AWS–1. This would ensure that products and services could be developed quickly and that the selection of spectrum would attract investment by the potential global economies of scale.

2. 1755–1850 MHz

The band 1755–1780 MHz, if paired with 2155–2180 MHz, is a high priority band for the commercial mobile industry and should be considered for reallocation on a licensed mobile

service basis. Currently, this band is allocated to the fixed, mobile, and space operation (earth-to-space) services on a primary basis for Federal use, and is used by the Department of Defense ("DOD"), Federal law enforcement agencies, and other agencies for a variety of satellite, surveillance, aeronautical operations, fixed microwave and other operations.

In the *Fast Track Report*, NTIA stated that it selected the 1755–1780 MHz segment for its potential to be paired with the 2155–2180 MHz band,[43] known as AWS–3.[44] The 1755–1850 MHz band is ideally suited to enable industry to rapidly deploy affordable mobile broadband across the U.S. because standards and system deployments already exist for mobile technology in the band. Industry has especially focused on the lower portion of that band, 1755–1780 MHz, to be paired as an uplink band with the AWS–3 band as a downlink band. This allocation would provide 2×25 MHz of contiguous spectrum that can be allocated in the wider blocks necessary for the technologies, such as LTE, that will be used to provide mobile broadband. This allocation and pairing also would extend existing uplink and downlink spectrum in the neighboring AWS–1 band and facilitate the expansion of an existing ecosystem. Therefore existing equipment could be modified to operate in this proposed pairing and thereby eliminate the need to develop a new band, which is always problematic to incorporate in equipment.

While Ericsson encourages continued consideration of the entire 1755–1850 MHz band for reallocation, 1755–1780 MHz has two unique benefits: it is the final remaining band identified internationally for next generation wireless systems that the U.S. has not yet allocated

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[43] *Id.* at 2-3 to 2-5 and 3-25 to 3-29.

[44] The AWS–3 band is currently 2155–2175 MHz, but the Commission has proposed adding the J block downlink spectrum at 2175–2180 MHz to the AWS–3 band. *See Service Rules for Advanced Wireless Services,* WT Docket 07–195, *Further Notice of Proposed Rulemaking,* 23 F.C.C.R. 9859 (2008) ("*AWS–3 FNPRM*").

for mobile broadband service,[45] and it has existing standards developed in accordance with those recommendations.[46] The Commission has long acknowledged that "[i]t is desirable for the spectrum chosen [for advanced wireless services] to be compatible with similar international developments"[47] because international harmonization of spectrum "will promote the timely introduction of new equipment and services into this spectrum."[48] Moreover, both NTIA and

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[45] This international recognition is long-standing. WRC–2000 identified 1710–1885 MHz for advanced wireless services. Although obviously such identification does not establish priority in the Radio Regulations nor preclude use of the band for other services, the U.S. has noted that identification of spectrum by WRCs "provide[s] uniform guidance to administrations, operators, and manufacturers in terms of deploying [advanced wireless services] and other advanced communication applications[.]" *Proposal for Terrestrial and Satellite Components of IMT–2000,* United States of America Proposals for the Work of the Conference, WRC–2000, at 15 (Apr. 17, 2000), *available at* http://www.itu.int/itudocr/itu-r/archives/wrc/wrc-2000/docs/1-99/12-a3_ww9.doc. And the U.S. itself urged international coordination of spectrum for advanced wireless services and proposed that "administrations deploying [advanced wireless services] should use the relevant international technical characteristics, as identified by ITU-R and ITU-T Recommendations." *Id*. at 16.

[46] Both the ITU and Organization of American States' Committee on Telecommunications ("CITEL") have recommended band plans pairing an uplink band at 1710–1770 MHz with a downlink band at 2110–2170 MHz band. *See Recommendation ITU-R M.1036-3,* Table 2 and Sec. 6.1.4.2 (2007) (recommending that administrations pair either 1710–1770 MHz or 1920–1980 MHz as an uplink band with 2110–2170 MHz as a downlink band), *available at* http://www.itu.int/rec/R-REC-M.1036-3-200707-I/en; CITEL, *XXI Meeting of Permanent Consultative Committee III: Radiocommunications, Final Report,* OEA/Ser.I/XVII 4.3, PCC.3/doc.2371/02 rev.2 (July 25, 2002) (recommending pairing 1710–1770 MHz for uplink use with 2110–2170 MHz for downlink use in Region 2, the Americas), *available at* http://www.citel.oas.org/pcc3_old/final/P3-2371r2_i.doc. 3GPP has already developed standards that support the ITU and CITEL recommendations. *See, e.g.*, 3GPP Technical Specification Group SA, *Meeting #25, Palm Spring, USA, September 13-16, 2004, Proposed Final Submission towards Rev. 5 of M.1457,* SP-040694, available at http://www.3gpp.org/ftp/tsg_sa/tsg_sa/TSGS_25/Docs/PDF/SP-040694.pdf.

[47] *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies,* Notice of Proposed Rulemaking, 7 F.C.C.R. 1542 (1992) (discussing decisions to be made at WARC–1992).

[48] *Advanced Wireless Services,* 68 Fed. Reg. 11986 (Mar. 13, 2003), cited in 47 C.F.R. § 2.106 NG178 (regarding the bands 2165–2180 MHz).

individual Federal agencies have previously released reports in 2000 and 2001 that address use of the 1755–1850 MHz band.[49]

All of these characteristics mean that this band provides numerous significant advantages that will enable a faster rollout of more affordable broadband and devices than if a different band were allocated for commercial use in its place. Because the band is adjacent to AWS–1 and the pairing has the same duplex separation between base and mobile operations as is present in AWS–1, multi-band devices will not need to support an additional band. As a result, existing AWS–1 base station receive antennas would require little, if any, modification to accommodate use of the 1755–1780 MHz band, and new network equipment, handsets, and other mobile devices can be produced at lower cost. In producing new equipment, manufacturers will be able to take advantage of global economies of scale instead of building network and handset equipment solely for the U.S. market,[50] also enabling lower-cost broadband and mobile devices. Internationally-harmonized bands also enable U.S. markets to benefit from exporting new technologies and services to other markets and U.S. consumers to benefit from developments in international markets.

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[49] *See, e.g.*, NTIA, *The Potential for Accommodating Third Generation Mobile Systems in the 1710–1850 MHz Band: Federal Operations, Relocation Costs, and Operational Impacts, Final Report*, NTIA Special Publication 01-46, at page 3-12 (March 2001), *available at* http://www.ntia.doc.gov/ntiahome/threeg/33001/3g33001.pdf; NTIA, *Federal Operations in the 1755–1850 MHz Band: The Potential for Accommodating Third Generation Mobile Systems, Interim Report*, NTIA Special Publication 01-41 (Nov. 15, 2000), available at http://www.ntia.doc.gov/osmhome/reports/imt2000/imt2000.pdf; *Department of Defense IMT–2000 Technical Working Group's Investigation of the Technical Feasibility of Accommodating the International Mobile Telecommunications (IMT) 2000 Within the 1755-1850 MHz Band*, Interim Report (Oct. 27, 2000), available at http://www.ntia.doc.gov/osmhome/reports/dodreport/DOD_IMT2K.pdf).

[50] *See* note 48 above.

These benefits, of course, do not negate the prerequisite of ascertaining the needs of incumbent federal users and providing for the continuance of those operations. Indeed, all parties involved acknowledge that those federal systems provide vital services to the country. Equally vital however, and of particular relevance at this time, are the economic benefits of providing mobile broadband across the country and of maximizing auction revenue for the Treasury.[51] So significant are the benefits of using 1755–1780 MHz for mobile broadband that it is worth every effort to find a solution to permit its allocation for that use.[52]

And indeed, it appears that there is no major obstacle standing in the way of reallocating the band to commercial use. T-Mobile has completed test scans of the band in eight major markets, four of which are near known government systems, and those results show that there is promise for reallocating the band for commercial use.[53] The federal uses of this band are predominantly similar to the uses of 1710–1755 MHz that industry has been clearing over recent years and T-Mobile has not identified any activity that would make clearing this band more

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[51] The Brattle Group recently conducted a study on the revenue that would be derived from pairing 20 MHz of AWS–3 with 20 MHz at either 1755–1775 MHz or 1690–1710 MHz. *See* letter from Coleman Bazelon, The Brattle Group, to the Secretary, ET Docket 10–123 *et al.*, (filed Apr. 11, 2011). The study concluded that the value at auction of the paired AWS–3 and 1755–1775 MHz bands is approximately $12 billion, and if the full 25 MHz of AWS–3 were paired with 1755–1780 MHz, the value would be approximately $15 billion. *Id*. at 11, 14-15. By contrast, the study concluded the value at auction of pairing 20 MHz of AWS–3 with 1690–1710 MHz is only $7.3 billion. *Id*. at 20.

[52] The possibility of establishing exclusion zones around the satellite earth stations to protect wireless broadband receivers would likely decrease the benefits of this band by increasing the complexity of the equipment design and possibly impacting its value at auction. *Public Notice,* 26 F.C.C.R. at 3489.

[53] Letter from Kathleen O'Brien Ham, T-Mobile, to the Secretary, ET Docket 10–123, at 1 (Aug 16, 2010).

challenging than clearing AWS–1.[54] Industry's recent experiences in working to clear AWS–1 also should provide the means to improve the process in this band.

3. 2155–2180 MHz (AWS–3)

As Ericsson and others have previously advocated, the Commission and NTIA should concentrate their efforts to reallocate the 1755–1780 MHz band for commercial mobile services on a primary basis and to pair that spectrum with the AWS–3 band, including the J block downlink spectrum at 2175–2180 MHz that the Commission has proposed adding to the AWS–3 band.[55] This is consistent with ITU and CITEL decisions endorsing the pairing of the 2110–2170 MHz band with the 1710–1770 MHz band as an option for North and South American implementation of 3G services.[56] Global standards also have been developed that support the ITU and CITEL endorsement.[57] In fact, as far back as 2000, NTIA acknowledged that reallocation of 1755–1780 MHz for commercial use is possible, albeit with some challenges.[58] In addition, the 2110–2170 MHz portion of the band is a global FDD downlink band, which has available products in the market today. Further, the 1755–1780 MHz band is adjacent to the

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[54] Comments of T-Mobile USA Inc., ET Docket 10–123, at 9 (June 28, 2010).

[55] *See AWS–3 FNPRM*.

[56] *See* note 46 above.

[57] *See* note **Error! Bookmark not defined.** above.

[58] *See* NTIA, *Federal Operations in the 1755–1850 MHz Band: The Potential for Accommodating Third Generation Mobile Systems, Interim Report*, NTIA Special Publication 01-41 (Nov. 15, 2000), *available at* http://www.ntia.doc.gov/osmhome/reports/imt2000/imt2000.pdf. This report included a thorough analysis of the electromagnetic compatibility between major federal systems in the 1755–1850 MHz band and advanced wireless systems, relocation costs, operational impacts of federal migration, and the time requirements should DOD systems move from the band. *See also* Letter from Chris Pearson, President, 3G Americas, to Lawrence Strickling, Asst. Secretary for Communications and Information, U.S. Dept. of Commerce (May 25, 2010).

AWS–1 uplink band and overlaps with GSM1800, which will help reduce the need for more technology developments and minimize the number of new bands in multiband devices.

4. 2700–2900 MHz

The 2700–2900 MHz band is globally harmonized and has radio wave propagation properties that make it an excellent band to consider for providing mobile broadband. Given the proximity of the 2700–2900 MHz band to the Broadband Radio Service ("BRS") at 2.5 GHz and the internationally standardized 3GPP Band 7 (2500–2570 MHz uplink paired with 2620–2690 MHz downlink), this band warrants particular consideration. Although NTIA did not consider the 2700–2900 MHz band for fast-track identification, the band nonetheless ought to be on the table for consideration as another band suitable for mobile broadband.

The 2700–2900 MHz band is currently licensed on a primary basis to Aeronautical Radionavigation Service (ARNS) and Meteorological Aids, and on a secondary basis to Radiolocation services.[59] The band also is subject to U.S.-Canada/Mexico bilateral agreements[60] and may therefore offer a harmonization opportunity to share same spectrum arrangement between our countries for mobile broadband services.

Band 7 is very heavily used in some countries and being rolled out in other countries in Asia-Pacific, Europe and Latin America. Equipment manufacturers, including Ericsson, are currently deploying IMT high speed mobile broadband infrastructure to operate in Band 7 providing more than 30 Mbps speeds on average to consumers, with noted top speeds of more than 90 Mbps in some cities in Europe. As such, given the *relative* ease of development and

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[59] *See Interim Report Spectrum Study of the 2500–2690 Band, The Potential for Accommodating Third Generation Mobile Systems,* App. 3.1 at A-35 (Nov. 15, 2000), *available at* http://www.fcc.gov/3G/3G_interim_report.pdf.

[60] *See Ten-Year* Plan at 7.

manufacturing of equipment designed for use in bands close in proximity to previously identified spectrum, the 2700–2900 MHz band could yield economies of scale fairly quickly were it to be opened for mobile use.[61]

Indeed, some countries are already studying the potential to relocate services currently in the 2700–2900 MHz band for the possible use by IMT. Notably, the UK's Ministry of Defence has identified three bands as priorities for investigation as possible spectrum to be reallocated for mobile broadband use, including the 2700–3100 MHz band.[62] Although at a very early stage of discussion, it is possible that 2700–2900 MHz band could be identified for auction after civil radars are moved out of the band.

Recognizing that reallocation of the 2700–2900 MHz band — as it may be identified as a safety of life band in some countries — may require a long timeframe to prepare for a mobile broadband service, Ericsson supports conducting studies regarding the potential for sharing the band in the short term. Although technical challenges for full-power downlink sites sharing with the radar services exist, it may be possible, in certain situations, to share spectrum in the 2700–2900 MHz band with radars by initially using microcells or picocells for downlinks to mobile broadband devices.

Ericsson asks that the Commission and NTIA survey this band to ascertain the possibility of initially segmenting the band by moving radar services not already located in the upper portion of the band toward that area. If, for example, the band could initially be repacked in a

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[61] *See Mobile Industry Backing (mib) Terrestrial Spectrum for IMT (Agenda Item 1.5) in WRC-07, Summary of Results of ITU-R Report M.2079 and the CPM Report* (Aug. 28, 2007), *available at* http://standards.nortel.com/spectrum4IMT/Geneva/R03-WRCAFR07-C-0024.pdf.

[62] Department for Culture, Media, and Sport, *Enabling UK Growth – Releasing Public Spectrum: Making 500 MHz of Spectrum Available by 2020,* at 6, 25, 33 (March 2011), *available at* http://www.culture.gov.uk/images/publications/Spectrum_Release.pdf.

manner to support radars in the upper 100 MHz of the band, that could potentially free up 100 MHz for mobile broadband beginning at 2700 MHz. Again, given the proximity to Band 7, equipment manufacturers could design equipment to take advantage of the possibility for radio frequency carrier aggregation with Band 7. Potentially larger blocks of spectrum near Band 7 could dramatically increase mobile broadband speeds for Internet, educational, health and multimedia services.

Accordingly, Ericsson recommends that the Commission and NTIA urgently study the band and analyze: (1) the potential for sharing with mobile broadband, or (2) segmentation of the band coupled with repacking to initially move radars toward the upper portion of the band before making the whole band available to mobile broadband services to provide American consumers with Internet, educational, health and multimedia services. In the long term, Ericsson supports reallocation of existing services in the 2700–2900 MHz band to the 2950–3400 MHz band.

5. 3410–3800 MHz

Ericsson recommends that spectrum in this band be reallocated according to globally harmonized activities within 3GPP and ITU. NTIA recommended "that the 3550–3650 MHz bands can be made available for wireless broadband, with some geographic limitations on wireless broadband implementation."[63] NTIA, moreover, "concluded that the range 3550–3650 MHz band offers the opportunity to implement wireless broadband over large portions of the United States."[64] "Staying above 3550 MHz," NTIA said, was intended to "greatly reduce[] the potential for interference from high power radars operating below 3500 MHz."[65]

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[63] *Fast-Track Report* at 1-4.

[64] *Id.* at 1-6.

[65] *Id.*

The *Public Notice* points out that NTIA's proposal would prohibit non-government users "from operating up to as much as 570 km from the U.S. coastline, and additional exclusion zones would be established for ten locations."[66] The exclusion zone distances are based on compatibility studies using wireless broadband transmitter characteristics stated in Appendix B of the *Fast-Track Report*. In Section II.C above, Ericsson offered changes to these parameters that will likely impact the exclusion zone distances.

Dense deployments at the next level of a cellular network can use the region between 1 GHz and 3 GHz for smaller cell diameters, while picocellular deployments can benefit from frequency bands between 1and 4 GHz. Deployments in enterprises and other public areas can span the frequency range 2 GHz to 5 GHz, while homes would benefit from deployments that span between 3 GHz and 5 GHz as well. The size and location of the exclusion zones prohibits their use in these dense, smaller-cell environments.

NTIA also recommended "that the FCC require the use of radio frequency front-end filters with between 30 and 40 decibels of attenuation at 3500 MHz in order to protect the new mobile and base station receivers from high power radar interference."[67] However, as in the AWS–3 proceeding, the passband losses due to filters at these frequencies are substantial with only *moderate* stopband attenuation.[68]

Based on the size and location of the exclusion zones, high-powered radars, stringent filtering requirements, and fixed satellite service in the band, the usage of the band 3550–3650 MHz for commercial mobile broadband services on a shared basis does not appear to be

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[66] 26 F.C.C.R. at 3488.

[67] *Fast-Track Report* at 4-78.

[68] Comments of Ericsson Inc and Sony-Ericsson Mobile Communications (USA) Inc., WT Docket 07–195, at (July 25, 2008).

supportable. As an alternative to sharing, Ericsson asks that the Commission and NTIA perform a survey of this band to determine the possibility of an initial initiative to segment the band and move the radar services. For example, if the band could be repacked in the short term to support radars in one portion of the band, that could potentially free up contiguous spectrum for mobile broadband.

In the longer term, it would be best to relocate services in the C-Band (3410–3800 MHz) to the 2950–3400 MHz band. The band plan for the range 3410–3800 MHz for mobile services is very much still under discussion within 3GPP, CEPT and ITU. It is generally agreed within 3GPP to use an unpaired arrangement in the band 3600–3800 MHz, whereas options are still being debated for the band 3410–3600 MHz. Ericsson would very much like national allocations to be aligned with global decisions.

III. CONCLUSION

For the reasons stated, the Commission should take into consideration the information and recommendations herein.

Respectfully submitted,

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