

Before the DEPARTMENT OF COMMERCE,
National Telecommunications and Information Administration,
Washington, DC 20554

National Spectrum Strategy

Docket Number: NTIA-2303-0003

COMMENTS OF SAMSUNG ELECTRONICS AMERICA, INC.

I. INTRODUCTION

Samsung Electronics America, Inc. (“Samsung”) submits these comments in response to the above-captioned Request for Comment (“RFC”)¹ seeking public input on the development of a National Spectrum Strategy (“NSS”). Samsung welcomes this opportunity to support the efforts of the Department of Commerce and the National Telecommunications and Information Administration (“NTIA”), in collaboration with the Federal Communications Commission (“FCC”), to develop information that will define the US strategy for spectrum.

Samsung is a global leader in 5G, across network equipment, semiconductor chips, mobile devices, services, planning tools, from a trusted and secure supply chain and continues to be an instrumental contributor and partner in the U.S. effort to rapidly deploy 5G. Samsung provided equipment for the launch of Verizon 5G Home, a fixed wireless broadband offering that launched in October 2018 as the world’s first commercial 5G service.² In September 2020,

¹ Department of Commerce, NTIA, Development of a National Spectrum Strategy, Request for Comments, 88 Fed. Reg. 16244 (Mar. 16, 2023) (“RFC”).

² <https://news.samsung.com/us/samsung-supports-verizons-5g-home-launch-5g-end-end-solutions/>

Samsung and Verizon signed a large-scale agreement to supply network equipment and services for Verizon's next-generation network.³ Our 5G equipment for Verizon, which is fully virtualized radio access network (vRAN) equipment using commercial, off-the-shelf processing hardware, is now operational in markets around the country.⁴ Last May, we announced an agreement with DISH Network to supply 5G Open RAN and vRAN equipment.⁵ That agreement involves over \$1 billion of radio units and software and supports all of DISH's low-band and mid-band spectrum. In October, Samsung announced a contract with Comcast to supply 5G RAN gear to power their 5G buildout.⁶ We also have partnerships to supply 5G equipment to AT&T⁷ and US Cellular.⁸ Globally, Samsung is supplying 5G network equipment to major carriers in key markets like Korea, Japan, Canada, New Zealand, India, and the UK.

In the standard-setting arena, Samsung is a leader in 3GPP and the O-RAN Alliance.⁹ Samsung pioneered cross-vendor RAN interoperability – i.e., between the equipment at the top

³ Samsung Electronics Announces Third Quarter 2020 Results, 29 October 2020, <https://news.samsung.com/global/samsung-electronics-announces-third-quarter-2020-results>

⁴ Verizon starts C-Band equipment deployment, 21 April 2021, <https://www.samsung.com/global/business/networks/insights/press-release/0419-verizon-starts-c-band-equipment-deployment/>

⁵ DISH Wireless Selects Samsung Electronics for 5G Open Radio Access Network Rollout, 3 May 2022, <https://www.samsung.com/global/business/networks/insights/press-release/0502-dish-wireless-selects-samsung-electronics-for-5g-open-radio-access-network-rollout/>

⁶ Samsung Tapped to Support Comcast's 5G Connectivity Efforts, 22 September 2022, <https://www.samsung.com/global/business/networks/insights/press-release/0921-samsung-tapped-to-support-comcasts-5g-connectivity-efforts/>

⁷ AT&T Selects Samsung as a Technology Supplier for CBRS and 5G Initiatives, 9 October 2018, <https://news.samsung.com/us/att-selects-samsung-technology-supplier-cbrs-5g-initiatives/>

⁸ <https://news.samsung.com/us/us-cellular-selects-samsung-5g-4g-lte-network-solutions/>, 21 February 2020, <https://news.samsung.com/us/us-cellular-selects-samsung-5g-4g-lte-network-solutions/>

⁹ Samsung Researcher Elected as the Chair of 3GPP Radio Access Network Working Group 1, 12 May 2021, <https://news.samsung.com/global/samsung-researcher-elected-as-the-chair-of-3gpp-radio-access-network-working-group-1>. Samsung Researcher Elected as the Vice Chair of 3GPP SA6 Working Group, 30 June 2022, <https://research.samsung.com/news/Samsung-Researcher-Elected-as-the-Vice-Chair-of-3GPP-SA6-Working-Group>. Samsung Is Elected to the Technical Oversight Committee of the O-RAN Open Source Project, 25 April 2022, <https://news.samsung.com/global/samsung-is-elected-to-the-technical-oversight-committee-of-the-o-ran-open-source-project>

and base of a cell tower - even before the founding of the O-RAN Alliance in 2018 and the subsequent development of O-RAN specifications.

Samsung is at the forefront of researching 6G technologies with the vision of bringing hyper-connected experiences for all.¹⁰ Samsung is actively researching the entire spectrum of key 6G enabling technologies, including core radio technologies for new frequency bands (e.g., 10-15 GHz in upper mid-bands and around 140 GHz in the sub-THz range), new channel coding, new waveforms, next generation network architecture, and utilization of AI across various entities in the whole communication network.

Samsung is striving to achieve a 6G vision in an industry consensus-based approach so that the technologies created can eventually be realized through global standards (e.g., 3GPP). To promote globally harmonized research activities, Samsung joined the Next G Alliance as a founding member and is participating in various industry and academic forums.¹¹ Samsung is also actively involved in the ITU-R working groups that are setting the basic framework, requirements, and evaluation methods for 6G.

Samsung fully agrees with NTIA that the United States increasingly depends on secure and reliable access to radio frequency spectrum. Sufficient access to spectrum is vital to national security, critical infrastructure, transportation, emergency response, public safety, scientific discovery, economic growth, competitive next-generation communications, and diversity, equity, and inclusion. Increased spectrum access will also advance U.S. innovation, connectivity, and

¹⁰ Samsung's 6G White Paper Lays Out the Company's Vision for the Next Generation of Communications Technology, 14 July 2020, [6G – The Next Hyper-Connected Experience for All](#). Samsung Unveils 6G Spectrum White Paper and 6G Research Findings, 8 May 2022, [6G Spectrum: Expanding the Frontier](#). Industry Experts Discuss the Present, Potential and Future of Next-Generation Communications Technologies at Samsung's First-Ever 6G Forum, 20 May 2022. [Samsung 6G Forum](#).

¹¹ ATIS Launches Next G Alliance to Advance North American Leadership in 6G, 13 October 2020, <https://www.atis.org/press-releases/atis-launches-next-g-alliance-to-advance-north-american-leadership-in-6g/>

competition, create high-paying and highly skilled jobs, and produce improvements to the overall quality of life. Access to more spectrum, in short, will help the United States continue to lead the world in advanced technology and enhance our national and economic security.

II. THE UNITED STATES MUST HAVE A SPECTRUM PIPELINE FOR LEADERSHIP IN SPECTRUM BASED TECHNOLOGIES AND TO ENSURE A STRONG ECONOMY

A spectrum pipeline is critical for leadership in spectrum-based technologies which will lead to a strong economy. In order to help develop this pipeline, we provide the following views to help provide an understanding of the spectrum needs as well as target spectrum for study.

A. Spectrum Needs

We appreciate NTIA's question on performance targets for 6G, which are currently under study to enable ultimate experience services such as truly immersive XR (extended reality), high-fidelity mobile holograms and digital replicas.¹² While the performance requirements for 6G are still being discussed, example requirements include the peak data rate of 200 Gbps and air latency of 100 microseconds, which are 10 times improved compared to 5G performance requirements. Accordingly, the NTIA target of 1500 MHz for study will provide a significant start for identifying the spectrum necessary to fulfill the performance requirements of 6G.

To realize the full experience of 6G, it will be essential to utilize a range of frequencies that can achieve enhanced coverage as well as enhanced capacity. Various applications and services require access to spectrum in low, middle, and high bands. The existing bands below 6 GHz currently used by 4G/5G are optimal for coverage and could be re-farmed for 6G, just as

¹² Samsung's 6G White Paper Lays Out the Company's Vision for the Next Generation of Communications Technology, 14 July 2020, [6G – The Next Hyper-Connected Experience for All](#).

the 2G/3G bands were re-farmed for 4G/5G services. The NSS should ensure that additional frequencies are considered in low bands with broad coverage to ensure broadband is available to everyone in the US. Middle bands will provide a balance of coverage and capacity, while high bands will provide less coverage but even greater capacity.

Meanwhile, it is becoming more and more difficult to identify frequency bands to be used exclusively for mobile communication. Therefore, it will be very important to use the limited frequency resources from low-band to high-band efficiently, and it is expected that selective, flexible use of frequency bands spatially and temporally, will be more significant in the 6G era. 6G should leverage advanced spectrum techniques as much as possible, and innovative new technologies for spectrum sharing and adjacent band compatibility will be crucial.

The Global mobile Suppliers Alliance (GSA), in which Samsung is participating as a member company, recently introduced initial study results¹³ on spectrum needs of specific 6G use cases such as extended reality (XR), holographic communications, and integrated communication and sensing. Based on assumptions and circumstances for wide-area deployments, GSA determined that 1 GHz bandwidth for XR and around 300-750 MHz bandwidth for integrated communication and sensing would be required for implementation. Taking into account the existing bands, the estimated additional wide-area spectrum needs per operator could be 500-750 MHz.

B. Target Spectrum for Potential Repurposing

6G spectrum requires all frequency ranges from low to high bands, and 6G communication systems will be deployed in all bands once 6G reaches full maturity. Samsung

¹³ “IMT-2030 (6G) Spectrum Needs Analysis “, APG23-5/INF-26, 13 Feb 2023, https://www.ap.tint/sites/default/files/2023/02/APG23-5-INF-26_IMT-2030_6G_spectrum_need_analysis.docx

defines mid-band as the frequency range from 1 GHz to 24 GHz. In the mid-band range, essential 6G spectrum would include 3.1-3.45 GHz¹⁴, 7.125-7.7 GHz, and 12.7-13.25 GHz¹⁵. The mid-band spectrum will provide high data rate as well as coverage by utilizing wide bandwidth and advanced radio technologies. The 3 GHz band is regarded and prioritized as the key global band for 5G service, with portions of the band identified for 5G in more than 25 countries around the world. Therefore, 3.1-3.45 GHz should be made available in the U.S as soon as practicable, as discussed in Section V below. Samsung also believes the 7.125-7.7 GHz range and the 12.7-13.25 GHz band should be identified for 6G. To optimize 6G services, Samsung has no doubt that exclusive licensed use would be optimal. However, due to the current situation of spectrum usage by incumbent services in these three bands, sharing with the incumbents may be also considered with the least possible restrictions on terrestrial usage for IMT.

Global/regional frequency harmonization has various benefits, such as equipment compatibility, roaming, economies of scale, as well as fast global industrial promotion. In the longer term, in order to have international harmonization of global 6G spectrum, Samsung supports the ITU adoption of an agenda item for WRC-27 studies that includes the ranges 10.7-15.35 GHz and 18.1-19.7 GHz.¹⁶ Among other possible candidate ranges, however, Samsung agrees with FiRa Consortium that the 7.7-9.3 GHz range should not be a part of the scope of ITU study or other future spectrum reallocation discussions.¹⁷ Currently, there are systems and

¹⁴ “New task group explores 5G spectrum sharing with DoD,” Fierce Wireless, 1 Nov 2021, <https://www.fiercewireless.com/regulatory/new-task-group-explores-5g-spectrum-sharing-dod>

¹⁵ [FCC to Examine 12.7 GHz Band for Next-Gen Wireless | Federal Communications Commission](https://www.fcc.gov/public/attachments/DA-23-296A1.pdf)

¹⁶ Office of International Affairs Seek Comment On Recommendations Approved by the World Radiocommunication Conference Advisory Committee, 12 Apr 2023, IB Docket 16-185, DA 23-296, <https://docs.fcc.gov/public/attachments/DA-23-296A1.pdf>.

¹⁷ [Spectrum-Position-Statement-January-2023.pdf \(firaconsortium.org\)](https://www.firaconsortium.org/Spectrum-Position-Statement-January-2023.pdf)

services utilizing ultra-wideband (UWB) technology within this band, which can coexist well with the incumbent spectrum applications in the band. UWB technology is based on the IEEE standard 802.15.4z, which enables highly accurate distance measurement between devices or between devices and infrastructure. Utilizing this technology, consumer and industrial services and products have been globally deployed to enable real-time location-based services, hands-free services and peer-to-peer services. For example, many consumer handsets sold by Samsung and other manufacturers are equipped with UWB and provide digital car key services with vehicles from BMW and Hyundai.¹⁸ Looking at future market growth it is estimated that the global indoor location market will grow from approximately \$7 billion in 2021 to \$19.7 billion by 2026.¹⁹ According to FiRa Consortium the total of all UWB-enabled devices shipped globally will grow from 109 million devices in 2019 to over 1 billion devices by 2025. Cumulatively, 3.6 billion UWB-enabled devices will be shipped globally by 2025.²⁰

III. PLANNING IS KEY TO SUCCESS IN DELIVERING SPECTRUM FOR NEAR, MID, AND LONG TERM

The National Spectrum Strategy should include plans for the provision of spectrum in the near, middle, and long term. Spectrum planning should be iterative, and once a national spectrum strategy is issued by NTIA/FCC, the plan should be revisited on a regular basis with the same level of focus and effort put into the current plan, such as on a 3-5 year cycle.

¹⁸ Samsung UWB: <https://news.samsung.com/global/samsung-expects-uwband-to-be-one-of-the-next-big-wireless-technologies>. Apple UWB: <https://developer.apple.com/nearby-interaction/>. BMW UWB: <https://www.bmw.com/en/innovation/bmw-digital-key-plus-ultra-wideband.html>. Hyundai UWB (Korean only): <https://www.hyundai.co.kr/news/CONT000000000021493>.

¹⁹ <https://www.marketsandmarkets.com/Market-Reports/indoor-location-market-989.html>

²⁰ [Spectrum-Position-Statement-January-2023.pdf \(firaconsortium.org\)](https://www.firaconsortium.org/Spectrum-Position-Statement-January-2023.pdf).

The initial NSS should define specific requirements for the collection of information about the spectrum utilization of incumbents, a federal spectrum mapping initiative that would provide much-needed data for spectrum planning. The NSS should consider the model the FCC has implemented under the national broadband map development process in which operators are required to provide a very detailed set of data describing their deployments for review and analysis by the FCC. A federal spectrum utilization mapping process should also identify a single government entity, such as the NTIA, to direct and manage submission of data by federal stakeholders.

While the FCC is the final arbitrator of non-federal spectrum decisions based on input from all parties, we recommend the NTIA take on this role with regard to federal spectrum. The NTIA should take a stronger role in the leadership of the federal government spectrum policy and be the technical arbitrator when disputes arise during the spectrum planning process. Once those disputes are resolved, the NTIA should limit revisiting the same issues during implementation.²¹ For example, while individual agencies may take a very restrictive view on issues such as interference and sharing, NTIA could leverage its strong technical resources, such as those at the Institute for Telecommunications Studies, to better quantify issues and bring to the discussion with FCC independent consolidated federal viewpoint of the issues and concerns.

The NSS should also leverage existing committees for expertise and analysis. For instance, FCC's Technical Advisory Committee (TAC) and NTIA's Commerce Spectrum Management Advisory Committee (CSMAC) have been taking significant roles to develop

²¹ Aviation Community Petitions FCC to Revisit 5G Approvals; FAA Warns of Potential Radar Altimeter Interference, 4 November 2021, <https://nbaa.org/aircraft-operations/communications-navigation-surveillance-cns/global-positioning-system-gps/aviation-community-petitions-fcc-to-revisit-5g-approvals-faa-warns-of-potential-radar-altimeter-interference/>

spectrum-related recommendations from participants from a broad range of stakeholders from industry, academia, etc.

Samsung has observed that in previous mobile communication generations, it has taken around 10 years from initial study until the spectrum becomes available for use. In order for 6G to be deployed in the 2030 time frame, planning on 6G spectrum has already begun. 6G spectrum needs to be secured expeditiously through exploring new bands as well as re-farming of existing bands. In order to support a smooth transition between generations, the initial 6G allocation should be in new frequency band(s). Re-farming of the existing bands could be performed later for network expansion as the ecosystem expands.

IV. SPECTRUM ACCESS AND MANAGEMENT THROUGH TECHNOLOGY IS ONE OF MANY TECHNIQUES TO ENABLE SPECTRUM SHARING

Spectrum access and management through technology has opened up new bands to allow for innovative opportunities for services that would not have been possible without technologies such as Dynamic Frequency Selection (DFS in the 5.25-5.35 GHz and 5.47-5.725 GHz unlicensed bands), Spectrum Access System (SAS in the 3.55-3.7 GHz shared access bands) or Automated Frequency Control (AFC in the 5.925-6.425 GHz and 6.525-6.875 GHz unlicensed bands). We support continued use and application of these tools in bands that would require such technology to allow for expanded spectrum access. One of the near-term actions we recommend is to complete rules for the shared access band at 37-37.6 GHz to provide a licensed-by-rule deployment scheme that employs database-managed automated technology to ensure compatibility.

We expect that spectrum management and access technologies, such as DFS, SAS, and AFC, currently deployed will evolve and be applied to 6G systems. To enable efficient spectrum

utilization, 6G could natively integrate spectrum sensing, data collection, analysis, and spectrum access. Furthermore, we expect there will be research effort on AI-based technologies for spectrum sensing, interference control, power control, and policy automation for efficient spectrum access and management.

However, the NSS should not overlook other, less complex techniques for spectrum sharing in addition to the above technology-based techniques. The NSS should also employ coordination between license-holders and incumbents to enable sharing with federal incumbents in licensed exclusive bands, as has been done to open other shared bands such as AWS and 3.45-3.55 GHz.

V. THE IMPLEMENTATION PLAN FOR THE NATIONAL SPECTRUM STRATEGY SHOULD PROVIDE FOR REGULAR REVIEWS AND UPDATES

As noted above, Samsung believes the implementation plan of the NSS should include a regular review of the current strategy with consideration of any new technology developments as well as updated spectrum needs. We recommend a review on a 3-5 year cycle with a focus on what is working and what can be done better.

The plan should include, in the next 12 months, completion of the process for shared access to the 37-37.6 GHz band, development of final plans for exclusive licensed spectrum in 3.1-3.45 GHz, and adoption of a global spectrum study for completion at WRC-27. In the next 12-36 months the plan should include completion of auctioning licenses in the 3.1-3.45 GHz band as well as studies for access to frequencies within the 7.125-7.7 GHz, 10.7-15.35 GHz and 18.1-19.7 GHz ranges.

VI. SUMMARY AND CONCLUSION

The United States increasingly depends on secure and reliable access to radio frequency spectrum, and the development of a National Spectrum Strategy is essential to ensure sufficient access to spectrum. This is vital to national security, critical infrastructure, transportation, emergency response, public safety, scientific discovery, economic growth, competitive next-generation communications, and diversity, equity, and inclusion.

The effort to identify 1,500 MHz for study is a good start at continuing U.S. leadership, and the strategy will need to be regularly updated as needs evolve. The strategy should enable near-term delivery of low-hanging fruit by completing the spectrum access rules for 37-37.6 GHz. For 6G spectrum studies under the ITU process, the US should focus on 7.125-7.7 GHz, 10.7-15.35 GHz and 18.1-19.7 GHz.

NTIA should take a stronger role in the leadership of federal spectrum policy and be a technical arbitrator when disputes arise during the spectrum planning process. Once those disputes are resolved, the NTIA should limit revisiting the same issues during implementation.

/s/ John Godfrey
John Godfrey
Senior Vice President, Public Policy

Robert Kubik, Ph.D.
Senior Director, Public Policy
Engineering & Technology

SAMSUNG ELECTRONICS AMERICA, INC.
700 Pennsylvania Avenue SE, Suite 600
Washington, DC 20003

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