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DSA
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September 10, 2023

Communication, Space and Technology Commission (CST)
Al Nakheel District
Prince Turki bin Abdu Aziz I Street intersection with Imam Saud bin Abdul Aziz Road
75606 Riyadh 11588
Saudi Arabia.

Re: Request for Public Consultation on the Spectrum Light Licensing Regulations; and Request for Public Consultation on the Light Licensing Regulations for the 4 GHz Frequency Band

Dear CST –

The Dynamic Spectrum Alliance (DSA) respectfully submits these comments in response to CST's "Request for Public Consultation on the Spectrum Light Licensing Regulations" and "Request for Public Consultation on the Light Licensing Regulations for the 4 GHz Frequency Band."

The DSA applauds CST's decision to "facilitate innovation and encourage investment in new wireless services by enabling private 5G networks through light licensing." We fully agree that light licensing can make more efficient use of scarce radio frequencies in a way that protects existing incumbents and increases spectrum access options for new wireless services, which will facilitate competition, enhance connectivity, and promote investment.

We commend CST's plans to implement a light licensing framework and believe the proposed framework is an excellent first step in the process of increasing and streamlining spectrum access for a wide range of new users. We agree with CST, however, that it will be important to take the next step by leveraging commercially available automated shared access technology and tools to further streamline and enhance users' experience with the light licensing framework.

DSA members have designed and operated automated dynamic spectrum management systems (DSMS) on a commercial basis in the TV White Space (TVWS), 3.5 GHz, and 6 GHz bands and have significant insight into their operational capabilities and benefits as they enable the introduction of new services, including broadband mobile and fixed networks, local and private use cases, and applications. The success of these automated spectrum management systems has been notable - both in terms of their ability to increase spectrum efficiency by enabling new services while successfully protecting incumbents as well as their ability to increase spectrum access options for a wide range of innovative, competitive services.

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We are available to discuss these comments and provide any additional information as CST finalizes its regulations for the 4 GHz Light License framework and refines its plans to implement DSMS solutions in the Kingdom of Saudi Arabia.

Respectfully submitted,

Martha SUAREZ
President
Dynamic Spectrum Alliance

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DSA RESPONSES TO QUESTIONS

Questions 1-4:

Q1: Do you have any plans for private wireless networks deployment?

Q2: What applications do you currently use and/or planning to implement through private wireless networks?

Q3: Please elaborate on how light licensing in the 4 GHz band can satisfy your demand for private wireless network deployment?

Q4: Are you currently running your own network? What are the pros and cons of running your own network?

The DSA is a global, cross-industry, not for profit organization advocating for laws, regulations, and economic best practices that will lead to more efficient utilization of spectrum, fostering innovation and affordable connectivity for all. Our membership spans multinationals, small-and medium-sized enterprises, as well as academic, research and other organizations from around the world all working to create innovative solutions that will benefit consumers and businesses alike by making spectrum abundant through dynamic spectrum sharing.

The DSA does not provide broadband services; however, several of our members develop chipsets, devices, technologies, and services to support wireless broadband services globally. We work closely with service providers, including a variety of Wireless Internet Service Providers (WISPs) that note the difficulties associated with accessing spectrum on an affordable basis under traditional exclusively licensed approaches to support their broadband service offerings, particularly to unserved and/or under-served populations and areas. Our members also support the efforts of numerous private wireless users that have been historically unable to access spectrum to support their particular use case and geographic requirements under traditional licensing approaches. With the introduction of shared licensing frameworks, the spectrum access needs of these users are now being met.

Questions 5-8:

Q5: What is your vision for private wireless networks as a service provider?

Q2: What applications do private wireless networks enable?

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Q3: Please elaborate on how light licensing in the 4 GHz band can utilize 5G capabilities for applications in Q6?

Q4: If service providers were allowed to obtain a 4 GHz light-license, would you be interested to provide infrastructure only or provide infrastructure and operating the network for the end-user?

As mentioned above, the DSA does not provide broadband services. However, our members work closely with private wireless network users and note that demand for streamlined, low-cost access for private wireless networks is strong and will continue to grow well into the future. We call to CST's attention the recent report issued by the U.S. Institute for Telecommunication Science (ITS), entitled "An Analysis of Aggregate CBRS SAS Data from April 2021 to January 2023."[1] This report shows that growth of access to the 3.5 GHz Citizens Broadband Radio Service (CBRS) has been strong, with a "mean quarterly increase of 12.0% and a total increase of 121% over the 21-month analysis period."[2] ITS notes that the majority of these deployments use spectrum in the CBRS licensed-by-rule General Authorized Access (GAA) tier, which does not require a user to apply for a license, but only to use certified equipment and to receive a spectrum assignment by one of the Spectrum Access System (SAS) administrators.

The SAS administrators use DSMS technology to manage spectrum assignments for over 360,000 4G and 5G base stations, deployed by both 228 Priority Access License (PAL) holders and more than 1200 GAA operators, while protecting incumbent operations from interference. Much of this deployment has been driven by enterprises for private wireless use cases, including utilities, retail, smart agriculture, smart warehousing, smart manufacturing, schools, healthcare institutions, etc. Examples of such private wireless network deployments using the CBRS GAA tier include:

Energy management:
https://www.fiercewireless.com/private-wireless/schneider-electric-adds-private-wireless-smart-factories

[1] Available at https://its.ntia.gov/about-its/archive/2023/new-first-of-its-kind-report-provides-analysis-of-early-cbrs-deployment-data.
[2] Id.

Retail:
https://www.druidsoftware.com/2019/11/15/cbrs-ongo-at-american-dream-entertainment-retail-complex-nj-usa/

Military logistics:
https://www.fiercewireless.com/private-wireless/federated-demo-dod-highlights-benefits-shared-spectrum

Municipal government:
https://www.fiercewireless.com/private-wireless/motorola-and-harris-county-build-private-lte-network

https://www.fiercewireless.com/private-wireless/cox-launches-cbrs-pilot-city-las-vegas

Transportation:
https://www.fiercewireless.com/wireless/boingo-deploys-trial-cbrs-network-at-dallas-love-field-airport

Education:
https://www.csrwire.com/press_releases/747561-private-wireless-helps-schools-close-digital-divide

https://www.fiercewireless.com/private-wireless/fort-worth-isd-builds-sustainable-cbrs-network

https://www.fiercewireless.com/private-wireless/samsung-amdocs-deploy-private-cbrs-network-howard-university

Entertainment:
https://inbuildingtech.com/venues/connectivity-wireless-jma-stadium-cbrs/

Hospitality:
https://www.thefastmode.com/technology-solutions/24585-airspan-networks-deploys-5g-cbrs-private-network-for-hospitality-industry

Manufacturing warehouse/supply chain:
https://www.fiercewireless.com/private-wireless/calchip-connect-emerges-key-player-private-wireless

https://www.fiercewireless.com/private-wireless/mxd-adds-second-private-wireless-network

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Agriculture:
https://www.fiercewireless.com/private-wireless/three-day-deployment-makes-tractors-autonomous

https://enterpriseiotinsights.com/20220607/smart-farm/how-robot-tractors-and-a-private-network-came-together-at-a-smart-vineyard

Questions 9-11:

Q9: Are any of the above eligibility options more economically and regulatory feasible than the position in section 4?

Q10: Do you have another alternative approach to the eligibility conditions for the 4 GHz Light License?

Q11: Are there any other matters related to the eligibility that CST should consider?

The DSA supports increasing access options for all broadband network operators, including private wireless network users. As mentioned above, the CBRS shared access framework supports a wide range of new and expanded broadband services, including nationwide public mobile networks, multiple system operators (cable companies), rural WISPs, and a wide variety of private networks. The use of DSMS tools and innovative licensing frameworks will spur the introduction of new competitive service offerings and make connectivity more affordable and accessible.

The DSA recommends that CST consider the importance of "Neutral Host" services as it defines the eligibility requirements for the 4 GHz Light Licenses. The DSA notes that neutral host networking is an important emerging use case for shared and/or local licenses. For instance, at Mobile World Congress Barcelona this year, Meta, AT&T, T-Mobile, and Verizon announced that Meta's corporate facilities in the United States would leverage their in-building private cellular deployments on CBRS spectrum to provide neutral-host services for the subscribers of the 3 Tier 1 Mobile Network Operators (MNOs).[3] Federated Wireless also recently announced a neutral host service offering using CBRS shared spectrum,[4] which California Polytechnic State University in San Luis Obispo has deployed in partnership with the nationwide mobile network operator, T-Mobile.[5]

[3] https://ongoalliance.org/5-bars-indoor-for-everyonethe-power-of-cbrs-and-neutral-hosts-in-wireless-networks/.
[4] https://www.rcrwireless.com/20230511/private-5g/federated-wireless-pushes-cbrs-neutral-host-model-for-us-operators.
[5] https://www.rcrwireless.com/20230526/private-networks/cal-poly-deploys-private-network-neutral-host-capabilities.

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Given this growing use case, the DSA urges CST to explicitly permit neutral-host use cases for enterprises, communities, industrial entities, etc. that wish to deploy a private wireless network using 4 GHz Light License spectrum and leverage that same network to provide improved connectivity for public mobile broadband subscribers where needed.

Questions 12-13:

> **Q9: What is your input regarding the available license term (5 years) for the 4 GHz Light License? Do you recommend a period less than 5 years? Why?**
>
> **Q10: Are there any other matters related to the license term and renewal that CST should consider?**

The DSA generally supports CST's proposal for a 5-year license term for the 4 GHz Light Licenses, which can support the needs of many private wireless network operators. However, we also recommend that CST consider that some private wireless use cases and business models need only periodic, rather than consistent, access to spectrum. Longer license terms may not be suitable for these use cases and may act as a barrier to entry. The option to deploy, at least initially, without committing to the cost of a multi-year license could be particularly useful for small providers and industries.

The DSA recommends two alternative approaches for CST's consideration: 1) a license-by-rule approach, akin to the GAA tier of CBRS, where no individual license is needed to operate; and 2) streamlined secondary market rights for licensed spectrum.

1) License-by-rule

In the CBRS GAA tier, the FCC's licensed-by-rule regulations do not require that users obtain an individual license to operate. Instead, GAA users must deploy certified equipment and maintain connectivity to a SAS to receive a spectrum grant for operations with a particular transmit power and antenna orientation at a specific location and height. These users may not need access to spectrum over a larger geographic area, may be operating indoors or on a campus, and/or may be operating in more remote areas where spectrum usage will not be as competitive. In many cases, such networks are deployed in very remote areas where spectrum is largely unused and the risk of interference to higher-tier users is negligible. There might be other cases where there is sufficient spectrum available and the envisioned applications allow QoS flexibility, for example because the band is used to provide additional capacity to networks using other anchor frequencies. In such cases, it is conceivable to have

a class of users with minimal regulatory barriers and no need for interference protection from other PAL or GAA users.

2) Streamlined secondary market rights

Another approach for CST's consideration is to implement streamlined secondary market rights for 4 GHz Light License spectrum. For example, 4 GHz Light License conditions might include the right for the license holder to lease the spectrum to other users – whether on a geographic basis (partitioning) or by sub-dividing the spectrum (disaggregating). Such a secondary market can drive innovation, allow new technology to be deployed by leased spectrum users, and support various sectors, such as enterprise networks and industrial uses. Streamlined secondary market rights can facilitate price discovery on both the supply and demand side. For licensees, it will both identify users interested in a potential lease or partition and provide information on the potential value (i.e., how much is my spectrum worth?). For users, opportunistic use is an opportunity to test the local market and to determine the value of a more secure, longer-term lease or partition agreement (i.e., how much am I willing to pay for spectrum?).

Q14: Are there any other matters related to the license modification and cancellation that CST should consider?

As CST and the DSA both recognize, the use of automation, cloud-computing, and machine learning can increase spectrum efficiency and facilitate low-cost, ready access for private wireless networks. Applying cloud-computing capabilities to spectrum management also enables more predictable quality of service, better congestion avoidance, and improved coordination. Automation of CST's 4 GHz Light License regulations can provide better user experience, significantly reduce time to access spectrum, and provide prospective users with the ability to identify quickly and with greater certainty where spectrum resources are available that meet their needs. It will also enable them to complete the licensing (and license modification) process on a near real-time basis for the duration and location of their choosing.

Q15: Are there any other matters related to frequency fees that CST should consider?

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As mentioned above, the DSA recommends that CST consider the impact that frequency fees may have on certain private wireless use cases and business models, especially those that need only periodic, rather than consistent, access to spectrum. Longer license terms and the associated fees may not be suitable for these private wireless use cases and may act as a barrier to entry. The option to deploy, at least initially, without committing to the cost of a multi-year license could be particularly useful for small providers and industrial users.

Q16: Are there any other matters related to the application process that CST should consider?

As described above, the DSA encourages CST to implement automated spectrum access tools as soon as practicable to provide prospective 4 GHz Light License users with the ability to identify quickly and with greater certainty where spectrum resources are available that meet their needs and will enable them to complete the licensing process in near real-time. In addition, the automation of the 4 GHz Light License process will support machine-to-machine interfaces that are becoming a greater part of "private 5G in a box" offerings.

Furthermore, automated DSMS tools will assist CST to make more efficient use of spectrum by making more realistic assumptions, which will lead to greater opportunities for co-existence amongst users. Using real-world data collected by DSMS tools directly from licensees' radio equipment to help identify/resolve causes of interference could be useful and improve the efficiency of assignments. Such real-world system parameters and performance metrics could also be used to develop and refine more efficient and effective spectrum management algorithms going forward.

The DSA also recommends that CST consider opportunities for increasing sharing within the same geographic area, such as between indoor and outdoor use cases, rather than authorizing only a single licensee at a time in a particular geographic area and frequency range. We also recommend the use of operational data, such as antenna orientation, to make more realistic assumptions about the potential for interference amongst users.

Finally, we commend CST's decision to require 4 GHz Light Licensees to coordinate amongst each other and improve co-existence rather than setting and enforcing on its own bright-line limitations, which may be overly conservative.

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Q17: Is there an actual need for channels greater than 20 MHz?

Q18: Are there any other matters related to frequency assignments that CST should consider?

The DSA notes that many of the private wireless networks being deployed in shared and/or local licensed bands are using multiple 20 MHz channels combined via carrier aggregation, especially for high-bandwidth, low-latency use cases, such as automation and AR/VR. To meet their business needs, the DSA recommends that CST permit 4 GHz Light Licensees to aggregate multiple 20 MHz channels within the 4 GHz band and to allow them to combine 4 GHz spectrum with channels in other bands.

Q19: Would 6 months be sufficient to commence operation a private network?

Q20: Is the 60-day timeline enough for maintenance stoppage?

The DSA supports CST's efforts to encourage 4 GHz Light Licensees to deploy quickly so that valuable spectrum assets do not sit fallow. We believe the proposed conditions are a reasonable starting point. However, as described above, use of automated DSMS solutions would enable CST to forego regulations governing commencement or termination of operations. Spectrum assignment grants can be regulated via closed-loop "heart-beat" requirements whereby frequency assignments can be granted and/or terminated in near real-time based upon actual usage. Users' rights would only be protected if actual spectrum usage occurs, which eliminates the risk of warehousing.

Q21: Are there any other matters related to the general conditions that CST should consider?

The DSA supports CST's general conditions for operation in the 4 GHz band. Again, we recommend that CST implement automated DSMS as soon as possible, which will greatly streamline compliance with the equipment type approval, frequency tuning, and licensee records requirements.

Q22: Please provide your input regarding the technical conditions in subsections (12-1 to 12-4) and how they fit operational needs of private wireless applications.

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Q23: Are there any other considerations for technical conditions that CST should take into account?

The DSA supports CST's proposed technical conditions for the 4 GHz Light Licenses.

However, we recommend that CST implement automated DSMS tools that will make more efficient use of spectrum by making more realistic assumptions, which will lead to greater opportunities for co-existence amongst users. Using real-world data collected by DSMS tools directly from licensees' radio equipment to help identify/resolve causes of interference could be useful and improve the efficiency of assignments. Such real-world system parameters and performance metrics could also be used to develop and refine more efficient and effective spectrum management algorithms going forward.

The DSA recommends that CST consider opportunities for increasing sharing within the same geographic area, such as between indoor and outdoor use cases, rather than authorizing only a single licensee at a time in a particular geographic area and frequency range. We also recommend the use of operational data, such as antenna orientation, to make more realistic assumptions about the potential for interference amongst users.

Advances in automation, cloud-computing, and machine learning are continually being made, which will greatly improve sharing and coexistence opportunities. Other technology advances, including advanced antenna systems and active RAN capabilities, will also contribute to greater opportunities for coexistence.

Q24: Do you have any input regarding the protection of incumbent conditions mentioned in subsection (5-12)?

Q25: Are there any use cases that might not be satisfied because of the technical conditions?

Q26: Are there any other matters related to the technical conditions that CST should consider?

The DSA encourages CST to implement automated DSMS solutions that have been proven to ensure protection of incumbent services, including military radars, fixed satellite services, fixed point-to-point microwave links, point-to-multipoint services, amongst others. Automated DSMS solutions will enable CST to adjust in real-time and at scale any incumbent protection adjustments (either more or less conservative) adopted for the 4 GHz band.

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Q27: Is there any input on CST's approach for achieving compatibility between light licensees?

Q28: Are there any other matters related to compatibility that CST should consider?

The DSA supports CST's efforts to enable coexistence/compatibility between Light Licensees. Use of automated DSMS tools can facilitate operator-to-operator co-existence (interference mitigation) by coordinating devices or managing coexistence groups. For example, one type of coexistence coordination could include voluntarily matching TDD frame structures, which could be used as part of the channel assignment process.

Q29: Is there any input on CST's approach for coordination?

Q30: Are there any other matters related to coordination that CST should consider?

The DSA supports CST's efforts to facilitate coordination between Light Licensees. Use of automated DSMS tools can facilitate operator-to-operator coordination by managing individual devices or by managing coexistence groups. Coordination amongst Light Licensees can be greatly enhanced via available automated DSMS solutions.

Q31: Are there any other matters related to light licensing regulations in the 4 GHz frequency band that CST should consider?

The DSA appreciates the opportunity to provide input on CST's Light License regulations, including the 4 GHz band. We believe that innovative licensing frameworks, spectrum sharing, and automated DSMS solutions will promote the emergence of new radio technologies, services and applications and improve efficient use of radio frequency spectrum. DSMS solutions lower transaction costs, ensure that spectrum is used more efficiently, speed time-to-market for new services, protect incumbents from interference with greater certainty, and generally expand the supply of wireless connectivity that is fast becoming, like electricity, a critical input for most industries and economic activity. The DSA and our members stand ready to work with CST to build on the success of existing spectrum sharing frameworks to improve spectrum efficiency, facilitate innovation, and encourage investment in new wireless services by enabling private networks through light licensing.