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September 27, 2020

Communications and Information Technology Commission
Al-Nakheel District
Prince Turki Bin Abdul Aziz I Street intersection with Imam Saud Bin Abdul Aziz Road
PO Box 75606, Riyadh 11588
Saudi Arabia

Spectrum.Strategy@citc.gov.sa

Re: DSA Comments to the Public Consultation on "Spectrum for IMT-2020 and beyond: Fostering Commercial and Innovative Use of Radio Spectrum in the Kingdom of Saudi Arabia".

Dear Sir/Madam,

The Dynamic Spectrum Alliance (DSA) respectfully submits its comments in response to the Public Consultation on "Spectrum for IMT-2020 and beyond: Fostering Commercial and Innovative Use of Radio Spectrum in the Kingdom of Saudi Arabia". 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[1].

The DSA welcomes the Communications and Information Technology Commission's efforts to promote innovation and commercial uses of spectrum to "Foster Commercial and Innovative Uses", by increasing access to spectrum, ensuring management practices account for competitive dimensions, and tackling problem issues unique to the local ICT market context. In particular, the DSA celebrates the National Spectrum Strategy (NSS) 2020-2025 goal of enabling applications and use cases that rely heavily on free/eased access to spectrum and unlocking spectrum related innovation to "Accelerate Innovation and Emerging Radio Technologies". The DSA agrees with CITC's aim to increase the total portion of unlicensed spectrum to enable the wireless Internet of Things and to promote emerging radio technologies.

[1] A full list of DSA members is available on the DSA's website at www.dynamicspectrumalliance.org/members

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As recognized by the CITC, the use of radio spectrum, through its role in enabling new technologies and innovation, also contributes to improvements in economic efficiency, productivity and return on investment. It is an ambitious target to keep Saudi Arabia IMT-2020 networks and other emerging radio technologies at the forefront, by making more than 10 GHz of spectrum available for innovative uses by 2024. The DSA believes that the CITC is moving on the right direction and that it is really important to target ambitious goals like in this case. Spectrum access for different technologies will foster innovation, and provide last-generation connectivity and digital empowerment in the Kingdom.

The DSA is available to discuss these comments and any additional requirement the Commission might have.

Respectfully submitted,

Martha SUAREZ
President
Dynamic Spectrum Alliance

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DSA COMMENTS

Section #	Question #	Response and comments
2. Spectrum Licensing Regimes	A	For DSA's comment on the licensing regimes in the 3.8-4.2 GHz band, 5925-7125 MHz band and E-band (71-76 GHz/81-86 GHz), please see the answers to questions 11.11.J, 11.12.B and 11.19.F below.
2. Spectrum Licensing Regimes	D	DSA agrees. For example, software-defined networking platforms with temporospatial features (Temporospatial SDN) have already been deployed in production that can orchestrate and facilitate coexistence between static point-to-point links and networks of moving antennas, whether they are on land, at sea, in the sky, or in space.[2] Temporospatial SDN, developed by Loon LLC, an Alphabet company, combines environmental data, signal propagation models, per-node radio hardware/antenna configurations, spectrum regulations, and licensing information through cloud-based software to optimize the operational control of aerospace networks and to coordinate interference avoidance. The system has been working in Loon's production network for more than three years, and has demonstrated the ability to create E-band (71-76 GHz / 81-86 GHz) meshes spanning more than 20 balloons and 4,000 km in the stratosphere and to coexist with other services (e.g., fixed service, fixed-satellite service, and radio astronomy service) without causing harmful interference. The software can also support nongeostationary satellite constellations and enable hybrid connectivity between HAPS, satellites, and ground-based networks.[3] Temporospatial SDN can maintain an updated set of link registration data and other spectrum usage data to anticipate potential harmful interference scenarios and dynamically avoid them. For example, the system regularly downloads and incorporates publicly available databases related to radio astronomy installations, fixed point-to-point links, fixed spot-beam satellite TLEs, and more. Temporospatial SDN also can incorporate regulatory constraints including power limits, allowable interference limits, or exclusive operation zones around ground stations to maintain compliance with regulatory requirements. Importantly, Temporospatial SDN is flexible enough to accommodate and coordinate static and moving links on the ground, in the sky, and in space in any spectrum band, so that as more users deploy services in bands allocated

[2] *See* Brian Barritt and Vint Cerf, "Loon SDN: Applicability to NASA's Next-Generation Space Communications Architecture," 2018 IEEE Aerospace Conference (link).
[3] *See* Salvatore Candido, "The connectivity brain behind Loon's network," Loon Blog (Jan. 31, 2019) (link).

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		for fixed, mobile, and satellite services (e.g., E-band, 39 GHz), Temporospatial SDN will enable such multiple services to coexist and even complement each other. It is also scalable, and capable of coordinating millions of antennas. To better enable the coexistence benefits of technologies such as Temporospatial SDN, CITC should consider opportunities to make accurate, real-time data about spectrum usage available in databases that are publicly available on the Commission's website or through a third-party database manager.
8. Emerging Radio Technologies	A, B, C	DSA provides answers to these questions in Sections 11.11 and 11.12 referring to emerging technologies like 5G, Wi-Fi6E. Furthermore, as explained in DSA's answers to Questions 9.A and B and Questions 11.19A, F, and I, CITC can foster the deployment of new and emerging aerospace technologies (including stratospheric Internet platforms such as HAPS) on a shared basis through the use of self-coordinated light licensing using online databases and automated frequency coordination mechanisms. E-band (71-76 GHz/81-86 GHz) has proven particularly amenable to self-coordinated light licensing of point-to-point backhaul links, and can support coexistence of ground-based, stratospheric, and satellite backhaul networks in a single, comprehensive database of spectrum use. A similar flexible framework may support innovative aerospace networks in other millimeter wave bands.
9. Competition and Complementarity of Technologies	A, B	CITC can help support the co-existence and complementarity of different technologies through flexible, data-driven spectrum policies that accommodate new and emerging technologies on a technology neutral basis, particularly where there is a low risk of interference to incumbent services. For example, CITC can adopt self-coordinated light-licensing frameworks in E-band (71-76 GHz/81-86 GHz) that accommodate emerging technologies such as aerospace networks (e.g., HAPS). Link registration database managers have indicated that feeder links to and from aerospace networks in E-band pose a low risk of interference to ground-based point-to-point links, and can be accommodated alongside ground-based links with only "minor" changes to the database.[4] By accommodating all services in E-band within the same database, CITC could enable coexistence of important emerging services such as HAPS, NGSO satellites, and 5G backhaul networks. As a first step, CITC can adopt a light-licensing framework for E-band that relies on an accurate database of spectrum usage in the band and accommodates self-coordination of ground-based and aerospace networks such as HAPS in the band. As more aerospace networks are deployed in these bands, CITC can support continued innovation through the adoption of

[4] *See* Comsearch, Aeronet Aviation and Maritime Communications Systems; Compatibility with Incumbent E-band Fixed Services and Link Registration System, 22 (May 2, 2019) (link).

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		dynamic spectrum management in the band to further support coordination and coexistence.
11.11. 3800-4200 MHz	B	The Dynamic Spectrum Alliance is technology neutral and encourages CITC to consider shared spectrum technologies to promote co-existence in the 3.8-4.2 GHz band, enabling incumbents to continue using the band and at the same time providing new 5G fixed/mobile access services.
11.11. 3800-4200 MHz	F	Yes, the DSA believes that The Communications and Information Technology Commission should consider the opportunity to implement a Tiered Spectrum Sharing Model (TSSM) in the band, where secondary users can access the band under the condition of not affecting the operation of licensed/primary users.
11.11. 3800-4200 MHz	H	The opportunities made possible by spectrum sharing go beyond the economy, facilitating the evolution of the ecosystem as the potential for new use cases expands and large-scale applications are realized. On a shared basis, private networks could be deployed in the band for indoor and/or outdoor applications. Additionally, Fixed Wireless Access will be a very relevant use case, especially in those areas where fibre coverage is limited. Spectrum sharing gives the possibility for different services providers to access the spectrum, enabling a larger ecosystem. The DSA would like to highlight some real applications that have been developed in the United States as a result of the commercial deployment of the Citizens Broadband Radio Service CBRS[5] authorized by the Federal Communications Commission (FCC) in January 2020 – a major milestone for spectrum sharing in the United States of America. The American Dream Entertainment and Retail Complex in New Jersey has implemented CBRS to cover the entire 3 million square foot venue, servicing over 40 million annual visitors and more than 450 stores[6]. Beyond the mall itself, CBRS has also been used for traffic and parking management, assessing approximately 33,000 parking spaces. Equipping security cameras, digital signage and other systems for both internal and external mall operations, CBRS has proved essential for supporting and enabling interesting new use cases such as this outside of public use Wi-Fi and cellular networks. It has been concluded that such IT infrastructures are faster and more economic than fixed infrastructures, offering reliable and simple, yet effective means of connectivity. In Dallas, CBRS has transformed airport communication systems, bringing airport staff and management connections onto the CBRS spectrum. Such

[5] *See* Dynamic Spectrum Alliance celebrates as CBRS commercialization becomes a reality (link).
[6] *See* How can Enterprise clients use CBRS? (link).

		deterministic spectrum access is critical in emergency scenarios to cater to higher power requirements and improve coverage. This network supports critical airport communications and coexists with a robust Wi-Fi network. On the west coast, the Angel Stadium in Anaheim, California, has adopted CBRS capabilities to support its internal communications within the stadium, lightening the load on the Wi-Fi system, similar to that of Dallas' airports. Since the full commercial deployment of CBRS, they have also been working as a neutral host provider, offering Mobile Network Operators (MNOs) support in managing signal traffic for customers attending events. By not only supporting internal connectivity for both staff and customers but extending this service for the reinforcement of existing MNOs, CBRS has presented the opportunity to eliminate barriers and limitations, providing full, flexible coverage whenever it is needed – even when roaming. A whole host of private network opportunities, from smart energy to smart city, are beginning to emerge. From business to leisure the development of smart offices, airports and stadiums have been initiated as Wireless Internet Service Providers (WISPs) are able to harness this newly available spectrum. Even WISPs which typically operate in rural areas, who have been using this part of the spectrum for the past 12-15 years, are transitioning spectrum to new CBRS rules and LTE equipment to expand their reach and strengthen their services. As we reflect on the use cases across the USA, it is clear that CBRS has revolutionized the ways in which spectrum is utilized to better connectivity across a diverse number of sectors. Adopting a spectrum sharing model in the 3.8-4.2 GHz band will enable more users to access scarce and valuable spectrum resources, leading to lower-costs, lower barriers to entry, and most effective allocation for innovative businesses. This, in turn, enables and encourages competition and innovation by existing service providers as well as new entrants.
11.11. 3800-4200 MHz	I	The DSA believes that spectrum sharing is fundamental to a modern spectrum policy framework and the 3800-4200 MHz band is an ideal candidate for establishing such a framework in the Kingdom. The Alliance encourages CITC to consider adoption of Dynamic Spectrum Access in the 3800-4200 MHz band to enable sharing between the Fixed Satellite Service (FSS), Fixed Service (FS) and Mobile incumbents and new wireless broadband users. Such sharing would maximize the overall public benefit by making more efficient use of this spectrum and would achieve other important objectives, such as developing a digital economy and smart cities, leveraging and developing artificial intelligence applications, rolling out 5G deployment, and improving digital connectivity.

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		There is increased interest in the 3800-4200 MHz band internationally for 5G services, particularly given the large bandwidths potentially available in this range. We encourage CITC to consider introducing new services across the whole band to maximize the opportunity for all interests. Given that according to the National Frequency Allocation Table (NFAT) the band is allocated on a co-primary basis to FSS, FS and mobile service and that the usage of the band is mainly by FSS earth stations and UWB Applications, this band is well suited for spectrum sharing. The use of commercially available dynamic spectrum access solutions would greatly facilitate the use of this critical mid-band spectrum for new wireless broadband services, while enabling incumbent services to continue to use the band on a protected basis. The Dynamic Spectrum Alliance and its member companies have extensive experience in enabling sharing of both fixed and mobile broadband services with incumbents and are ready to assist CITC in its efforts to introduce innovative services in this band while also maintaining access for existing users. In the whitepaper entitled "*Automated Frequency Coordination - An established tool for modern spectrum management*"[7] the Dynamic Spectrum Alliance makes the case that the use of databases to coordinate spectrum assignments has evolved but is *nothing new*. The basic steps are exactly the same as in a manual coordination process. What is new are: (1) surging consumer demand for wireless connectivity and hence the need to intensively share underutilized frequency bands; (2) significant improvements in the computation power to efficiently and rapidly run advanced propagation analysis and coordinate devices and users in near real-time; and (3) more agile wireless equipment that can interact directly with a dynamic frequency coordination database. There is no question that today we have the technical ability to automate frequency coordination and thereby lower transaction costs, use spectrum more efficiently, speed time to market, protect incumbents from interference with certainty, and generally expand the supply of wireless connectivity that is fast becoming, like electricity, a critical input for most other industries and economic activity. Under a dynamic spectrum access approach, equipment communicates directly with a database to be granted access to spectrum at the location and time required on whichever frequencies are unused at the time by existing users. Based on the type of device (fixed or personal/ portable) and its coordinates, information about the transmitter's location and operating parameters, and the technical rules the regulator puts in place to protect incumbents from

[7] *See* DSA, *Automated Frequency Coordination: an Established Tool For Modern Spectrum Management*, White Paper, 18-20 (March 2019) (link).

		harmful interference, a calculation engine determines the list of available channels at the secondary user's device location and its maximum permissible radiated power. This capability enables a regulatory framework for shared access without disruption to incumbent operations, giving regulators control and flexibility in improving spectrum utilization while simultaneously protecting against harmful interference. Regulators in a number of countries have authorized automated and even dynamic frequency coordination databases to manage real-time assignments in shared bands and to protect incumbent operations (including military and public safety systems) from harmful interference. These database technologies are widely available, sufficiently mature, scalable and secure.[8] Adopting dynamic database systems also has the added benefit of reducing the administrative burden on both industry players and the regulator by eliminating the need for each individual user to apply for permission to share spectrum and thus encouraging more users to leverage shared spectrum.
11.11. 3800-4200 MHz	J	We believe that the technical and industry capability challenges to DSA today can be more than sufficiently addressed by a combination of technological innovation and policy/regulation. Today, the rapidly growing dynamic spectrum access industry includes global businesses, academia, radio manufacturers and regulators, which can share experiences and best practices on these areas. On the licensing and regulatory fronts, the CITC will likely need to develop its own rules on spectrum sharing to ensure fair, safe, and responsible use while protecting incumbents from interference. However, it is always useful to consider international experience in order to replicate good practices. The CBRS system in the US demonstrates the viability of shared spectrum use among secondary and opportunistic users, while also ensuring protection of military and satellite incumbents from harmful interference. Under the CBRS regulatory framework, the spectrum access system (SAS) coordinates CBRS frequency use and manages coexistence among the three tiers of access--incumbent (e.g., navy radar and satellite), priority access licensed (PAL), and general authorized access (GAA)--while the ESC network detects incumbent naval radar use of the band, thereby alerting the SAS to move commercial operations to non-interfering channels.[9] This framework ensures that incumbent and licensed operations can be protected and operate without harmful interference from other users of the band. Furthermore, the success of this framework, as most recently demonstrated

[8] *See* DSA, *Automated Frequency Coordination: an Established Tool For Modern Spectrum Management*, White Paper, 18-20 (March 2019) (link).
[9] *See* 47 C.F.R. § 96.

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		in the commercial deployments, creates conditions to make sharing acceptable for private and governmental stakeholders in other bands that are concerned foremost about the continuity and reliability of their operations. It should be kept in mind, however, that CBRS is a unique framework suited for a unique spectrum environment in the US requiring the accommodation and protection of unpredictable naval radar use. Spectrum sharing regimes need not be as complex in other countries or contexts. Indeed, DSA supports spectrum sharing regimes that are only as complex as required by the particular environment. Simpler is always better. In that vein, a simpler version of dynamic spectrum sharing may be more relevant for the Kingdom of Saudi Arabia. The Communications and Information Technology Commission should consider the opportunity to implement a Tiered Spectrum Sharing Model (TSSM) in the band, with a licensing framework that supports in-building, and outdoor usage under a general authorization on a no-protection, non-interference basis. Authorizing multi-authorization arrangements and applying a dynamic database approach are two examples of such measures that would help to keep the regulatory framework for 5G and new broadband generation agile, flexible and future-proof. The CITC should also consider a "use-it-or-share-it" policy. Conceptually, use-it-or-share-it rules authorize opportunistic access to licensed spectrum that is locally unused or underutilized. Until the spectrum is actually put into service in a local area it should be available for non-interfering use by networks and devices. Licensees lose no rights whatsoever. Building on this precedent, in 2016 the FCC authorized opportunistic access by GAA users to unused PAL spectrum.[10] Opportunistic use of unused PAL spectrum is controlled by the SAS, which requires that GAA users must periodically check with the database to renew permission to continue operating. This is one of the key reasons for the success of CBRS and a similar policy should be considered in a simpler TSSM framework. A general use-it-or-share-it authorization has a number of affirmative benefits. First, opportunistic access reduces spectrum warehousing in areas where the economics are least attractive for large service providers. It might increase access for operators that are interested in deploying, but who lack needed spectrum access in that local area. Second, opportunistic access further encourages secondary market transactions by facilitating price discovery on both the supply and demand side. For licensees, it will both identify users interested in a potential lease or

[10] *See* Order on Reconsideration and Second Report and Order, GN Docket No. 12-354, at ¶ 177 (April 28, 2016).

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		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?). Third, opportunistic access will lower barriers to entry for innovative new use cases by parties that at least initially either cannot afford or do not believe they need to pay for exclusive use and interference protection. The option to deploy, at least initially, without committing to the cost of a long-term lease or license could be particularly useful for small providers and industries. The combination of the PAL and GAA access is fundamental. The FCC successfully completed Auction 105 for the CBRS Priority Access Licenses (PAL) in the 3550-3650 MHz band and saw the largest number of spectrum licenses ever made available in a single FCC auction. Gross proceeds reached $4.6 billion, with net proceeds totalling $4.5 billion. A total of 228 bidders won 20,625 of 22,631 – or more than 91.1% - of available licenses. In the months since the first commercial deployments in January (only GAA initially), the CBRS ecosystem has rapidly expanded, with tens of thousands of indoor and outdoor deployments catering to a wide range of use cases. To us, this is proof of the opportunities enabled by spectrum sharing – market growth, increased stakeholder involvement in providing broadband connectivity, new opportunities for innovation, new use cases and an efficient use of the spectrum.
11.12. 5925-7125 MHz	A	No. In total, 17.25 GHz of spectrum has been identified for IMT by the Conference, in comparison with 1.9 GHz of bandwidth available before WRC-19. Out of this number, 14.75 GHz of spectrum has been harmonized worldwide, reaching 85% of global harmonization.[11] As it is indicated in the consultation document, Saudi Arabia has 1110 MHz of IMT spectrum licensed to five different operators. This makes Saudi Arabia one of the lead countries among the G20 countries in terms of the amount of radio spectrum awarded to operators in IMT frequency bands.[12] Initial benchmark analysis conducted by CITC shows that mobile operators in Saudi Arabia have access to larger contiguous bandwidth in most bands compared with operators in most of the advanced countries. Additionally, CITC is considering releasing the remaining parts of the 700 MHz band (723-733/778-788 MHz), the 1500 MHz and the 26 GHz bands by late 2020, early 2021. Furthermore, many additional bands are targeted for release for commercial and innovative use, including 5G in the current consultation.

[11] *See* WRC 19 Wrap-up: Additional spectrum allocations agreed for IMT-2020 (5G mobile) (link)
[12] *See* How Saudi Arabia is deploying ICTs against COVID-19 – and beyond, ITU News, July 24, 2020

		For all these reasons, it seems that in Saudi Arabia, the issue is not necessarily identifying new spectrum for IMT in the 6 GHz band, because the appropriate spectrum planning actions has been undertaken in the past years and there is an aggressive plan to continue releasing spectrum for 5G in other frequency bands. Unlicensed access will be a complement for 5G[13] and from the DSA perspective, it is important that CITC complements the licensed mobile access with enough spectrum for unlicensed access. The 5G strategy, goes beyond assigning high-band, mid-band and low-band spectrum for licensed access. The 5G Fast Plan[14] in the United States recognizes that unlicensed spectrum will be important for 5G, and that new opportunities for the next generation of Wi-Fi in the 6 GHz and above 95 GHz band should be created.
11.12. 5925-7125 MHz	B	Yes, the DSA is convinced about the importance of enabling license-exempt access to the 6 GHz band in the Kingdom. This will benefit Saudi citizens with better Wi-Fi services, and access to license-exempt wireless devices. In the case of the new Wi-Fi generation, WLAN/RLAN will carry offload from cellular 5G technologies (total data offload to unlicensed going from 74% to 79% in 2022)[15]. This will lower the costs of network deployment for mobile operators and for edge investment by neutral host and third-party providers (e.g., cable companies, enterprises that want to build private 5G networks to run factories). It will also lower costs for consumers. Wi-Fi6E indoor use cases include residential Multi-AP / mesh networks, multiple dwelling unit (MDU), single-AP networks, high-density enterprise networks, indoor public venues and industrial IoT. Very low power portable usages are for example mobile AR/VR, UHD video streaming, high speed tethering and in-vehicle entertainment.
	C	A large ecosystem is growing for the different operating classes devices on a license-exempt basis in the 6 GHz band, that include Very Low Power (VLP), Low Power Indoor (LPI) and Standard Power (SP) devices. The ecosystem is ready, Wi-Fi6 is already standardized since 2019. Wi-Fi chipset vendors have indicated that the first Wi-Fi6E products will be available by the end of this year. So, it is expected to find LPI Wi-Fi6E and VLP devices, available by December 2020 in those countries that have adopted regulations, like the United States, the U.K., South Korea and possibly a few others.

[13] *See* Enterprises building their future with 5G and Wi-Fi 6, Deloitte's Study of Advanced Wireless Adoption (link)
[14] *See* The FCC's 5G FAST Plan (link)
[15] *See* Cisco Systems, Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2017-2022. (link)

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		Standard power devices might take additional time to be available in the market, because in the United States they require Automated Frequency Coordination (AFC) and the AFC systems should be authorized by the FCC. However, first deployments are expected in 2021. Wi-Fi is a great example of how global harmonization benefits economies of scale and final users. It is expected that Wi-Fi6E will be largely adopted in the coming years.
	D	Studies performed in the United States by the FCC and in Europe by the ECC have shown that Wi-Fi services can be introduced into the "6 GHz" band without causing harmful interference to incumbent services. In Europe, in March 2020, the Electronics Communication Committee of CEPT (ECC) approved draft CEPT Report 73[16] (Report A) for public consultation in response to the European Commission 2017 Mandate[17], an assessment and study of compatibility of RLAN systems with incumbent systems in the lower 6 GHz band (5925-6425 MHz). This Report confirmed the findings of ECC Report 302[18], published in May 2019, that coexistence with Fixed Service (FS), Fixed-Satellite Service (FSS) and Radio astronomy is technically feasible for indoor and low-power outdoor RLANs. The Report also concluded that coexistence with Communications Based Train Control (CBTC) systems and Road-ITS would be technically feasible if suitable measures, such as a guard-band and strict out-of-band emissions (OOBE) requirements, were included. Higher power outdoor usage was not studied in Europe and at the present time will not be authorized without further study within ECC. Like in Europe, the FCC in the United States concluded that LPI and VLP devices need can coexist with incumbent services in the band and need no further mitigation measures. The studies in the United States were conducted in the complete 6 GHz band (5925-7125 MHz). For SP devices, in order to manage interference with incumbent services in the 5.925-6.425 GHz and 6.525-6.875 GHz sub-bands, the FCC has proposed the use of an automated frequency control (AFC) system, This system will coordinate outdoor deployments to insure no interference with tens of thousands of point-to-point microwave links and other incumbents.

[16] *See* Report 73, Report from CEPT to the European Commission in response to the Mandate "to study feasibility and identify harmonised technical conditions for Wireless Access Systems including Radio Local Area Networks in the 5925-6425 MHz band for the provision of wireless broadband services" Report A: Assessment and study of compatibility and coexistence scenarios for WAS/RLANs in the band 5925-6425 MHz (link)
[17] *See* Mandate to CEPT to study feasibility and identify harmonised technical conditions for wireless access systems including radio local area networks in the 5925-6425 MHz band for the provision of wireless broadband services (link)
[18] *See* Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425 MHz (link)

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11.19. 71-76 & 81-86 GHz	A	DSA is interested in E-band because it is a promising band for light licensing and dynamic spectrum management to promote the coexistence of all incumbent and emerging uses in the band, including emerging aerospace networks such as HAPS and nongeostationary satellites. Over the past several years, E-Band has become an increasingly attractive band for the deployment of robust backhaul networks. Several mobile network operators around the world have explored ways to extend terrestrial mobile networks into unserved areas using stratospheric Internet platforms such as HAPS that rely on E-band for platform-to-platform and ground-to-platform feeder links. Similarly, satellite operators have expressed interest in using E-band for feeder links to nongeostationary satellite constellations in low-earth orbit. E-band also holds significant promise for 5G backhaul, which may be provided via ground-based or stratospheric services. Fortunately, the nature of E-band enables coexistence of all of these co-primary services. From a technical perspective, the high-gain, directional nature of "pencil beam" point-to-point systems within E-band enable coexistence of both static and moving links with a very low risk of interference using traditional coordination and frequency planning techniques. As a result, the band has long served as fertile ground for innovative licensing regimes such as self-coordinated light licensing. Recently, national regulatory authorities have started to consider how to open E-band to aerospace networks. In the United States, the Federal Communications Commission has proposed to expand its existing light-licensing regime to incorporate "endpoints in motion" to, from, and between airborne platforms through "3D" spectrum management. This framework can also support aerospace networks such as HAPS and NGSO satellites. If CITC were to adopt a similar approach, it would enable highly efficient coexistence between services in the band and promote rapid deployment of innovative aerospace networks to support rural connectivity.
11.19. 71-76 & 81-86 GHz	F	CITC should adopt a self-coordinated light-licensing framework for E-band licensing that accommodates both ground-based links and links between the ground and emerging aerospace networks such as HAPS. Self-coordinated light licensing has proven to be a successful model that promotes innovation and efficiency, and has been adopted by a number of national regulators.[19] Self-coordinated light-licensing is supported by online databases, which permit licensees to obtain information about available link locations and conduct automated self-coordination to register links, promoting cost-

[19] *See* DSA, *Automated Frequency Coordination: an Established Tool For Modern Spectrum Management*, White Paper, 18-20 (March 2019) (link).

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		effective and rapid deployment with low administrative overhead. Importantly, these databases can ensure coexistence between a variety of services, including 5G backhaul, stratospheric, and satellite services, as explained in more detail in the answer to Question 11.19.I below.
11.19. 71-76 & 81-86 GHz	I	Traditional interference avoidance techniques such as physical separation of stations, avoiding boresight alignment, and frequency planning are generally sufficient to prevent interference between systems in E-band, including ground-based static links and moving links to/from aerospace platforms. For this reason, E-band is well-positioned for self-coordinated light licensing to ensure coexistence in the band. For example, as the US Federal Communications Commission recognized in 2003, due to the high-gain, directional nature of "pencil beam" point-to-point systems within the E-band, links "may be engineered to operate in close proximity to other systems so that many operations can co-exist in the same vicinity without causing interference to one another," particularly in "less-densely populated rural and suburban areas, where there is an even lower chance of interference."[20] A similar analysis applies to aerospace networks. A recent coexistence study from Comsearch, one of the two E-band database managers in the United States, found that "except in cases of direct antenna alignment in azimuth and elevation," interference into ground-based fixed point-to-point links from aerospace links above a 5-degree elevation angle would be "rare."[21] Due to this low risk of interference, CITC should consider adopting a self-coordinated light-licensing framework for E-band links. This framework can be implemented through an online database with an automated coordination mechanism as described in the answer to Question 11.19.F. Over time, CITC should consider setting a pathway toward dynamic spectrum sharing in E-band. For example, by making available real-time information about moving links (e.g., antenna locations, radiation patterns, ephemerides, and beam-pointing information) through an application programming interface (API), CITC could enable the self-coordination and coexistence of multiple aerospace backhaul networks (e.g., HAPS, NGSO satellites) in the same geographic region.

[20] *See Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318 ¶ 45 (2003).
[21] *See* Comsearch, Aeronet Aviation and Maritime Communications Systems; Compatibility with Incumbent E-band Fixed Services and Link Registration System, 22 (May 2, 2019) (link).