هيئة الاتصالات والفضاء والتقنية
Communications, Space & Technology Commission

SPECTRUM OUTLOOK FOR COMMERCIAL AND INNOVATIVE USE

2025-2027

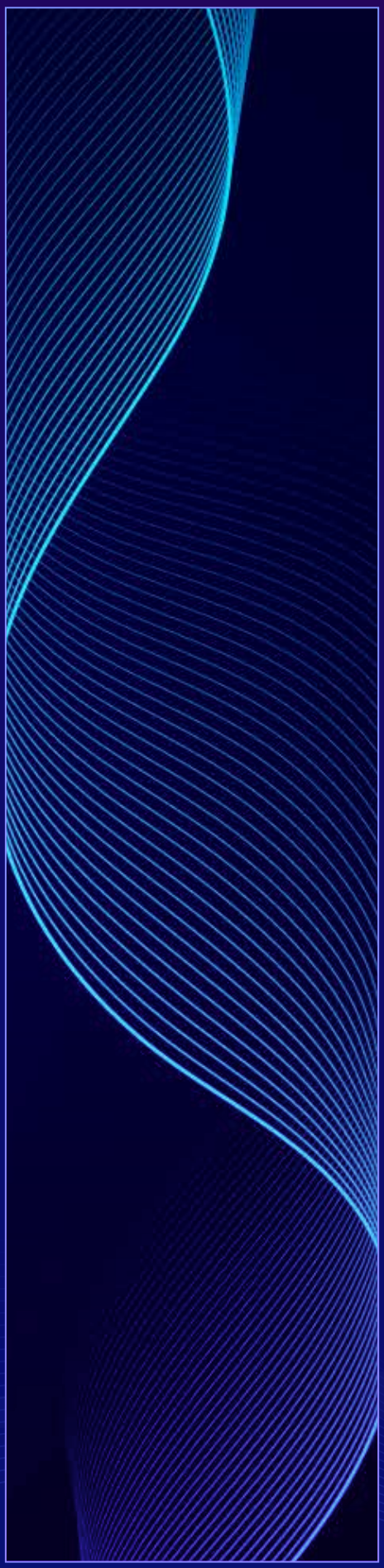
Contents

Document Structure

With this second iteration, CST looks to establish a consistent structure for the Spectrum Outlook going forward, both with regards to its frequency – every four years – and the structure and content of the document. CST will align the publication of a new Spectrum Outlook with the year that the WRC event concludes. In addition, CST will provide stakeholders with annual updates on the ongoing spectrum cycle's spectrum release timelines with short commentary where needed.

The remainder of this document is structured as follows:

- **In Section 1,** we provide a general overview and the purpose of this document.
- **In Section 2,** we review the previous outlook's initiatives and evaluate their current implementation. This provides stakeholders with a clear overview of the achievements in the previous outlook cycle, while promoting accountability on each initiative.
- **In Section 3,** we set out CST's spectrum priorities for the next outlook cycle.
- **In Section 4,** we inform stakeholders about the spectrum releases CST is planning. Planned releases are grouped by spectrum access regime.
- **In Section 5,** we summarize all spectrum priorities and releases in an indicative timeline for the next years.
- **In Section 6,** we provide an overview of the spectrum trends and bands CST will be monitoring over the upcoming outlook cycle. We expect planning work to take place during the outlook cycle on these issues and bands, but implementation of any proposals will likely be left to a future outlook cycle.

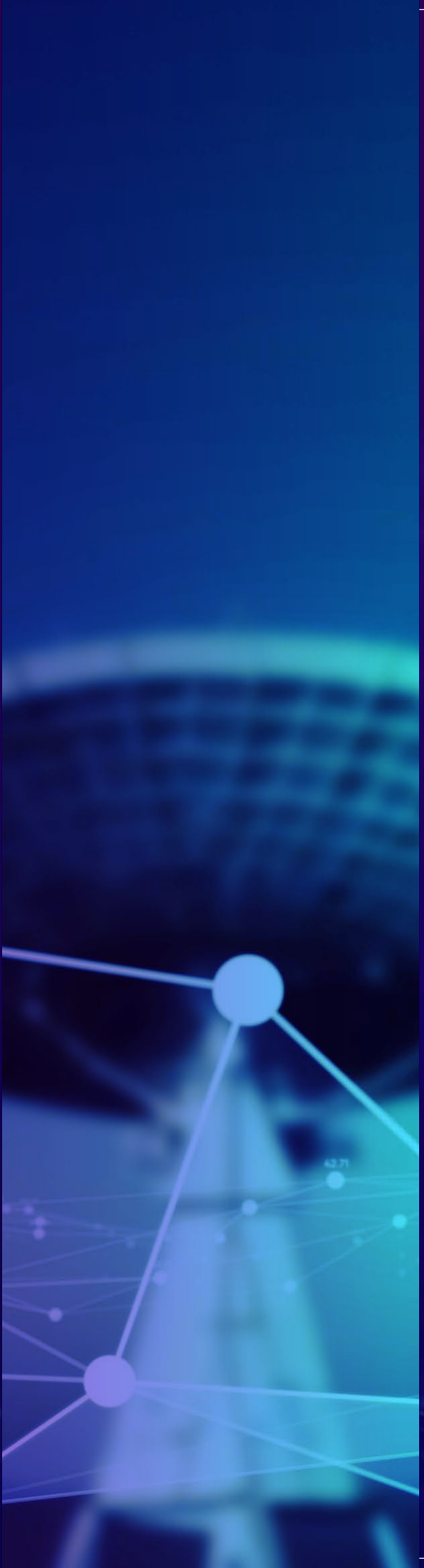


Glossary

3GPP	3rd Generation Partnership Project
A2G	Air to Ground
AAM	Advanced Air Mobility
AFC	Automated Frequency Control
AI	Artificial Intelligence
BVLOS	Beyond-visual-line-of-sight
CEPT	European Conference of Postal and Telecommunications
CST	Administrations
CBRS	Communications, Space and Technology Commission of the KSA
C-V2X	Citizens Broadband Radio Service
D2D	Cellular V2X
DECT	Digital Enhanced Cordless Telephone
DECT NR+	5G Digital Enhanced Cordless Telephone
DSA	Dynamic Spectrum Access
DSRC	Dedicated Short Range Communication (also referred to as ITS-G5)
ECC	Electronic Communications Committee
EESS	Earth Exploration Satellite Service
EIRP	Equivalent Isotropically Radiated Power
ESIM	Earth station in motion
ETSI	European Telecommunications Standards Institute
FSS	Fixed-Satellite Service
FRMCS	Future Railway Mobile Communication System
FWA	Fixed Wireless Access
GAA	General Authorized Access
GEO	Geostationary Orbit
GNSS	Global Navigation Satellite System
GSM-R	Global System for Mobile Communications-Railway
HAPS	High Altitude Platforms
HIBS	High-altitude IMT Base Station
HTS	High Throughput Satellite
IoT	Internet of Things
IMT	International Mobile Telecommunications
ITS	Intelligent Transport Systems
ITU	International Telecommunications Union
ITU BR	ITU Radiocommunications Bureau
ITU RR	ITU Radio Regulations
LPWAN	Low-Power Wide Area Network
LSA	Licensed Shared Access

Glossary

MEO	Medium Earth Orbit
MetSat	Meteorological Satellite
MNO	Mobile Network Operator
MOCN	Multi-Operator Core Network
MORAN	Multi-Operator Radio Access Network
MSS	Mobile Satellite Service
mmWave	Millimetric Waves
NFP	National Frequency Plan
NFAT	National Frequency Allocation Table
NTN	Non-Terrestrial Network
NGSO	Non-GeoStationary Orbit
P2MP	Point to MultiPoint
PAL	Priority Access License
PAMR	Public Access Mobile Radio
PMR	Private Mobile Radio
PMSE	Program Making and Special Events
RSA	Recognized Spectrum Access
RPAS	Remotely Piloted Aircraft System
SAR	Synthetic Aperture Radio
SDL	Supplemental Downlink
SRD	Short Range Device
SRS	Space Research Service – as defined in ITU RR 1.55
TDD	Time Division Duplex
UAS	Unmanned aircraft system
UHF	Ultra-High Frequency
USL	Universal Service License
WRC	World Radiocommunication Conferences
WLAN	Wireless local-area network
Wi-Fi	Wireless Network Technology referring to IEEE 802.11
WiGig	Set of 60 GHz wireless network protocols including IEEE 802.11ad and IEEE 802.11ay
V2X	Vehicle to Everything
VSAT	Very-Small-Aperture Radio
VHF	Very High Frequency



01

Setting Out a Spectrum Outlook That Fosters The Kingdom's Evolving Use of Radio Spectrum

1.1. Document Introduction

CST regulates, monitors and empowers the communications, space and technology sectors in Saudi Arabia as per the Telecommunications and Information Technology Act (the 'Act') issued by Royal Decree No. (M/106) and dated 2/11/1443 AH corresponding to 1/6/2022, the Act's Bylaw, and the Communications, Space and Technology Commission (CST) Ordinance (Ordinance). This gives CST the authority to issue this new Spectrum Outlook for Commercial and Innovative Use.This document is for guidance purposes only and is non-binding. Everything contained within it represents plans that outline CST's future endeavors

When CST published its inaugural Spectrum Outlook in 2021, it broke new ground in the Kingdom. For the first time, stakeholders were provided an advanced plan of spectrum releases and spectrum regulatory priorities over the coming three years, from 2021 to 2023. Much has been achieved in this timeframe and as that spectrum outlook cycle concludes, CST is setting out its spectrum release and regulation priorities for the next cycle, from 2025 to 2027.

The objective of the Spectrum Outlook is to provide transparency and predictability for all spectrum users in the Kingdom with regards the spectrum that is going to be made available as well as the terms and regulations governing access and usage. This will maximize incentives for investment and ensure that spectrum users and CST are aligned in a manner that can maximize the economic impact of spectrum use.

CST remains committed to the spectrum management principles outlined in the previous Spectrum Outlook, as mentioned below, while ensuring alignment with the Telecommunications and Information Technology Act and the National Spectrum Strategy, and this can be done through

01 **Placing spectrum in the hands of those who can use it most effectively.** Spectrum is a valuable national resource and is essential to many activities. A fundamental element of our approach is to enable shared access to bands unless it is clear that this is not possible. Sharing enhances the efficiency of use, and as databases, artificial intelligence and other tools become more capable, new and more effective forms of sharing will open up over the coming years.

02 **Relying on competitive, market-led mechanisms to determine the optimal use of spectrum.** With regards to the assignment of exclusive-use spectrum licenses, this means relying on competitive award mechanisms where possible. With regards to existing licenses, this means facilitating trading and subleasing.

03 **Ensuring a fair balance of complementary and competing technologies.** Where complementary or competing, technologies need different forms of allocation – for example licensed for one and license-exempt for another – we will seek to balance spectrum provision such that both have the potential to enter the market and/or expand. Ensuring fairness of access for all will inevitably be a subjective assessment, but we will use evidence as far as possible and consult widely so that all voices can be heard.

04 **Ensuring a suitably competitive market.** Where we believe that different market structures would improve investment, we will ensure regulations allow for these, for example by enabling shared use of spectrum and/or infrastructure. Furthermore, CST will continue to monitor for and implement, where applicable, innovative approaches to spectrum access.

05 **Facilitating innovation.** By enabling advancements in emerging technologies and remaining technology neutral we will allow new ideas, technologies and business models to inject competition and dynamism into the market.

06 **Supporting** the improvement of public telecommunications by continuing to support upgrades in network coverage and quality.

The radio spectrum industry and wireless connectivity demands have evolved since the last outlook. Mobile data consumption continues to grow which puts increasing pressure on mobile networks, in particular in urban areas. At the same time, CST has seen an increased interest in other wireless connectivity use cases, such as enterprises, transport, and smart cities. This diversification has been accompanied by a growth in popularity of innovative solutions, including NTN, FWA and private networks. There is likely going to be an increase in the number of different spectrum users and networks that result from these heterogeneous use cases meaning that we will see a greater diversity of networks and competing demands. At the same time, there is greater scope for sharing between these users due to their different needs. This puts an increased emphasis on sharing with CST making even greater use of the light-licensing regime it established in the previous Outlook cycle.

Building upon the principles set forth in the previous Spectrum Outlook, this document proposes several key regulatory directions to address the evolving connectivity needs. CST has identified nine priority areas for the current outlook cycle as follows:

01 UNLOCKING THE POTENTIAL OF NTN AND BROADER SATELLITE SPECTRUM USE

02 INCREASING IMT MOBILE SPECTRUM CAPACITY

03 FOSTERING SPECTRUM USE FOR FWA

04 PROMOTING SPECTRUM SHARING

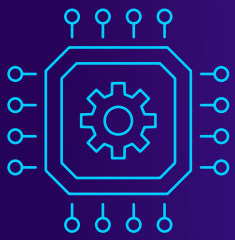
05 ENABLING SPECTRUM USE BY VERTICALS, FOR PRIVATE NETWORKS AND IOT

06 FACILITATING THE FUTURE OF TRANSPORT

07 IMPROVING SPECTRUM ACCESS FOR PMSE

08 FACILITATING SPECTRUM TRADING

09 PROMOTING SPECTRUM USE FOR RESEARCH & INNOVATION



While CST will focus on these areas, this does not mean that other topics will not be considered if they arise. We set out a number of areas that we will be monitoring in Section 6. A significant number of frequency bands suitable for deployment of commercial services are discussed in this document. These include bands where new spectrum license assignments are planned (such as the forthcoming IMT award), where liberalization measures are expected to permit new use cases alongside existing ones (such as in existing WLAN bands, DECT NR+, or HIBS), or where CST is opening up bands for extended use (such as outdoor use of the 6 GHz and 60 GHz bands).

With respect to spectrum sharing, CST intends to make extensive use of the light-licensing regime it developed in the previous outlook cycle. To optimize spectrum utilization, CST will explore the implementation of dynamic spectrum access techniques. This will enable opportunistic access to underutilized spectrum bands, promoting efficient use of resources and accommodating the increasing demand for wireless connectivity.

Reflecting the dynamic nature of the telecommunications landscape, we understand the importance of adaptability. Within CST, the Spectrum Outlook is a living document, updated in response to consultations, market developments, and technological advancements. The spectrum releases and directions described in this document, and the dates proposed for their initiation, are a non-binding statement of intent. Directions, dates, and details may change as future circumstances evolve. We aim to publish and consult on a new Spectrum Outlook every 3 to 4 years going forward, ensuring that CST remains forward-looking and responsive to the evolving needs of the industry. CST will further publish annual updates on the timetables shown in Section 5 together with a short summary of any updates on each item

By embracing these principles and regulatory changes, we aim to create a transparent, predictable, and flexible spectrum management framework that maximizes the value of spectrum resources, promotes investment, and supports the growth and innovation of the telecommunications industry in the Kingdom. CST plans on making up to 54 GHz of spectrum available through the implementation of this outlook.

02

Review of The 2021–2023 Spectrum Outlook

As envisaged in the previous outlook cycle, 2021-2023 was a busy period for spectrum policy, as CST embarked on an ambitious spectrum release and regulatory program. Notably, CST delivered on its target of releasing over 6 GHz of unlicensed spectrum. It also introduced new policy regimes for spectrum sharing and spectrum trading. While much has been achieved, some of the spectrum releases for licensed and lightly-licensed spectrum have been extended into the current outlook cycle.

2.1. Planned spectrum release program 2021–2023

In the 2021-23 Outlook, CST planned to release spectrum under the following licensing regimes:

Exclusive Use

- MSS and A2G - 60 MHz in the 2.1 GHz band available for MSS and A2G use with the possibility of extending the scope of the license to become technology neutral to enable hybrid satellite-terrestrial network.
- IMT – an additional 4 GHz of spectrum available for IMT use.

License-exempt use – 6.2 GHz of license-exempt spectrum.

Light licensing – a new spectrum access regime to deploy database and manual licensing solutions which promote sharing and provide greater flexibility in terms of spectrum access to users.

01 Licensed spectrum

CST envisaged four separate awards of licensed spectrum in 2021-2023:

- **A2G and MSS.** Award of 2x30 MHz for Air-to-Ground and Mobile Satellite Service, with goal of facilitating new services, and improving connectivity in the aeronautical sector and in remote areas.
- **IMT Auction to enable digital services.** Award of spectrum in multiple bands, including 600 MHz, 700 MHz and 3800 MHz.
- **IMT Auction to promote innovation and provide additional 5G capacity.** Award of spectrum in the 26 GHz mmWave band and the L-Band.
- **Verticals.** Award of licensed spectrum in the 450 MHz band to support a nationwide PAMR network.

The auction of A2G and MSS spectrum was completed in November 2022. Four entities qualified to participate in the auction: STC, Salam, Omnispace and EchoStar. This was the first spectrum auction in the Kingdom with participation from international telecommunications companies. The licenses were ultimately won by STC.

The IMT auction, originally scheduled for 2023, has been postponed to 2024. This has enabled further consultation on the lot structure and auction design with the industry. The auction was completed in Q4 2024.

CST also considered awarding IMT spectrum at 1500 MHz (L-band) during the previous outlook cycle. The ecosystem for this band is still developing and operators did not indicate any demand for the spectrum in 2021-2023. Accordingly, CST decided to delay the award of this band, and will instead explore release in the 2025-2027 period.

CST had planned to make additional IMT capacity available in the 26 GHz band. We monitored the demand for IMT spectrum over the outlook period and informally consulted with stakeholders on when to release the band. However, as with the 1500 MHz band, operators did not indicate strong demand for the spectrum at the time and generally suggested a later release date. For this reason, CST decided to award the spectrum in the current outlook cycle instead.

CST identified the potential to make available spectrum suitable for use by verticals that require private connectivity solutions, either provided by a nationwide PAMR network or via deployment of private mobile networks using lightly licensed spectrum. During the previous outlook cycle, CST developed a plan to license a single nationwide PAMR network, to be deployed in the 450 MHz band. The PAMR award, was conducted using a comparative selection process and completed in June 2024.

02 License-exempt spectrum

CST made exceptional progress with the release of spectrum for license-exempt, indoor use during the 2021-2023 period. Over 6 GHz of spectrum was released in two bands, at 6 GHz and at 60 GHz. The 6 GHz spectrum is expected to be used for a wide variety of unlicensed use cases, including Wi-Fi. To date, Saudi Arabia is one of only a few countries to have released the entire 6 GHz band for unlicensed use. With respect to 60 GHz spectrum, the Kingdom has taken a similar approach to many other developed countries in releasing this exceptionally large band; it is expected to be used to deploy WiGig technology, a Wi-Fi compatible standard that allows devices to communicate without wires at multi-gigabit speeds, suitable for high-performance wireless data, display and audio applications. For now, both bands have been released for indoor use only. CST will enable outdoor use in both bands in the 2025–2027 cycle.

03 Light licensing

The previous Outlook introduced light licensing as a new licensing regime. Light licensing is an approach that utilizes databases to provide flexibility, control, and streamlined access to radio frequency bands. These databases automate the request process, allowing for quick and efficient processing of requests without human intervention. Different types of databases can be used, ranging from simple registration databases to more complex ones that verify assignments or link to equipment. CST first consulted on its light-licensing regime in August 2021.[1] We then consulted on an updated version of the draft regulations in August 2023[2]. The regulations are flexible to allow for both manual and database solutions in individual bands. The regulations will be applied to individual bands through annexes that set out the rules that apply to specific bands. CST finalized these regulations in 2024, establishing a foundation for enabling light licensing in a range of bands.

In the previous Outlook, CST set out how it planned to apply the light licensing regulations to individual bands. Here, we summarize these bands, our direction at the time and our plans going forward:

[1] https://www.cst.gov.sa/ar/new/publicConsultation/Pages/144301.aspx

[2] https://regulations.citc.gov.sa/ar/Pages/PublishedPublicConsultations.aspx#/PublishedPublicConsulationDetails/46

4000–4200 MHz

There is limited use of FSS deployments in the band in the Kingdom, with some unregistered receive-only terminals. The UK has established a local licensing regime to enable sharing between existing services and 5G services in this sub-band. CST intended to make spectrum between 4000 MHz and 4200 MHz available for low-power innovative uses, using a geolocation database for shared access, while protecting FSS earth stations and aeronautical altimeters. CST issued draft light-licensing regulations for the band in August 2023. See Section 4.3.1.

10–10.5 GHz

The band is a shared band in the Kingdom. An IMT identification for this band in ITU Region 2 was studied at WRC-23, but ultimately only adopted in a dozen countries through a footnote. In the previous Outlook, CST said it would open up this band on a lightly licensed basis, requiring registration in a database and commitment to avoid interfering with existing deployed systems, while protecting satellite use at 10.7 GHz and above. However, as there was no interest in the band, CST did not pursue its plan further. CST will study the introduction of a light-licensing regime again in this outlook cycle.

28 GHz

The band is allocated for satellite services globally and in the Kingdom primarily for satellite uplink transmissions. Some countries, such as the US, have assigned the band for 5G services. In the previous Outlook, CST stated that it recognized the importance of this band for satellite use and committed to protecting satellite services. It said it would consider the possibility of secondary access for IMT, subject to protecting satellite use, and lightly-licensed 5G usage with detailed protection measures. CST has reviewed its direction in the previous Outlook and decided to refrain from establishing a light licensing regime in this band for now. For more information, see Section 4.4.6.

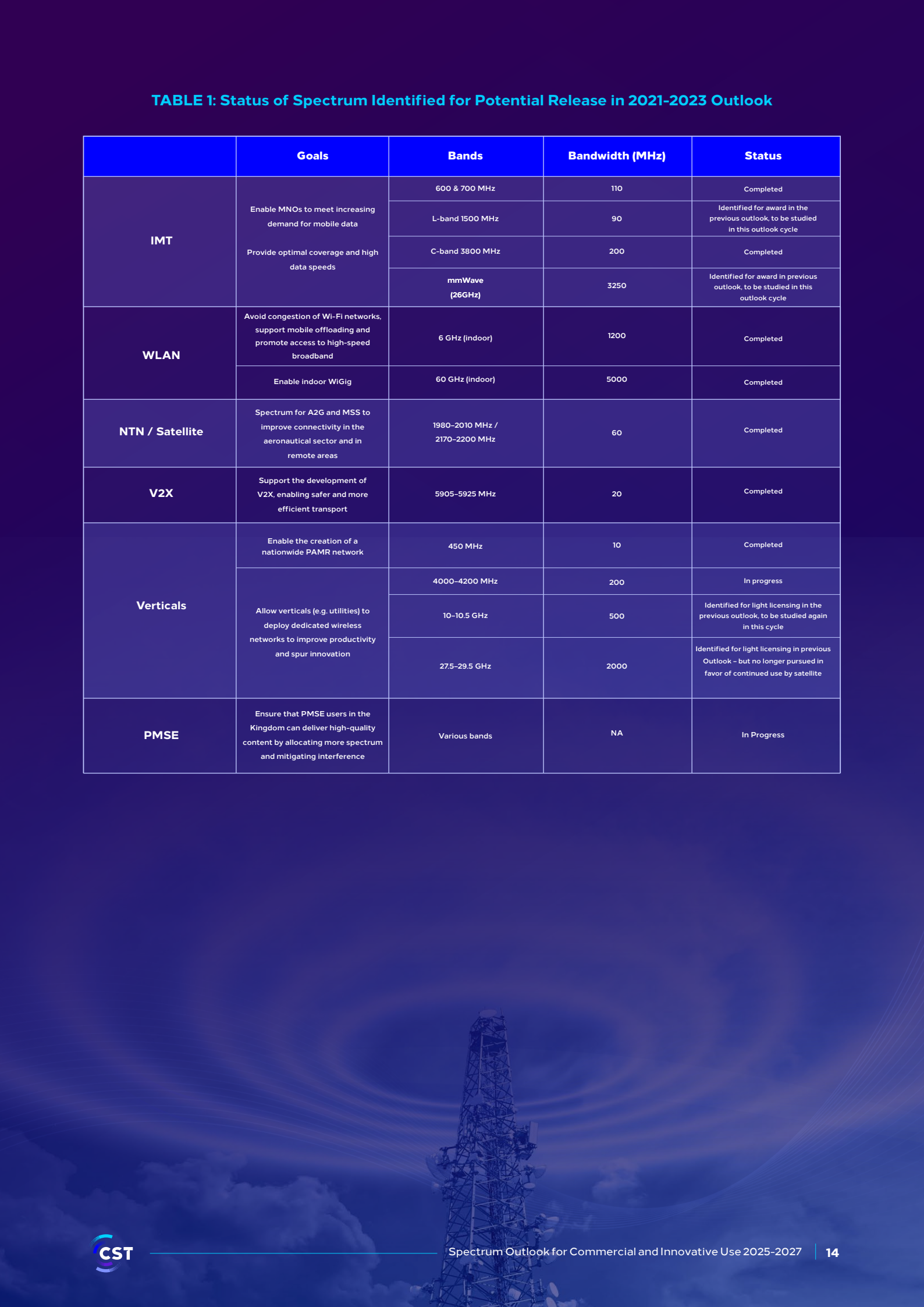
71–76 / 81–86 GHz

There are a considerable number of paired backhaul assignments (point-to-point) in this frequency range in the Kingdom. The band will likely continue to be used for backhaul both in the Kingdom and globally. We propose to continue the current link-by-link assignment approach. CST has reviewed its direction in the previous Outlook and decided to refrain from establishing a light licensing regime in this band.

Additional spectrum for service provision to verticals is expected to be released during the current outlook cycle, as described in Section 3.5. CST will further look to release three bands above 100 GHz on either a lightly-licensed or license-exempt basis.
Table 1 identifies the use cases, goals and specific spectrum bands identified for release in the 2021-2023 Outlook and provides an update on their status.

TABLE 1: Status of Spectrum Identified for Potential Release in 2021-2023 Outlook

	Goals	Bands	Bandwidth (MHz)	Status
IMT	Enable MNOs to meet increasing demand for mobile data Provide optimal coverage and high data speeds	600 & 700 MHz	110	Completed
		L-band 1500 MHz	90	Identified for award in the previous outlook, to be studied in this outlook cycle
		C-band 3800 MHz	200	Completed
		mmWave (26GHz)	3250	Identified for award in previous outlook, to be studied in this outlook cycle
WLAN	Avoid congestion of Wi-Fi networks, support mobile offloading and promote access to high-speed broadband	6 GHz (indoor)	1200	Completed
	Enable indoor WiGig	60 GHz (indoor)	5000	Completed
NTN / Satellite	Spectrum for A2G and MSS to improve connectivity in the aeronautical sector and in remote areas	1980–2010 MHz / 2170–2200 MHz	60	Completed
V2X	Support the development of V2X, enabling safer and more efficient transport	5905–5925 MHz	20	Completed
Verticals	Enable the creation of a nationwide PAMR network	450 MHz	10	Completed
	Allow verticals (e.g. utilities) to deploy dedicated wireless networks to improve productivity and spur innovation	4000–4200 MHz	200	In progress
		10–10.5 GHz	500	Identified for light licensing in the previous outlook, to be studied again in this cycle
		27.5–29.5 GHz	2000	Identified for light licensing in previous Outlook – but no longer pursued in favor of continued use by satellite
PMSE	Ensure that PMSE users in the Kingdom can deliver high-quality content by allocating more spectrum and mitigating interference	Various bands	NA	In Progress



2.2. Planned spectrum regulatory program 2021–2023

Over the last decade, KSA has shifted from a largely planned approach to spectrum to one where the market plays a significant role in determining the technologies and services deployed. As part of this process of giving the market a greater role in spectrum management, CST introduced new regulations for trading of selected frequency bands and has explored the potential for shared access to various frequency bands.

With respect to trading, the new regulations[3] allow for whole or partial transfers of spectrum licenses, subject to approval. However, the regulations currently only cover transfers of spectrum in the mobile, maritime, and satellite services. Some constraints on trading also remain, such as USL rules which de facto prevent subleasing of mobile spectrum to non-MNOs for commercial use. As described in Section 3.8, CST intends to benchmark its trading regulations against other leading regulators, and explore scope for revisions that extend trading to new frequency bands, and explore scope to clarify rules and ease on-going barriers to trades.

During 2021-2023, CST studied the potential for introducing a lightly licensed spectrum regime, with access to spectrum coordinated using smart databases. This included dedicated bands for verticals and other users as well as the possibility of allowing sharing in IMT bands on a secondary, coordinated basis in locations where the primary user is not using the spectrum. CST set out a potential regulatory framework as part of its consultation on spectrum trading in 2021. CST anticipates further policy advances with respect to spectrum sharing in the current outlook period. See Section 4.3 for more details on CST's plans for releasing more spectrum under the light-licensing regime.

In the previous outlook, CST said it would evaluate the potential to use crowdsourced data to monitor spectrum utilization and inform policy. CST considered this approach but ultimately decided that the information available was not sufficiently reliable for this purpose. CST will continue to evaluate crowdsourced data as part of its spectrum monitoring but will rely primarily on deployment data to monitor utilization.

[3] https://regulations.citc.gov.sa/ar/pages/public-decision.aspx#/publicDecisionDetails/467

03

CST's Spectrum Priorities For 2025–2027

In this section, we set out CST's spectrum priorities for the 2025-2027 outlook cycle:

3.1. Unlocking the potential of NTN and broader satellite spectrum use

The use of spectrum by the space sector covers a wide range of services, as shown in Figure 1. Satellite systems are international due to the nature of their network design which is based on accessing space orbit resources as well as radio spectrum. Therefore, satellite systems regulations are established internationally. The International Telecommunications Union (ITU) Radio Regulations (RR) addresses the use of frequencies and orbits in space by defining coordination and notification procedures. These procedures are continually reviewed at an international level by the World Radiocommunication Conference (WRC).

Fixed Satellite Service (FSS)	Mobile Satellite Service (MSS)	Broadcasting Satellite Service (BSS)	Radionavigation Satellite Service (RNSS)
Radio Astronomy Service (RAS)	Earth Exploration Satellite Service (EESS)	Space Operations Service (Space Operations)	Aeronautical Mobile Satellite Service (AMSS)
Meteorological Satellite Service (MetSat)	Aeronautical Mobile Satellite Service (Route)	Maritime Mobile Satellite Service (MMSS)	Inter Satellite Service (ISS)
Amateur Satellite Service (Amateur Satellite)	Space Research Service (SRS)	Land mobile satellite service	Aeronautical Mobile Satellite (Off Route) Service
Radio Determination Satellite Service	Maritime Radionavigation satellite service	Aeronautical Radionavigation Service	Radiolocation Satellite Service

FIGURE 1: RANGE OF SPACE SECTOR SERVICES

International developments

The space sector has been undergoing significant changes as evidenced by the outcome of WRC-23 and the agenda items for WRC-27 which to a great extent focus on satellite spectrum issues. There are more space users deploying more satellites, particularly large numbers of NGSO satellites, and this impacts access to and the use of spectrum. International coordination is becoming ever more important to avoid interference between systems operating in different orbits. Further significant developments include

- **Software defined satellite systems** which are reconfigurable, modular and scalable. These systems are effective through the efficient use of resources and the ability to share and allocate capacity across multiple satellites and responsive as new functionalities can be introduced and modified rapidly through software updates. The use of spot beams which translate to high antenna gains leading to an increased satellite EIRP and therefore data transmission rate per Hertz so greater spectral efficiency. In addition, the use of artificial intelligence can provide opportunities for improving network management.
- **Small satellite technologies** which are based on compact and reconfigurable satellite payloads enabling constellations of small satellites, ranging from a few kilograms up to 600 kilograms, to be deployed in low earth orbits, to take advantage of: low latency communication services; reduced time between Earth and space sensing measurements; and accurate positioning, navigation and timing. Systems range from CubeSats designed for short term missions to LEO constellations aiming to provide global services for consumer, business and governmental use cases. The time to build these satellites and costs associated with getting them into orbit have fallen dramatically in recent years.
- **Hybrid constellations** which aim to combine advantages offered by different orbit types, such as low latency of LEO and MEO, and global coverage areas of GEO to maximize the benefit of satellite networks.

The availability of radio spectrum is one of the key factors to the success of the satellite industry. Satellite systems usually require a long investment cycle and, therefore, long-term strategic planning is necessary for international satellite spectrum allocations. Satellite networks are deployed in a number of frequency bands and, as the number of satellite frequency bands have increased over the years, frequency band designations have been developed for ease of referencing. The designations used for the satellite frequency bands are shown in Figure 2 below with L, C, Ku, Ka and Q/V being the main satellite bands.

FIGURE 2: SATELLITE FREQUENCY BANDS

Current situation

CST is responsible for representing the KSA in the ITU and internationally on matters relating to spectrum and orbital resources. In the space sector this includes managing national satellite filings and influencing the development of new international rules for spectrum use by satellites. Spectrum use by satellites is coordinated under procedures described in the ITU RR and CST has adopted those procedures.

The KSA National Frequency Plan and the National Frequency Allocation Table (NFAT) set out which frequency bands are allocated to which space service in the Kingdom in line with ITU RR. CST authorizes satellite equipment on the ground, as well as on Saudi planes and ships, according to the NFAT and national satellite services regulations.

The international nature of satellite services necessitates that the management of spectrum and orbital positions takes place within a framework of international rules administered by the ITU. Two important areas of ITU Radio Regulations regarding satellite networks are frequency allocations and the coordination, notification and recording in the Master Register.

However, two aspects need to be managed at a national level:

- **Regulatory framework for satellite filing registration**
- **Regulations for the use of radio spectrum for Earth Stations**

CST has taken several key regulatory steps for the development of the space sector in the KSA:

- **Three documents describing NTN regulations[4] were published in 2022. These address CST's regulatory requirements for the provision of satellite services in the KSA and address:**
  - Provisioning of Operational Services of NTN under the General Class License,
  - Provisioning of Telecommunication Services over NTN under the General Class License, and
  - Registration of Telecommunication Space Stations.
- **There was an auction in the same year for an award of 2 x 30 MHz spectrum in the 2100 MHz band for A2G and MSS.**
- **CST published a public consultation on Space Radiocommunication Services Outlook assessing the current and future state of satellite spectrum allocations. The outlook addresses demand for satellite and space services and need for further spectrum, taking into account inputs from public consultation. Key objectives were updating satellite regulations to allow NGSO, ESIM and IoT use in existing satellite bands. The responses to the Space Radiocommunication Services Outlook were used to inform topics included in this Outlook.**
- **CST has supported a number of trials for NTN that cover[5]:**
  - GEO and LEO IoT satellites,
  - LEO satellite broadband and backhaul,
  - Air-to-Ground,
  - HAPs, and
  - Hybrid non-terrestrial network.

[4] https://regulations.citc.gov.sa/ar/pages/public-decision.aspx#/publicDecisionDetails/468
[5] https://www.cst.gov.sa/en/ntn/Pages/default.aspx

Our direction

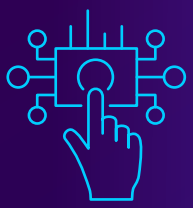
The priority for the 2025–2027 outlook cycle will be to finalize the draft regulations, including the associated technical conditions and license application forms, and ensure the allocations in the National Frequency Allocation Table (NFAT) are aligned with the updated Article 5 of the Radio Regulations following WRC-23 and the regulations.

In addition, CST will be working on enhancing the regulatory framework for NTN. CST has identified additional focus areas to ensure innovative space services can be developed and supported, the use of satellite spectrum is improved, the satellite market is expanded, and the KSA is an attractive country for the international space sector, namely:

- Develop Regulatory framework for satellite filing registration
- MSS use in sub-1 GHz bands
- Develop earth station regulations
- CST's Direction for Direct to Device
- Review of the 28 GHz band
- Opening certain IMT bands up for use by HIBS. At WRC-23, a decision was made to open up IMT bands for use by HIBS. CST is minded to implement this decision in the current outlook cycle.
- Register receive-only earth stations
- Promote development of EESS sector in the KSA including the use of synthetic aperture radars (SAR) in EESS active band allocations.

Further information on each area will be provided in Section 4.4.

3.2. Increasing IMT mobile spectrum capacity



IMT spectrum refers to the specific frequency bands allocated for mobile telecommunications services. These bands are essential for enabling wireless communication, including voice calls, text messaging, and mobile data services.

International developments

Most developed countries make spectrum available for IMT as fast as they are able to, depending on the demand. Recent additions of spectrum for 5G, include 600 / 700 MHz, 3400–4200 MHz and mmWave.

Current situation

Current bands used for mobile in Saudi Arabia are 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2600 MHz and 3500–3800 MHz. In addition to the completed auction in Q4 2024 that awarded new spectrum in 600 MHz, 700 MHz and 3800-4000 MHz.

As the use of mobile devices and data-intensive applications continues to increase, IMT spectrum plays a key role in meeting the connectivity needs of consumers in the Kingdom.

One of the primary reasons for the continued importance of IMT spectrum is the ongoing growth in mobile data consumption. With the proliferation of smartphones, tablets, and other connected devices, people are increasingly relying on mobile networks to access the internet, stream videos, engage in social media, and utilize various online services. While there are indications that the growth rate itself is coming down, the continued surge in data traffic requires sufficient spectrum resources to ensure reliable and high-speed connectivity.

Furthermore, the continued deployment of 5G relies heavily on adequate spectrum resources. 5G networks deliver ultra-fast speeds, low latency, and massive device connectivity, enabling transformative applications like smart cities and IoT. To fully realize the potential of 5G, a significant amount of spectrum is required to support the capacity and bandwidth demands of these advanced applications.

Our direction

Releasing more spectrum is crucial to avoid a spectrum crunch and meet the continued growth in demand for mobile connectivity. The award of additional IMT spectrum in 2024 ensured that Saudi MNOs have sufficient capacity to serve customers over the next years. This represents a transformation of the Kingdom's mobile capacity compared to the end of the 4G era in 2016.
Additionally, CST plans to undertake the following in this outlook cycle to ensure sufficient spectrum is available to mobile networks as illustrated in Figure 3.

See Section 4.1 for more detail on each of these items:

- Allocation of mmWave spectrum in the 26 GHz band
- Allocation of spectrum in the L-Band. CST is considering use by either IMT or for drones. See Section 4.1.3 for more details.
- Allocation of spectrum in the C-band for indoor use. See Section 4.3.5 for more details
- Study possible options for renewing / reallocating existing licenses.

FIGURE 3: IMT ASSIGNMENTS FOR PUBLIC MOBILE NETWORKS IN SAUDI AS OF END-2023, AND IMPACT OF FORTHCOMING SAUDI IMT AND MMWAVE AWARDS

3.3. Fostering spectrum use for FWA

International developments

CST follows ITU Recommendation F1399-1[6] which defines FWA as a wireless access application in which the location of the end-user termination and the network access point to be connected to the end-user are fixed. FWA has emerged as a promising solution for providing high-speed broadband connectivity to underserved areas, complementing traditional wired infrastructure. FWA can be provided through Point-to-Multipoint systems, within 5G systems or in WLAN bands. In 5G systems, operators are offering FWA alongside mobile access, often in the same frequency bands such as in 3400–3800 MHz. 5G FWA can further be enabled in mmWave bands. The second form of FWA is in WLAN bands, in particular in the 6 GHz and 60 GHz bands once they are enabled for outdoor use.

Current situation

To date, only provision using IMT spectrum has been enabled. Table 2 lists the additional spectrum bands identified for provision of FWA services that will be enabled in this outlook cycle.

Going forward, CST intends to foster all forms of provision of FWA services. CST recognizes that each type of provision will require different types of spectrum access in different spectrum bands.

Enabling FWA requires collaboration among various stakeholders, including government agencies, industry players, and local communities. CST will actively engage with these stakeholders to foster partnerships and knowledge sharing. This may involve organizing workshops, forums, and consultations to gather insights and best practices from industry experts and community representatives. By fostering collaboration, CST aims to create an ecosystem that supports the sustainable growth of FWA and maximizes its benefits, in particular in areas outside of the fiber footprint and in underserved areas.

[6] https://www.itu.int/rec/R-REC-F.1399-1-200105-I/en

TABLE 2: SPECTRUM IDENTIFIED FOR PROVISION OF FWA SERVICES

Access	Spectrum	Timeframe
Exclusive	3.8–4.0 GHz	Completed in 2024
To be decided in this outlook cycle	26	2026
Light licensing for outdoor use (AFC)	6	2025
License Exempt	60	2026

Our direction

The following new spectrum releases will support the development of FWA in the Kingdom:

- The award of the 26 GHz band following the public consultation in 2026.
- Enabling outdoor use in the 6 GHz band through an AFC will enable FWA in WLAN bands.
- Enabling standard power outdoor use in the 60 GHz band will facilitate FWA in WLAN bands.

3.4. Promoting spectrum sharing

International developments

Spectrum sharing provides the means of achieving a better spectrum efficiency within a band through technical means and associated licensing approaches. It will play an increasingly important role with the increasing demand for access to spectrum for a wide range of users and services. It is particularly applicable to underutilized bands and crucially for incumbents, where the spectrum rights may not need to be relinquished, but the spectrum is made available to others on terms acceptable to the incumbent. Regulators around the world rely increasingly on spectrum sharing to enable efficient use of spectrum. For example, the FCC has established the CBRS system in the 3.4 GHz band and an AFC in the 6 GHz band. Ofcom in the UK has adopted more flexible management approaches such as its local access regime in the 3.8–4.2 GHz band.

Figure 4 differentiates the various forms of sharing implemented internationally along two dimensions:

- Interference control: Whether the access regime includes a dynamic interference control or not; and
- Exclusivity: Whether access is exclusive – i.e. only user has access to a particular frequency range (potentially subdivided by geographic area and/or time) – or not

	Non-exclusive access	Exclusive access
No dynamic interference control	01 License-exempt spectrum	02 Classical sharing
Controlled interference	03 Light licensing / Dynamic spectrum access (DSA)	04 Licensed-shared access (LSA)

FIGURE 4: DIFFERENT TYPES OF SPECTRUM SHARING

I. License-exempt spectrum

Unlicensed spectrum is a common good, that can be used by anyone that meets a minimum set of requirements for access to the particular band. It is used for low powered devices on a non-interference non-protection basis assuming there is sufficient spectrum to meet demand. As there is no interference protection there can be no guarantee for QoE (Quality of experience) and QoS (Quality of service) especially as more users / devices access the spectrum. CST has enabled license-exempt access to spectrum in multiple bands, for example for WLAN at 2.4 GHz, 5 GHz and 6 GHz.

II. Classical sharing

Classical sharing is the assignment of the same spectrum band to two or more licensed services based on a geographic or time based separation necessary to avoid the potential for interference in the band. Interference is controlled by, for example, a pre-defined geographic exclusion zone which is not dynamically altered. A typical example is sharing between fixed links and satellite earth stations,

III. Light licensing / Dynamic spectrum access (DSA)

In the previous outlook cycle, CST published general light-licensing regulations. The next step is to develop regulations and technical conditions for light-licensing in specific bands. The first band identified for shared use on a coordinated light-licensed basis will be 4.1-4.2 GHz.

A 'light licensing regime' supports registration on a "first-come-first-served basis" and provides basic protections against interference through coordination. Users notify the regulator with the position and characteristics of their wireless deployment, and new users are constrained to compatible activities. Key features of light licensing regimes in other jurisdictions are that they are implemented on a technology and service neutral basis, but with generic power and deployment restrictions that support sharing, and they do not require prior licensing. This is somewhat different to the situation in the Kingdom where registration is always required under the light-licensing regime.

Dynamic spectrum access facilitates spectrum sharing between services through the use of databases or sensing. Decisions on sharing are based on pre-determined rules, technical restrictions and geographic location for each new transmitter. Sensors may also be used to establish whether specific frequencies are already being used by other services. Some examples are provided in Figure 5.

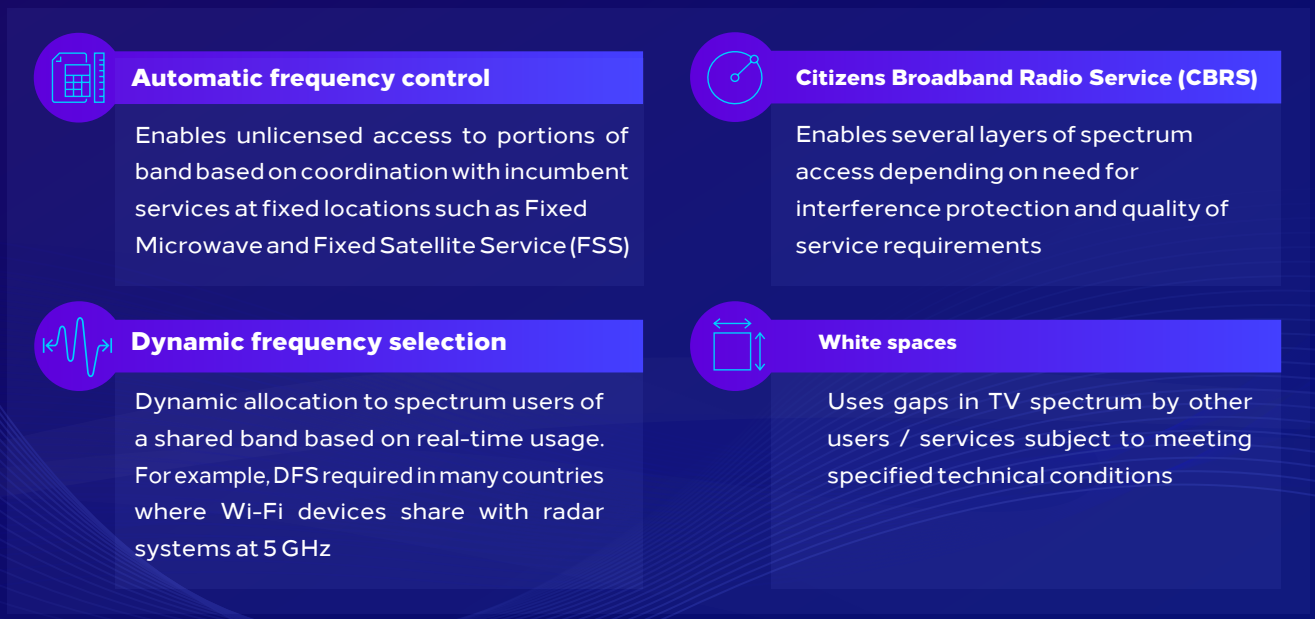


FIGURE 5: DIFFERENT FORMS OF DYNAMIC SHARING ACCESS

The most well-known example of a dynamic shared access regime, which CST has studied, is the US CBRS regime, which has three tiers of licensees (as illustrated in Figure 6): incumbents (tier 1) enjoy priority protection from interference but only for their designated legacy activities (military radars and receive satellite earth stations); tier 2 consists of priority access users that bought their licenses through auctions and receive protection from tier 3 users but must not interfere with tier 1 use; and tier 3 Generally Authorized Access (GAA) users are unlimited in number but their use of the spectrum is constrained as they cannot cause interference to any tier 1 and 2 users. GAA users are lightly licensed. The Citizen's Band Radio Services Devices operating under this regime can only operate under the authority and management of a centralized cloud-based Spectrum Access System which manages all the different interference scenarios through appropriate rules, sensing of tier 1 frequency use and databases.

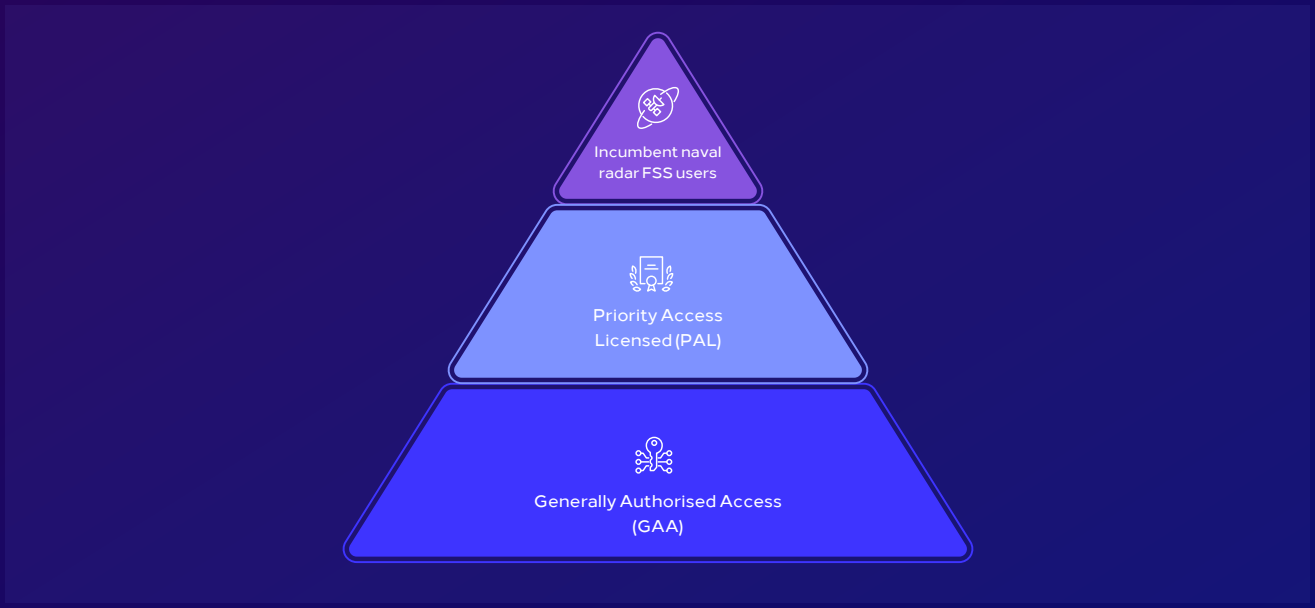


FIGURE 6: US CBRS – AN EXAMPLE OF A LIGHTLY LICENSED ACCESS REGIME USED FOR THIRD PRIORITY ACCESS (GAA)

IV. Licensed-shared access (LSA)

In the case of LSA (also sometimes referred to as Authorized Shared Access (ASA)), access is restricted and interference is also actively controlled. The concept of LSA is to allow a limited number of additional users into a band on a licensed basis. This might just be one other user in some cases. LSA is currently primarily foreseen as a mechanism to enable mobile broadband operators to access spectrum that has been harmonized for mobile broadband use but where there are incumbents that are difficult to relocate. The idea is to award a license, similar to an exclusive license, but with the requirement to share with the incumbent radio services. There are also examples of PMSE sharing government spectrum on a secondary basis.

Current situation

CST has made considerable progress with regards to enabling some forms of spectrum sharing. We plan to expand the use of all forms of spectrum sharing in this Outlook cycle as set out below.

Our direction

CST will leverage the light-licensing regime to enable sharing in a number of additional bands in the current Outlook cycle. These are set out in detail in Section 4.3 and include:

- A light-licensing access regime in 4.1-4.2 GHz to provide mid-band spectrum for private wireless network, CST is monitoring the 4.0-4.1 GHz band for future needs.
- 6 GHz (Outdoor standard power).
- A number of bands above 100 GHz.

CST will also work on enhancing trading regulations to cater to market demand and needs.
Lastly, CST will work with stakeholders to enhance spectrum sharing through engagement and workshops.

3.5. Enabling spectrum use by verticals, for private networks and IoT

International developments

In recent years, there have been significant international developments in making spectrum available for use by verticals, private networks, and for IoT (Internet of Things) applications. Private networks have gained significant traction as organizations seek greater control, security, and customization in their connectivity solutions. Similarly, the IoT has emerged as a transformative technology, connecting billions of devices and enabling innovative applications across various sectors. Many countries have implemented new access regimes that provide localized access to IMT bands such as the Shared Access Licenses and Local Access Licenses regimes in the UK. Many countries also allow leasing of IMT spectrum by verticals which opens up mobile bands for alternative use on a commercial basis in area where the license holder does not need it. This includes, among others, Australia, USA, Canada, Sweden and UK (in some bands).

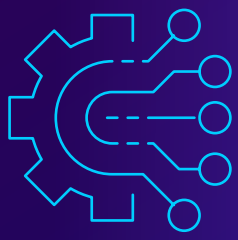
Current situation

By facilitating the deployment of dedicated networks and fostering innovation in IoT applications, CST aims to unlock the full potential of vertical industries and drive economic growth:

- **Private Networks:** CST recognizes the importance of private networks and will facilitate their deployment. By enabling private networks, CST aims to empower enterprises, government agencies, and critical infrastructure providers to meet their specific connectivity needs and drive digital transformation.
- **IoT applications:** CST will actively support the growth of associated applications by reviewing and updating regulations and technical specifications. By enabling IoT, CST aims to unlock new opportunities for automation, data analytics, and smart services, driving efficiency and innovation across industries.

CST's approach for enabling spectrum use by verticals, for private networks and IoT rests on the following pillars:

1. Access to spectrum in a range of suitable bands.
2. Maximizing the extent to which spectrum is shared.



These pillars will support a platform for choice and innovation.
Verticals require access to a range of different frequency bands, so as to dimension private networks with different capacities, indoor and outdoor reach. Private networks and IoT connectivity may also be provided over existing IMT infrastructure, by a specialized PAMR network or via satellite. Accordingly, CST has identified a range of bands suitable for supporting the provision of services to verticals as summarized in Table 3, including low band (sub-1 GHz), mid-band (1-6 GHz) and high band (mmWave) spectrum.

TABLE 3: SPECTRUM IDENTIFIED FOR PRIVATE NETWORKS AND FOR IOT

Use Case	Low (sub-1 GHz) bands	Mid bands	Higher bands
Licensed (For IMT)	Through Mobile Network Operator	Through Mobile Network Operator	Through Mobile Network Operator
License Exempt	LPWAN (released and further studied in this outlook cycle)	WLAN in 2.4, 5 and 6 GHz indoor (released)	• WiGig indoors 60 GHz (released) • 60 GHz outdoors (To be released in this outlook cycle)
Light Licensing	-	• 4.1-4.2 GHz (To be released in this outlook cycle) • 6 GHz outdoors (To be released in this cycle)	• 26 GHz • (To be released in this Outlook cycle) • 100+ GHz (To be released in this Outlook cycle)
Specialized Network Provider	• PAMR network in 450 MHz (assigned) • Leasing of IMT Low bands (To be studied in this Outlook cycle)	Leasing of IMT mid-bands (To be studied in this Outlook cycle)	26 GHz (To be released in this Outlook cycle
Satellite	See Section 4.4.3	The most common bands for IoT, in order are L-band, S-band, C-band and X-band	Not needed as they require higher power

Our direction

As illustrated in Table 3, CST has already progressed in making spectrum available for use by verticals and for IoT, through:

- Licensing of IMT spectrum in low and mid bands to mobile operators who can provide services to verticals, private networks and for IoT at their discretion.
- The award of a single license for a nationwide specialized PAMR network in the 450 MHz network.
- As part of the 450 MHz award, the 410 MHz band is currently being evacuated to be refarmed. CST is monitoring the development and will take a decision on this band after the evacuation.
- Making license-exempt spectrum available in a range of bands.
- Satellite spectrum bands from 1 to 12 GHz which can be used to provide IoT services.

Significant further progress will be made in the new outlook cycle, including:

- A light-licensing access regime in 4.1-4.2 GHz to provide mid-band spectrum for private wireless network, CST is monitoring the 4.0-4.1 GHz band for future needs.
- The award of spectrum at 26 GHz, based on the public consultation in Q1 2026.
- Enabling standard power outdoor use in the 60 GHz band.
- As discussed in Section 4.4.3, open up spectrum below 1 GHz for Satellite IoT.
- A number of bands above 100 GHz as set out in Section 4.3.4.
- As discussed in Section 3.8. CST will also explore expanding trading to a specialized network service provider as part of updating the spectrum trading regulations.

3.6. Facilitating the future of transport

CST recognizes that connectivity is increasingly important to transportation systems, whether on the land, in the air or at sea. In this outlook cycle, CST will focus on the following areas, which are set out in more detail in the following sub-sections:

- Monitor the need for an additional spectrum identification for V2X;
- Start the work on exclusive-use licensing for drones;
- Study the spectrum requirements for Advanced Air Mobility;
- Investigate the possibility of establishing a commercial radar network; and
- Consult and decide on the optimal allocation of 1900–1920 MHz including a possible allocation for Future Railway Mobile Communication Systems.

Vehicle-to-Everything (V2X)

International developments

V2X generally encompasses all vehicle communications including ITS and V2V systems[7]. We note that there has been interest in V2X in the 5 GHz band for many years but limited deployment to date as the technology continues to be developed. Partly this has been caused by a lack of agreement over a common standard with the Wi-Fi based ITS-G5 competing with the 5G-based C-V2X.

The US allocated 75 MHz in the band (5850–5925) MHz for ITS applications in 1999 with DSRC as the technology of choice. However, it recently reallocated this spectrum for unlicensed devices and C-V2X due to a lack of use by DSRC. In Europe, the band (5855–5875) MHz has been designated for non-safety ITS applications and (5875–5925) MHz for road-related safety ITS applications.

Current situation

Vehicles are becoming increasingly connected and V2X systems enable a wide range of applications, including safety measures as illustrated in Figure 7. In the previous outlook cycle, CST issued its Roadmap for using the 5.9 GHz band for V2X systems in which it identified the upper 20 MHz in the 5.9 GHz band from 5905–5925 MHz for C-V2X to Support the deployment of connected vehicles in the Kingdom[8]. The remaining 50 MHz in (5855–5905) MHz are reserved for future identification

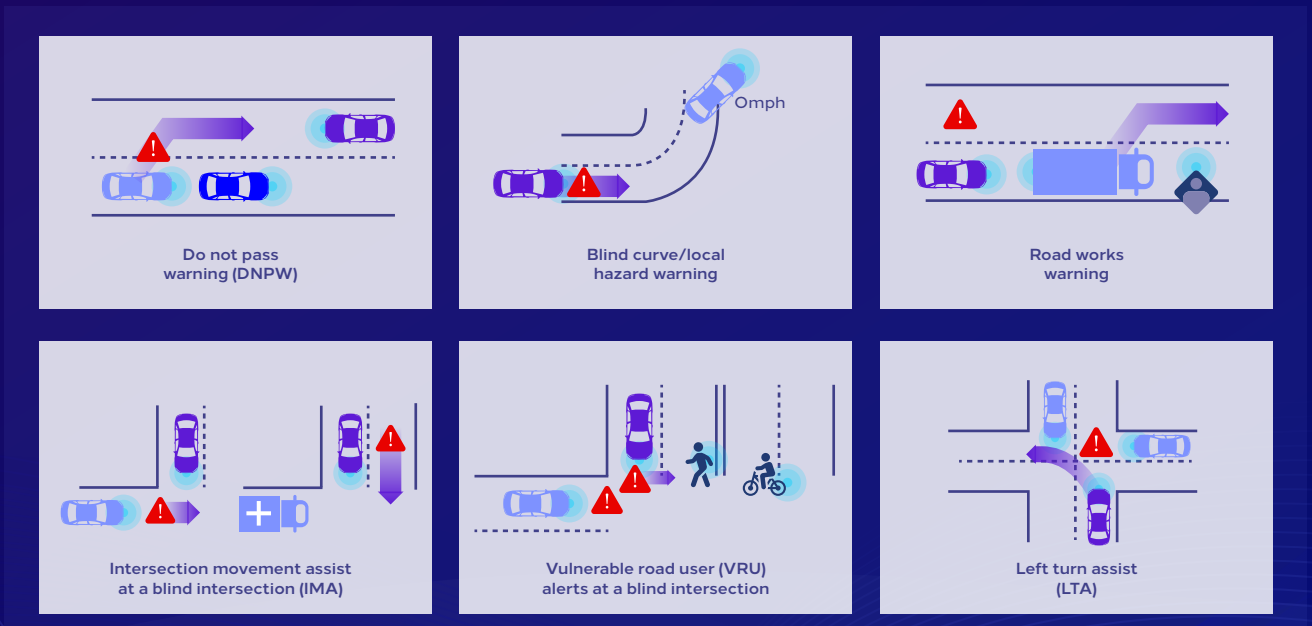


FIGURE 7: V2X USE CASES

[7] This includes automotive radars usually operating at 76 GHz, anti-collision 'short-range' radars usually operating at 24 GHz and 79 GHz bands; road radars, e.g. incident detection radars usually operating at 34 GHz; electronic tolling operations, e.g. CEN DSRC operating at 5.8GHz band; and inductive-loop traffic detectors usually operating at 10 – 200 kHz.

[8] https://www.cst.gov.sa/en/mediacenter/pressreleases/Pages/2023091601.aspx

Following public consultation, CST released 20 MHz in the upper part of the 5.9 GHz band for C-V2X applications. Respondents to the consultation supported CST's efforts to enable V2X in the Kingdom and agreed that an initial 20 MHz allocation was sufficient to support safety applications. However, respondents' views diverged on whether C-V2X or DSRC/ITS-G5 should be implemented in the Kingdom. For this reason, CST reserved the remaining 50 MHz in the lower part of the 5.9 GHz band without further identification.

Our direction

In this outlook cycle, CST will continue to welcome trial applications in the lower 5.9 GHz band to investigate new technologies such as DSRC/ITS-G5, advanced C-V2X, and unlicensed Wi-Fi, and assess their feasibility for future identifications. As set out in the Roadmap, CST will review the outcomes of these trials and monitor the uptake of V2X. CST will retain flexibility to identify the remaining part of the 5.9 GHz range in way that ensures the optimum use of spectrum. CST will engage with infrastructure and automotive manufacturers to explore ways to foster V2X development within the Kingdom

Drones

International developments

Most countries currently enable the use of drones operating in visual line of sight via license-exempt spectrum in the 2.4 and 5.8 GHz bands. However, the lower power limits in these bands mean they are not suitable to support beyond visual line of sight applications. An increasing number of countries are therefore looking into allocating the 5030-5091 MHz band for command and control (non-payload) communications. In this frequency range, transmission would be allowed at higher power, over dedicated networks. The FCC is leading this trend and is planning to hold an auction to allocate the 5030-5091 MHz band in 2024. Beyond visual line of sight command and control of drones can be facilitated by satellite – for example Velaris uses the Inmarsat L-band satellite global network for command and control.[9] Some countries, like the UK, have already enabled BVLOS using satellite technologies. The UK UAS Operator Radio license authorizes the licensed operators to use a range of technologies on their drone fleet, including mobile and satellite technologies. Permit use requires the specific agreement of the network operator(s)[10].

Current situation

Drones in the Kingdom (and elsewhere) have so far been limited to line-of-sight flight owing to their use of unlicensed spectrum in the 2.4 and 5 GHz bands. This has limited the technology's reach, applications, and impact. To enable beyond-visual-line-of-sight applications, drones require access to dedicated spectrum assignments. Beyond-visual-line-of-sight (BVLOS) drones have the potential to emerge as a transformative technology with myriad applications, as illustrated in Figure 8, including for agriculture and mining, delivery services, infrastructure inspection, and emergency responses. CST is committed to supporting the development of this technology in the Kingdom.

[9] https://www.inmarsat.com/en/solutions-services/aviation/services/velaris.html

[10] https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/238648-spectrum-for-unmanned-aircraft-systems-uas/associated-documents/drone-statement.pdf

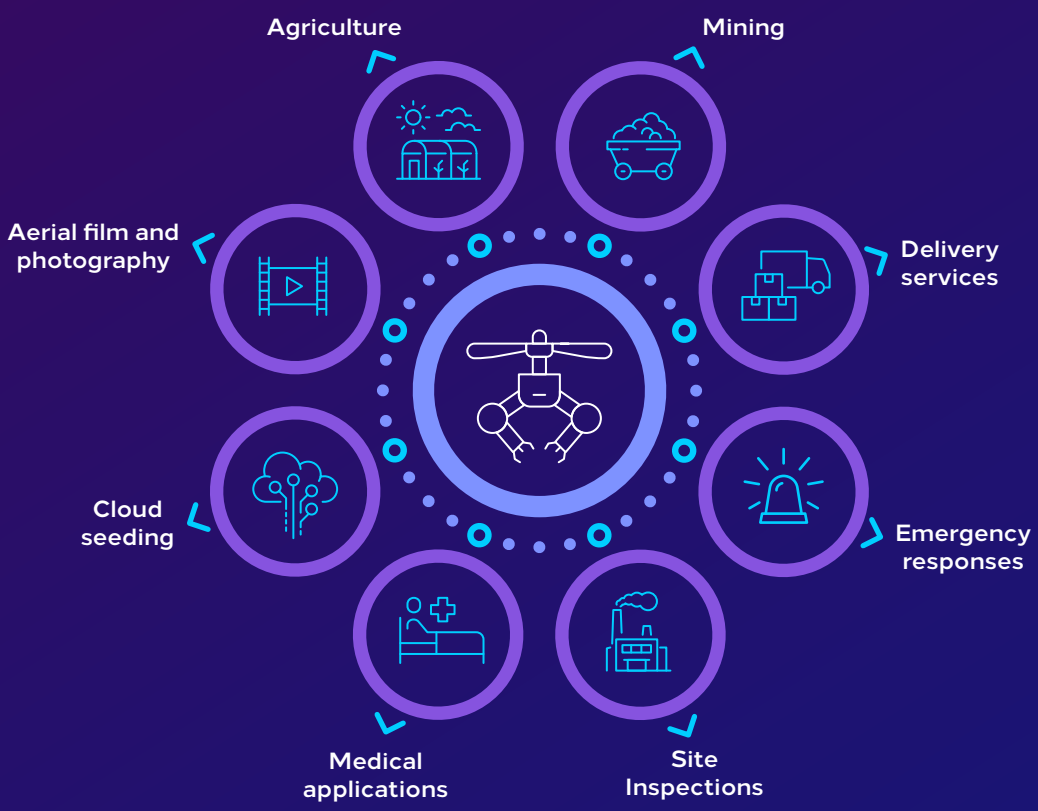


FIGURE 8: EXAMPLE OF DRONE USE CASES

Our direction

There are generally three possible spectrum solutions to enable BVLOS:

- **Mobile spectrum.** Mobile operators have extensive coverage. Their existing networks could be leveraged to provide connectivity to drones;
- **Aeronautical spectrum.** Drones would leverage existing technology used in aircraft.
- **Dedicated network.** Drone operators deploy their own networks in dedicated spectrum bands, such as the 5030–5091 MHz range.

Satellite technology may be a fourth options for enabling BVLOS.

CST has noted the interest in drone services expressed in responses to the consultation. In this outlook cycle, CST will study the spectrum needs for drones and investigate making exclusive-use spectrum in the 5030-5091 MHz range available for use by drones as well as advanced air mobility. CST will monitor international developments and expects to consult with the industry in Q4 2026 on how and when the spectrum should be made available.

We will also consider the type of trial licenses in light of satellite enabled BVLOS.

Advanced Air Mobility

International developments

Advanced Air Mobility (AAM) is a new technology for futuristic air travel. It refers to systems that move individuals and/or goods both intra- and inter-city using aircrafts without a pilot. They will make use of electric vertical take-off and landing, electric short take-off and landing unmanned aerial vehicles.

AAM has the potential to revolutionize how people and goods are transported, improving connectivity within and between cities. Furthermore, AAM could reduce congestion and Greenhouse Gases (GHG) emissions relative to existing modes of transport.

As of now, no globalized framework has been agreed upon yet for AAM. While spectrum requirements remain unclear, the considerations to enable AAM are similar to drones. They required continuous and reliable communication, a dedicated spectrum band, and harmonized bands and standards.

Current Situation

Saudi Arabia places significant value on advanced air mobility (AAM) as a cornerstone of its commitment to innovation and efficiency in transportation. Recognizing the potential of AAM technologies to revolutionize mobility, the Kingdom has integrated these solutions into major events, including the 2024 Hajj season to ensure safe, efficient, and modern transportation solutions to support large-scale operations and deliver exceptional experiences.

Our direction

AAM is still in its early stages. CST will look to contribute to the development of AAM. This may be done through the establishment of a working collaboration with other international actors to promote AAM by defining spectrum requirements and secure frequencies for AAM. CST is working closely with the General Authority of Civil Aviation (GACA) to enable AAM in the Kingdom.

CST also plans to develop a spectrum regulation for Unmanned Aircraft Systems (UAS) This will provide the industry with a direction on the different technologies, uses, and spectrum available to them.

Commercial radar network

International Developments

Commercial radar networks see limited use on an international scale, as radar applications are predominantly overseen and regulated by government entities, often with the guidance and support of national spectrum management authorities. The majority of radar deployments are focused on critical functions such as security and navigation.

Current situation

In KSA, access to radar spectrum is managed through a case-by-case approval process through CST. Entities seeking spectrum access must submit requests through established channels.

CST has been approached to consider alternative solutions to the case-by-case process. One solution is to assign a commercialized radar network provider to manage civilian access to the spectrum. The provider would receive access to a block of spectrum and could implement a more streamlined application process for civil radar users.

Our direction

CST will facilitate access to radar spectrum and work on improving the current process.

Future Railway Mobile Communication Systems (FRMCS)

International developments

> Future Railway Mobile Communication Systems (FRMCS) represent the next generation of communication systems for the railway industry. FRMCS is set to replace the existing Global System for Mobile Communications-Railways (GSM-R) technology, which has been in use for several decades. This new communication system is expected to revolutionize railway operations by providing enhanced connectivity, improved safety, and increased efficiency. Key features of FRMCS are as follows:

Interoperability: FRMCS aims to establish a standardized communication platform that can be seamlessly integrated across different railway networks and countries. This interoperability will enable efficient cross-border operations and facilitate international railway connectivity.

Enhanced Data Transmission: FRMCS will offer significantly higher data transmission rates compared to GSM-R. This increased bandwidth will support the transmission of large volumes of data, such as real-time train status, video surveillance, and passenger information, enabling more efficient and reliable operations.

Improved Reliability and Safety: FRMCS will provide enhanced reliability and safety features, including better coverage, improved signal quality, and reduced latency. These advancements will enable faster and more accurate communication between trains, control centers, and other railway infrastructure, enhancing overall safety and operational efficiency.

Support for Advanced Applications: FRMCS will support a wide range of advanced applications, such as train control systems, asset management, predictive maintenance, and passenger services. These applications will leverage the increased connectivity and data capabilities of FRMCS to optimize operations, improve maintenance practices, and enhance the passenger experience.

FRMCS is designed to be a future-proof communication system that can adapt to evolving technologies and industry requirements. The Electronic Communications Committee of the CEPT allocated the following two bands for Railway Mobile Radio (for use by FRMCS) in 2020:

- Band n100 in 874.4–880 / 919.5–925 MHz which is currently used for GSM-R.
- Band n101 in 1900–1910 MHz. This band has been designated for FRMCS for CEPT.

Current situation

There is an existing allocation for GSM-R in the Kingdom which will need to be refarmed.

The 1880–1920 MHz range has a civil allocation for mobile and fixed (both primary).

The 1900–1910 MHz range is currently not identified for any use, though, but could alternatively be allocated for DECT.

Our direction

CST will support the refarming of the current GSM-R band from a regulatory and licensing perspective as needed. CST will further make the 1900–1910 MHz range available for FRMCS in this outlook cycle.

3.7. Improving spectrum access for PMSE

International developments

> PMSE makes widespread use of UHF frequencies in 470–614 MHz, mostly for audio applications such as wireless microphones and in-ear monitors. These also use "white spaces" where TV channels are not being used. Audio can also be accommodated in the DECT band (1880–1900 MHz) while video is predominantly transmitted in the 7 GHz band (7.11 to 7.25 GHz and 7.3 to 7.425 GHz in the UK, for example) and also in some cases in the DECT band.

Current situation

PMSE is an important use of spectrum for audio and video in the Kingdom and globally. PMSE uses spectrum to support broadcasting and live events, including but not limited to including religious events, concerts, theater, and major sporting events. It also encompasses wireless microphones widely used by many in religion, business and entertainment. CST recognizes that PMSE underpins many other activities, enables culturally important events and is critical to significant employment and revenue generation. Given this, there is a clear need to update CST's spectrum strategy for PMSE.

Our direction

CST is working on a comprehensive spectrum strategy for PMSE that will ensure sufficient spectrum resources are readily available for this important use case. CST will consult stakeholders on the optimal spectrum for PMSE in Q2 2025 with a view to releasing PMSE regulations by Q3 2025. This will include a list of spectrum bands in which CST is planning to enable PMSE.

CST will further, review the scope of the current identification for DECT in the 1880–1900 MHz band and explore whether the band could be opened up to include a broader set of devices and DECT NR+ technology. In addition, CST will monitor uptake of DECT and, if necessary, consider identifying further spectrum to DECT either in 1910–1920 MHz or in 1900–1920 for indoor use only.

CST continuously monitors international spectrum management approaches in search of innovative solutions. One such approach is the initiative by the French regulator ANFR to implement a blockchain database solution for sharing and coordinating PMSE spectrum. The regulator believes the blockchain solution will improve efficient spectrum use, in particular for large scale events such as the held 2024 Olympic Games in Paris. Blockchain allows players to self-organize and anticipates their needs without the intervention of a centralized management body, while remaining transparent and being cryptographically secure. In the future, blockchain may even manage cross-border events, involving the participation of several national spectrum regulation authorities.

CST will further investigate the blockchain sharing solution, as it may alleviate strain on spectrum for upcoming large-scale events in the KSA such as the Expo 2030.

3.8. Facilitating spectrum trading

Spectrum trading is part of the policy that outlines the authorization regime for the right to use spectrum in a country. In the previous outlook cycle, CST established regulations to trade spectrum. To date, no trades have taken place, which may in part be attributed to the sectoral limitations and lack of clarity on leasing and pooling. CST will explore broadening the regulations to allow a greater variety of spectrum trades.

International Developments

Our review of international developments on spectrum trading highlighted that the CST's approach is generally aligned with the trading regimes in other jurisdictions. Other leading regulators have established trading regulations which generally allow for full or partial transfers (in frequency, geography and time). Most regulators also enable leasing and pooling of spectrum. There is no clear trend with regards to the radio services and entity types (government / civilian) that are allowed to trade.

However, our review suggests that most regulators have focused on enabling spectrum trading for commercial services; extending trading to government users is often more challenging owing to lack of clarity of definition of some spectrum access rights to such users.

Current Situation

The current regulations are limited to mobile, maritime and satellite services. They are not explicit regarding the scope for licensees to engage in subleasing and spectrum pooling, activities which could enable greater sharing. CST would like to enable trading to the greatest extent possible and make the following clarifications:

- Spectrum leasing is permitted under the current regulations. This use may not lead to the provision of services to other parties unless this is covered by a service license.
- Spectrum pooling is permitted under the current regulations. CST is generally supportive of spectrum pooling and associated infrastructure sharing through MOCN or MORAN network sharing arrangements, but arrangements must satisfy competition law.

Our Direction

CST will study extending the trading regime to other entities, including subleasing to a specialized network service provider. CST will take the consultation responses into consideration when doing so.

3.9. Promoting Spectrum Use for Research & Innovation

International developments

We have noted that a number of benchmark countries have aimed to minimize administrative burdens associated with regulation of satellite systems designed for research and innovation such as the UAE[11], through for example reduced or no license fees and simplified license application processes. In the UK inexpensive licenses[12] are available that provide fast access to spectrum to conduct research and to develop and trial innovative wireless technologies on a non-permanent, non-commercial basis. In Ireland[13] , ComReg operates a special licensing regime to encourage innovation and development involving new radio technologies or services. Two license types are available, one covering technology tests and the other covering service trials involving third parties or the public.

Current situation

Research and innovation activities involve both terrestrial and non-terrestrial networks including for example future IMT networks such 6G and small satellite platforms. There is therefore a need to access spectrum for research and innovation and CST will support the development of new technologies and solutions.

Ericsson has established partnership in KSA with the King Abdullah University of Science and Technology for conducting intensive research into 6G networks[14]. Furthermore, a technological and industrial alliance has been announced including the Ministry of Communications and Information Technology, the Saudi Authority for Research, Development, and Innovation, Saudi Aramco, and the Saudi Telecommunications Company (STC) with an aim to supporting research and development in the fields of fifth and sixth-generation communication technologies, as well as Open RAN technologies[15].

In April 2023, King Abdullah University of Science and Technology successfully launched a CubeSat aimed at providing high resolution earth observation data to help Saudi Arabia observe and characterize it natural resources[16] . A recent article refers to the KSA plan to launch two CubeSats to help with environmental issues such as water exploration and identification of oil spills[17] . The same article notes that the Saudi Space Agency has ambitions to launch at least two CubeSats every year to boost the academic activities in KSA.

CST is also monitoring developments in the satellite industry, noting any new technologies that might require regulatory support. A recent addition to the satellite space has been Software Defined Satellites, which have the ability to reconfigure satellites so that their mission can change over time by replacing traditional hardware components with software.

[11] https://space.gov.ae/en/media-center/blogs/2/3/2020/uae-shaping-future-of-earth-observation-satellites-and-space-exploration
[12] https://www.ofcom.org.uk/spectrum/innovative-use-of-spectrum/non-operational-licences
[13] https://www.comreg.ie/industry/radio-spectrum/licensing/search-licence-type/wireless-test-trial
[14] https://www.mitsloanme.com/article/6g-technology-will-be-crucial-enabler-for-advanced-capabilities-says-ericssons-fadi-pharaon/
[15] https://entarabi.com/en/2024/03/saudi-technical-alliance-to-support-6g-and-open-ran-technologies/
[16] https://saudigazette.com.sa/article/631669
[17] https://www.agbi.com/tech/2024/02/saudi-cubesats-could-send-environmental-monitoring-into-orbit/

Our direction

CST encourages research and innovation in the KSA and will consider the options that may be adopted. CST plans to create a "Research License" for all wireless technologies to facilitate access to spectrum. CST will incorporate the responses to the consultation on the spectrum outlook when setting out the license conditions. CST plans to publish guidelines for potential applicants in Q4 2025. CST will facilitate research and trial access to all frequency bands allocated for civilian use in the NFP, contingent on availability and adherence to specified conditions. CST will establish licensing requirements to ensure that research remains non-commercial, complies with rigorous reporting standards, is confined to specific durations and geographic areas, and safeguards existing users from interference within the same and adjacent bands.

04

Planned Spectrum Releases and Satellite, HAPS/HIBS Initiatives

In this section, CST provides more information about its planned schedule for spectrum releases over the next years. This is discussed under four headings, according to the type licensing regime: licensed; license-exempt, lightly licensed; and satellite, HAPS/HIBS. While this reflects CST's current intentions, such plans are subject to change, including delay to a future cycle, in response to market, policy or other developments. Table 4 below provides an overview of the planned releases in the current outlook cycle.

TABLE 4: SPECTRUM IDENTIFIED FOR RELEASE AND MONITORING IN 2025-2027 OUTLOOK

Use Case	Goals	Bands	Bandwidth (MHz)	Status
IMT	• Enable MNOs to meet increasing demand for mobile data • Provide optimal coverage and high data speeds • Enabling 5G Private Networks	L-band 1500 MHz	90	Monitoring
		26 GHz	3250	To be released for IMT, FWA and vertical use
		4.1-4.2 GHz	100	To be released on a lightly licensed basis
WLAN	• Additional spectrum for FWA, verticals, and other unlicensed use cases	6 GHz (outdoors)	1200	To be released on a lightly licensed basis through an AFC
		60 GHz (outdoors)	14000	To be released, on a license-exempt basis
Drones	• Support the development of BVLOS by making exclusive-use spectrum available for drones as well as advanced air mobility	5 GHz	60	Monitoring
V2X	• Support the development of V2X, enabling safer and more efficient transport	5.9 GHz	50	Monitoring
Innovative spectrum use	• Enable innovative spectrum use including high-speed data communication, sensing, high precision, and high-device setting	100+ GHz	21000	To be released, either lightly licensed or license exempt
PMSE / FRMCS	• Enable a broader set of devices and DECT NR+ technology • Support the next generation of communication systems for railways	1880–1920 MHZ	10	1880–1900 MHz – enable a broader set of devices and DECT NR+ in this cycle 1900–1910 MHz to be made available for FRMCS Monitor uptake of DECT

4.1. Licensed spectrum

CST will focus on the following spectrum releases for licensed spectrum in the 2025-2027 outlook cycle:

- 26 GHz band
- L-Band
- Exclusive-use spectrum for drones
- Studying options for extending/reallocating expiring IMT licenses

CST also plans to monitor international developments in a number of bands as set out in Section 6.1.

4.1.1 IMT Auction 2024

International developments

Globally, all three bands have been identified for IMT use, but the extent to which these bands have been allocated for IMT varies:

- **The 600 MHz** is a new IMT band that has been assigned in Canada and the United States. In many other countries, this spectrum is still used for terrestrial broadcasting, but that use is generally in decline. There has been discussion in many countries, notably Germany, about refarming 600 MHz for mobile.
- **The 700 MHz** spectrum available is part of a band previously identified by CST for IMT, and has been assigned to mobile operators in many countries (notably across Europe). It is identified as a 5G band.
- **The 3800-4000 MHz** band is a natural extension of the existing Saudi IMT band at 3400-3800 MHz. These frequencies have been assigned for licensed high power mobile use in the United States and Canada. In some other countries, notably the United Kingdom, a lightly licensed low-power regime has been adopted.

Current situation

The spectrum to be awarded at 600 MHz, 700 MHz and 3800 MHz has been cleared for IMT use. There are existing FSS deployments in the 3800 MHz band that will need to be protected.

Our direction

CST held the IMT auction in November 2024. The auction included spectrum in the 600 MHz band, 700 MHz and the 3800-4000 MHz spectrum.

The spectrum awarded through this auction positions the Kingdom as the G20 leader in total licensed spectrum for mobile networks in sub-6 GHz bands, and as the first country in Europe, Africa, and the Middle East to license the 600 MHz frequency band for mobile telecommunication networks.

4.1.2 Enabling the use of mmWave (26 GHz band)

International developments

The frequency band ranging from 24.25 to 27.5 GHz has garnered significant interest as a prominent mmWave band following its designation IMT at WRC-19. The potential economic impact of mmWave technology is believed to be considerable. Several European and Asian countries have already allocated this band for mobile use. However, some countries have postponed assigning the band owing to a current perceived lack of demand. So far, only Japan and the USA have seen extensive deployments in mmWave bands.

Current situation

To date, CST has approved the use of a limited number of point-to-multipoint (P2MP) links in the band. CST is working with the existing license holders to clear the band for mobile use before new spectrum licenses for IMT use are issued. CST is currently exploring potential use cases for this band. It sees three primary applications for this band subject to 3GPP standards:

- **Additional capacity for mobile networks in dense urban areas and hotspots.** CST believes there is a strong case for making this frequency band available for IMT use in the current outlook cycle. Recent assignments in European and Asian countries, as well as a rapidly developing 5G ecosystem support the case for such an assignment in the Kingdom. Currently, mobile operators lack the option to deploy wide mmWave carriers, and 26 GHz is the most suitable choice for this.
- **FWA.** mmWave spectrum can be used for the provision of FWA (Section 3.3). With its wide carriers, mmWave spectrum can significantly increase total capacity as well as the bandwidth that can be offered to end users. Given its limited propagation, mmWave spectrum will supplement rather than replace FWA provision in lower bands.
- **Verticals.** Due to its ability to support ultra-high-speed data transmission and low-latency communication, mmWave spectrum will be crucial in driving the digital transformation. Amongst others, it will support the development of advanced automation, machine-to-machine communication and real-time monitoring.

Other regulators have adopted varying approaches to licensing, including nationwide (e.g., Finland, Italy, Greece, Slovenia, Spain, Croatia, Estonia, Austria, South Korea, Taiwan, and Thailand) and regional (e.g., Australia and the United States). Ofcom in the UK is exploring an assignment of spectrum licenses for urban areas only which would then allow use by other entities elsewhere.

Our direction

CST is planning to release spectrum in the 26 GHz band in this outlook cycle. As the responses to the public consultation on this Outlook did not provide a definitive direction, CST plans to run a new public consultation on the final allocation method in Q1 2026. CST will allocate the spectrum based on 3GPP standards. Until then, CST will explore the possibility of making portions of the spectrum available on a location-specific basis to support early adopters and address market needs. Interested parties are encouraged to reach out to CST with their deployment plans, as each request will be assessed individually on a case-by-case basis.

4.1.3 Releasing L-Band

International developments

> WRC-15 partially identified this band for IMT in region 1. Since then, the ecosystem has developed slowly. Newly identified arrangements for the band include FDD, TDD, and SDL, each with their own duplexing schemes and used for 4G and 5G services. Only a few countries (e.g., Italy, Switzerland, the Netherlands, Austria, Slovenia, Belgium, the United Kingdom, Germany, and Japan) have assigned the band for IMT use.

Current situation

The L-Band from 1427-1518 MHz is currently not in use in the Kingdom. If it is assigned to a new user, neighboring bands will need to be protected. Currently, the spectrum above 1518 MHz is being used by MSS, while the spectrum below 1427 MHz is used by EESS.

CST has recently granted a trial license in the band for use by drones.

Our direction

CST originally planned to assign licenses in this band during the previous outlook cycle. However, owing to a lack of interest in the band from industry as well as the limited progress the ecosystem had made, CST refrained from assigning the spectrum.

CST is exploring additional applications, such as drones, MSS use, IMT (SDL), and private networks, while considering the potential allocation of the band to other services. These topics will be further addressed in the public consultation in Q1 2026.

4.1.4 Exclusive-use spectrum for drones

International developments

As discussed in Section 3.6, other countries are seeking to allocate dedicated spectrum for drones to enable Beyond Visual Line of Sight drone operations. Internationally, the 5030-5091 MHz band is the key band under study by regulators for command-and-control purposes:

- The FCC in the United States has consulted on plans to auction licenses in the 5030-5091 MHz band for non-payload command-and-control applications.
- ISED in Canada has identified the band for future release and is monitoring international developments
- ACMA in Australia has temporarily allowed the 5055-5065 MHz part of the band to be used for drones on a line-of-sight basis.

Current situation

The 5030–5091 MHz band is a shared band and has been assigned to aeronautical use in the KSA.

Our direction

CST recognizes that drones require access to dedicated spectrum to enable Beyond Visual Line operations and is committed to enabling this technology in the Kingdom. Given the international concentration on the 5030-5091 MHz band, CST will explore making spectrum available in this band for use by drones as well as for advanced air mobility. CST would liaise with the incumbent user to discuss the possibility of sharing. In Saudi Arabia, the aeronautical mobile, aeronautical mobile-satellite, and aeronautical radionavigation services currently have a co-primary allocation in the band. CST will monitor international developments and expects to consult with the industry in Q4 2026 on how and when the spectrum should be made available. CST has pushed back the date of the consultation in line with the responses it received as part of the public consultation for this outlook.

4.1.5 Studying options for extending/reallocating expiring IMT licenses

International developments

Regulators employ different approaches to expiring spectrum licenses ranging from near automatic renewal to full re-auctioning of all spectrum. For example,

- in the United States, renewal rules are included in the license and renewal is granted if the license is still in use and the licensee has met all obligations. Renewal is then granted at no material cost.
- Canada and the UK have also adopted regimes where renewal is near automatic but comes at a more substantial fee that is set in a way that reflects market value.

European countries, on the other hand, have either adopted full re-auctions or decided on a case-by-case basis whether licenses are renewed.

In several other countries, including in Singapore and Hong Kong, regulators have also adopted hybrid approaches where existing license holders are given the opportunity to acquire part of the spectrum at a fixed price and then compete for additional spectrum in an auction.

- CST is following the current regulatory processes in Australia, where the ACMA is implementing a staged approach to deciding on expiring licenses, and in Germany, where the Bundesnetzagentur is proposing to extend some licenses to facilitate a broader re-allocation in the future.

Current situation

All IMT spectrum licenses extend beyond the current outlook cycle. However, a number of them will expire in the next outlook cycle 2028–2031.

Our direction

CST understands the importance of this process to existing license holders as well as the potential implications for the mobile market. To provide regulatory certainty to all license holders, CST will start this process early. In the current outlook cycle, CST will study the different approaches adopted globally.

4.2 License-exempt spectrum

With respect to license-exempt spectrum releases in the 2025–2027 outlook cycle, CST intends to focus on the following actions:

- Review of WLAN Regulations and Technical Specifications to ensure all license-exempt Short-Range Devices (SRDs) and data communication equipment is enabled.
- Improving access to LPWAN bands
- Investigate V2X spectrum requirements.
- Use of the 1880-1920 MHz range (DECT and FRMCS)
- 60 GHz outdoor and standard power use.

4.2.1 Review of WLAN Regulations and Technical Specifications

International developments

Other regulators have issued a single document that sets out the technical requirements for equipment in license-exempt bands (such as the EU[18] or the UK[19]). Most regulators have enabled all uses under the technical specification IEEE 802.15.4 for SRD.

[18] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D1345
[19] https://www.ofcom.org.uk/__data/assets/pdf_file/0028/84970/ir-2030.pdf

Current situation

CST published separate technical specifications for SRDs (RI054) and data communication equipment (RI117). These partially overlap, but also leave gaps which creates uncertainty with regards to the equipment that is permissible, e.g. the technical specifications mention specific technologies (such as Zigbee), but not the technical standard they are built on (IEEE 802.15.4) which makes it unclear what equipment can be used.

Our direction

To ensure seamless integration and interoperability, CST will conduct a comprehensive review of its WLAN (Wireless Local Area Network) regulations and the technical specifications. The objective is to ensure that it is possible for all types of SRDs that follow the same standard to be enabled, allowing for efficient and reliable communication between devices. CST will also create a single technical specification for all license exempt bands

4.2.2 Facilitating Access to Low Power Wide Area Networks (LPWAN)

International developments

LPWANs facilitate a wide range of services including smart metering, facilities and logistics management, wearables, smart dustbins, smart street lighting, industries with connected appliances, environmental monitoring, and various other applications. They also generally are lower cost and have a greater power efficiency than traditional mobile networks, making it an attractive solution to industry users. LPWAN technology takes many shapes and forms. Common technologies include CAT-M1, NB-IoT, LoRaWAN, and Sigfox. LPWAN can operate using both licensed or unlicensed frequencies. However, unlicensed use in the 868 MHz or 902 MHz band is one of the most widely deployed LPWANs today.

LPWANs have been implemented in many countries worldwide, in some cases on a national scale. Most recently, there have been international roaming tests between countries, such as in France and the Netherlands, where Orange, KPN and an IoT connectivity platform tested roaming between nationwide public IoT networks.

Analysts are projecting 3 billion LPWAN IoT connections globally by 2027, representing a 26% CAGR from the current 1.3 billion connections[20].

CST also notes that ECC Report 357[21] discusses devices communicating directly with satellites in the shared frequency range 862-870 MHz, commonly referred to as the 868 MHz SRD band.

Current situation

CST published the LPWAN technical specification (RI114) in 2021 which enables LPWAN applications to deploy in unlicensed SRD bands, including different types of terminal nodes and network gateways/stations.

Our direction

CST will continue promoting LPWAN technologies and applications and is continuing its work to improve access to LPWAN bands.

[20] https://iot-analytics.com/lpwan-market
[21] https://docdb.cept.org/download/4514

4.2.3 Monitoring V2X Need

International developments

The 5.9 GHz band has long been allocated for Intelligent Transport Systems (ITS). For example, the FCC in the United States allocated 75 MHz in the 5.9 GHz band to ITS in 1999. In recent years, regulators have started to reexamine the band and renew allocations to enable the use of more modern standards, such as C-V2X. In 2020, the FCC reallocated the 75 MHz in the 5.9 GHz band for C-V2X and unlicensed use. Many regulators have done, or are doing the same. The 5.9 GHz band is designated or under consideration for ITS applications in Europe, China, South Korea, Australia and Canada.

Current situation

In the 2021–2023 spectrum cycle, CST assigned 20 MHz from 5905–5925 MHz to V2X. Since then, CST has not received any trial applications for the band. This is not surprising, as V2X is still a developing technology, and requires complementary infrastructure investment alongside spectrum allocation.

Our direction

Following public consultation, CST released 20 MHz in the upper part of the 5.9 GHz band for C-V2X applications. Respondents to the consultation supported CST's efforts to enable V2X in the Kingdom and agreed that an initial 20 MHz allocation was sufficient to support safety applications. However, respondents' views diverged on whether C-V2X or DSRC/ITS-G5 should be implemented in the Kingdom. For this reason, CST reserved the remaining 50 MHz in the lower part of the 5.9GHz band without further identification.

In this outlook cycle, CST will continue to welcome trial applications in the lower 5.9 GHz band that explore new technologies such as DSRC/ITS-G5, advanced C-V2X, and unlicensed Wi-Fi and their feasibility for future allocations. CST will review the outcomes of these trials and monitor the uptake of V2X and, if and when appropriate, release more spectrum for V2X in the 5.9 GHz range. CST will engage with infrastructure and automotive manufacturers to explore ways to foster V2X development within the Kingdom.

4.2.4 Enabling the Use of the 1880–1920 MHz range (DECT and FRMCS)

International developments

To date, most countries have assigned spectrum to DECT use. The assigned frequency varies depending on the ITU region, and on the regulator's decision on how much spectrum DECT requires. In the case of ITU region 1, most countries have assigned the 1880–1900 MHz band to DECT use. There have been initiatives to assign additional spectrum for DECT use. Australia recently assigned an additional 20 MHz of spectrum to DECT use in the 1900–1920 MHz band, whereas the UK ran a public consultation on its use and decided against assigning the additional 20 MHz to DECT as it has reserved 1900–1910 MHz for FRMCS.

With regards to FRMCS, there are two frequency ranges of interest:

- 3GPP band n100 (RMR 900) in 874.4–880 / 919.4–925 MHz; and
- 3GPP band n101 (RMR 1900) in 1900–1910 MHz.

Different to DECT use in the band, FRMCS is licensed.

> The Electronic Communications Committee (ECC) approved a harmonized use of the paired frequency bands 874.4–880.0 MHz and 919.4–925.0 MHz for both GSM-R and FRMCS, and the unpaired frequency band 1900–1910 MHz for railway mobile radio (RMR) for FRMCS. However, due to safety critical applications of FRMCS, 5G NR is recommended to be deployed in the n101 band only.

Current situation

Following international best practice, CST issued DECT technical specifications (RI040) in 2021. This specification enabled the continued use of DECT Cordless Telephones, Base Stations and Ancillary Equipment in the 1880–1900 MHz band.

Our direction

CST will review the DECT specification document with the aim of broadening the scope of DECT applications allowed in the Kingdom.

In addition, CST will monitor uptake of DECT and, if necessary, consider adding an identification in 1910–1920 MHz or 1900–1920 MHz (indoors) subject to appropriate interference studies.

CST will make 1900–1910 MHz available for FRMCS in this outlook cycle.

4.2.5 Enabling 60 GHz outdoor & standard power use

International developments

> Many countries including the USA and most European countries have enabled unlicensed outdoor use at both low and higher power. Ofcom in the UK has enabled low power use on a license-exempt basis and higher power use on a lightly-licensed basis. It justified the use of a light-licensing regime for higher power use on the basis that this would ensure compliance with the International Commission for Non-Ionising Radiation Protection (ICNIRP) guidelines on limiting exposure to electromagnetic fields. According to Ofcom, as the transmit power for higher power equipment is above the 10 Watt e.i.r.p. threshold, the provisions relating to the ICNIRP Guidelines should apply to this equipment[22].

Current situation

CST has already released the entire 57-71 GHz range for indoor use on a license-exempt basis in 2021.

[22]https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-2-6-weeks/208847-notice-of-ofcoms-changes-to-license-exemption-for-wireless-telegraphy-devices-and-consultation-on-licensing-equipment-in-57-to-71-ghz/associated-documents/2021-le-exemption-statement-final.pdf

Our direction

For Fixed Wireless Access (FWA) and WiGig applications, CST requires that interested parties obtain the necessary service licenses to operate and deliver these services within the 60 GHz band. Recognizing the growing demand and advancements in these technologies, CST is committed to supporting deployments while ensuring a balanced regulatory framework that aligns with industry needs.

To facilitate this, CST has decided to make the 60 GHz band available on a License Exempt basis depending on certain eligibility criteria and technical specifications. CST plans to update the WLAN regulations to reflect these changes in Q2 2026.

4.3 Shared regulated access (Light licensing)

CST introduced the light-licensing regulations in the previous outlook cycle and plans to capitalize on this sharing regime in this outlook cycle. In particular, CST plans to release the following spectrum bands under the light-licensing regime:

- 4.1–4.2 GHz
- 6 GHz outdoor use
- 26 GHz
- Release additional spectrum above 100 GHz
- C-band Spectrum for Indoor Use

4.3.1 Private Networks in 4.1–4.2 GHz

International developments

Our review of international trends has highlighted that many countries have made some spectrum in the 3.4–4 GHz range available on a shared basis. The exact ranges differ by country, but notable examples are the CBRS regime in the USA, the non-competitive local licensing regime in Canada, the Area-wide licensing regime in Australia, the shared-access licenses in the UK, and the Local access licenses in Germany.

Current situation

There is a limited use of FSS deployments in the band in the Kingdom. There may also be some unregistered receive-only terminals in this range. Aeronautical altimeters operating above 4200 MHz appear to be vulnerable to transmissions in this range and mitigation will be required until legacy equipment can be upgraded or replaced. With the completion of the IMT auction in 2024, there are also adjacent IMT users in the 3.8–4 GHz.

Our direction

CST had planned to release 200 MHz in the 4–4.2 GHz range under the light-licensing regime in the previous outlook cycle. Work is underway and CST intends to publish a final decision by Q3 2025.

CST is currently monitoring the 4.0–4.1 GHz spectrum for future needs, and is planning to license the 4.1–4.2 GHz spectrum on a location basis in a way that mitigates interference and protects incumbent users as well as radio altimeters operating above 4.2 GHz and IMT below 4 GHz.

4.3.2 Enabling 6 GHz outdoor & standard power use

International developments

There is still an ongoing global debate on the best usage of the upper part of this band. Some countries, notably the USA, Canada and the Kingdom of Saudi Arabia have released the entire range for license-exempt use by WLAN. Others, such as the UK and countries in Europe have only released the lower part from 5925 to 6425 MHz on a license-exempt basis for WLAN and have yet to make a decision on allocation of the upper part of the band.

At WRC-23, the upper part from 6425 to 7025 MHz received an IMT identification in ITU Region 1 and the 100 MHz from 7025 to 7125 MHz received an IMT identification in ITU Region 1 and 3. Various footnotes were added to the identification including one which allows the Kingdom to allocate the spectrum differently.

The European regulatory body CEPT and Ofcom in the UK are exploring options for sharing the upper part of the band between WLAN and IMT. Ofcom recently published a vision for sharing the upper 6 GHz band between Wi-Fi and mobile but has yet to decide on the exact approach. The published paper sets out two possible sharing scenarios, one where both Wi-Fi and mobile can use any part of the band where the other is not deployed, and one where there is an indoor/outdoor split, prioritizing indoor use of Wi-Fi while also prioritizing mobile use outdoors.

It should also be noted that China has identified the entire band for IMT use.

CST expects a number of ecosystems to develop on this basis, both for WLAN and for IMT.

Current situation

CST released the entire range from 5925 to 7125 MHz for low-power indoor license-exempt use in 2021. There are also some very limited satellite and fixed deployments in the 5925–7125 MHz band. Satellite use is concentrated in the lower sub-band.

CST is a strong advocate for spectrum sharing and AFC, recognizing their critical role in maximizing spectrum efficiency and enabling innovative wireless applications. CST has published a public consultation on the use of AFC in the 6GHz band, reflecting its commitment to exploring innovative approaches for efficient spectrum management

Our direction

CST has already released the entire range for license-exempt indoor use. It is now planning to make available 1200MHz of lightly-licensed outdoor use and standard power use through an AFC system.

CST will license and regulate AFC systems and is exploring the possibility of enabling AFC in other bands to enhance spectrum sharing and support the coexistence of multiple services. CST encourages interested parties to reach out for further engagement and collaboration.

4.3.3 Enabling the use of mmWave (26 GHz Band)

International developments

The ACMA in Australia developed an Area-wide Licensing (AWL) regime which it then implemented in parts of the 26 GHz band. The AWL licenses allow exclusive use of a specific frequency range in a well-defined area. The licenses may be used for a wide range of purposes, uses, services, applications and technologies. Users apply for a specific area and are then granted access if spectrum is still available in the particular area. Ofcom in the UK is exploring an assignment of exclusive spectrum licenses for urban areas only which would then allow alternative licensing outside of these areas which would enable use by other entities.

Current situation

To date, CST has approved the use of a limited number of point-to-multipoint (P2MP) links in the band. CST is working with the existing license holders to clear the band for mobile use before new spectrum licenses for IMT use are issued. CST is currently exploring potential use cases for this band as mentioned in Section 4.1.2

Our direction

In addition to what has been mentioned in Section 4.1.2 CST is exploring the release of spectrum in the 26 GHz band during this Outlook cycle. To facilitate efficient and innovative use of this spectrum, CST is considering approaches that offer flexibility and adaptability to address market needs. Various mechanisms, including frameworks that reduce complexity, are being explored to enable broader access while maintaining effective spectrum management.

Stakeholders are encouraged to engage with CST to discuss potential deployment plans, as CST remains committed to evaluating all requests individually to support diverse applications and emerging opportunities.

4.3.4 Releasing Spectrum above 100 GHz

International developments

It is expected that this spectrum will play an important role in future generations of integrated systems and technologies associated with 6G.

ECC Report 334[23] contains a comprehensive compatibility and sharing study concerning several new and innovative ultrawide band radiodetermination applications covering many potential use cases and their impact on incumbent radio service The spectrum has numerous possible applications, including:

- High-speed data communication. Bands above 100 GHz provide greater bandwidth and capacity compared to lower frequency ranges. This enables high-speed data communication and applications, such as advanced 3D imaging and holography.
- Sensing. Bands above 100 GHz have unique propagation characteristics that make them ideal for detecting defects in manufactured products. They are also well-suited for health screening, including early detection of skin cancer.

[23] https://docdb.cept.org/document/26187

- High precision. High signal reflection and wide bandwidths in bands above 100 GHz are ideal for high-precision applications. Examples include robotic assembly, accurate inventory management, and detecting subtle movements in building structures.
- High-density devices. Bands above 100 GHz are also suitable for high-speed/short-range connections in dense applications, such as between microchips and circuit boards, due to their improved interference properties.

Spectrum above 100 GHz has been made available for terrestrial use in the UK, the European Union, USA, Canada and Japan:

- **UK:** In 2020, Ofcom opened up bands in the 100-200 GHz range for commercial applications. Ofcom introduced a new 'Spectrum Access: EHF' license to enable to the 100 GHz band on a non-protection and non-interference basis. Ofcom will consult on introducing license-exempt use later in 2024 (noting that SRDs are already allowed to operate on a license-exempt basis at 122-123 GHz). [24]
- **USA:** In 2019, the FCC adopted new rules to promote the development of services above 95 GHz. The FCC made 21.2 GHz of spectrum available for unlicensed use in the 100-246 GHz range. The FCC also permits outdoor fixed point-to-point use with higher power levels. [25]
- **Canada:** In 2022, ISED enabled both indoor and outdoor license-exempt use in the 116-122.25 GHz, 122.25-123 GHz, 174.8-182 GHz, 185-190 GHz and 244-246 GHz bands, on a no-protection, no-interference basis. [26]
- **Japan:** The Ministry of Communications opened up 116–134 GHz for broadcast auxiliary services on a non-interference, non-protection basis following successful trials by NTT during the 2008 Olympics. [27]

Current situation

- The frequency ranges 116–122 GHz, 174–182 GHz and 185–190 GHz are currently allocated for EESS (passive), Space Research (passive), Inter-Satellite, and Fixed and Mobile use.
- The 134–136 GHz band has been allocated to Amateur and Amateur-Satellite use.
- The 136–141 GHz and 244–246 GHz bands have been allocated on a primary basis to Radio Astronomy and Radiolocation use.
- Lastly, the 141–148.5 GHz band has been assigned to Fixed, Mobile, Radio Astronomy, and Radiolocation use.

Our direction

CST is planning to release these spectrum bands on either a license-exempt or lightly-licensed basis in Q4 2027. CST may adopt a different access regime for low-power and high-power use in these bands.

In line with technological advancements and the need for additional spectrum resources, CST plans to release additional spectrum above 100 GHz. Specifically, CST will focus on the frequency ranges that were enabled in the USA, Canada and the UK which include 116–122 GHz, 174–182 GHz, 185–190 GHz, and 244–246 GHz, as well as the 134-148.5 GHz band to align with Europe. The release of this spectrum will unlock new opportunities for advanced technologies and applications, fostering innovation and driving the next generation of wireless communications. CST welcomes trials in any of these bands.

[24] https://www.ofcom.org.uk/__data/assets/pdf_file/0024/203829/100-ghz-statement.pdf
[25] https://docs.fcc.gov/public/attachments/FCC-19-19A1.pdf
[26] https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/learn-more/key-documents/decision-technical-and-policy-framework-frequency-bands-above-95-ghz
[27] https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8700131

4.3.5 Exploring C-Band spectrum for indoor use

International developments

There has only been limited initiatives worldwide to enhance indoor coverage through obligations. Notable exceptions include the indoor 3.3-3.4 GHz spectrum auction in Hong Kong, which attached indoor coverage obligations to each license. ANACOM, the Portuguese regulator, also secured site-specific indoor coverage by tying obligations to the 3.6 GHz spectrum licenses assigned in 2021. Lastly, the Chinese government granted 3.3 GHz licenses for 5G indoor coverage in 2020. Licensees would co-develop and share 5G indoor access networks to cut costs and boost efficiency.

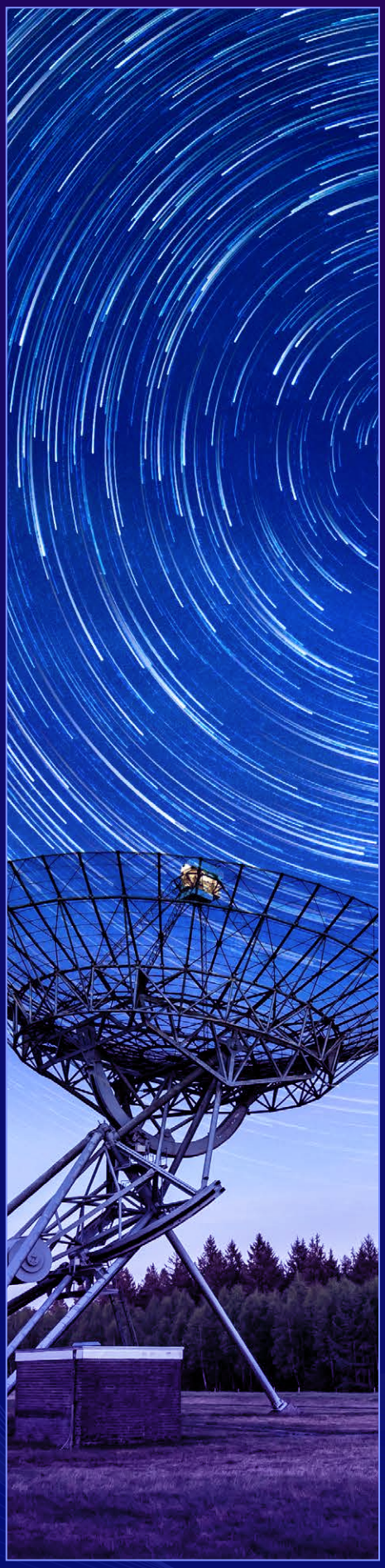
Current situation

Thus far, CST has not assigned mobile operators licenses for indoor use of spectrum. It has provided general licenses in the C-band for capacity licenses in the 3.4–3.8 GHz and has assigned further IMT spectrum in the 2024 auction in the 3.8–4.0 GHz band.

Our direction

CST will explore an indoor-only IMT allocation to improve connectivity. It is currently assessing the possibility of allocating 100 MHz of spectrum in the C-Band on a light licensing basis for this purpose. CST is planning to include conditions such as:

1. The spectrum is used to provide or enhance indoor coverage.
2. That licensees hold the relevant CST licenses.
3. The requirement to share infrastructure with other operators.



4.4 Non-Terrestrial Networks Spectrum Initiatives

4.4.1 Review NFAT allocations and align with WRC-23 decision

International developments

> Any regulations will also need to take account, as far as possible, international developments such as the introduction of software defined satellites, small satellite technologies, hybrid constellations, satellite IoT, commercial earth observation initiatives and 5G/6G satellite/Non-Terrestrial-Network (NTN)

Current situation

As for any service in the KSA managed by CST the NFAT is the key instrument for enabling satellite networks to access the spectrum. Currently the NFAT and the satellite regulations are the two key documents for managing the use of spectrum by space networks. It is important that they are aligned with the latest ITU RR.

Our direction

In terms of defining the regulations for spectrum access for satellite services, there is a need to:

- Ensure that the allocations in the National Frequency Allocation Table (NFAT) are aligned with those for Region 1 in Article 5 of the ITU Radio Regulations including any changes resulting from the recent World Radio Conference in 2023 (WRC-23). This will also require a review of the frequency finder on CST's website.
- Identify those frequencies that will be licensed in the KSA based on technical, regulatory and market developments as well as current use of spectrum and ensure they are included in the regulations for the use of radio spectrum for satellite services.

4.4.2 Develop a Regulatory Framework for Satellite Filing Registration

International developments

> National regulators generally publish a regulatory framework regarding their satellite filing handling procedures. These describe how the national regulator addresses authorization of satellite deployments in compliance with ITU RR.

Current situation

Satellite filing regulatory framework should be developed and published to clearly define CST's procedures for NGSO and GSO satellite network filing requests.

Our direction

Over the next outlook cycle, CST will develop a regulatory framework for satellite filing registration to identify CST's and potential satellite operator's responsibilities in the context of filing preparation, submission to ITU BR, resolving issues raised by ITU BR, coordination activities, notification, bringing into use and registration in ITU MIFR.

4.4.3 Faciliating MSS use in sub-1 GHz bands

International developments

> Access to sub-1GHz bands for MSS is already being addressed in the US, Australia and CEPT countries in the VHF and UHF bands identified above. For example, in the US In 2020, the FCC granted permission to Myriota[28] , Kineis[29] and Hiber[30] to use the 400 MHz band for non voice non geostationary (NVNG) MSS:

- Myriota's proposed network of satellites will provide low-cost communications for a new generation of IoT devices
- Kineis' constellation[31] will provide connectivity for IoT devices, and enhance maritime domain awareness through monitoring of maritime communications. Kineis is a French satellite operator and in Summer 2024 will launch its constellation of 25 nanosatellites dedicated to IoT with global coverage.
- Hiber's constellation of satellites will operate as part of a new low-power global area network that will provide connectivity for sensors and IoT devices and Australia systems.
- In Australia Hiber[32] and Kineis' have been included in ACMA's Foreign Space Objects Determination and have Communication with Space Object class licenses.

CEPT ECC Report 322[33] addresses inter service and intra service compatibility in the 137-138 MHz (s-E) and 148-150 MHz (E-s), and 399.9-400.05 MHz (Earth to space) and 400.15-401 MHz (space to Earth). It provides the operational constraints for Hiber, Argos Kineis, SWARM and Myriota based on a compatibility analysis.

[28] 364633 Myriota Order and Declaratory Ruling DA 20-571 release May 29 2020 (fcc.gov)
[29] DA-24-542A1.pdf (fcc.gov)
[30] Order and Declaratory Ruling DA 20-491
[31] Kineis: IoT everywhere - KINEIS
[32] randd-solutions.com.au/hiber-launches-satellite-enabled-well-monitoring-technology-in-australia
[33] ECO Documentation (cept.org)

Current situation

There are several international satellite IoT systems providing narrowband IoT connectivity via constellations of low earth orbiting satellites. These networks primarily use MSS allocations in VHF and UHF bands including the bands 148–150 MHz (Earth to space) and 137–138 MHz (space to Earth), and 399.9-400.05 MHz (Earth to space) and 400.15-401 MHz (space to Earth).

Our direction

CST will ensure that any proposed MSS use in sub-1 GHz frequencies is in line with the KSA NFAT and will follow the approach adopted in Europe in SE 40 and included in ECC Report 322[34].

4.4.4 Satellite earth station regulations

International developments

> Most countries already have satellite earth station regulations in place. There may be new developments over this spectrum outlook period, such as initiatives in the UK to ensure different NGSO systems can coexist without undue or harmful interference[35], that will merit the inclusion of additional regulations.

Current situation

The regulations for spectrum use for satellite earth stations should be finalized in Q3 2025 and will establish the regulatory framework going forward.

Our direction

Over this outlook cycle, CST will put comprehensive regulations in place to identify satellite earth station categories, licensing mechanisms for each category, and associated reference technical conditions. The regulations will facilitate the development of earth station licensing procedures to enable license applicants to choose the right category and form when applying for spectrum access authorization and be aware of any applicable technical and regulatory licensing requirements. These will provide the framework which can be updated and added to over time to take account of any changes in Spectrum use to enable current and developing technologies, applications and uses.

[34] Further information can be found in the SE 40 Chairman's report – for example in document SE(21)045 SE 40 Chairman Report
[35] Statement: Satellite Earth Station Network licenses - Ofcom

4.4.5 CST's Directon for Direct to Device

International developments

There are two proposed approaches for providing Direct-to-Device satellite communication:

- Direct-to-Device in licensed IMT bands.
- Direct-to-Device in MSS bands.

There is no international agreement on IMT Direct to Device use yet. IMT Direct to Device will be part of WRC-27 Agenda Item 1.13 which addresses IMT bands between 694/698 MHz and 2.7 GHz.

The US has determined to facilitate deployment of supplemental coverage from space (SCS)[36] so that users in areas not covered by terrestrial networks can be connected using their existing devices via satellite-based communications. The US Table of Frequency Allocations will be updated "to authorize bi-directional, secondary mobile-satellite service operations in certain spectrum bands that have no primary, non-flexible-use legacy incumbents, federal or non-federal". The specific proposed bands are:

- **600 MHz:** 614-652 MHz, 663-698 MHz,
- **700 MHz:** 698-769 MHz, 775-799 MHz, 805-806 MHz,
- **800 MHz:** 824-849 MHz, 869-894 MHz,
- **Broadband PCS:** 1850-1915 MHz, 1930-1995 MHz, and
- **AWS-H Block:** 1915-1920 MHz, 1995-2000 MHz.

For these bands, SCS will only be authorized "where one or more terrestrial licensees—together holding all licenses on the relevant channel throughout a defined geographically independent area—lease access to their spectrum rights to a participating satellite operator, whose part 25 license reflects these frequencies and the geographically independent area in which they will offer SCS".

In Australia, ACMA has recently consulted on whether the current regulatory environment is suitable for future satellite direct-to-mobile services[37]. There are a range of responses including proposals that if satellite direct-to-mobile services are allowed this should be on a secondary, non-protected, non-interference basis to ensure the protection of incumbent and existing services operating within existing regulatory frameworks. ACMA following the consultation have published a regulatory guide for operators of IMT satellite direct-to-mobile services .

Current situation

There are currently no Direct-to-Device (D2D) users in the Kingdom. CST is exploring this emerging technology. In November 2024, as part of the "Connecting the World from the Skies" global forum, CST successfully conducted the first-ever D2D trial in the Middle East. The global forum, hosted by CST in collaboration with the ITU, brings together prominent decision-makers and regulators to drive advancements in Non-Terrestrial Networks and showcase cutting-edge innovations in the sector.

[36] Federal Register :: Single Network Future: Supplemental Coverage From Space; Space Innovation
[37] Satellite direct-to-mobile services: regulatory issues | ACMA

Our direction

CST is monitoring international developments on Direct-to-Device (D2D) communication. As this technology is still under development and being studied in WRC-27 Agenda items. CST will take an active role in international forums to steer the debate and shape a harmonized global framework for spectrum use.

4.4.6 Review 28 GHz band

International developments

Due to congestion in lower satellite bands (Ku-band), the 28 GHz band has become more important for satellite use. Next-generation high throughput satellite (HTS) systems can deliver gigabit connectivity, and the 28 GHz band will be a key enabler, especially as the 11-14 GHz band becomes congested. HTS services are expected ubiquitous and on the move through ESIMs. This makes co-channel use of HTS & IMT in 28 GHz difficult.

Current situation

In the previous outlook, CST consulted on light licensing in a number of bands including the 28 GHz band. However, since WRC-23, the 28 GHz band has become more important for satellite use. The 28 GHz band has been identified for ESIMs.

Our direction

Given the importance of the 28 GHz band for satellite, and availability of the 26 GHz band for IMT CST has decided to retain the 28 GHz band for satellite use.

4.4.7 HAPS/HIBS

International developments

While there has not been significant spectrum regulatory activity related to HAPS internationally, this will likely change after recent decisions at WRC-23. HAPS/HIBS stand to deliver the most benefits if they can be integrated with terrestrial networks. For this reason, HAPS/HIBS are expected to use IMT bands below 6 GHz to provide connectivity to standard mobile devices. WRC-23 identified specific bands for the provision of connectivity using HIBS. They key bands are 600 MHz, 1800 MHz, 2100 MHz and 2600 MHz. Table 5 summarizes the bands identified for HIBS by ITU region.

Current situation

HAPS/HIBS are wireless network nodes that operate in the stratosphere. HAPS/HIBS systems may provide robust, cost-effective broadband connectivity for end users and transmission links for backhaul. They appear positioned to emerge as important components of next-generation wireless networks, enabling wide-spread connectivity in remote areas and helping to close the digital divide. Figure 9 illustrates some of the potential use cases for connectivity provided by HAPS/HIBS.

Furthermore, the Kingdom recognizes the immense potential of (HAPS/HIBS) and has conducted the first-ever HAPS trial to validate the concept and assess the feasibility of this technology in bridging the connectivity gap for underserved areas. Additionally, the NTN service license regulations have been updated to accommodate and support the deployment of such innovative solutions.

Network coverage expansion

Enable coverage in remote or inaccessible areas where building terrestrial infrastructure is impractical or expensive. HAPS/HIBS can help narrow the digital divide between urban and remote areas quickly and affordably

IoT applications

HAPS/HIBS have the potential to complement terrestrial networks to provide coverage for IoT devices in diverse and remote locations (e.g., farms, mines, etc.). HAPS/HIBS could also support V2X by reducing the cost of deploying road-side units

Disaster resiliency

HAPS/HIBS offer robust connectivity from the stratosphere, making them resilient to natural disasters. HAPS/HIBS can serve as reliable backup to ensure uninterrupted critical operations if terrestrial infrastructure fails due to a disaster

Drones

HAPS/HIBS, operating from the stratosphere, can offer extensive 3D coverage. Unlike terrestrial networks, which are optimized for ground coverage, HAPS/HIBS can provide connectivity from the ground to the sky, making them ideal for serving drones

FIGURE 9: ILLUSTRATIVE USE CASES FOR CONNECTIVITY VIA HAPS/HIBS

TABLE 5: BANDS IDENTIFIED FOR HIBS BY ITU REGION

ITU Region 1	ITU Region 2	ITU Region 3
694-960 MHz	694-960 MHz	694-960 MHz
1710-1885 MHz	1710-1885 MHz	1710-1885 MHz
1885-1980 MHz	1885-1980 MHz	1885-1980 MHz:
2010-2025 MHz	N/A	2010-2025 MHz
2110-2170 MHz	2110-2160 MHz	2110-2170 MHz
2500-2690 MHz	2500-2690 MHz	2500-2655 MHz
38-39.5 GHz	38-39.5 GHz	38-39.5 GHz
47.2-47.5 GHz	47.2-47.5 GHz	47.2-47.5 GHz
47.9-48.2 GHz	47.9-48.2 GHz	47.9-48.2 GHz

Our direction

In February 2022, Saudi Arabia was the first country worldwide to successful trial provision of 5G coverage using a HAPS system. The trial showed the potential for providing high-speed, low-latency connectivity. To further enhance coverage and capacity, CST will look to enable HAPS/HIBS in existing IMT bands by developing an appropriate regulatory framework. CST will consult on this matter in Q1 2027.

4.4.8 Receive-only earth stations

International developments

An approach adopted by some countries, such as the UK and Ireland,[38] is to issue a grant of Recognized Spectrum Access (RSA)[39] for which there is a low annual spectrum fee. Such an approach has merits in minimizing the risk of interference particularly with the need for increased spectrum sharing.

In the UK receive only earth stations in the bands 1690–1710 MHz, 3800–4200 MHz, 7750–7900 MHz and 25.5–26.5 GHz, may apply for a grant of RSA. A grant of RSA for receive-only earth stations can incorporate any number of receive-only earth stations that are located within 500 meters of a nominated center point for the grant.

Current situation

Currently there are earth stations in the KSA that are receive only and do not require licensing as there is no potential for them to cause interference. As these have not been registered, there is no information available for these stations. They are not taken into account when making frequency assignments for other services so there is a risk of them receiving interference from the other services operating in the same or adjacent frequency band.

[38] The Wireless Telegraphy (Recognised Spectrum Access for Satellite Receive Only Earth Stations) Regulations 2011 (legislation.gov.uk)

[39] Recognised Spectrum Access for Receive Only Earth Stations - Ofcom

Our direction

CST proposes to introduce a registration process for receive only earth stations. This will provide greater visibility of use and allow current and future receive only stations to reduce the risk of interference. This is planned to be implemented in the regulations for the use of radio spectrum for earth stations and in the relevant regulations subject to identification of applicable bands and services.

4.4.9 Synthetic aperture radars (SAR)

International developments

> There is increasing interest in environmental monitoring worldwide supported by the deployment of SAR technology and missions such as the European Space Agency's (ESA) Copernicus Earth observation program[40].

Current situation

EESS active SARs[41] use a wide range of different frequency bands depending on the data needed[42] and can be used for:

- environmental monitoring such as land cover changes and natural disasters such as floods, and landslides.
- urban planning, by monitoring the stability of buildings and detecting subsidence, and infrastructure development, such as monitoring pipeline networks,

SARs are also used for maritime surveillance, agriculture, disaster management (e.g. oil spillage) and mapping of remote areas.

SAR technology continues to evolve, driven by advancements in radar systems, signal processing algorithms, and data analysis techniques. Future developments in SAR technology are expected to further enhance the capabilities and applications of SAR imagery.

Our direction

CST aims to promote the growth of the EESS sector and support applications that advance research in this area, including the development of SAR technology.

[40] Learn about Synthetic-Aperture Radar (SAR) (detektia.com)
[41] What is Synthetic Aperture Radar? | Earthdata (nasa.gov)
[42] Learn about Synthetic-Aperture Radar (SAR) (detektia.com)

05

Indicative Timeline For The Spectrum Outlook

5.1. Spectrum Outlook Action Items Timeline

CST has set out an indicative timeline for its 2025–2027 spectrum outlook. The dates are intended to provide stakeholders with a better understanding of the planned activities.

TABLE 6: LICENSED SPECTRUM TIMELINE

Objective	Consultation	Expected Release Date
mmWave allocation	Q1 2026	Q4 2026
L-Band	Q1 2026	Q3 2027
Enable HAPS/HIBS in existing IMT bands	Q1 2027	Q3 2027
Make the 1900–1910 MHz available for FRMCS	-	Q2 2027

TABLE 7: LICENSE-EXEMPT SPECTRUM TIMELINE

Objective	Consultation	Expected Release Date
Review of License Exempt Regulations	Q2 2026	Q4 2026
Enable 60 GHz outdoors	Q2 2026	Q4 2026
Review allocations alongside LPWAN assignment	-	Monitoring
Investigate V2X spectrum requirements	-	Monitoring

TABLE 8: LIGHTLY-LICENSED SPECTRUM TIMELINE

Objective	Consultation	Expected Release Date
Finalize the 4.1-4.2 GHz band allocation	-	Q3 2025
Enable 6 GHz outdoors	-	Q4 2025
Release additional spectrum above 100 GHz	Q2 2027	Q4 2027

TABLE 9: FACILITATING SATELLITE SPECTRUM USE TIMELINE

Objective	Consultation	Expected Release Date
Review allocations in NFAT & add results of WRC-23	Q4 2025	TBD
Develop regulatory framework for satellite filing registration	Q4 2025	Q1 2026
MSS use in sub-1 GHz band	Q4 2026	Q2 2027
Finalize Earth Station Regulations	-	Q3 2025

TABLE 10: OTHER PRIORITY ITEMS TIMELINE

Objective	Consultation	Expected Release Date
Develop a Regulation document on UAS	Q4 2026	Q1 2027
Develop a Regulation document on PMSE	Q2 2025	Q3 2025
Consider allocation of the 1900–1920 MHz (indoor) or 1910–1920 MHz band for DECT	-	Q3 2027
Review of services enabled under trading regulations	Q3 2026	Q1 2027
Promote research and innovation	-	Q4 2025

06

Monitored Spectrum and Spectrum Innovation

In this section, we highlight other bands, technologies and services that CST intends to monitor during the current outlook cycle, with a view to future actions as necessary.

6.1. Monitoring international developments in specific bands

3100–3300 MHz

The 3100-3300 MHz band is globally largely used, amongst others for radar operations. The United States is investigating sharing opportunities between commercial users and government users at 3100-3300 MHz. CST intends to monitor the situation with a view to potential future actions to promote shared use of the band.

4400–4800 MHz

The band is currently allocated for fixed, mobile and fixed-satellite use in the KSA. There is potential to share the band with IMT services. The ITU has identified the band to be studied as agenda item 1.7 under WRC-27 for Regions 1 and 3. Japan has already awarded the 4500–4600 MHz band to a mobile operator. CST will follow international developments in the band, and contribute to study items and work at the ITU.

7125–8400 MHz

The 7125–8400 MHz band is currently assigned to Fixed and Ultra-WideBand (UWB) applications. The band (or parts thereof) has been identified for shared IMT use under WRC-27 agenda item 1.7. CST will follow international developments and contribute to study items and work at the ITU level. We will also consider slowing down the proliferation of fixed links in this range, in particular in urban areas to maximize the potential for IMT in this range.

14.8–15.35 GHz

The 14.8–15.35 GHz band will be considered at WRC-27 for shared access for IMT, subject to existing primary services operating at these frequencies and in adjacent bands being protected. CST will follow international developments and contribute to study and work at the ITU level.

37–43.5 GHz

The 37–43.5 GHz band has been globally allocated for FSS. The band below 40 GHz is heavily used for fixed (point-to-point applications) in the KSA. The 37–43.5 GHz band was one of the mmWave bands identified for IMT at WRC-19 and has been allocated for IMT in the United States. Canada plans to auction the spectrum for IMT (or other) CST will continue to monitor international developments in the band and review national demand for the spectrum.

6.2. Monitoring Innovations in Services and Technologies

Over Water 5G Mesh Networks and Autonomous Surface Ships

CST is dedicated to ensuring the maritime sector has access to sufficient radio spectrum to support its operations and development. In 2023, CST published "Frequency Spectrum Regulations for Maritime Services", which regulate the use of the maritime radio services, improve the efficiency of spectrum use by organizing the channels for these services, and ensure international harmonization to protect these services from harmful interference.

CST is also committed to supporting technological developments in the sector. In 2024, Saudi Arabia successfully ran the first trial of a maritime 5G mesh network. High-speed communications at sea have the potential to revolutionize shipping, offshore operations, environmental monitoring, and enable new technologies like Autonomous Surface Ships.

Many of these technologies are still in their early stage without an immediate need for dedicated spectrum allocations. In this outlook cycle, CST will continue to enable access to spectrum for trials in the maritime sector and monitor the need for new spectrum assignments as they arise.

6G

6G is the latest generation of cellular networks with commercial networks expected to be deployed in the early 2030s. CST will be following ecosystem and international regulatory developments to ensure the Kingdom can benefit from the newest technologies as soon as they become available and economically viable.

CST is open for 6G trials in the Terahertz range and encourages potential users and operators to submit trial requests.

Open RAN

Open RAN, or Open Radio Access Network, represents a significant shift in mobile network architecture, emphasizing interoperability and standardization. This approach allows network equipment from different vendors to interoperate. CST will monitor the need to adjust its spectrum regulations to enable Open RAN. One area that CST is monitoring in this respect is the possibility to use mmWave spectrum in licensed and license-exempt bands to support x-hauling in Open RAN deployments.

Innovative Emerging Wireless Technologies

CST will continue monitoring the different industries for innovative emerging technologies. Wireless technologies, such as Wi-Fi-based sensing and contactless radar-based vital-sign monitoring are examples of technologies that are considered innovative wireless technologies, which CST plans to monitor for developments and regulatory needs.

Wi-Fi-based sensing has become an active area of research and development. Applications include presence detection, environment monitoring in smart buildings, and remote wellness monitoring. The IEEE Standards Association already formed a Task Group (IEEE 802.11bf) to develop an amendment to the IEEE 802.11 standard to enhance the standard's ability to support Wi-Fi sensing and applications[43].

Contactless radar-based vital-sign monitoring allows consumers and doctors to detect health problems at an earlier stage by monitoring vital-signs such as the heartbeat and respiration rate. The radar sensor enables continuous and contactless monitoring with low power consumption using 60-GHz spectrum[44].

Reconfigurable Intelligent Surfaces (RIS)

Reconfigurable Intelligent Surfaces (RIS) are envisaged to be a new candidate wireless technology for the control of the radio signals between a transmitter and a receiver in a dynamic and goal-oriented way. The technology is a programmable surface structure that can be used to control the reflection of electromagnetic waves by changing the electric and magnetic properties of the surface. It can potentially be deployed for both indoor and outdoor usage, including offices, airports, shopping centres, lamp posts and advertising billboards. A possibly important future implementation is a low-cost solution to fill in gaps in mobile coverage and extend coverage where needed[45]. CST will monitor the development of the technology and investigate the role it can play in supporting connectivity targets.

Satellite services

Satellite services may require additional spectrum, technical studies and regulatory measures in the future. CST will align with international developments in the band.

CST is already monitoring four satellite-related WRC-27 agenda items:

- Mobile satellite service new allocations agenda item 1.11, 1.12, 1.13 and 1.14 being addressed in ITU WP4C;
- ESIMs agenda item 1.1 in WP4A;
- Agenda item 1.2, 1.3, 1.4, 1.5, 1.6 in WP4A; and
- Agenda item 1.10 in WP5C.

Space monitoring

The space sector is seeing increased global developments. CST has marked two trends that it believes are of national interest to monitor: space power limits and in-orbit servicing.

CST will continue to monitor technical and international developments on EPFD limits on broader space activities.

In-orbit servicing includes refueling, refurbishment, assembly, manufacturing, and recycling. The ESA has already invited stakeholders to submit ideas on how to open up an in-orbit servicing market. CST will continue to monitor developments by the ESA and other global actors, and review pertinent uses as needed.

[43] https://www.ieee802.org/11/Reports/tgbf_update.htm

[44] https://www.infineon.com/dgdl/Infineon-Contactless_Measurement_of_Vital_Signs_with_Radar_Sensors-Article-v01_00-EN.pdf?fileId=8ac78c8c8caa022e018ce79f05e3046d

[45] https://www.etsi.org/technologies/reconfigurable-intelligent-surfaces

Cognitive radio networks

Cognitive radio involves networks that are 'intelligent' and able to detect unused channels and instantly move traffic to them to avoid congestion and interference. There are two main types of cognitive radio:

- Full: every possible parameter observable by a wireless network is considered
- Spectrum-Sensing: only spectrum is considered

CST will monitor developments on both full and spectrum-sensing cognitive radio, with the potential to implement a cognitive radio network if it has been successfully tested and its use shows significant promise to improve spectrum use.

Promote innovation & sustainability

CST continues to look for opportunities to provide easy access to spectrum, both for testing and trialling. One such opportunity is blockchain use for spectrum management, while other use regulations include the ACMA's push towards higher sustainability and power efficiency by aiming towards net zero emissions with the help of smart technologies. The RTR, the Austrian telecommunications regulator, introduced an innovate approach where winners of the 3.6 GHz and 26 GHz bands were allowed to turn off their airwaves overnight to permit sustainable use of the spectrum. CST will continue monitoring innovative and sustainable solutions in order to apply successful innovations where applicable in the KSA.

AI's role in spectrum management

AI may improve data collection and analysis as well as new sharing techniques. AI may also be used to analyze and forecast trends to predict future spectrum demand. CST will investigate the role of AI in spectrum management and continue monitoring international developments.

CST welcomes trials

CST would like to re-iterate that it welcomes applications for trials in the Kingdom. In particular, CST will welcome trials that support CST's priorities for this Outlook cycle as set out in Section 3 .

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