هيئة الاتصالات وتقنية المعلومات
Communications & Information Technology Commission

خارطة طريق الاستخدام التجاري والمبتكر للطيف الترددي

(٢٠٢١ - ٢٠٢٣)م

طلب مرئيات العموم

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كيفية الرد والخطوات التالية

المقدمة

استمرارا لمتابعة هيئة الاتصالات وتقنية المعلومات (CITC) مهامها المتمثلة في تعزيز الاستثمار في الخدمات اللاسلكية ودعم المنافسة و حماية المستخدمين لضمان توفير خدمات اتصالات ذات موثوقية عالية ونشر أحدث التقنيات رقمية الناشئة والمبتكرة؛ وأخذا بالاعتبار طلب مرئيات العموم حول تمكين الاستخدامات التجارية والمبتكرة من الطيف الترددي في المملكة ٢٠٢١م-٢٠٢٣م والتي تم نشرها بتاريخ ٢٠٢٠/٧/٢٦م ، وحيث شاركت العديد من الجهات المحلية والدولية في تزويد الهيئة بمرئياتها بهذا الشأن، فقد قامت الهيئة بتحليل هذه المرئيات ودراستها واعداد مسودة وثيقة "خارطة طريق الاستخدام التجاري والمبتكر للطيف الترددي (٢٠٢١-٢٠٢٣)م" .

الغرض من الوثيقة

تهدف هذه الوثيقة لاستطلاع مرئيات العموم وجميع المهتمين من المشغلين والمصنعين والمستثمرين والمؤسسات والجمعيات ومختلف الجهات محليا ودوليا في مجال الاتصالات الراديوية والتقنيات اللاسلكية، حول مسودة " خارطة طريق الاستخدام التجاري والمبتكر للطيف الترددي (٢٠٢١-٢٠٢٣)م " وذلك تماشيا مع رؤية المملكة ٢٠٣٠ لتمكين تحول المملكة الرقمي لتكون ضمن الدول الرائدة رقميا إضافة الى تحقيق رؤية هيئة الاتصالات وتقنية المعلومات لفتح افاق المستقبل الراديوي في المملكة العربية السعودية، وصولا لتأمين مستقبل أكثر ذكاء وأمانا من خلال إدارة الطيف بشكل فعال.

إرسال المرئيات

تدعو الهيئة جميع الجهات ذات العلاقة والمهتمين داخل وخارج المملكة من كافة القطاعات بتقديم المرئيات والملاحظات على جميع ما ورد في هذه الوثيقة وفقا لما يراه مزود المرئيات مناسبا، وذلك في موعد أقصاه الأحد ٢٠٢١/٠٢/٢٨م، الموافق ١٤٤٢/٠٧/١٦ هـ .حيث تحث الهيئة المهتمين على تقديم الملحوظات والمرئيات بالتفصيل، مدعومة بالمبررات إن وجدت، علما بأن المرئيات المقدمة لا تعد ملزمة للهيئة. ويمكن تقديم المرئيات على هذه الوثيقة على عنوان أو أكثر من العناوين التالية:

- عبر البريد الإلكتروني إلى(Spectrum.Strategy@citc.gov.sa).
- تسليمها باليد (ورقيا وإلكترونيا) في مقر الهيئة.

- عبر البريد (نسخة ورقية وإلكترونية) على العنوان البريدي التالي: هيئة الاتصالات وتقنية المعلومات، حي النخيل - تقاطع شارع الأمير تركي بن عبد العزيز الأول مع طريق الإمام سعود بن عبد العزيز ، ص.ب ٧٥٦٠٦ ، الرياض ١١٥٨٨ ، السعودية شبه الجزيرة العربية.

ويرجى من المشاركين عند إرسال مرئياتهم الإشارة إلى الفقرة أو العبارة المرغوبة في التعليق عليها مع دعم مرئياتهم بالمبررات ذات الصلة، والتحليلات، والبيانات اللازمة، وأيضا تحديد تفاصيل الاتصال (اسم المشارك-العنوان-رقم الهاتف) علما بأن ما يتم تقديمه في هذا الشأن لا يعتبر ملزما للهيئة.

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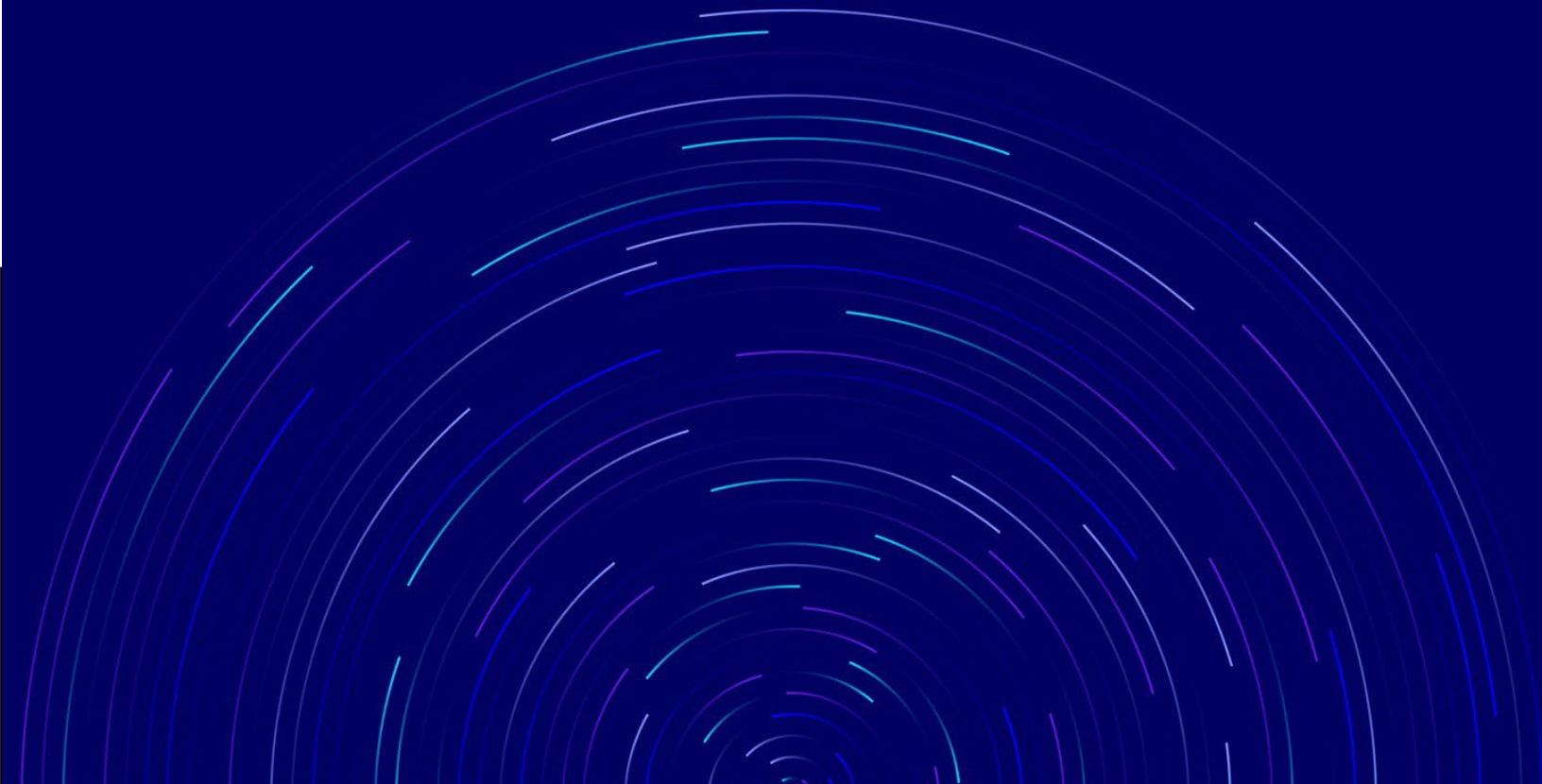

Preamble - How to Respond & Next Steps

Introduction

The Communications and Information Technology Commission (CITC) is responsible, in accordance with the Telecommunications Act, Telecom Act Bylaw and CITC Ordinance; for managing radio spectrum for all users in the Kingdom of Saudi Arabia.

CITC continues to pursue its mission to protect consumers, promote investment and safeguard competition in order to ensure reliable communications services and innovative digital technologies, and is pleased to publish a Public Consultation document on its "Spectrum Outlook for Commercial and Innovative Use 2021 - 2023".

Scope and Objective

The purpose of this public consultation is to provide the relevant interested parties with an opportunity to submit their views and comments on the document titled "Spectrum Outlook for Commercial and Innovative Use 2021 - 2023". This strategy was prepared to achieve the vision of CITC to unlock the potential of radiocommunication in Saudi Arabia, in order to secure a smarter and safer future by managing spectrum effectively and efficiently.

Submitting Comments

Participants who wish to submit their views/comments on this Public Consultation Document must submit them to CITC no later than Sunday 28/02/2021, corresponding to 16/07/1442 H. Views/comments can be submitted to one or more of the following addresses:

- By email to (Spectrum.Strategy@citc.gov.sa).
- Hand-delivered (paper and electronic) at the CITC premises.
- By mail (paper copy and electronic) to the following postal address: Communications and Information Technology Commission, Al-Nakheel District- Prince Turki Bin Abdul

Aziz I Street intersection with Imam Saud Bin Abdul Aziz Road, PO Box 75606, Riyadh 11588, Saudi Arabia.

CITC invites all members of the public, including individuals, public organizations and commercial entities to engage in this process by submitting comments. Participants are invited to provide their views in detail. CITC also encourages Participants to support their comments with relevant data, analysis, benchmarking studies and other information. CITC will take all comments into consideration during its deliberation process, but CITC is under no obligation to adopt the comments or proposals of any participant.

1. Abbreviation

A2G	Air to Ground
CBRS	Citizens Broadband Radio Service
CDMA	Code-Division Multiple Access
C-V2X	Cellular V2X
DAB+	Digital Audio Broadcasting
DECT	Digital Enhanced Cordless Telephone
DSA	Dynamic Spectrum Access
DTT	Digital Terrestrial Television
EAN	European Aviation Network
ESIM	Earth stations in motion
FSS	Fixed-satellite Service
FWA	Fixed Wireless Access
GDP	Gross Domestic Product
GPS	Global Positioning System
HAPs	High Altitude Platforms
HDFSS	High Density application in the Fixed Satellite Service
HIBS	High-altitude IMT Base Station
ICT	Information and Communication Technologies
IoT	Internet of Things
IMT	International Mobile Telecommunications
IT	Information Technology
ITS	Intelligent Transport Systems
ITU	International Telecommunications Union
LEO	Low Earth Orbit (satellite)
LPWAN	Low Power Wide Area Network
LTE	Long-Term Evolution
LTE-M	Long Term Evolution for Machines
M2M	Machine to Machine
MNO	Mobile Network Operator
NB-IoT	Narrow Band IoT
NGSO	Non-geostationary
NR-U	New Radio Unlicensed
P2MP	Point to MultiPoint

PMR	Private Mobile Radio
PMSE	Program Making and Special Events
PPDR	Public Protection and Disaster Relief
SBA	Saudi Broadcasting Authority
SD	Standard Definition
SDL	Supplemental Downlink
TDD	Time Division Duplex
UHF	Ultra-High Frequency
WRC	World Radio Conference
WLAN	Wireless Local Area Network
V2X	Vehicle to anything
V2V	Vehicle to Vehicle
VFH	Very High Frequency

2. Our Vision for the Use of Radio Spectrum

This spectrum outlook implements our National Spectrum Strategy 2025, consistent with the overall vision that we set out in the associated document published in 2020:

"*Our vision is to 'Unlock the potential of radiocommunication in Saudi Arabia for a smarter and safer future'. This is a holistic vision that outlines the potential of radio spectrum to transform Saudi Arabia into a digital society by enabling different industries, including, for example, transportation, space, media, and Industry 4.0. Our vision aligns with the Saudi Vision 2030 by ensuring availability of radio spectrum to meet the needs of the public entities that deliver key safety and security services. We also aim to ensure that the spectrum fulfils the needs of direct spectrum users and end-users, thus serving the interests of the nation and benefitting all of Saudi Arabia.*"

This vision is summarized in the following chart.

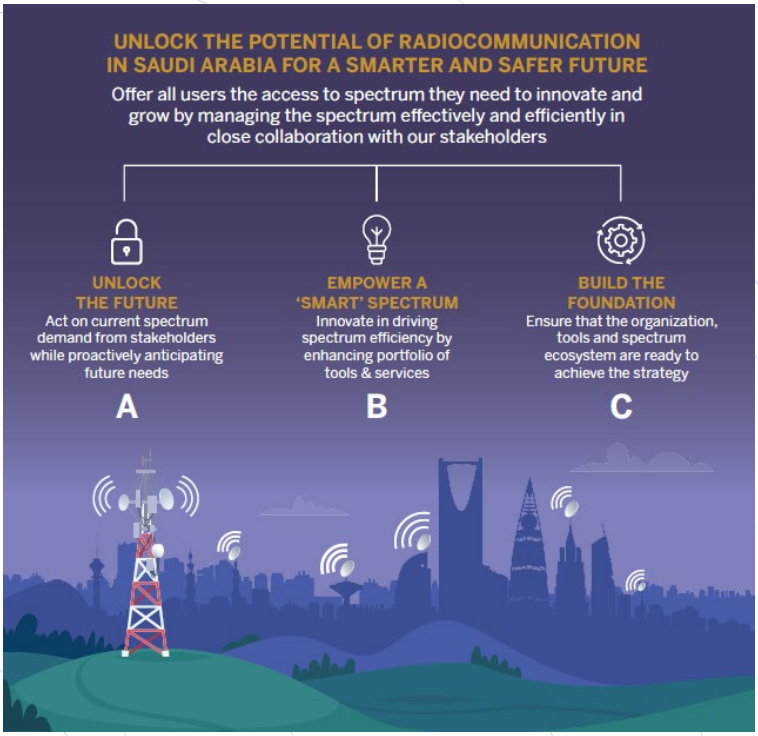

Figure 1: Unlocking the potential of radiocommunications in Saudi Arabia

Our strategy is set against a backdrop of rapidly growing demand for wireless data transmission to support many services. For example, mobile data consumption continues to grow regionally at a rate of 30-50% per year and may grow more quickly as 5G adoption increases. Similarly, fixed broadband data consumption is growing at around 30% annually and is likely to further grow as working and living patterns change after the Covid-19 pandemic. To support these and other uses, we anticipate similar growth in demand for Wi-Fi usage and high speed fixed wireless access (FWA). Use of these systems is also increasing demand for backhaul links, many of which are using microwave spectrum.

Our National Spectrum Strategy rests on three pillars, as summarized in Figure 1 and set out here:

Pillar A: Unlock the future: by ensuring that we continue to provide timely, sufficient access to spectrum to meet current and future spectrum demand, thus optimizing economic and social benefits for Saudi Arabia. The captured demand covers spectrum needs of various industry verticals, national operators as well as those within the broader umbrella of private and public sector users. This outlook is a key part of the Pillar A initiative of "Fostering commercial and Innovative use spectrum". CITC will foster these uses by

- Driving 5G+. CITC will provide timely and sufficient spectrum access to mobile operators and enable deployments of private 5G networks.
- Accelerating innovation, sciences and radio technologies. CITC will enable applications and use cases that rely on free or eased access to spectrum. It will aim to increase license-exempt spectrum by at least 6 GHz. CITC will also look to enable IoT and promote emerging radio technologies.
- Upgrading media. CITC will optimize the spectrum used for broadcasting by supporting an expansion of DAB+ and repacking the 600 MHz band.

Pillar B: Supply: Empower smart spectrum: This pillar pays special attention to the spectrum supply-side by addressing the identified areas of improvement pertaining to carrying out basic functions of spectrum management. Delivering cutting-edge spectrum management capabilities will benefit all stakeholders in the spectrum ecosystem and help in advancing the Kingdom to be among those countries with the best spectrum management practices.

Pillar C: Build the foundation: In order to achieve the goals enumerated under pillars A and B, we have identified a set of key enablers that will help us improve engagement in spectrum management ecosystem and expand our toolkit with better equipment, while growing our own institutional capabilities and those of our stakeholders.

In the final section of this document we explain how we have addressed each of the pillars.

We observed that spectrum in Saudi Arabia currently contributes around 2.4% to GDP, as compared to around 3.4% of GDP in the top 20 ICT countries. We aspire to be one of the leading countries globally in both provisioning communications and enabling wireless technologies, and this Spectrum Outlook sets out approaches that we believe will achieve this. Ultimately, our goal is to make spectrum available in a timely manner to support established users and enable new users to offer enhanced communication services and introduce new technologies throughout the Kingdom. We intend to do this in a manner that aligns with international directions and enables the dramatic growth in data usage which in turn will further drive demand for spectrum.

We will achieve this goal through a combination of making more spectrum available and enabling more efficient use of spectrum through better approaches to sharing, changing use and changing ownership. A summary of the spectrum that we plan to release by 2025 is set out in Table 1. This is grouped by indicative use case, although it should be noted that, going forward, spectrum will generally be awarded on a service and technology neutral basis, so other use cases are not necessarily precluded.

In total we are planning to make available, or improve access to more than 23 GHz of spectrum for a wide range of uses, of which:

- Almost 4 GHz will be licensed;
- 6.2 GHz will be license-exempt; and
- More than 13 GHz will be lightly licensed.

We are also actively monitoring other bands for future releases.

Table 1: Summary of spectrum release plans by use case

Use	Access regime[1]	Low band (below 1 GHz)	Mid band (1 – 6 GHz)	High band (above 6 GHz)
Mobile (IMT)	Licensed	116 MHz	Around 350 MHz	3.25 GHz
	Lightly-licensed		220 MHz	2 GHz
IoT	Provided within mobile spectrum (above) or available license-exempt spectrum for technologies			
WLAN and NR-U	License-exempt		1.2 GHz	5 GHz
Satellite (including broadband and LEO)	Licensed		• Continued guaranteed and protected access to all existing satellite bands for current and future uses, which include L, C, Ku and Ka bands (except 3800-4000 MHz which we expect to make available for IMT). • Enable new satellite technology and applications: o CITC is open to receiving applications for NGSO broadband satellite services in the Kingdom in the Ku and Ka bands o Active monitoring of additional bands for new services satellite IoT and High density FSS (HDFSS) as well as new applications in existing bands (ESIM, broadband satellite services) o New bands to be released in close collaboration with ITU and industry stakeholders	
Mission critical	Licensed	At least 6 MHz		
	License-exempt		1.2 GHz	
	Lightly-licensed		Up to 235 MHz	2 GHz
Innovative uses e.g. V2X, HAPs	Open for trials		More than 500 MHz spectrum Active monitoring of additional bands	Active monitoring of additional bands
	License-exempt		1.2 GHz	5 GHz
	Lightly-licensed		Up to 735 MHz	2 GHz

2.1. The Purpose of This Document

The broad aim of this Spectrum Outlook is to provide transparency and predictability for all spectrum users in the Kingdom, providing spectrum users certainty over the amount of spectrum available in different bands and the terms and regulations governing access and usage. This will maximize incentives for investment and ensure that spectrum users and CITC are aligned in a manner that can maximize the value that spectrum provides.

The key regulatory changes that we are proposing in this document are:

- To introduce innovative approaches to spectrum management using databases to deliver greater sharing and more flexible access.
- To introduce spectrum trading in a measured manner to allow the market to change the ownership and in some cases the use of spectrum.
- To seek a balance between complimentary technologies in those cases where the market cannot deliver this.
- To monitor spectrum utilization as a way to provide more evidence for our decision making.
- To assist innovation by making a variety of bands available for new concepts in a range of different manners from trial licenses to shared and short-term access.

Equally, due to future uncertainty, we would not want to deliver a rigid framework that would not be able to accommodate future changes in technologies, uses or business practices. Hence, we envisage the Spectrum Outlook will be a living document providing regular updates, in response to consultations and market developments, and publishing a new Spectrum Outlook every 3-4 years, always looking ahead by at least 5 years.

[1] By "access regime" we mean the generic method of allocating the spectrum. Licensed spectrum provides a license to operate typically exclusively, such as the licenses auctioned to mobile operators. License-exempt allows anyone to use the spectrum subject to certain restrictions, such as is the case for Wi-Fi. Lightly-licensed allows many users, subject to measures to control interference between them.

2.2. The Structure of the Document

The remainder of this document is structured as follows:

- Section 3 discusses the manner in which we will allocate and award spectrum. It covers our general approach to auctions and making spectrum available on a license-exempt basis.
- Section 4 analyses the current spectrum holdings of different user groups, and evaluates their competing spectrum needs for future uses.
- Section 5, sets the spectrum release plan for licensed spectrum, on a band-by-band basis. The release plan shows when the licensed frequencies will be awarded and when stakeholders can expect to be consulted on the details of these awards. In some cases, we also provide some initial, high-level guidance on the characteristics of the award.
- Section 6 sets the spectrum release plan for license-exempt spectrum. It also summarizes our proposed updates to the regulations for license-exempt spectrum.
- Section 7 sets the spectrum release plan for lightly-licensed spectrum. It also discusses the use scenarios and managing lightly-licensed spectrum.
- Section 8 provides details on bands which are open for trials as well as a list of bands which we will be monitoring closely.
- Where appropriate, we refer to earlier sections of the report and to a separate document, published alongside this Outlook, that summarizes and assesses the responses to CITC's Consultation: *Spectrum for IMT-2020 and beyond – Fostering Commercial and Innovative Use of Radio Spectrum in the Kingdom of Saudi Arabia* (the "Consultation Report").

3. Our General Approach to Spectrum Allocation

3.1. Overall Approach

Broadly, the direction of CITC is to place spectrum in the hands of those who can use it most effectively. This process involves:

a. Identifying spectrum bands that are to be made available. These may be vacant, may require clearing of incumbents, or may involve finding ways to enable sharing and coexistence.

b. Deciding on whether a band should be licensed, license-exempt or some hybrid of the two.

c. If licensed, awarding licenses typically via an auction if there are competing demands. If license-exempt enabling use of the band through publishing the rules of access.

Typically, the first step is instigated by international developments, such as ITU agreements that particular bands should be re-purposed (e.g. for IMT usage).

The second step – deciding on whether the band should be licensed – is a complex one. It will be informed by the most likely use as well as the characteristics of the band and technologies that will be deployed – for example if a band is expected to be used for IMT then it is likely that licensing will be used, whereas if it is expected to be used for Wi-Fi it is likely that license-exempt approaches will be adopted. The choice of approach may also be informed by economic assessments as to the likely contribution to GDP that the spectrum would make under different allocation approaches, but such assessments are necessarily forecasts and often difficult to conduct with accuracy and certainty. Our decision will also be informed by our intention to adopt a mixture of licensed, license-exempt and lightly licensed regimes, so different entry modes are possible.

A fundamental element of our approach is to enable shared access to bands unless it is clear that this is not possible. We believe that 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.

Where we have insufficient information about potential uses of a band to make a decision on the allocation regime, we may designate it as an 'innovation band', which we will make available for trials via temporary licenses, allowing various uses to be trialed and providing more insight as to how we should subsequently allocate the band.

3.2. Role of New Spectrum Management Approaches

Over the last decade a number of new approaches to spectrum management have emerged, predominantly based on using database technology to more dynamically manage spectrum access. Such approaches include:

- Simple registration of location of usage;
- Systems that aim to reduce interference between registered users, for example, by preventing new registrations that might interfere with existing registrations; and
- Systems that dynamically allow use, perhaps for limited time periods based on other users in the band.

We believe that innovative approaches can play a valuable role where there are incumbents in the band to be shared with or where users require some protection from interference caused by others, but where an exclusive license is not merited or efficient. Such approaches are already being implemented in some countries with initiatives such as TV white space (in the UK) and CBRS (in the US).

We believe that novel approaches will increasingly make use of databases as these can provide more flexibility, deliver greater control of the band and provide important insight into usage. Importantly, databases can also make it simpler and quicker for users to access spectrum, for example they could automate their request process such that their network planning tool automatically sends requests to the CITC database, which in turn automatically processes them and returns responses, all in a matter of seconds and

without any human intervention. Such schemes have an important role to play in increasing the efficiency with which spectrum is used and we will study their potential application further. If we do intend to apply such approaches, we will likely consult further on them at an appropriate time.

We note that spectrum is generally used more intensively in urban areas, leaving it relatively under-utilized in other areas. We believe that if there are other potential users of under-utilized spectrum in less urban areas, such as verticals, FWA, transport-providers and others, they should ideally be able to access these frequencies. We plan to adopt an approach where users wishing to access bands they believe are unused in their area can either directly approach the license holder to agree access or can approach CITC who may facilitate access after appropriate discussions with the license holder.

Next steps: We will consult on the use of new sharing approaches including database solutions in 2021.

3.3. Determining the Optimal Spectrum Licensing Regime

Each band is different and will need a bespoke licensing approach designed for it. We will rely on the market as much as possible to make decisions, understanding that some decisions, such as the duplexing arrangements, need to be made by the regulator in advance of any award.

If we cannot use the market to decide between competing demands, we will aim to develop a proxy for the market by estimating the economic value that different uses will deliver and favoring the approach that delivers the greatest value. However, we will do this with caution as predicting future economic impact is difficult and there may be an inherent bias towards existing uses.

In some cases, non-market factors such as national security, complementary government objectives, and broader benefits to society, may be relevant to our decision process. We will discuss and debate these such that we can understand the impact that they should

have on any award process, recognizing that ultimately this is likely to be a qualitative decision that will need to be made on a judgement-basis.

In specifying an award on a case-by-case basis, we will make decisions on lot sizes in terms of geography and MHz, and scope for aggregating lots, in ways that are most likely to support expected use cases for the spectrum. For licensed spectrum to date, this has primarily involved generic lots that reflect the base unit of demand for likely technologies, that can be aggregated to form larger contiguous blocks, and the use of national licenses. Other approaches may be appropriate in the future.

Next steps: We will develop a case-by-case approach to each of the bands that we plan to release, using these principles to guide our actions. We will use market-based assignments wherever possible, and administrative assignments otherwise. We will work with the market to find solutions to fragmentation of spectrum holdings, as they arise, with powers to intervene when necessary to support the national interest. We will debate any non-market interventions that might be needed.

3.4. Changes to Spectrum Access Rights to Allow the Market to Reassign Spectrum

The process of identifying bands, clearing them if appropriate and then awarding them is not necessary if the market itself can reassign bands through processes such as trading. In general, we prefer market mechanisms to regulatory intervention and wish to support market-led reassignment as far as possible, recognizing that in some cases such as clearance of TV broadcasting, regulatory intervention is inevitable.

We will introduce trading in a measured way, understanding that there is much detail to be worked through, and aim to keep obligations on licenses to the minimum necessary to deliver our vision, commensurate with meeting Government policy and achieving social goals.

We will facilitate trading of spectrum to the maximum extent possible, subject to review and confirmation from CITC for major trades and in some cases competition assessments. We have a long-term aim to enable trading across a wide range of bands, including partial trading of licenses (on a geographical or bandwidth basis), time-limited trading (leasing and short-term access) and other approaches. However, there will be some bands where trading will not be practicable. Where bands currently have obligations then these obligations must remain in place after any trade. We propose to implement trading in a number of steps, starting with the simplest forms of trading in the bands where secondary market activity is most likely.

We note that when there is a significant change of use of a band it is possible that interference can occur to neighboring users if the new use generates more interference, or interference that the neighbors are less able to accommodate. We will seek to avoid the introduction of harmful interference by setting out for those bands to be made tradable our expectations of the maximum interference that a license-holder can cause in terms of power-flux density across an area. Should a user wish to exceed this, they can negotiate for relaxation with their neighbor(s) and submit applications for any agreed changes for final approval from CITC.

Next steps: We will publish a consultation document setting out our proposed approach to implementing spectrum trading in selected bands towards the end of 2021.

3.5. Ensuring a Fair Balance of Complementary and Competing Technologies

We recognize that:

- There will often be multiple technologies that can deliver the same service.
- There will be cases where complementary technologies are needed such as Wi-Fi to off-load some mobile traffic and enable access to fixed communication services.
- While there is a strong case for more spectrum for IMT, this needs to be balanced with the needs of other users.

In general, our preference is to let the market select the optimal technology. Hence, our licenses and access regulations will remain technology neutral as far as is possible. Where spectrum is to be auctioned, we will aim to construct the auctions to allow different uses and technologies.

However, there will typically be a need to constrain technologies and uses to some degree to prevent harmful interference occurring between neighboring users or to ensure efficient use of spectrum.

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.

Next steps: We will adopt these principles as we make key decisions on awarding spectrum bands. In summary, these are:

- Letting the market select the optimal technology; but
- Seeking a balance between complementary technologies and services to ensure equitable access to spectrum.
- Make maximum use of sharing in achieving these objectives. In particular, we are planning to implement a new light-licensing regime in bands where sharing with existing users is possible and will make it easier for other parties to obtain access to unused licensed spectrum.

3.6. Approach to Monitoring Spectrum Utilization

In order to evaluate and potentially modify our approach over time we need to be informed as to the usage of spectrum, whether the likelihood of congestion is growing and other pertinent factors.

For cellular systems, much information can be gained from crowd-sourced data measurements which can show the speed of deployment of base stations for a given frequency band in many countries across the world. We also believe that crowd-sourced data is a key way to assess spectrum utilization by mobile operators including benchmarking it against other countries. Our expectation is that Saudi Arabia should normally be in the upper quartile usage of spectrum when compared globally.

For other systems, crowd-sourced information is not available and instead we will update our spectrum monitoring system where this can provide useful information and consider appropriate metrics for measurement.

As we introduce database-managed solutions in some bands, we will also be able to use data derived from the requests to the database to understand utilization and demand growth.

Next steps: We will evaluate the role of crowdsourcing. We will update our monitoring system. Where appropriate we will publish utilization data and where possible we will benchmark against selected other countries. With regards to the IMT bands, we are planning to publish utilization indexes by the end of 2021.

3.7. Spectrum Licensees

In general, we believe in the power of open markets and are open to new entry. We therefore would only wish to restrict entry in any auction or other assignment process if there was clear economic or other evidence that entry is undesirable.

CITC is also eager to ensure that spectrum reserved for innovative and commercial use is also accessible to new digital operators, so they may play a role in spearheading the country's digital transformation.

In terms of the structure of the existing mobile operators and whether they should be separated into one or more wholesale providers and multiple service providers, we have not identified any compelling evidence for making this separation. Therefore, given the

disruption that it would entail, we anticipate continuing with the status quo for the foreseeable future.

Next steps: We do not see a need for any change or action in regard to market structure, but we will periodically review whether this remains the case.

3.8. The Role of Spectrum Management in a Broader Context

Spectrum is a valuable national resource and is essential to many activities. However, it is one input to a broader process and businesses also require other factors such as access to infrastructure, competitive markets and supportive regulation.

We will manage spectrum so that it is available for the most efficient users when they need it. We will make available enough spectrum to support competition both within and across different uses; and we will offer a flexible, market-orientated management regime that is responsive to changes in technologies and business cases.

We will ensure that the conditions are right for innovation to emerge by enabling a wide range of ways to access spectrum – licensed, light-licensed, license-exempt, innovative dynamic spectrum access (DSA) approaches such as those discussed in Section 3.2, and others as needed. By its nature we cannot predict what innovations will emerge, but we can be receptive to requests for spectrum access and can signal our support for innovative ideas.

We will help ensure a suitably competitive market, although spectrum alone does not drive competition. For example, where we believe that there is insufficient competition, we can tailor awards to encourage more players. 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. By facilitating innovation and remaining technology neutral we will allow new ideas, technologies and business models to inject competition and dynamism into the market. We discuss our thoughts on the current levels of competition in relation to major uses of spectrum in subsequent sections.

In some cases, the market does not deliver as much connectivity as would be desired – for example with poor mobile coverage in rural areas. We can influence coverage through obligations on licenses, through enabling shared rural infrastructure and via new technologies such as HAPS and LEO-satellites that might change the costs of provision. We also emphasize that spectrum interventions are not the sole means for achieving such an outcome.

Hence, spectrum policy may not be able to solve broader challenges on its own, such as promoting competition in downstream services and ensuring universal availability of high-quality connectivity to areas where provision is highly uneconomic. To address these challenges, CITC will work to coordinate spectrum policy with other government policies, both within and outside the Commission.

4. Supporting Spectrum User Groups and Emerging Radio Technologies

A key input to the allocation process is understanding which user groups (e.g. the mobile operators, broadcasters, satellite operators etc..) have need for additional spectrum. While it may not always be possible to meet this need, it is valuable to understand where we expect the most pressing demand to come from.

In this section we set out our views on the current spectrum holdings and future needs of the major groups of spectrum users. We have not listed all users here for reasons of brevity but are committed to taking all users into account.

4.1. Mobile (IMT 2020 & NR-U)

Mobile usage currently accounts for the greatest contribution to the GDP of all the spectrum users. 5G Mobile is a critically important technology for Saudi Arabia, adding additional mobile capacity and enabling innovative new features that may be the basis for important new use cases. We welcome its deployment in the Kingdom. We have already provided a substantial spectrum for 5G and will continue to make additional spectrum

available as needed. While we remain open to new entry based on 5G, CITC believes that the current market structure in terms of the number of operators and their vertical integration level is appropriate, and we have no plans to change this proactively through spectrum awards.

International developments

Most developed countries are making spectrum available for IMT as fast as they are able to. Key bands for 5G include 600/700 MHz, 3400 – 4200 MHz and the 26/28 GHz bands, often termed the 5G "low", "mid" and "high" bands respectively. In some cases, there are incumbents in these bands and countries have explored novel approaches for shared and dynamic access – for example the CBRS approach in the US that allows licensed 5G use to co-exist with military usage and for license-exempt users to deploy where there is no other use. Best practice is generally seen as awarding as much spectrum as possible in a timely manner using auctions.

Current bands

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, mobile accesses license-exempt bands for uses such as Wi-Fi off-load and multiple bands above 10 GHz for backhaul and in some cases FWA.

New bands over the next 5 years

Demand for mobile data continues to grow rapidly and this places increasing pressure on mobile networks. Meeting this demand can be assisted with more spectrum. A balance of spectrum is needed in low, medium and high bands to allow increased capacity in both dense areas and less-dense areas.

We plan to make available licensed spectrum in the bands 600 MHz, 700 MHz or 800 MHz, 1500 MHz, extended 2100 MHz, 3800 – 4000 MHz and 26 GHz for mobile use between 2021 and 2023, as discussed in more detail in Section 5. In addition, mobile can benefit from

various other forms of access to bands at 4000 – 4200 MHz, 6 GHz, 28 GHz, 70 GHz and 80 GHz.

Licence-exempt modes have been added to 5G termed New Radio – Unlicensed (NR-U). These enable IMT systems to access license-exempt spectrum, including at 5 GHz and 6 GHz, potentially enabling over 1 GHz of additional spectrum for indoor and low-power deployments.

4.2. WLAN

WLAN, normally deployed as Wi-Fi, is critically important and, just as cellular systems need more spectrum, so do WLAN systems. We intend to provide spectrum in the 5925 – 7125 MHz band for Wi-Fi6e and other licence-exempt technologies (such as NR-U).

Another Wi-Fi technology is WiGig which operates in the 57-71 GHz band. Its primary application is short-range connectivity but is also the basis of FWA solutions such as Terragraph. We wish to allow such technologies to be trialed and launched commercially. We will broaden the licence-exempt allocation at these frequencies to allow greater WiGig use.

Other uses of bands used by WLAN include next generation positioning, radar systems, gesture recognition and more.

International developments

There has been a significant move globally to allocate all or part of the 5925 – 7125 MHz band for Wi-Fi access, enabling the next generation of Wi-Fi technologies (currently labelled Wi-Fi 6e in the 5925 – 7125 MHz band). Some countries have allocated the lower half of the 6 GHz band from 5925 – 6425 MHz, while others have allocated, or are considering allocating, the entire 6 GHz band (i.e. 5925 – 7125 MHz). Equipment supporting the entire 5925 – 7125 MHz band is already available..

Many countries have already enabled Wi-Fi/WiGig access in 57-66 GHz and the UK has gone further in opening 66-71 GHz on a similar basis. Other countries such as Japan have

allowed trials in this band and the US has opened the entire 57 – 71 GHz range to license-exempt use.

Current bands

Current bands used for WLAN are 2.4 GHz (2400 – 2483.5 MHz) and 5 GHz (5150 – 5350 MHz and 5470 – 5825 MHz) while the 57-66 GHz is available for systems such as WiGig.

New bands

We intend to make available spectrum at 5925 – 7125 MHz and 66-71 GHz for WLAN use, as discussed in more detail in Section 5.

4.3. Satellite

Satellite use is critical for Saudi Arabia. Satellites provide a wide range of functions including connectivity in less-served areas. Satellites are used for delivering positioning via GPS and other constellations, communications, monitoring of the earth and much more. In future, low-earth orbit (LEO) satellite systems with constellations of thousands of satellites may dramatically increase the capacity and coverage of satellite systems and earth stations in motion (ESIMs) might enable a range of new uses for broadband satellite systems currently in orbit. High-density application in the Fixed Satellite Services (HDFSS) may provide backhauling capacity for 5G, particularly in rural areas. Satellites can also provide IoT connectivity in those areas where there are no terrestrial networks or for devices that roam across large areas. We are committed to protecting existing use and enabling new satellite use both in current satellite bands and in new bands if needed.

International developments

Satellite provides multiple services. Most satellite allocations are provided through the ITU including those needed for the emerging LEO satellite solutions. At a national level, the key decisions tend to be whether satellite bands can be shared with others, and the mechanisms to best enable this.

Current bands

Current bands used for satellite services include:

- L-band (1–2 GHz) for Global Positioning System (GPS) carriers and also satellite mobile phones, such as Iridium and Inmarsat for providing communications at sea, land and air.
- S-band (2–4 GHz) for weather radar, surface ship radar, and some communications satellites.
- C-band (4–8 GHz) primarily used for satellite communications, for full-time satellite TV networks or raw satellite feeds.
- X-band (8–12 GHz) primarily used by the military for radar applications also used in civil, military and government institutions for weather monitoring, air traffic control, maritime vessel traffic control, and defense tracking.
- Ku-band (12–18 GHz) and the band (18- 21.2) GHz used for TV and satellite communications.
- Ka-band (26–40 GHz) used or communications satellites, uplink in either the 27.5 GHz or 31 GHz bands, and high-resolution, close-range targeting radars on military aircraft.

A number of newer satellite technologies are under consideration. Reduced launch costs are progressively making non-GEO systems more viable. Other developments include "earth stations in motion". At present it is anticipated that these will be deployed within existing satellite allocations.

New bands

We have no immediate plans to make available additional bands for satellite use but will keep this under review and will work with the ITU on satellite allocations. We will protect all satellite use except at 3800 – 4000 MHz where we believe spectrum can be repurposed for IMT. We will update regulations as needed to allow NGSO, ESIM, IoT and other innovative uses that might emerge in existing satellite bands. We plan to consult further on satellite use of spectrum and its future needs later in 2021 where we will show in more

detail how we will protect this important usage and enable future growth in applications and use as well as make additional bands available should the ITU recommend this be done.

4.4. HAPS and HIBS

The concept of HAPS (and HIBS) could make paradigm shift in providing internet connectivity worldwide, as it can cover large areas with low latency connectivity. HAPS has been discussed for over 30 years, with few commercial deployments to date. However, the progress in drones able to stay aloft for many hours is slowly changing the economics of this service. We see HAPS (and HIBS) as predominantly a solution for rural areas, and we have interest to support such technology, as we are large country with many rural areas.

International developments

There has not been significant spectrum regulatory activity related to HAPS. Some HAPS systems seek to use existing IMT bands, primarily as part of an operator's license.

Current bands

There are no bands specifically set aside for HAPS, but often HAPS system use IMT spectrum such that the platform can communicate directly with mobiles. As decided at WRC-19, the 38-39.5 GHz, 47.2-47.5 GHz, and 47.9-48.2 GHz bands have been identified globally for HAPS feeder links and some of these frequencies are available within Saudi Arabia.

New bands

Spectrum is rarely constrained in rural areas and we anticipate, should HAPS become viable, that geographical sharing of spectrum should be possible both with IMT and other users, perhaps via direct agreement between the HAPS provider and the current license holder (for example a mobile operator) or via the new approach to sharing unused IMT spectrum that we set out in Section 3.2 earlier. Feeder link bands as identified by the ITU are available.

Hence, we are not inclined to reserve spectrum specifically for HAPS at this stage but will make bands available on a shared basis that HAPS can use and will keep developments under review. Also, we are open to adopt trials in the kingdom for HAPS to support ecosystem growth technology.

4.5. Fixed Wireless Access

FWA has historically played a limited role in providing fixed broadband in the Kingdom. Looking forward, we recognize that this may change both owing to the increased capabilities being developed for 5G and other FWA technologies not related to 5G (e.g. Terragraph), and demand for more and better fixed broadband as more activities move into the home. We are keen to enable several different approaches such that the market can decide which of them is optimal.

International developments

FWA has emerged in two discrete areas. The first is within 5G systems, where operators are offering FWA alongside mobile access, often in the same frequency bands such as in 3400 – 3800 MHz. This does not require any further regulatory action (other than awarding as much as possible of the bands). The second is in mmWave where some of the activity is within bands considered to be 5G "high bands" (e.g. 26/28 GHz) and some within license-exempt bands, notably around 60GHz. Best practice for regulators has been to award some 5G "high band" on a technology-neutral basis enabling it to be used for a variety of possible uses including FWA, and to exempt 60GHz with sufficient power levels to allow for FWA deployment.

Current bands

FWA can be provided on a technology-neutral basis in 3400 – 3800 MHz, 10 – 10.5 GHz[2], 60 GHz and other mmWave bands. It can also be delivered by existing mobile systems in any of the IMT bands we have made available.

[2] Existing users will be protected. Any change in the way incumbent users access the spectrum will be subject to their approval.

New bands

We do not intend to dedicate any spectrum to FWA as it can be used through the current IMT holdings, but new allocations we plan at 3800 – 4000 MHz, 4000 – 4200 MHz, 5925 – 7125 MHz, 26 GHz, 28 GHz and 66 -71 GHz as well as streamlined access regimes at 10 – 10.5 GHz and 71-76 and 81-86 GHz could all be used to deliver FWA services. These will be available in a range of different licensing approaches facilitating a variety of business models and potential new entrants.

4.6. Demand of Verticals and Broadband Private Mobile Radio

Private industry or "verticals" can include factories, refineries, farms, various campuses and other similar locations. These are typically characterized by a limited geographical area, sometimes enclosed within a building. Just as there is a great variety of verticals, there is great variety in their connectivity requirements. This might include simple analogue single channel systems through to 5G ultra-low latency networks.

International developments

One emerging development has been the use of bands around 400 MHz for large-scale PMR networks covering much of the country, often deployed by utilities, and sometimes also shared with other similar users. These deployments are predominantly based on optimized variants of LTE.

A second development has been the provision of 5G spectrum for "vertical" organizations to deploy their own networks. However, there is no clear best-practice as to whether this is best achieved through setting aside dedicated spectrum (as in Germany) or enabling shared access to spectrum used by either mobile operators or other C-band users (as in the UK).

Current bands

PMR systems already operate in a range of bands at VHF and UHF bands and private network users also make use of license-exempt bands such as those for WLAN and IoT.

In addition, industry can procure services from mobile operators and others, and we will ensure that operators have sufficient spectrum to deliver this, as discussed above.

New bands

We will facilitate a range of PMR and vertical industry deployments from conventional single channel, to LTE and 5G-based local and national networks. The model of licensing the spectrum for those specialized network will be discussed on next steps, we are considering the option of directly assign the spectrum to the vertical entity or to build those spcilized networks through the operators. We plan to make available the bands at 1900 MHz, 4000 – 4200 MHz, 5925 – 7125 MHz and 28 GHz for a range of uses of which specialized networks will be an important set, discussed in more detail in the next section. In particular, we envisage that a single wide-area network might be deployed at 450 MHz which could provide communications for utilities, transport organizations, safety and security related bodies and also service to those currently deploying small-scale PMR solutions.

4.7. IoT Services

IoT network are connected in two main manners:

- By mobile operators using a range of technologies from 2G through IoT-specific 4G technologies such as NB-IoT and LTE-M.
- Through self-deployment of LPWAN technologies such as Sigfox and LoRa.

IoT services could also potentially be delivered from satellites using various technologies such as variants of NB-IoT. However, there are no commercial examples of such applications so far.

As a result, IoT networks can be considered as a sub-set of mobile networks or private network deployments.

Currently, NB-IoT is provided by Zain and there are no barriers to other operators to deploy NB-IoT in their existing spectrum. LoRa networks are deployed by private entities.

International developments

There have been few regulatory developments related to IoT. Mobile operators are able to deploy within their own spectrum with no regulatory change, and self-deployment solutions are designed to work with existing regulation. Hence, there is no clear best practice in this area.

Current spectrum

IoT deployments occur in existing mobile bands. LPWAN license-exempt deployments occur in the 870 MHz band and WLAN bands. A license needs to be obtained to deploy LPWAN networks.

New bands

By making further spectrum available to mobile operators and others below 1 GHz, we will increase the pool of spectrum that could be used for NB-IoT. We also wish to ensure LPWAN can be deployed with as few restrictions as possible. Spectrum is already available for this, but we recognize that there are restrictions that can impact deployment and will work to remove these as far as possible.

4.8. Terrestrial Broadcasting and PMSE

Broadcasting consists of audio and video broadcasting, as well as program making and special equipment (PMSE) which is used both to assist in producing content and for non-broadcasting users such as theatres.

4.8.1. Broadcasting

There is very limited demand for terrestrial TV in Saudi Arabia: only 1% of all households actually view terrestrial broadcast TV.[3] Instead there is a strong reliance on satellite reception of TV and increasingly on streamed services (via the Internet). Globally, there is a

[3] Plum Consulting, 2015, Terrestrial broadcasting and spectrum use in the Arab states.

trend away from broadcast reception and towards streaming and on-demand services and we expect to see a similar trend in Saudi Arabia.

There are very few terrestrial TV stations and audio channels in the Kingdom (all SD). It would be possible to repack this content into 1 or 2 DTT multiplexes, dramatically reducing the spectrum needed. Broadcasters have indicated their willingness to repack and hence spectrum can be repurposed from broadcasting to other uses.

International developments

Over the last decade many countries have been reducing the spectrum available for terrestrial TV, progressively moving TV towards the lower end of the band (at around 470 MHz) and allowing mobile use of the upper part. In some cases, "command & control" clearance has been used, for example in the UK, whereas in other cases novel market-oriented approaches have been used such as the US "reverse auction" in the 600 MHz band.

Current bands

The spectrum currently used for broadcasting is predominantly VHF (audio) and UHF (mostly TV). In addition, broadcasting occurs via satellite as discussed above.

New bands

We do not envisage any new bands for terrestrial broadcasting.

4.8.2. PMSE

PMSE is a very important use of spectrum in Saudi Arabia and globally. PMSE encompasses spectrum-using activities needed for broadcasting and many activities including religious events, live performances, theatre, major sporting events and more. It also encompasses wireless microphones widely used by many in religion, business, entertainment, etc. We recognize that PMSE underpins many other activities, enables

culturally important events and is critical to significant employment and revenue generation. We are committed to fully supporting PMSE use of spectrum.

PMSE may be impacted by a decision to reallocate part of the UHF band to IMT.

Current bands

PMSE makes widespread use of TV UHF frequencies mostly for audio applications, using "white spaces" where TV channels are not being used. Audio is predominantly accommodated in the UHF band and increasingly the DECT band (1880 – 1900 MHz) while video is predominantly accommodated in the 7GHz 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.

New bands

We anticipate that PMSE will use a range of bands in the future including the remaining 470 – 600 MHz assigned to broadcasting, an enhanced "DECT" band from 1880 – 1920 MHz, the 2010 – 2025 MHz band on a trial basis, and potentially using commercial 5G services. We will publish a full strategy for PMSE in due course.

4.9. Vehicle Communications (V2X)

V2X encompasses all vehicle communications including ITS and V2V systems. We note that there has been interest in V2X 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. We believe that there will be a role for V2X communications in the future, although the timing and extent of this is unclear.

There is a risk that if we move too quickly to allocate spectrum to V2X that we might either provide an allocation that subsequently proves not to be aligned with global preference, or that we provide an allocation that is unused and so sterilizes spectrum that could be beneficial to Wi-Fi or other uses. Equally, there is a risk that if we move too slowly that

drivers in Saudi Arabia have to wait longer than they might otherwise to gain the benefits of V2X.

Our approach is to open the band for trial usage while consulting on its longer-term use for V2X. We will consult as soon as is practicable and make the band available well in advance of widespread deployment of V2X-enabled vehicles. We will move to make harmonized spectrum available for this application in line with international developments such as the FCC provision for V2X in the band 5895 – 5925 MHz. We also note the standardization developments in which IMT bands (such as 600 MHz and 2300 MHz) can be used to support V2X services. As discussed in Section 7.2, and while factoring in standardization developments, we will consult further on this in the first half of 2022 with the aim of making spectrum available in 2022 such that it does not become a constraining factor in the availability of V2X services in the Kingdom. In the interim we will allow trial applications in the band such that further insight can be gained into V2X systems.

4.10. Air-to-Ground

Air-to-ground provides communications to planes, primarily for passenger connectivity (as there is already pilot connectivity provided via other aviation systems). It is typically achieved either through special ground stations connecting planes or through a mix of satellite connectivity and communications with ground stations when in range. We agree that there is a demand for connectivity in flight and we recognize the successful deployment of air-to-ground in Europe and North America. As there are potentially competing demands for spectrum in a relevant band (1980 – 2010 / 2170 / 2200 MHz), we propose to let the market decide on the optimal split between A2G and mobile use in a technology-neutral auction (see Section 5.3).

5. Release Plan for Licensed Spectrum

We have studied and consulted on a number of frequency bands potentially available for award for private and commercial use in the Kingdom. In this section we discuss the bands that we envisage awarding between 2021 and 2024 as well as some of the regulatory changes to licensed spectrum which we believe are necessary to promote investment and ensure efficient use of spectrum.

Our proposed approach is informed by the following:

- Unused or lightly used bands for which there is harmonization for mobile use and either a developed ecosystem or a clear path towards an ecosystem should be auctioned with the expectation they will be used for 4G/5G.
- Where there is debate over whether a band should be licensed or license-exempt we have a general preference towards license-exempt use.
- In bands where many potential users could be accommodated but some coordination is necessary to prevent harmful interference, we propose to use a lightly licensed regime based on databases.
- Where there is no clear usage for a band, we will enable it for innovative access on a relatively short-term basis to allow for new concepts, and periodically review future allocation options as more insight becomes available.

Over the next 3 years, we plan to make available exclusive-use licenses in the following bands:

- 452.5 – 457.5 / 462.5 – 467.5 MHz
- 617 – 652 / 663 – 698 MHz
- 738 - 758 MHz (SDL)
- 723 – 733 / 778 – 788 MHz or 811 – 821 / 852 – 862 MHz
- 1427 – 1518 MHz (either TDD or SDL)

- 1980 – 2010 / 2170 – 2200 MHz
- 3800 – 4000 MHz; and
- 24.25 – 27.5 GHz.

We plan to offer spectrum in these bands in two auctions, one in 2021 and the other in 2022. Noting that all of these bands were introduced and discussed in some detail in the Consultation Report, we do not seek to duplicate that information here. When we are ready to award each band, we will issue detailed documentation on our proposals, typically on a consultative basis. Here we provide sufficient information to allow users to plan ahead, including identification of the frequency bands, an outline of the likely award approach and the timing.

The remainder of this section is structured as follows:

- Section 5.1 summarizes our proposed updates to the regulations for licensed spectrum.
- Section 5.2 provides an overview of our proposed auction in 2021 as well as the bands we are intending to award.
- Section 5.3 provides an overview of our proposed auction in 2022 and the bands we are intending to award.
- Section 5.4 discusses other bands (namely 450 MHz) which we are intending to make available on a licensed basis.
- Our release plan for licensed spectrum is summarized in Figure 2.

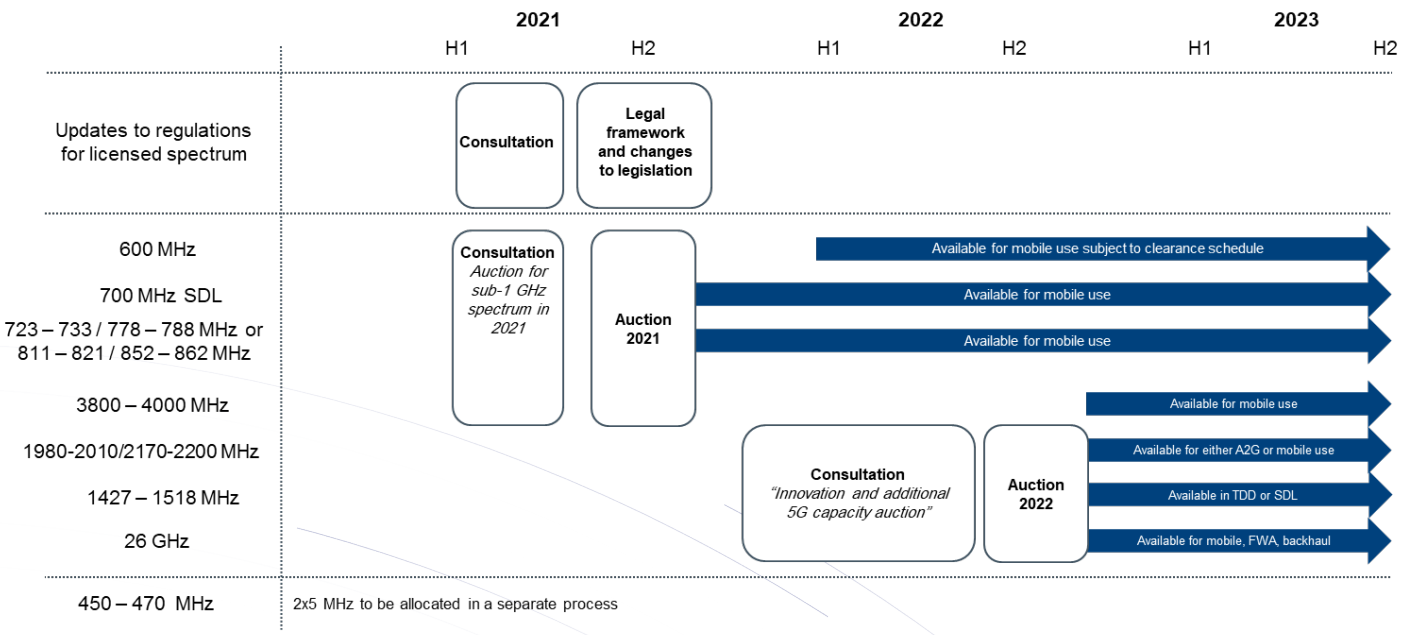

Figure 2: Release plan for licensed spectrum

5.1. Updates to Regulations for Licensed Spectrum

Where spectrum is licensed our general approach will be:

- *To be as neutral as possible on the technology and usage of the band,* understanding that in some cases restrictions will be needed to prevent interference or deliver policy goals.
- *To allow for secondary (shared) usage through an appropriate mechanism* (e.g. geographical sharing, dynamic database access), understanding that in many cases this will not be practical or economically viable.
- *To facilitate trading of spectrum* to the maximum extent possible, subject to review and confirmation from CITC for major trades and in some cases competition assessments. We believe that trading is a valuable mechanism whereby the market can change the ownership of spectrum without the need for regulatory intervention. The market is typically faster and more responsive than the regulator and so can allow spectrum to be more quickly repurposed or more efficiently used. As a result, we have a long-term aim to enable trading in all bands, including partial trading of licenses (on a geographical or

bandwidth basis), time-limited trading (leasing and short-term access) and other approaches. However, there will remain some bands where trading will not be practicable. Where bands currently have obligations then these obligations must remain in place after any trade. We propose to move towards this long-term aim in a number of steps, starting with the simplest forms of trading in the bands where trading is most likely.

- *To use auctions as the primary mechanism to distribute spectrum*, but to assess each award on its merits and to adopt other approaches such as direct assignment where there is a case for these. Where auctions are selected, we will adopt auction formats and rules that we identify as being most likely to deliver an efficient, pro-competitive allocation and assignment.
- *For licensed spectrum, we will typically apply annual fees and / or a minimum upfront fee*. The purpose of such fees is to cover the administrative cost of managing spectrum and to ensure users of scarce spectrum pay a price that reflects the market value of the underlying frequencies, so as to incentivize them to use spectrum efficiently. When setting spectrum fees, we will adopt a conservative approach to assessing market value to minimize the risk that valuable spectrum goes unallocated.
- *To use market mechanisms and spectrum sharing* as our preferred approaches to promote efficient use of spectrum, rather than more interventionist approaches. Notwithstanding this preference for market mechanisms, when making decision on allocation and setting fees for spectrum, we will consider if there are particular use cases that could generate broader value to society that cannot readily be monetized.
- *To provide long-term licenses*, in general with a longer duration, in bands where investment cases require certainty of access to spectrum.

Some of these approaches, such as the introduction of trading and longer license durations, represent significant changes to current policies and regulations. As a result, we will develop our proposals in more detail and consult. To the extent possible, we will aim to

consult and make decisions on changes before the next auction, so that changes to licensing rules can be incorporated into the awards or at least anticipated by bidders.

We plan to consult on our proposed changes in the first half of 2021 (before the next spectrum auction), and to update the current IMT policy to reflect those changes.

5.2. Auction 2021: Sub-1 GHz Spectrum and 3.8-4 GHz

We are minded to include the following bands in an auction in 2021:

- 617 – 652 / 663 – 698 MHz;
- 738 - 758 MHz SDL;
- 723 – *733 / 778 – 788 MHz or 811 – 821 / 852 – 862 MHz; and
- 3800 – 4000 MHz with the most likely use cases being either mobile or FWA.

CITC's intention is to group sub-GHz bands into a single auction and have a separate bidding process for the 3800 – 4000 MHz band.

The reason for grouping sub-GHz bands together is three-fold:

- Interdependence. The sub-1 GHz bands are all suitable for wide-area mobile coverage using 4G and 5G technology. They are both substitutes and complements. If we sell them together in a multi-round auction with activity rules that enable bidders to switch demand between bands, operators will be able to take a portfolio approach to bidding.
- Rationalization of sub-1 GHz holdings. With multiple bands sold together, there is the possibility for bidders to focus demand on particular bands, so that they can secure larger contiguous holdings. We will consult with existing licenses holders on whether such a process would bring benefits and could be implemented in a way that does not disrupt existing 4G and 5G networks, and associated investment plans.
- Availability. We anticipate that most spectrum in these bands will be available for use within 1-3 years from the award date. Spectrum at 700 MHz and/or 800 MHz is available immediately. 600 MHz spectrum, on the other hand, will need to be cleared before it can

be used fully for mobile. However, given the fact that this spectrum is not used in parts of the country and can likely be cleared quickly in most other parts of the country, we intend to allocate it to mobile use together with the other low band spectrum in 2021. We note that there may be national border issues that prevent use of some of the 600 MHz spectrum for a longer time period. We will investigate these issues, and provide more information regarding timing of availability in the award consultation.

In the 3800 – 4000 MHz band, while the spectrum itself can likely only be available in 2022, we believe the inclusion of this band in the 2021 Auction is critical to provide the necessary certainty for operators to ensure continued investment in the band.

We expect to consult on the detailed design of a combined auction for sub-GHz and 3800 – 4000 MHz frequencies in the first half of 2021. We will assess whether competition measures, such as a common sub-1 GHz cap that takes into account existing holdings, are appropriate. We will also explore with the operators whether it is practical and beneficial to use the auction or auctions to repack sub-1 GHz holdings to promote access to larger contiguous blocks now or at some point in the future.

600 MHz (617 – 652 / 663 – 698 MHz)

Current use

This band has historically been allocated for terrestrial TV in both Saudi Arabia and much of the world.

Recent developments

The US and Canada have already assigned this band for IMT (b71/n71), having repacked broadcasters in lower UHF frequencies. The band has also been identified for IMT by Colombia and Mexico. There is very limited demand for terrestrial TV in Saudi Arabia: only

1% of all households view terrestrial broadcast TV.[4] This suggests an opportunity to clear 600 MHz for IMT, adopting the North American band plan.

Our direction

We are minded to adopt the North American band plan (i.e. B71, n71), with 2x35 MHz spectrum available. This configuration uniquely offers an established mobile ecosystem. It is also possible that other countries in ITU Region 1 will in due course adopt this same band plan, making it a global band. We understand that WRC-23 will study IMT use in the 600 MHz band in ITU Region 1 which may lead to even more countries in this region repurposing this band for IMT and we will make our position clear at WRC-23.

Repacking TV stations into other parts of the UHF or the VHF frequencies may take some time. We will coordinate with the Ministry of Media, General Commission for Audiovisual Media and with the Saudi Broadcasting Authority (SBA) on a smooth migration of broadcast use. We will also need to discuss cross-border interference issues with neighboring countries who will continue to use this band for broadcasting and will continue to honor our commitment to the GE06 plan where necessary. At the same time, the spectrum does not appear to be in use in large parts of the Kingdom. Therefore, although 600 MHz may not be fully available nationwide in 2021, we expect gradual clearance and full availability in the future. We will consider adopting payment terms that would account for the band clearance plan.

700 MHz SDL (including decisions on 796 – 703 / 753 – 758 MHz, 733 – 736 / 788 – 791 MHz and 738 – 758 MHz)

Current use

The spectrum just outside the core 700 MHz band (b28, n28) is currently not in use in the Kingdom.

[4] Plum Consulting, 2015, Terrestrial broadcasting and spectrum use in the Arab states.

Recent developments

There are four potential use cases for the spectrum just outside the core 700 MHz band (b28, n28) in Europe:[5]

- Option 1: Up to 20 MHz in the duplex gap as supplemental downlink (SDL);
- Option 2: PPDR use in 698-703 / 753-758 MHz or 733 – 736 / 788-791 MHz, or both;
- Option 3: Machine-to-machine radio communications (M2M) in 733 – 736 / 788-791 MHz; and
- Option 4: PMSE can be allowed to continue using 694-703 MHz and 733-758 MHz.

European regulators have generally chosen option 1. This avoids any interference concerns between SDL and the uplink of the paired block in 733 – 736 MHz.

Our direction

To avoid any interference concerns, we plan to follow one of these options and not mix them. As it is unclear whether a viable mobile ecosystem will ever develop for band 68 and the available bandwidth is, in any case, very limited, we do not intend to make the block 698-703 / 753-758 MHz or the block 733-736/788-791 MHz available for either PPDR or M2M. Instead, we will make available the 738 – 758 MHz SDL block for which an ecosystem is developing.

723 – 733 / 778 – 788 MHz or 811 – 821 / 852 – 862 MHz

Current use

The block 723 – 733 / 778 – 788 MHz is currently unused and available for assignment. There is a well-established ecosystem for using this block as part of band b28/n28 or band b20/n20.

[5] CEPT Reports 53 and 60, which are cited in the Commission Implementing Decision (EU) 2016/68.

Our direction

We will either make 723 – 733 / 778 – 788 MHz or 811 – 821 / 852 – 862 MHz available for exclusive mobile use.

3800 – 4000 MHz

Current use

There are a very small number of FSS deployments in the band in the Kingdom. There may also be some unregistered receive-only terminals.

Recent developments

The band could be used for mobile 5G deployments and a number of regulators, most notably the FCC in the US has just auctioned the spectrum. The band plan in the US has a mobile / FWA allocation up to 3980 MHz, a 20 MHz guard band from 3980 to 4000 MHz and then satellite FSS from 4000 MHz upwards. Canada is currently consulting on adopting the same band plan. Japan has allocated licenses for full-power mobile use up to 4000 MHz and allocated a license for 4000 – 4100 MHz for lower-power use subject to additional geo-restrictions to protect aeronautical altimeters.[6]

Other countries (such as Australia and the UK) are exploring the concept of spectrum sharing between existing services and 5G services, with the 3800 – 4200 MHz sub-band considered to have suitable characteristics.

Our direction

Within the 3800 – 4200 MHz range, we see a near-term opportunity to adopt the plans in the US (and Canada) and make 3800 – 4000 MHz available for exclusive use by mobile operators. There is low usage above 4000 MHz by satellite, but we consider that a guard

[6] Mobile use in 4000 -4100 MHz is subject to power limits that are much lower than full power in the US (3700 – 3980 MHz) and only somewhat higher than the low-power shared use in the UK (3800 – 4200 MHz).

band of 20MHz between mobile and satellite use would ensure complete protection for satellite users. We will consult on whether this guard band should be just below or just above the 4GHz boundary as part of our broader consultation on the 3800 – 4000 MHz band. This will include the measures we intend to take to migrate existing satellite users within the 3800 – 4000 MHz range elsewhere. There is limited use of the 3800 – 4000 MHz by satellite with services in only a select few areas. We will ensure that there will be a smooth transition of the few existing users. If migration is not feasible, we may allow continued use at specific sites.

We intend to make this spectrum available by auction. The release of 3800 – 4000 MHz will increase the amount of spectrum available for IMT use in the C-band to 600 MHz. Our goal is to offer mobile operators an opportunity to acquire up to 200 MHz of bandwidth in this core 5G band (subject to the positioning of the guard band at the 4 GHz boundary). The auction design may also include an option to rationalize existing holdings, such that winning bidders emerge with contiguous blocks across both new and existing holdings, or otherwise ensure that holdings are sufficiently close that mobile operators have cost-effective options to deploy carrier aggregation across two blocks.

We plan to allow and protect continued satellite use in the 4000 – 4200 MHz range including new deployments of satellites and ground stations if required. We will also open up all or part of this range to low-powered deployments using a light licensing regime subject to restrictions that protect existing and new satellite deployments in this range.

5.3. Auction 2022: Innovation and Additional 5G Capacity

We are minded to include the following bands in an auction in 2022:

- 1427 – 1518 MHz in either SDL or TDD configuration with the most likely use case being mobile.
- 1980 – 2010 / 2170 – 2200 MHz with the most likely use cases being Air-to-Ground and/or mobile.

- 26 GHz for the provision of mobile, FWA and backhaul services.

We will make spectrum in all three bands available on a technology neutral basis, but when making decisions on spectrum packaging and license terms, we will take into account the most likely use cases.

We anticipate selling spectrum in these bands in the same auction. However, as we have not identified any interdependence of demand between the bands, we anticipate conducting separate bidding processes within one auction. Bidding processes for each band may be conducted sequentially or in parallel. We will consult on the details of this auction and the available licenses in the first half of 2022 and expect to run the auction in the second half of 2022.

1427 – 1518 MHz

Current use

The band is currently not in use in the Kingdom.

Recent developments

This band was identified partially for IMT in region 1 at WRC-15. Since then, the ecosystem for this band has evolved slowly. 3GPP has identified many different arrangements for the band for (4G and 5G) services, with different duplexing schemes including FDD, TDD, and SDL. Europe has harmonized this band for SDL. The most widely used part of the band is the central 40 MHz component, which is used for example for SDL in Germany and the United Kingdom and for which an established ecosystem now exists.

The alternative TDD ecosystem timeline is uncertain. The ASMG has opted for the TDD configuration although no devices currently support N50/N51[7].

[7] GSMA, October 2019, The WRC Series - IMT @ 1500 MHz

Our direction

We agree that the TDD configuration could provide operators with greater flexibility. However, owing to the lack of an ecosystem for this configuration as well as the nascent nature of the ecosystem for SDL in B75/n75. Even though that we lean towards TDD configuration we prefer to wait before releasing this spectrum to see how the two ecosystems develop and will consult on the optimal duplexing scheme before the auction.

1980 – 2010 / 2170 – 2200 MHz

Current use

The band is currently not in use in the Kingdom.

Recent developments

This frequency range is allocated for mobile and mobile satellite services. It is adjacent to band 1 (2100 MHz) and could serve as an extension for this band. It is part of the standardized band b65/n65 – an extension of core band 1 (2100 MHz). There are currently no devices for b65/n65 and we are unaware of mobile deployments in this band.

There is interest in deploying LTE Air-To-Ground (A2G) technology or IMT satellite services in the band. In Europe, Inmarsat and EchoStar were each selected as operators of pan-European systems providing MSS. Deutsche Telekom and Inmarsat have since formed a strategic partnership to develop the European Aviation Network (EAN). We also note that A2G services have been provided in North America using license-exempt bands and also IMT bands, and welcome bringing these developments to the Kingdom.

Our direction

There are competing demands for this spectrum. As the two main rival use cases (A2G and mobile) can exist adjacent to each other, we intend to rely on market forces in a technology-neutral auction to determine the optimal allocation in this band. License holders will then be able to deploy either A2G and/or mobile.

26 GHz (24.25 – 27.5 GHz)

Current use

There are a small number of point-to-multipoint (P2MP) links deployed in this band in the Kingdom.

Recent developments

The 24.25 – 27.5 GHz band has received much attention as one of the prominent mmWave bands since its designation for IMT at WRC-19. The potential economic impact of mmWave is thought to be substantial. Countries in Europe and Asia have started allocating this band for mobile and we expect equipment for this band to be available in 2021.

Our direction

There is a strong case for releasing this band in a manner suitable for IMT use. The 5G ecosystem is developing quickly, with multiple recent assignments and forthcoming awards in European and Asian countries. Mobile operators in the Kingdom do not currently have an option for deploying very wide 5G carriers using mmWave, and we believe this band is the best option.

There are a number of possible approaches that we could adopt with respect to the packaging of this band – large or small lots, national or geographic. The standard base unit for IMT is 50 MHz, but existing equipment allows operators to deploy 5G in larger carriers up to 400 MHz, with carrier aggregation of 800 MHz and possibly 1 GHz. We may package spectrum in a way that allows operators to bid for and win different quantities of contiguous spectrum, with a possible spectrum cap. We observe that some regulators have adopted nationwide licenses (Finland, Italy, South Korea, Taiwan, Thailand) whereas others have adopted a regional licensing approach (US, Australia).

5.4. Other Bands

450 -470 MHz

Current use

The 450 – 470 MHz band is used for specialized networks for private user groups in the Kingdom by about 1,000 licenses, mainly in cities, but some across the Kingdom. These are predominantly analogue and simple, low-bandwidth, digital PMR systems.

Recent developments

Other countries have deployed CDMA and, more recently, LTE networks in this band to deliver specialized networks for utilities, private users and emergency services. These networks have been assigned as nationwide licenses, and those remaining CDMA networks have largely completed the process of migrating toward Long Term Evolution (LTE) technology.

Our direction

We plan to allocate between 2x3 and 2x5 MHz of spectrum to provide nationwide coverage of a specialized network. We will announce the procedure and the mechanism of releasing this license in the first half of 2021 and then move to release this spectrum as soon as possible.

Since there are current user in the band, the reallocation process will require moving some of the existing users within the band. We will therefore have to find the right balance between moving incumbents while allowing for harmonized equipment to be used in the band. We will do this in coordination with the relevant stakeholders.

6. Release Plan for License-Exempt Spectrum

We anticipate significant license-exempt allocations over the next 5 years in the following two bands:

- 5925 – 7125 MHz; and
- 66-71 GHz.

When we are ready to release each band, we will issue detailed documentation on our proposals and consult if appropriate. We may also make available license-exempt spectrum for V2X in 5.9 GHz as discussed in Section 4.9. We will consult on licence-exempt use in this band in 2022. There may also be further allocations and potential changes to regulations in existing bands.

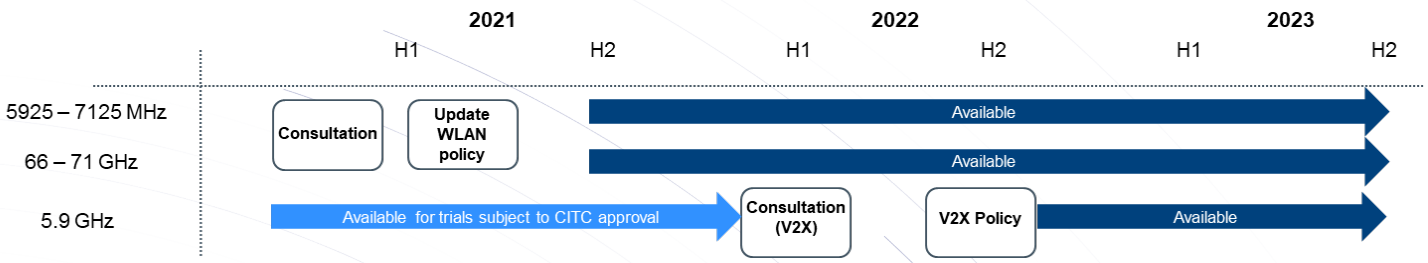

Figure 3: Release plan for license-exempt spectrum

The remainder of this section is structured as follows:

- Section 6.1 summarizes our proposed updates to the regulations for license-exempt spectrum.
- Sections 6.2 and 6.3 provide an overview of the spectrum we intend to make available on a license-exempt basis.
- Section 6.4 provides an outlook on the 5.9 GHz band.

6.1. Updates to Regulations for License-Exempt Spectrum

When making spectrum exempt from licensing, rules on aspects such as transmit power limits and out-of-band emissions need to protect existing users (e.g. satellite and fixed links

in 5925 – 7125 MHz) and unlicensed users need to co-exist in a manner that maximizes utilization of the band. We generally propose to follow international best practice (for example regulations set out by the UK and US for these bands).

We also note that license-exempt use could be augmented with light licensing, for example in the US, low-power Wi-Fi use in the 5925 – 7125 MHz band is license-exempt but higher power outdoor use requires database registration. Light licensing is discussed further below.

6.2. 5925 – 7125 MHz

Current use

There are some very limited satellite and fixed deployments in the 5925 – 7125 MHz band. Satellite use is concentrated in the lower sub-band.

Recent developments

The 5925 – 7125 MHz (6 GHz) band offers higher capacity than low-band spectrum while also affording greater coverage than mmWave bands. There is a global debate as to the best usage of this band. The upper part of the band, from 6425 – 7125 MHz, is on the agenda for WRC-23 with a possible IMT identification in Region 1, either licensed or license-exempt for NR-U. The 6 GHz band is also being considered for Wi-Fi6e to alleviate capacity constraints in the congested 2.4 GHz and 5 GHz bands and enabling new use cases such as augmented and virtual reality. The US, South Korea and Chile have already made the entire range from 5925 to 7125 MHz available on a license exempt basis. Other countries (Taiwan, Brazil, Costa Rica and Canada) are expected to follow the US lead soon.

Ofcom in the UK has decided to open up the lower part of the band from 5925 to 6425 MHz on a license-exempt basis for low power indoor and very low power outdoor use. At the

European level, it is expected that the discussion on similar action in the 5925 – 6425 MHz band will soon progress to the EU Radio Spectrum Committee.

Our direction

CITC is minded to make the entire 5925 – 7125 MHz band license-exempt for the following reasons:

1- Importance of WLAN use in the Kingdom and substantial amount of Wi-Fi traffic, which was exemplified during the COVID-19 lockdowns, and the emergence of a promising device ecosystem that can be taken advantage of starting from 2021.
2- The substantial amount of licensed TDD mid band spectrum already being made available for IMT and 5G. With the release of the 3800 – 4000 MHz band, a total of 890 MHz will be available in large contiguous channels for exclusive IMT use across 2300 MHz, 2600 MHz and 3400 – 4000 MHz. CITC believes that this bandwidth will be sufficient to cover the mid-band spectrum needs of IMT for the foreseeable future. We note that the situation is different in the EU where less exclusive mid-band spectrum (in particular in TDD configuration) is available for IMT. On the other hand, countries with substantial exclusive mid-band spectrum for IMT (such as South Korea) have decided to release the entire 6 GHz band for license-exempt use.
3- The existing mid-bands for exclusive IMT use have robust ecosystems already as well as superior propagation characteristics. If mobile operators want to access the 6 GHz band, they can do so on a license-exempt basis using NR-U (which 3GPP has defined as band n96).

Nevertheless, given that segments of the band are considered for a possible IMT identification in Region 1, we will consult with relevant stakeholders before finalizing our decision.

6.3. 66 – 71 GHz

Current use

The band is not currently in use in the Kingdom.

Recent developments

The 66 – 71 GHz band was identified for IMT at WRC-19. Studies are currently underway to determine potential co-existence issues between unlicensed 5G and Wi-Gig systems, but a license-exempt release of this band would pave the way for the deployment of these and other wireless technologies. There is also an opportunity to enhance wireless systems in the transportation sector, particularly for providing broadband connectivity to rail passengers. Many other countries such as the US currently use the 66 – 71 GHz band for unlicensed services.

Our direction

We will make this band available on a license-exempt basis in 2021.

6.4. 5.9 GHz

Current allocation

The band is not in use in the Kingdom.

Recent developments

Both Europe and the USA have made spectrum in the range 5850 – 5935 MHz available for Intelligent Transport Systems. In the USA, the range 5895 – 5925 MHz was made available on a license-exempt basis for C-V2X technology. Technology development continues as part of 3GPP Release 17 and clarity on technology maturity and readiness is expected to materialize in the first half of 2022.

Our direction

As discussed earlier, we plan to consult on opening up part or all of this band for V2X technology on a license-exempt basis in the first half of 2022. In the meantime, the band will be open for trials and short-term deployments subject to CITC's approval.

7. Release Plan for Lightly-Licensed Spectrum

We discuss the bands that we envisage making lightly-licensed in the next 5 years.

Light licensing is an approach where spectrum is not exclusively assigned, but users need to register in some manner. There are three broad types:

- Simple registration of location of usage.
- Systems that aim to reduce interference between registered users, for example, by preventing new registrations that might interfere with existing registrations.
- Systems that dynamically allow use, perhaps for limited time periods based on other users in the band.

Light licensing can play a valuable role where:

- There are incumbents in a band that need to be protected; or
- Users require some protection from interference caused by others, but where an exclusive license is not merited or flexible enough to ensure efficient use.

Light licensing approaches should increasingly make use of databases as these provide more flexibility, deliver greater control of the band and provide important insight into usage. Payment for usage will generally be set at a low level that is sufficiently high to discourage speculative or vexatious applications and to cover administrative costs, but sufficiently low to allow for innovation.

We plan to adopt a light licensing regime using a database solution in the following bands over the next 5 years, alongside the approach already adopted for incumbents where relevant:

- All or parts of the 4000 – 4200 MHz band, in a manner that does not impact existing or new satellite users;
- 10 – 10.5 GHz[8];
- 28 GHz, in a manner that does not affect existing satellite use and allows operation of new applications such as NGSO and ESIM; and
- 71 – 76 / 81 – 86 GHz[9].

Note that each of these bands was introduced and discussed in some detail in the Consultation Report and we do not seek to duplicate that information here. Our general direction is summarized in the following sub-sections. When we are ready to open up each band, we will issue detailed documentation on our proposals, and will consult if appropriate. Here we seek to provide sufficient information to allow users to plan ahead, including identification of the frequency bands, an outline of the likely award approach and the timing.

We will implement databases to enable this release plan, seeking flexible databases that can automate processes as far as possible, but avoiding complexity where it is not warranted.

Our release plan for the four bands mentioned above is summarized in Figure 4.

[8] Existing users will be protected. Any change in the way incumbent users access the spectrum will be subject to their approval.

[9] See further discussion below on the future award of this band which might include a role for block licensing.

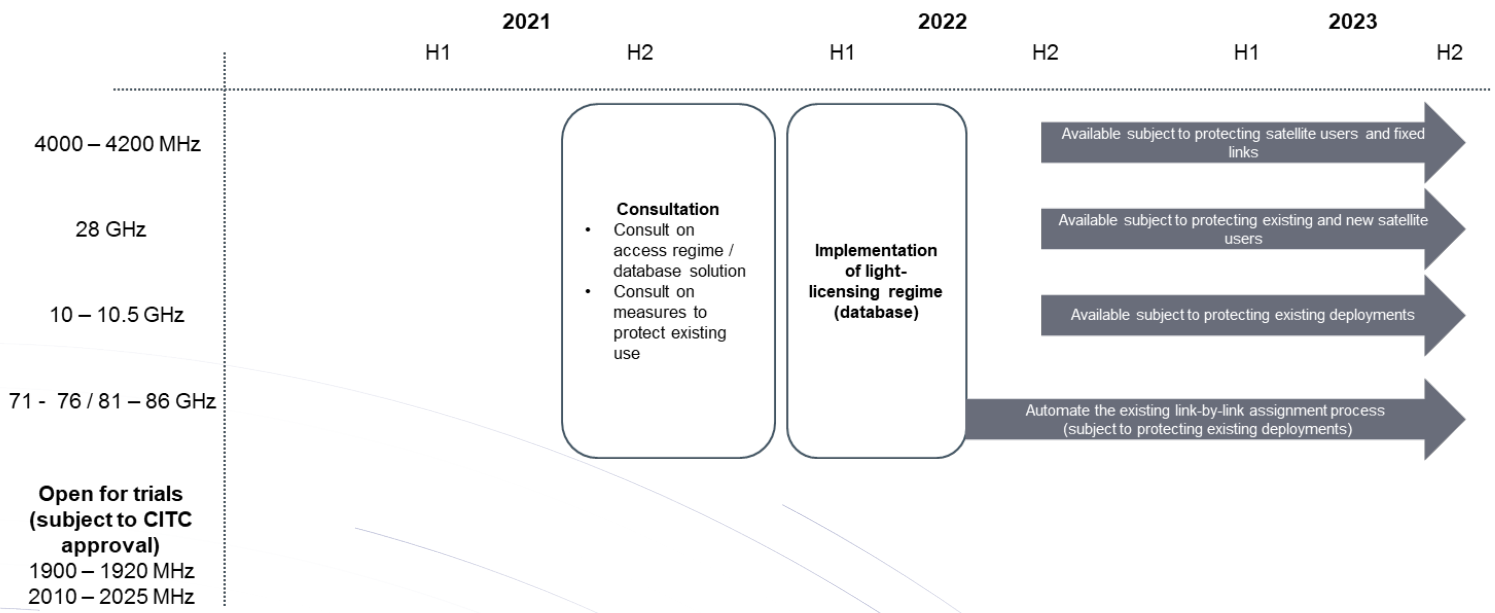

Figure 4: Release plan for lightly-licensed spectrum

The remainder of this section is structured as follows:

- Section 7.1 summarizes our proposals to developing new regulations for lightly-licensed spectrum.
- Sections 7.2 – 7.5 provide an overview of the spectrum we intend to make available on a lightly-licensed basis.

Over the next 5 years, we may expand the database-based access regime to include trials in the following bands:

- 1900 – 1920 MHz; and
- 2010 – 2025 MHz.

7.1. New Regulations for Lightly-Licensed Spectrum

We believe that light licensing approaches should increasingly make use of databases as these can provide more flexibility, deliver greater control of the band and provide

important insight into usage. Databases can also make access simpler and quicker for users, for example they could automate their request process such that their network planning tool automatically sends requests to the CITC database, which in turn automatically processes them and returns responses, all in a matter of seconds and without any human intervention.

As with light licensing, the term “databases” covers a wide range of implementations including:

- A simple database that registers specific deployments, such as individual fixed links, initially accessible only by CITC but increasingly on-line so users can directly enter uses.
- A database that runs a verification process before approving and entering an assignment, for example, validating a new fixed link against existing links, before returning confirmation to a user, perhaps through an on-line portal.
- A database that links to equipment, such that the equipment, perhaps a Wi-Fi router, automatically sends a request to a database on initial deployment, and automatically receives approval from the database.
- A dynamic database that links to equipment, granting short-term requests from the equipment perhaps on an annual, weekly or even daily basis.

These are listed in approximate order of complexity in implementation and operation. All of these have already been implemented in some countries, with examples of the most complex arrangements being “TV white space” management in the UK and the new CBRS database deployed in the US. Such implementations are typically developed and managed by commercial companies who could assist us in Saudi Arabia if we so wished.

Broadly, we do not currently see the need for a dynamic database, but anticipate one or more could become useful in the future. We are minded to build a database capability to

cover the first three examples listed above, and similar cases, but in a manner that allows evolution to a more dynamic solution if needed.

7.2. 4000 – 4200 MHz

Current use

There are a limited use of FSS deployments in the band in the Kingdom. There may also be some unregistered receive-only terminals in this range.

Recent developments

Australia and the UK are exploring the concept of spectrum sharing between existing services and 5G services, highlighting the potential of the 4000 MHz to 4200 MHz sub-band as an excellent opportunity given its characteristics.

Our direction

We recognize the demand for spectrum by verticals and the possibility of sharing the band with satellite subject to protection of continued FSS use in this band. We therefore intend to make spectrum between 4000 MHz and 4200 MHz available for low-power innovative uses. The spectrum will be available on a shared basis using a geolocation database with exclusion zones to protect FSS earth stations.

We are minded to follow the approach adopted in the UK for innovative use between 4000 and 4200 MHz.

7.3. 10 – 10.5 GHz

Current use

The band is used for fixed links and other uses in the Kingdom.

Recent developments

An IMT identification for this band will be studied at WRC-23.

Our direction

The band is predominantly used for fixed links in the Kingdom and we would anticipate that any future usage would be for similar applications, albeit potentially on a point-to-multipoint or FWA basis.

We are inclined to open up this band on a lightly licensed basis, requiring applicants to register their usage in a database and to commit to avoid interfering with existing deployed systems. Should, over time, it become clear that demand is exceeding supply then we will consider approaches to limit demand such as increased spectrum pricing in high-demand areas. Existing users will be migrated to the database automatically which will ensure that they are protected from interference from any new deployments.

7.4. 28 GHz (27.5 – 29.5 GHz)

Current use

The 27.5 – 29.5 GHz (28 GHz) band has long been allocated for satellite services both globally and in the Kingdom. The 28 GHz band is a global satellite uplink band.

Recent developments

There is some demand globally to use the band for 5G as the band is sometimes jointly considered with the 26 GHz band for millimeter wave 5G services, and some countries (for example the US) have assigned the band for these services.

The primary user in this band will be satellite

The CITC acknowledges that this band is in heavy use by satellite and there are new technologies and deployments that have the potential to improve connectivity throughout the Kingdom and in particular in areas that are currently underserved.

We recognize the importance of this band for satellite and commit to protecting satellite use within the band.

Access for IMT on a secondary basis, subject to protecting new and existing satellite use

Satellite use in this band is for uplink transmissions from earth stations to satellites. Interference into the uplink from terrestrial mobile use is extremely unlikely given the low power levels and that transmission is directed horizontally. However, interference from the sidelobes of the uplink into mobile use could be significant in the vicinity of a satellite transmitter and in future these transmitters may become mobile.

5G use on the basis that it will have no protection from satellite transmissions appears plausible and in practice constraints created by on-going satellite use on mobile deployment are likely to be minimal. This implies that lightly-licensed 5G usage may be appropriate subject to protecting new and existing satellite use. The resulting restrictions would likely encourage mobile operators to see the band as secondary to 26 GHz. At the same time, this could open the band for private network deployments for verticals uses – in particular for indoor use.

To be clear, any mobile use would be on a secondary basis and mobile users will not be able to request any protection. We will not constrain satellite use in any manner to facilitate this secondary mobile use.

7.5. 71 – 76 / 81 – 86 GHz

Current use

There are a considerable number of paired backhaul assignments (point-to-point) in these bands in the Kingdom.

Recent developments

The band will likely continue to be used for backhaul globally.

Our direction

We anticipate that the band will continue to be used for backhaul services and that demand will grow significantly as 5G networks are deployed. We are proposing to continue the current link-by-link assignment approach. We will explore if it is possible to automate the licensing process so that approval for new deployments is faster. Links would only be assigned if they would not interfere with other existing users. While we are automating the process, we will continue to allow applications for links such that there are no delays to the deployment of 5G and similar networks. Once the automation is complete, we will seamlessly transition to the new approach.

We will periodically review whether block licensing (where a block of spectrum in a city or similar is awarded to one entity such as a mobile operator) might be more appropriate to this band. To facilitate this, we will aim to license individual links requested by one entity in one part of the overall band. If we do subsequently decide to move to block licensing, we could then provide a block assignment that encapsulates existing individual assignments. CITC will also review the current pricing for the band and we expect the new pricing regime to be ready soon.

8. Other Bands

8.1. Identification of Innovation Bands – Open for Trials Subject to No Interference

The bands identified below were discussed in some detail in the Consultation Report and we do not seek to duplicate that information here. When we are ready to award each band, we will issue detailed documentation on our proposals and consult if appropriate. Here we seek to provide sufficient information to allow users to plan ahead, including identification of the frequency bands, an outline of the likely award approach and the timing.

We plan to open two bands specifically for innovation. In these bands, three-year trial licenses will be available for organizations interested in trailing new ideas and concepts. The bands are:

- 1900 – 1920 MHz;
- 2010 – 2025 MHz; and

More details on each of these is provided in the Consultation Response report.

Should other uses, such as satellite NB-IoT in the 2010 – 2025 MHz range emerge, we will consider how to award this spectrum.

We will allow innovative and trial uses of these band on the basis of a three-year license with the understanding that there is no expectation or guarantee of use beyond this time. Applicants will need to provide details of the geographical area they will cover, the bandwidth they will use, their preferred power levels and other relevant information. Applicants will also need to demonstrate that their trial use will not interfere with the adjacent usage. We will review applications for such innovative use on their merits and on a first-come first-served basis from any organization. We may allow multiple such uses if we believe that they can co-exist.

8.2. Other Bands We Are Monitoring

There are some bands where we do not see the need for immediate action but envisage that this will change as usage develops and international norms emerge. We will continue monitoring the following bands over the coming years:

- 1880 – 1900 MHz which is currently assigned for DECT;
- 37 – 43.5 GHz, some of which may be allocated to IMT in the future; and
- 47.2 – 48.2 GHz, which may be allocated to IMT in the future.

9. Summary

This document sets out a clear roadmap for the coming 3 years and a direction for the next 5 years, ensuring Saudi Arabia increases the benefit it gains from radio spectrum, facilitating investment and meeting the needs of all users.

The table below provides a summary of the key documents we are planning to publish over the coming 3 years including an indicative publication date.

Table 2: Summary of planned Consultations and Publications over the next 3 years

Access regime	Document	Contents	Type of document	Target publication
Licensed spectrum	Trading consultation	Document setting out approach to trading including process, CITC approval, managing change of use, partial transfer, etc.	Consultation	Q2 2021
	Summary and Policy on Trading	Summary of responses and CITC decision	Statement	Q3 – Q4 2021

Access regime	Document	Contents	Type of document	Target publication
	Update IMT policy	Update current IMT policy[10] to reflect outcome of the outlook	Statement	Q2 2021
	Auction 2021	Document setting out approach to awarding sub-1 GHz spectrum in the 600, 700 and possibly 800 MHz bands along with the 3800 – 4000 MHz band. CITC will also offer the option to bring forward 1980 – 2010 / 2170 – 2200 MHz and 1500 MHz bands.	Consultation	Q2 2021
	Auction 2021 – Statement	Summary of responses and CITC decision	Statement	Q3 2021
	Auction 2022	Document setting out approach to awarding spectrum in 1.5 GHz, 26 GHz as well as 1980 – 2010 / 2170 – 2200 MHz if not already included in Auction 2021.	Consultation	Q1 – Q2 2022
	Auction 2022 – Statement	Summary of responses and CITC decision	Statement	Q2 2022
Lightly-licensed spectrum	Consultation on the use of databases for lightly licensed bands as well as its application in the 4 GHz, 10 GHz, 28 GHz and	Sets out the use of databases in KSA and the approach to implementing them and charging for use	Consultation	Q2 2021

[10] https://www.citc.gov.sa/ar/services/spectrum/Documents/IMTSpectrumPolicy.pdf

Access regime	Document	Contents	Type of document	Target publication
	71 – 76 / 81 – 86 GHz bands			
	Regulations and Policy Document for Lightly Licensed Bands	Document setting out regulation of databases and bands and providing a national policy on lightly-licensed spectrum	Statement	Q4 2021
License-exempt spectrum	Unlicensed consultation (5925 – 7125 MHz and 66 – 71 GHz)	Detailed plans for the 6 GHz and 66 – 71 GHz bands including power levels and any restrictions	Consultation	Q1 2021
	WLAN Policy Document	Update of CITC WLAN policy to include future bands, other regulation, set out vision for usage	Statement	Q2 2021
	V2X consultation	Proposals for releasing spectrum in the 5.9 GHz range for V2X	Consultation	Q1-Q2 2022
	Summary and responses to above consultation	Summary of responses and CITC decision	Statement	Q3- Q4 2022
	V2X Policy Document	Document setting out the spectrum available for as well as the regulations governing use of 5.9 GHz for V2X	Statement	Q3- Q4 2022
Other documents	PMSE Strategy		Statement	To be determined
	Spectrum for satellite	Consultation on steps to promote existing and new satellite applications	Consultation	Q3 – Q4 2021

Access regime	Document	Contents	Type of document	Target publication
	Spectrum for satellite	Summary of responses and CITC decision	Statement	To be determined
	450 MHz	Document setting out award options for 450 MHz	Consultation	To be determined
	450 MHz	Summary of responses and CITC decision	Statement	To be determined

The table below shows how we have addressed all the key promises we made in our National Spectrum Strategy.

Table 3: Implementation of National Spectrum Strategy in the Spectrum Outlook

Key strategy	What we will do	Section
Pillar A		
Optimize legacy spectrum	Upgrade access to bands such as 10-10.5 GHz, refarm UHF, optimize 700-900 MHz, and more. Improve fixed link access by optimizing licensing approach across bands.	4, 6
Driving 5G+	Make available 700 MHz, 3800 – 4200 MHz, 26 GHz and other spectrum for backhaul	4, 6
Accelerating innovation	Increasing license-exempt spectrum, enabling "innovation spectrum" and expanding light licensing approaches	5, 6, 7
Upgrading media	Refarming UHF	4.2, Appendix A
Enabling space spectrum	Ensuring LEO satellite systems can operate	3.3
Empowering industry	Enabling PMR networks at 450 MHz, ITS at 5850 – 5935 MHz, private networks in 4000 – 4200 MHz and 28 GHz and shared access to unused licensed bands	4, 6, 7
Improve public safety	PMR in 450 MHz and spectrum access in 700-900 MHz	4
Pillar B		
Adaptive regulatory mechanisms	Clear overall approach including use of monitoring data	3, especially 3.6
Facilitate investment	Clear overall approach, multiple light licensing bands and bands for innovation	3, 6, 7.1
Market-oriented approaches	Widely introducing sharing and database access	6, 7
Pillar C		
Engage the eco-system	Consultations and documents such as this one	N/A
Expand the toolkit	Will be taking place internally	N/A
Grow CITC capabilities	Will be taking place internally	N/A

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