هيئة الاتصالات وتقنية المعلومات
Communications & Information Technology Commission

Spectrum Auction 2021 – Preliminary Consultation

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Closing Date for Responses: 26 July 2021

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1. Introduction

Earlier this year, CITC published its Spectrum Outlook 2021 – 2023[1] that set out our plans to release more than 23 GHz of spectrum for a wide range of uses, 4 GHz of which will be licensed, 5.2 GHz will be license-exempt, and more than 13 GHz of which will be lightly licensed. This allocation seeks to address both the needs arising from the ongoing rapid increase in local data consumption while allocating new spectrum for emerging wireless technologies that will enable multiple use cases across different industries and verticals as part of the drive for Saudi Arabia to build a digital society.

1.1. Our Direction

To this end, CITC has started preparations for a spectrum auction in the second half of 2021 which will include spectrum in the following bands:

- 600 MHz FDD;
- 700 MHz FDD (723 – 733 / 778 – 788 MHz);
- 700 MHz SDL;
- 1980 – 2010 / 2170 – 2200 MHz FDD; and
- 3800 – 4000 MHz TDD.

CITC is also planning to release 2x5 MHz each in the 410 – 430 MHz and 450 – 470 MHz bands either as part of this auction or in a separate award process.

The purpose of this preliminary consultation is to obtain initial views from the industry on key topics that will help shape our thinking on the design of the award.

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1 https://www.citc.gov.sa/en/mediacenter/pressreleases/PublishingImages/Pages/2021033001/Spectrum%20Outlook%20for%20Commercial%20and%20Innovative%20Use%202021-2023.pdf

As stated in our Spectrum Outlook, CITC will award spectrum on a service and technology neutral basis:

- In the 1980 – 2010 / 2170 – 2200 MHz range, we expect interest from users and operators wishing to deploy different wireless technologies, including, IMT, Air-to-Ground (A2G) or Mobile Satellite Services with a complementary ground component (CGG).
- In the 410 – 430 and 450 – 470 MHz bands, we expect interest from users and operators to deploy specialized narrowband and broadband services to enterprises, civil users and verticals, including mission-critical services, to allow digital transformation for utility and industrial sectors in the Kingdom and enable adopting advanced industrial internet of things applications.
- The 600 MHz, 700 MHz, 700 MHz SDL and 3800 – 4000 MHz bands will be primarily used to provide IMT services in other countries. Given the resulting (and in some cases rapidly growing) ecosystem for IMT in these bands, we expect that entities acquiring spectrum in these bands in Saudi Arabia will also primarily use them to provide IMT services. There is a wide variety of potential use cases under this umbrella definition ranging from existing mobile networks to verticals and new types of connectivity solutions. For example, the United States held an auction for regional priority-access licenses in a shared portion of the C-Band - Citizens Broadcast Radio Service (CBRS) – which were acquired by a wide range of companies.[2]

CITC seeks to ensure spectrum allocation in Saudi Arabia enables a broad range of market driven use cases and allows them to compete for contested spectrum in an auction on a reasonably level playing field. This ensures an efficient allocation of spectrum to the use case(s) with the highest economic value. To enable fair access to spectrum, CITC would like to make sure that any associated licensing requirements are structured in a way that allows new use cases to establish themselves which, in turn, will aid the growth of the wider digital economy.

[2] The list of winning bidders is available on the FCC's website: https://docs.fcc.gov/public/attachments/DA-20-1009A2.pdf

1.2. Structure of This Document

To help us plan our auction, we would like to get the industry's view on the following topics:

- Market access: We would like to hear from national and international firms who may wish to acquire spectrum, enter the market or provide services, irrespective of use case, technology or business model. This could include, for example, wholesale service provision[3], provision of services to specific consumer segments, provision of mobile, fixed or satellite services or the provision of services to specific types of verticals / industries. Our questions to companies interested in entering the market in Saudi Arabia to provide services are set out in Section 2.
- 600 and 700 MHz bands: Our questions on matters related to these two bands are set out in Section 3 and cover the following:
  - Broader sub-1 GHz reallocation: Auction 2021 will bring a substantial amount of new sub-1 GHz spectrum to market. We believe that this provides an opportunity for a broader reallocation of sub-1 GHz spectrum among existing holders to ensure all operators have access to large, more spectrally efficient, contiguous blocks. We would therefore like to hear the views of the existing mobile network operators regarding whether a reallocation would be beneficial and how it could best be achieved.
  - Block sizes: We would like to hear from the industry what block sizes they would favor in each of the three sub-1 GHz bands.
  - Spectrum caps: The auction rules should reflect recent and emerging market developments while safeguarding and fostering competition. To this end, we are minded to place limits on the overall amount of spectrum that any one operator can hold after the auction has concluded. We are furthermore examining the option of imposing additional caps on the amount of spectrum any operator can hold in the sub-1GHz spectrum band (i.e. the combined frequency holdings in the 600 MHz, 700 MHz,

[3] For example, 700MHz wholesale network in Mexico: https://www.commsupdate.com/articles/2018/03/22/red-compartida-700mhz-wholesale-network-launches-ahead-of-schedule/

800 MHz and 900 MHz bands) as well as in the C band (3400 - 4000MHz). The sub-1GHz band will play an important role in providing rural coverage and fostering infrastructure-based competition. CITC views the need to extend rural coverage and reduce any digital gap between urban and rural coverage as a key priority. The C-band has emerged as a key 5G band owing to its favorable propagation characteristics and the large capacity available. It also has a well-established ecosystem.

- 1980 – 2010 / 2170 – 2200 MHz: Our questions on matters related to the allocation of this band are set out in Section 4.
- 3400 – 4000 MHz: Our questions on matters related to the allocation of new spectrum in this range are set out in Section 5 and include the following:
  - Alignment of spectrum holdings across 3400 – 4000 MHz: We wish to understand whether mobile operators want to align their holdings across 3400 – 3800 MHz and 3800 – 4000 MHz after the auction to ensure that all operators receive either a contiguous assignment or one in which two contiguous blocks are within the instantaneous bandwidth (IBW) of relevant equipment.
  - Block sizes: The spectrum in 3800 – 4000 MHz could be offered in either larger (50 – 100 MHz) or smaller blocks. We would like to hear from stakeholders on the optimal block sizes for this band.
  - Spectrum caps: We propose a cap of 100 MHz for the additional spectrum in 3800 – 4000 MHz to avoid an undue concentration of spectrum.
- Reserve prices and payment terms: Our questions concerning issues specific to setting reserve prices and payment schedules for the 600 MHz and 1980 – 2010 / 2170 – 2200 MHz are set out in Section 6.
- Specialized Radio Network for Enterprises and Critical Infrastructure: Our questions on matters related to these two bands are set out in Section 7.

1.3. Indicative Timeline

To help potential bidders understand the process leading up to the Auction 2021, we have prepared an indicative timeline. This timeline is for guidance only and should not be relied upon. Dates in this timeline are estimates and may change. We will provide an update on this timeline in the full consultation on the draft Information Memorandum.

Table 1: Indicative Timeline

Date	Event
30 May 2021	CITC publishes this Preliminary Consultation
26 July 2021	Closing date for responses to this Preliminary Consultation
August 2021	CITC publishes Draft Information Memorandum and invites comments from interested parties
September 2021	Closing date for comments on the Draft Information Memorandum
October 2021	CITC publishes Final Information Memorandum and invites applications to participate in the auction
October 2021	Application deadline
October 2021	CITC publishes list of qualified bidders
November 2021	Bidder training sessions and mock auctions held to familiarize qualified bidders with the auction process and software
December 2021	Auction start

1.4. How to Respond to This Consultation

Participants who wish to submit their views/comments on this Consultation Document must submit them to CITC no later than 08/07/2021. To participate in this consultation process, stakeholders are requested to provide their comments in the format shown below.

Question #	Response & Comments

Comments can be submitted to one or more of the following addresses:

- By email to (auction@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.

Kindly note that any assessments and views expressed in this document are preliminary. Responses to this consultation may be submitted on a confidential or non-confidential basis. Regardless, CITC does not intend to publish any of the responses. Please indicate if you believe it will be helpful for CITC to refer to your submission in the full consultation on the auction design.

2. Market Access

We intend to release a substantial amount of both sub-1 GHz and mid-band spectrum in Auction 2021. All spectrum will be made available on a technology-neutral basis and can be deployed for a variety of different use cases.

This is directly relevant for the 1980 – 2010 / 2170 – 2200 MHz band which could be used by a number of different technologies, including Air-to-Ground, MSS/CGC and IMT.

While we expect the sub-1 GHz spectrum and the C-Band to be used by IMT given precedent in other countries and their ecosystems, there is a wide variety of potential use cases that falls within this category, including:

- existing mobile network operators using the spectrum to provide mobile services to consumers and businesses;
- verticals deploying this spectrum in localized private networks; and
- New types of connectivity solutions by service providers who wish to build networks that cater to the needs of different types of users including verticals that operate across different sectors of the digital economy.

CITC is monitoring closely different types of Non-Terrestrial Networks (NTN) as illustrated in the figure below, and is keen to explore holistic design for this auction to allow fair chance to all technology providers (both terrestrial and non-terrestrial) to have access to spectrum, and ensure Saudi Arabia's digital transformation will make good use of this wireless technologies.

CITC will maintain a policy of neutrality regarding the technology, service (use case), and business models of different spectrum users. However, companies that do not hold a Unified Telecommunications Services License will need approval from CITC first before providing new services.

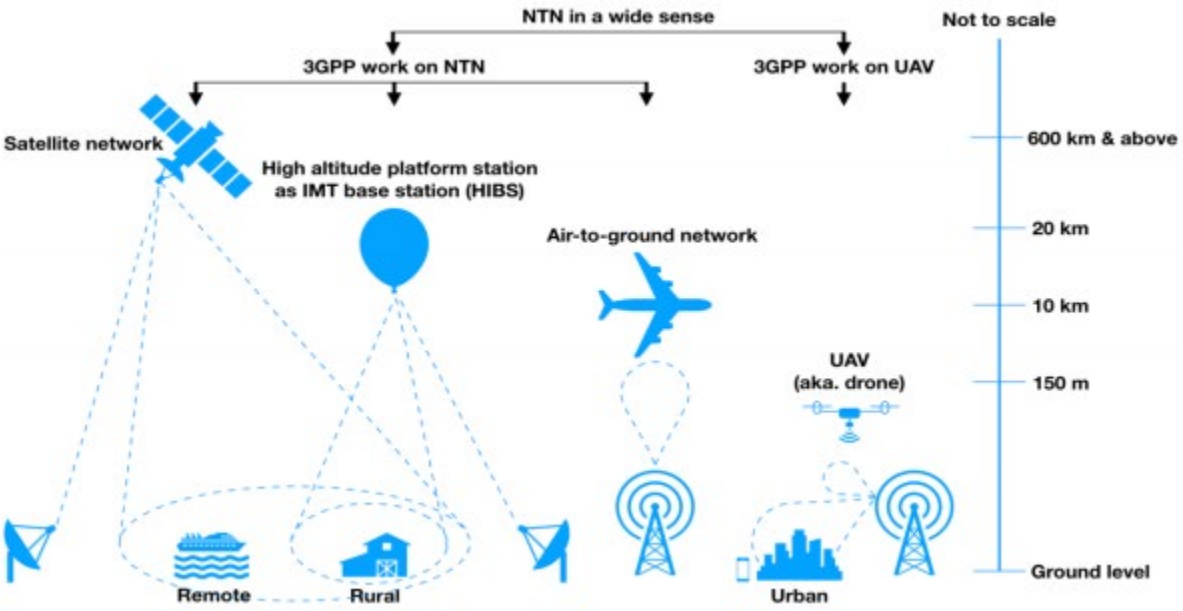

Figure 1: Different types of non-terrestrial networks[4]

We would like to reiterate that we welcome interest from any domestic or international new spectrum users that can develop a business case to provide services using this spectrum. We appreciate that there are challenges for any company to enter a mature communications services market that is characterized by high levels of coverage. Accordingly, we would like to assure any prospective new entrant that CITC intends to maintain and develop a positive environment to maximize the chance of promoting viable new communications operators.

If you are looking to provide digital radio services in Saudi Arabia through the released frequency bands, we would be grateful if you could answer the following questions to provide us with a better understanding of your needs and spectrum requirements.

[4] Xingqin Lin, Stefan Rommer, Sebastian Euler, Emre A. Yavuz, and Robert S. Karlsson, "5G from Space: An Overview of 3GPP Non-Terrestrial Networks", March 2021

2.1. Information about Your Likely Service Offering and Presence in Saudi Arabia

2.1.1: What service(s) would you like to provide in the KSA using the spectrum available in this auction? Which (5G or other) use cases will your service offering enable?

2.1.2: What are your target customer segments? Are you planning to enable specific (5G or other) use cases by verticals?

2.1.3: What would be the scale of your deployment, with respect to both area (national/regional/city/sub-city etc…) and capacity?

2.1.4: What are your roll-out plans and timelines for providing the services mentioned above? What percentage of the country area/population/target customers would you cover over which time scale?

2.1.5: Are you planning to deploy your own network (using your own spectrum) or are you planning to rely on the existing nationwide mobile networks for connectivity? Please provide details.

2.1.6: Do you have a presence in Saudi Arabia? If not, what are your plans for operating your business in Saudi Arabia?

2.1.7: Are you planning to form a joint venture with another company to enter the market? If so, who are you planning to partner with?

2.2. Spectrum Requirements

2.2.1: If you are planning to deploy your own network, what mix of spectrum do you need to deploy in your network? Please elaborate on why you would need that mix.

2.2.2: If you are planning to deploy your own network, what are your plans for acquiring access to the spectrum mentioned above?

2.2.3: Of the spectrum that will be available in the Auction 2021, how much would you minimally need to provide services specified in your answer to question 2.1.1 for your target customer segment specified in your answer to question 2.1.2?

2.2.4: Of the spectrum available in the Auction 2021, how much would you ideally like to acquire in each of the bands on offer?

2.2.5: If you cannot get access to spectrum in this auction, are there alternative spectrum bands that you could use? Would you be interested in any of the bands designated for light licensing or unlicensed spectrum access bands in CITC's Spectrum Outlook? Please elaborate.

2.2.6: Are there any other spectrum bands you would need for your services? Please mention them.

2.3. Roll-Out Targets and Obligations

2.3.1: If CITC offered you spectrum in one or more bands, what network deployment or service coverage and performance targets would you pursue? Would these differ by band / spectrum portfolio? If so, please elaborate and detail how these targets would achieve best use of spectrum in that band. If there are requirements to integrate your network based services with other network products/services in order to provide a turnkey service to your clients, irrespective of whether these other products/services are provided on a regulated wholesale basis or on commercial arrangements, please set these out below in Section 2.5 and 2.6.

2.4. License Conditions

2.4.1: What other license conditions (license duration, power limits etc…) are appropriate for specific bands? Please detail why they would be appropriate.

2.5. Any Other Regulatory Changes

2.5.1: Please elaborate on any other regulatory changes you would like to see in Saudi Arabia that would make market entry more attractive. While not explicitly part of our preparations for the auction, this will help our future planning.

2.6. Any Other Assistance CITC Can Provide

2.6.1: Please elaborate on anything that CITC can do to help you with your applications for setting up a business or obtaining any required permits and licenses.

2.7. Participation in the Auction

2.7.1: Are you planning to participate in the auction as either a standalone bidder or in consortium with other national or international companies? If so, who are you planning to form a consortium with?

2.7.2: Are there any specific rules on participation in the auction that you would like to see, including any comment on the proposed auction timeline. If yes, Please provide details

3. 600 and 700 MHz Bands

3.1. Broader Reallocation of Sub-1 GHz Spectrum

Auction 2021 will bring a substantial amount of new sub-1 GHz spectrum to market which opens up the possibility of rearranging the existing holdings in the other sub-1 GHz bands.

The following amounts of spectrum will be offered in the auction:

- 600 MHz band: 2x35 MHz
- 700 MHz SDL band: 20 MHz
- 700 MHz band: 2x10 MHz

For reference, the existing allocations of spectrum to mobile operators in the sub-1 GHz mobile bands are set out in Figure 1.

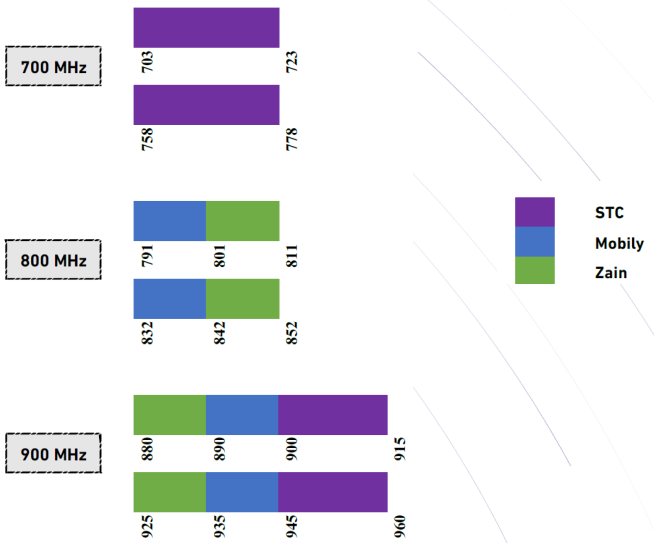

Figure 1: Current sub-1 GHz holdings

We note that STC has access to a full 2x20 MHz carrier in the 700 MHz band while the maximum carrier size Mobily and Zain have access to is 2x10 MHz in the 800 MHz. We also

note the 5G standardization developments which introduced 2x30 MHz carrier bandwidth in the 700 MHz band and 2x35 MHz carrier bandwidth for both the 600 MHz and the 900 MHz bands. In addition, we also note refarming activities of the 900 MHz in multiple countries which aim to take advantage of the switch-off of 2G and 3G networks to support the bridging of the digital divide by enabling the cost-effective delivery of high-performance broadband services in rural areas.

An additional 2x10 MHz will be released in the 700 MHz band. The frequencies being auctioned are beside the frequencies that STC already holds in the 700MHz band. If STC acquires these, it could end up with a contiguous 2x30MHz block in the 700MHz band. Alternatively, one of the other existing MNOs (Zain or Mobily) or a new entrant could acquire this block which is ideally suited for providing wide 5G coverage.

We would like to explore whether there is interest among existing frequency band holders in re-allocating spectrum after the auction to de-fragment holdings and how important it is to spectral efficiency to have contiguous blocks of more than 2x10MHz; particularly when factoring in the cost of network radios and the technical limitations which prevent the aggregation of non-contiguous sub-GHz carriers.

Depending on the answer, we would then like to explore how best any de-fragmentation could be facilitated. We have developed two initial proposals below but are open to alternative proposals from the industry.

Proposal 1: Pre-auction exchange

This proposal could be built into the auction design, as follows. CITC could run a pre-auction 'exchange phase' involving existing license holders in the 800 MHz band to return spectrum in either the 800 or 900 MHz band in exchange for a larger contiguous block in the 600 MHz band.

Under this approach:

- The minimum exchange fee would be set with reference to the reserve price for 600 MHz spectrum in the auction (i.e. a % of the reserve price). The switch-off and exchange of legacy blocks would be gradual and could span multiple years to ensure service continuity and avoid disruption.
- If more than one license holder in the 800/900 MHz band offered to return spectrum in exchange for a larger contiguous block in the 600 MHz band, the license holders would be asked to compete in a bidding process, with the bidder offering the highest level of exchange fee being selected.
- The returned spectrum would then be offered to the other license holder
- Any spectrum not allocated at the end of the exchange phase would be included in the auction.

In any case, the pre-auction exchange would include a grace period for any operator who is willing to return spectrum in 800 or 900 MHz to allow an orderly transition and minimize service disruption.

Proposal 2: Post-auction negotiation

This proposal involves a two-phase approach comprising an assignment phase and a negotiation phase, a variant of an approach that was used by Ofcom in the UK when it sought to defragment the lower part of the C band (3.4-3.8GHz)[5].

CITC would run the main auction with all spectrum in the 600 MHz band first. Existing holders in the 800 and 900 MHz bands will then be given a specified time period to negotiate spectrum swaps involving the spectrum they acquired in the 600 MHz band in the auction and their existing holdings in the 800 MHz and 900 MHz bands.

[5] https://www.ofcom.org.uk/__data/assets/pdf_file/0011/152102/consultation-defragmentation-spectrum-holdings.pdf

After the negotiation phase, CITC would run the assignment stage for the 600 MHz band which will ensure that all spectrum holders in the band receive a contiguous assignment.

To help shape our thinking on the options set out above, we would like the industry's views on the following questions.

3.1.1: In your view, how important is it generally for mobile operators to acquire contiguous bandwidth within a single band? Please provide technical reasons to support your response, in particular relating to the spectrum in this award.

3.1.2: In your view, how important is contiguity of sub-1 GHz holdings for competition? What would be the impact of an asymmetric allocation of contiguous sub-1 GHz holdings on competition if overall sub-1 GHz holdings are otherwise fairly balanced? Please provide technical and economic reasons to support your response (for example, costs of radios and the ability to aggregate sub-GHz carriers).

3.1.3: While the state of the ecosystem varies today between the 800 MHz, 900 MHz and 600 MHz bands, do you perceive 800 MHz, 900 MHz and 600 MHz as largely substitutable in the medium to long term? Please provide technical reasons to support your response.

3.1.4: What block size of spectrum would you be potentially interested in to support your business plan for providing mobile services in KSA, irrespective of whether the underlying business model is wholesale, retail, enterprise, or public cellular network?

3.1.5: What are your views on CITC's initiative to defragment the sub-1 GHz holdings above, including the possible refarming of the 800 MHz/900 MHz bands? If you have an alternative proposal, please share it with us. Note that we would particularly welcome proposals that are workable (either as an auction / negotiation) and that are on a voluntary basis.

3.1.6: With regards to CITC's Proposal 1 above, how should CITC determine the exchange fee and the fixed price for the returned spectrum?

3.1.7: With regards to CITC's Proposal 1 above, how long should the transition / grace period be for license holders returning spectrum in the 800 or 900 MHz bands, respectively?

3.1.8: What are your views on enabling spectrum trading and license transfers during the auction as part of the competitive process? (see section 5.2)

3.2. Block Sizes

The 2x35 MHz in the 600 MHz band could be made available as either:

- A single 2x35 MHz block, to take advantage of standardization developments to further advance KSA's 5G leadership
- two large blocks (2x20 MHz and 2x15 MHz)
- 5 MHz blocks that bidders can aggregate to form larger channels.

We welcome the industry's views on the optimal block size. It should be understood that our ultimate decision here will also be informed by our decision on the auction format (and vice versa).

The size of the blocks being made available, allied with rules that will restrict the amount of spectrum any one operator may hold in the sub-1GHz band (see Section 0) will have a strong influence on the outcome of individual holdings in the sub-1GHz band.

Please respond to the following questions:

3.2.1: What block sizes should be offered in the 600 MHz, 700 MHz and 700 MHz SDL band in the auction?

- In the 600 MHz band, CITC could offer either a single 2x35 MHz block, 2 large blocks (2x20 MHz and 2x15 MHz), or smaller blocks (of 2x5 MHz each).
- In the 700 MHz SDL band could be offered in one or two larger blocks or in smaller blocks.
- In the 700 MHz band could be offered in two 2x5 MHz blocks or a single 2x10 MHz block.

Please provide your views on the optimal block sizes in each of these bands and include technical and economic reasons to support your response.

3.2.2: If CITC offered smaller blocks in any of these 3 bands, would this in turn necessitate the use of a combinatorial auction format with package bidding so as to avoid exposing bidders who wish to acquire larger quantities from aggregation risk?

3.3. Spectrum Caps

CITC has already allocated a total of 150 MHz of sub-1 GHz spectrum in the 700MHz, 800MHz and 900MHz bands to the three mobile operators in Saudi Arabia. The position with respect to previously allocated and newly available spectrum is shown in Table 2.

Table 2: Current sub-1 GHz holdings & Spectrum in Auction 2021

	600 MHz	700 MHz SDL	700 MHz	800 MHz	900 MHz	Total
STC			2x20 MHz		2x15 MHz	70 MHz
Mobily				2x10 MHz	2x10 MHz	40 MHz
Zain				2x10 MHz	2x10 MHz	40 MHz
Auction 2021	2x35 MHz	20 MHz	2x10 MHz			110 MHz
Total per Band	70 MHz	20 MHz	60 MHz	40 MHz	70 MHz	260 MHz

Of the 150 MHz that is already allocated, STC holds 70 MHz whereas Zain and Mobily hold 40 MHz each. Another 110 MHz will be released in the auction increasing the total amount of sub-1 GHz spectrum to 260MHz. CITC is unaware of any service provider globally with more than 100 MHz of sub-1 GHz holdings. Further, CITC believes that to safeguard long term competition, no single operator should hold more than 110 MHz (i.e. 42%) in total across all sub-1 GHz band at the conclusion of the auction.

This preliminary position implies the following caps on additional spectrum from the auction:

- STC: 40 MHz
- Zain and Mobily: 70 MHz.

The wide coverage characteristics and superior in-building penetration of sub-1GHz spectrum means that it will play a vital in improving coverage in rural areas, which CITC regards as a priority to help reduce the digital divide. The spectrum also has the potential to foster infrastructure-based competition. This is based on the current number of players existing in these bands, and it will be revaluated when needed.

Please respond to the following questions:

3.3.1: In your view, what competition measures (spectrum caps, set-asides, right of first refusal) would be required to safeguard and foster competition in the mobile telecommunications market and to avoid an undue concentration of sub-1 GHz holdings? Please provide economic and technical justifications if these differ from CITC's proposal above.

3.3.2: in your view, how important is to cap the amount of sub-1GHz spectrum that any one operator can hold? Would you agree that large imbalances in spectrum ownership can result in competition concerns?

4. 1980 – 2010 / 2170 – 2200 MHz

This frequency range is suitable 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 owing to the lack mobile deployments in this band.

There is interest in deploying LTE Air-To-Ground (A2G) technology or IMT satellite services in the band (MSS with a common ground component (CGC)). In Europe, Inmarsat and EchoStar were each selected as operators of pan-European systems providing MSS in the lower part of the band. Deutsche Telekom and Inmarsat have since formed a strategic partnership to develop the European Aviation Network (EAN).

4.1. Coexistence

MSS/CGC is effectively a hybrid deployment where the same frequency range could be used for both satellite (MSS) and mobile (CGC). The mobile deployment (CGC) could be used to provide extra capacity in urban areas whereas the MSS component could be used to provide services in rural areas. The MSS and CGC have a common spectrum access control mechanism to coordinate their use in the same frequency range.

ECC Report 233 studied coexistence of MSS/CGC and A2G in 1980 – 2010 / 2170 – 2200 MHz, mobile (in B1), PMSE, Mobile communication on Aircraft (MCA), DA2GC (in 2010 – 2025 MHz) and LTE-public mobile use by CGC and recommends five mitigation measures for the A2G component on board of aircrafts. These would be the same regardless of how much spectrum is allocated to A2G in this band as it would always be adjacent to a mobile user. We plan to adopt the technical restrictions established in Europe to ensure coexistence.

ECC Report 233 has shown that adjacent mobile use in B1 can coexist with MSS/CGC and A2G in this band, so a partial mobile allocation (e.g. in part of this band) should also be possible. This is because the A2G system has very similar characteristics to a mobile

system. The downlink is transmitted from the aero-ground station upwards towards the aircraft and from the satellite down to the aircraft. A mobile network in an adjacent band would have similar ground stations, albeit transmitting horizontally rather than inclined more vertically. For mobile terminals receiving from a ground station this is no different from two terrestrial networks in adjacent bands. The signal from the satellite will be too weak to have any interference effect. In fact, the vertical discrimination caused by A2G base stations transmitting in an upward direction and mobile network base stations transmitting slightly downward will mean less interference than between two mobile networks or two A2G networks.

The uplink is transmitted from the aircraft down to the earth station. A mobile network would have mobiles transmitting to nearby base stations. Broadly, again, this is similar to having mobile networks in adjacent bands and again the vertical antenna discrimination would mean less interference than for like networks.

Hence, we conclude that any of the following band arrangements could co-exist:

- Two terrestrial networks (e.g. 4G or 5G) using the b65/n65 FDD arrangement.
- Two A2G or MSS/CGC networks.
- One terrestrial network and one A2G or MSS/CGC network.

We therefore intend to make spectrum available on a technology-neutral basis so it can be used by either technology.

Please respond to the following questions:

4.1.1: Do you agree with our view and the studies presented above on the coexistence of mobile, MSS and A2G in this sub-band? Please provide technical evidence to support your response.

4.1.2: We plan to adopt the license conditions established in Europe for this band to ensure coexistence between adjacent users. Do you have any views on the appropriate license conditions for users in this band?

4.2. Types of Users and Uses in the Band

Based on the results of the coexistence study quoted above, it appears possible that all three types of modes of operation can coexist in adjacent channels. We therefore intend to offer exclusive-use licenses on a technology-neutral basis. For example, the license(s) could be acquired by:

- A mobile operator who would like to provide mobile services only.
- A satellite operator who would like to provide MSS (or A2G) and then offer access to its spectrum to mobile operators to provide the CGC. This could be done via subleasing where frequency control resides with the satellite operator.
- A mobile operator to provide mobile services and then augment this with A2G in collaboration with a satellite/A2G operator.

To enable all possible types of users to compete directly for spectrum, we do not intend to preclude access in the auction by adding obligations or requirements that would have the effect of precluding a specific type of users. For example, in Europe and Canada the spectrum was assigned to satellite operators exclusively and any CGC use was made contingent on having satellite service in the same band. This would effectively prevent mobile operators from acquiring the spectrum directly in the auction and could lead to an inefficient allocation.

Based on the above, we intend to make the licenses available on a technology- and service-neutral basis putting as few requirements as possible on the potential use of this band. For example:

- The licenses will not be for MSS/CGC use only but would also allow mobile only use.
- License holders will not need to have existing satellite services in the S-band.

- With regards to the licensing requirements, we would be guided by the responses we receive to this consultation. We expressly welcome interest from international entities to operate in the band.

We would look to restrict use only where necessary to protect adjacent users (please refer to our explanation and questions in 4.1.1 above).

4.2.1: Do you agree with our view on minimizing the restrictions on potential users? Please provide technical evidence to support your response.

4.3. Block Sizes

The spectrum could be made available in either larger or smaller blocks. We would value your input on the optimal block sizing in this band:

4.3.1: In your view, what block sizes should be offered in the auction? Please provide your views on the optimal block size and include technical and economic reasons to support your response.

4.3.2: If CITC offered smaller blocks, would this in turn necessitate the use of a combinatorial auction format with package bidding so as to avoid exposing bidders who wish to acquire larger quantities from aggregation risk?

4.3.3: If you support the use of the band for an A2G network, what kind of performance can be provided (in both coverage and speeds) for the different possible bandwidths?

4.3.4: If you support the use of the band for an MSS/CGC network, what kind of performance can be provided (in both coverage and speeds) for the different possible bandwidths?

4.4. Spectrum Caps

We do not foresee the need to impose any spectrum caps in this frequency range. If the spectrum is used for IMT, it represents only a small proportion of the available capacity spectrum. In the case of A2G or MSS/CGC we do not foresee the need to enable more than one service provider.

4.4.1: Do you agree with our assessment of the spectrum caps for this frequency range? Please provide technical and economic reasons to support your response.

5. 3400 – 4000 MHz

5.1. Alignment of spectrum holdings across 3400 MHz – 4000 MHz

As part of the auction design, CITC is considering including an option to rationalize all existing holdings across 3400-4000 MHz, 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.

The existing holdings in the 3400 – 3800 MHz band are depicted in Figure 2.

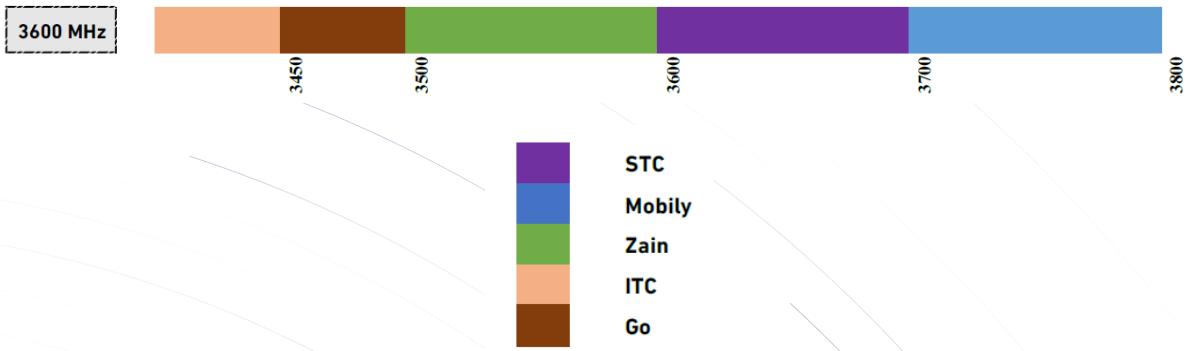

Figure 2: Current holdings in 3400 – 3800 MHz

A realignment of spectrum holdings to promote contiguity may require moving existing holdings that currently sit below 3800 MHz into 3800 – 4000 MHz – i.e. from 3GPP band n78 (3300 – 3800 MHz) to band n77 (3300 – 4200 MHz). Further, CITC notes that all current licenses in the 3400 - 3800 MHz band explicitly provision the possibility of moving existing holdings to maximize the efficient use of spectrum. While we believe that both bands will be equally well supported in handsets in the short-to-medium term, such a reassignment may require existing holders to replace any n78 equipment that they have already installed, so would have an associated cost.

We could add restrictions on the band plans we would consider in the assignment stage such that, for example, an existing operator that does not acquire any additional spectrum in the auction will be guaranteed spectrum below 3800 MHz.

Please respond to the following questions:

5.1.1: What are your views on our preliminary plan of targeting contiguity of all spectrum blocks in the 3400 – 4000 MHz band? Please provide your input on the best means to achieve this contiguity and provide technical and economic reasons to support your response.

5.1.2: If you have an alternative proposal, please share it with us. Note that we would particularly welcome proposals that are workable (either as an auction / negotiation) and that are on a voluntary basis to the largest extent possible.

5.1.3: What is the breakdown of 5G handsets in your network? What is the number and percentage of them that support both bands n77 and n78? What is the number and percentage of them that support band n78 only?

5.2. Enabling Transfers in the Auction

In the 3400 – 3800 MHz range, CITC has allocated 50 MHz to ITC and Go as well as 100 MHz to STC, Mobily and Zain, respectively. We would like to understand whether any of these existing license holders would be interested in transferring the remaining license period in their licenses to another competitor as part of the auction.

For example, we could ask existing holders to specify whether they would like to transfer their existing holdings before the auction and what compensation they would require. They would submit their offer in a sealed envelope. At the start of the auction, the available supply in the auction will be 200 MHz (i.e. 3800 – 4000 MHz). The auction mechanism would then add the relevant transferred spectrum to the auction supply once the auction price exceeds the required level of compensation.

Note that any existing holder wishing to transfer the remaining license period in their licenses this way would not be allowed to bid for spectrum in the auction.

5.2.1: What are your views on enabling transfers in the auction? Please elaborate and provide technical and economic reasons to support your response.

5.2.2: If you have an alternative proposal, please share it with us. Note that we would particularly welcome proposals that are workable (either as an auction / negotiation) and that are on a voluntary basis to the largest extent possible.

5.3. Block Sizes

CITC could offer the available spectrum in larger (e.g. 50 or 100 MHz) or smaller (e.g. 10 or 20 MHz) blocks.

5.3.1: In your view, what block sizes should be offered in the auction? Please provide your views on the optimal block size and include technical and economic reasons to support your response.

5.3.2: If CITC offered smaller blocks, would this in turn necessitate the use of a combinatorial auction format with package bidding so as to avoid exposing bidders who wish to acquire larger quantities from aggregation risk?

5.4. Spectrum Caps

CITC has already allocated a total of 400 MHz in the 3400 – 3800 MHz range and will offer an additional 200 MHz in the 3800 – 4000 MHz in Auction 2021. The position with respect to previously allocated and newly available spectrum is shown in Table 3.

Table 3: 3.4 – 4 GHz - Current holdings & Spectrum in Auction 2021

	3400 – 3800 MHz	3800 – 4000 MHz
STC	100 MHz	
Mobily	100 MHz	
Zain	100 MHz	
ITC	50 MHz	
Go	50 MHz	
Auction 2021		200 MHz
	400 MHz	200 MHz

All three mobile operators already have access to a full 100 MHz 5G carrier in this band. This reduces competition concerns in case of an asymmetric allocation of any incremental spectrum. Having said that, CITC would still like to ensure that at least two operators can acquire additional spectrum in the auction. Our initial proposal is therefore to limit the additional spectrum any operator can acquire in the auction to 100 MHz (i.e. a cap of 200 MHz on total holdings in the 3400-4000 MHz band). However, this is based on the current number of players existing in these bands, and it will be revaluated when needed.

5.4.1: In your view, what competition measures (spectrum caps, set-asides, right of first refusal) would be required for the additional spectrum in 3800 – 4000 MHz to safeguard and foster competition in the mobile telecommunications market?

5.4.2: In your view, how important is to cap the amount of additional spectrum in 3400 – 4000 MHz any one operator can hold?

6. Reserve prices and payment terms for 600 MHz and 1980 – 2010 / 2170 – 2200 MHz

We welcome the industry's views on the reserve prices and payment terms for the 600 MHz band and the 1980 – 2010/2170 – 2200 MHz. Our initial proposal and questions to the industry are set out in the following two sub-sections.

6.1. 600 MHz

The determination of the reserve prices and payment terms for the 600 MHz band should take into account the delay in full availability of the spectrum as well as the ecosystem and device availability for this band in the KSA.

Our initial view on the former is that we will look to link payment terms to actual availability measured as the % of the population that can be served with the spectrum at that point in time. At the start of each license year, CITC will measure the % of the population that can be served with the spectrum given the current state of the migration of TV broadcasting as well as current cross-border interference management arrangements. The difference in the % relative to the previous year multiplied by the auction price will then need to be paid. This is illustrated in Table 4.

Table 4: CITC's initial view on payment terms for 600 MHz

Year	Average % of population that can be served during year	Auction price	Payment
'22	$Y_{'22}$	P	$Y_{'22} * P$
'23	$Y_{'23}$		$(Y_{'23} - Y_{'22})*P$
'24	$Y_{'24}$		$(Y_{'24} - Y_{'23})*P$
'25	$Y_{'25}$		$(Y_{'25} - Y_{'24})*P$
'26	$X_{'26}$		$(X_{'26} - Y_{'25})*P$

We are also considering linking the reserve price to the expected timeline for full availability of handsets and devices of this spectrum (compared to 700 MHz and 800 MHz).

These issues raise the following questions:

6.1.1: In your view, how should CITC take account of the ongoing migration of TV from the band when setting reserve prices and payment terms for the 600 MHz band?

6.1.2: In your view, how long will it take for a 600 MHz ecosystem to be similar to that of the 700 MHz and 800 MHz bands?

6.2. 1980 – 2010 / 2170 – 2200 MHz

This band could be used for Air-to-Ground (A2G), MSS with a complementary ground component (MSS/CGC) or mobile. As we discussed in the Consultation Report that accompanied our Spectrum Outlook, we understand that all three technologies can coexist in adjacent channels in the band.

A2G and MSS/CGC would be innovative uses with no precedent in the KSA. We also understand that while the ecosystem is developing rapidly in Europe, the industry is still nascent there as well. At the same time, it is unclear when mobile use will be possible in the band in the short-term as a mobile ecosystem for this band does not yet exist.

We would like to ensure that the reserve prices we set for this band strike the right balance, i.e. they are high enough to discourage frivolous bidding or spectrum hoarding but at the same time low enough to encourage all entities interested in providing telecommunications services in the band to participate in the auction.

We propose to look at annual fees for the CGC in Europe on a per-pop basis as a starting point,[6] and also consider how other regulators price spectrum for innovative uses.

6.2.1: Do you agree with CITC's proposed approach? If not, we would be interested in alternative proposals. Please justify your response.

[6] See, for example, Ofcom' s decision on the technical conditions and license fees: https://www.ofcom.org.uk/__data/assets/pdf_file/0022/107464/Authorisation-terrestrial-mobile-networks-2-GHz-MSS.pdf

6.2.2: In your view, which benchmarks should CITC consider and/or put considerably more weight on when determining reserve prices for this band?

6.2.3: In your view, what would be the optimal payment terms for this band? Should the licenses be subject to a (largely) upfront fee or annual fees? Please justify your response.

7. Specialized Radio Network for Enterprises and Critical Infrastructure

The UHF band is utilized today by 120 private mobile radio networks- with about 1,000 frequency licenses - for user groups in the Kingdom, mainly in cities, but some across the Kingdom. These are predominantly analogue and simple, low-bandwidth, digital PMR systems.

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

CITC is planning to allocate two 2x5 MHz blocks to deploy specialized radio network for enterprises, civil users and verticals to manage critical infrastructure and mission-critical communications:

- A 2x5 MHz block in the 410 – 430 MHz band will be allocated in regional and local licenses for the provision of narrowband and/or broadband services.
- A 2x5 MHz block in the 450 – 470 MHz band will be allocated for broadband services in a single nationwide license.

CITC objective of this award is to allow digital transformation for industrial users in the Kingdom and enable them to adopt advanced industrial internet of things applications, and provide broadband mission-critical communications. Ultimately, CITC would like to ensure availability of nation-wide, highly resilient and secure broadband specialized network(s) for applications of industry 4.0, energy, utility and other critical infrastructures.

There are a number of different ways these bands could be operated ranging from the deployment of a nationwide network by a single operator to provide these services to a band manager manages and grants access to individual users with their own deployments.

Before making a decision on this band, CITC would like to hear from all parties interested in this band as to the best way forward (including vendors, operators and private companies and enterprises). As set out in detail below, we would like to gain a better understanding of the following:

- The optimal mode of operation for this band.
- The link between the specialized network and 5G vertical use cases; and
- The link between the specialized network and self-deployed private networks by verticals).

As there are about 120 existing users in these bands, the reallocation process will require migrating some of them. We will do this in coordination with the relevant stakeholders. At this preliminary stage, we would like to hear from parties interested in deploying and managing this new system.

7.1. Interest

7.1.1: Are you interested in providing narrowband (or broadband) services in 410 – 430 MHz or broadband services in 450 – 470 MHz?

7.1.2: Are you interested in providing broadband services in other bands not listed here? e.g. 698-703/728-733 MHz.

7.1.3: What are your target customer segments?

7.1.4: On what geographical scale you are willing to provide the service?

7.2. Challenges

7.2.1: What technological, regulatory or commercial challenges do you foresee in providing the services mentioned above. Please elaborate on ways in which CITC can reduce these challenges.

7.2.2: What technical and commercial challenges do you foresee in the provision of new (mission-critical) devices for your users in the band? Please provide suggestions on how these could be

overcome, potentially with reference to how other countries have successfully dealt with the technology transition in these bands.

7.3. Technology

7.3.1: What technology are you planning to deploy/offer to your customers in these bands (TETRA, LTE, 5G, 5G for private networks, Industrial WiFi or a mix)?

7.3.2: Do you find it a viable approach that spectrum is made available for both narrowband (e.g. TETRA) and broadband (e.g. LTE) networks?

7.3.3: Do you have prior experience in offering similar services either in Saudi Arabia or elsewhere? What capabilities do you have in-house and what are you planning to outsource?

7.4. Operating Model

7.4.1: How are you planning to operate in these bands? For example, would you deploy and operate a (nationwide) network yourself, only act as a band manager who allocates spectrum to other entities to deploy and manage their own networks or a mix of both? Please provide as much detail as possible on your operating model to help us set the right license conditions for these bands.

7.4.2: Is forming a joint venture from representatives of utility and industrial entities to a common construct and operate a unified network a viable option?[7]

7.5. Link with Existing Mobile Networks

7.5.1: Are you planning to rely on the existing mobile networks to provide some of your services? If so, please detail the mission-critical and industrial features you are planning to provide using the 410 and/or 450 MHz bands on top of the ones provided over the existing mobile networks (for example multicast features, lower cost or specific applications).

7.5.2: Is it strictly necessary to build a standalone network to provide the features of this network or could these be provided on the existing mobile networks?

[7] For example, Representatives of the energy and water industry in Germany have agreed on construction and operation of a nationwide 450 MHz radio network. See: https://450alliance.org/the-german-utility-industry-agrees-on-joint-venture-for-the-450-mhz-radio-frequencies/

7.6. Link with Private (5G) Networks

7.6.1: Do you expect verticals to augment their own private networks with the specialized broadband services you would provide on your network?

7.7. License Conditions

7.7.1: What license conditions (license duration, power limits etc…) are appropriate for these bands? Please detail why they would be appropriate.

7.7.2: What obligations are appropriate to ensure advanced use cases and industrial IoT applications are adopted to support industry 4.0 and digitization?

7.7.3: How should CITC set fees / reserve prices for these bands?

7.7.4: If CITC offered you spectrum in these bands, what network deployment or service coverage and performance targets would you pursue and be willing to commit to?

7.8. Other

7.8.1: If more than one entity expresses an interest in providing services in these bands, CITC may decide to include them in Auction 2021. Please confirm if you have any concerns with this approach.

7.8.2: Are there any specific obligations or requirements that you would be most concerned about that, in your view, would render the provision of services in these bands unattractive from an economic point of view.

7.8.3: If you have any other comments on these bands, please include them here.

8. Expression of Interest Document

The prospective applicant must complete, in full, this form of (Expression of Interest) shown in Annex 1 and submit it to CITC no later than 08/07/2021 for consideration if they intend to apply to participate in Auction 2021. Any additional documentation the prospective applicant deems relevant and wishes to submit may be appended to this document.

CITC will study the Expressions of Interest and take all necessary actions to review according to the Telecom Act and the Telecom Bylaw. CITC may invite the prospective applicant to formally apply to participate in Auction 2021. Meaning that, submitting this application doesn't provide any entitlement nor does it imply any obligation to participate in the auction. All submitted applications will be treated as strictly confidential by CITC.

Annex 1: Expression of Interest Form

THE PROSPECTIVE APPLICANT

Company name: _____

Year of incorporation: _____

Country of incorporation: _____

Address: _____

COMPANY INFORMATION

Number of employees: _____

Products or services to be offered: _____

Local partners in Saudi Arabia (if any): _____

CONTACT DETAILS

Each prospective applicant must provide contact information for a representative that will be the main point of contact for CITC.

Natural Person

Name: _____

Position: _____

Telephone: _____

E-mail: _____

The prospective applicant hereby acknowledges that all communication given by CITC shall be sent by e-mail to the e-mail address of the representative provided above. All communication shall be deemed received by the prospective applicant at the time of transmission. The representative must remain contactable at all times.

ALTERNATIVE REPRESENTATIVE

In addition to the primary representative, a prospective applicant may, but is not required to, name up an alternate representative.

Alternate representative

Name of alternate representative _____

Position of alternate representative _____

Telephone of alternate representative _____

E-mail of alternate representative _____

The alternate representative will be contacted in the case that the primary representative, for whatever reason, is not immediately contactable.

PROSPECTIVE APPLICANT DECLARATION

We, the undersigned, being the representative(s) of _____ (the "prospective applicant") hereby declare that all information provided in, or in support of, the expression of interest is to the best of the knowledge and belief of the prospective applicant true, accurate, and complete.

Signature of primary representative: _____

Name of primary representative: _____

Date: _____

هيئة الاتصالات وتقنية المعلومات
Communications & Information Technology Commission