Communications Regulatory Authority State of Qatar

هيئة تنظيم الاتصالات دولة قطر

Consultation regarding the implementation of Private Mobile Networks using 5G technology in Qatar

Summary of Comments Received and CRA's Responses

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1 Introduction

On June 14, 2022, the Communications Regulatory Authority (**CRA**) initiated a public consultation regarding the implementation of Private Mobile Networks using 5G technology in Qatar (**Consultation Document**).

In the Consultation Document, CRA described three options for the implementation of 5G private mobile networks in Qatar, reviewed relevant regulatory issues, presented its views on the pros and cons of each implementation option and invited stakeholders to submit their views on the options and related issues (for example on radio spectrum matters). The three options for the implementation of 5G private mobile networks discussed in the Consultation Document are:

Option 1: Use the 5G networks and services of the public mobile operators (i.e., maintain the current situation).

Option 2: Entirely self-provisioned network. CRA would issue spectrum licenses to the eligible Enterprises[1] who wish to establish and operate 5G private mobile networks under the existing "Class License to Own and/or Operate a Private Telecommunications Network" (Closed User Group).

Option 3: A new licensee dedicated to providing 5G private mobile networks to Enterprises.

The consultation was announced publicly on the official CRA website, by press release and by sending email to relevant stakeholders. In total, 68 different entities covering the following areas were sent an email to notify them of the consultation:

- Telecommunications service providers;
- Information and Communications Technology equipment vendors and their associations;
- Government entities;
- Companies engaged in oil, gas and petrochemical industries;
- Utility providers;
- Transport sector;
- Healthcare;
- Media;

[1] The term '**Enterprise**' is used as a convenient means of referring to any organization that may wish to establish a 5G private mobile network and therefore encompasses businesses as well as government organizations.

- Real estate developers; and
- Business incubators and science parks.

The deadline for the submission of responses to the consultation was originally established as July 21, 2022 but was extended to August 21, 2022 in response to requests for more time from stakeholders. Submissions were received from (listed in alphabetical order):

1. Dynamic Spectrum Alliance Limited (DSA).
2. GSM Association (GSMA).
3. Hewlett Packard Enterprise (HPE).
4. Huawei.
5. Intel Corporation (Intel).
6. Ministry of Interior – Telecommunications Department (MoI – Telecom Department).
7. Nokia.
8. Ooredoo Qatar Q.P.S.C. (Ooredoo).
9. QatarEnergy.
10. Qatar Satellite Company (Es'hailSat).
11. QTerminals L.L.C. (QTerminals).
12. Qualcomm International Incorporated (Qualcomm).
13. SITA Information Technology Services and Consultancy Doha L.L.C. (SITA).
14. Viasat Inc. (Viasat).
15. Vodafone Qatar P.Q.S.C. (Vodafone).

The remainder of this document provides a summary of the comments received from each of the stakeholders, the responses of CRA, and CRA's final position regarding this subject.

2 Comments Received

The views expressed by each stakeholder are summarized below (in alphabetical order):

1. Dynamic Spectrum Alliance Limited (DSA)

- All three options are beneficial and having options will encourage competition, innovation and rapid deployment of 5G networks.
- The following comments are made regarding radio spectrum matters:

- Having just a single option for spectrum access creates artificial scarcity and limits competition which may have a negative impact on cost and speed to market.
- A combination of licensed, unlicensed, and lightly licensed access to radio spectrum is required as this will maximize innovation, flexibility and competition, as well as spur more rapid deployment of 5G networks and services.
- The technical ability to coordinate spectrum use and protect incumbent users from interference is well established. DSA recommends that automated frequency coordination systems are deployed to facilitate such shared access and describes how the automated spectrum access system that underpins the Citizens Broadband Radio Service (CBRS) has enabled new users to share radio spectrum in the 3.5 GHz band with the existing users without causing any reported interference to the existing users.
- In addition to the 3.5 GHz band, DSA suggests making the entire 6 GHz band (5925 to 7125 MHz) available on a shared “license-exempt” basis.
- DSA encourages CRA to follow a multi-tiered approach to enable different spectrum access and protection options. Licensees operating in the top tier would be protected from users operating in lower tiers. Users in the middle tier would have no protection from users in the top tier but must protect each other. Users in the bottom tier must protect the upper tiers whilst having no protection from the upper tier users or other users operating in the bottom tier. Further, DSA recommends that CRA implements a “use it or share it” policy on spectrum licensed to mobile operators as this will reduce the risk of creating artificial scarcity.

2. GSM Association (GSMA)

- The views expressed on each of the three options are as follows:
  - Option 1: This option is fully supported. The public mobile operators can address the needs of Enterprises.
  - Option 2: This option is not supported as it represents an inefficient use of spectrum and GSMA questions the knowledge and ability of Enterprises to implement and fund a 5G private mobile network, as well as prevent and deal with radio interference. However, DSA also states that “where industries require access to specific licensed bands, they can do so through the spectrum assigned to mobile

operators via sharing leasing agreements, for example".

- Option 3: This option is not supported as the Qatar mobile market is mature and an additional entrant is not warranted due to market saturation. Further, an additional player may not bring user benefits or be financially stable in the mid-term.

- Further, Options 2 or 3 would prevent Qatar from realizing the full economic benefit of 5G. This position is supported by the following:
  - A GSMA study[2] "showed that up to USD 120 per capita could be lost in GDP if 100 MHz in the 3.5 GHz band were reserved" for Enterprises.
  - A GSMA study[3] claims that "up to 40% of the expected benefits of mid-band 5G could be lost if no additional mid-band spectrum is assigned to mobile services".
- Licensing spectrum to Enterprises through dedicated "set-aside" spectrum in core mobile bands is not the best option as it risks underuse, can undermine fair spectrum awards and can result in slower rollouts, worse performance and reduced coverage of public mobile networks. Enterprises can share or lease radio spectrum assigned to mobile operators.

3. Hewlett Packard Enterprise (HPE)

- The views expressed on each of the three options are as follows:
  - Option 1: This option is strongly supported.
  - Option 2: This option is also strongly supported with spectrum assigned directly to the Enterprise.
  - Option 3: No strong opinion but, if adopted, this option should not prohibit Option 1 or 2.
- Options 1 and 2 are preferred as they provide for a range of deployment and operational models.
- The following inputs are provided concerning international experience with making spectrum available for 5G private mobile networks:
  - HPE believes that the following information regarding experience in the USA

[2] https://www.gsma.com/spectrum/resources/mobile-spectrum-maximising-the-socio-economic-benefits/
[3] https://www.gsma.com/spectrum/resources/mid-band-5g-spectrum-benefits/

demonstrates that flexible schemes can be used successfully to make spectrum available to Enterprises for private networks:

- In addition to the licenses awarded by auction as mentioned in the Consultation Document, Enterprises and other organizations may access CBRS spectrum across the whole 3550 – 3700 MHz band via the General Authorized Access (GAA) scheme.
- Under the GAA scheme, Enterprises and other organizations can use radio spectrum at any time and location so long as the use does not interfere with higher priority users i.e., Tier 1 users (incumbents) and Tier 2 users (the above licenses awarded by auction). This is facilitated by dynamic frequency coordination and assignment by the Spectrum Access System (SAS) databases.
- Examples of sectors where private networks have been deployed under the GAA include, schools and universities, smart cities, oil and gas, retail, hospitality, healthcare, military and agriculture.

– Regarding spectrum access in Europe, the European Commission has mandated a study into the technical conditions under which the 3.8 – 4.2 GHz band can be shared by users, including for the provision of broadband private networks. It is anticipated that the outcome will recommend making spectrum available to Enterprises for the self-provision of private mobile networks following the examples of France, Germany, the Netherlands, Sweden and the UK.

– HPE recommends making spectrum available for private networks in the 3.4 – 4.2 GHz band due to the growing equipment ecosystem.

4. Huawei

- The views expressed on each of the three options are as follows.
  – Option 1: This option is favored for the following reasons:
    - The existing licensed operators have the expertise required to deploy and operate 5G networks;
    - It supports the efficient use of spectrum and infrastructure; and
    - It should be more cost effective due to economies of scale.

- Option 2: No support is given for this option for the following reasons:
  - It will result in fragmented and underutilized spectrum (lower spectrum efficiency), may impact on future spectrum availability for public mobile operators and will lead to radio interference;
  - The lack of Enterprise knowhow may result in failure to realize the objectives for the network;

    In support of these first two arguments, Huawei stated that only a small number of licenses have been issued to Enterprises in countries (for example in Germany and the UK) where dedicated spectrum has been made available, and there has been limited usage, with delays in deployment and coexistence issues;
  - It may slow down the future growth of public mobile operator's networks and reduce their appetite to invest in future technologies; and
  - It may result in higher costs per bit for Enterprises and consumers.
- Option 3: Some limited support is shown for this option but, in comparison with Option 1, it is considered to lack economies of scale and spectrum efficiency and concerns are expressed that the business case for B2B services is not proven. And further, Huawei considers that all spectrum related concerns mentioned as arguments against Option 2, also apply to Option 3.

- Regarding spectrum matters, Huawei suggests that:
  - CRA considers enabling spectrum leasing between the existing public mobile operators and Enterprises.
  - The 6425 – 7125 MHz band should be made available for licensed use to support 5G services and that this additional spectrum would enable public mobile operators to satisfy future needs of Enterprises for 5G private mobile network services.
  - Enterprises can operate in "unlicensed" spectrum if this is consistent with their QoS expectations.
  - As spectrum is becoming scarce, CRA should "allocate" spectrum only after careful technical analysis and study of market demand and socio-economic benefits.
  - Existing 5G public mobile operators should be given priority when licensing radio

spectrum so that they can serve both Enterprises and consumers. In the event that CRA decides to make spectrum available to Enterprises for 5G private mobile networks, then the following is recommended:

- Enterprises should justify why the 5G services of existing public mobile operators cannot be used and their resulting spectrum requirements very clearly defined.
- If spectrum is made available to Enterprises, it should be in bands not in demand by the existing public mobile operators and with a clear obligation not to interfere with the existing public mobile operators.
- CRA is invited to reserve enough spectrum in large contiguous blocks and on a nation-wide basis for existing public mobile operators (as per GSMA – after 2025, 2 GHz will be required in mid-band spectrum alone).
- If spectrum is proposed for 5G private mobile networks, then it should be assigned by auction and the existing public mobile operators should be able to participate in the auction. CRA might apply "use it or lose it" conditions to any spectrum assigned for 5G private mobile networks.

- From a supplier perspective, Huawei states that it is possible for a public mobile operator to deploy a 5G private mobile network that is dedicated to a single Enterprise, but this would result in much higher costs.

5. Intel Corporation (Intel)

- Intel's response provides a general overview of the emergence and benefits of Industry 4.0, and the importance of 5G private mobile networks to the realization of the promised benefits.
- Intel supports all three options and states that more than one may be adopted according to the situation in Qatar, whilst taking other case studies and benchmarks into account.

6. Ministry of Interior – Telecommunications Department (MoI-Telecom Department)

- Restricting the options to a single approach is considered to "limit the country's capabilities in the deployment of 5G nationwide". No explicit comments on, or references to, Options 2 or 3 are made in the response, however, support is expressed

for the licensing of private mobile operators, with the supporting arguments appearing to favor the proposed Option 2. MoI-Telecom Department states that it considers it essential to license private mobile operators such as the MoI-Telecom Department. Such a license should enable MoI-Telecom Department to provide services to other public safety agencies and first responders, utility agencies and other government agencies. This would assist in establishing a business case to incentivize vendors to better address the specific needs of these user groups. And further, such licensing should be restricted to organizations such as the MoI-Telecom Department.

- 5G services are not currently provided but there is the potential to do so to support the digitization across all government agencies and utility service providers.
- MoI-Telecom Department has worked to extend its coverage to areas where public mobile networks are not available, so that critical agencies can benefit from this coverage.
- If licensed to provide 5G private mobile networks, MoI-Telecom Department would be better able to fulfill its "goals and strategies to provide highly secure, highly reliable 4G and 5G services".
- It would be completely achievable for MoI-Telecom Department to provide private mobile networks for all government agencies, utility service providers and any agency/organization of national importance.

7. Nokia

- No explicit opinion related to the three options for the implementation of 5G private mobile networks is offered. However, Nokia does recommend taking into consideration new international trends to allow the deployment of Very High Speed Mobile using internationally standardized 3GPP networks as this would align with the growing demand for speeds, while enabling innovation and the introduction of new technological solutions to meet the needs of different stakeholders.
- The following contribution is made concerning radio spectrum matters:
  - Regarding spectrum used for 5G private mobile networks, Nokia shares that:
    - 3.3 to 4.2 GHz is typically used for 5G private mobile networks. An assigned bandwidth of up to 100 MHz is currently suitable for industrial use but it is

possible that this may not be sufficient in the future. However, it must be taken into account that this band is also important for public mobile networks (who also should each have 100 MHz of contiguous spectrum per operator).

- 2.6 GHz is used by Enterprises in France.
- 2.3 GHz is partially used by Enterprises in Finland and the UK.
- 4.0 – 4.2 GHz is proposed to be made available to Enterprises in Saudi Arabia via a light licensing regime.
- 26 and 28 GHz bands are being considered in some countries.
- Regarding the use of the 900 MHz band by GSM-R, CRA should consider the envisaged extension of the GSM-R band to 2x5.6 MHz and also the additional 10 MHz between 1900 – 1910 MHz as standardized in 3GPP.

– Regarding how spectrum for 5G private mobile networks should be licensed, Nokia states that CRA should set up simple transparent processes that are open to all stakeholders, with well-defined rules and obligations and short approval cycles. As the cost of establishing a 5G private mobile network will be significant, Nokia also shares the following.

- Assign the licenses for sufficient duration to allow recovery of the investment. In Ireland and Germany this is 15 to 20 years with the possibility of renewal and in the UK the term is indefinite.
- The conditions attached to the license must be transparent and predictable to enable an informed investment decision.

– Each frequency band has specific characteristics which will impact the kinds of services that they may support in terms of coverage and capacity.

– Nokia adds that it has observed the growth in the use of the 400 MHz band by critical networks (i.e., those concerned with national security and public safety etc.) and that this has been driven by the propagation characteristics of the band which enable nationwide coverage with the fewest base stations and supporting infrastructure, thus minimizing costs.

8. Ooredoo Qatar Q.P.S.C. (Ooredoo)

- The following general concerns regarding the consultation are expressed:
  - Stakeholders are required to comment on a consultation in isolation and in the absence of information on the direction in which CRA is heading.
  - The Consultation Document does not identify the need or market failure that CRA wishes to address.
  - The impact assessment in the Consultation Document is limited to qualitative aspects only and does not include a quantitative evaluation (i.e., a cost-benefit analysis of the options).
- The need for 5G private mobile networks that are independent of public networks is questioned. Ooredoo considers the opportunity afforded to serve industry customers with 5G private mobile network services to be one of the major justifications for its investment in 5G public networks. Therefore, any scenario other than Option 1 would undermine the development and performance of 5G public mobile networks and lead to higher prices for public mobile services. The views expressed on each of the three options are summarized as follows:
  - Option 1: Only this option, with both radio and non-radio elements provided by the 5G public mobile operator, would efficiently and effectively protect the interests of the Enterprises and also promote the development of the sector and of the country as a whole. Ooredoo states that this option would help deliver:
    - For Enterprises: Cost efficiency and continuous advancement in technology and solutions.
    - For public mobile operators: Further investment and innovation.
    - For Qatar: Full enjoyment of national, social and economic development.
  - Option 2: 5G networks are complex to design, deploy and operate, and it would take longer for an Enterprise to realize such a network under this option compared to Option 1. Further, Option 2 is contrary to Option 1 as it would “likely prevent” public mobile operators from achieving coverage and QoS targets set by CRA. Therefore, Option 2 would lead to many negative externalities, including:
    - Higher set-up costs for Enterprises.

- Spectrum rationing which would make it costlier (perhaps impossible) to meet QoS and coverage obligations.
- Interference (including TDD network synchronization and cross-border issues), inefficient spectrum use, spectrum fragmentation and scarcity. Setting aside spectrum for Enterprises may imply “misuse” of the band as the Enterprise may only operate in a small number of places and leave the band unused in other areas.

  Ooredoo suggests that allowing public mobile operators to lease spectrum to Enterprises (as in Finland, Sweden and the UK) could be a feasible path to overcoming the interference issues.
- Fragmentation in the market and stagnation in public mobile operator financial performance and reduction in investments and technological innovation with resulting negative impacts on users and the economy.
- Security issues

  Further, Ooredoo states that the security benefit identified by CRA as arising from keeping data within a private mobile network under Option 2 is not consistent with CRA’s Cloud Policy Framework, which states that encryption is an effective means of protecting data.

– Option 3: Ooredoo states that this option has significant cost/efficiency disadvantages compared to Option 1 and would result in the same fragmentation and spectrum issues raised for Option 2. Further, 5G private mobile networks implemented under this option would potentially miss out on new features when they are adopted by 3GPP because 5G private mobile networks would not benefit from the updates in network technologies or new features and capabilities which would be delivered by the “normal” evolution of 5G public mobile networks and services.

  Ooredoo considers that this option would add a new element to the value chain which would increase costs and complexity and may result in the deterioration of public mobile operator performance, as well as limit accountability amongst the two players involved in the service (i.e., the public mobile operator and the entity licensed under this option).

- The B2C segment is considered to be almost saturated and therefore the B2B segment represents the only possible area for growth.
- 5G private mobile network services are not currently offered by Ooredoo in Qatar but Ooredoo plans to conduct testing in a lab environment. Ooredoo is investing in a 5G standalone network that will support network slicing and states that a conducive regulatory environment and assurances regarding spectrum availability (spectrum roadmap) are required to encourage such investments.
- Ooredoo's 5G network does not currently support network slicing. The feature will be introduced in the "medium" term in all areas covered by 5G and in the meantime it has successfully tested an "alternative 5G feature called millimeter wave, which provides similar functionality to network slicing".
- A standalone 5G private mobile network would "definitely be deployed for a specific customer" should that be the customer's request. Additionally, Ooredoo stated that private mobile networks would be deployed in accordance with its policies and procedures.
- It is considered not advisable to license radio spectrum to Enterprises for 5G private mobile networks, citing as support the fact that such networks are provided exclusively by Etisalat in the UAE. Further, the bands most suited to establishing coverage (800, 1800, 2300, 2600, 3500 MHz bands) are almost fully occupied, thus the Enterprise or new licensee would need to operate in the 26 or 60 GHz bands and will struggle to establish coverage or to source suitable handsets.
- If CRA determines to make spectrum available exclusively for 5G private mobile networks, then it should:
  - Perform a cost-benefit analysis.
  - Consider the impact on the competitive landscape of licensing spectrum on a first-come, first-served basis and take measures to deal with entities competing for spectrum.
- If CRA determines that private and public 5G mobile networks should share the bands, then CRA should:
  - Promote an agreement on network synchronization.
  - Put in place procedures to prevent or deal with interference at a national level and

with neighbors.

9. QatarEnergy

- The views expressed on each of the three options are as follows:
  - Option 1: Does not meet QatarEnergy's cyber security or SLA requirements.
  - Option 2: Is in line with QatarEnergy's requirements and QatarEnergy agrees with CRA's assessment of the advantages that this option offers.
  - Option 3: Does not meet QatarEnergy's cyber security or SLA requirements.
- Option 2 is the preferred deployment scenario (and QatarEnergy is not aware of a better alternative deployment scenario). The reasons for this include:
  - It has experienced staff and will hire any additional expertise that may be required to build, operate and maintain its own dedicated 5G private mobile network.
  - It has a clear vision for the transformation of its industrial communications using a 5G private mobile network to deliver its cyber security and SLA requirements which it believes can only be realized by self-provision.
- Option 3 would have similar issues to Option 1 which include:
  - Its cyber security policies do not allow its sensitive data to pass through third-party networks.
  - A third-party service provider will not be able to support the required SLAs or control and monitoring of QoS in off-shore locations.
- QatarEnergy wishes to deploy the 5G private mobile network as soon as possible.
- Given the offshore operational areas, long range communications requirement and limited infrastructure, QatarEnergy would prefer low or mid-band spectrum. Preliminary estimates indicate that at least 100 MHz will be required (although 2 x 100 MHz would be preferred).
- QatarEnergy requests CRA to investigate offshore and onshore spectrum for 5G private mobile networks separately.

10. Qatar Satellite Company (Es'hailSat)

- A neutral position is expressed regarding the three options presented and Es'hailSat could not suggest an alternative option for the provision of 5G private networks. However, Es'hailSat stated that preference should be given to the existing public telecommunications service providers.
- It is considered that Option 3 would bring competition to the market but any decision regarding a solution would be based on the merits of the solution on offer.
- "Deep concerns" are expressed regarding which frequency bands would be "allocated" for 5G private mobile networks. Es'hailSat strongly opposes the use of Ku and Ka bands as it is actively operating in these bands. Es'hailSat stated that CRA should ensure the protection of incumbent services in Qatar.
- Es'hailSat is not currently considering deploying a 5G private mobile network.

11. QTerminals L.L.C. (QTerminals)

- The following views are expressed on each of the proposed options.
  - Option 1: This is already available, is costly and does not scale-up.
  - Option 2: This option is particularly suitable for terminals and ports and is cost effective and does scale-up.
  - Option 3: Is close to Option 1 and will not reduce costs significantly. However, it is further stated that a new licensee might provide a better service and competitive tariffs, with a positive impact on the development of telecommunications in Qatar.
- Option 2 is preferred as it enables QTerminals to have full control of security, QoS, configuration and cost.
- There is no alternative deployment scenario that would be preferred.
- The plan is to have the 5G private mobile network operational as soon as possible – preferably in 2023.
- Preference is expressed to operate in spectrum between 3.3 – 3.4 MHz or in the 26 GHz band.
- Interest is expressed in hearing more from CRA about spectrum licensing for 5G private

networks including the process so that it may obtain the license as soon as possible.

12. Qualcomm International Incorporated (Qualcomm)

- It is agreed that different options for the implementation of 5G private mobile networks could be adopted and the best choice for a given Enterprise would depend on that Enterprise's requirements. Qualcomm therefore encourages CRA to adopt more than one option.
- The following comments are made regarding radio spectrum matters:
  - Making spectrum available is key to opening the 5G private mobile network market and Qualcomm believes that, in the Middle East, there is a significant opportunity for private mobile networks to support mining, energy, manufacturing, transportation and ports.
  - Support is expressed for CRA's stated intention (should options 2 or 3 be adopted) to establish eligibility criteria, assignment processes and appropriate spectrum licenses to enable access to spectrum. CRA is reminded that regulatory certainty is key for all parties and procedures for the use of spectrum must be objective, timely, transparent and non-discriminatory.
  - CRA is encouraged to consider mmWave bands for Enterprise use.
  - In Europe, regulators are making dedicated spectrum available for 5G private mobile networks. The 3.8 – 4.2 MHz and 26 GHz bands are widely being considered.
  - In areas where public mobile operators are not planning or able to use spectrum assigned to them, some regulators are considering use-it-or-lease-it, use-it-or-share-it, or use-it-or-lose-it mechanisms to ensure efficient utilization of spectrum. For example, in Denmark, public mobile operators are subject to a regulatory obligation to either provide a 5G private mobile network service, or lease spectrum in the 3.74 – 3.8 MHz band to the Enterprise in the specific area.

13. SITA Information Technology Services and Consultancy Doha L.L.C. (SITA)

- The benefits and concerns associated with each of the options are captured in the consultation document.

- Option 2 is preferred from the perspective of giving Enterprises flexibility, but Option 3 is preferred from the perspective of facilitating the provision of telecommunications services amongst the air transport industry.
- SITA would utilize the services of a provider licensed under Option 3. The reasons for this include:
  - A dedicated 5G private mobile network means greater autonomy which would enhance operational efficiency and awareness and passenger experience, whilst reducing the carbon footprint and operational costs. A dedicated 5G private mobile network is better able to address the challenges of increased digitization at airports.
  - A purpose-built 5G private mobile network would enable the realization of operational goals, for example, an edge core would ensure sensitive data remains secure on the premises, provide reliability and the low latency that enables new services.
  - With a dedicated private mobile network, the Enterprise has independence from the demands placed on the public network by passengers, i.e., rising passenger demands degrades the Enterprise operational service.
  - Removing operational airport services from the public network allows the public network to provide more capacity to passengers.
- No alternative approach would be preferred to options 2 or 3.
- SITA wishes to have a 5G private mobile network operational in 2023.
- The following comments are made regarding radio spectrum matters:
  - It is recommended to use at least 100 MHz of contiguous spectrum and SITA states that the following bands are used by Enterprises in other countries:
    - 2.6 GHz is used in France.
    - 2.3 GHz is used in Finland and the UK (but not the entire band).
    - 26 GHz and 28 GHz (no example countries are given).
  - Each frequency band has specific characteristics which will impact the kinds of service that they may support in terms of coverage and capacity.
  - Regarding how spectrum for 5G private mobile networks should be licensed, SITA

states that CRA may consider simple application processes with short approval cycles and:

  - Assign the licenses for 15 to 20 years with the possibility of renewal such as in Ireland and Germany, or alternatively as in the UK where the term is indefinite.
  - The conditions attached to the license must be transparent and predictable to enable an informed investment decision.

- SITA would appreciate the following from CRA:
  - The adoption of transparent processes.
  - The ability to request spectrum online on behalf of customers.
  - Bring parties together for the collective utilization of services amongst the air transport industry.
  - Recognition that SITA's interest is in operating the network and service on behalf of its customers who remain the licensee.

14. Viasat Inc. (Viasat)

- Viasat focuses on the spectrum issues and, in summary, expresses concern that CRA should take into account the fact that critical satellite services operate in the Ka-band and in particular between 27.5 – 29.5 GHz (i.e., the 28 GHz band) and CRA is urged not to identify this spectrum for terrestrial 5G, including 5G private mobile networks. Viasat's supporting arguments are provided below:
  - Satellite broadband services require access to the entire 28 GHz band.
  - They provide speeds of up to 1 Gbit/s and can uniquely serve a broad range of customers and use cases, including in remote locations and when the customer is not stationary.
  - The ITU has recognized that the introduction of terrestrial 5G should not constrain 28 GHz satellite broadband services and, consistent with this, the ITU has not included the 28 GHz band as a candidate band to be studied for terrestrial 5G.
  - Terrestrial 5G is incompatible with existing satellite use of the 28GHz band, i.e., 5G terrestrial services and satellite broadband services are incompatible in the same band – "they cannot share". This has been demonstrated by many studies.

- Vast amounts of spectrum are available for terrestrial 5G outside of the 28 GHz band and should CRA decide to add to this by making mmWave spectrum available to Enterprises for 5G private mobile networks, then the 26 GHz band provides sufficient spectrum to accommodate multiple licensees.

15. Vodafone Qatar P.Q.S.C. (Vodafone)

- Since the primary issue of this consultation is whether or not spectrum should be made available to Enterprises or a new licensee for the provision of 5G private mobile networks, Vodafone's main request to CRA is that clear spectrum policy guidelines be set out, implemented and enforced. This should include:
  - The main and secondary objectives.
  - A full analysis and evidence to support the decision made, including a detailed impact assessment/cost-benefit analysis.
  - A proper consultative process.
- The Consultation Document does not identify the market failure that CRA wishes to address.
- The benchmark countries shared by CRA all have larger land masses and therefore have remote areas that are more difficult and costly to cover with 5G mobile networks and their 5G coverage is lagging behind Qatar which is a global leader.
- Vodafone refers CRA to the GSMA publication "5G Use Cases for Vertical China 2021" which concludes that setting aside spectrum for verticals in priority 5G spectrum bands could jeopardize the success of public 5G services and may waste spectrum. Sharing approaches such as leasing are better.
- The following opinions were expressed about each of the proposed implementation options:
  - Option 1 is the only suitable option for Qatar and the entire network (radio and core) should be provided by the 5G public mobile operator in order to avoid security challenges and coordination issues. The following comments are offered in support of this view:
    - Vodafone's extensive experience of operating its 5G public mobile network would allow the Enterprise to focus on its core business.

- Option 1 leads to greater spectrum efficiency and reduces the complexity of spectrum management and the threat of interference.
- Option 1 simplifies the tasks of the security agencies regarding access to private mobile networks as the required interfaces are already in place with the public mobile operators.
- Vodafone's investment in its 5G public mobile network means that it would be more cost effective to take 5G private mobile network services from Vodafone than for the Enterprise to establish a separate standalone 5G private mobile network.

– Option 2: Vodafone does not support this option as it has invested extensively in its 5G network to meet QoS and coverage obligations set by CRA and is able to meet the needs of Enterprises. Allowing Enterprises to self-provide will remove part of the market and undermine Vodafone's ability to capitalize on its investment. In addition, Vodafone refers to the inverse of all the points made above in support of Option 1.

– Option 3: Vodafone considers this option to be not required in Qatar as Vodafone is able to meet the needs of Enterprises and it is also strongly against a 3rd licensed mobile network operator in Qatar. Further, Vodafone states:

- This option would deny Vodafone a significant opportunity to capitalize on investments made in its 5G mobile network.
- That such a licensee would seek out the prime business opportunities only and would adversely affect the telecoms market and consumers.
- In the interests of non-discrimination, such a licensee would have to pay a license award fee commensurate with the potential market impact and also comply with the applicable regulatory framework.
- The advantage that the Enterprise would not need the required skills to establish and operate a 5G private mobile network can also be realized under Option 1.
- Vodafone has both consumer and Enterprise departments and therefore it is already focused on serving the needs of Enterprises.
- CRA would need to define a new market for competition purposes. However, CRA has not provided any evidence of market failure as a justification for the

new licensee.

- This option would result in lower spectrum efficiency, increased risk of interference and more complicated spectrum management.

- Vodafone is offering 5G private mobile network services to customers and is actively engaging with potential customers for these services.
- So far, no 5G private mobile networks have been provided but Vodafone is ready to meet the demand from Enterprises.
- Network slicing capabilities are planned for 2023 and it is not planned to limit slicing to any specific areas.
- Vodafone is not in favor of 5G public mobile operators providing standalone, dedicated 5G private mobile networks as this is not necessary with network slicing. Further, this option would require spectrum to be granted to the Enterprise, which is effectively Option 2, which Vodafone does not support.
- The awarding of spectrum for 5G private mobile networks to any party other than the existing public mobile operators is not supported.

3 Compiled Summaries of Comments Received

3.1 High-level summary of comments by respondent

Table 1 below provides a high-level summary of the responses received from stakeholders (listed in alphabetical order):

Respondent	High-level summary of comments	Preferred Option
DSA	DSA is supportive of all three options and its response is very much focused on making spectrum accessible to as many users as possible through sharing mechanisms.	All
Es'hailSat	Es'hailSat states that it strongly opposes the use of Ku and Ka spectrum bands for 5G private mobile networks as it is actively operating in these bands and that incumbent spectrum users should be protected. Preference should be given to the existing public	No preference

Respondent	High-level summary of comments	Preferred Option
	telecommunications service providers but, other than this, Es'hailSat is neutral on all options.	
GSMA	The GSMA response is very much focused on the spectrum licensing aspects of the three options: • Option 1 is preferred because it implies more spectrum is available for the public mobile operators. • Option 2 is not supported but is considered to be viable on the basis of carefully planned sharing or leasing of spectrum that is assigned to the public mobile operators. • Option 3 is perceived not to offer any benefits over Option 1 or 2.	Option 1
HPE	HPE expresses strong support for options 1 and 2, and shares examples of spectrum being made available to Enterprises for self-provision of 5G private mobile networks.	Options 1 and 2
Huawei	Huawei clearly supports Option 1 and considers Option 2 unnecessary as the 5G services of the existing public mobile operators can address the needs of Enterprises. Huawei shows some limited support for Option 3 but considers that Option 3 offers no benefits over Option 1 and, further, considers the business case for Option 3 to be unproven.	Option 1
Intel	Intel supports all three options and states that more than one may be adopted according to the situation in Qatar.	All
MoI-Telecom Department	MoI-Telecom Department states that Option 1 is too limiting and it is essential that it be awarded a license to provide private mobile services to other public safety agencies and first responders, utility agencies and other government agencies (and that no other 5G private mobile network licenses should be awarded).	Option 2

Respondent	High-level summary of comments	Preferred Option
Nokia	Nokia does not express an opinion regarding any of the options but shares information on spectrum assignment to Enterprises for self-provision of 5G private mobile networks.	No opinion
Ooredoo	Ooredoo strongly supports Option 1 and it is strongly opposed to options 2 and 3. Any scenario other than Option 1 would undermine the development and performance of 5G public mobile networks and lead to higher prices for public mobile services.	Option 1
QatarEnergy	QatarEnergy's clearly stated preference is for Option 2 so that it may self-provide a 5G private mobile network in accordance with its cyber security polices and SLA/QoS requirements.	Option 2
QTerminals	QTerminals clearly states a preference for Option 2 as this would be particularly suitable for terminals and ports and is cost effective and scales-up.	Option 2
Qualcomm	Qualcomm considers that each of the three options has its own merits, depending on the requirements of the network to be deployed.	All
SITA	SITA prefers Option 2 from the perspective of giving Enterprises flexibility, but Option 3 is preferred from the perspective of facilitating the provision of telecommunications services amongst the air transport industry.	Option 2 or 3
Viasat	Viasat does not express any opinion regarding the three options. However, it argues strongly that CRA should not make any spectrum in the 28 GHz band available for terrestrial 5G services.	No opinion
Vodafone	Vodafone strongly supports Option 1 and it is strongly opposed to options 2 and 3. The entire network (radio and core) should be provided by the 5G public mobile	Option 1

Respondent	High-level summary of comments	Preferred Option
	operator in order to avoid security challenges and coordination issues.	

Table 1: High-level summary of the responses

3.2 Summary of preference by Option and by respondent

The preference (supportive, against, or neutral) of the stakeholders regarding each of the three Options is shown in Table 2 below:

Options	Supportive	Against	Neutral
Option 1	1. Ooredoo 2. Vodafone 3. DSA 4. GSMA 5. HPE 6. Huawei 7. Intel 8. Qualcomm	1. MoI-Telecom 2. QatarEnergy 3. QTerminals *Note: These stakeholders are not "against" Option 1 being available, but they are against it being the only option available.*	1. Es'hailSat 2. Nokia 3. SITA 4. Viasat
Option 2	1. DSA 2. HPE 3. Intel 4. MoI-Telecom 5. QatarEnergy 6. QTerminals 7. Qualcomm 8. SITA	1. Ooredoo 2. Vodafone 3. GSMA 4. Huawei	1. Es'hailSat 2. Nokia 3. Viasat
Option 3	1. DSA 2. Intel 3. Qualcomm	1. Ooredoo 2. Vodafone 3. GSMA	1. Es'hailSat 2. HPE 3. Huawei

	4. SITA	4. MoI-Telecom 5. QatarEnergy 6. QTerminals	4. Nokia 5. Viasat

Table 2: Summary of the preference of the stakeholders

3.3 Summary of proponent/opponent comments for Option 1

Proponents

The summary of key comments expressed by stakeholders who are supportive of Option 1 are shown in the Table 3 below:

Proponent	Comments
GSMA	The public mobile operators can address the needs of Enterprises.
Huawei	The existing licensed operators have the expertise required to deploy and operate 5G networks.
	It supports the efficient use of spectrum and infrastructure.
	It should be more cost effective due to economies of scale.
Ooredoo	Would efficiently and effectively protect the interests of the Enterprises and also promote the development of the sector and of the country as a whole.
	Cost efficiency, advancement in technology, further investment and innovation.
Vodafone	Leads to greater spectrum efficiency and reduces the complexity of spectrum management.
	It would be more cost effective to take 5G private mobile network services from Vodafone than for the Enterprise to establish a separate standalone 5G private mobile network.

Table 3: Summary of key comments expressed in support of Option 1

Opponents

The summary of key comments expressed by stakeholders who are not supportive of Option 1 (or who do not want this to be the only option available) are shown in Table 4 below:

Opponent	Comments
DSA	Single option may have negative impact on cost and speed to market.
HPE	Having more than 1 option would provide a range of deployment and operational models.
MOI–Telecom	Having only this option would limit the country's capabilities in the deployment of 5G nationwide.
QatarEnergy	Does not meet QatarEnergy's cyber security or SLA requirements.
QTerminals	It is costly and does not scale-up.

Table 4: Summary of key comments expressed which are not supportive of Option 1

3.4 Summary of proponent/opponent comments for Option 2

Proponents

The summary of key comments expressed by stakeholders who are supportive of Option 2 are shown in the Table 5 below:

Proponent	Comments
QatarEnergy	It is in line with QatarEnergy's requirements.
	It has experienced staff and will hire any additional expertise that may be required to build, operate and maintain its own dedicated 5G private mobile network.
QTerminals	It is preferred as it enables QTerminals to have full control of security, QoS, configuration and cost.
MOI	Should be restricted to provide services to other public safety agencies and first responders, utility agencies and other government agencies.
	It would be completely achievable for MoI to provide private mobile networks for all government agencies, utility service providers and any agency/organization of national importance.
SITA	Would give Enterprises flexibility.

Table 5: Summary of key comments expressed in support of Option 2

Opponents

The summary of key comments expressed by stakeholders who are not supportive of Option 2 are shown in Table 6 below:

Opponent	Comments
GSMA	Inefficient use of spectrum.
	Concerns about the knowledge and ability of Enterprises to implement and fund a 5G private mobile network.
Huawei	It will result in fragmented and underutilized spectrum.
	Lack of Enterprise knowhow.
	It may slow down the future growth of public mobile operator's networks and reduce their appetite to invest in future technologies.
Ooredoo	No proper cost-benefit analysis of the options.
	Networks are complex to design, deploy and operate.
	Prevent public mobile operators from achieving coverage and QoS targets.
	CRA's statement that one of the benefits of Option 2 is "enhanced security" is not consistent with CRA's Cloud Policy Framework.
	Ooredoo is investing in a 5G standalone network that will support network slicing and states that a conducive regulatory environment and assurances regarding spectrum availability (spectrum roadmap) are required to encourage such investments.
	Ooredoo explores alternative 5G feature called millimeter wave, which provides similar functionality to network slicing.
Vodafone	Enterprise to focus on its core business.
	Self-provision will remove part of the market and undermine ability to capitalize on investment.

Table 6: Summary of key comments expressed which are not supportive of Option 2

3.5 Summary of proponent/opponent comments for Option 3

Proponents

The summary of key comments expressed by stakeholders who are supportive of Option 3 are

shown in Table 7 below:

Proponent	Comments
SITA	This option would facilitate the provision of telecommunications services amongst the air transport industry.
	A dedicated 5G private mobile network means greater autonomy which would enhance operational efficiency and awareness and passenger experience, whilst reducing the carbon footprint and operational costs.
	A dedicated 5G private mobile network is better able to address the challenges of increased digitization at airports.

Table 7: Summary of the key comments expressed in support of Option 3

Opponents

The summary of key comments expressed by stakeholders who are not supportive of Option 3 are shown in Table 8 below:

Opponent	Comments
GSMA	Not supported as the Qatar mobile market is mature and an additional entrant is not warranted due to market saturation.
Huawei	It is considered to lack economies of scale and spectrum efficiency and concerns are expressed that the business case for B2B services is not proven.
Ooredoo	It has significant cost/efficiency disadvantages and would result in fragmentation and spectrum issues. It would add a new element to the value chain which would increase costs and complexity and may result in the deterioration of public mobile operator performance. Ooredoo is investing in a 5G standalone network that will support network slicing.
QatarEnergy	Its cyber security policies do not allow its sensitive data to pass through third-party networks.
QTerminals	Will not reduce costs significantly.
Vodafone	Would deny a significant opportunity to capitalize on investments made in its 5G mobile network. This option would result in lower spectrum efficiency, increased risk of interference and more complicated spectrum management.

	CRA would need to define a new market for competition purposes. However, CRA has not provided any evidence of market failure as a justification for the new licensee. This option is not necessary with the possibility of network slicing. The new licensee would seek out the prime business opportunities only and would adversely affect the telecoms market and consumers.

Table 8: Summary of key comments expressed which are not supportive of Option 3

4 Request for Further Information

Following the review of the consultation responses received, and in order to complete its information, CRA requested additional and specific information from the two public mobile operators and some large Enterprises in Qatar which had expressed their interest in self-providing 5G private mobile networks. The additional information received can be summarized as follows:

- The two public mobile operators reiterated their confidence that they can meet the requirements (e.g., security, QoS, etc.) of the Qatari Enterprises for private mobile networks using 5G technology, but they believed that the interested Enterprises should inform them about their specific needs and requirements in order for the mobile operators to be able to provide to them customized technical and commercial proposals.
- The relevant Enterprises informed CRA that they had already started discussions with the two mobile operators about their specific needs and requirements, and that the two mobile operators were interested in exploring commercial and technical solutions to meet those needs and requirements.

5 CRA Responses

Having carefully considered all the consultation responses from the stakeholders, CRA's responses are as follows:

5.1 Regarding the three Options

1. CRA is supportive of the provision of 5G private mobile network services by the existing public mobile operators and therefore is aligned with the views and comments

expressed by many stakeholders.

2. CRA notes the interest in self-providing 5G private mobile networks expressed by some of Qatar's largest Enterprises and that this interest is motivated by SLA/QoS, cyber security and scalability requirements, as well as concerns over costs.
3. CRA also notes the concerns expressed by some Enterprises regarding procuring 5G private mobile network services from the existing public mobile operators, as the only option available. The stated concerns include[4]:
    a. The 5G private mobile networks established using the 5G public mobile network may not be able to meet the Enterprise's cyber security requirements or policies (i.e., the Enterprises have concerns about transferring business sensitive data over a public 5G network);
    b. The public mobile operators may not be able to meet the specific SLA requirements of some Enterprises; and
    c. The 5G private mobile network services provided by the public mobile operators may be "costly".
4. However, those concerns were not substantiated by supporting proof or evidence. For example, the stated concerns were not the outcome of any discussions or other interactions between the relevant Enterprises and the public mobile operators in Qatar. On the contrary, these operators have expressed their confidence that they can meet the security and QoS requirements of the Qatari Enterprises for private mobile networks using 5G technology.
5. CRA believes that Option 2 should only be available to Enterprises that can prove that the public mobile operators cannot satisfy their business needs and requirements.
6. It is important to recognize that 5G is a connectivity technology that is not the goal itself but is a key part of a solution required by Enterprises. CRA wishes for Enterprises in Qatar to be able to access the most suitable solutions for their business needs and requirements through the public mobile operators.
7. CRA recognizes the argument that Option 1 has the potential to bring the benefits of "economies of scale". However, it is not for CRA to take this for granted; it is for the

[4] These concerns are as expressed by some stakeholders; they do not necessarily represent the views of CRA.

public mobile operators to use this advantage in attracting Enterprises by offering cost-effective, innovative and flexible solutions to Enterprises, and which meet the specific business and technical requirements of the Enterprises.

8. Option 3 is intended to authorize a new licensee to provide 5G private mobile network services to third party Enterprises. Under this option, the new licensee would both own and operate the 5G private mobile network. However, the business case for the licensee is unlikely to support the roll-out of a national 5G private mobile network and therefore the licensee would mainly be obliged to implement bespoke standalone networks. This would limit the opportunities for the licensee to benefit from economies of scale.
9. Moreover, it appears that Option 3 would offer few advantages over those of Options 1 and, given the limited support for Option 3 expressed by stakeholders, CRA considers that this option is not appropriate or required in Qatar at the current time.
10. CRA considers that the two public mobile operators are in a strong position to benefit from their investment in 5G networks (e.g., experience in the implementation and management of 5G networks, economies of scale, national coverage, etc.) to offer innovative and cost-effective solutions that address the needs and requirements of Enterprise.

5.2 Regarding the ownership and/or operation of a private network

No comments have been provided by stakeholders regarding the suitability or applicability of the existing "Class License to Own and/or Operate a Private Telecommunications Network[5]" (for Closed User Groups) as the means by which to authorise the operation of 5G private mobile networks. Therefore, at this stage, CRA sees no need to update that Class License.

5.3 Regarding licensing of radio spectrum to Enterprises for 5G private mobile networks

1. CRA notes that stakeholders have shared examples of different frequency bands and licensing mechanisms that have been deployed in other countries to enable Enterprises

[5] Version 3, issued on June 20, 2022.

to access radio spectrum for 5G private mobile networks.

2. CRA recognises that the use of class licenses, light licenses and regular individually licenses, as well as shared spectrum and leasing are all means through which radio spectrum is made available to Enterprises to establish 5G private mobile networks in different countries. If needed, CRA will consider how these might be used to make 5G radio spectrum available to Enterprises in Qatar, but any such consideration will be in the context of what is possible and appropriate for radio spectrum licensing in Qatar.
3. With respect to suggestions made by stakeholders regarding the use of specific radio spectrum bands by Enterprises for 5G private mobile networks, CRA's current position is as follows:
    - The 3.5 GHz band is currently assigned exclusively to the public mobile operators, meaning it cannot be shared with Enterprises and neither can it be made available via a General Authorized Access scheme.
    - A decision on making the entire 6 GHz band (5925 to 7125 MHz) available on a shared "license-exempt" basis or not will be made after the WRC-23.
    - A decision will be made after the WRC-23 regarding the future use of the 3.8 – 4.2 GHz band or any part thereof for 5G. The potential impact on the aeronautical service will also need to be taken into consideration before this band can be made available.
    - The 2.3 GHz band is currently planned to be used by the public mobile operators.
    - Re-farming of 2.6 GHz is required. The band is currently planned to be used by the public mobile operators in Qatar.

5.4 Regarding radio spectrum interference from Enterprise 5G private mobile networks

CRA is of the opinion that experience in benchmark countries, including the examples shared by stakeholders, demonstrates that with careful planning and licensing it will be possible to establish (if needed) a radio spectrum licensing regime that enables the release of radio spectrum to Enterprises for 5G private mobile network implementation without resulting in harmful interference or undermining the ability of the public mobile service providers to meet their license obligations.

5.5 CRA responses to the specific spectrum related comments

Table 9 below provides a summary of the comments made by each stakeholder on spectrum matters related to 5G private mobile networks along with the response of CRA:

Respondent	Spectrum comments	CRA response
DSA	New users to share radio spectrum in the 3.5 GHz band with the existing users.	This is not applicable as spectrum is assigned on an exclusive basis to public mobile operators.
	Making the entire 6 GHz band (5925 to 7125 MHz) available on a shared "license-exempt" basis.	A decision will be made on this matter after WRC-23. Implementation may take time (growing of the ecosystem). Shared license exempt may not be a favorable model for Enterprises or security agencies.
GSMA	Up to USD 120 per capita could be lost in GDP if 100 MHz in the 3.5 GHz band were reserved" for Enterprises.	Noted
	Licensing spectrum to Enterprises through dedicated "set-aside" spectrum in core mobile bands is not the best option as it risks underuse, can undermine fair spectrum awards and can result in slower rollouts, worse performance and reduced coverage of public mobile networks. Enterprises can share or lease radio spectrum assigned to mobile operators.	Noted
HPE	May access spectrum across the whole 3550 – 3700 MHz band via the General Authorized Access (GAA) scheme.	This is not applicable as spectrum is assigned on an exclusive basis to public mobile operators.
	European Commission has mandated a study into the technical conditions under which the 3.8 – 4.2 GHz band can be shared by users, including for the provision of broadband private networks.	A decision will be made after WRC-23. Implementation may take time (growing of the ecosystem).

Respondent	Spectrum comments	CRA response
	Making spectrum available for private networks in the 3.4 – 4.2 GHz band due to the growing equipment ecosystem.	CRA may consider 3.8 – 4.2 GHz or part of it after WRC-23 for 5G. Implementation may take time (growing of the ecosystem).
Huawei	CRA should consider enabling spectrum leasing between the existing public mobile operators and Enterprises.	This is not applicable as spectrum is assigned on an exclusive basis to public mobile operators.
	Enterprises can operate in “unlicensed” spectrum.	Shared license exempt may not be a favorable model for Enterprises or security agencies.
	If spectrum is proposed for 5G private mobile networks, then it should be assigned by auction and the existing public mobile operators should be able to participate in the auction.	This would require the amendment of the radio spectrum policy.
Nokia	3.3 to 4.2 GHz is typically used for 5G private mobile networks. Bandwidth of up to 100MHz.	CRA may consider 3.8 – 4.2 GHz or part of it after WRC-23 for 5G. However, implementation may take time (growing of the ecosystem).
	2.6 GHz is used by Enterprises in France.	This is not applicable in the current situation. However, re-farming of 2.6 GHz is needed. The band is currently planned to be used by the public mobile operators in Qatar.
	4.0 – 4.2 GHz is proposed to be made available to Enterprises in Saudi Arabia via a light licensing regime.	CRA may consider 3.8 – 4.2 GHz or part of it after WRC-23 for 5G. However, implementation may take time (growing of the ecosystem). The potential impact on the aeronautical service must be taken into consideration.
	26 and 28 GHz bands are being considered in some countries.	26 GHz band is currently planned to be used by the public mobile operators in Qatar.
	Regarding the use of the 900 MHz band by GSM-R, CRA should consider the envisaged extension of	This is not applicable.

Respondent	Spectrum comments	CRA response
	the GSM-R band to 2x5.6 MHz and also the additional 10 MHz between 1900 – 1910 MHz as standardized in 3GPP.	
QatarEnergy	Low or mid-band spectrum. Preliminary estimates indicate that at least 100MHz will be required (although 2 x 100 MHz would be preferred).	This is not applicable as spectrum is assigned on exclusive basis to public mobile operators.
QTerminals	In spectrum between 3.3 – 3.4 MHz or in the 26 GHz band.	The 3.3 – 3.4 GHz is currently allocated to Radiolocation Service and is used in Qatar for radar applications. 26 GHz band is currently planned to be used by the public mobile operators in Qatar.
Qualcomm	In Europe, regulators are making dedicated spectrum available for 5G private mobile networks. The 3.8 – 4.2 MHz and 26 GHz bands are widely being considered.	CRA may consider 3.8 – 4.2 GHz or part of it after WRC-23 for 5G. However, implementation may take time (growing of the ecosystem). The potential impact on the aeronautical service must be taken into consideration. 26 GHz band is currently planned to be used by the public mobile operators in Qatar.
	In areas where public mobile operators are not planning or able to use spectrum assigned to them, some regulators are considering use-it-or-lease-it, use-it-or-share-it or use-it-or-lose-it mechanisms to ensure efficient utilization of spectrum.	Noted.
SITA	It is recommended to use at least 100 MHz of contiguous spectrum. – 2.6 GHz is used in France. – 2.3 GHz is used in Finland and the UK (but not the entire band). – 26 GHz and 28 GHz (no example countries are given).	CRA may consider 3.8 – 4.2 GHz or part of it after WRC-23 for 5G. However, implementation may take time (growing of the ecosystem). Potential impact on the aeronautical service must be taken into consideration.

Respondent	Spectrum comments	CRA response
		The 2.3 GHz band is currently planned to be used by the public mobile operators in Qatar. 26 GHz band is currently planned to be used by the public mobile operators in Qatar.

Table 9: Summary of spectrum comments and CRA responses

6 CRA's Final Position

After a thorough assessment of the subject from all aspects and taking into consideration the stakeholders' responses, the final position of CRA is as follows:

1. CRA encourages Enterprises to use the 5G networks and services of the public mobile operators in Qatar (i.e., Option 1 - The current situation).
2. If an Enterprise wants to establish and operate its 5G private mobile network (under the existing "Class License to Own and/or Operate a Private Telecommunications Network" for Closed User Groups) and requests a spectrum license from CRA to be able to do so (i.e., Option 2), CRA would be willing to examine such exceptional cases provided that the spectrum license application of the Enterprise must include the following as a minimum:
    a. Proof that the Enterprise has seriously tried to acquire the required networks and services from the public mobile operators in Qatar. This may include, for example, tender documents launched by the Enterprise to acquire the desired 5G networks and services from the mobile operators.
    b. Supporting solid evidence that the mobile operators cannot meet the reasonable requirements of the Enterprise. This may include, for example, letters from the mobile operators, proposals from the mobile operators, official minutes of meetings between the Enterprise and the mobile operators, etc.
    c. The prices offered by the mobile operators compared with regional/international benchmarks (if the issue of the Enterprise with the offers/proposals of the mobile operators is related to prices).

d. The geographic scope and locations of the intended network.

e. The scope of the intended services (use cases).

f. The desired spectrum band and spectrum bandwidth with justification.

3. CRA would assess the spectrum license application of the Enterprise and take the appropriate decision (i.e., approve, reject, or request further information/ documentation).

4. CRA will also take into consideration the national and public interest when deciding whether to grant spectrum licenses to an Enterprise to establish and operate its own 5G private network.

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