
Future Spectrum Demand in Qatar **CRA Consultation Document**

Communications Regulatory Authority
Spectrum Affairs Department - © June 2014

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1. Introduction

Communications Regulatory Authority (CRA) manages radio frequency spectrum in the State of Qatar. Continuous evolution of sophisticated wireless technologies and the rapid growth in the demand for spectrum from different users and services has made spectrum management a challenging task. This is CRA - being a national regulator - major responsibility to balance the needs of existing spectrum users while facilitating spectrum access for new technologies. In order to provide greater transparency for spectrum users about the current spectrum use and the future trends CRA has planned to develop a five years spectrum outlook.

This outlook will complement CRA spectrum management framework illustrated in section 3 below. Since this outlook is being developed to have better transparency regarding CRA's approach to cater for the current and future spectrum demand it will be a consultation document that would be updated every year and will always be available for comments from the stakeholders. The comments on this outlook will then assist CRA in making decisions about the possible future planning, licensing, pricing and allocation arrangements for the radiofrequency spectrum. However, nothing in it should be taken to bind CRA to any particular course of action in later processes.

2. Methodology

The first phase in the development of this Outlook is to estimate the spectrum requirements/demand over next five years. This is the first document while the rest will be published in future. This consultation document has hence been developed to serve the following purposes:

- To provide a general overview of the currently available spectrum
- To provide a general overview of the existing spectrum regulatory framework in place to cater for the current and future spectrum users
- To gather information on the current or future spectrum requirements by consulting with the industry stakeholders

The second phase would involve the estimation of the spectrum requirements based on the analysis of regional and international trends in spectrum use.

The third phase would involve the development of action plan to address the key issues to be resolved during next 5 years in order to ensure equitable spectrum access while balancing the conflicting requirements of all types of spectrum users (commercial or private).

The spectrum outlook hence would contain the outcomes of all the three phases as mentioned above, which would provide a greater degree of certainty to industry stakeholders about CRA's priorities and will promote dialogue with spectrum users about these priorities.

3. Current Spectrum Management Framework

The current spectrum management regulatory framework consists of the following documents:

<p>Law and By Law</p>	<p>The Telecom Law sets the broad principles for CRA (formerly ictQATAR) to manage the radio frequency spectrum in the State of Qatar.</p> <p>Article 3 of the Law provides a legal mandate for CRA in respect of: 3(2) determining the fees for Individual and Class Licenses and the fees for the use of radio spectrum or any other fees or expenses that must be paid by service providers; and 3(3) approval of the national plans for Radio Spectrum, Numbering and the Universal Service policy.</p> <p>Article 4 of the Law also empowers CRA to (inter alia): (1) grant, amend, renew, suspend and revoke Class Licenses, Radio Spectrum Licenses and Authorizations and determine the terms and procedures necessary for their issuance; (2) monitor compliance of licensees with their Licenses and Authorizations; and (3) set and manage the plan for Radio Spectrum and for other scarce resources, ensuring the optimal use of such resources and maximizing revenues generated from them within the limits specified by international rules.</p>
<p>Radio Spectrum Policy</p>	<p>As per the objectives set out within the Telecommunications Law and Executive By-Law and international best practice, CRA's (formerly ictQATAR) radio spectrum policy was developed and published in 2010 setting the following principles for spectrum management to:</p> <ul style="list-style-type: none"> - Promote the economic and societal benefits from use of all spectrum; - Provide a transparent, non-discriminatory and predictable approach to spectrum management; - Take the least intrusive interventions consistent with achieving public policy objectives and efficient spectrum use; - Set the spectrum fees in a manner which will enable efficient use of this scarce national resource; - Use market mechanisms (e.g. pricing structures / administered incentive pricing (AIP) and auctions) for encouraging efficient spectrum use where there are competing demands for spectrum unless there are good policy reasons to do otherwise; - Facilitate stakeholder participation in key allocation decisions.

National Frequency Allocation Table	CRA developed a National Frequency Allocation Table, and completed a public review of its policy for allocating and assigning radio spectrum.
Terms and Conditions for Spectrum Licensing	These terms and conditions further enhances and illustrates the relevant sections and sub sections of the law and the by law. These include the terms and conditions for regulating the spectrum that are common to all types of spectrum uses and additionally the terms and conditions that are applicable to the particular type of spectrum use.
Spectrum Fee Policy and Fee Schedule	<p>According to Article 19 of Decree Law No. 36 of 2004, sources of CRA (formerly ictQATAR) funding shall include monies realized from its activities. Decree Law No. 36 of 2006 on the promulgation of the Telecommunications Law makes the following relevant provisions:</p> <p>Article 3: The Board of ictQATAR shall have the power and authority to determine the fees for the use of radio spectrum;</p> <p>Article 4: The General Secretariat of ictQATAR shall have the authority and power to grant, amend, renew, suspend and revoke radio spectrum licenses;</p> <p>Further provisions relevant to radio spectrum fees are included in Chapter 3 of the Decision of the Board of the Supreme Council of Information and Communications Technology No. 1 of 2009 on the promulgation of the Executive By-Law for the Telecommunications Law. In particular, Article 43 in Chapter 3 states:</p> <p>Any regulations, decisions and orders issued pertaining to fees shall contain the following principles:</p> <ul style="list-style-type: none"> - Stipulate the entity to which the fees and charges shall be paid. - Fees and charges shall be levied on Licensees in an impartial manner. - Fees and charges may be based on factors such as the amount of radio frequency spectrum provided in the License; whether the Licensee is operating in a shared or exclusive frequency band; or a percentage or proportion of the revenues of Licensees from the use of radio spectrum. - Fees and charges payable under the Law and this By-Law are in addition to any other fees or charges that must be paid by Service Providers in connection with their operations or commercial activities. <p>This document sets out the spectrum management related fees from which CRA will derive its revenue as foreseen in the above legal provisions.</p>

4. Radio Frequency Assignment Principles

Frequency assignment principles as derived from the spectrum management framework are illustrated in detail in this section. Radio spectrum to be assigned to users has been segregated into different categories and each category has its own principles of assignment. This segregation is as follows:

- a) **Uncongested:** A band allocated for a particular service (or a set of services) in which availability of radio frequencies, spectrum band, spectrum sub-band and/or spot frequency is more than the demand
- b) **Congested:** A band allocated for a particular service (or a set of services) in which availability of radio frequencies, spectrum band, spectrum sub-band and/or spot frequency is less than the demand. Congested band can be:
 - i. **Commercial:** A congested Spectrum required for provision of service intended to generate commercial activity
 - ii. **Non-Commercial:** A congested Spectrum required for provision of service with no commercial intention
- c) **Shared:** Spectrum allocated for use by more than one service or users

On the basis of above categorization, following approaches are being followed for frequency assignment procedures.

4.1 First Come First Served (FCFS)

If spectrum is plentiful and no rationing (no reservation of spectrum for any future need) is required as per the allocation plan, then all available frequency bands are to be assigned on a FCFS basis. Usually these are the bands where congestion is unlikely and/or spectrum is used to support internal business activities (closed user group). CRA applies this policy so as to have greater sharing of spectrum and its efficient use. Generally this policy is adopted for private mobile radio and fixed spectrum licenses which have localized requirements and helps in conserving the spectrum resource while ensuring that undue costs are not imposed on users. Hence, this approach is to be adapted for assignment of uncongested and non-commercial congested bands.

4.2 Competitive Assignment Process

For public services like Cellular Mobile Networks (GSM, DCS, UMTS, 3G, 4G or any new technology) competitive assignment processes are typically required to meet competition objectives. Two options are available in this regards; Spectrum Auctions or beauty contests; Spectrum auctions are generally considered to be more efficient, transparent and timely than beauty contests and this is why they have been adopted worldwide to assign spectrum.

CRA will consider the use of auction as the first option for assignment in commercial congested spectrum. However, if there are other qualitative criteria (i.e. parameters related to issues other than spectrum management) or public policy issues which make these options impractical then a comparative tender or a beauty contest is used.

4.3 Direct Assignment

Direct assignment is generally not considered an efficient method of spectrum management. However, direct assignment at an opportunity cost based price may be efficient for assigning small blocks of spectrum that complement incumbent operators' (e.g. Mobile or BWA operators) larger spectrum holdings.

CRA applies this approach on a case by case basis for applicants such as defence forces, aeronautical and maritime bodies, telecom operators, amateur societies and some large users. The licensees are required to notify details regarding technical usage of assignments to the regulator so that the spectrum as a whole can be affectively managed (e.g. to resolve interference disputes and change allocations).

4.4 Temporary Frequency Assignments

For ease of frequency planning for events, trial demonstrations and for other applicants requiring frequency assignment on defined temporary basis, spectrum management department is to maintain a temporary frequency assignment pool. This pool covers the bands and services which have high demand for temporary assignments. The frequencies in the temporary assignment pool remain in the national Master Frequency Register (MFR) but to be clearly marked as reserved for temporary assignment. All the temporary assignment is done strictly on the basis of NFAT. The temporary frequency pool register is considered to be regularly evaluated by spectrum management department for any addition or subtraction or modification.

4.5 Class Authorization and R&TTE Guidelines

In order to ensure interference free spectrum to all the authorized users of spectrum it is necessary that only standardized radio equipment is allowed for operation. Type approval of the radio equipment is done as per Type Approval Guidelines for Radio Equipment and Telecommunications Terminal Equipment (RTTE) to serve this purpose. This section of the general terms and conditions obliges the licensee to use only type approved equipment for accessing the radio spectrum.

5. Factors affecting spectrum demand

There are many factors that affect the spectrum demand from spectrum users. The major challenge in estimating the spectrum demand is that the different users have different requirements. Some users require mobility more than data rate while others are bandwidth intensive and can compromise on mobility. Similarly, some users have higher security and safety requirements while others might require all the features without any compromise and they all may be able to justify their requirements. To accommodate the demands of all such users with conflicting requirements is thus becoming a challenging task. The following factors can be identified generally that affect the spectrum demand from spectrum users:

- a) **International and Regional Regulatory Framework:** due to the global nature of certain technologies such as Satellite and HF communications, and greater emphasis on regional and global harmonization to benefit from the economies of scales, spectrum management is not done entirely at the national level these days. There are international (ITU, ICAO, IMO) and regional forums (CEPT, APT, ASMG) where the spectrum is allocated in coordination with other administrations. Since ITU Radio Regulations have a treaty status and State of Qatar is a signatory to this as well, CRA is obliged to follow these regulations. In addition to that, since CRA is in ITU region 1 which is the same as for European countries, decisions and recommendations published by CEPT are also to be considered while developing national spectrum management regulatory framework.
- b) **Increased use of shared spectrum:** since more and more technologies are being developed that have the capability to share spectrum on secondary basis with already operational technologies, CRA plans to identify more shared spectrum for such technologies which is to be considered carefully before estimating the spectrum demand because in future some portion of traffic is going to be offloaded from Mobile and Fixed networks to such technologies.
- c) **Demand for bandwidth-intensive applications:** an exponential growth of the data use has been experienced globally in recent years and this is one of the main agenda items being discussed in the international and regional forums. More and more bandwidth intensive applications are being developed that need faster access technologies and since wireless access is the fastest way to the market for the telecom operators, pressure is increasing on the regulators to designate more frequency bands for this purpose.
- d) **Increasing Government's demand for spectrum:** due to the global and regional trend toward adopting e-Government applications, the requests for gaining excess to the larger chunks of spectrum from government bodies are increasing. Since State of Qatar is emerging as a regional leader in this domain, the accommodation of spectrum demand from the government organizations and especially from the national security organizations while balancing it with demand from commercial operators has become and will remain in years to come one of the major challenges for CRA.
- e) **Challenges regarding spectrum reuse:** in order to cater for the increasing spectrum demand, spectrum reuse is a must requirement. Since, Qatar is relatively a small country; it is really challenging to reuse VHF and UHF bands which have become really congested. Hence this is an important factor that would affect the estimation of spectrum demand.
- f) **Accommodation of more commercial operators to ensure healthy competition:** healthy competition is crucial for the delivery of telecommunication services at reasonable rates and with good quality to the customers. CRA annually conducts the strategic sector review to analyse the level of competition in the different sectors of telecommunication market. The results show that Qatar still has room for more operators to ensure healthy

competition. This is a very important factor affecting spectrum demand as it requires certain spectrum to be reserved for future use in each sector.

- g) **Frequency-dependent propagation characteristics:** these characteristics can drive demand for particular parts of the spectrum. Lower frequencies generally propagate further, but higher frequencies allow higher bandwidths and hence higher data rates. Furthermore, the propagation characteristics of high frequency (HF) spectrum allow over-the-horizon communications using ionospheric reflection while very high frequency (VHF) and ultra-high frequency (UHF) spectrum suit both long-range line-of-sight (LOS) communications and mobile non-LOS applications. Microwave frequencies above 1 GHz suit fixed LOS applications and satellite communications. Hence different portions of spectrum may suit multiple applications that would mean increased demand in such bands.
- h) **Back-haul connectivity:** the lesser cost of deployment of wireless backhaul links as compared to wire line infrastructure keeps this an attractive approach. The spectrum demand is in lower microwave bands and the situation is expected to remain as it is until the deployment of optical fiber backbone network is done by the operators.
- i) **End-Users' Requirement of Mobility:** as per the work-place and social needs of the end users, they need now connectivity 'anywhere, anytime' which is putting more pressure on the regulators to reserve more spectrum for wireless access technologies.
- j) **Remote sensing and Monitoring Applications:** remote sensing and remote-monitoring has become an integral part of any industry. All such devices being developed internationally mostly use wireless technologies. Both government and commercial organizations need access to such technologies to enhance their work capacity and hence pressure is expected to increase over such bands within next 5 years.
- k) **Remote Control Applications:** Most devices these days have the capability to be controlled remotely through wireless connection. Their needs have to be catered for.

Question 1	Please provide and illustrate any other factors not listed above that could affect the spectrum demand in next 5 years?
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6. Assessment of the future spectrum requirements

The sections below give overview of the current status of spectrum used for broadcasting, fixed, land mobile, satellite and special events. A preliminary estimation of the spectrum demand within next coming 5 years has also been provided, However detailed analysis as well as the detailed action to address the key issues to be resolved during next 5 years in order to ensure equitable spectrum access while balancing the conflicting requirements of all types of spectrum users (commercial or private) will be prepared after receiving the input from stakeholders.

6.1 Broadcasting

Broadcasting stations are used to transmit broadcasting content. There are two types of broadcasting stations: terrestrial and satellite. This section covers the terrestrial broadcasting stations only. Historically all terrestrial stations in Qatar have been using analogue technology. However, keeping in line with the global and regional trend towards adoption of more efficient digital technology, digital switchover in Qatar is planned to be completed by Jun 30, 2015. The legacy analogue broadcasting stations use MF/HF, VHF or UHF spectrum for transmission. Because of the long distance propagation characteristics of electromagnetic waves in MF/HF, VHF and UHF bands the spectrum planning has been done at the regional or international level in order to ensure the interference free operation of stations. Qatar is a part of the following ITU Regional Plans regarding the broadcasting services:

Plan Name	Frequency Bands
GE-75	LF: 150-285 kHz MF: 525-1605 kHz
GE-84	Band II: 87.5 - 108 MHz
GE-06	Band III: 174-230 MHz Band IV: 470-582 MHz Band V: 582-862 MHz

6.1.1 Current Status

The current status of the different bands in use for broadcasting is as follows:

a) AM radio Broadcasting

AM radio broadcasting is done using the MF band, which has long-range characteristics and hence require international/regional coordination to ensure interference free operation. Since, AM radio has a poor voice quality than FM radio, currently there is not much demand for AM radio and the situation is likely to remain as it in next 5 years.

b) FM Radio Broadcasting

FM radio broadcasting is done using VHF band II. High power transmission in this band also require international or regional coordination, however this is not required for low power transmissions. Currently all commercial broadcasting is done via Qatar Media Corporation, which holds all the recorded channels in Band II as approved via the GE-84 Plan. However, this will not be the case in future as other broadcasters authorized by Ministry of Culture, Arts and Heritage (Broadcasting content regulator) will be given access to FM spectrum. In addition to this, there are a couple of

frequencies assigned for community radio broadcasting services and in future more spectrum will be available for community radio broadcasting.

c) Digital Radio broadcasting

Digital switchover is planned in the State of Qatar to be completed by June 2015. Currently, some digital broadcasting assignments have been done in the State of Qatar. As per the new licensing framework three types of licenses are available for digital broadcasting:

- i. Digital Terrestrial Audio Multiplexer Network License
- ii. Digital Terrestrial TV Multiplexer Network License
- iii. Digital Video Broadcasting-handheld Multiplexer Network License

The licensing regime allows the deployment of a multiplexer network that would distribute the broadcasting content of authorized broadcasters.

The spectrum will be assigned by CRA in accordance with the frequency channels decided in the digital broadcasting plan that was agreed in the GE-06 plan but excluding those frequencies that have subsequently been agreed internationally and regionally for wireless broadband i.e. 690-790 MHz and 790-862 MHz bands. The deployment of latest technologies is encouraged by CRA. In this regard, T- DAB has been approved to be deployed in Band III on the agreed frequencies as per the GE-06 plan. Whereas, DVB-T2 standard has been approved for deployment in bands IV and V as per GE-06 plan for which ETSI standard EN 302 775 is to be followed by the licensees.

Table 1 Digital broadcasting frequency plan for Bands IV and V

Transmitter Location	Channels	Frequencies (MHz)
Abu Samra	42,45	642,666
Al Amiriyah	39	618
Al Arish	24,29	498, 618
Al Khor	45	666
Al Ruwais	21,68	474,850
Al Udaid	23,50,51,52,59	490,706,714,722,778
Al Wakra	27,29	522,536
Dukhan	25,51,59	506,714,778
Ghuwairiya	54	738
Halul	58,62,63	770,802,826
Julaiha	24,49,50,58	498,698,706,770
Jumailiah	49(H&V),52	698,722
Markhiyah	21,37,42	474,602,642
Mufaidh	27,68	522,850
Mukainiss	31,66	554,834
Shahaniyah	5,7,9,60	177.5,191.5,205.5,786
Sudantheel	54	738

The broadcasting content is sometimes relayed via broadcast satellite links before its distribution to general public. Section 9 may be referred for further details in this regard.

6.1.2 Spectrum demand in next 5 years

Since there a number of satellite broadcasting footprints (including the networks supporting HDTV) covering the state of Qatar and considering the geographic size of the State of Qatar, it is expected that there will be little demand for analogue and digital terrestrial broadcasting in coming years. Since digital switch-over date has been set by the government to be June 2015 the demand for more efficient digital technology may be higher as compared to the conventional Analogue technology. In order to cater for this demand as per the new spectrum licensing framework that will come into effect from 1st July 2014, three types of licenses have been developed to cover the use of digital Audio or TV broadcasting stations in the State of Qatar. CRA is also in the process of procuring latest Automated Frequency Management System (AFMS), which would enable low power assignments in addition to the high power assignment as per the GE-06 Plan. These statutory and technical tools thus will help to cater for the requirements of broadcasting spectrum users in the next five years.

Question 2	Do you expect that spectrum demand for analogue broadcasting would decline within next 5 years?
Question 3	What is your opinion about the future of broadcasting services (BC) in MF and HF frequency bands in Qatar?
Question 4	What would be the future of Digital Broadcasting in the State of Qatar?
Question 5	What's the percentage of overall broadcasting traffic that is expected to be carried over by Digital Multiplexer Networks as compared to the Satellite networks?
Question 6	What is your spectrum demand for the next five years? Please provide your requirement with justifications.

6.2 Fixed

Fixed links are generally used to provide network infrastructure and customer access applications across a wide range of frequency bands, currently ranging from 450MHz to 86GHz. Fixed point-to-point links mainly use digital technologies, directional antennas and typically operate at very high levels of propagation availability. These links are normally assigned individual frequencies by CRA and are licensed on a link by link basis.

6.2.1 Current Status

Fixed links are generally being deployed across the entire radio spectrum. In Qatar the main allocations are in UHF and EHF (microwave) bands. The current status is as follows:

a) UHF band:

The main use of this band in the state of Qatar is for tele-command, Data link, and telemetry applications (Most of these allocations are for P-MP network deployment while are or P-P link deployment). There are currently a number of licenses issued for this purpose in the UHF band in addition to the PMR licenses, which makes it a highly congested band and the situation is likely to remain as this in next five years.

b) Microwave Bands:

These bands can be classified into four major categories of use:

- Low capacity long haul links—7 and 8 GHz bands;
- Medium capacity medium haul links—13 GHz bands;
- High capacity short haul links –15, 18, 22, 28 and 38 GHz bands.

In additions to this following microwave bands have also been allocated for other uses:

- 3.4 GHz band has been reserved for commercial fixed service providers and is expected to be assigned for this purpose in near future.
- 4.9 GHz band has been reserved for public safety broadband
- There have been some assignments in 75 GHz band for short haul high capacity links. As per the new spectrum licensing framework the bands 65, 75 and 85 GHz will be light licensed.
- The 2.4, 5.4 and 5.8 GHz ISM bands have been identified for P-MP/MP-MP deployments on shared basis.
- A portion of 26 GHz band has been reserved for ;private/commercial P-MP deployments

6.2.2 Spectrum demand in next 5 years

As per the regional and international trend, spectrum requirements in the microwave bands will change during next five years. With the deployment optical fibre network by the Operators, the use of microwave backhaul links is expected to decline. However, more and more high speed fixed access technologies are going to be developed in lower microwave bands (i.e. < 15 GHz band) which in addition to the legacy backhaul assignments will make these bands congested.

Additionally the decision made in WRC 2007 to share most of the fixed bands with other services needs careful consideration as by doing so congestion would increase in some of the heavily used fixed bands such as 22 GHz band sharing with potential satellite broadcast for HDTV (21.4-22 GHz).

Similarly, WRC-12 Agenda item 1.5 asked for global harmonization of ENG spectrum, for which some of the bands have to be reserved and these bands are more likely to be in the congested lower microwave bands.

Finally, at WRC-07 the bands 27.9–28.2 GHz (28 GHz) and 31–31.3 GHz (31 GHz) bands have been identified for HAPS. It is not expected that there would be any case of HAPS In Qatar within next 5 years simply because of the geographic size of Qatar. However, there may be a possibility of deploying such as system at regional level and hence the spectrum may need to be reserved. In addition to this under WRC-12 Agenda item 1.20 the identification of band 5850–7075 MHz has been considered for gateway links for HAPS, which may also need to be considered.

Additionally

Question 7	Please provide current and forecasted needs and deployment plans for short-haul, medium-haul and long-haul fixed systems within your network in the listed frequency bands? Please address technical issues, the feasibility of sharing, and coordination considerations with the incumbent services as well as any other relevant factors regarding the use of this band?
Question 8	Is there a continuing need for bands below 7 GHz for long-haul systems or could this need be met

	in bands at 7 GHz and above?
Question 9	Please explain and provide proposals on alternative definitions and/or measures for assessing the band congestion and when technical requirements should be relaxed or tightened?
Question 10	Given current and anticipated deployments, identify specific frequency bands and corresponding geographical areas in which you are experiencing or expect congestion. Please provide your deployment plans for these areas and proposals to mitigate congestion?
Question 11	Please identify any bands that are underutilized and are expected to be utilized in this way within next 5 years. Please address any technical characteristics or regulatory provisions limiting deployment, and provide proposals on specific policy or allocation revisions to improve usage within the bands.
Question 12	Provide general information on your use of non-radio alternatives to resolve backhaul challenges. What is the combination (and percentage of fixed wireless and other backhaul solutions such as optical fibre) used within your network? Has this ratio changed within the last few years, and do you expect it to change within the next three to five years?

6.3 Land Mobile

Land Mobile Radiocommunication involves communication between land stations and land stations and mobile or handheld stations. There are two types of Land mobile systems:

Private Land Mobile Systems: These are extensively used for mission critical applications required by organizations relating to construction, oil and gas, emergency response, security, defense and public facility provision (Transportation, Electricity and Gas) for internal communications. There a range of frequency bands being used by Land Mobile Systems including HF, VHF and UHF. The technologies range from conventional PMR radio for deploying on site or regional networks to trunked and digital systems such as TETRA.

Public Land Mobile Systems: This has become technology of choice for providing “anywhere anytime” voice and data connectivity to common people. There a range of frequency bands being used by Public Land Mobile Systems including mainly UHF and EHF frequency ranges. Apart from the currently assigned GSM 900 and DCS 1800 MHz bands, and UMTS 900, 1800 and 2100 MHz, and 800, 1800, 2300 and 2600 MHz bands for LTE services more IMT bands are being considered at WRCs.

6.3.1 Current Status

a) Private Land Mobile System:

Frequency bands currently being used by private land mobile systems are as follows:

- VHF low band (30-47 MHz)
- VHF high band (146–165 MHz);
- 400 MHz UHF band (360-380, 410–430 MHz and 450–470 MHz); and

Currently oil and gas companies that operate near offshore areas prefer VHF for their PMR network, the main reason is that in this way they can use marine international channels for docking, mooring, loading and unloading of the large vessels. This band has hence been extensively used by such organizations. Apart from this other organizations operating inshore prefer UHF band for their simplex or duplex or conventional or trunked operations. Suitable propagation characteristics, lesser susceptibility to man-made noise and the spectrum availability makes this an appropriate band for land mobile applications.

b) Public Land Mobile System:

Frequency bands currently being used by public land mobile systems are as follows:

- 800 MHz
- 900 MHz
- 1800 MHz
- 2100 MHz
- 2600 MHz

In addition to these bands for cellular mobile systems, the 410-430 MHz band has also being allocated and assigned for their PAMR network.

Currently two operators have been assigned spectrum to operate their GSM and UMTS networks. With the continuous growth in the data usage in Qatar, digital dividend bands (690-790 MHz and 790-862 MHz) are also being considered and will be assigned subject to availability.

6.3.2 Spectrum demand in next 5 years

a) Private Land Mobile System:

Considering the development work currently undergo and the oil and gas exploration on full swing, there is a substantial growth in the number of assignments in VHF and UHF bands and situation is likely to remain as this in years to come. The main reason is that the specific requirements of mission critical applications cannot be catered for by cellular mobile and satellite technologies.

Qatar is going through a major development phase prior to the 2022 World cup. This includes development of new cities, stadiums, transportation infrastructure (e.g. Qatar Metro and High Speed Train) and national safety and security broadband network. This would hence increase the pressure on the current bands while the possibility of assigning other bands such as GSM-R for rail and metro networks.

Considering the increasing interest in the use of land mobile systems, it is also expected that the public service providers may also improve their PAMR infrastructure and be able to cater for the needs of some of the major users in a competitive environment which might reduce pressure on other land mobile bands.

One of the major developments in the Land mobile sector is that the systems with operation capability of 6.25 KHz channels may be readily available in the market in couple of years. This would greatly cater for the congestion problem currently being faced in these bands.

Finally, as per WRC-03 and WRC-12 decisions bands (especially 380-385/ 390-395 MHz) have been identified for Narrow Band PPDR applications in Region 1. The issue is going to be discussed further under agenda item 1.3 of WRC-2015 which is likely to be used in coming years and hence will pose more pressure on already congested UHF band.

Recently there has been an increased interest in using LTE for PMR deployments to support bandwidth intensive applications such as communication of real-time video data for security and safety critical applications. It is expected that globally or regionally harmonized frequency bands will be identified for PPDR, which means that there will be more spectrum demand for public safety broadband applications in next 5 years.

b) Public Land Mobile Systems:

The mostly deployed technologies currently include GSM and UMTS. With the development of more and more bandwidth intensive mobile applications and online services (including e-Government services) in Qatar the bandwidth requirements per user have been increasing rapidly which is complemented with the continuous development of high speed mobile technologies termed as IMT technologies in ITU. Due to this spectrum requirements to support such technologies and services have increased manifold since the last 10 years and the situation is expected to remain as it is in future as well.

This is the reason agenda one of the main issues to be discussed in WRC-15 is agenda item 1.1 which is regarding the availability of spectrum for mobile broadband application over the next 15 years. It is expected that new frequency ranges (including WiFi) will be added in Radio Regulations for IMT services (term referring to 3G, 4G and 5G wireless broadband systems).

Similarly under agenda item 1.2 the technical compatibility studies being carried out since WRC-12 will be considered in order add primary allocation and IMT identification of Band 694-790 MHz in Region 1 that expected to become a key band for the future mobile broadband deployments.

Frequency ranges for which ITU has received proposals for study under WRC-15 agenda item 1.1 include 470-694 MHz, 1300-1400 MHz, 1427-1527 MHz, 1452-1492 MHz, 1695-1700 MHz, 2700-2900 MHz, 3600-3800 MHz, 3800-4200 MHz, 5350-5470 MHz, 5850-5925 MHz, 5925-6425 MHz, 4400-4900 MHz, 13.4-14 GHz, 18.1-18.6 GHz, 27-29.5 GHz, 38-39.5 GHz. The ranges for which proposal have received not to conduct studies include 1400-1427 MHz, 1518-1559 MHz, 1626.5-1660.5 MHz, 1668-1675 MHz, 2025-2110 MHz, 2200-2290 MHz, 3400-4200 MHz, 4500-4800 MHz and 5850-6425 MHz.

In addition to this work is going on also at the European Union level where Radio Spectrum Policy Group is conducting a detailed analysis of the suitable frequency bands for IMT services from 400 MHz to 6GHz which is linked with the Radio Spectrum Policy Program that required member states to identify 1200 MHz spectrum in order to cater for the current and future wireless data traffic by 2015.

In order to anticipate the future spectrum demand for public land mobile systems, questions relating to the following key factors have been detailed below for stakeholders' input:

- Future mobile data demand;
- offload of mobile data to Wi-Fi and other technologies in class licensed spectrum;
- spectral efficiency of mobile technologies;
- mobile application data rates;
- the prevalence of small cells; and
- the balance between uplink and downlink traffic

Private Land Mobile Systems:

Question 13	Is uptake of equipment with 6.25 KHz channel spacing expected within 5 years? How would this impact the overall spectrum efficiency of the band?
Question 14	Should LTE be considered for the PMR applications considering the international framework to keep it for the commercial use?
Question 15	What are the pros and cons of the proposed PPDR bands for existing services and for future private broadband applications?
Question 16	Should certain spectrum be reserved for mega events such as Olympics and FIFA world Cup? What will be the pros and cons of this approach for existing and future services?
Question 17	Do you expect healthy competition in PAMR in 5 years? How would this impact the overall spectral efficiency of PMR bands?
Question 18	What is your spectrum demand for the next five years? Please provide your requirement with justifications.
Question 19	Please provide current and forecasted needs and deployment plans for Public Land Mobile systems within your network in the listed frequency bands? Please address technical issues, any other relevant factors regarding the use of the bands?

Public Land Mobile Systems:

Question 20	How will the mobile data demand change in the next 5 years? Please provide supporting arguments for the proposed trend?
Question 21	How will the mobile data demand vary across different types of user terminals i.e. Mobile, iPads, Laptops, desktops, M-to-M devices etc.?
Question 22	What factors should be considered or assessing the consumer benefits achieved by meeting this mobile data demand?
Question 23	What portion of mobile data is expected to be offloaded to WiFi and other class licensed spectrum in next 5 years?
Question 24	How will the cell size change the spectral efficiency of cellular technologies in 5 years considering the possible increase in the device penetration?
Question 25	What portion of traffic will be carried on different cell types (micro, pico and femto cells etc.) considering the technical and economic constraints in 5 years?
Question 26	How will the ratio of downlink to uplink traffic over cellular networks change in 5 years considering the

	expected take up of cloud computing services?
Question 27	What are the pros and cons of allocating listed frequency ranges for Mobile Broadband applications on existing services being provided over the bands? The list of other ranges not included may also be provided with justifications for consideration.
Question 28	What impact would the introduction of mobile broadband services have on the operation of existing services in the identified band in areas of high, medium and low density?
Question 29	What are your views on bands, which should be a priority for consideration for mobile broadband?
Question 30	What is your spectrum demand for the next five years? Please provide your requirement with justifications.

6.4 Satellite

Satellite communications because of their reliability and easy deployment, has become technology of choice in underdeveloped and troubled countries. In developing countries satellite serves as an alternative to the terrestrial access technologies. With the developments in satellite technology, both the size and price of satellite terminals is decreasing considerably, and it is expected that within few years it may be able to compete with terrestrial technologies not just in backhaul but also in the last mile. The three of mostly provided satellite services globally are as follows:

- Fixed-Satellite Service (FSS)—satellites communicating with Earth stations located at fixed, specified locations on the Earth;
- Mobile-Satellite Service (MSS)—satellites communicating with Earth stations that move across the Earth’s surface; and
- Broadcasting-Satellite Service (BSS)—satellites transmitting signals intended for direct reception by the general public.

Due to the global nature of satellite technology, most of the spectrum management is done internationally through ITU-R. Satellite operators intending to deploy their space stations in space are required to launch coordination requests to ITU-R via national administrations. Similarly, coordination may also be required before deployment of large earth stations. Small Earth Stations such as VSATs as being low powered terminals are not required to be coordinated.

6.4.1 Current Status

Satellite services being provided worldwide are FSS, BSS and MSS. The major satellite operators globally are Intelsat, SES Global and Eutelsat which are complimented by the regional satellite networks such as Arabsat, Nilesat and Asiasat. In addition to this Qatar has also launched its national satellite Es’hailSat which is capable of providing FSS and BSS services. Broadcasting is the major service being provided via FSS (for outside broadcast links) and BSS satellites. The major frequency bands being used by FSS and BSS satellite operators are C, Ku and Ka bands, with Ku the most preferred band. Ku band is also a preferred band for VSAT applications and SNG terminals. In addition to broadcasting C band is also used for feeder links to MSS and to provide services such as distance learning, telemedicine and disaster recovery.

MSS is used for providing GMPCS services that are being used to cater for the communication needs under rough environments associated generally to maritime, aeronautical, oil & gas and transportation sectors. The major satellite operators of the MSS covering Qatar are Inmarsat, Iridium, Globalstar, Orbcomm and Thuraya. These services primarily use L- and S-band spectrum.

6.4.2 Spectrum demand in next 5 years

As mentioned above the spectrum for satellite services is agreed at international level and the satellite networks are planned for at least 15 years. This means that the national plan has to be in line with the international regulatory framework. As per the global trend there has been a considerable increase in the consumer's interest in satellite services (especially digital TV) and increased interest of governments in GCC countries in launching their own satellite networks. This growth will continue to increase in next 10-15 years. However, with the advancements of beam technology Ku band is expected to become more favorite as compared to C-band.

FSS and BSS in the C-band and higher frequencies

Since more and more spectrum in lower EHF band is being assigned for IMT services (e.g. 2500-2690MHz) further allocations for FSS and BSS would be restricted to bands above C-band. The C-band is expected to grow in the region steadily in the next 5-10 years.

C-band

As mentioned above advancements in the beam technology y make Ku-band more favorite than C-band, but since there is a huge investment by satellite operators and equipment manufacturers in C-band and some applications require higher level of service availability which can only be provided via C-band, this migration is expected to happen gradually.

S-band:

As per ECC decision ECC/DEC/(06)09 the bands 1980–2010 MHz (uplink) and 2170–2200 MHz (Downlink) were designated for MSS. On the basis of this European Commission awarded 2 x 15 MHz spectrum to INMARSAT and Solaris Mobile in S-band in May, 2009. Similarly, EutelSat W2A is an S-band satellite launched in April 2009. These satellites are capable of supporting next generation broadband platforms and hence have a potential to gain popularity in coming years.

L-band:

Considering the congestion in L-band the prime band for MSS, bands 1518-1525 MHz (downlink) and 1668-1675 MHz (Uplink) have been additionally allocated in WRC03. With the advancements in the satellite technology and reduction in the price of terminals the MSS is going to be more and more popular and hence more spectrum in the lower microwave bands needs to be allocated accordingly. However as per ITU studies the consideration as per WRC-15 Agenda item 1.10 is being given to the additional MSS allocations in the range 22 GHz to 26 GHz.

Ku and Ka-bands

As mentioned before Ku band is the most favorite band for broadcasting, SNG, Broadband, VSAT Links and mobile television and is experience fastest growth in satellite communication. Among these FSS and BSS services, television distributing is the mostly provided service in Ku-band. Considering the volatile state of the region high growth of FSS and BSS is expected in the region and it is expected that Ku-band will be mostly used to satisfy this need in near future.

In addition to Ku, Ka-band is also gaining popularity for distribution of broadcasting services. Agenda 1.13 of WRC-12 decided to allocate band 21.4 – 22 GHz band for HDTV in BSS and feeder link bands. Since this band has been shared with terrestrial fixed links, relocation of these fixed links may be required to free up more spectrum for Ka-band operation.

Questions 31	What would be the data and voice traffic distribution across C, Ku and Ka bands within next 5 years?
Questions 32	What would be the impact of reduction in MSS terminal sizes and prices over the spectrum demand in L and S bands in next 5 years?
Questions 33	What would be the effect of satellite broadband technology maturity on the overall spectrum demand in Ku, Ka, S and L bands?

6.5 Special Events

Qatar is becoming a favourite destination for international and regional major events. Qatar Masters, MotoGP, Exxon mobile Tennis Tournament are some of the major events that are being arranged in Qatar annually. And then there are mega events such as FIFA World Cup 2022 which would require access to larger portions of spectrum. Managing the spectrum requirements during these events will be a challenging task as there may be a requirement to reserve certain spectrum for such events.

6.5.1 Current Status

The spectrum requirements for special events are currently catered for on case by case basis. Whenever there is an event the event organizers contact us and the spectrum is assigned accordingly. However this approach will not be followed while managing spectrum during mega events such as FIFA World Cup.

6.4.2 Spectrum demand in next 5 years

Even though the mega events are being planned to be organized after 5 years, the spectrum strategy has to be finalized the work plans for the next five years are to be developed accordingly. Effective wireless communications are essential for the organisation and delivery of mega events such as FIFA World Cup. The following types of wireless equipment are expected to be used during such events:

Wireless cameras and microphones: Broadcasters seeking the most dramatic sights and sounds of the Games want to be as close as possible to the action and need wireless links to capture them. For example, close-ups of the marathon runners from motor bikes are some of the most exciting images of the Games; and live coverage from helicopters shows the full grandeur of the Ceremonies. This coverage would be impossible without wireless links.

Private Mobile Radio (PMR): The massive scale of the Games needs all functions to have reliable radio communications. Substantial new PMR networks were needed, for example for the stewards managing the road races, the athletic teams and the organisers' transport function.

Timing and scoring: Following the progress of an event and communicating the final result depends in many cases on wireless links. For example, wireless links allow the location of boats in the sailing events to be tracked and displayed for spectators.

Services for the audience: Wireless links deliver audio description services for hearing and visually impaired spectators and sports presentation content for the whole audience.

Satellite uplinks: Getting pictures and sound to the billions of people in the worldwide audience relies on satellite systems as well as other communications links.

Mobile phones: The mobile network operators delivering their planned coverage and capacity for public mobile service relies on the frequencies they use remaining clear of interference.

The managing of the spectrum for these different types of wireless systems will hence be a challenging task and the work load is expected to increase manifold. Additionally the quality of service especially that of wireless links for the activities mentioned above have to be up to the mark and hence careful planning will be required to ensure that they work at full capacity and to avoid interruption by harmful interference otherwise there may be serious consequences. It is also expected that there may be spectrum requirements in unplanned bands not normally used for special events. Hence there will be a lot of challenges in planning and assigning the spectrum during such events that would need careful consideration.

Questions 34	What other types of wireless systems not listed above are expected to be used during mega events?
Questions 35	What would be the frequency bands in which there will be additional demand from the listed wireless systems?

7. Consultation Questions

Responses to the questions asked in this consultation should be provided in the consultation response template provided below:

Question:	
Response:	
Justification:	

7.1 Your details

YOUR GENERAL INFORMATION	
Name	
Job Title	
Organization	
Postal Address	
Contact number	
Email address	

7.2 How to Respond

Please respond to those consultation questions which affect your business/operations and those on which you have a pertinent view. You do not need to respond to all questions.

Please send your completed response by post, courier or as an email attachment to:

Spectrum Affairs Department
Communications Regulatory Authority
18th Floor, Al Nasr Tower B, Al Corniche
P.O. Box 23404
Doha
Qatar

Tel: 4499 5515
Fax: 4483 0630

Email: spectrumaffairs@cra.gov.qa

Your response must be received by CRA by the Closing Date of the consultation, which is: August 28th, 2014.

8. Next Steps

At the end of the consultation period, CRA will:

- Review the responses, noting the points made and the impact that any suggested changes might have on the proposed licensing regime
- Prepare and distribute a response to stakeholders. This will include a summary of the main points raised in the responses to the consultation, the conclusions that CRA has drawn and the actions to be taken
- Estimation of the spectrum requirements based on the analysis of regional and international trends in spectrum use.
- Development of action plan to address the key issues to be resolved during next 5 years in order to ensure equitable spectrum access while balancing the conflicting requirements of all types of spectrum users (Government, Commercial or Private).