Radio Spectrum Policy for the State of Qatar

Supreme Council for Information and Communications Technology (ictQATAR)

Public Consultation

5 October 2010

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1 Introduction

1.1 Background

This Public Consultation document outlines the proposed Radio Spectrum Policy to be issued by the Supreme Council for Information and Communications Technology ("ictQATAR") in accordance with Decree Law No. (34) of 2006 and the Telecommunications Law and related legislation.

Article 3 of the Telecommunications Law provides a legal mandate for ictQATAR 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.

Article 4 of the Telecommunications Law also empowers ictQATAR to (inter alia):

(1) grant, amend, renew, suspend and revoke Class Licences, Radio Spectrum Licences and Authorisations and determine the terms and procedures necessary for their issuance;

(2) monitor compliance of licensees with their Licences and Authorisations; and

(3) set and manage the plan for Radio Spectrum and for other scarce resources, ensuring the optimal use of such resources and maximising revenues generated from them within the limits specified by international rules.

Spectrum is a fundamental, finite and valuable national resource which belongs to the State of Qatar, and which ictQATAR is mandated to manage on behalf of the State. Spectrum is important to all sectors of the communications services industry and other strategic industries. There are international regulatory frameworks for the management of spectrum, and regulators world-wide are continually reviewing the way in which spectrum policy, allocation and assignments are determined. This helps to ensure that the resource can be fairly and appropriately distributed and used to optimum national and economic benefit.

In this Public Consultation, ictQATAR seeks views and comments from interested parties on the proposed Radio Spectrum Policy for the State of Qatar. ictQATAR will carefully consider all submissions received through this consultation process in finalising the Policy. However, ictQATAR is not obliged to take a final position on Radio Spectrum Policy based on this document alone or the views submitted by any third party. It must act in the best interests of managing spectrum efficiently and effectively.

The background to the proposed policy, and the policy itself have been developed after a long process of engagement and research with national industry stakeholders and international experts. The research has enabled the policy to be developed with full visibility of the current issues faced by spectrum users in Qatar and their mid term expectations for service development and spectrum needs. The findings of this research are documented in Sections 2 to 7 of this Public Consultation document. The questions which respondents are asked to answer are contained in Section 8 of this document.

1.2 Scope

The proposed Radio Spectrum policy covers all issues related to the allocation, assignment and management of radio frequencies in Qatar for which ictQATAR is responsible under the Telecommunications Law and related legislation.

1.3 Objectives

The objectives of the Radio Spectrum Policy are to enable spectrum in Qatar to be managed in a manner which is consistent with the objectives set out within the Telecommunications Law, Executive By-law 1 of 2009, other legal instruments related to Radio Spectrum in Qatar, and international best practice for such policy.

Many aspects of policy and procedures for the administration and implementation of Radio Spectrum policy are in place in Qatar, but are in need of review and some revision. The Radio Spectrum policy will bring clarity and benefits to Qatar, as it will ensure that:

1. spectrum users are well-informed, allowing them to make rational investment decisions and informed decisions when they bid or apply for spectrum;
2. ictQATAR makes consistent and predictable decisions about Radio Spectrum, and these decisions have legitimacy with business, consumers and government with the following policy objectives:
    - to reduce regulatory barriers to radio frequency access;
    - to promote efficient use of radio spectrum for the orderly development and efficient operation of radio communications systems and services;
    - to improve spectrum planning and promote the use of market-mechanisms in spectrum management;
    - to ensure public safety communications needs and interoperability;
    - to ensure the appropriate balancing of commercial and public interests;
    - to support and promote innovation and encourage competition; and
    - to improve stakeholder participation in the process.
3. ictQATAR's Radio Spectrum policies will be guided by the following principles:
    - to promote the economic and societal benefits from use of all spectrum;
    - to provide a transparent, non-discriminatory and predictable approach to spectrum management;
    - to take the least intrusive interventions consistent with achieving public policy objectives and efficient spectrum use;
    - to set the spectrum fees in a manner which will enable efficient use of this scarce national resource;
    - to 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 sufficient and justifiable reasons to do otherwise;
    - to facilitate stakeholder participation in key allocation decisions.

1.4 Next Steps

At the end of the consultation period, ictQATAR will carefully review all responses received and finalise the Radio Spectrum policy.

Following the finalisation of the Radio Spectrum policy, ictQATAR may develop and publish guidelines, rules, procedures and forms outlining how the policy will be implemented.

1.5 Definitions

Telecommunications Law: The Telecommunications Law issued pursuant to Decree Law 34 of 2006.

Executive By-Law: The Executive By-Law of the Telecommunications Law No1 of 2009.

Allocation of radio spectrum: entry in the national frequency allocation table, prepared by the Regulatory Authority pursuant to the Executive By-Law, of a given frequency band for the purpose of its use by one or more terrestrial or space radio-communications services or the radio astronomy service/s under specified conditions.

Allotment of Radio Spectrum: Entry of a designated frequency channel in an agreed plan adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunications service in one or more identified countries or geographical areas and under specified conditions (RR-08).

Assignment of a radio frequency or radio frequency channel: authorization given by the Regulatory Authority pursuant to the Executive By-Law for a radio station to use a radio frequency or radio frequency channel under specified conditions.

Authorization: an approval granted to use radio spectrum or provide telecommunications services.

Broadcasting Service: the broadcasting of radio and television programming to the public free of charge or for payment, by subscription or any other basis using any type of telecommunications network.

Class License: A License granted in accordance with Chapter Three of the Telecommunications Law for a certain class of service providers and which applies to any person falling within that class without that person having to apply for such license.

Customer: subscriber, user or consumer of telecommunications services, whether an individual, corporation, governmental body or any other public or private legal entity and regardless of whether the services are acquired for the customer's own use or for resale.

General Secretariat: The General Secretariat and Regulatory Authority in ictQATAR.

ictQATAR: The Supreme Council for Information and Communications Technology.

Individual License: A License granted to a particular legal person in accordance with the provisions of Chapter Three of the Telecommunications Law.

International Rules: any rules, instructions, orders, regulations, recommendations, guidelines, provisions, specifications, terminologies, definitions or any other matters provided for in the agreements of the International Telecommunications Union (ITU) and the Arabic Chapter of the ITU or in any other agreements ratified by the State of Qatar.

License: The legal permission granted and issued by ictQATAR to an individual or class of individuals to own or operate a telecommunications network, provide telecommunications services, and/or use radio frequency spectrum, and it does not constitute a contract or bilateral agreement.

Licensee: A person who holds a License pursuant to the provisions of the Telecommunications Law.

National Frequency Allocation Plan: A component the National Radio Spectrum Plan which provides specific allocation policies and information on the availability of spectrum for particular applications.

National Frequency Assignment Register: The component of the National Radio Spectrum Plan in which spectrum assignments are recorded.

National Radio Spectrum Plan: The plan established for allocation and use of radio spectrum by the concerned entities.

Radio-communications: any transmission, emission or reception of signs, signals, writing, images, sounds, data or information of any kind by means of electromagnetic waves in the radio spectrum.

Radio Spectrum: Radio frequencies that are capable of being used in radio communications in accordance with the publications of the International Telecommunications Union.

Radio Spectrum License: The License to use radio spectrum in accordance with the plan, allocations, assignments and terms as stated in Chapter Four of the Telecommunications Law.

Frequency Band: a portion of the radio spectrum which starts at a particular frequency and ends at another.

Secretary General: The Secretary General of ictQATAR.

Service Provider: a person that is licensed to provide one or more telecommunications services to the public or licensed to own, establish or operate a telecommunications network to provide telecommunications services to the public. This includes providers of information or content provided using a telecommunications network.

Tariff: any statement of prices, rates, charges or any other compensation including related service descriptions or terms and conditions such as rebates, waivers or discounts offered by a Service Provider regarding any of its services.

Telecommunications: the transmission, emission or reception of writing, signs, signals, images, sounds, data, text or information of any kind or nature by wire, radio, optical or other electromagnetic means of communications, or by any other telecommunications means.

Telecommunications Equipment: equipment capable of being connected directly or indirectly to a telecommunications network in order to send, transmit or receive telecommunications services, and includes radio-communications equipment.

Telecommunications Facilities: any facility, apparatus or other used or capable of being used for transmitting telecommunications services or for any operation directly connected with the transmission of telecommunications services.

Telecommunications network: any wire, radio, optical or electromagnetic systems for routing, switching and transmitting telecommunications services between network termination points including fixed and mobile terrestrial networks, satellite networks, electricity transmission systems or other utilities (to the extent used for telecommunications), circuit or packet switched networks (including those used for Internet Protocol services), and networks used for delivery of broadcasting services (including cable television networks).

Telecommunications Service: any form of transmission, emission or reception of signs, signals, writing, text, images, sounds or other intelligence provided by means of a telecommunications network to a third party.

1.6 Public Consultation document contents

The key issues identified in the research, and proposed policy and operational directions are outlined in **Section 8** of this Public Consultation. **Section 8** also presents the proposed Radio Spectrum Policy and the consultation questions.

The preceding sections of this consultation provide detailed discussion about the issues, supported where appropriate with references to international best practice in a structured manner:

- In **Section 2**, we review the legislative framework in Qatar, the current Radio Spectrum policy, and the associated licensing and processes.
- **Section 3** looks at international developments in Radio Spectrum policy, the administrative processes, policies and market mechanisms used in some leading administrations.
- **Section 4** and **Section 5** consider the current demand for Radio Spectrum, and the future demands in Qatar, respectively.
- In **Section 6,** there is an assessment of the issues which need to be considered in the allocation policy.
- **Section 7** discusses and reviews the issues related to assignments and licensing, as well as recommendations on that.

1.7 Instructions for Responding to this Consultation document

All interested parties are invited to submit responses to the questions specifically identified in this document and to provide their views on any other relevant aspects.

Comments should reference the number of the question being addressed or the specific section of this document if not responding to a particular question.

Submissions should be supported by examples and relevant evidence.

All submissions will be carefully considered and taken into account by ictQATAR. Nothing included in this Public Consultation is final and binding and ictQATAR is under no obligation to adopt or implement any comments or proposals submitted.

Communications with ictQATAR concerning this Public Consultation must be submitted in writing by no later than 3pm on Wednesday 28 November 2010.

Submissions are to be submitted by either of the following two methods:

(1) By email to consult@ict.gov.qa and the subject reference in the email should be stated as 'Radio Spectrum Policy'. It is not necessary to provide a hard copy in addition to the soft copy sent by email; or

(2) By hand, courier or post (one hard copy accompanied by a CD Rom) to:

Mr Mohammed Sadeq
Technical Department
Regulatory Authority
ictQATAR
Level 18, Al Nasser Tower
Al Corniche (Post Office Roundabout)
Po Box 23264
Doha QATAR

Publication of Submissions

In the interests of transparency and public accountability, ictQATAR intends to publish the submissions in this Public Consultation on its website. All submissions will be processed and treated as 'non-confidential' unless confidentiality is requested and approved (in the interests of public benefit) by ictQATAR.

While ictQATAR will endeavour to respect the requests of respondents, in all instances the decision to publish submissions in full, in part or not at all remains at the sole discretion of ictQATAR.

By making submissions to ictQATAR in this Public Consultation, respondents will be deemed to have waived all copyright or intellectual property claims that may apply to property contained therein.

2 Current Radio Spectrum policy in Qatar

2.1 Legislative framework

The regulation of Radio Spectrum in Qatar is governed by the Telecommunications Law [1]. Under the Telecommunications Law, ictQATAR is responsible for allocating, assigning and managing radio frequencies (Ch 4, Art 13). More detailed implementation of legal and regulatory requirements concerning Radio Spectrum are set out in the Executive By-Law[2].

ictQATAR has produced internal drafts of regulations, for example, in respect of the management of the radio spectrum, various uses of short range devices and for the use of radio frequencies by broadcasting services. The results of this study will inform about the future development of these regulations.

The key provisions of the Telecommunications Law and the Executive By-Law in respect of Radio Spectrum and their implementation are described below.

Roles and functions of ictQATAR[3]

ictQATAR has powers to grant, amend, renew, suspend and revoke Individual and Radio Spectrum Licenses, to approve the national radio spectrum plan, and to determine fees for the use of the Radio Spectrum. Individual licences have been awarded for the provision of public fixed and mobile telecommunications networks and services. These licences list the relevant public network spectrum licences for each service operator, respectively.

In accordance with Article (4) of the Telecommunications Law and Article (24) of the Executive By-Law, the General Secretariat at ictQATAR is responsible for, but not limited to:

- granting, amending, renewing, suspending and revoking radio spectrum licences and authorisations
- setting and managing the radio spectrum plan
- monitoring spectrum use
- preparing a national frequency register
- forming and monitoring committees to coordinate spectrum use, including issuing regulations and rules to establish and operate such committees
- ensuring the optimal use of the radio spectrum and maximising revenues generated from them within the limits specified by international rules.

The Telecommunications Law envisages three key elements of the spectrum management regime:

- a National Frequency Allocation Plan (NFAP)
- a National Frequency Assignment Register (NFAR)
- a committee to coordinate all spectrum uses – civilian and non-civilian.

[1] http://www.ict.gov.qa/files/elaw(1).pdf

[2] http://www.ict.gov.qa/files/images/The_Telecommunication_Executive_By-Law.pdf

[3] Chapter 2: Article (3) and Article (4); Chapter 4 Article (14) and Article (17)

In addition, the Executive By-Law (Article 24) states that the General Secretariat shall prepare and publish a national frequency assignment plan (NFAP) for the spectrum allocated to the telecommunications sector and a national frequency allocation plan.

Spectrum management objectives

Under its powers and authority in the Telecommunications Law (Art 2 para 3), ictQATAR must ensure:

- Optimise the use of spectrum in accordance with international best practice;
- support and promote innovation and encourage competition; and
- establish a fair, objective and transparent licensing regime.

The Executive By-Law reiterates the above 'objectives' in Article 24 (4) and requires the General Secretariat to:

- "ensure the best and most efficient use of radio spectrum in accordance with international best practice in order to promote the objectives identified in Article (2) of the Law."

The General Secretariat is required under Article 26 of the Executive By-Law to develop regulation to implement an efficient approach to manage the radiofrequency spectrum.

These objectives are interpreted at a working level to mean ictQATAR should manage the spectrum to promote its optimal or efficient use, in respect of achieving overall economic and social objectives. The reference to 'maximising revenues' requires ictQATAR to take account of international rules and best practice when considering revenue raised from spectrum access and use.

As noted in the Executive By-Law, all the objectives stated in the Telecommunications Law at Article 2 are generally relevant. In particular, the following objectives are likely to be most relevant to spectrum management:

- promoting the telecoms sector's development;
- encouraging competition;
- encouraging the introduction of and investment in new and innovative technologies to meet customer and public needs; and
- establishing a fair, objective and transparent licensing regime.

These objectives may be supported by the release of some spectrum. For example, for competing operators, for self-provision of radio systems by private companies, and for new services on a fair, objective and transparent basis. Where this is warranted and in these circumstances, specific conditions may be applied.

Spectrum policy affects the achievement of objectives in numerous other sectors, such as broadcasting, defence, security, provision of emergency services and aeronautical and maritime services. In developing policy proposals for Radio Spectrum management that meet ictQATAR's statutory objectives, the proposed Radio Spectrum policy takes into account the factors and constraints imposed through policies and legislation that applies to these other areas and sectors.

Allocation Policy

At present there is no formal allocation policy, although allocations are mainly (though not always) aligned with internationally harmonised allocations for Region 1 (table of

allocations for Region 1 of ITU Radio Regulations). There is a draft NFAP (which is discussed in Section 6), and information on frequency assignments is held on Excel spreadsheets and in paper form (see Section 2.3 below).

There is a written proposal for the establishment and constitution of a Qatar National Spectrum Coordination Committee (QNSCC)[4]. This committee would be responsible for high level allocation policy, and this is discussed further in Section 6.

2.2 Licensing

Types of licences

No person may operate any radiocommunications equipment or make use of frequencies without a Radio Spectrum Licence or a radio frequency Authorisation under the Telecommunications Law (Ch4, Art 15). The distinction between a licence and an authorisation is an important one. The distinction is similar to that in service provision between an Individual Licence and a Class Licence. Specifically:

- A licence gives the right to an individual or organisation to access specific frequencies under specified technical conditions (e.g. location of use, power etc) or to use a specific piece of radio equipment
- An authorisation is intended to be a general permission for all individuals or organisations in Qatar to allow use of specific equipment under technical conditions specified in the authorisation. This will generally be applied to consumer equipment under specified technical conditions. As a rule these technical conditions will derive from equipment standards and frequency-use conditions for low power, short range devices in the relevant frequency ranges that have been set by standardisation bodies in Europe, the US and the ITU that are approved by ictQATAR.

Public Network Spectrum licences have been issued to the two telecoms operators (Qatar Telecom (QTel) QSC and Vodafone Qatar QSC) for periods of 20 years (mobile) or 25 years (fixed) to match the duration of the associated Individual Licences. The spectrum licences are technology neutral, though the accompanying Individual mobile licences have coverage obligations that are specified by technology.

The types of equipment and/or services covered by frequency licence categories, and the mapping with the category codes used for fee calculations, is interpreted and shown in Table 2.1 below:

Table 2.1 Frequency licence categories

[4] "Qatar National Spectrum Coordination Committee, Establishment and Constitution, Ref: ICT Qatar-NWG-CTO-CTO-QNSCC-v1.0.

Licence type	Equipment covered	Fee code(s)	Comments
Aircraft Station	All aeronautical mobile and radionavigation equipment used on board aircraft, except Inmarsat terminals	3118	
Fixed Station	Point to point links, PMR base stations, aeronautical ground stations, ground based radars or radionavigation beacons, maritime coastal stations, satellite earth stations , fixed satellite terminals other than VSAT, TVRO or SNG	3111, 3130, 3119, 3120, 3136, 3121,	May include VSAT hub stations
Hand held radios	Hand held land mobile terminals	3128, 3129	Telemetry covers both fixed and mobile applications, depending on the nature of the terminal.
GMDSS station	Ship-borne radios operating on maritime frequencies on vessels > 300 gross tonnes or under the Qatari flag	3117	Applies to each piece of equipment on board the ship
Mobile (vehicle) station	Land mobile equipment [permanently] mounted in a vehicle	3138, 3139, 3140	Exempt from licence fee. Users pay rental fees to Qtel only.
Amateur station	Amateur radio operators (one licence per operator)	3110, [3126]	
Ship station	Ship-borne radios operating on maritime frequencies on vessels < 300 gross tonnes and not under the Qatari flag	3117, 3133	Covers all equipment used on board the vessel
Inmarsat station	Inmarsat terminals (fixed or mobile)	N/A	Inmarsat subscription fee collected on behalf of operator
VSAT / TVRO	VSAT, TVRO or SNG terminals	3137	Per terminal, uni- or bi-directional. Assume hub stations are classed as fixed.

Source: ictQATAR data

ictQATAR's website[5] currently provides information to applicants seeking a licence or authorisation about the process they must follow to apply for frequency licences and electronic copies of some application forms are provided.

The importation of some telecommunications equipment includes the authorised use of spectrum related to that equipment use, provided the equipment meets type approval requirements. Previously, personal telecommunications equipment such as cordless phones

[5] http://www.ict.gov.qa/output/Page623.asp

and handsets were exempted from licence obligations by QTel as a practical measure. This has continued to be the case under ictQATAR.

We note that ictQATAR has published Class Licences which is discussed further in Section 7.2, in the light of international practice regarding licence exemption.

Article 30 of the Executive By-Law indicates that the General Secretariat shall publish:

- applicable licensing procedures and licensing criteria (for licences and authorisations);
- the basic terms and conditions of licences;
- the period of time expected to reach a decision concerning an application for a licence.

All licensing criteria are not published at present. ictQATAR aims to process licence applications and renewals within 10 working days of receiving an application.

Neither frequency nor Radio Spectrum Licences or Authorisations may be traded (in part or as a whole) without the approval of the Secretary General (Article 32, Executive By-Law). A transfer or change of control of a Licensee or segregation or partitioning of radio frequency spectrum rights, or a combination of that or sharing rights is deemed to be an assignment of the Licence or Authorisation or spectrum rights or any portion thereof (Aritcle 32, Executive By-Law).

Article 33 of the Executive By-Law provides a process for facilitating trade under which a licensee may apply to the Secretary General to assign a licence to a third party and the Secretary General must issue its decision (which may include an extension to the decision period) within 30 days of receiving the request.

Assignment policy

Public network spectrum licences have been assigned as part of the process of assigning Individual licences for fixed and mobile telecommunications operators. The licences were awarded by a competitive award process to the second fixed and mobile operator (Vodafone Qatar QSC) and by direct issue to Qtel:

- in the case of the second mobile licence, the competition involved an evaluation stage followed by an auction stage. In addition to the payment at the auction stage for the mobile licence opportunity, there are separate recurring annual fees paid under Individual Licences for spectrum. The second mobile licensee was awarded frequencies at 900 MHz, 1800 MHz and 2100 MHz, together with licences for frequencies to support microwave links (at 14 and 22 GHz)
- in the case of the award of the second fixed licence, a beauty contest was held and spectrum licences were issued for frequencies supporting fixed wireless access and microwave fixed links.

The Consultation on Liberalisation of the Telecommunications sector noted that the second fixed and mobile operator would be able to request additional spectrum in the 4, 8, 15, 23, 26, 28 and 38 GHz bands, if necessary. In its consultation, ictQATAR also stated that for frequencies below 13 GHz, it would not issue spectrum blocks, but rather licensees could apply for frequencies for specific links[6].

A number of issues arise in respect of radio spectrum licensing policy, some of which are:

[6] Explanatory Statement Concerning Final Public Telecommunications License Texts - 23 July 2007, Para 4.2

- should frequencies be conserved or not through the licensing process? If so, what principles should govern how this is done?
- is the approach to assignment on a national basis consistent with the objectives for optimal spectrum use?
- should users be expected to use public rather than private systems?
- should spectrum be assigned in blocks or on a frequency-by-frequency basis (note that the optimum approach may vary by band and/or service)?

ictQATAR recognises that further policy development is needed in these areas, with principles consistent with ictQATAR's objectives. This will be addressed after this Public Consultation on the Radio Spectrum Policy. In all cases, it is necessary to consider the costs and benefits in relation to the overall objectives of promoting optimal spectrum use. We discuss these issues further in Section 7.

Exemptions to licensing and paying licence fees

Article 3 of Decree Law 34 of 2006 exempts the application of the Telecommunications Law to content of audiovisual broadcasting services (i.e. television), equipment or radio stations which are imported or used by the Armed Forces and by the Ministry of the Interior (MoI) or other security bodies. However, these organisations are required to register with ictQATAR the relevant information on the equipment and spectrum they use. In the case of the Armed Forces and the MoI such registration shall not attract a fee (eg. no registration fees). The Armed Forces and the MoI manage their block frequency allocations. At present, they have not registered their spectrum use with ictQATAR though some of their assignments are recorded by ictQATAR.

Broadcasters' use of spectrum to distribute audio-visual services to end-users must also be registered with ictQATAR. Spectrum used to distribute radio services is not exempt. We note, however, that QMC does not pay fees for its use of spectrum for this purpose, even though commercial radio broadcasters do pay a fee set at the rate for a fixed transmitter.

Frequencies used by broadcasters for ancillary services and transmission infrastructure are not exempted from licensing or paying fees. Past assignments to broadcasters for non-broadcast purposes have not yet been licensed, and no fees have yet been paid in respect of this spectrum use. New assignments made to broadcasters for non-broadcast purposes have been licensed and licence fees have been paid. In principle, all assignments of spectrum for broadcasting or any other purposes should be made by ictQATAR, as it is the statutory authority empowered and authorised to do so. This issue is discussed further in Section 6.

On 1 June 2010, ictQATAR issued a Class License for Short Range Devices (SRD). On 23 August, 2010, ictQATAR also issued the Camel Racing Equipment Class License. The above-mentioned Class Licenses allow Licensees to operate such equipment and use the frequencies in accordance with the terms of the Licenses. These Class Licenses apply to any person falling within that class without that person having to apply for those licenses.

Under these Class Licenses, there are no license or spectrum fees. These Licenses shall remain in force indefinitely. The Licensee must comply with the terms and conditions of the respective Class License and the Telecommunications Law so long as that Licensee falls into the particular class covered by the Class Licence.

These are the first Class Licenses issued by ictQATAR, with a range of additional Class Licenses to be issued by ictQATAR in the near future pertaining to telecoms equipment and services.

Licence amendment, renewal, non-renewal and revocation

Radio Spectrum Licences may be suspended, revoked or not renewed if licence conditions or the Telecommunications Law are violated or the licensee ceases to exist (Article 17, the Telecommunications Law). Amendments to a Licence may be made in accordance with the legislation, changes to international treaties and at the request or agreement of the licensee (Article 34, Executive By-Law). In all these cases,the General Secretariat shall follow the procedures set down in Articles 36-40 of the Executive By-Law. These procedures allow the licensee to comment on the proposed action and have time to take remedial measures to correct licence or other legal violations. Licence revocation for reasons of spectrum refarming is not explicitly addressed, though this may sometimes fall under the category of changes to international treaties. In this case, the issue of the appropriate notice period may arise.

Licences may be renewed by the General Secretariat but at present there are no general criteria setting out the conditions under which licences are likely to be renewed (although conditions under which they will not be renewed are clear). In the case of individual mobile and fixed licences[7] (and the associated public network spectrum licences), the licensee may apply for renewal between one and three years before the licence terminates. Renewal is at the discretion of ictQATAR, and its decision must be given within six months of receiving the application for renewal. The renewal period shall be no less than five years. The licence may be amended on renewal. For annual licences there is no legal provisions on renewal conditions, though the presumption is that licences will be renewed unless there are good reasons to do otherwise.

Licence fees

Radio Spectrum Licence fees in Qatar are being set to encourage efficient spectrum use and to recover the costs of spectrum management.

The Executive By-Law states in Article 43 that fees and charges may be based on factors such as the amount of radio frequency spectrum provided in the licence, whether the Licensee is operating in a shared or exclusive frequency band or a percentage or proportion of revenue from use of the radio spectrum. Principles for setting licence fees are proposed in Section 7.

Frequency licences

Licence fees for frequency licences were last set in or around 1997. The licence fee schedule for frequency licences is not published, and licensees have complained about the lack of transparency in how their fees are calculated.

The total frequency licence fees collected by class/category of licence to date is shown in Table 2.2 below, which shows that:

- the majority of fees come from licences for fixed and handheld devices
- SNG licensees face much higher fees than others, and these seem to be levied on a monthly (or per-event) rather than an annual basis
- aircraft payments appear to be much lower when compared with fees for large ships (GMDSS).

[7] Section 22 of the Individual mobile and fixed licences.

The fee schedule used by ictQATAR differentiates between equipment using specific assigned frequencies in international frequency bands (Table 2.3) and in other bands (Table 2.4). There are also radio station fees for services using common frequencies in international bands (e.g. ships, aircraft and amateur users) and charges for satellite receivers and transmitters as shown in Table 2.5. The bottom line of Table 2.5 also gives the per/kHz charge for block allocations to some users that are not covered by public network spectrum licences.

Table 2.2 Fees collected – by class of licence

Licence type	Fees (QAR)	No of licences	Average licence fee (QAR)
Fixed	8,052,350	1,190	6,767
Handheld	2,608,750	746	3,497
F.I. – Mobile satellite terminals	94,000	94	1,000
F.F.- Mobile terminals (vehicle mounted).	629,850	355	1,774
GMDSS1	468,250	91	5,146
GMDSS2	326,700	67	4,876
Small ships	76,400	204	375
SNG	625,000	25	25,000
Craft (Aircraft)	70,500	141	500
VSAT	340,000	68	5,000
Total	**13,291,800**	**2982**	

Source: ictQATAR data

Up to now, the fees have been applied in the following way.

For mobile systems, the charges are related to frequency and radio equipment/handheld/vehicle radio as follows:

If the number of frequencies used equals 1, then no frequency charge applies. The charge equals the number of items of equipment multiplied by a fee, where the fee depends on the nature and power of the equipment as follows:

- handheld equipment (items 3-4 in Table 2.3 or items 9-10 in Table 2.4).
- fixed stations (items 5-6 in Table 2.3 and items 11-12 in Table 2.4).
- vehicle radios (items 20-22 in Table 2.4).

If the number of frequencies is greater than 1, then the charge equals the number of items of equipment multiplied by a fee plus the number of frequencies (international or private) multiplied by the fee. The fees are described in Table 2.4 and Table 2.5.

The frequency charge is intended to give an incentive for more efficient spectrum use. In most cases, systems only use international or private frequencies. However, a maritime user may operate equipment on private and international channels, and they then pay the two highest of the three fees applied by the formula.

In the case of point to point links, the fee is determined by the same formula as for mobile use; i.e. the charge equals the number of items of equipment multiplied by a fee plus the number of frequencies multiplied by the fee. Here, the relevant fees are items 11-16 in Table 2.4).

In the case of an FM radio transmitter, the fee is based on item 14 in Table 2.4; i.e. is QAR 3,000. ictQATAR notes that this fee is low, given the FM frequency band is congested and could have considerable commercial value.

In the case of a satellite earth station that receives and transmits signals, the fee is calculated as follows:

Charge equals two times the frequency charge (which depends on the total channel bandwidth) plus the satellite earth station charge (i.e. the VSAT/TVRO, fixed station or satellite terminal charge, depending on the type of earth station).

Aeronautical and maritime equipment on board vessels. These equipment use common international frequencies and only a per/vessel charge applies (Table 2.5). The charge is lower for yachts and pleasure craft than for aircraft and ships.

QTel operates coastal maritime stations, and the frequencies are covered by one of its public network spectrum licences (ICTRA 04/07 D-17). Charges for land based radars (aeronautical and maritime) and equipment at airports and ports used for communications, navigation and surveillance are determined based on their bandwidth use. ictQATAR believes this is not clear and should be clarified by reviewing the fees.

Temporary use: All temporary mobile and fixed link uses (but not SNG) pay discounted rates.

Table 2.3 Fees for equipment operating in international frequency bands

Number	Description	Annual Fee (QAR)	Comments
1	Amateur radio used locally	100	Not applicable
2	RX for special purpose	100	
3	Frequency and h/h radio up to 5 watt	150	
4	Frequency and h/h radio 5-10 watt	200	
5	Frequency and eqpt radio 10-25 watt	300	
6	Frequency and eqpt radio above 25 watt	500	
7	Frequency and eqpt used on a temporary basis (for less than a year)	300	

Source: ictQATAR data

Table 2.4 Fees for equipment operating on assigned frequencies

Number	Description	Annual Fee (QAR)	Comments
8	Frequency or eqpt for special use	100	
9	HH and Freq up to 5 watt	200	
10	HH and Freq 5-10 watt	300	

11	Eqpt and Freq up to 25 watt or 12.5 kHz channel spacing	500	Fixed station
12	Eqpt and Freq over 25 watt	700	Fixed station
13	Eqpt and Freq of BW 25-54 kHz	1,000	Fixed station
14	Eqpt and Freq of BW 54-300 kHz	3,000	Fixed station
15	Eqpt and Freq of BW 300 kHz to 1 MHz	5,000	Fixed station
16	Eqpt and Freq above 1MHz	10,000	Fixed station
17	Eqpt and freq temporary use (less than one year)	300	Not always used for temporary uses. In some cases annual fees are pro-rated.
18	Eqpt and freq for private use on International level	1,000	Application unclear
19	Reservation of a frequency for less than one year	500	For frequencies reserved in advance of a licence being issued.
20	Vehicle radio and freq up to 10 watt	300	
21	Vehicle radio and freq up 10- 25 watt	500	
22	Vehicle radio and freq above 25 watt	700	

Source: ictQATAR data

Table 2.5 Radio station and frequency band fees

Number	Description	Annual fee (QAR)	Comments
23	Ship station/multiple eqpt	500	This covers all on board equipment for small ships. For ships required to carry GMDSS (i.e. 300 gross tonnes and above) and that operate under the Qatar flag, the charge is per piece of equipment.
24	Aircraft station	500	This covers all on board equipment
25	Amateur station	500	
26	Yachts and pleasure boats	300	This covers all on board equipment
27	Satellite terminals	1,000	Terminals for the mobile satellite service – on land, ships and airborne
28	VSAT/TVRO[8]	5,000	
29	Every 12.5 kHz channel	500	Applied to block assignments
30	SNG	25,000	This charge is levied per channel per month per event

[8] Note that satellite earth stations are only operated by holders of public network spectrum licences and so incur fees as shown in Table 2.4.

Source: ictQATAR data

It is notable that the current fee structure:

- does not relate the fees paid to the frequency band used;
- does not relate the fees paid to the extent of sharing (either geographically or by frequency);
- has no variation with bandwidth above 1MHz which is a relatively narrow bandwidth for fixed link and satellite services and many radar / radionavigation systems;
- results in very high payments by SNG systems relative to others, which is again unrelated to the frequency band and bandwidth used; and
- involves licence fee payments for the use of 'receive only' hand held devices (e.g. pagers), in addition to the payment of fees for the transmitter station, although it is only the operation of the transmitter station that requires exclusive use of spectrum.

It is apparent that there is no clear relationship between licence fees and revenues. This is to be expected as the applications licensed under frequency licences do not generally earn revenues directly from the use of radio spectrum - either costs are saved or revenue effects are indirect (e.g. by enabling aircraft to fly safely).

Public network spectrum licences

In its consultation on Liberalisation, ictQATAR noted that "*In some congested bands, a higher level of spectrum fees could be imposed on all operators using those bands with the aim of promoting the efficient use of the radio spectrum*"[9].

Licence fees paid as part of public network spectrum licences are published and appear in an annexure to the relevant licences. These are listed in Table 2.6 below.

The licence fees are effectively a function of bandwidth assigned and the frequency range used, with higher fees paid if more spectrum is assigned and lower fees paid at higher frequencies. The fees are independent of the service or technology used. All else being equal, these fees should provide an incentive to use less bandwidth and higher frequency ranges where spectrum is typically less congested. Public network licensees also pay Licence and Industry fees under their Individual Telecommunications Networks and Services licences that are related to revenues earned.

Table 2.6 Public network spectrum licence fees

Applicable spectrum range (MHz)	Fees (QAR/2x1MHz/year)
Below 800	47,320
800-1,900	36,400
1,900-3,000	29,120
3,000-5,000	21,840
5,000-10,000	10,920
10,000-20,000	3,640
20,000-35,000	2,912
above 35,000	1,092

[9] Section 6.11, Consultation on Liberalization of the Telecommunications Sector in the State of Qatar

Source: ictQATAR data

Most spectrum licences published on ictQATAR's website contain fees that agree the fees listed in Table 2.6. The main exception is a 25 year licence issued to Qtel for use of the 8GHz and 13 GHz bands (ICTRA 08/07 D-8). Fees in this licence are set at QAR 546 and 364/2x1MHz. In principle, the same fee schedule should apply to all spectrum licences.

Comparison of frequency fees and spectrum fees

ictQATAR believes there should be a clear relationship between the frequency licence fees and the public network licence fees, as they apply to similar frequency ranges and in some cases the same application is being used.

While the spectrum fees paid for frequency bands used to supply public mobile services are low relative to fees paid in auctions of such spectrum, Vodafone Qatar QSC paid a very high licence opportunity fee to win the second mobile licence and it is a fact that such a licence has little value without radio spectrum rights. However, the cost of spectrum to the mobile network operators is not a major cost in their overall business plans, and as such, there is currently little incentive for the operators to optimise their use of spectrum.

ictQATAR believes an approach to stimulate efficiency of use needs to be established as the demand for Radio Spectrum will continue to increase. One approach for addressing this issue which has been adopted elsewhere has involved setting fees for mobile operators at a level that reflects the saving in infrastructure costs arising from having an extra block of spectrum[10]. This will be considered in a future fees review.

2.3 International coordination, monitoring and enforcement

Qatar is a member of the Gulf Cooperation Council (GCC) which provides a forum for discussing common issues, developing coordinated policies where cross boundary issues arise (e.g. for digital broadcasting switchover), and for resolving international coordination issues (bi-lateral discussions also occur).

We understand that guidelines have been developed for frequency coordination between GCC countries and, in practice, bilateral coordination between operators is generally effective. However, there have been a number of instances of cross-border interference and unintentional roaming by Qatari mobile subscribers onto neighbouring countries' networks, resulting in higher charges. We note that there are mechanisms in place to support international co-operation, involving periodic meetings of regional network operators as well as regulators.

Under Chapter 15 of the Telecommunications Law, ictQATAR has powers to request information required to carry out its functions and enforce any violations of the law in respect of the use of radio equipment. Article 44 of the Executive By-Law sets some

[10] This has been done for example in New Zealand – see Renewal of management Rights for Cellular Services (800/900 MHz), Network Strategies, Ministry of Economic Development, October 2007 http://www.med.govt.nz/templates/MultipageDocumentTOC____32548.aspx. and the UK, see An Economic Study to Review Spectrum Pricing", Indepen, Aegis Systems and Warwick Business School, Ofcom, February 2004.

options for interference dispute resolution, and gives the General Secretariat the power to issue an order to resolve a dispute.

Although the majority of interference cases have originated from outside Qatar, and often result from anomalous propagation conditions (e.g. ducting), there have been cases of illegal equipment causing interference to licensed users. For example, high power cordless phones designed for use in the North American 900 MHz ISM band have occasionally caused interference to Qtel's GSM network.

ictQATAR believes an effective monitoring and market enforcement programme is essential to minimise the risk of such interference in the future. Such monitoring will take account of Qatar's specific characteristics. For example, the importance of offshore communications for the oil and gas industries means that monitoring facilities should extend to offshore facilities.

As many of the reported interference and outage problems arise from phenomena such as ducting and sandstorms, which are particularly prevalent in the Gulf region, there may be merit in undertaking measurements to aid understanding of these effects on individual radio systems and frequencies so that better account can be taken of them at the frequency assignment stage.

2.4 Spectrum policy and management issues

The main issues ictQATAR has identified concerning the legal and policy framework for spectrum management in Qatar are:

- the absence of published documents articulating ictQATAR's spectrum management policy principles, its allocation, assignment and licensing policy, the basis for licence fees and specific frequency band policies. The main purpose of this study is to provide such a policy framework (see Sections 6-8)
- the absence of a published NFAP for all frequency ranges and a NFAR for telecommunications services. A draft NFAP has been prepared and we discuss this briefly in Section 6
- the need to implement provisions concerning the registration of spectrum use by the army, MoI and broadcasters, and to resolve issues concerning the management of spectrum assigned to these organisations..
- the need for an overarching body representing major users to advise ictQATAR on future allocation issues has been identified. Draft proposals for such a body have been prepared and these are discussed in Section 6
- there is an absence of comprehensive and up to date database of assignments that allows ictQATAR to monitor trends in the use of frequency bands over time and to readily generate data on the extent to which bands are heavily occupied or not.
- there is an absence of documentation on Radio Spectrum licensing policy for internal use. In practice, ictQATAR issues frequency licences where it considers the demand to be justified and where there is no alternative public service offered by QTel or Vodafone. But there are exceptions in some cases, and a more consistent policy is required that takes into account the extent of congestion in different bands and reflects best international practice
- fees for frequency licences are not published and the current fee structure does not provide incentives for efficient use. In particular, the structure appears to unduly penalise the use of higher frequency bands and provide fixed link users with little

incentive to adopt narrower bandwidths. In addition, fees for frequency licences bear no relation to those for spectrum licences. These issues are addressed in Section 7.

3 International developments in Radio Spectrum policy

3.1 Introduction and summary

The economic importance of wireless communications has increased rapidly in the last 20 years as wireless services underpin an increasing range of economic and social activities. Technology change, rapid growth in demand for wireless (particularly mobile) communications and the possibility of wireless communications providing competition to wired platforms are also leading to changes in spectrum policy and management.

Increasingly, policy is less focussed on achieving technical objectives in respect of spectral efficiency (though the avoidance of harmful interference is still a core requirement of any spectrum policy). It is becoming more focussed on promoting economic and social objectives. These objectives include rapid development of the communications sector, efficient provision of public safety, defence and other security services and liberalisation of broadcasting markets.

The economic and social value from use of Radio Spectrum is now well recognised by policy makers and industry. For example, the total volume of services which depend on Radio Spectrum availability is estimated to be worth at least €200 billion annually in Europe[11].

From a policy perspective, this has led to efforts by regulators to release frequencies for use now, rather than conserve them for an uncertain future use, to adopt market mechanisms for spectrum management and to provide more transparent and rigorous evaluation (using economic data) of and support for allocation and refarming decisions. More liberal spectrum release policies, together with rapid technology advances and shorter product/service lifecycles, mean there is more need for policies that allow flexibility to change the use of frequency bands once they are fully assigned.

In summary, the main aspects of radio spectrum policy that have been changing are:

- **Administration policies**, particularly the introduction of approaches that support greater openness and transparency of information on spectrum allocation and spectrum use, and of the regulator's spectrum strategy. This has led to increased public consultation and requirements for decisions to be objectively and publicly justified. In addition, administrative processes (e.g. licensing) have had to become more efficient and timely
- **Licensing policy.** Changes in this area include moves to lighter/less intrusive licensing regimes, greater clarity over the terms and conditions of licence renewal, and greater flexibility in the technologies and services that may be deployed in specific bands (termed liberalisation)
- **The use of economic incentives** to promote efficient spectrum allocation (and reallocation), assignment and use. This has involved increasing use of mechanisms such as auctions, trading and spectrum pricing

[11] http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/index_en.htm

- **Policy in respect of non-commercial use.** As demand for spectrum from commercial and non-commercial use has grown, the extent of some non-commercial allocations and the efficiency with which they are used have been called into question.

These changes are interrelated as better regulatory processes and clearer and more flexible licensing are required to support market based approaches to spectrum management and to manage non-commercial spectrum use. Market based approaches have been applied mainly to commercial use but some commentators have argued financial incentives also have a role with non-commercial use.[12]

Below are some examples of good practice in these areas.

3.2 Administrative processes

Spectrum strategy

A spectrum strategy comprises:

- a set of policy objectives and supporting principles
- a spectrum release plan
- a statement of the specific regulatory tools for managing different frequency bands, including administrative and market-based tools.

The spectrum strategy may be embodied in a single document but, typically, it also results in a series of specific detailed consultations that either elaborate on the policy or apply it to specific frequency bands.

Some examples of good practice in this area include:

- Australia: In 2008 the regulator ACMA announced [13]a new approach to consulting on spectrum matters including: the establishment of a Radiocommunications Advisory Group, an annual conference on radio spectrum matters and publication of a five year rolling spectrum plan. The regulator followed this with consultations on the application of its regulatory principles[14] and on the five year rolling spectrum outlook[15]
- Bahrain: In 2006, the TRA and Ministry of Transportation published their joint spectrum policy[16] outlining its approach to spectrum management and decisions on the allocation and assignment in a wide range of frequency bands
- Canada: In 2005 the government initiated a consultation on the spectrum policy framework and this resulted in a policy statement in 2007[17]
- Hong Kong: In 2007 the Government announced the publication of a spectrum policy framework[18]. The regulator has since published a spectrum release plan [19] and initiated actions to implement the plan

[12] http://www.spectrumaudit.org.uk/pdf/20051118%20Final%20Formatted%20v9.pdf

[13] http://www.acma.gov.au/scripts/nc.dll?WEB/STANDARD/1001/pc=PC_310939

[14] http://www.acma.gov.au/WEB/STANDARD/pc=PC_311103

[15] http://www.acma.gov.au/WEB/STANDARD/pc=PC_311105

[16] http://www.tra.org.bh/en/pdf/spectrum_policy_TRA_MOT_final.pdf

[17] www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08776.html

[18] http://www.cedb.gov.hk/ctb/eng/telecom/topical_b.htm

[19] http://www.ofta.gov.hk/en/freq-spec/spr.html

- Ireland: The regulator ComReg produces three year spectrum strategy documents[20] detailing its approach to managing spectrum overall and for managing specific frequency bands
- UK: In 2005, the regulator Ofcom set out its strategy for increased use of trading and liberalisation of spectrum use,[21] making additional spectrum available for licence exempt use and its plans for spectrum release
- US: In 2002, the Federal Communications Commission's (FCC) Spectrum Policy Taskforce developed recommendations for improving the way Radio Spectrum is managed.[22] This report advocated increased reliance on market oriented reforms together with increased use of a spectrum commons model. The FCC has initiated rule makings to further liberalise spectrum use and to introduce secondary spectrum markets (through spectrum leasing)[23] and has continued its programme of spectrum auctions.

In addition, at a European level, the European Commission has been pursuing the development of a policy to promote more flexible use of spectrum and to bring greater integration of spectrum policy with wider European policy initiatives (e.g. i-2010 initiative, EU-wide transport policies). The strategy[24] is aimed at ensuring a common approach to managing spectrum resources at the EU level to allow innovators to place new technologies on the EU single market quickly and with legal certainty. The Commission has emphasised the need for "a gradual but systematic liberalisation of radio spectrum use" with a view to introducing spectrum trading and more flexible spectrum use in the period up to 2010[25]. It has applied harmonisation policies in a number of frequency bands[26]. In support of these policies the EC has initiated studies on spectrum management information, spectrum trading and liberalisation, collective spectrum use, public sector spectrum use and exploiting the digital dividend[27]. It has also mandated CEPT to develop technical conditions required for the introduction of new applications and liberalised spectrum use in specific bands[28].

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20 http://www.comreg.ie/publications/consultation_on_proposed_strategy_for_managing_the_radio_spectrum__2008_-_2010.583.103039.p.html

21 Spectrum Framework Review, Ofcom, June 2005; Spectrum Implementation Plan – Interim Statement, July 2005, Ofcom

22 Spectrum Policy Task Force, Report, ET Docket No 02-135, November 2002, FCC

23 http://wireless.fcc.gov/licensing/secondarymarkets/

24 European Commission. 29 September 2005. "Commission proposes advancing single market for radio spectrum use." IP/05/1199.

25 European Commission. June 2005. "A forward-looking radio spectrum policy for the European Union: Second Annual Report." COM (2005) 411.

26 http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/documents/legislation/index_en.htm

27 http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/documents/studies/index_en.htm

28 http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/manage/eu/rsc/rsc_subsite/mandates/index_en.htm

Information

To manage spectrum efficiently the regulator must have readily available, complete and accurate information on allocations and assignments[29]. This information is also of value to manufacturers of radio equipment and all users of spectrum, as it allows them to see what equipment and frequency ranges may be used, and indicates the potential for introducing new products and services. In countries where spectrum is tradable, licensees and spectrum brokers need to know the identity of other licensees to initiate trading activity. For all users, knowledge of use in adjacent bands can assist in dealing with interference issues.

It is for these reasons that the European Commission adopted a Decision on the harmonised availability of information regarding spectrum use within the European Community.[30] This Decision required the development of the EFIS database[31] (by CEPT) which contains data for member states on allocations, applications, technical interfaces and other relevant documents. In addition, from 2010 onwards, information on individual rights of use (i.e. licensed use) is expected to be placed in the database.

On-line databases of licence assignments[32] are also provided by regulators in Australia, New Zealand, Norway, the UK and the US[33]. In some cases, these are comprehensive and cover all assignments. In others, they only cover some frequency ranges. In the US, a private firm Kantor Fitzgerald also provides on-line access to licence data for the purpose of facilitating spectrum trading, and Spectrum Bridge provides a spectrum trading service including a price index for traded spectrum[34].

Issues of commercial confidentiality and confidentiality of data for safety and security reasons have arisen in all of these cases, and the scope of what information can be published depends on local data protection law. In Australia, for example, the following data can be found on the on-line database:

- lower and upper frequency bounds
- bandwidth
- whether it is paired and what the frequency pairing is
- licence category
- geographic area
- licence number

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[29] See for example the results of a study for the European Commission on this issue. http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/studies/allocation/spectrum_info_fin_rep.pdf

[30] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:129:0067:0070:EN:PDF

[31] http://www.efis.dk

[32] In some cases (e.g. Australia) the database is also provided on CD.

[33] US: http://wireless.fcc.gov/uls/index.htm?job=transaction&page=weekly

Australia: http://web.acma.gov.au/pls/radcom/register_search.main_page

New Zealand: http://www.rsm.govt.nz/cms/licensing/register-of-radio-frequencies

Norway: http://www.npt.no/portal/page/portal/PG_NPT_NO_EN/PAG_NPT_EN_HOME/PAG_RESOURCE/PAG_FREQUENCY

UK: http://www.ofcom.org.uk/radiocomms/isu

[34] http://spectrumbridge.com/web

- status
- organisation name
- date of effect
- date of expiry.

Experience in different countries shows that:

- it can take time to build confidence that the data released will not be misused, and so the extent of information released tends to expand over time. This has been the case in the EU. A particular UK example relates to the release of information on defence use. It was once the case that defence allocations were not noted in the national allocation plan. However, it is now the case that the Ministry of Defence has published a plan for reforming its spectrum use and an analysis of its future demand for spectrum by frequency band[35].
- the regulator's internal IT systems need to be capable of supporting external access to data with suitable security controls. This can require considerable changes to and upgrading of these internal systems, but it should be noted that this can provide benefits for the regulator (e.g. ensuring assignment data is accurate, complete and readily accessible) as well as external stakeholders accessing the system.
- the information provided is valued by all stakeholders.

3.3 Licensing policies

Use of Radio Spectrum is licensed primarily in order to avoid harmful interference. This suggests that if harmful interference is unlikely to occur, then use should either be licence exempt or some form of "light licensing" should apply. This approach has been adopted by some regulators to give users greater flexibility and reduce regulatory burdens. For example, under the EU Authorisation Directive (Art 5), where the risk of harmful interference is negligible, use of radio frequencies is not licensed but rather is permitted under a general authorisation.

In addition, licences provide a mechanism to manage use. For example, to know who is using what frequencies at any time so planning and coordination can be more easily undertaken. Licences also provide a framework for terminating or changing use and a mechanism for collecting fees. For example, in cases where potentially interfering uses are not licensed (e.g. defence), all of these activities are made more difficult. As the spectrum becomes more crowded, this has led some regulators to extend formal licensing (or similar arrangements) to certain unlicensed users – in particular public sector users. One example is in the UK where the government is "licensing" Ministry of Defence allocations using a legal instrument termed 'Recognised Spectrum Access', which will have all the properties of a tradable licence[36].

Licence Exemption

35

http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/ConsultationsandCommunications/PublicConsultations/UkDefenceSpectrumManagement200812.htm

36 This is explained more fully in the Ofcom consultation on the grant of an RSA for Ministry of Defence use of the 3.4-3.6 GHz band in the UK. http://www.ofcom.org.uk/consult/condocs/3_4ghz/3_4ghz.pdf

In some circumstances, the likelihood of harmful interference arising from the operation of a wireless device is negligible and it is, therefore, not necessary to license radio frequencies to individual users. In such cases, it is appropriate to authorise use of the spectrum on a licence-exempt basis so long as certain technical conditions are complied with. Examples of applications where such an approach can be used include low power, short range devices, terminals connected to licensed public networks (fixed or mobile) or devices operating in very high frequency bands (typically above 50 GHz) where short range, line of sight radio propagation limits the likelihood of interference to other devices. In each case it is necessary to specify the frequency band(s), technical characteristics (e.g. transmit power, duty cycle, etc) and any operational constraints (e.g. restrictions on outdoor use or directional antennae).

Many parts of the world have defined consolidated regulations that define most or all of the bands that are exempt from individual licensing. For example, in the European Union regulators are required to apply licence exemption (in the form of a general authorisation) "where possible and in particular where the risk of harmful interference is negligible"[37]. Individual frequency bands for operation of licence-exempt short range devices and the associated technical parameters are defined in Recommendation 70-03 of the European Communications Committee (ECC)[38], reference to which is usually made in the national regulations governing licence exemption in each European country. Typically, the national exemption regulations will also provide provision for exemption of terminals connected to public mobile, fixed wireless access or mobile satellite networks.[39]

Light licensing:

Examples of light licensing regimes and other innovations include:

Registration or notification. This approach requires the user to notify the spectrum use to the regulator and possibly to provide basic information such as the location and type of equipment, but does not require a formal licence application to be submitted so long as the specified technical conditions are complied with. This is typically applied in situations where there is no immediate concern about interference but where there may be a need to make changes to the use of the spectrum in future. Hence, there is a need to maintain a record of those who are using the spectrum. There may be limits on the number of users but not always. Typically, light licensing permits greater power than licence-exempt bands. A small fee may be payable to cover the costs of the registration / notification scheme.

Some European countries allow the use of the 5.8 GHz band for fixed wireless access services on a light licensing basis without the need to apply for an exclusive licence or right of use. Other examples include: 1) a registration scheme proposed in the U.S for use of the 3650 – 3700MHz band on a collective basis[40] for fixed wireless access where the risk of interference is mitigated by technical means, and where licensees are mutually obliged "to cooperate and avoid harmful interference to one another"; and 2) the UK regulator Ofcom recently awarded through auction, twelve low-power concurrent rights of use through

[37] Article 5.1, EC Directive 2002/10/£C (the Authorisation Directive)

[38] Available from www.erodocdb.dk/Docs/doc98/official/pdf/REC7003E.PDF

[39] A good example is the UK exemption regulation which can be downloaded from http://www.opsi.gov.uk/si/si2003/20030074.htm

[40] Users are required to use contention-based protocols to minimise the impact of interference. See "FCC Opens Access to New Spectrum for Wireless Broadband in the 3650 MHz Band", March 10, 2005, available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-257309A1.pdf.

auction for the frequencies 1781.7-1785MHz paired with 1876.7-1880MHz.[41] Licensees are expected to coordinate their use of the spectrum to avoid harmful interference.

Private Commons: An individual 'right of use' is required but access to spectrum may be 'sub-let' to third parties on an unlicensed basis without the need for coordination, so long as pre-defined regulatory conditions are adhered to. Responsibility for avoiding interference with users outside the spectrum band rests with the right of use holder rather than the lessee. In the U.S., the Federal Communications Commission (FCC) has introduced rules permitting spectrum leasing under which a licensee may acquire a block of spectrum to create a private commons for use by thousands or even millions of new users.

Managed spectrum park[42]: The New Zealand Government has proposed this approach to shared use in part of the 2.5 GHz band. It allows local/regional access for a selected number of users, but with requirements to coordinate with other users to enhance the quality of service otherwise achievable. It is a middle ground option between nation-wide spectrum rights with exclusive access (highest acquisition cost but offering high quality of service) and open (public) access in the licence exempt bands (easy access with no licence fees, but a greater risk of interference and reduced quality of service). If there are competing requirements for spectrum then applicants are expected to resolve any interference issues. If these cannot be resolved then applicants will be removed by ballot. Compliant applicants will be licensed and pay modest licence fees.

The other major change in the area of licensing is the move towards licences that offer flexibility in the technology and, sometimes the services, that may be deployed. Such licences have existed in Australia and New Zealand since the early 1990s but have been introduced more recently in Europe under the acronym WAPECs[43], North America and other parts of the world, in order to give licensees flexibility to change the technology or service offered in response to market conditions. This helps avoid a situation in which technology may be specified but then not prove to be economically viable leaving the spectrum sterilised until a new regulatory decision is made. It is important to emphasise that while such licences offer greater flexibility, the technical conditions they contain inevitably place some restrictions on the technologies and services that may be economically deployed. Hence, they are often termed technology and service flexible rather than technology and service neutral.

3.4 Market mechanisms

The term 'market mechanisms' has been used to cover the following spectrum management tools:

- **Auctions:** Auctions involve assigning licences based on the sums bid. These may be absolute amounts or percentages of revenue (i.e. royalties). Bidders may be required to meet minimum technical, financial or other criteria. To the extent that auctions are

[41] The number of licences was determined by the auction.
http://www.ofcom.org.uk/radiocomms/spectrumawards/completedawards/award_1781/documents/

[42] http://www.rsm.govt.nz/cms/policy-and-planning/current-projects/radiocommunications/managed-spectrum-parks

[43] Wireless access policy for electronic communications services.
http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/mandates/ec_to_cept_wapecs_06_06.pdf

well designed, they are likely to result in the allocation and assignment of spectrum to the highest value uses/users.

- **Administered incentive prices (AIP):** Prices charged to spectrum licensees are set by the regulator and are intended to reflect the opportunity cost of spectrum use[44] and thereby provide effective incentives for efficient use of spectrum. They are applied to incumbent users of spectrum in circumstances where the spectrum is not auctioned. AIP can be applied to government and non-government users. In addition, regulators normally set fees to recover their spectrum management costs.
- **Secondary trading:** Secondary trading involves allowing licensees to trade their licences. It spans a range of trading arrangements including simple sale, leasing and aggregation, and subdivision of rights of access to spectrum. The analogy with trading in land can be useful in thinking about how spectrum trading might work: By making spectrum tradable users face the opportunity cost of their spectrum use, and therefore have incentives to economise on their spectrum use and to reallocate spectrum to higher value uses/users. Through leasing spectrum users in effect become private frequency band managers.

There are also variants of these approaches that can be used to refarm spectrum. For example, organisations winning spectrum though an auction may be required to move incumbent users where necessary and governments have established spectrum funds to pay part of incumbents' (or final users') refarming costs in order to free up spectrum for higher value users.

Table 3.1 summarises the main market mechanisms and gives examples of countries where these approaches have been applied. Use of auctions to assign vacant blocks of spectrum, particularly for public mobile services, is now common practice. Trading is less widespread. Trading (including aggregation and disaggregation of licences) often requires legislative change to introduce tradable licences, rights of access to spectrum to be very clearly defined (so they can be enforced legally), procedures for making and approving trades and new procedures for dealing with interference disputes. Experience with trading shows these requirements are not unduly difficult to put in place. However, dealing with competition issues can be more problematic. In particular, regulators need to consider whether they will apply spectrum caps (in advance) to licensees holdings in certain bands or whether they will examine competition issues on a case by case basis.

Many countries claim to have introduced spectrum pricing or AIP, in the sense that their regulators have set fees that are related to the "amount" of spectrum licensed to the user (e.g. bandwidth and area covered often proxied by power) and other parameters such as:

- the type of service supplied often with higher fees for public mobile as compared with other services;
- the frequency band, with higher values in bands that are internationally harmonised, that offer better propagation characteristics and that are more likely to be congested;
- the location of use with higher values in more congested areas, e.g. higher values in urban versus rural areas; or
- the fraction of the national population covered as a proxy for the value of a regional as compared with a national licence.

[44] Opportunity cost is the value of an asset or resource in the next best alternative use that is forgone as a result of its actual use. In a competitive market the prices set should reflect the opportunity cost of the resource in question.

However, the levels of the key parameters in the formulae used are not directly related to opportunity cost, with the exception of New Zealand and the UK. Rather, values are set with discretion and, with ad hoc changes made over time, as certain bands become more congested and so attract a higher fee than would be the case under pure cost recovery fees. In addition, historical precedent heavily influences the level of prices because of the political difficulties of making major changes in fees paid by users. In some countries (e.g. Australia, Portugal, Spain and France) prices are discounted for government users or where public interest issues arise (e.g. broadcasting). These discounts are set on an ad hoc basis.

Table 3.1 Market mechanisms and their application

Mechanism	Circumstances applied	Examples of countries
Auctions	Most vacant spectrum blocks excess demand likely	Australia, Ireland, Norway, New Zealand, UK, US
	Spectrum for public communications services (e.g. mobile, BWA and sometimes broadcasting)	Most countries in Europe, North & South America, South & East Asia and Middle East for new spectrum releases where excess demand is expected.
Trading	Most licensed spectrum	Australia, Guatemala, Norway, UK
	Auctioned spectrum[45]	Canada, NZ, Austria, France, Germany, Hungary, the Netherlands, Italy, Spain and Sweden, US
Administered incentive pricing	Set to reflect opportunity cost	New Zealand, UK
	Set on a discretionary basis	Australia, Bahrain, Canada, France, Ireland, Japan, Spain
Refarming using financial incentives	Government fund	Japan, UK
	New users pay	Australia, France, Jordan, Morocco, Jordan, US

Source: National regulatory authorities

The reasons why market mechanisms have been used vary but include:

- users have appropriate incentives for efficient spectrum use. This will lead to economically efficient use (in the sense that there is an incentive to transfer spectrum to the highest value use), technically efficient use of spectrum (in the sense that there are incentives to use narrower bandwidth technologies and sharing is encouraged) and reduce hoarding (because there is a cost to doing this)
- spectrum use decisions will be more responsive to market developments and fewer mistakes will be made because decisions are being made by those with the relevant information and incentives (i.e. market participants)
- Governments are susceptible to lobbying by special interest groups and this can result in poor decision-making with high economic costs[46]. Also, reallocating or reassigning

[45] Note in some countries only certain licences or licence types can be traded

spectrum from low to high value uses will be faster because incumbents' ability to block or delay changes through lobbying will be more limited

- the State is due a fair return for the use of scarce resources it holds, such as Radio Spectrum.

The advantages of administrative decision-making on the other hand are:

- it enables costly transaction processes to be undertaken more efficiently in some cases (e.g. in refarming spectrum occupied by many small licensees with interdependent spectrum use)
- it may take account of long term social and other policy objectives that are not taken into account through market mechanisms (e.g. national security and national cultural values in broadcasting)
- problems of monopolisation can be addressed directly, although this is also possible with auctions and trading through "bright-line" rules that limit the amount of spectrum an organisation may hold in a given frequency range.

Clearly there is a balance to be struck between these two positions as the arguments are stronger or weaker depending on the frequency bands and services under consideration. Hence, changes tend to be incremental. As the starting point in most countries is that all spectrum is managed administratively over the last 10 years there have been moves to manage increasing amounts of spectrum using market-based approaches.

3.5 Policy in respect of non-commercial use

In recent years, a number of countries have conducted significant national policy reviews concerning public sector spectrum management and use: Australia (2008), the Netherlands (2005), Sweden (2007), the UK (2005), and the US (2008). In all cases, the purpose of the review was to identify ways of improving the efficiency and effectiveness of use of spectrum by public sector organisations, and explore the potential for release of spectrum to new commercial and non-commercial uses. While there are other non-commercial uses of spectrum (e.g. some broadcasting services and use by charities), similar issues apply.

In most cases, the reviews have undertaken an examination of the actual use of frequency bands allocated to the public sector. This provides the information base for any assessment of efficiency of use, and helps the public sector user to identify candidate opportunities for sharing or otherwise releasing spectrum where exclusive use is no longer required. Next, specific bands where spectrum might be released or shared are evaluated in greater detail, which often requires additional studies to be undertaken to ensure that any changes do not result in harmful interference or otherwise reduce safety or security requirements. In all cases, opportunities for spectrum release or additional sharing have been found.

The reviews have examined the extent to which administrative arrangements for managing public sector spectrum could be improved variously through (1) the application of more formal licensing arrangements, (2) collecting and disseminating more information on use,

[46] For example, in the US it is estimated that delays in licensing cellular services cost the economy around $50bn per annum. "Valuing the Effects of New Telecommunications Services", J Hausman, Brookings Papers: Microeconomics, 1997, http://econ-www.mit.edu/faculty/download_pdf.php?id=470

(3) the application of IT in licensing and coordination activities, and (4) better integration with the management of non-public sector spectrum. Finally, in some cases the potential for use of market-based approaches to spectrum management such as pricing, trading and auctions has been considered.

Table 3.2 contains a summary of the main recommendations from the reviews. Follow-up actions are also noted. While reviews in each country place different degrees of emphasis on specific policy reforms, there are common elements, including:

- audits of current use and forecasts of future requirements;
- approaches to increase the technical efficiency of use and thereby accommodate sharing or release to other uses;
- changing administrative arrangements that impact on spectrum demand and use – licensing of public sector users, use of IT to reduce costs and allow more intensive spectrum use, and changing procurement processes so users' spectrum requirements become a factor in the choice of equipment systems.
- possible use of market-based approaches to providing public sector users with financial incentives for economically efficient spectrum use. The application of such approaches has however been limited so far. The use of market-based mechanisms depends on clear definition of the access rights of public sector users. In some countries, access rights are not well defined at present.

Table 3.2 Typical policy review recommendations in other countries

Type of recommendation	Country details	Actions
Spectrum audits	Australia: Increase transparency in use of spectrum by the public sector (use regular audits) esp. Defence Netherlands: Conduct three yearly audits of public sector spectrum use - Netherlands UK: Detailed audit of Ministry of Defence bands required	Netherlands: Two audits have been completed. Some spectrum returned and sharing opportunities found UK: Audit of Ministry of Defence bands on-going. Bands for sharing/release identified. US: NTIA has just completed a comprehensive audit of usage by Federal agencies.
Forecast future spectrum requirements	Australia: Form a committee to advise on future government priorities Netherlands: produce forecasts as part of 3 yearly audits UK: Public sector to produce a forecast of requirements every two years – the "Forward Look" US: Do further work to quantify future spectrum requirements	UK: First "Forward Look" published
Improve technical efficiency	Sweden: Defence to adopt new digital equipment to facilitate sharing/spectrum release US: Investigate sharing using dynamic frequency systems	UK: Study to rationalise aero navigation aids started

Type of recommendation	Country details	Actions
Release spectrum for other users – sharing or release of bands for others	Australia: increase sharing in public sector bands. Incentivise through licence fee relief Sweden: Re-plan and increase sharing in Defence bands UK: Seek to release spectrum in particular bands US: Use more dynamic spectrum technologies to share public sector spectrum allocations.	UK: Radar sharing trials commence; A Ministry of Defence consultation document published setting out plans for spectrum release[47]
Use of IT	US: Automate spectrum coordination and sharing among federal users and between the NTIA and FCC	
Licensing	Australia: put public sector licensing on same basis as for commercial use; develop criteria for renewal of public sector licences UK: Formalise public sector spectrum access through a legal instrument termed Recognised Spectrum Access[48]	UK: Policy statement on implementing a tradable RSA (subject to AIP)
Procurement	Australia: early identification of spectrum requirements for major public sector projects US: Integrate spectrum value in capital budgeting for new spectrum-dependent systems	
Market approaches	Australia: continue to apply market approaches where practicable; allow public sector users to make financial gains from improved spectrum use Netherlands: rejected use of spectrum pricing Sweden: Consider application of pricing UK: Adopt market mechanisms (pricing, trading and auctions)	UK: Extension of pricing to more bands (esp. MoD) Study on applying pricing to aero/maritime bands US: Refarming of public sector spectrum using auction proceeds

Source: National regulatory authorities

Our recommendations in Section 8 of this report address many of these points.

[47] 406.1-430 MHz and 3400-3600 MHz and eight possible bands between 4.4 GHz and 15.2 GHz have been identified for release.

[48] In the UK many public sector organisations do not need to be authorised (by law) to use spectrum.

4 Current spectrum demand and issues - by service

4.1 Introduction

Current demand for spectrum in Qatar is largely driven by three key sectors: (1) public commercial services (broadcast, cellular and fixed wireless); (2) private radio systems (mobile radio and fixed links); and (3) government systems (military and public safety).

The recent licensing of a second cellular network has led to a re-planning of the cellular spectrum and substantially increased demand for fixed links in the microwave frequency bands to provide backhaul. In the private sector, the gas and oil industries are substantial users of spectrum, to support both onshore and offshore operations. Many smaller organisations (and some larger ones) use Qtel's national digital trunked radio network (TETRA) rather than deploying their own systems – they are required to do so currently unless they can demonstrate that this will not fully satisfy their needs. A second national TETRA network, that is operated by the Ministry of the Interior and caters for the State Security agencies, state medical service, Ministry of the Environment, public safety services and some armed forces requirements. The armed forces also operate their own dedicated trunked radio network, and there are various other dedicated military and security systems.

International spectrum allocations for aeronautical and maritime use are allocated and licensed by ictQATAR in accordance with international (ITU, ICAO and IMO) regulations, as are more specialised allocations for applications such as meteorology and amateur radio. A number of frequency bands are exempted from individual licensing, subject to compliance with relevant regulations or technical standards. These include harmonised international bands such as the WiFi bands at 2.4 GHz and 5 GHz, however in some cases frequency licences are required to use these bands (notably where outdoor use is involved).

In the following sections, the current use of spectrum in Qatar is analysed on a 'service by service' basis with a view to identifying bands where there are congestion issues and if refarming is required in any bands.

4.2 Data sources used in analysis

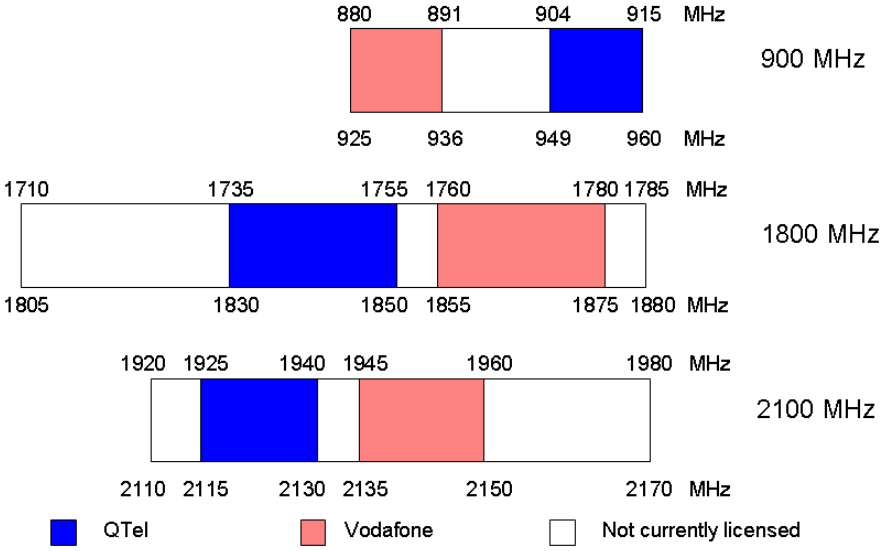
This analysis of current spectrum use in Qatar is based mainly on assignment and allocation data obtained and applied by ictQATAR, supplemented by additional information that has been obtained from key public and private sector stakeholders. While ictQATAR has information on currently licensed and licence-exempt spectrum use in Qatar, there is little information available on historic trends in Qatar and, in many cases, only limited information on how a particular frequency has been used. For example, in some cases it is not clear whether a particular frequency has always been licensed for use only at a specific location or is and has been available throughout Qatar. Specific technical details such as radiated power are included in individual licence documents but not in the frequency listing spreadsheets that have been used in the analysis, so it is not possible at this stage to identify particular sub-categories of use, such as on-site or wide area business radio. There has also been a number of instances where the data does not directly accord with the information provided by stakeholders and this is noted in the sections that follow.

4.3 Analysis of current spectrum use

Mobile

Mobile use falls into two broad categories, namely public mobile (cellular) services and private mobile radio (PMR). The award of a public mobile telecommunications licence to Vodafone in 2008 means there are now two cellular networks in Qatar - the other is operated by Qtel. These operate on internationally harmonised frequencies in the 900, 1800 and 2100 MHz bands and the two operators have access to equal amounts of bandwidth within each band, as illustrated below.

Figure 4.1 Cellular frequency assignments in Qatar



Source: ictQATAR data

The remaining spectrum is currently reserved for a potential third operator. Licences are technology neutral and both operators are planning to deploy third generation technology (UMTS / HSPA and in the longer term, LTE) in the 900 MHz band as well as the internationally more established 2100 MHz band, to minimise the cost of achieving national coverage. This will require some modification to the networks as the band is already heavily used to deliver second generation (GSM services). However, international comparisons suggest that operation of both technologies with the spectrum currently available to each operator is feasible.

Currently, the 900 MHz band is used nationally whilst the 1800 MHz and 2100 MHz bands are used mainly in the Doha metropolitan area. In November 2009, in-flight GSM services were introduced by Qatar Airways, operating via Inmarsat and covered initially by an Authorisation from ictQATAR.

PMR in Qatar is served by a mix of Qtel's national digital trunked radio network and individually licensed self-provided networks. The Qtel network uses the Terrestrial Trunked Radio (TETRA) technology standard and operates on 2x5 MHz of spectrum in the 410 – 430 MHz band. Self-provided systems are currently analogue, but there is interest among the oil and gas community in setting up an independent, self-provided TETRA network.

Unlike most countries, Qatar requires users to use the Qtel TETRA network where it is available, and will generally only issue a PMR licence where the applicant can demonstrate

that the TETRA network would not satisfy its needs. This would typically be due to inadequate coverage or functionality. Smaller business radio users, such as taxi operators, therefore mostly use the Qtel TETRA networks (though some may just rely on cellular), whilst some larger organisations with more specialised requirements have acquired their own licences and frequencies. According to Qtel, there are currently between 6,000 and 7,000 users of the Qtel TETRA network, however our discussions with large oil and gas companies such as Qatar Petroleum, who currently use the Qtel network for much of their onshore communication, suggests there could be significantly more – up to 20,000 for the oil and gas industry alone.

The oil and gas companies would like to have an integrated system which covers all of their onshore and offshore operations, possibly covered by their own operating licence. If this route is pursued, then guidelines will be needed to qualify competent applicants and to provide guidance on the efficient use of spectrum, for example, in the form of loading criteria. The latter could be expressed in terms of a minimum number of mobile terminals or a minimum network traffic level (Erlangs or data throughput) per frequency channel. For example, the Canadian regulator specifies a minimum of 50 mobiles per traffic channel for safety critical applications[49]. TETRA systems are already widely deployed in the oil and gas sector, including countries such as China, Russia and Nigeria. Vendors such as Motorola and EADS produce equipment that is optimised for the specific needs of the sector, such as intrinsically safe mobile terminals for use in hazardous areas.

Qtel has expressed an interest in providing additional TETRA services in the 380 – 400 MHz band, alongside the existing Government network that operates in that band, but it is questionable whether there would be sufficient traffic to justify this, especially if the oil and gas industry were to commission its own network.

Analysis of assignments in each of the PMR bands, indicates that individual assignments are based on geographic area or specific location and a change of location requires a licence to be updated, although mobile operator and Government users are exempted from this requirement. Information that identifies the number of mobiles associated with each assignment is available in the individual licence, but is not collated into a central register at this point in time. It is therefore difficult to gauge the volume of radio traffic in each of the frequency bands.

There are a very large number of former Qtel assignments in the PMR bands that have been relinquished and could be made available to other users either for PMR or other applications, depending on the specific frequencies. This represents a substantial spectrum resource that should be analysed thoroughly so that it can be configured in the most economically and technically efficient manner, e.g. with regard to channel bandwidths and duplex spacings, to reflect as far as possible internationally harmonised frequency bands and technical standards.

In addition to these core bands there are a number of specialist applications that use other frequencies. These include remote control systems that operate in the 310 MHz band and are used to control facilities such as aircraft hanger doors, cranes on building sites which use the 430 MHz band. Coordination between government users and ictQATAR may be required to ensure that interference does not arise between government and civil systems.

The 310 MHz band is widely used by low power, licence exempt devices in ITU Region 2 (the Americas), and there is probably merit in permitting this band to be used for low

[49] Source: Industry Canada (www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01058.htm)

power applications in Qatar so long as this does not conflict with other applications. A light licensing regime (registration of the equipment, frequency and location) may be appropriate to ensure that the location of any such devices is known to ictQATAR. The 433 MHz band is widely used around the world for low power licence exempt devices. It is exempted from licensing in Qatar. Exemption regulations could reflect the CEPT guidelines adopted throughout Europe and defined in Recommendation 70-03[50].

Various SCADA and telemetry systems are deployed, mainly at oil and gas installations and by the aviation sector. These generally operate within the core PMR bands, although some telemetry systems operate in non-standard ranges.

Fixed Services

Fixed radio services are widely deployed in Qatar, in the form of point to point and point to multipoint systems. Point to point links are primarily used to provide backhaul for mobile network base stations and to provide dedicated communication links to onshore and offshore oil and gas installations. Point to multipoint systems are used to provide telephony and data to subscribers who do not have access to wired alternatives.

Point to Point Links

Point to point links operate in microwave bands at frequencies generally above 6 GHz (though a small number of links are operated by the government in the 1.8 GHz band). The bands and associated channel plans generally follow relevant ITU Recommendations (although there are some exceptions). In some cases, exclusive blocks of spectrum have been assigned to individual users who are then able to plan their own individual links using frequencies within these blocks. This typically applies to larger users such as Qtel and Vodafone who require a large number of links in one or more bands. Other users are assigned individual links and require one licence per link, although in the case of Qtel, Vodafone and government users, a single licence may cover several individual links.

Table 4.1 Frequency bands used by point to point links in Qatar

Band	Frequency Range (GHz)	Main User(s)	Assignment type(s)	Comments
7 GHz	7.11-7.75	Commercial communications / industry	Individual (5 bi-directional and 2 unidirectional)	Mix of different channel plans and duplex spacings means spectrum may be used inefficiently.
8 GHz	8.2 – 8.5	Commercial communications / industry and government	Individual (12 bi-directional and 2 unidirectional)	
10GHz	10.4-10.68	Commercial communications / industry	Individual (5 bi-directional and 1 unidirectional)	Non-standard channel plan. (See Note 1)
13GHz	12.75-13.25	Commercial communications	Individual (12 bi-directional)	

[50] Available from www.erodocdb.dk/Docs/doc98/official/pdf/REC7003E.PDF

		/ industry		
15GHz	14.4-15.35	Commercial communications / industry and government	Block assignment; Individual (8 bi-directional)	
18GHz	17.7-19.7	Commercial communications / industry and government	Individual (40 bi-directional)	Some private and government links do not conform to ITU channel plan. (See Note 1)
23GHz	22-23.6	Commercial communications / industry and government	Block assignments; Individual (12 bi-directional)	

Note 1: the use of these frequency bands needs to be addressed in a review of the channelling plans and fees

Source: ictQATAR data

The bands below 10 GHz are particularly lightly used (only 26 links recorded compared to several hundred backhaul links in the block assignments used by Vodafone, for example), and often only a single link is assigned on a particular frequency channel. There would appear to be scope for substantially greater use of this spectrum to support backhaul of broadband mobile data networks as capacity demands grow in the future. ictQATAR is looking at procuring a fixed link planning tool which should enable more intensive shared use of fixed link frequencies to be achieved.

Table 4.2 Assigned Fixed Link spectrum by user (paired MHz)

User	Bands < 10 GHz	Bands 10-20 GHz	Bands > 20 GHz	Total
Commercial	135 MHz	367 MHz	182 MHz	684 MHz (30.9%)
Commercial	42 MHz	63 MHz		105 MHz (4.7%)
Commercial		126 MHz	182 MHz	308 MHz (13.9%)
Government	42 MHz	414 MHz	168 MHz	624 MHz (28.2%)
Broadcasting	28 MHz			28 MHz (1.3%)
Industry	75 MHz	255 MHz		330 MHz (14.9%)
Others		135 MHz		135 MHz (6.1%)

Source: ictQATAR data

Qatar Media Corporation currently uses microwave links to feed the signals to their broadcast transmitters but when digital TV is introduced these are to be replaced by fibre links leased from Qtel. New transmission sites for the digital network are, therefore, being sought at locations close to the Qtel fibre network.

Qtel claims to have spectrum in the 2 GHz, 4 GHz, 10 GHz, 13 GHz, 18 GHz , 22 GHz and 38 GHz bands for backhaul applications, but only the 13, 18 and 22 GHz assignments appear to be in the ictQATAR frequency listings. Use of 26 GHz and 28 GHz bands is also being considered. Vodafone now has spectrum in the 7 GHz, 10 GHz, 14 GHz, 15 GHz and 23 GHz bands. The use of these bands needs to be checked and recorded through a combination of audit and monitoring.

Airlines are licensed to operate HF links, although in practice these are back up systems that are rarely used. The armed forces also make extensive use of HF frequencies.

WiMAX has been deployed by Qtel for service distribution, and point to point WiMAX links are also deployed, for both access and backhaul purposes (backhaul is provided using the 10 GHz frequency band). The WiMAX network operates on 2 x 24.5 MHz of spectrum at the upper end of the 3.5 GHz band. This allocation is based on an historic fixed wireless channel raster of 3.5 MHz which has been largely superseded by 5 MHz, so there may be a case for reviewing the current allocation to be more compatible with current technology. This can be carried out as part of the spectrum audit and review of frequency allocations.

Vodafone's fixed licence also includes spectrum in the 3.5 GHz band. The spectrum could be used in the longer term for mobile services, but this may be constrained by the fixed licence conditions.

Broadcasting

Terrestrial broadcasting in Qatar has historically been under the control of the Qatar Media Corporation (QMC), who currently provide two national TV channels and are planning a third channel in Doha.

Table 4.3 TV channels in Doha

Channel	ERP (kW)	Content
9	10	Arabic (Doha)
37	40	English (Doha)
49	30	Arabic (rest of Qatar)
52	40	English (rest of Qatar)
47	-	Planned sports channel (Doha)

Source: QMC

There are also plans to accommodate three more private analogue stations on a managed service basis using frequencies assigned to QMC.

A study is underway (by QMC) to determine network requirements for digital TV implementation. Current thinking is up to 30 sites will be needed, compared with the existing five analogue sites (most of these would be repeater stations). The plan is to have up to 30 programme channels, but the number of multiplexes is still under discussion. There are no immediate plans to launch a digital service – the anticipated start date is not before 2012. There will be a pilot service first to check coverage. The current study will consider network options (SFN, MFN etc) and whether existing shared sites or new sites can be used. QMC is aware of the planned refarming of channels 61-69 for mobile and do not believe loss of these channels will affect plans for digital TV. ictQATAR may take responsibility to drive the migration of broadcasting to all digital platforms. The analysis being undertaken by QMC at present will be a valuable contribution to the migration planning.

The State of Qatar currently has 14 FM radio frequencies within the Geneva Plan 84 (GE84) and is expecting a further 44 low power assignments for Doha ($\leq$ 2 kW). QMC use the 14 FM Channels of GE 84 and expect to have a further six channels. Ideally, broadcasters would like 25 in total. The additional frequencies would be to sub-let to other broadcasters (they already do this for the BBC, Radio Monte Carlo, etc.). Most FM stations

only cover Doha due to international constraints. Cross-border interference is a big problem on FM, hence there is interest in using DAB to extend national coverage. A DAB trial is planned in eight months (to test the signal and coverage), with possible commercial launch in two to three years. QMC has five AM radio frequencies, four of which are currently in use.

Multi-channel TV is available via satellite, a Microwave Multipoint Distribution Service (MMDS) operating in the 2.6 GHz band (2474 – 2705 MHz) and a microwave video distribution service (MVDS) operating in the 11 GHz band (11464 – 12335 MHz). The MMDS and MVDS services are provided by Qtel and have relatively few subscribers (approximately 1500 each), but are considered to be an important alternative to satellite as they provide a more controlled range of channels than the satellite services (which all originate from outside Qatar). Qtel recognises that the MMDS service may, in time, be superseded by an IPTV service, in which case the spectrum could be released back to ictQATAR for reallocation.

For programme making and news gathering activities, QMC operates its own licensed portable microwave links for TV and VHF terrestrial links for radio. These account for relatively small amounts of spectrum.

In addition, quite recently ictQATAR assigned new FM broadcasting channels to Al Jazeera and Qatar Foundation to cover the Doha area.

It should be noted that ictQATAR only assigns frequency to parties that have been given the legal right to broadcast – which now rests with the Ministry of Culture.

Satellite Services

Qatar has a sizeable population of non-domiciled workers and an increasing number of tourists entering and leaving the country. The country therefore attracts a significant volume of international voice and data communications traffic. Although the bulk of this traffic is carried by optical fibre, fixed satellites continue to provide an important backup facility. Some international telephone traffic is carried by satellite, but 90 – 95% is handled by undersea cable.

Satellites are used to relay broadcast television and radio, emanating from both within and outside Qatar. Broadcasters use earth stations (either their own or leased capacity) for uplinks in the C (4 / 6 GHz) and Ku band; with both uplink and downlink frequencies within the 6 GHz band (usually used exclusively for uplinks).

The Oil and Gas industries are major users of satellite communications, particularly to provide communications to offshore facilities, typically using VSAT linksMobile satellite services also provide an important role, particularly in the maritime and aviation communities.

In some cases, satellite services are augmented by terrestrial repeater stations. ictQATAR believes provision should also be made for complementary ground based components of mobile satellite services, which are also currently being licensed in a number of countries around the world.

Not all major providers use satellite for international traffic as alternate sub-sea cable systems may provide an alternative to satellite for back-up.

ictQATAR has awarded three Very Small Apperture Terminal (VSAT) operator licences to meet the communications needs of closed user groups. These will be issued in due course.

Aeronautical and Maritime

The Civil Aviation Authority (CAA) is responsible for operational aspects of air traffic management but frequency planning and licensing is undertaken by ictQATAR. The CAA has licence documents that cover all its frequency use. A licence fee is payable for each piece of equipment, even if it is only being used as a standby. This differs from most other countries where only a single fee is payable for each frequency assignment. The means by which CAA licences are issued and their fees will be addressed in a future review of licensing and fees.

There is, in general, no spectrum sharing between military and civil aviation, apart from one special shared communication channel for emergency use. No new frequency requirements are anticipated beyond those for the New Doha International Airport (NDIA).

Other Licensed Services

WLAN services must be licensed if they are deployed outdoors or used to provide services to the public. WiFi technology is sometimes used to provide point to point links (wireless bridges) and this must also be licensed. For example, Qatar Airways uses wireless bridges to connect aircraft whist in the hangars.

4.4 Issues identified by Stakeholders in relation to frequency use

Public Mobile (Cellular)

The main areas of concern raised in relation to the mobile cellular bands relate to the ability to develop enhanced data services using emerging "fourth generation" standards, such as IMT Long Term Evolution (LTE). LTE has the potential to offer much higher bit rates but may require use of wider channels (10 or 20 MHz compared with 5 MHz for today's 3G technology) to realise the full benefit. To deliver such services will require either re-farming of existing mobile assignments or access to additional spectrum. Refarming of existing spectrum would need to be done in such a way that existing deployment of 2G and 3G technologies is not unduly compromised while demand for these services continues.

The operators' main concern relates to the limited availability of spectrum below 1 GHz, which is the optimum frequency range for delivering cost-effective wide area mobile coverage due to the superior radio propagation characteristics. The international shortage of these lower frequencies for mobile use has been recognised by the ITU, which in 2007 designated the upper 72 MHz of the UHF TV broadcast band (790 – 862 MHz) for future use by IMT systems. A channel plan is close to being agreed for the European (CEPT area) that will provide an additional 2 x 30 MHz of spectrum for mobile services, almost as much as is currently available in the 900 MHz band. This plan will almost certainly be adopted throughout ITU Region 1, which includes the Gulf region. However, the availability of this spectrum in individual countries may be affected by the continuing presence of analogue TV broadcasting.

Currently, one third of the available spectrum in the 900 MHz band (2 x 12 MHz) is reserved to allow for the possible introduction of a third mobile network in Qatar, which limits the existing two networks to 2 x 11 MHz each. This makes it impractical to deploy wider bandwidth LTE services in the band unless all existing 2G and 3G services are

restricted to the higher frequency bands, which might be feasible in urban areas but not in the more remote parts of the country. There is also a risk that some subscribers with older single band handsets may not be able to access the networks. Vodafone claims that a third of Qatari subscribers fall into this category. A further problem, according to Vodafone, is that most of its 900 MHz spectrum is in the extended GSM (EGSM) band (880-890 MHz), which up to 15% of handsets in use globally cannot access. Whilst it is true that subscribers acquiring a new phone will gain access to all bands, this would not be the case for SIM-only subscribers who may make up a substantial portion of the overseas workforce.

Private Mobile Radio (PMR)

The relatively strict rules governing the licensing of self-provided PMR systems in Qatar is a cause of concern to some stakeholders. Some larger organisations, mainly within the Gas and Oil industries, have successfully argued for the right to operate their own systems. However, others are required to use the TETRA network operated by Qtel. Although Qtel makes some attempts to meet the specific needs of individual users, there are concerns about the level of service provided, in particular Qtel's unwillingness to develop customer-specific service level agreements (SLAs) which are commonplace in other markets, and the poor level of indoor coverage at some sites. The latter has resulted in some organisations (such as Qatar Petroleum) to operate two radio systems, namely the Qtel network for outdoor coverage and their own self provided analogue system for indoor coverage. The lack of interoperability between the two systems raises questions about the suitability of this approach in safety critical locations like oil refineries.

The growing demand for spectrum for Qtel's TETRA network in the 410-430 MHz band is also having an impact on those who have opted to retain their own networks. For example, Ras Gas currently operates an analogue trunked radio network in this band but is under pressure from Qtel to migrate this to the 400 – 410 MHz band to release more spectrum for Qtel. This is likely to have significant cost implications, as this band is not a core international PMR band, and equipment will therefore be less readily available. There is also a concern (by the oil and gas industry) that acquiring additional frequencies for the existing trunked network has been very time consuming, requiring letters of justification from senior management and taking up to 18 months to get the licence.

The preference for self-provision tends to be based on the greater degree of operational and cost control that this provides. For example, RasGas argues that reliance on a single outside supplier is too risky both financially and in reliability terms, and that that those that have migrated to Qtel's TETRA service have suffered outages. It is also easier to deal directly with the equipment supplier than have to go through the network operator as in intermediary. Qatar Petroleum has expressed interest in the possibility of developing a dedicated TETRA network for the oil and gas industry, which could be more tailored to meet the specific needs of that industry than Qtel's nationwide service.

Fixed links

The nature of mobile networks means that a range of link lengths and bandwidths are required for backhaul purposes, and this implies that a range of frequency bands should be available. In many cases, bands above 20 GHz are adequate for connecting base stations to the local control centres. However, access to more remote stations, and backbone links to major switching centres are likely to require lower frequency bands. Adverse weather conditions, such as sandstorms, can severely affect the performance of radio links and favour the use of lower frequency bands and frequency or route diversity for the most

critical parts of the network. Both operators currently have access to spectrum in the 14 – 23 GHz range, but currently only Qtel has access to frequencies below 14 GHz. Vodafone has recently been given access to 7 GHz, 10 GHz, and 14 GHz.

Interference concerns

Most interference concerns that have been raised relate to interference emanating from outside Qatar. Examples that have been cited include:

- HF links – Qatar Airways has suffered interference due to shared use by the Saudi Air Force.
- Telemetry links – Ras Gas has suffered interference to UHF links from ships' on-board communication systems which operate on the same or nearby frequencies.
- Offshore UHF point to point links have suffered interference and outages due to ducting, but these are now tending to be replaced by microwave links (e.g. Ras Gas has replaced its UHF links with 13 GHz systems)
- PMR – Ras Gas has suffered interference to its trunked radio systems in the 410 – 430 MHz band and feels improved monitoring is required to identify the source of the interference.
- Interference to GSM networks near the border is a significant issue, resulting in inadvertent roaming of Qatari subscribers onto neighbouring countries' networks.
- Interference to broadband wireless systems have been reported and there have been problems reported in the 150 and 400 MHz bands .

4.5 Conclusions

Analysis of ictQATAR's licensing data and discussions with key stakeholders from the telecommunications, broadcasting, transport and industrial sectors have indicated that, whilst there are no particular shortages of radio spectrum in Qatar there are areas where it could be used to better effect and the processes involved in gaining access to spectrum could be improved. A number of discrepancies and omissions have also been identified in the data held by ictQATAR. The following key issues and recommendations have been identified:

- A key issue highlighted by the two public mobile operators is the need to introduce new, higher speed mobile broadband technologies without compromising the services of existing GSM subscribers. The operators have argued that reservation of spectrum in the 900 MHz band for a potential 3rd operator, whilst justifiable on competition grounds in the longer term, is likely to hinder the provision of GSM and new high speed services in more remote areas. There may be a case for the continued availability of this spectrum on a temporary basis to the existing operators pending the award of a third licence.

  Based on analysis and conclusions drawn in other countries, we do not believe that this claim can be substantiated for various reasons. The analysis of this is presented in the next chapter.

  Much of the spectrum allocated to fixed link and PMR use appears to be very lightly used and a sizeable proportion of this spectrum is reserved for government use. A large number of PMR frequencies and some fixed link frequencies are also reserved for Qtel, even though Qtel no longer requires them as the services operated over the frequencies have been discontinued. Commercial stakeholders have expressed interest

in accessing such spectrum, e.g. for the deployment of longer backhaul links in microwave bands below 10 GHz or for self-provided PMR systems as an alternative to the Qtel TETRA network. Both of these options merit consideration by ictQATAR.

- There do not appear to be any significant issues concerning TV broadcast spectrum, and the current use of the UHF band in Qatar and neighbouring countries does not appear to be a significant constraint to the future refarming of internationally identified spectrum for mobile applications. Sound broadcasting is more challenging in that interference is a problem on FM frequencies. Trials of digital audio broadcasting are therefore planned.

  Interference problems have also been widely experienced by PMR users (particularly offshore) and on Qtel's GSM network, where the latter has led to inadvertent roaming of subscribers onto foreign networks. ictQATAR will continue to implement its improved monitoring systems and international coordination which will be helpful in addressing such problems.

5 Future demand for spectrum

5.1 Summary

The evolution of spectrum demand in Qatar over the next decade is likely to exceed that in other markets, driven not only by the availability of new technologies such as IMT Long Term Evolution (LTE) and higher speed broadband wireless and mobile services, but also by the high adoption rates for new technologies in Qatar, the heavy reliance on wireless technology by the oil and gas industries, an increasing population and high economic growth. The global nature of most wireless services and technologies necessitates the use of internationally harmonised bands to provide manufacturing economies of scale and facilitate international roaming. A number of areas where demand trends are likely to require action have been identified. These are summarised briefly below and discussed in more detail in the following sections.

Spectrum demand growth is likely to be driven mainly by the need to support mobile broadband services and the possible introduction of a third mobile network in Qatar. In particular, additional spectrum in the 800 MHz band (currently allocated to TV broadcasting but not used in Qatar) and the 2600 MHz band (currently used by the Qtel MMDS network) is likely to be required, along with the release of the remaining spectrum in the existing 900, 1800 and 2100 MHz bands. Both the 800 and 2600 MHz bands are already in the process of being released in other parts of the world. Although the Qatari mobile operators have been arguing for early access to additional spectrum in the existing 900 MHz band to facilitate broadband mobile provision in the short term, it is believed that this is not justified in the light of other countries' experience and the potential requirement for this spectrum to support a third mobile operator.

Expansion of mobile and other wireless subscriber services will necessitate a corresponding growth in backhaul capacity. Backhaul can be provided by either fibre optic cables, which will benefit from a competitive market, or wireless links. Fibre provides very high capacity and low ongoing costs once installed, but the initial installation cost is very high, particularly in areas where there is no existing infrastructure (underground ducts, poles) along which to run the cables. Hence, wireless links often provide the most affordable and expedient solution to meeting backhaul requirements, particularly for new market entrants. Action will therefore be needed to increase the supply of spectrum for fixed radio links, both in lower (below 10 GHz) and higher (above 10 GHz) frequency bands, to cater for long haul and short haul applications. Greater sharing of spectrum between operators is likely to be needed, especially in the lower frequency bands where spectrum is scarcer.

Demand for private mobile radio (PMR) frequencies is also likely to grow, driven largely by the opening of the New Doha International Airport and the oil and gas sector's requirements for specialised and highly reliable mobile communications. The latter may include a requirement for a dedicated trunked radio network to service the oil and gas industry, potentially using spectrum in the 420 MHz band that has recently been vacated by Qtel.

Other areas of spectrum use may see a relative decline in spectrum demand over the coming years. For example the migration from analogue to digital broadcasting is expected to reduce the overall spectrum requirement for TV broadcasting and enable further spectrum to be released to meet growing demand from the mobile sector. Other major users of spectrum such as aviation, the military and emergency services are likely to see

some changes in the way they use spectrum, but it is currently less clear how spectrum demand for such users will evolve in practice. It is expected that there may be some potential for release of analogue PMR spectrum by the government once all the users have been migrated onto the QSTRS[51] TETRA network. There is also likely to be a case for adoption of more efficient technology in the GCC region for aeronautical mobile communications, in line with developments elsewhere in the world, to accommodate regional growth in air traffic movements over the next decade.

5.2 Spectrum Demand Trends by Sector

Mobile

Currently the following bands have been identified by the ITU for use by mobile cellular services:

Table 5.1 ITU bands for mobile cellular services

Band	Frequencies (MHz)	International Status	Status in Qatar
450 MHz	450-470	Limited use for public services in remote areas; mostly still used for business radio	Mainly used for business radio and telemetry
800 MHz	790-862	New band becoming available in many countries as "digital dividend" on closure of analogue TV services	Allocated to analogue TV, planned for migration to digital TV by 2015. No assigned use currently
900 MHz	880-915 925-960	Widely used by 2G services (GSM) but 3G technology being introduced in some countries	Licensed to Q-Tel and Vodafone for 2G or 3G services. Part reserved for possible third operator
1800MHz	1710-1785 1905-1880		
2100MHz	1920-1970 2110-2170	Core band for 3G mobile services	Licensed to Q-Tel and Vodafone, Part reserved for possible third operator
2600MHz	2520-2690	Expansion band for 3G mobile – so far licensed in three countries but many more are planning licence awards	Currently used for MMDS
3500MHz	3400-3600	Used for broadband wireless services in many countries. Some mobile use emerging	Used for broadband wireless (WiMAX)

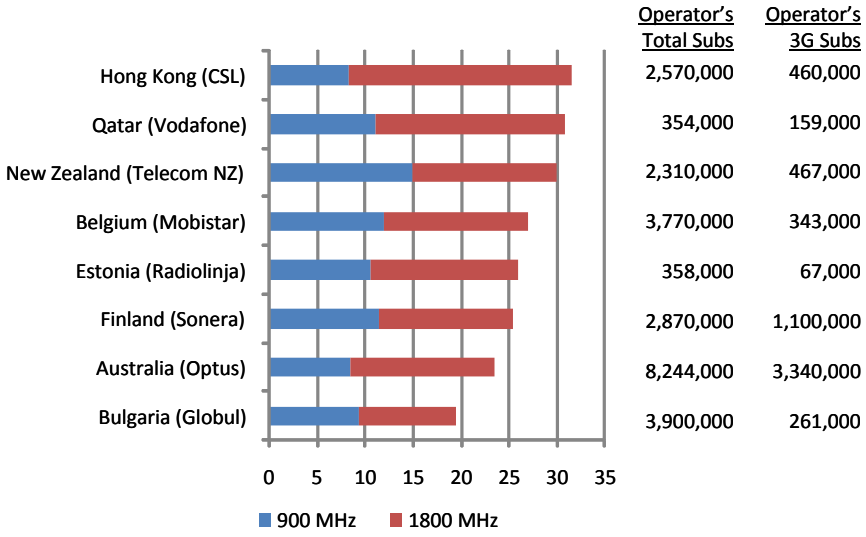
Source: ITU and ictQATAR data

[51] Qatar Secure Tetra Radio System

The licensing of the second mobile network in Qatar saw the adoption of a technology neutral approach to licensing the cellular spectrum below 2 GHz. This provides a significant benefit to operators in terms of being able to rollout higher speed mobile data services in more remote parts of the country, taking advantage of the larger cells that can be deployed using 900 MHz spectrum. A number of countries are now implementing 3G technology at 900 MHz (see Figure 5.1).

Since deployment of 3G technology in the band requires a minimum of 2x5 MHz, this means only 2x6 MHz would remain to serve GSM traffic. Qtel and Vodafone have claimed that this could lead to congestion on the networks or the need to deploy smaller cells than would otherwise be the case, adding to network rollout costs. However, comparison with the situation in other countries where operators have already launched 3G services in the 900 MHz band suggest that the current spectrum holdings should be sufficient, as illustrated in the chart below:

Figure 5.1 Spectrum holdings (paired MHz) of operators that have launched UMTS900 services



Source: Aegis

The spectrum held by the two Qatari telecommunications operators compares favourably with most of the other operators that have successfully launched UMTS 900 networks, especially when 1800 MHz spectrum is taken into account. The assignment of additional 900 MHz spectrum could provide the operators with short term cost savings in the provision of 3G services. These savings would be likely to be offset should the spectrum subsequently be required to accommodate a third mobile network at which time the requirement to reconfigure the network to free the spectrum could result in delay in releasing the spectrum or disruption to the operators' 3G services. We therefore advise against releasing further 900 MHz spectrum to the existing operators until a firm decision has been made on whether or not to license a third cellular network.

In the longer term, continuing growth in cellular data traffic is likely to require access to additional spectrum beyond the currently licensed bands. The 800 MHz band (790-862 MHz) have been identified for expansion and there are now moves in the US and Europe to identify further bands.

- In the US, the FCC has indicated that the FCC will be looking to refarm additional spectrum for mobile broadband[52]. The CTIA has also indicated the need for at least 800MHz for mobile broadband services and have identified spectrum at 1700 and 2100 MHz as an immediate priority[53]. Further pressure has come from the Consumer Electronics Association[54] who commissioned a report that estimates the market value of over 300 MHz of UHF spectrum reallocated from broadcasting to mobile broadband would be $62bn[55]. To release the spectrum, either the broadcasters would need to be compensated - $12bn – or households migrated – at an estimated cost of $9bn. The authors also estimate the consumer surplus from reallocating the spectrum would be in the range $500bn-1,200bn.
- In Europe, a report for the European Commission has estimated that clearing 694-790 MHz might yield €31bn in private value if there is mid-high mobile broadband growth[56]. It is suggested that the Commission reviews the situation in 2012-2014.

The 800 MHz band is likely to be of considerable interest to mobile operators, due to the benefits it provides in terms of remote area coverage and improved building penetration in urban areas. Early clearance of analogue TV services from this band would therefore be advantageous, especially if a third mobile licence is awarded, as allocation of the 800MHz band for mobile services would ease the current operators' requirement for additional spectrum in the 900 MHz band.

The 2.6 GHz band may be attractive for serving traffic hot spots, for example in the main business centres of Doha. But the availability of existing spare spectrum in the 1800 MHz band could provide a more attractive alternative, at least in the short to medium term.

Initial deployments of next generation mobile technology (LTE) seem likely to be focussed on urban areas where traffic demand is highest, enabling higher frequency bands (1.8 GHz and above) with greater spectrum availability to be deployed.

Although lower frequency bands also provide benefits in terms of in-building coverage from outdoor sites, it is unlikely such an approach would provide sufficient capacity for high quality mobile broadband services in a high density urban environment like Doha. The use of in building pico and femto cells operating in higher frequency bands creates a possibility to provide a more effective and less costly solution, providing the necessary backhaul provision is available.

Operators' views on future spectrum requirements

Vodafone has stated that it would like an additional 5MHz in the 900MHz band for mobile broadband provision using LTE technology. Although Vodafone already has 2 x 11MHz in this band, the operator claims that additional spectrum would allow for services offering a reasonable broadband service to end users. It would also alleviate the problem that some subscribers only have single band terminals that do not accommodate 1800 MHz or the

[52] Remarks of Chairman Genachowski, *"America's Mobile Broadband Future"* at International CTIA WIRELESS I.T. & Entertainment, San Diego, CA. 7 October 2009, http://www.fcc.gov/headlines.html

[53] http://files.ctia.org/pdf/filings/2009_09_29_Spectrum_Demand._FINAL.pdf

[54] http://online.wsj.com/article/SB10001424052748703574604574499730302393274.html

[55] http://www.brattle.com/_documents/UploadLibrary/Upload809.pdf

[56] http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/studies/digital_dividend_2009/dd_finalreport.pdf

extended GSM band which accounts for most (2x10 MHz) of Vodafone's current GSM900 spectrum.

Vodafone would also like additional 2x10MHz in the 1800MHz band to provide a balanced national footprint and improved in-building coverage. In the longer term, to enable high user/ coverage requirements in hot spot locations such as conference centres, business districts and the airport, Vodafone would be seeking 2x20MHz in the 2.6GHz band. A minimum of 2 x 5 MHz would also be sought in the 800 MHz band (see below).

Qtel would like to retain access to additional spectrum in the 900 MHz band which it had to recently vacate, and is interested in the longer term in the 800 MHz band, but Qtel does not feel there is likely to be any real demand for 2.6 GHz spectrum in Qatar.

As noted above, the current spectrum holdings of the two Qatari operators are comparable to those of other international operators and ictQATAR does not think that any additional assignment of 2G spectrum is justified in the short term.

Implications of release of 800 MHz spectrum

The release of the 800 MHz band for mobile spectrum could provide particular benefits for Qatar in the medium to long term, especially if a third mobile operator were to be licensed, by facilitating the rollout of broadband mobile data services into the more remote parts of the country. The use of this spectrum by mobile services could be constrained in practice by the presence of any continuing analogue TV services in the band, either in Qatar or in neighbouring countries. Our understanding is that currently there is no use of the 790 – 862 MHz frequencies for TV in Qatar, and no plans for the introduction of such services. However, according to data lodged with the ITU, there are frequencies assigned to neighbouring countries that may have an impact.

Analysis carried out in Europe has shown that the worst interference scenario affecting the co-existence of TV transmissions and cellular mobile services using the same frequencies is where high power TV transmissions cause interference to cellular base station receivers[57]. The band is most likely to be used in frequency division duplex mode using the harmonised channel plan currently under development by CEPT, under which channels 61 – 64 will be used for mobile transmissions and channels 66 – 69 for base station transmissions, i.e. channels 61 to 64 will be the most susceptible to interference. Analysis of the current high power analogue TV assignments in the Gulf area (based on ITU data) shows that there is only one high power assignment on channels 61 – 64 within 200 km of Qatar, as illustrated in Figure 5.2 below. This suggests that it should be feasible to introduce mobile services into at least part of this band prior to the closure of analogue TV services in the region.

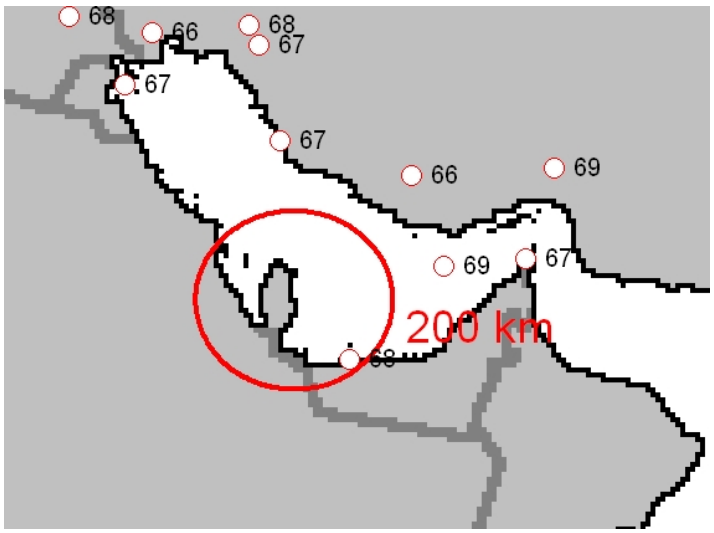
[57] See CEPT Report 29 http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP029.PDF

Figure 5.2 Current proposed international channel plan for 800 MHz CEPT)

61	62	63	64	65	66	67	68	69
790-798	798-806	806-814	814-822	822-830	830-838	838-846	846-854	854-862
Downlink				Duplex gap	Uplink			
30 MHz (6 blocks of 5 MHz)				12 MHz	30 MHz (6 blocks of 5 MHz)			

Source: CEPT

Figure 5.3 High power analogue TV assignments on channels 66-69 inclusive in the Gulf region



Source: ITU Geneva plan database

Fixed Link Spectrum Demand

Future demand for spectrum for microwave radio links will almost certainly be dominated by backhaul requirements for mobile base stations. The data throughput capacity of a mobile base station has already increased dramatically even since the launch of the first 3G services, and will rise much further as new mobile frequency bands and new, more spectrum efficient technologies, come on stream.

Whereas the first 3G networks had a peak base station capacity of no more than 6 Mbps per sector (assuming 3 RF carriers), this has already increased to as much as 64 Mbps per sector and, in the future, may reach several hundred Mbps. This is likely to require both additional bandwidth in existing backhaul frequency bands and access to additional lower frequency bands to enable reasonable hop lengths to be achieved on the highest capacity routes. Access to spectrum below 10 GHz will be necessary in some cases to avoid the substantial additional costs of deploying repeater stations in remote desert locations.

PMR Spectrum

There will be increasing demand for PMR frequency assignments as the New Doha International Airport develops. Qatar Airways expects to grow its aircraft fleet from 68 currently to over 100 by 2013 which will require an increase in the number of its PMR

frequencies**.** Much of this use will be within the airport premises and should be able to re-use existing frequencies.

There may also be a requirement from the oil and gas industry for access to spectrum to support an industry-specific digital trunked radio network that would better support the industry's requirements (e.g. for reliable indoor coverage) than the current Qtel TETRA network.

Much of the existing PMR spectrum is identified in ictQATAR's data as being assigned to Qtel, in some cases for legacy rural telephone links that have now been replaced by WiMAX. Our understanding from discussions with Qtel is that these frequencies, which include a contiguous 2 x 1.5 MHz in the 410 – 430 MHz band that was formerly used by analogue trunked radio, are no longer in use. There should, therefore, be considerable scope for expansion in the number of PMR licences should a more favourable policy towards these be adopted.

Public Sector Spectrum Demand

The armed forces and Ministry of the Interior are major users of spectrum for both mobile and fixed applications. There would appear to be scope to reduce the extent of mobile use at least by the government by releasing spectrum formerly used by legacy analogue systems where traffic has migrated to the government TETRA network.

Continuing growth in air traffic means there is unlikely to be any reduction in the demand for spectrum for aeronautical applications. However, since these operate in internationally harmonised, exclusive bands it will not have any significant impact on the availability of spectrum for other services. It is possible that the growing volume of air traffic in the Gulf region will lead to shortages of spectrum in the VHF aeronautical mobile band. This could be addressed my migration to a more efficient communications platform, such as the 8.33 kHz analogue channel plan deployed in Europe or the VHF digital data link technology favoured by the US Federal Aviation Authority. It is recommended that ictQATAR work with the CAA to encourage a coordinated move to more efficient aeronautical mobile technology in the GCC region.

Broadcast Spectrum Demand

The main driver of future broadcast spectrum demand will be digital terrestrial television. Our understanding from Qatar Media Corporation (QMC) is that up to 30 digital TV channels may be available in the longer term, though the number of multiplexes has not yet been decided. Under the ITU GE06 frequency plan for digital TV, Qatar can possibly have provision for up to five multiplexes, though it is noted that most transmission sites have fewer than this. Of 40 individual frequency assignments in the GE06 plan, five lie within the 790 – 862 MHz band that has been identified for future mobile use.

Detailed planning of the terrestrial digital TV network has not yet commenced but, according to QMC, a network of up to 30 transmitter sites are planned across the country. This should enable relatively low transmitter powers to be deployed enabling greater flexibility in the choice of frequencies (as lower power transmitters are less constrained by international coordination requirements). QMC confirms it is aware of the likely re-farming of 790 – 862 MHz to mobile and it does not consider this will have an impact on the planned introduction of digital TV.

6 Allocation Policy

6.1 Introduction

In this Section, the principles that will guide Qatar's Radio Spectrum allocation decisions, ways of improving the allocation information required by users and for policy, the institutional arrangements for making allocation decisions and the key allocation issues to be addressed in Qatar, are discussed.

As discussed, ictQATAR's statutory objectives require it to:

- Optimise the use of spectrum in accordance with international best practice;
- support and promote innovation and encourage competition; and
- establish a fair, objective and transparent licensing regime.

Consistent with these objectives and international best practice (see Section 3) this confirms ictQATAR's radio spectrum policies should be guided by the following principles:

- 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;
- use market mechanisms for encouraging efficient spectrum use where there are competing demands for spectrum unless there are good policy reasons to do otherwise; and
- facilitate stakeholder participation in key allocation decisions.

ictQATAR is minded to adopt these principles. The discussion of allocation and assignment policy given in this and the next Section is based on these principles.

Allocation policy is concerned with the types of services and applications that may use particular frequency bands. Economies of scale in equipment production, international mobility and the need to minimise cross border interference, all mean that allocations are increasingly harmonised regionally and internationally. The key requirements of a national spectrum allocation policy are therefore:

(a) to ensure full advantage can be taken of international market and technology developments by ensuring the timely availability of the requisite radio spectrum, and

(b) to provide stakeholders with good visibility of any planned changes to spectrum allocations.

Where possible, the views of stakeholders should be taken into account in making decisions on future allocations. However, a balance needs to be struck between catering for the needs of existing market players and maintaining or creating the potential to attract new entrants or stimulate innovative service offerings.

6.2 Making allocation decisions

As a small country, Qatar has much to gain from harmonising its allocations with those of its neighbours (so as to minimise cross border interference and to facilitate roaming in the region), and with allocations made in Europe, the US or Asia (in order to benefit from access to low cost, competitively supplied equipment, to support international mobility of radio equipment and common use of services). If Qatar does not provide harmonised allocations for the radio services likely to be required by business, government and final consumers, the costs of doing business and providing services in Qatar will be raised, the benefits from new services many be forgone and internationally mobile businesses may locate elsewhere. This will be to the long term detriment of the Qatari economy and its people.

Although spectrum allocations are largely influenced by the international framework (principally the ITU Radio Regulations and the existence of international technical standards), in many bands there is considerable flexibility on how the spectrum may be deployed nationally. For example, depending on local market conditions, some higher frequency (microwave bands) may be used for either terrestrial or satellite services and lower frequencies may be used for a variety of mobile, fixed and broadcast applications.

Accommodating international developments in spectrum use can often involve costs and disruption to existing users. There are trade-offs that have to be made concerning: (1) whether to harmonise with others; and, (2) when to harmonise. These trade-offs depend in part on local circumstances as the benefits from new services and the costs of refarming existing uses differ between countries. In addition, it is noted that not all harmonised allocations prove to be commercially successful. For example, European initiatives to develop harmonised spectrum and standards for a number of specialised and consumer services have proved unsuccessful, resulting in spectrum remaining unused and ultimately being re-allocated for other purposes. Examples include:

- The European Radio Messaging Service (ERMES) – intended to be a harmonised one-way paging standard operating on dedicated spectrum in the 169 MHz range, ultimately failed due to industry preference for existing proprietary standards and consumer preference for GSM SMS text messaging
- The Terrestrial Flight Telephony Service (TFTS) – intended to be a harmonised system for passenger communications on aircraft using ground based transmitters, failed due to lack of demand and existence of alternative lower cost approaches based on satellites
- Digital Short Range Radio – intended to be a licence-exempt short range PMR technology, failed due to industry preference for a low cost analogue alternative
- CT2 cordless telephones – intended to be a harmonised pan-European standard for cordless phones but not all countries adopted CT2 and the technology was ultimately superseded by DECT.

These examples demonstrate that there can be benefits to Qatar in waiting to observe whether markets take off elsewhere. However, the decisions to adopt new technologies are primarily commercial rather than regulatory.

As a national regulator, ictQATAR has an important role to play in ensuring that international developments in spectrum use are accommodated and with low disruption to existing users, whilst continuing to cater for any specific local needs where these do not conflict with internationally harmonised use. At a minimum qualitative assessment of the

costs and benefits of reallocating spectrum need to be considered. The benefits include those from:

- user benefits from new services and/or new technologies (e.g. more efficient service operation, social benefits from improved communications services)
- spectrum release if a more efficient technology is deployed (e.g. digital TV switchover)
- lower cost service delivery, if additional or more appropriate frequency ranges are supplied
- increased competition, if additional operators or competing services are licensed.

The costs are typically the costs of moving incumbent users, but there may also be costs to final consumers who have to buy new equipment when frequency ranges change.

In some cases, regulators quantify these costs and benefits as an input to decision making. For example, a recent study for the European Commission sought to quantify the benefits from different scenarios for refarming the UHF digital dividend.[58] In other cases, some of the money raised from tendering spectrum licences is used to pay incumbents to move. In the US, certain bands have been designated for potential transfer from government to non-government use. The costs of moving government users from these to other (less highly desired) bands are estimated. The designated bands are auctioned but are only released to private sector bidders if the revenues raised exceed 110% of the cost of moving the government users – this is the reserve price of the spectrum[59].

In summary, efficient spectrum use and competitive development of communications services in Qatar will be promoted by an allocation policy that seeks to:

- meet users' requirements: Allocate spectrum to new services in a timely manner, as indicated by stakeholder demand and developments in the region and elsewhere
- be internationally harmonised: Ensure, as far as is practical, that spectrum allocations are consistent with internationally harmonised bands
- take account of all the benefits and costs of spectrum reallocation.

It has been recommend that these principles underpin the allocation decisions made by the National Spectrum Coordination Committee and implemented by ictQATAR through the NFAP.

6.3 Improving information on spectrum allocations and policy

There is currently little publicly available information on frequency allocation policy and practice in Qatar. A National Frequency Allocation Plan and associated table of frequency allocations was prepared in draft form by ictQATAR and was originally due for publication in 2008. The document as it stands provides comprehensive information on the current allocation of frequency bands in Qatar and internationally, but it contains very little information on specific allocation policies or on the availability of spectrum for particular applications.

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[58] http://www.analysysmason.com/PageFiles/13359/Analysys%20Mason's%20public%20presentation%20of%20final%20results%2020090909.pdf

[59] Under the Commercial Spectrum Enhancement Act, 2004

In order for Qatar to gain maximum benefit from the use of radio spectrum, it is important that existing and potential future users have a good understanding of how different frequency bands can be used now and any anticipated developments that might lead to more spectrum being released in the future. A number of countries around the world have published written spectrum strategy documents that identify where new opportunities for spectrum use might arise, or where existing spectrum use might be improved. This might, for example, include the impact of technology migration (such as analogue to digital television or the adoption of next-generation mobile standards) or the liberalisation of licensing conditions (such as the replacement of technology-specific licences with technology neutral spectrum rights of use).

It has been recommended that the existing draft NFAP should include an additional column in the table of frequency allocations highlighting how the spectrum is currently used in Qatar, any potential changes of use over the next five years, or international developments that might have a bearing on the long term use of that spectrum in Qatar. This will be complemented by a chapter summarising any known significant changes likely to take place. Such near term changes are discussed below.

The NFAP is recommended to updated periodically, ideally every 3 – 4 years to coincide with the timing of the world radio conferences.

6.4 Consultation arrangements

ictQATAR is legally responsible for the management, allocation and assignment of all radio spectrum within Qatar. To carry out these functions effectively it requires inputs from current and potential users in addition to those gained from its own research and analysis. Dialogue with major users is an essential part of any spectrum management regime, in addition to formal consultation through published consultation documents. The proposed Qatar National Spectrum Coordination Committee (QNSCC), chaired by ictQATAR, will provide a forum for such dialogue. It will allow all users to share their perspectives and allow inputs to be provided by government users who do not normally participate in formal consultation, as well as input from the main commercial users. Such dialogue is likely to be of most benefit if it is kept at a high level, dealing with strategic issues around allocation policy.

The current proposals for the QNSCC indicate that it would be open to all major wireless users and would be concerned primarily with providing advice to ictQATAR on:

- international and domestic radiocommunication issues;
- allocation issues as these relate to the National Frequency Allocation Plan;
- the development of proposals for international conferences and meetings, in particular the development of national or regional positions for World Radiocommunications Conferences and for regional coordination in specific bands; and
- issues requiring coordination and liaison between various wireless users.

The QNSCC should provide advice with a view to promoting the long term economic and social interests of Qatar.

The formation of the QNSCC is an important element of the spectrum management regime as it should provide both a source of expert advice for ictQATAR and a forum to promote dialogue between users whose radio requirements may increasingly interact with each other. The allocation proposals recommended by this report provide an initial set of issues for the QNSCC to consider.

6.5 Allocation Issues

A key requirement in making decisions on future spectrum allocations is to anticipate global trends in spectrum demand and ensure that spectrum is made available nationally to take full advantage of technology and market developments.

Bands for public mobile services

In Qatar's case, the timing and manner in which internationally identified spectrum in the 800 MHz and 2.6 GHz bands is released is likely to have bearing on how the two public mobile networks configure the use of their existing spectrum, for example with regard to the split between second and third generation technologies in the 900 MHz and 1800 MHz bands. Early confirmation of the release of these bands and the schedule for licensing would enable operators to plan for the introduction of new higher speed mobile data technologies whilst minimising the impact on their existing mobile subscribers.

Greater visibility on the availability of spectrum in the microwave bands for backhaul applications would also be beneficial in helping users to make forward plans for their network rollout. There appears to be significant under-utilisation of fixed services spectrum in the bands below 10 GHz. These bands would be attractive to mobile and broadband wireless access providers for provision of high capacity backbone links, complementing the higher frequency bands (15 and 23 GHz) that are used to connect individual base stations. As these bands are allocated internationally for fixed service use and do not appear to be reserved for any other use in Qatar, ictQATAR will encourage wider deployment of these bands to support roll out of mobile and broadband services into more remote parts of the country.

Digital TV switchover

The switchover from analogue to digital TV transmission provides an opportunity to introduce more choice and competition in terrestrial TV, new services such as high definition TV (HDTV), and to release some of the existing TV broadcast spectrum for other uses such as mobile broadband (the "digital dividend"). An international plan for the introduction of digital TV in the European, African and Middle Eastern regions (ITU Region 1) was agreed by the ITU in 2006[60]. A number of countries, including the USA, Netherlands, Sweden and parts of the UK, have already ceased analogue transmission and many others (including all of the European Union countries) plan to do so by 2012. The US has already released digital dividend spectrum and most European countries are expected to follow suit over the next two years. As noted previously, there is likely to be strong demand for digital dividend spectrum to support mobile broadband growth in Qatar but currently there are no official plans to switch over to digital TV before 2015.

There is a need for clarification of the respective roles of ictQATAR and QMC in allocating and licensing this spectrum. Legally, ictQATAR is responsible for managing all the radio frequency spectrum in Qatar, although at a practical level QMC has the broadcasting planning expertise and largely self-manages the broadcast bands. QMC is also responsible both for providing content on its own radio and TV channels and providing managed transmission facilities to other broadcasters, using its own assigned frequencies. This arrangement has proved adequate in an analogue environment where the number of frequencies and TV stations is limited and the technology limits capacity to one TV station

[60] The Geneva 2006 (GE 06) plan for digital terrestrial broadcast services

per available frequency. Digital transmission provides much greater capacity to accommodate new TV stations, but the extent of this capacity gain depends on the licensing approach and how the technology is deployed.

Many countries have decided to separate the transmission and content provision aspects of broadcasting, on the basis that an independent transmission provider has more incentive to maximise the capacity of the available spectrum than would an existing incumbent broadcaster which may wish to keep all the capacity for its own services. This is an area that ictQATAR hopes to investigate further as part of its planning for digital switchover. One advantage of Qatar migrating to digital television later than other regions such as Europe, is that full advantage can be taken of recent technology developments. The most significant of these is the introduction of the DVB-T2 standard which provides a significant improvement in the capacity of each available frequency channel relative to the earlier DVB-T standard. Earlier adopter of digital TV will be constrained from early deployment of the new standard by the incompatibility of existing receivers, hindering the rollout of new services like HDTV.

Future QMC's spectrum management activities will be undertaken by ictQATAR, as this is consistent with the Telecommunications Law. Such an approach took place in the UK on the liberalisation of the independent television sector in the 1990s.

In the meantime, ictQATAR and QMC are planning to jointly develop technical and policy proposals for digital switchover in Qatar, through the establishment of a Switchover Working Group.

Mobile Satellite Services

There is a need to cater for mobile satellite terminals under the licence exemption regime. In the case of Globalstar, there is also an allocation issue in that the downlink frequency band (2483.5 – 2500 MHz) is not currently allocated to the mobile satellite service in Qatar and is currently used by Qtel's MMDS network. This could impair the performance of the Globalstar network in parts of Qatar. We note that Globalstar includes Qatar among the countries that are served via its Saudi Arabia Gateway[61] and it is likely that there will be some occasional use of Globalstar mobile terminals in Qatar, for example by US nationals who are visiting the country.

6.6 Balance between government and commercial allocations

The balance of allocations between government and commercial users has historically been determined in many countries based on administrative decisions made at an international level (e.g. in international bodies such as ICAO and IMO that make representations to the ITU), regional level and national level. These decisions have been informed by technical analysis and an appraisal of users' spectrum requirements. While experience suggests that so far there has been sufficient provision for public sector use, it is less clear that this has resulted in sufficient spectrum being made available for commercial use. Reallocations to commercial use have typically been made in response to commercial and political pressure for additional spectrum to accommodate new applications, such as cellular telephony, broadband wireless access, fixed links and commercial satellite uses. In many countries,

[61] www.itzcomm.com/Globalstar/coveragebycountry.html

including Qatar, the absence of transparent information on public sector use has meant that getting the balance right has been difficult.

Looking forward, there are growing demands for spectrum from both commercial and public sector uses, primarily to support a wide variety of mobile broadband services (on land, sea and air). For example, growing deployment of unmanned aircraft systems is driving demand for additional terrestrial and satellite spectrum to support broadband ground to air data links[62]

If allocations to public use are too high then economic costs will be imposed on commercial users (e.g. they will have to deploy more infrastructure or service quality will be lower than otherwise) and on society, in general. If allocations to public use are too low then the societal benefits from the services provided will be reduced. To achieve the right balance in Qatar, international best practice (reviewed in Section 3) suggests that the following policies should be implemented in Qatar:

- all allocations to government users should be included in and identified as such in the NFAP;
- within these allocations, assignments to government users, including technical limits on this use, should be registered with ictQATAR. The possible exceptions would be where assignment information is confidential for security reasons;
- any future requirements for spectrum should be submitted to ictQATAR and fully justified. There should be a general expectation that when upgrades occur (e.g. migrating from analogue to digital operation) that old systems are retired and the relevant frequencies returned to ictQATAR for use by others.

These are basic requirements that apply to all commercial uses and are necessary if ictQATAR is to be able to undertake its spectrum management functions effectively. To go further than this and optimise spectrum use, public sector users need to face incentives to use spectrum efficiently.

Under a purely administrative approach to spectrum management, spectrum users have incentives to hoard spectrum, as there is no assurance that more spectrum will be reserved for them in future, nor is there assurance that any spectrum released for others will be returned at some future time. These incentives to hoard may be weakened by having to pay for spectrum access. However, major public sector users in Qatar do not pay any spectrum fees. In principle, government users should pay fees on a comparable basis to commercial users, so they have incentives to use spectrum efficiently.

Otherwise, public sector users' incentives for efficient spectrum use could be strengthened by:

- limiting the quantity of spectrum available to the public sector spectrum user so that they are motivated to invest in new technologies or to acquire spectrum in the same way as commercial spectrum users to the extent that they need to support service growth and/or development; and/or
- making the users accountable for their spectrum use and for their associated technology choices. This would involve periodic audits of spectrum assignments and use.

[62] Agenda item 1.3 of the 2011 World Radio Conference will consider spectrum requirements to support the safe operation of unmanned aircraft systems, based on the results of ITU R studies

The first approach is unattractive because it does not allow for changing spectrum requirements. However, it could be applied in combination with the second approach under which public sector users must justify both their existing and new spectrum requirements to the regulator/government in terms of specific operational requirements. This approach is used in Australia, the Netherlands and the UK to promote more efficient spectrum use overall. These countries are at the vanguard of reform in this area, and we recognise that it could be some time before such policies are adopted in Qatar.

It is in the pipeline in Qatar that once registration of spectrum use by government agencies and broadcasters has been completed, ictQATAR will be putting in place a process by which these users are required to periodically justify their spectrum use, through audits of their assignments and actual and planned use of spectrum.

In order to inform its discussions with public sectors users, ictQATAR may benchmark use/requirements in Qatar with those in other developed economies where the public sector is expected to be an efficient user of spectrum (e.g. the UK, Australia). Key to fruitful dialogue in this area is that both sides recognise the benefits and the costs associated with more/less of spectrum allocations to the public sector.

6.7 Conclusion

Spectrum allocation policy in Qatar is broadly in line with the best practice international framework, but there is currently a lack of visibility regarding changes to spectrum allocations to reflect international market and technology developments. The proposed NFAP provides a means to address this by including within the plan details of the factors likely to affect spectrum demand in the future and anticipated changes to spectrum allocations to meet such demand. The proposed QNSCC should help to facilitate regular dialogue with key stakeholders and enable more informed decisions on allocation policy to be reached.

7 Assignment and licensing

7.1 Policy principles

Principles underpinning ictQATAR's approach to assigning spectrum have not been articulated clearly in any of the current documentation. Radio Spectrum policy principles essentially flow from ictQATAR's objectives. Of particular importance in this respect are objectives which aim to optimise the use of spectrum, encourage competition and innovation, and establish a fair, objective and transparent licensing regime.

Optimal spectrum use will be achieved if it is assigned to those uses, and users which deliver the highest economic and social value. Value mainly arises from spectrum being in use (even if just occasionally for intermittent requirements[63]). Although in some cases, users need spare capacity to provide for uncertain future demands. This suggests that spectrum should be assigned rather than kept in reserve, taking due account of any constraints implied by future allocation plans and competition objectives and the practical reality that spectrum cannot be refarmed quickly or without cost.

Users' demands for spectrum will depend on its cost, and so policy on licence fees should support efficient spectrum use.

Competition will be facilitated by ensuring that competitors have fair, objective and transparent access to spectrum. There are two types of competition that need to be considered – competition between public network operators and competition between private and public systems. Spectrum assignment policies should support both of these types of competition.

Innovation will be stimulated by low cost timely access to spectrum with the minimum regulatory burden imposed; eg. by allowing users flexibility over technology choices within technical operating constraints. In some countries, this has been facilitated through "light licensing" and the offer of temporary licences for test and development purposes. Technology innovations may also permit sharing of spectrum by cognitive devices that sense the radio environment, and so avoid interference without the need for licensing. The level of licensing should therefore be proportionate to the likelihood of interference, which in turn will be determined by transmission characteristics and capability of devices to mitigate any potential interference.

This discussion suggests the following principles underpin ictQATAR's assignment policy:

- spectrum should be assigned rather than kept in reserve, taking due account of any constraints implied by future allocation plans and competition objectives and the practical reality that spectrum cannot be refarmed quickly or without cost;
- competition between public network operators and competition between private and public systems should be supported by spectrum assignment policies;
- the level of licensing should be proportionate to the likelihood of interference, with authorisations given where interference issues do not arise; and
- spectrum fees should be set so as to encourage efficient spectrum use.

[63] Use of spectrum by defence and the emergency services is particularly intermittent. Public network operators also must dimension their networks to cater for demand peaks some of which may be difficult to anticipate.

7.2 Licensing policy

The Telecommunications Law makes provision for authorisation, licences and registration of spectrum assignments.

Registration

So far, spectrum and frequency licences have been issued by ictQATAR and there has been some but not complete registration of use by government and broadcasters. It has been recommended that registration be undertaken as a matter of some urgency, together with the overall audit of the assignment data.

Authorisations

ictQATAR has published a Class Licence for short range devices which largely reflects the internationally harmonised bands for short range devices specified in ECC Recommendation 70-03. The Class Licence on Short Range Devices will be revised from time to time to include network terminals[64] and ensure technical characteristics reflect internationally recognised norms for licence-exempt equipment, especially in bands where visitors to Qatar are likely to be importing and operating wireless equipment.

Frequency licences

In the case of annual frequency licences, the following issues need to be addressed:

- some greater clarity around conditions for licence renewal and revocation could be given;
- users asked for longer duration licences to reduce administrative costs associated with licence renewal; and
- whether or not licences could be made tradable.

Frequency licences and spectrum licences are typically renewed if the licensee is compliant with licence conditions, and if there are no competition or spectrum management reasons (e.g. the need to refarm the band to another use) to do otherwise. This policy could be made more explicit and, additionally, the policy around licence revocation. The key issues here are the notice periods and whether compensation is paid or not.

When licences are revoked it takes time for users to terminate services, acquire new equipment and plan processes for migrating to other bands or services. Hence, notice periods must be given to allow these processes to happen smoothly. Notice periods elsewhere range from one or two years (e.g. Denmark) to five years or more (e.g. the UK). Notice periods of 2-5 years would seem reasonable as business planning periods are rarely longer than this. However, if notice is inadequate or unreasonable, having regard to the services of the current licensees, a prima facie case for compensation may arise. The approach to compensation would need to be made explicit in the guideline document on the notice process.

Having notice periods of 2-5 years for annual licences may seem rather odd but this is what happens in practice in most other countries, in recognition of licensees' equipment

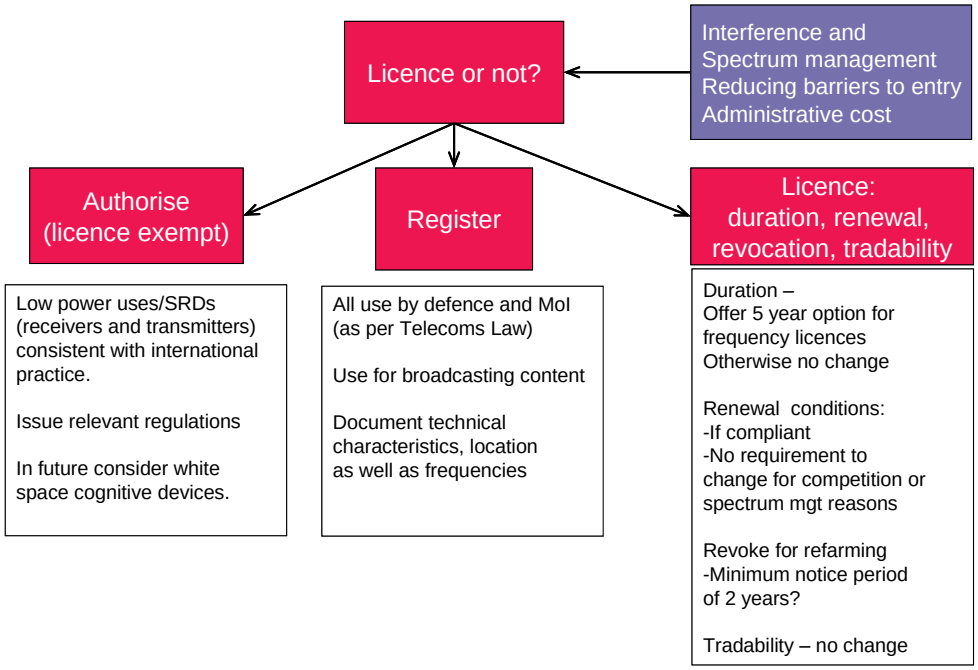
[64] That is terminals that connect directly to any licensed public mobile or fixed wireless access network, or to an internationally recognised mobile satellite service (Inmarsat, Iridium, Globalstar, Thuraya, etc)

investments and the time taken to put in place alternative communications facilities. In recognition of this oddity and to reduce the administrative costs of annual licence renewal, some regulators have extended the duration of annual licences to five years (e.g. the UK, Denmark). There could be merit in implementing such a policy in Qatar. It could be combined with an upfront payment for a 5 year licence.

Currently, ictQATAR does not permit licensees to trade spectrum. As discussed in Section 4, much of the spectrum in Qatar is not heavily used and, as discussed in Section 3, international experience with tradable licences is still evolving. ictQatar does not plan to change arrangements allowing spectrum trading but will review the situation in five years.

A summary of our recommendations in given in Figure 7.1

Figure 7.1 Licensing policy – proposed framework



Source: Ovum

7.3 Assignment policy

If spectrum is plentiful (at low fee levels), then no rationing is required and all licences could be assigned on a first come first served basis. However, in practice, excess demand is likely in some (e.g. lower) frequency bands and there is the risk that when fees are low users will request large amounts of spectrum either to inhibit competition or to guard against the possibility of future shortages. Radio Spectrum assignment policy needs to anticipate these circumstances.

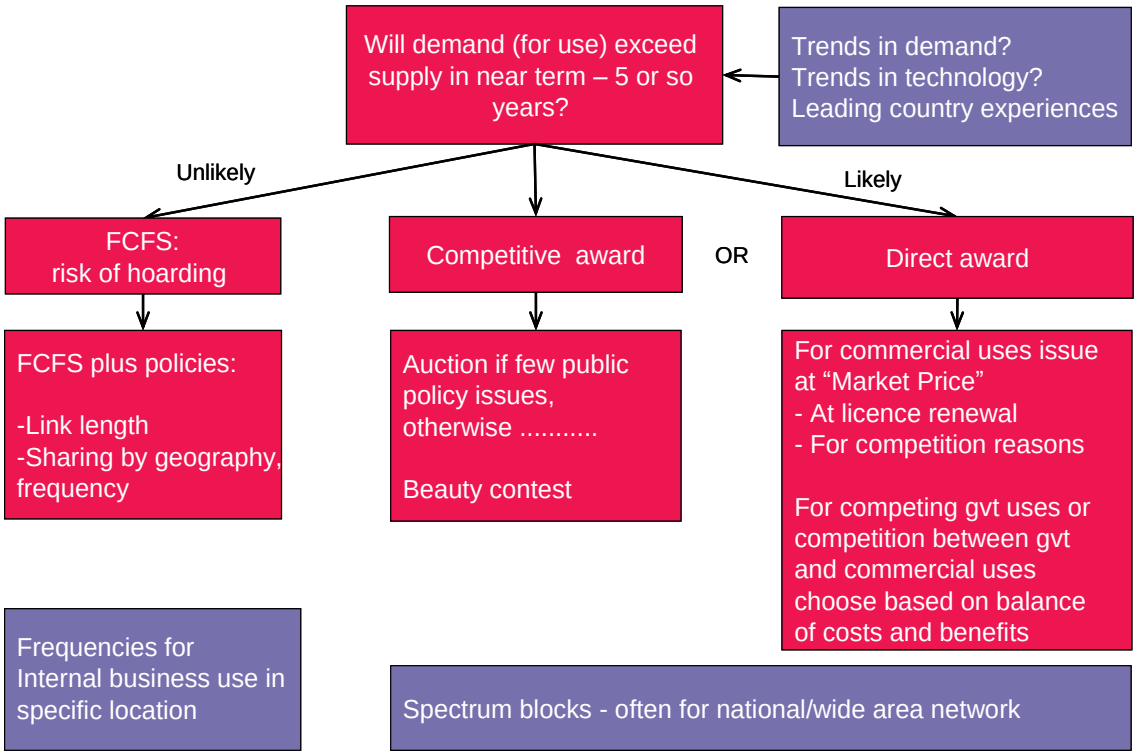
Possible options are as follows:

- **Option 1:** First come, first served, and administrative rules. Such rules may address sharing requirements, channel loading, link length (for fixed links), and whether individual assignments or block allocations are made.

- **Option 2:** First come, first served, and spectrum pricing. Here pricing is used as the main tool to ration demand.
- **Option 3:** Non-competitive assignment (i.e. direct award), possibly with pricing. Here the regulator chooses who gets the spectrum licence.
- **Option 4:** Competitive assignment process: Auctions or beauty contests where the latter may include a substantial fee but where decisions are made on non-financial grounds.

The approach taken depends on the type of use envisaged (see Figure 7.2).

Figure 7.2 Assignment policy – proposed framework



Source: Ovum

First come, first served, is generally appropriate for private use of spectrum (e.g. fixed applications, PMR) as demand appears intermittently over time - meaning that competitions are often not practical unless the regulator is seeking to delegate management to private sector band managers. If congestion is very unlikely, then first come, first served, with fees at current levels should be sufficient to meet users needs. If congestion is thought likely then licence fees should be set at a higher level to reflect the opportunity cost of the spectrum.

In either case, it is good spectrum management practice to make assignments on a geographically shared basis when the user requirements are localised, and to use a link length policy in fixed link bands as neither of these policies is likely to impose undue (if any) costs on users and helps conserve the spectrum resource should increased demand occur in future. For example, in the UK the following minimum path lengths are applied by

Ofcom (assuming users pay standard fees[65]). The propagation conditions in the GCC region may of course mean that there are different path lengths in Qatar.

	<140Mbps	**140 Mbps and above**
Minimum path length at 4 GHz	24.5km	16km
Minimum path length at 10 GHz	10km	6km
Minimum path length at 20 GHz	4km	2km

For public services, competitive assignment processes are typically required to meet competition objectives. Competition for the market is important as well as competition in the market when the number of licences is limited by spectrum availability. Auctions are generally considered to be more efficient, transparent and timely than beauty contests[66] and this is why they have been adopted to assign spectrum for a wide range of frequency bands in many countries around the world, including the Middle East. However, if there are many qualitative criteria to be considered, then beauty contests may be appropriate.

Direct assignment at no (or little) price would not be efficient. 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. While this situation does not apply at present in Qatar, it could arise in future when markets are more mature so the prospect of new entry is very low and the regulator wishes to assign particular amounts of spectrum (e.g. equal amounts) to each operator for competition reasons. Of course if this requirement was dropped then the blocks could be auctioned to the highest bidder. This happens in the US and Hong Kong.

In summary, it has been recommended that as shown in Figure 7.2:

- where congestion is unlikely and/or spectrum is used to support internal business activities a first come first served approach is used to assign spectrum. ictQATAR should consider applying policies aimed at greater sharing of spectrum, such as link length policies for fixed links and geographic sharing for PMR;
- where congestion is likely and spectrum is used to deliver services to the general public, ictQATAR should consider the use of auctions unless public policy issues mean that this is not practical in which case a comparative tender or beauty contest should be used; and
- where congestion is likely but competitive award processes are not feasible (e.g. for some government users) or could cause significant disruption (e.g. at the end of the licence term for mobile, broadcasting and BWA services), then direct award should be considered. Particularly in the case of commercial services there is a strong case to apply a renewal fee in order to promote efficient spectrum use and give a fair return to the public purse.

7.4 Licence fees

In Section 2, the following issues with the current licence fees were identified:

- the licence fees for frequency licences are not currently published;

[65] Higher fees may be paid for shorter path lengths.

[66] See for example "Why Auction Spectrum", John McMillan, Telecommunications Policy, 1994

- the licence fees for frequency licences give little incentive for efficient spectrum use, as they are not related to bandwidth, the extent of sharing or the frequency band used;
- some services pay much higher fees than others for no apparent reason, as in the case of SNG services;
- the licence fees for spectrum licences and frequency licences are not consistent, in the sense that application of each fee schedule for a given service can give very different payments;
- The licence fees for FM radio broadcasters appear to be very low at QAR3,000 given the FM band is congested.

Publication of a fee schedule for frequency licences is essential for reasons of transparency and so that licence applicants take account of the fees paid when deciding how much spectrum access they require. First, however, there needs to be an agreed fee schedule for frequency licences. Existing schedules need to be revised so that the fees for private mobile radio and fixed services provide some incentive for efficient spectrum use, as in both cases there is growing demand for the spectrum. Other fees will remain as at present.

Such incentives could be provided by relating licence fees to:

- the quantity of spectrum used in terms of MHz, area sterilised and duration of use;
- the frequency band with higher fees in the lower, typically more valuable frequency bands. This is now a standard approach for fixed links fees as can be seen in Figure 7.3.

One option would be to apply the fee structure that applies to spectrum licences to frequency licences for mobile and fixed services. This could be done in a way that gave greater consistency between the spectrum and frequency fees. However, some additional features would be required. In particular, because fixed links and PMR are location specific meaning frequencies can be reused either:

- an assumed reuse factor could be applied to give the fees per assignment; or
- the fees paid could be a function of the power of the transmission, which is related to the area sterilised.

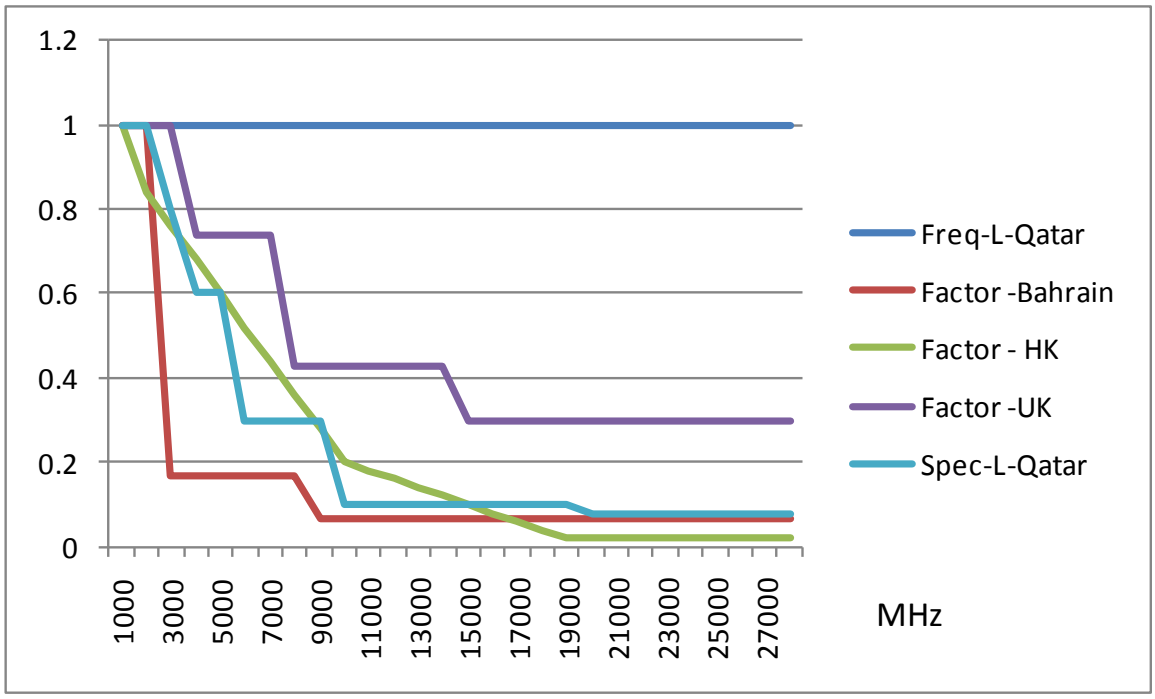
The first approach has the benefit of simplicity. It also removes the need to set fees based on the number of handsets, as this has no bearing on the extent of spectrum use. For temporary assignments the fees could be prorated by the fraction of the year for which use applies, perhaps with a minimum of fee of 10% of the annual fee. This should be considered as part of a wider review of licence fees.

It has been recommended that frequency licence fees for bands used for mobile radio and fixed transmitters be restructured so that the fees are a function of the quantity of spectrum sterilised, extent of potential reuse and duration of use. If the frequency fees for fixed services and PMR are changed as proposed it will be necessary to consider the implications for ictQATAR's overall revenues and the implications for specific users. Some fine tuning of the levels of fees is likely to be required to avoid excessive disruption to users. This process is expected to be commenced following the finalisation of the Radio Spectrum policy by ictQATAR.

The fees set for aeronautical and maritime users may not need to be revised as they have relatively little flexibility in their spectrum use. In the case of mobile satellite terminals and TVRO, it has been suggested that the use of these terminals should be licence exmpt and so no fees should apply in future.

The fees for VSATs and SNG appear to be high and, in both cases, although there is no apparent congestion in the frequency bands they use. It has been suggested that they are included in the formula used for fixed transmitters mentioned above, so that they are related to the bandwidth used, extent of reuse and duration of use.

Figure 7.3 Relative variation of fees by frequency for fixed links



Source: Ovum

In the case of FM radio, the band is congested and there is a stronger case in this instance for using fees to ration demand. In principle, such fees should apply to QMC as well as commercial stations as they all contribute to congestion in the band. The difficult issue is then to decide at what level to set fees.

Market benchmarks from Australia, Denmark, Netherlands, New Zealand and the UK are shown in the table below. These show a very wide range in values, depending on the location. The value will depend importantly on the number of established competing stations and broadcasting policy as in some cases the format of programmes is regulated.

As a first step in Qatar, it has been suggested that charges are set based on spectrum use using the spectrum licence fee structure, as suggested for other applications. Assuming an FM station uses 200kHz and no reuse, this would imply an annual payment of nearly QAR10,000 p.a.

Figure 7.4 International benchmarks for radio licences

Country , date	Method	Value

Australia, 2004	Auction – FM	Sydney67 - $A106m Brisbane68- $A80m
Denmark, 2003	Auction – FM	National licence – assumes uses 2MHz – sold, operator withdrew and then resold to TV 2 for €3m
Netherlands, 2003	Auction – FM	Whole 20 MHz band cleared and sold for €300m
New Zealand, 2008	Calculated offer prices for FM	Wide range of values depending on population served69
UK, 200470	Annual licence payments set by Ofcom – FM and MW	£1.8m/MHz converts to around £13.5/MHz for the duration of the 12 years licence assuming a 10% discount rate £0.09m/kHz (or about £90m/MHz) for MW

Source: Ovum

7.5 Planning and licensing processes

ictQATAR is legally responsible for licensing and planning spectrum use but there are areas where it may be more efficient for major users to undertake detailed planning and assignment activities because of their detailed knowledge of the radio systems used and operational requirements. In particular, it is common in other countries for the defence forces, aeronautical and maritime bodies, telecom operators and some large users to undertake detailed management of blocks of spectrum they have been assigned, though in most cases assignments still need to be registered with the regulator so that spectrum as a whole can be managed (e.g. to resolve interference disputes and change allocations). It is therefore necessary that all frequency use in Qatar should be registered with ictQATAR.

Consistent with international best practice and taking account of competition and resourcing issues, it has been recommended that in Qatar:

- defence forces and the Ministry of the Interior manage their assigned blocks of spectrum and register all use with ictQATAR. ictQATAR may also make individual assignments to these bodies in bands that it manages from time to time;
- international aeronautical bands be dealt with by the CAA. There is a strong case for the CAA to plan assignments in these bands, deal with ICAO and notify ictQATAR of assignments so that ictQATAR can issue relevant licences and record assignments on its database;
- broadcasting bands: For competition reasons, ictQATAR should take over management of these bands (in particular those at VHF and UHF) so that it undertakes the detailed planning and assignment in consultation with major broadcasters;

[67] http://www.acma.gov.au/WEB/STANDARD/pc=PC_91585

[68] http://www.acma.gov.au/WEB/STANDARD/pc=PC_91592

[69] http://www.rsm.govt.nz/cms/policy-and-planning/current-projects/radiocommunications/rights-at-expiry/am-fm-renewal/data-on-offer-4-of-licences/data-on-offers-of-licences-vhf-fm/

[70] http://www.ofcom.org.uk/consult/condocs/futurepricing/aipstudy.pdf

- telecommunications operators currently self manage bands they use for public mobile services, FWA, MMDS and some blocks used for fixed links, though they are required to report all assignments to ictQATAR. This may continue for bands used to provide public services as this enables operators to best meet their business needs in a timely manner. However, in future ictQATAR may undertake more detailed management of fixed link bands for competition reasons.
- other large users such as the oil and gas industry have suggested they be assigned spectrum to construct their own private mobile network. This will be assessed by ictQATAR taking account of the availability of suitable spectrum and other potential demands.

Some of these recommendations imply the need for additional engineering resources and expertise in ictQATAR particularly in the area of broadcasting services.

Finally, it is noted that licence fee collection is currently split between ictQATAR and Qtel for historic reasons. This is not a practical or satisfactory arrangement in a competitive sector and it has been recommended that all licensing and licence fee collection activities should be undertaken by ictQATAR, the statutory authority empowered to do so.

8 Radio Spectrum Policy

ictQATAR develops and administers its policy in accordance with Decree Law 34 of 2006 and the Telecommunications Law, the Executive By-law for the Telecommunications Law and related legal instruments.

Within this Public Consultation document, specific sections and paragraphs of the Telecommunications Law and Executive By-law are referenced to set the context for the Radio Spectrum policy. ictQATAR will issue guidelines on regulatory policy in due course to provide details on policy implementation.

8.1 Policy principles

Telecommunications Law and Executive By-Law

Article 2 of the Telecommunications Law states that ictQATAR is responsible for regulating the telecommunications sector and:

3. encouraging the introduction of advanced and innovative information and telecommunications technologies to meet the needs of customers and the public;

8. establishing a fair, objective and transparent licensing regime for service providers;

Article 4 of the Telecommunications Law states that the ictQATAR General Secretariat shall have the following powers and authorities:

1. granting, amending, renewing, suspending and revoking Class Licenses, Radio Spectrum Licenses and Authorizations and determining the terms and procedures necessary for their issuance

2. monitoring the compliance of the licensees with the terms of the Licenses and Authorizations issued to them;

3. setting and managing the plan for Radio Spectrum and for other scarce resources, and ensuring the optimal use of such resources and maximising revenues generated from them within the limits specified by international rules;

Radio Spectrum Policy Principles

RSP1 Consistent with the objectives set out within the Telecommunications Law and Executive By-law and international best practice, ictQATAR's radio spectrum policies will be guided by the following principles:

- to promote the economic and societal benefits from use of all spectrum ;
- to provide a transparent, non-discriminatory and predictable approach to spectrum management;
- to take the least intrusive interventions consistent with achieving public policy objectives and efficient spectrum use;
- to set the spectrum fees in a manner which will enable efficient use of this scarce national resource;

- to 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;
- to facilitate stakeholder participation in key allocation decisions.

Question 1: Do you consider these to be an appropriate set of principles to guide ictQATAR's Radio Spectrum Policy? Are there any additional principles that you think should be considered? If yes, please specify the additional principles with your rationale.

8.2 Spectrum Allocation

Telecommunications Law and Executive By-Law

Article 14 of the Telecommunications Law states that the General Secretariat shall manage, assign and allocate the frequencies in the Radio Spectrum in an orderly systematic and effective manner in accordance with the rules of this Law and the related international rules. And it may in this respect perform the following:

1. prepare and maintain the National Plan for Radio Spectrum and manage, assign and allocate the frequencies in accordance with that plan.

Article 24 of the Executive By-law states that in relation to radio spectrum management, the General Secretariat shall:

2. prepare and publish a national frequency allocation table identifying all radio spectrum allocations.
3. ensure that the use of radio spectrum is consistent with the national frequency assignment plan, related allocations and assignments, any applicable international treaties, commitments, protocols and standards and Radio Spectrum License conditions, including taking related compliance and enforcement actions.
4. ensure the best and most efficient use of radio spectrum in accordance with international best practice in order to promote the objectives identified in Article (2) of the Law.

Radio Spectrum Allocation Policy

Allocation policy is concerned with the types of services and applications that may use particular frequency bands. Economies of scale in equipment production, international mobility and the need to minimise cross border interference all mean that allocations are increasingly harmonised regionally and internationally. Where possible, the views of stakeholders will be taken into account in making decisions on future allocations. A balance will be struck between catering for the needs of existing market players and the potential to attract new entrants or stimulate innovative new service offerings. This balanced approach is important for the prosperity of Qatar and its developing position in international trade and regional policy development.

RSP2 ictQATAR's objectives for the national radio spectrum allocation policy will be:

- to promote efficient spectrum use and competitive development of communications services

- to ensure that full advantage can be taken of international market and technology developments by ensuring the timely availability of the requisite radio spectrum, and
- to provide stakeholders with good visibility of any planned changes to spectrum allocations.

Question 2: Do you consider these to be appropriate objectives for ictQATAR's Radio Spectrum Allocation Policy? Are there any additional objectives that you think should be considered? If yes, please specify the additional objectives with your rationale.

National Frequency Allocation Plan

Frequency allocations will largely be influenced by the ITU Radio Regulations and international technical standards. It may be necessary to cater for local conditions and the ITU regulations provide flexibility on how the spectrum may be deployed nationally.

RSP3 The principles and objectives detailed in RSP1 and RSP2 will underpin the allocation decisions made by and implemented by ictQATAR through the National Frequency Allocation Plan (NFAP) and National Frequency Assignment Register (NFAR). The NFAP and NFAR are two components of the overall National Radio Spectrum Plan: the plan established for allocation and use of radio spectrum by the concerned entities

RSP4 ictQATAR will develop the National Frequency Allocation Plan (NFAP) and associated table of frequency allocations to provide comprehensive information on the current allocation of frequency bands in Qatar and internationally

RSP5 The NFAP will provide specific allocation policies and information on the availability of spectrum for particular applications

RSP6 The NFAP will be progressively developed and expanded to identify how the spectrum is currently used in Qatar, any known or potential changes of use over the next five years, or any international developments that might have a bearing on the long term use of that spectrum in Qatar.

Question 3: ictQATAR invites comments on the principles and approach for the National Frequency Allocation Plan.

Communication of the National Frequency Allocation Plan

RSP7 The National Frequency Allocation Plan (NFAP) will be communicated through the Qatar National Spectrum Coordination Committee (QNSCC) and published on the ictQATAR website. The proposed QNSCC, chaired by ictQATAR, will provide a forum for dialogue of issues related to the management, allocation and assignment of all radio spectrum within Qatar. It will allow all users to share their perspectives and allow inputs to be provided by government users who do not normally participate in formal consultation, as well as input from the main commercial users.

Question 4: ictQATAR invites comments on the proposed policy that the National Frequency Allocation Plan (NFAP) will be communicated through the Qatar National Spectrum Coordination Committee (QNSCC) and published on the ictQATAR web site.

Balancing spectrum assignments between government users[71] and private sectors

It is necessary to balance the allocations of spectrum between government users and the commercial sector to ensure that the all users have sufficient resources to enable them to meet their commercial, statutory and public interests. Use of spectrum free of charge by major government sector users in Qatar does not encourage its efficient use or the return of unused spectrum.

To allow ictQATAR to undertake its spectrum management functions effectively, and taking into account international best practice, the following policies will apply to government sector users in Qatar:

RSP8 To encourage efficient use of spectrum, all allocations to government users will be included in and identified as such in the NFAP. The possible exceptions will be where assignment information is confidential for security reasons

RSP9 Within these allocations, assignments to government sector users, including technical limits on this use, will be registered with ictQATAR.

RSP10 Any future requirements for spectrum from government sector users will be submitted to ictQATAR and fully justified. There will be a general assumption and expectation that when upgrades occur (e.g. migrating from analogue to digital operation) that old systems are retired and the corresponding frequencies returned to ictQATAR for assignment to other users in accordance with the Radio Spectrum Policy.

Question 5: ictQATAR invites comments on the proposed policy that all non-confidential spectrum allocations to government users will be included in and identified as such in the National Frequency Allocation Plan (NFAP).

Question 6: ictQATAR invites comments on the proposed policy that non-confidential spectrum assignments to government sector users, including technical limits on this use, will be registered with ictQATAR.

Question 7: ictQATAR invites comments on the proposed policy that any future requirements for spectrum from government sector users will be submitted to ictQATAR with full and detailed justification.

Fees payable by government users of spectrum

Article 3 of Decree Law 34 of 2006 states that certain services, content delivery and equipment used by the Armed Forces or the Ministry of Interior or other security bodies and its spectrum needs must be registered with ictQATAR and that there will be no fees for this registration. This Article does not preclude that government users should pay fees for the use of spectrum.

[71] In general, the term Government users includes military users and applications, Ministry of the Interior, Civil Aviation Authority, and the coastguard.

Accordingly:

RSP11 ictQATAR will enable the entities identified in Article 3 of Decree Law 34 of 2006 to register their data and the spectrum needed for their equipment or stations. As per the Decree Law, this registration shall not incur fees.

RSP12 To provide incentives to use spectrum efficiently, Government users shall pay fees for the use of spectrum which shall be on a comparable basis to commercial users.

Question 8: Do you have any views on the proposed policy that Government users shall pay fees for the use of spectrum which shall be on a comparable basis to commercial users?

Question 9: Do you agree that this would provide an incentive for efficient use of spectrum? If you disagree please give your reasons.

8.3 Frequency Assignment

Article 14 of the Telecommunications Law states that the General Secretariat shall manage, assign and allocate the frequencies in the Radio Spectrum in an orderly systematic and effective manner in accordance with the rules of this Law and the related international rules. And it may in this respect perform the following:

1. prepare and maintain the National Plan for Radio Spectrum and manage, assign and allocate the frequencies in accordance with that plan.

Paragraphs of Article 24 of the By-law state that in relation to radio spectrum management, the General Secretariat shall:

1. prepare and publish a national frequency assignment plan for the spectrum allocated to the telecommunications sector and to promote the optimal and most efficient use of radio spectrum, and assign radio spectrum in accordance with that plan.

5. determine, allocate, and assign, and re-allocate or re-assign, radio frequencies and frequency bands and channel assignments, and issue Radio Spectrum Licences or Radio Frequency Authorisations, in accordance with the national frequency assignment plan.

Frequency Assignment Principles

To ensure that radio spectrum in Qatar may be effectively used to meet ictQATAR's objectives to encourage competition and innovation, and establish a fair, objective and transparent licensing regime, the following principles underpin ictQATAR's assignment policy:

RSP13 ictQATAR will prepare a forward plan of spectrum requirements for specific applications where government and commercial users may require assignments. This will allow these spectrum bands to be identified to users and reserved for the specific use.

RSP14 Spectrum bands, which are not identified for specific future requirements and where there is existing demand for access, will be made available and assigned in line with this Radio Spectrum Policy

RSP15 The decision whether to license or make licence-exempt specific spectrum allocations will be proportionate to the likelihood of interference, with authorisations given where interference issues do not arise[72]

RSP16 The level of spectrum fees will be set so as to encourage efficient spectrum use.

Question 10: Do you have comments on the principles of frequency assignment? Are there any additional principles that ictQATAR should consider? If yes, please specify any additional principles with your rationale.

Management of spectrum assignments for broadcasting

ictQATAR is legally responsible for the management, allocation and assignment of all radio spectrum within Qatar. Major decisions which might impact major organisations (e.g. national licensing for communications network operators which provide public services, public bodies such as the Civil Aviation Authority, etc., are made by ictQATAR.

Currently, at a practical level, Qatar Media Corporation (QMC) largely self manages the broadcasting bands. The introduction of digital transmission can provide additional capacity and the opportunity for new television and radio broadcast services to be launched. The extent of this capacity gain depends on the licensing approach and how the technology is deployed. It is therefore appropriate to review these management arrangements.

RSP17 QMC's current spectrum management activities will in future be undertaken by ictQATAR, as this is consistent with the Telecommunications Law and removes any potential conflict of interest that arises from QMC managing frequency ranges its competitors would like to access.

Question 11: Comments are invited on the proposal that ictQATAR should undertake the spectrum management activities for spectrum assigned for broadcasting?

Refarming the 800 MHz band

The migration from analogue to digital TV is happening internationally and is resulting in the release of spectrum in the 790 – 862 MHz band (generally referred to as the 800 MHz band) for new uses. The 800 MHz band, which is not used for analogue TV services in Qatar, and which is suited to providing remote area communications service coverage and improved building penetration in urban areas, is of interest to cellular network operators to meet the demands of continuing growth in cellular data traffic.

In line with these developments, Qatar needs a digital TV switchover plan and to co-ordinate the future use of the UHF band with neighbouring countries in the GCC.

RSP18 ictQATAR will work with QMC to develop technical and policy proposals for digital switchover in Qatar, through the establishment of a Switchover Working Group. ictQATAR will instigate action as soon as possible to facilitate the early introduction of non-broadcast services in the 800 MHz band.

[72] For example, relatively low power on-site radio systems (such as remote control door control systems or certain WiFi installations) and receive-only devices such as pagers

Question 12: Do you have any comments on the proposal that ictQATAR will work with Qatar Media Corporation (QMC) to develop technical and policy proposals for digital TV switchover in Qatar?

Question 13: Do you agree that the early introduction of non-broadcast services in the 800 MHz band will be beneficial for the State of Qatar? In particular, are there any practical reasons for delay?

8.4 Radio Spectrum Licensing

The Telecommunications Law makes provision for authorisation, licensing and registration of spectrum assignments. It is necessary to ensure that there is clarity around conditions for the issuing and renewal of frequency licences, and mechanisms established which allow for an efficient licensing process.

Licence authorisations

RSP19 On 1 June 2010, ictQATAR issued a Class Licence for Short Range Devices. On 23 August, 2010, ictQATAR also issued the Camel Racing Equipment Class License. ictQATAR will prepare an authorisation for licence exempt use which will include network terminals[73]. The authorisation will ensure that technical characteristics reflect internationally recognised norms for licence-exempt equipment, especially in bands where visitors to Qatar are likely to be importing and operating wireless equipment.

An information sheet will be published indicating the equipment that is authorised and the conditions under which it is exempted from licensing through a Class Licence.

Question 14: Aside from the terminals and devices mentioned in the proposed policy, are there other devices or uses of spectrum that you think should be licence-exempt and that should fall under a Class Licence?

Licence renewal

For licences which are of longer duration than one year, it will be beneficial to ictQATAR and the licensee to reduce administrative costs associated with licence renewal.

RSP20 ictQATAR will review whether to modify its licensing policy to increase the licence period for some single year licences to a period of up to 5 years. ictQATAR will also review the structure of payments for such licences to consider whether this policy is combined with an upfront payment for the full period of the licence.

RSP21 The policy revision will include principles for the provision of licence fee refunds in the case of a licence being released prior to its termination. These principles will allow ictQATAR to charge an appropriate administration fee for fee refund.

Question 15: ictQATAR invites comments on the proposed modification to the licensing policy. In particular, do you see any benefits in longer licence periods?

[73] That is terminals that connect directly to any licensed public mobile or fixed wireless access network, or to an internationally recognised mobile satellite service

Terms of licence revocation

It is important that, for frequency licences which are renewed annually, there is clarity around the conditions for licence renewal and revocation, particularly with regards to the notice period and whether compensation is paid or not.

Notice periods of 2-5 years for annual licences is the practice in most other countries, in recognition of licensees' equipment investments and the time taken to put in place alternative communications facilities.

RSP22 ictQATAR will publish a policy guideline document on licence revocation. This may include notice periods of 2-5 years, to be reasonable to allow for users' business planning periods. The approach to compensation will be made explicit in the guideline document on the notice process.

Question 16: ictQATAR invites views on the terms for licence revocation, in particular the proposed notice periods.

Spectrum trading

Spectrum licences in Qatar may not be assigned to third parties without the approval of ictQATAR.

RSP23 ictQATAR will not change arrangements for spectrum assignment as these arrangements are sufficient at present. The situation will be reviewed in 2015.

RSP24 ictQATAR will hold an industry consultation before any introduction of spectrum trading is permitted.

Question 17: Do you think that the subject of spectrum trading should be reviewed before 2015? What do you think would be the advantages or disadvantages of spectrum trading, and which types of licence holders do you think should be able to participate in a trading process?

8.5 Radio Spectrum Assignment Policy, Fees and Billing

Telecommunications Law and Executive By-Law

Article 24 of the Telecommunications Law states that the General Secretariat shall manage, assign and allocate the frequencies in the Radio Spectrum in an orderly systematic and effective manner in accordance with the rules of this Law and the related international rules. In this respect, it may perform the following:

7 regulate matters related to radio spectrum fees;

8. conduct public inquiries relating to the use or management of radio spectrum as it deems appropriate;

9. mediate, resolve and manage interference disputes, where such disputes are not resolved by the disputing parties to the satisfaction of the General Secretariat

Policy for Radio Spectrum Assignment

Radio Spectrum assignment policy needs to be set to ensure that there is a balance between the availability of spectrum and the demand for that spectrum, whilst also guarding against the possibility of hoarding or inefficient use. The main options for assignment policy are:

- **Option 1**: First come, first served, and administrative rules. Such rules may address sharing requirements, channel loading, link length (for fixed links), and whether individual assignments or block allocations are made.
- **Option 2**: First come, first served, and spectrum pricing. Pricing is used as the main tool to ration demand.
- **Option 3**: Non-competitive assignment (i.e. direct award) possibly with pricing. Here the regulator chooses who gets the spectrum licence.
- **Option 4**: Competitive assignment process: Auctions or beauty contests where the latter may include a substantial fee but where decisions are made wholly or partially on non-financial grounds.

The approach taken depends on the nature of demand and type of use envisaged.

ictQATAR is responsible for determining how and when spectrum should be assigned.

ictQATAR will develop its frequency assignment policy, in general, as follows:

RSP25 Where congestion is unlikely and/or spectrum is used to support the users' internal business activities, a first come first served approach will be used to assign spectrum. ictQATAR will consider applying policies aimed at greater sharing of spectrum, such as link length policies for fixed links and geographic sharing for private mobile radio (PMR).

RSP26 Where congestion is likely and spectrum is used to deliver services to the general public, ictQATAR will consider the use of auctions unless public policy issues mean that this is not practical. In this case, a comparative tender or beauty contest may be used.

RSP27 Where congestion is likely but competitive award processes are not feasible (e.g. for some government users) or could cause significant disruption (e.g. at the end of the licence term for mobile, broadcasting and broadband wireless access services), then direct award may be considered. In the case of commercial services, there is a strong case to apply a renewal fee at this stage in order to promote efficient spectrum use and give a fair return to the public purse.

RSP28 In cases where there is a potential change in control of a licensee, the assignment of spectrum will be reviewed and approved by ictQATAR prior to the change in control.

Question 18: ictQATAR invites views on the general spectrum assignment principles described in RSP25 – RSP28.

Question 19: Are there additional principles that you think should be considered by ictQATAR and why?

Licence fees schedule

The current licence fee arrangements require review and a revised fee schedule needs to be published in order that:

- the basis upon which licence fees are set is clearly articulated; and
- licence fees for frequency licences are published and in the public domain.

This will be a high priority for ictQATAR, following this consultation.

RSP29 The existing licence fee schedule will be reviewed periodically in order to set fees which provide incentives for efficient spectrum use.

Question 20: Once the licence fees for frequency licences are published by ictQATAR and in the public domain, how frequently do you think the licence fee schedule should be reviewed? Please provide your reasons.

Licence fees determination

The principles that underpin new licence fees that promote efficient spectrum use are:

RSP30 All users of spectrum, apart from those specifically exempted in RSP19, will pay fees for using spectrum that, at a minimum, recover ictQATAR's costs of managing the spectrum

RSP31 Licence fees will, in general, reflect the opportunity cost of spectrum access, in addition to the costs of spectrum management.

Note: In bands where there are now or are expected to be in future competing uses/users for a band (i.e. where bands are congested) the opportunity cost of spectrum is greater than zero. Hence, opportunity cost based licence fees should be applied (where practical) to all licensees (primary or secondary) whose spectrum use denies access to other potential users in congested bands.

RSP32 To provide incentives for efficient spectrum use spectrum fees/prices will be related to:

- the quantity of spectrum used (i.e. number of kHz or MHz), area sterilised, degree of sharing or exclusivity and duration of use;
- the frequency band, with higher fees in the lower, typically more valuable bands.

RSP33 Principles for setting fees and the fee schedule will be published.

RSP34 Spectrum fees for frequency and spectrum licences will be set on a consistent basis.

Question 21: ictQATAR invites views on the principles (RSP30 to RSP34) for licence fees determination.

Please note, the review of licence fees to be undertaken by ictQATAR will be subject to public consultation.

8.6 Radio spectrum management processes

Telecommunications Law and Executive By-Law

Article 14 of the Telecommunications Law states that the General Secretariat shall manage, assign and allocate the frequencies in the Radio Spectrum in an orderly systematic and effective manner in accordance with the rules of this Law and the related international rules. It may in this respect perform the following:

> (3) form and monitor the operation of committees including any current committee(s) to co-ordinate uses of radio frequencies including civilian, non-civilian and commercial uses and the General Secretariat may issue regulations and rules necessary to establish and operate such committees.

Qatar National Spectrum Coordination Committee

RSP35 ictQATAR is legally responsible for the management, allocation and assignment of all radio spectrum within Qatar. To carry out these functions effectively, it requires inputs from current and potential users in addition to those gained from its own research and analysis. The proposed Qatar National Spectrum Coordination Committee (QNSCC), chaired by ictQATAR, will provide a forum for such dialogue. It will allow all users to share their perspectives and allow inputs to be provided by government users who do not normally participate in formal consultation, as well as input from the main commercial users. Such dialogue is likely to be of most benefit if it is kept at a high level, dealing with strategic issues around allocation policy.

RSP36 The QNSCC will be open to all major radio spectrum users and its primary function will be to provide a forum for discussion with ictQATAR on:

- international and domestic radiocommunication issues;
- allocation issues as these relate to the National Frequency Allocation Plan;
- the development of proposals for international conferences and meetings, in particular the development of national or regional positions for World Radiocommunications Conferences and for regional coordination in specific bands; and
- issues requiring coordination and liaison between various radio spectrum users.

The QNSCC can provide advice with a view to promoting the long term economic and social interests of Qatar but the ultimate discretion lies with ictQATAR.

RSP37 ictQATAR will develop a rolling annual programme for the QNSCC and instigate the committee.

Question 22: What are your views on the proposed functions of the Qatar National Spectrum Coordination Committee (QNSCC)?

Planning and assignment responsibilities

Whilst ictQATAR is legally responsible for licensing and planning spectrum use, there are areas where it may be more efficient for major users to undertake detailed planning and assignment activities because of their detailed knowledge of the radio systems used and

operational requirements. In particular, it is common in other countries for the defence forces, aeronautical and maritime bodies, telecommunications operators and some large users to undertake detailed management of blocks of spectrum they have been assigned, though in most cases assignments still need to be registered with or licensed by the regulator so the spectrum as a whole can be managed (e.g. to resolve interference disputes and change allocations).

Consistent with international best practice and taking account of competition and resourcing issues in Qatar, the following will be implemented in Qatar:

RSP38 Government sector users who manage their assigned blocks of spectrum will register all use with ictQATAR. ictQATAR may make individual assignments to these bodies in bands that it manages from time to time.

RSP39 To ensure fair competition and for spectrum management reasons ictQATAR will manage the broadcasting bands (in particular those at VHF and UHF) and will undertake the detailed planning and assignment of these bands in consultation with major broadcasters.

RSP40 Within their assigned bands, Service Providers may self manage bands they use for public mobile services, FWA, MMDS and some blocks used for fixed links and shall report all assignments to ictQATAR.

RSP41 ictQATAR, taking account of the availability of suitable spectrum and potential demand, will consider whether to assign spectrum to allow other major users e.g. the oil and gas industries to construct their own private mobile networks.

Question 23: ictQATAR invites views on the proposed policy that Government sector users who manage their assigned blocks of spectrum will register all use with ictQATAR.

Question 24: ictQATAR invites views on the proposed policy that Service Providers may self-manage bands they use for public mobile services, FWA, MMDS and some blocks used for fixed links and shall report all assignments to ictQATAR.

Question 25: ictQATAR invites views on the proposed policy that ictQATAR will consider whether to assign spectrum to allow other major users to construct their own private mobile network.

ictQATAR regulatory technical skills

RSP42 ictQATAR will assess the resources needed to implement Radio Spectrum Policy and develop the skills within the Regulatory Authority needed to deploy the policy.

8.7 Monitoring and enforcement

Telecommunications Law and Executive By-Law

Article 14 of the Telecommunications Law states that the General Secretariat shall manage, assign and allocate the frequencies in the Radio Spectrum in an orderly systematic and effective manner in accordance with the rules of this Law and the related international rules. It may in this respect perform the following:

> (2). monitor the implementation of radio frequencies and radio spectrum in accordance with the National Radio Spectrum Plan and related assignments and

allocations and applicable license terms, and prepare a national frequency register to record information related to radio frequencies and their allocations, assignments and use

Monitoring and enforcement

Interference can impair the performance of services using spectrum which has been assigned by ictQATAR.

RSP43 ictQATAR will deploy monitoring systems to ensure compliance with spectrum licence and authorisation conditions, and to identify and resolve interference between Radiocommunication services. Monitoring will also be used to verify existing assignment data and identifying any unauthorised spectrum use.

RSP44 ictQATAR will coordinate at an international level to help prevent and address interference problems.

Question 26: ictQATAR invites views with rationale on which spectrum bands would most benefit from monitoring and enforcement.

Please note this question is asked notwithstanding the requirements on Telecommunications Licensees in their licences.

8.8 List of questions

Question 1: Do you consider these to be an appropriate set of principles to guide ictQATAR's Radio Spectrum Policy? Are there any additional principles that you think should be considered? If yes, please specify the additional principles with rationale.

Question 2: Do you consider these to be appropriate objectives for ictQATAR's Radio Spectrum Allocation Policy? Are there any additional objectives that you think should be considered? If yes, please specify the additional objectives with rationale.

Question 3: ictQATAR invites comments on the principles for the National Frequency Allocation Plan.

Question 4: ictQATAR invites comments on the proposed policy that the National Frequency Allocation Plan (NFAP) will be communicated through the Qatar National Spectrum Coordination Committee (QNSCC) and published on the ictQATAR web site.

Question 5: ictQATAR invites comments on the proposed policy that all non-confidential spectrum allocations to government users will be included in and identified as such in the National Frequency Allocation Plan (NFAP).

Question 6: ictQATAR invites comments on the proposed policy that non-confidential spectrum assignments to government sector users, including technical limits on this use, will be registered with ictQATAR.

Question 7: ictQATAR invites comments on the proposed policy that any future requirements for spectrum from government sector users will be submitted to ictQATAR and fully justified.

Question 8: Do you have any views on the proposed policy that Government users shall pay fees for the use of spectrum which shall be on a comparable basis to commercial users?

Question 9: Do you agree that this would provide an incentive for efficient use of spectrum? If you disagree please give your reasons.

Question 10: Do you have comments on the principles of frequency assignment? Are there any additional principles that ictQATAR should consider? If yes, please specify any additional principles with rationale.

Question 11: Comments are invited on the proposal that ictQATAR should undertake the spectrum management activities for spectrum assigned for broadcasting?

Question 12: Do you have any comments on the proposal that ictQATAR will work with Qatar Media Corporation (QMC) to develop technical and policy proposals for digital TV switchover in Qatar?

Question 13: Do you agree that the early introduction of non-broadcast services in the 800 MHz band will be beneficial for the State of Qatar? In particular, are there any practical reasons for delay?

Question 14: Aside from the terminals and devices mentioned in the proposed policy, are there other devices or uses of spectrum that you think should be licence-exempt?

Question 15: ictQATAR invites comments on the proposed modification to the licensing policy. In particular, do you see any benefits in longer licence periods?

Question 16: ictQATAR invites views on the terms for licence revocation, in particular the proposed notice periods.

Question 17: Do you think that the subject of spectrum trading should be reviewed before 2015? What do you think would be the advantages / disadvantages of spectrum trading and which types of licence holders do you think should be able to participate in a trading process?

Question 18: ictQATAR invites views on the general spectrum assignment principles described in RSP25 – RSP28.

Question 19: Are there additional principles that you think should be considered by ictQATAR and why?

Question 20: Once the licence fees for frequency licences are published by ictQATAR and in the public domain, how frequently do you think the Licence fees schedule should be reviewed? Please provide your reasons.

Question 21: ictQATAR invites views on the principles (RSP30 to RSP34) for licence fees determination. Note – the review of licence fees to be undertaken by ictQATAR will be subject to public consultation.

Question 22: What are your views on the proposed functions of the Qatar National Spectrum Coordination Committee (QNSCC)?

Question 23: ictQATAR invites views on the proposed policy that Government sector users who manage their assigned blocks of spectrum will register all use with ictQATAR.

Question 24: ictQATAR invites views on the proposed policy that Service Providers may self manage bands they use for public mobile services, FWA, MMDS and some blocks used for fixed links and shall report all assignments to ictQATAR.

Question 25: ictQATAR invites views on the proposed policy that ictQATAR will consider whether to assign spectrum to allow other major users to construct their own private mobile network.

Question 26: ictQATAR invites views with rationale on which spectrum bands would most benefit from monitoring and enforcement.

Annex A. Spectrum management in selected GCC countries

In this Annex we present information regarding the management of spectrum in a number of GCC countries. This information includes:

- An overview of spectrum policy (Table A.1)
- An overview of allocation and assignment procedures (Table A.2)
- The national frequency plan (Table A.3)
- Spectrum usage fees
- Spectrum management, administration and enforcement processes (Table A.5)
- Consultations in relation to spectrum and forthcoming market reviews (Table A.6)
- Broadcasting issues (Table A.7).

We present this information for the following GCC countries:

- Bahrain
- Oman
- Saudi Arabia
- The United Arab Emirates.

Our review does not include Kuwait, as at the time of writing, the regulator's website was under development and therefore public-domain information was not readily available. Our review also does not include Iran, which although not a GCC country, we had originally planned to research as an interesting case study due to proximity to Qatar. However, there is currently no information available in English on the Iranian regulator's website.

Table A.1 Overview of Spectrum Policy

	Bahrain	Oman	Saudi Arabia	UAE
Is there a spectrum policy?	Yes. A spectrum policy document was issued in 2006 publically reviewing spectrum use in Bahrain, outlining the joint spectrum management policy of the TRA and Ministry of Transportation and noting decisions on the allocation and assignment of spectrum in each frequency band and for the main telecommunications applications.	Yes. Spectrum policy and management derives its statutory mandate from the Telecommunications Regulatory Law (2002). However there is no specific spectrum policy document.	Yes. Policies, regulations and guidelines have been made for the allocation of spectrum based on the Telecommunications Act of Saudi Arabia, the Ordinance of CITC, By-laws and ITU Radio Regulations and Recommendations. However there is no specific policy or regulatory framework document.	Chapter 6 of the Telecommunications Law deals with frequency management and allocation. There is also a documented policy in relation to spectrum fees. However there is no specific spectrum management or policy document.
What are the key objectives of the spectrum policy?	The TRA lists its objectives for spectrum management as the maximisation of spectrum efficiency and the minimisation of interference.	The TRA states that its broad mission in spectrum management is to facilitate the development of world-class telecommunications infrastructure, technologies and services to enhance competitiveness, economic growth and quality of life. Specific objectives include maximisation of the public benefit of radio spectrum, encouragement of use of efficient radio technologies, reliance on market forces to ensure economically efficient use of spectrum, flexibility to respond to market forces, assurance of future frequency availability to deliver new services, to ensure domestic policies are consistent with world spectrum policies and to	CITC does not explicitly state its objectives in relation to spectrum management. However it notes that the importance of its national frequency plan is to: ensure that adequate spectrum is provided over both the short and long term for different services; promote the deployment of new services with reasonable quality and affordable prices; and account for current and future demand for spectrum. CITC also notes that the NFP should facilitate equitable access among all spectrum users, and should promote efficient and effective spectrum use.	The TRA does not explicitly state its objectives in relation to spectrum management. However the General Policy for the Telecommunications Sector (see below) states as a broad policy objective that management of scarce national resources, such as spectrum, should have objectives of transparency and non-discrimination in their allocation.

		attract investments to the telecom sector.		
Is there an overarching national strategy?	Yes, 'Bahrain 2030 Economic Vision'.	Yes, 'Oman Vision 2020'	There is no overarching national strategy.	Yes, the 'General Policy for the Telecommunication Sector (GTP)'.
URL of national strategy	**http://www.tra.org.bh/en/pdf/Vision2030Englishlowresolution.pdf**	http://www.omanet.om/english/oman2004/ECONOMIC%20DEVELOPMENT.asp	Not applicable	http://www.tra.gov.ae/download.php?filename=legal_references/national_telecom_policy_uae.pdf
What does the national strategy cover?	The guiding principles of 'Bahrain 2030' are sustainability, competitiveness and fairness. The aim is to shift from an economy built on oil wealth to a globally competitive economy shaped by the government and driven by a pioneering private sector. Bahrain 2030 includes measures such as: incentives for private sector productivity gains; measures to increase the quality and consistency of regulation; and improvements to regulatory enforcement through increased inspection and stronger consequence management.	Oman's economic policymaking initially drew on five-year plans setting objectives for all government sectors. In 1995, following the first phase of development, policymakers decided to formulate a longer term vision of Oman's development over 25 years. This vision outlined various economic and social goals between 1996-2020, including: reshaping the role of Government and increased private sector participation; and diversification in sources of national income.	Not applicable	The GTP is intended to accelerate growth in the telecommunication sector in order to support the Government's goal of developing UAE as a premier ICT hub. Key government objectives include increased use of advanced technology and further development of policies and strategies to develop a diverse economic infrastructure. Policies in the GTP include: the establishment of regulatory frameworks to develop ICT and telecoms infrastructure and increased development of value-added services using broadband, wireless and other innovative technologies.
URL for regulator	**http://www.tra.org.bh**	http://www.tra.gov.om	http://www.citc.gov.sa	http://www.tra.gov.ae

Table A.2 Overview of allocation and assignment procedures

	Bahrain	Oman	Saudi Arabia	UAE
Outline of allocation and assignment policies	Spectrum allocation is based on a two-step review and consultation process. The MoT holds the Master Frequency Registry and allocates frequency bands upon request from the TRA. Frequencies are then assigned by the TRA in an open, transparent and non-discriminatory manner. The process for selecting licensees differs by service and is assessed on a case-by-case basis. Bespoke auctions are the preferred mechanism, particularly if demand is likely to exceed supply. For some licences however (such as FWA and PMSE licences and non-public uses such as private, individual and local assignment of spectrum for fixed links) a First Come First Served process may be used to assign spectrum.	Allocation and assignment of spectrum is governed by Chapter 4 of the Telecommunications Act (Articles 29 – 37). A joint committee is responsible for studying present and future needs and uses of spectrum, and for allocating bands for military, security and civilian purposes. The committee is chaired by the Minister and includes representatives from the Ministry of Defence, Security bodies, the Ministry of Information and the Ministry of Transport and Communications. The TRA assigns or reassigns frequencies according to the National Frequency Allocation Plan. The TRA does not state a preferred method of spectrum assignment.	CITC sets the national plan for the distribution and use of frequencies for civil and commercial purposes, and submits this to the Minister for approval. The Commission then assigns spectrum in accordance with international and regional regulations, agreements, and standards, and the national plan. Requests for frequencies are made to the CITC, which then determines whether to grant the specific assignments. If the number of licences is limited, it will implement an objective, transparent, and non-discriminatory award process. In such cases, the CITC may use one of the following assignment mechanisms: a comparative evaluation process; an auction process; or another process which CITC deems appropriate in the circumstances.	The TRA has responsibility for studying current and future spectrum needs for military, governmental, security and commercial purposes. A coordination committee (see below) is then responsible for setting the national spectrum plan on the basis of the TRA's study. The TRA has authority to distribute, assign and revoke spectrum in accordance with the national plan. It may assign licences either by a comparative process of considering the merits of the assignment or through the use of beauty contests or auctions. If a comparative process is used, the TRA evaluates all spectrum applications objectively based on clear criteria.
Is there a national spectrum	There is no national spectrum coordination	As noted above, a joint committee exists, chaired by	There is no national spectrum coordination	A coordination committee exists, chaired by the

coordination committee?	committee.	the Minister and including representatives from the Ministry of Defence, Security bodies, the Ministry of Information and the Ministry of Transport and Communications. The TRA may send a representative to attend Committee meetings, but the representative does not have a vote to determine resolutions or recommendations.	committee.	Director General and including representatives from the TRA, Armed Forces, Ministry of Interior, State Security and the National Media Council. Other entities' representatives may also be included if required.
Is there cross GCC coordination?	There is no specific reference to cross GCC coordination.	There is no specific reference to cross GCC coordination. However, the TRA notes that it will commence local and international coordination to prevent interference where required. It also notes that as a treaty signatory, it takes an active role in the ITU in order to ensure that regulatory frameworks in Oman are consistent with international policies.	There is no specific reference to cross GCC coordination. However the CITC notes that the biweekly International Frequency Information Circulars (IFIC) published by the ITU provide it with pertinent information in relation to international coordination.	There is no specific reference to cross GCC coordination. However the TRA highlights that it is actively involved in international meetings and negotiations which focus on convergence through cooperation and information exchange among regulators. It also notes that it participates in activities centred around international platforms such as the **ITU**, regional / special groupings, border coordination, inter-Governmental organisations, and bilateral co-operation.
How are the spectrum needs of Government and the commercial sector balanced?	There is no specific reference to the balancing of the Government's and the commercial sector's needs for spectrum.	There is no specific reference to the balancing of the Government's and the commercial sector's needs for spectrum. However as noted above, a coordination committee exists which includes Government representatives.	There is no specific reference to the balancing of the Government's and the commercial sector's needs for spectrum.	There is no specific reference to the balancing of the Government's and the commercial sector's needs for spectrum. However as noted above, a coordination committee exists which includes Government

		Additionally the TRA states that its view is that classification of frequency bands into only governmental and non-governmental use results in inefficient use of spectrum. Therefore, it prefers to allocate some spectrum bands on a shared basis (as a consequence, there are three categories of spectrum band: exclusive military bands; exclusive civil bands; and military and civil bands on a shared basis).		representatives.
Do the requirements of the telecoms law apply to broadcasters and security forces?	The definition of telecommunications in the Telecommunications Law excludes broadcasting. The second article states that the provisions of the law govern all telecommunications except the radio frequency spectrum, telecommunications networks and services used by the Bahrain Defence Forces and all security organs in the Kingdom. Therefore the requirements of the telecoms law apply neither to broadcasting or security forces.	According to the unofficial translation of the Telecommunications Regulatory Acts and Amendments, the TRA's spectrum regulation applies to broadcasting. In relation to the applicability of the regulatory requirements to security forces, the provisions of the act are 'applicable to all types of telecommunications including the frequency spectrum bands distributed for military and security uses, with the exception of other telecommunications networks that are used by these parties'.	In the Telecommunications Act, telecommunications services are defined to include TV and radio transmission. CITC only manages and supervises frequencies assigned for civil and commercial purposes. Therefore the requirements of the telecommunications law apply to broadcasting but not to security forces.	In the Telecommunications Law, telecommunications networks and services are defined to include broadcasting. The requirements of the Telecommunications Law also apply to security forces.
Licence periods	Frequency licences for national fixed services, mobile services, international	Licences to use or own radio equipment initially have a duration of one year. The validity of these licences may then be	Licences for use of radio frequencies are typically issued for one year and renewed annually (or for	The TRA issues two types of spectrum licence: individual and class licences. Individual licences are issued where

	telecommunications facilities, VSAT, paging and public access mobile radio services are valid for 15 years. The TRA can renew licences upon request for additional terms of up to 10 years upon expiration. Licences for WiFi use in the 2.4GHz band are valid for five years. Generally, a frequency licence will be valid for as long as the holder's operating licence is effective, unless the frequency licence is modified, revoked or terminated. Short term licences have also been introduced for technology testing and PMSE use. These licences are issued for a fixed and limited period.	extended for a maximum period of five years after an advance payment of fees for the whole period is made. The licensee may request a temporary cessation of the licence for a period not exceeding three years, during which period he must continue to pay licence fees. The TRA may also issue temporary licences, which are automatically cancelled on expiration.	periods specified in the licence conditions), unless a cancellation request is submitted, and provided the original technical parameters remain the same. There are about 40 different radio-communication service categories for which frequency licences may be issued.	there is resource scarcity or where more regulatory supervision is required. Class licences are issued where there is no resource scarcity or less regulatory supervision is required. Both types of licence have a term of 10 years. In addition to obtaining a licence, the licensee must apply for a frequency authorisation to use spectrum. Frequency authorisations are valid for one year. The TRA also issues temporary authorisations up to 90 days for equipment demonstration, testing or other short term requirements. The TRA may revoke a frequency authorisation if the frequencies have not been used within 4 months of the date of issue.
Is licence exempt use permitted?	Licence-exempt use is not permitted in Bahrain under current law. However the TRA and MoT have developed a light licensing regime. Under this scheme, users can easily obtain a 'light' licence at a low cost (or potentially no cost,	There is some licence exempt use, for example indoor WiFi use is licence exempt. However outdoor use is restricted.	There is some licence exempt use, for example in the 2400 - 2483.5MHz band.	There is some licence exempt use, for example indoor WiFi use is licence exempt. However outdoor use is restricted.

	depending on the service). However users remain governed by type approval of equipment and limits are placed on the maximum power of the equipment. In some cases, the light licensing regime also limits the use of the technology to a specific application.			
Are users charged for spectrum licences in 2.4GHz WiFi band?	There is currently some Government use in this band, although plans are to phase this out, after which the 2.4GHz band will be reserved for WiFi (there is already some WiFi use in this band). A light licensing scheme has been applied in this band and no licence fees are payable for use.	N/A	The 2400 – 2483.5MHz band is subject to licence exempt use in Saudi Arabia.	N/A
Are licences in 900MHz band only for GSM or are they technology neutral? How many licences will be reissued?	It is envisaged that assignments in 900MHz band will be technology neutral.	N/A	N/A	N/A

Table A.3 National Frequency Plan

	Bahrain	Oman	Saudi Arabia	UAE
URL of the national frequency plan	Allocation table: http://www.tra.org.bh/en/pdf/Frequency_Allocation_Summary_v5.pdf	Allocation table: **http://www.tra.gov.om/newsite1/Portal/Upload/Documents/158_allocation_table.pdf** Assignment table: http://www.tra.gov.om/newsite1/Portal/Upload/Documents/159_assignment_table.pdf	Allocation table: http://www.citc.gov.sa/NR/rdonlyres/13EB475F-502E-4D13-B9B0-D8B0475E6F20/0/NATIONAL_FREQUENCYPLAN_IN_KSA.pdf	Allocation table: http://www.tra.gov.ae/download.php?filename=spectrum_affairs/national_spectrum_plan_national_table_of_frequency_allocation.pdf
How often is the NFP reviewed?	The TRA and MoT review and revise the national frequency plan as and when necessary to reflect changes in government policy and strategy, technological developments and the likely needs of the country.	The content of the frequency allocation table and associated regulations are continuously under the optimisation of the TRA in order to accommodate the increasing demands of the telecommunication sector.	It is intended that the national frequency plan be reviewed on a regular basis and that consideration should be given to new developments in the radio field and results of ITU World and Regional Radiocommunication Conferences. The revision period should not exceed 5 years.	The Ministry of Communications or the TRA may request that the coordination committee (see above) reviews and amends the national spectrum plan when the need arises, provided that the policies and goals relating to the future usages of the radio frequencies in the State are considered.

A.1 Spectrum Usage Fees

Bahrain

Where justified, spectrum fees are set at levels which help to achieve socio-economic objectives. For example, fees charged for access to scarce spectrum are proportional to the amount of the resource consumed and the revenues from scarce spectrum used for commercial purposes reflect its market value.

The annual spectrum fee for non-temporary assignments is calculated by multiplying the relevant entry from the table below by the required bandwidth (in MHz):

Table A.4 TRA Bahrain - spectrum fees

	Spectrum charge, BD per MHz (USD equivalent)					
	Nationwide	**≥ 25W e.r.p**	**≥ 1W & < 25W**	**≤ 1W**	**Fixed P-P**	**Earth Stn and VSAT**
3kHz – 3MHz	4338 (11,513)	3904 (10,357)	2169 (5,753)	1085 (2,878)	434 (1,151)	434 (1,151)
3 – 30MHz	6507 (17,260)	5857 (15,535)	3254 (8,633)	1627 (4,317)	651 (1,727)	651 (1,727)
30 – 300MHz	4338 (11,513)	3904 (10,357)	2169 (5,753)	1085 (2,878)	434 (1,151)	434 (1,151)
300 – 470MHz	3254 (8,633)	2928 (7,770)	1627 (4,318)	813 (2,157)	325 (862)	325 (862)
470 – 2700MHz	6507 (17,260)	5857 (15,535)	3254 (8,635)	1627 (4,317)	651 (1,727)	651 (1,727)
2.7 – 10 GHz	1085 (2,878)	976 (2,589)	542 (1,438)	271 (719)	108 (287)	108 (287)
10 – 55GHz	434 (1,151)	390 (1,035)	217 (576)	108 (287)	43 (114)	43 (114)
55 – 275GHz	Fixed fee of BD1000 ($2,653) per fixed link, independent of bandwidth					

Source: TRA Bahrain

Table A.5 Bahrain - Fees for temporary frequency licences

Bandwidth	Charge, BD per assignment (USD equivalent)
0 – 1MHz	20 (53)
> 1MHz	20 per MHz (53 per MHz)

Source: TRA Bahrain

Table A.6 Bahrain - annual fees for call signs and amateur radio licences

Station / call sign	Charge, BD (USD equivalent)
Marine ship-station – private	10 (27)
Marine ship-station – commercial	100 (265)
Aircraft call-sign – private or commercial	100 (265)
Coast-station	40 (106)
Amateur	10 (27)

Source:

Oman

Detailed information on spectrum utilisation fees in Oman is available at: www.tra.gov.om/newsite1/Portal/Upload/Documents/254_FrequencyPricing_TRA.zip

We do not provide a full explanation of TRA's fee policy here, as the annual fees are charged on a per service basis for more than 25 services. Instead, in the table below we provide a number of examples of the fees charged:

Table A.7 TRA Oman – examples of spectrum fees

Service	Utilisation fee
Broadcasting services (Radio and TV except SW)	basic fee for broadcasting + (service factor x power factor x coverage zone factor)
Fixed services except microwave links	basic fee x weighting factor x range factor
Microwave links services	basic fee x weighting factor x number of locations x occupancy factor
VSAT services, fixed terminals	depends on number of terminals and the frequency range
GSM services	number of channels x coverage factor x 3500 OMR ($9,090)
Wireless broadband services	number of channels x coverage factor x 5000 OMR ($12,985)

Source: TRA Oman

Saudi Arabia

Saudi Arabia implements a formula to calculate spectrum fees using the following steps:

1. Identify the usable frequency bands given the available technology;

2. Compute the maximum number of possible assignments (units) in every band based on the minimum usable bandwidth in each band, nature of the service, characteristics of the antennas used and the possibility of frequency reuse;

3. Compute the overall number of units in the band;

4. Evaluate the average annual expenditure of the spectrum management sector, including the cost of the spectrum management system, employee costs and the annual contribution of KSA to the ITU budget;

5. Divide the average annual expenditure by the total number of units to determine the cost of a single unit annually (U);

6. Determine the value of the other factors characteristic of assignment, including:

- B = bandwidth factor relating the required bandwidth to the minimum usable bandwidth of a specific band;
- H = antenna height factor;
- M = mobile or non-directional antenna factor;
- P = power factor;
- W = spectrum demand density factor, which depends on the relative congestion of frequency bands;
- L = high-usage-cities factor for Riyadh, Jeddah, Mecca, Yanbu, Jubail and Dhahran-Dammam-Khobar; and
- G = coverage factor.

The annual spectrum fee is then given by:

Fee (in Saudi Riyals) = U x B x H x M x P x W x L x G

This formula does not apply to ARNS, MRNS and amateur services, which are charged as follows:

Table A.8 Saudi Arabia - Aeronautical Radio Navigation Service fees

Station	Fees per station, SR (USD equivalent)
Fixed Aeronautical Radionavigation Ground Station	1000 (267)
Mobile Aeronautical Radionavigation Ground Station	300 (80)
Gliders Ground Station	150 (40)
Navigational Aids Station	150 (40)

Source:

Table A.9 Saudi Arabia - Maritime Radio Navigation Service fees

Station / equipment	Fees per station / equipment, SR (USD equivalent)
Radiocommunication equipment onboard ships	200 (53)
Port Operations Coastal Stations	300 (80)
Coast Stations for Commercial Communications	1000 (267)
Coast Stations for Yacht Clubs	500 (134)
Navigational Aids Stations	200 (53)

Source:

Amateur services are charged at 150 SR ($40) annually per station. No spectrum fees are implemented for low power equipment, receive-only equipment, GPS Receivers, CB radio equipment and terminal or handheld TX/RX equipment belonging to a network using frequencies which have already been charged.

UAE

The annual spectrum charges depend on the type of service provided, and are calculated as shown in the table below:

Table A.10 UAE - annual spectrum charges

Service	Formula for calculating spectrum fees	Explanation of formula
Public land mobile radio (cellular including GSM and UMTS)	$(PxMHz)^{EM}$ x $[(1+(MC-CC)/CM]^{EC}$	P=Price / MHz, EM= Efficiency factor for MHz, MC= Minimum coverage, CC= Current coverage of operator, CM= Maximum coverage, EC= Efficient Factor for coverage
Private mobile radio	NCx500+SUM(WEx500xPF) Countrywide allocation NCx2000	NC=Number of Channels, WE=Wireless Equipment, PF=Power Factor
Fixed services (point–to–point)	(Fx2000)+(Px500)+(BWx500)	F=Frequency range factor, P= Power range factor, BW= Bandwidth factor
Fixed services (pt-to-multipoint, WLL and broadband)	BWxF	F=Frequency range factor, BW =Total Bandwidth
Optical and laser links	Application processing fee and annual registration charge	-
Wireless LAN	No charge	-
GMPCS	BWx5000	BW=Bandwidth factor
Amateur service	200 AED ($54) per wireless equipment	-
Aeronautical radio	1000 AED ($272) per aircraft	
Maritime radio	Depends on vessel size	
Satellite	Depends on equipment	-

	charge and service	
Radio navigation	1000 AED ($272) per station	-
Radio astronomy	500 AED ($136) per station	-
Radio location	Depends on type of radar	-
Broadcast radio	225,000 AED ($61,259) for audio uplink 450,000 AED ($122,519) for TV uplink 10,000 AED ($2,723) for broadcast downlink	

Source:

All wireless equipment with an output power less than 100mW, and DECT cordless telephony base stations up to 250 mW, are exempted from spectrum fees. Spectrum charges for temporary authorisation are calculated on pro-rated basis of the annual charges.

Table A.11 Spectrum management, administration and enforcement processes

	Bahrain	Oman	Saudi Arabia	UAE
Does the NRA use spectrum management systems?	There is no reference to the type of spectrum management system used.	There is no reference to the type of spectrum management system used.	The CITC uses a 'Computerised Spectrum Management Unit' to improve the efficiency and effectiveness of its spectrum management processes. This unit is responsible for a number of systems and support operations including for example: support for specialised spectrum management applications such as the radio frequency management system, the radio monitoring system and the equipment inspection system; support and maintenance of the national frequency register, maintenance of geographic data for propagation analysis; and preparation of data for calculating spectrum fees.	There is no reference to the type of spectrum management system used.
How do operators apply for spectrum?	Typically the process starts with an application for a frequency licence submitted to the TRA. The TRA then notifies the applicant within 14 days of the applicable licence and / or spectrum fees. After receiving payment, the TRA notifies the applicant within 14 days that the application is valid. Within 30 days of receiving a valid application, the TRA will decide whether to grant the licence. If	There is a four stage process for obtaining authority to use radio equipment. In stage 1, an application is submitted for a radio equipment license, detailing the purpose of use of the equipment. The TRA then matches this use with that listed in the national frequency allocation table to determine appropriate frequencies. After checking that the	Requests for frequency assignments are made by submitting the relevant application forms to the CITC. In considering whether to grant requests, the CITC will take into account the Saudi national frequency plan, band plans and channel plans, ITU Radio Regulations and Recommendations and the general and specific licence conditions of existing users. If an applicant for a	Applications for frequency authorisations can be made online, using a service specific application form. In addition to the application form, applicants may be required to submit documents such as technical brochures, passport copies, photographs, network details on network, usage details and copies of a valid commercial license. Applicants must also pay a AED

	further information is required, the TRA will notify the applicant within 15 days. A final decision will be made within the longer of: 15 days after the receipt of additional information; or 60 days after the submission of the valid application. Applications for short-term licences for PMSE are made according to the following process: Applicants must submit information in relation to the characteristics of radio emissions, the type of application, the amount of spectrum required, the preferred frequencies, the area over which transmissions will be made, the duration of the event, and the precautions that will be taken to ensure that interference is not caused to other users. The TRA and MoT will then determine whether the preferred frequencies are free, and if they are not, whether there are alternative suitable frequencies. A short-term licence will then be issued. The application process is similar for short-term licences for temporary testing.	frequency assignment does not interfere with existing assignments, the TRA sends an advisory note to the applicant requesting payment of a frequency assignment registration and spectrum utilization fee. Following payment, in stages 2 and 3, the applicant applies for type approval and provisional approval is obtained for both the equipment and the required frequency (see above). In the final stage, a radio equipment licence is issued by the TRA.	telecommunications licence requires spectrum, the applicant can file an application for both a telecommunications and a radio licence and the CITC will process both applications concurrently. It will not deny issuance of the radio licence unless: spectrum is unavailable; there is a need to avoid harmful interference with other spectrum users; issuance of a radio licence would contravene a statute; or the telecommunications licence to which the radio licence relates is not granted.	500 application processing fee. After assessing the applications, the TRA contacts successful applicants to inform them of the statutes of their authorisations.
How is spectrum use monitored and what enforcement powers does the	The TRA does not have a specific policy on spectrum monitoring, however provisions in the Telecommunications law state that the TRA has the	The TRA carries out pre and post licence inspections in order to control frequency use and detect any illegal use. The main tasks	The CITC undertakes the following frequency monitoring activities: regular monitoring of spectrum to detect the transmission of the unauthorised stations and out-of-	The TRA does not have a specific policy on spectrum monitoring, however it has the right to suspend or revoke a spectrum authorisation if the

NRA have in respect to spectrum misuse?	right, in the course of its duties, to enter premises wherein there exists telecommunications equipment, network or facilities, or infrastructure used in telecommunications services, and that it has the right to inspect and seize any equipment that is unlicensed, unauthorised or used in an unlicensed activity, or whose use would interfere with or harm existing telecommunications systems.	undertaken in this respect include: verification of the applicant's planned location of equipment; random checking of installations to verify compliance in relation to the condition of equipment declared unused; verification of the compatibility and interference-free use of authorised emissions; and identification of unauthorised transmissions. The Telecommunications Regulatory Act gives the TRA authority to enter all relevant locations with the purpose of inspecting them and checking all documents and licences are in order.	band emissions (there are 5 monitoring stations at Riyadh, Jeddah, Dammam, Khamis, Mushayt and Sakaka); direction finding to identify harmful emissions; interference resolution and enforcement using communication receivers to monitor harmful interference; technical measurement of emissions; and occupancy recording to establish actual spectrum use. In the event of misuse of spectrum, the Telecoms Act and Bylaws give the CITC authority to issue a decision to suspend or revoke a radio licence. Prior to suspending or revoking the licence however, the CITC must inform the licensee in writing that it is in the process of suspending or revoking the licence. It must also give the licensee an opportunity to remedy the violation.	holder has breached its conditions or if this is required due to the public interest. The Telecommunications Law states that a person will be punished with imprisonment of not more than two years and / or a fine of not less than 50,000 and not more than 200,000 Dirhams if he conducts a regulated activity without being licensed to do so (or being exempted from the necessity to obtain a licence). Additionally, a person will be punished with imprisonment of not more than one year and / or a fine of not less than 50,000 and not more than 200,000 Dirhams if he intentionally and unlawfully obstructs any Telecommunication Services.

Table A.12 GCC - Spectrum consultations and forthcoming market reviews

	Bahrain	Oman	Saudi Arabia	UAE
Have there been any consultations in relation to spectrum issues recently?	Equipment Approval Regulation (March 2009) Migration of Telecommunications Frequencies (November 2008) Assignment of Spectrum in the 1785 – 1805MHz band (April, July 2007) 2.4GHz and 5GHz Frequency Licensing (July 2006) Spectrum Policy and Planning (June 2006)	There is no reference to any recent consultations in relation to spectrum issues.	There is no reference to any recent consultations in relation to spectrum issues.	There is no reference to any recent consultations in relation to spectrum issues.
Are any consultations in relation to spectrum issues planned in the near future?	The 2007 – 2009 TRA work-plan states that work will begin in 2009 on adopting a framework for assigning spectrum for experimental / R&D telecommunications purposes (in conjunction with the Directorate of Wireless Licensing, Frequency and Monitoring). The work-plan also refers to work to: develop a comprehensive spectrum refarming plan; review the processes associated with allocation, assignment, monitoring and enforcement in the use of spectrum; and procure a modern spectrum management system.	There is no reference to any forthcoming consultations in relation to spectrum issues.	There is no reference to any forthcoming consultations in relation to spectrum issues.	There is no reference to any forthcoming consultations in relation to spectrum issues.
Are any market reviews due?	There is no reference to any forthcoming market reviews.	There is no reference to any forthcoming market reviews.	There is no reference to any forthcoming market reviews.	There is no reference to any forthcoming market reviews.

Annexure B. Abbreviations

AIP	Administrative Incentive Pricing
CAA	Civil Aviation Authority
CT2	Cordless telephony standard
DECT	ETSI standard for Digital Enhanced Cordless Telecommunications
ERMES	European Radio Messaging System
FCC	Federal Communications Commission
F.F.	Mobile terminals (vehicle mounted).
F.I.	Mobile satellite terminals
GMDSS	Global Maritime Distress and Safety System
ICAO	International Civil Aviation Organization
IMO	International Maritime Organisation
ITU	International Telecommunications Union
LTE	Long Term Evolution (cellular mobile standard)
MFN	Multi-Frequency Network
MMDS	Multichannel Multipoint Distribution Service
MoI	Ministry of the Interior
NDIA	New Doha International Airport
NFAP	National Frequency Allocation Plan
NFAR	National Frequency Assignment Register
NTIA	National Telecommunications and Information Administration (US Agency)
QMC	Qatar Media Corporation
QNSCC	Qatar National Spectrum Coordination Committee
QSDRS	Qatar Secure Digital Radio System
PAMR	Public Access Mobile Radio
PMR	Private Mobile Radio
RSA	Recognised spectrum access
VSAT	Very Small Aperture Terminal
SCADA	Supervisory Control and Data Acquisition
SFN	Single-Frequency Network
SNG	Satellite News Gathering
TETRA	Terrestrial Trunked Radio
TFTS	Terrestrial Flight Telephony Service
TVRO	Television Receive Only
UHF	Ultra high frequency
WAPECS	Wireless Access Policy for Electronic Communications Services