



هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

A public consultation document issued by the
Telecommunications Regulatory Authority of the
Kingdom of Bahrain

**Telecommunications Radio Frequency Spectrum
in the Kingdom of Bahrain
Management – Current and Future Requirements – Release Plan**

LIC/1209/883

10 December 2009

Request for comments:

The Telecommunications Regulatory Authority (“TRA”) invites comments on this consultation document from all interested parties.

Comments should be submitted before 17:00 (5pm), 14 February 2010.

Responses should be sent to TRA for the attention of the General Director preferably by e-mail (or by fax or post) to:

The General Director
spectrum-consultation@tra.org.bh
Telecommunications Regulatory Authority
P.O. Box 10353, Manama, Kingdom of Bahrain
+973 1753 2125

Purpose: To ascertain the potential future demands for access to radio spectrum in order to develop an appropriately informed Telecommunications Spectrum Release Plan for the Kingdom of Bahrain.

Table of Contents

INSTRUCTIONS FOR SUBMITTING A RESPONSE	1
INTRODUCTION AND BACKGROUND	2
THE FUTURE SHAPE OF RADIOCOMMUNICATIONS	8
SPECTRUM RIGHTS.....	11
SPECTRUM MIGRATION (REFARMING)	14
SPECTRUM RIGHTS AT THE END OF THE LICENSING AND ASSIGNMENT PERIOD	20
CURRENT TELECOMMUNICATIONS SPECTRUM ALLOCATION AND POLICY PLAN (SAPP)	21
SPECTRUM AVAILABILITY	27
ADDITIONAL CANDIDATE BANDS IDENTIFIED FOR INCLUSION IN THE TSRP	29
GENERAL COMMENTS	36
NEXT STEPS.....	36
ROLE OF THIS DOCUMENT	38
ANNEX 1.....	39
ANNEX 2	43
APPENDIX 1 OF ANNEX 2	43
APPENDIX 2 OF ANNEX 2	46
ANNEX 3 GLOSSARY OF TERMS.....	54

INSTRUCTIONS FOR SUBMITTING A RESPONSE

The Telecommunications Regulatory Authority (“TRA”) invites comments on this consultation document and the documents issued by TRA from all interested parties. Comments should be submitted before 17:00 (5pm), 14 February 2010.

Responses should be sent to TRA for the attention of the General Director preferably by email (or by fax or post) to:

The General Director

spectrum-consultation@tra.org.bh

Telecommunications Regulatory Authority

P.O. Box 10353, Manama, Kingdom of Bahrain

+973 1753 2125

Responses should include:

- the name of the company/institution/association etc.,
- the name of the principal contact person, and
- full contact details (physical address, telephone number, fax number and e-mail address),
- in the case of responses from individual consumers, please provide name and contact details.

In the interest of transparency, TRA intends to make all submissions received available to the public, subject to the confidentiality of the information received. TRA will evaluate requests for confidentiality in line with relevant legal provisions and TRA’s published guidance on the treatment of confidential and non-confidential information.¹

Respondents are kindly asked to follow the structure of the documents consulted upon in preparing their responses and to clearly indicate to which documents their comments refer to.

Respondents are required to mark clearly any information included in their submission that is considered confidential. Where such confidential information is included, respondents are required to provide both a confidential and a non-confidential version of their submission. If a part or a whole submission is marked confidential, reasons should be provided. TRA may publish or refrain from publishing any document or submission at its sole discretion.

Subsequent to the closure of the Consultation period, TRA will publish a Report on its findings in respect of the responses received to all of the questions posed. TRA will additionally provide details of the frequency bands that it will invite the SSCC to consider making available for telecommunications in future. Once this process has been completed and subject to the findings of this Consultation process and the SSCC, a Spectrum Release Plan may be published, detailing the frequency bands to be included, the timetable for release and the mechanism for reviewing and modifying the Plan.

¹ [TRA, A Guidance Paper issued by the Telecommunications Regulatory Authority on its treatment of Confidential and Non-confidential Information, Guidance Paper No. 2 of 2007, 10 September 2007.](#)

INTRODUCTION AND BACKGROUND

1. In today's society radio spectrum is becoming increasingly important and with that comes a need for its efficient and effective management. Whilst spectrum management has always been important the complexity of the task has in recent years been compounded by the proliferation both of traditional and entirely new radio spectrum frequency-using services.
2. The growing demand for information rich content, faster access speeds and mobility by both business and private users is increasingly being met by broadband wireless applications, alongside other technologies such as Digital Subscriber Line (DSL).
3. The economic importance of the radio spectrum has been vividly demonstrated in recent years by the outcome of market based licensing processes and the proliferation of radio based applications. There is a clear relationship between: the range of radio applications, the number of users; and the value of the spectrum to society.
4. The long lead-time needed for the introduction of major new services necessitates the requirement for long term planning. This is often conducted in the absence of certainty with respect to whether the envisaged new services will actually come to market. For example, the first global allocation of spectrum for third generation (3G) mobile services, then known as FPLMTS (Future Public Land Mobile Telecommunications System) was agreed at the International Telecommunication Union's (ITU) World Administrative Radiocommunication Conference in 1992, about 10 years before the entry into commercial operation of the service. However, the preparatory work in various international bodies began considerably earlier than that.
5. Technology convergence between fixed and mobile telecommunications services as well as broadcasting is increasingly causing the traditional boundaries between these services to become blurred and challenging the allocation categories for radio spectrum. Near term developments such as short range, low power ultra-wideband (UWB) technology may also have profound implications for spectrum management. Such technologies could eventually make the very concept of rigid spectrum allocations redundant, at least for some services. Other non-radio communications technologies, such as DSL and

Power-Line Technology, may also impact on spectrum management because of their potential to interfere with conventional radio communication services.

6. The following story illustrates the divergent uses of spectrum and how spectrum impacts on all of us in our daily lives. Not all these examples may be pertinent to the Kingdom of Bahrain, for example the automated motorway toll collection but the overall message is indicative of current and future spectrum usage:

A Day in the Life of Spectrum²

I wake up at 6am to the alarm clock radio bringing me news that the world's population is expected to grow significantly over the coming decades, with the main increases occurring in the developing countries, and that global warming will impact severely on global food production – news brought to me by the radio in the VHF-FM band 87.5 to 108 MHz.

From checking my diary I see that my meeting schedule is quite full this morning, so I need to get a move on! I go to the garage and unlock the car and garage doors with two remote keys – each operating at around 433 MHz.

On the motorway, the traffic update signs warn me of a delay ahead – they and the cameras that detect the traffic are linked back to the control room using 5.8 GHz fixed links. The emergency services are in attendance at a road traffic accident using their 380 MHz radios. I pass through the motorway toll area. There's a 'bleep bleep' as I pass through the toll gates – my E-Tag operating at around 5 GHz. Just then the mobile rings – at 900 MHz – and I use the hands-free, operating wirelessly with 'Bluetooth' at 2.4 GHz. It's our Media Manager asking me to come into the office early to discuss a breaking story.

At last I arrive at the office car park. My 433 MHz swipe card opens the car park boom gates. The radar parking-aid operating at 24 GHz helps me safely park the car. My 433 MHz key locks the car doors. A 24 GHz motion detector keeps my vehicle safe throughout the day. As I approach the entrance to the office, I swipe my card using 13.6 MHz and the door opens.

At my desk I open my laptop and catch the latest overseas market reports – coming directly to the antenna on the roof of our office, via satellite, at 11 GHz and then distributed around the building using a WiFi network at 2.45 GHz.

I make a couple of phone calls from a cordless phone operating at 1890 MHz, and then it's time for the 9am video conference with a colleague. The video is streamed using a variety of fixed and wireless links at 18 GHz and 7.5 GHz. At 10.30, I leave the office to fly to an important meeting.

At the airport I have half an hour to kill because the flight's been delayed - a chance to buy some birthday presents. I buy one son a radio controlled boat – which operates in the 27 MHz band – and the other a toy car – operating at 40.68 MHz. For my daughter it's a new mobile phone – this one can download video using the 3G, 2100 MHz band.

² Based on the opening address by Chris Chapman to the inaugural ACMA Radiocommunications Conference 2006.

I also purchase a weather station for myself which will be connected seamlessly to a visual display and on to the Internet by means of an 863 MHz data link. I also buy a wrist watch which is locked to a time standard operating at 77.5 kHz. At the checkout the gifts are scanned at 865 MHz and I pay for them with bank-notes containing RFID chips working at 2.5 GHz. I hear the boarding call and make my way to the Gate. Airport ground-staff are using a new commercial TETRA trunked radio system operating at 410/420 MHz. Twenty minutes later the plane is taxiing along the runway – ground guidance courtesy of 121.8 MHz. Take-off.

In the cockpit, pilot and crew are busy monitoring the instrument panels – air traffic control direct them using radar in the 2.9 GHz and 1.03 GHz bands – GPS guidance on 1600 MHz establishes the correct course to our destination – air traffic control operating at 118.6 MHz ensures traffic avoidance – automatic direction finding at 362 kHz makes sure we stay on course. On the way I use my GSM at 1.7/1.8 GHz to make a telephone call, which is linked to ground by satellite operating at 14/11 GHz. And I enjoy a quick game of Tetris using the in-flight entertainment system at 5.2 GHz.

At the destination airport, air traffic control on 119.3 MHz authorises the plane to land. An Instrument Landing System at 109.9 MHz brings it down safely, even though visibility is limited. The plane is guided to the gate by the controller using surface radar operating at 15 GHz.

My taxi, despatched on 452 MHz, takes me to my meeting destination, where it's meetings, emails, phone calls, emails, phone calls, meetings – one blurring into another – and then it's back in the taxi, onto the plane, and takeoff!

I make it home in time for the nine o'clock news – brought to me on spectrum in the 470 to 862 MHz UHF broadcast band and linked from the TV studio to the transmitter at 6 GHz. My son is watching a DVD, but I'm in no mood for an argument, so I pack him off to the other TV where he tunes in at 12 GHz to the satellite 35,800 km away above the equator. I turn back to the news where there is a live-broadcast – using 7.5 GHz – to an outside broadcast unit reporting on the day's events in Parliament

I go to the Meteorological Office web-site to check details of the weather report I heard on the news. The colour weather images come from radar operating at 5.6 GHz and confirm that a storm is on its way from the south west. Somewhere overhead a meteorological satellite is using five different frequency bands to gather the data used in meteorological modelling. I go out to close the garage door – at 433 MHz.

Back in the house, I shut all the windows and doors. In the kitchen, I microwave last night's leftovers – at 2.4 GHz. Back in front of the TV, I put up my feet and wait for the storm to arrive.

This is today. It could be any day. A day in my life. A day in your life. A day of normal activities for which we depend on spectrum.

And what about tomorrow?

In the future, more and more devices in your house will communicate wirelessly, using bands like 865 MHz, 2.4 GHz, 5.8 GHz, 60 GHz, 80 GHz, and maybe even infrared. These applications will need more spectrum.

Our children will soon download entertainment on demand, requiring ten times the bandwidth we're using today. This will need more spectrum. You will be able to watch mobile TV and access the internet, no matter where you are. In fact, the world will

become your virtual office, whether you're sitting at home, in your favourite café, or on the move in a taxi or train. This will require spectrum.

Global warming will mean that earth-monitoring is more important than ever, not just to monitor the fingerprints of nature – those little signals that let us predict the weather – but to check up on producers of greenhouse gases and destroyers of forests. This will need more spectrum.

But there is one issue that needs to be addressed. Spectrum is a limited resource and we need to be smarter in how we manage and use it.

7. As a consequence the task of strategic spectrum planning is becoming increasingly complicated. It must take account of the complex interaction between: technical developments; market forces; and social trends whilst remaining mindful of international developments (radio waves do not stop at national frontiers and most major radio services are now developed for a global or at least a regional market). Due to the long lead time associated with the introduction of new services spectrum planning must also take a long term perspective.
8. In the Kingdom of Bahrain the telecommunications market has been transformed following Government policy to stimulate the national economy. In October 2002, Legislative Decree No. 48 of 2002 promulgated the Telecommunications Law (the Law) that enabled liberalization of the telecommunications sector and the formation of the Telecommunications Regulatory Authority (TRA). TRA is an independent body and has a direct responsibility to ensure effective liberalization of the telecommunications market, oversee fair competition, give private investors confidence with regard to competition, and make available the related telecommunication resources, such as the radio spectrum, in a fair and transparent manner.
9. On 27 June 2006 the Ministry of Transportation (MoT) and TRA jointly issued the Spectrum Policy and Planning (SPP) document³ for the Kingdom. This contains a Spectrum Allocation and Policy Plan (SAPP) (see section 1.3 of the SPP). In September 2009 a Report was prepared which provides information on developments since the SPP document was published. This Report can be found at Annex 1. The SPP and Report outlines the spectrum available in the Kingdom of Bahrain and the various award mechanisms.

³ http://www.tra.org.bh/en/pdf/spectrum_policy_TRA_MOT_final.pdf

10. On 6 October 2008, the Minister responsible for Telecommunications issued in Ministerial Order No.4⁴ the National Spectrum Planning and Allocation Policy ("National Spectrum Policy (NSP)") for the Kingdom of Bahrain.
11. In October 2008, the Minister responsible for Telecommunications in Ministerial Order 5⁵ also created the Spectrum Strategy and Coordination Committee (SSCC) which has members from the main spectrum stakeholders in the Kingdom of Bahrain. The main objective of the SSCC is to stimulate cooperation between stakeholders in order to facilitate the coordination of spectrum in the Kingdom.
12. A further objective of the National Spectrum Policy is to "ensure the effective implementation of radio spectrum policy in Bahrain to ensure the availability and efficient use of radio spectrum". During the revision of the National Frequency Plan (NFP)⁶, approved by the SSCC in May 2009 several applications were identified where additional spectrum might be considered.
13. TRA has also received a number of requests for the assignment of spectrum in a number of bands for a variety of different technologies and/or services. The spectrum proposed includes the band 698 - 870 MHz and bands in the vicinity of 2.1 GHz, 2.3 GHz, 2.5 GHz and 2.6 GHz. The TRA has decided at this stage not to proceed with these requests and instead engage in a wide ranging consultation process in an attempt to establish need and to determine how spectrum should be best utilised in the overall national interest.
14. Respondents to this public consultation document should therefore include their current and future requirements for access to radio spectrum as well as submitting their views on the questions dealing with spectrum management techniques. The information received addressing spectrum requirements will facilitate the preparation of a spectrum release plan in which TRA will provide details on the radio frequency assignments and bands it plans to make available, including timescales for release and the licensing mechanisms which will be employed.

⁴ http://www.tra.org.bh/en/pdf/NationalSpectrumPlanning_and_AllocationPolicy-MinisterialOrder4-English.pdf

⁵ http://www.tra.org.bh/en/pdf/ResolutionNo5of2008with_respect_toSSCCEnglish.pdf

⁶ <http://www.tra.org.bh/en/pdf/KingdomOfBahrainNationalFrequencyPlanFianl.pdf>

15. TRA will thus respond to the anticipated demands for spectrum from the telecommunications sector and in addition will develop short and long-term plans for spectrum release. It is believed that this will meet the sector's spectrum requirements based on a review of overall spectrum need, as well as recent developments in service delivery and technology, which in turn will stimulate the efficient and effective utilisation of the radio spectrum and the provision of innovative and cost effective telecommunications systems and services.

THE FUTURE SHAPE OF RADIOCOMMUNICATIONS

16. Future communications service market conditions in the Kingdom of Bahrain and hence future spectrum requirements are likely to be similar to those pertaining in other similar markets and economies around the World. Notwithstanding Article 42 of the Law, which states that TRA is responsible for co-ordination, assignment and monitoring of telecommunications frequencies, the Law does not provide TRA with responsibility for managing the entire national radio frequency spectrum. In addition, due to historical reasons and the current distribution of frequency assignments across the radio frequency spectrum it is understood to be difficult to partition the NFP for individual management by multiple spectrum management organisations. With this in mind the SSCC was established in order to create a forum for the various controlling authorities and stakeholders, through which the National Frequency Plan can be determined and spectrum issues, which concern two or more SSCC members can be adjudicated. It should also be noted that some of the items in the list of developments provided below may impact on more than one SSCC member.
17. The likely developments in the communications market that will affect the future availability through the use of more spectrally efficient technologies and better spectrum planning techniques as well as the demand for spectrum as a result of new spectrum requirements include:
- The evolution of mobile communications services including: the continuing global changeover from 2G to 3G mobile services; the ongoing and future development of International Mobile Telecommunications (IMT). Long Term Evolution (LTE) and fourth generation (4G) mobile services will also have an impact on current spectrum policy, allocation and management;
 - The rollout of digital television (TV) services and mobile multimedia services (e.g. mobile TV services);
 - The rollout of services arising from fixed-mobile convergence⁷ and telecommunications-broadcasting convergence;

⁷ Convergence of fixed and mobile telecommunications services enables a customer to use telecommunications services using a single device, irrespective of whether he is connected to a fixed or mobile network.

- The need to respond to requirements for new and innovative radiocommunication systems, which seek to share the same spectrum because of significant demand. For example, cognitive radio technologies⁸ should be able to improve the degree to which spectrum sharing is possible; and
 - Potential uses of unused frequencies between broadcast TV channels (“White space”). The possibility of utilising ‘white-space’ spectrum through the introduction of “underlay”⁹ or “overlay”¹⁰ techniques. Such techniques can allow spectrum to be utilised more efficiently but may still have the potential to cause interference unless rules and procedures are in place to manage their operations.
18. The above developments confirm that traditional command and control approaches for the spectrum manager to predict the market and to make provisions accordingly is no longer sustainable. This is due principally to the increased complexity, scope and competing requirements for spectrum for telecommunications systems, in particular in frequency bands where demand outstrips supply. It is often argued for example that the exclusive nature of the command and control approach is an artefact of outdated technologies
19. Efficient economic telecommunications investment decisions balance the risk of uncertainty created through technology evolution and market dynamics with a lower risk profile associated with a stable, predictable and non-discriminatory regulatory environment in which the markets operate.
20. Within the existing regulatory framework TRA recognise that the following are not as well defined as they could be within the spectrum allocation and assignment procedures:
- Details of radio frequency bands which are potentially available for release to the market;
 - The spectrum allocation and re-allocation decision making framework between TRA and the SSCC;
 - The timing of spectrum release decisions;

⁸ Cognitive radio technology enables a radiocommunication device to adapt its transmission or reception characteristics in real-time to avoid interference with other radiocommunication systems using the same band of spectrum.

⁹ Underlay operations are based on transmission at very low powers (at or near the surrounding “noise” levels) so that, in theory, they should not cause interference to existing users of spectrum.

¹⁰ Overlay operations are based on using spectrum on an opportunistic basis when the spectrum in question is not being used by others in time and/or geography.

- What factors will determine how spectrum released will be packaged; and
 - The amount of notice that will be given in the case of variation or withdrawal of spectrum assignments.
21. Spectrum management decisions will increasingly be required to take into account wider regional strategic initiatives. For example, an objective of GCC countries is to formulate similar regulations in various fields including:
- Economic and financial affairs;
 - Commerce, customs and communications; and
 - Education and culture.
22. Consequently with increasing levels of economic cooperation and integration between GCC member countries spectrum allocation and release decisions in the Kingdom may need to take into account the potential wider benefits that may be brought about through this harmonisation process.
23. Spectrum is a finite and valuable public resource. It may be argued that any party who makes use of spectrum for commercial purposes should, as a matter of principle, be required to compensate the community for the use of such resource. On the other hand, spectrum lying idle and not put to use would not generate any economic benefit for the community and could thus be considered a wasted public resource. It is therefore imperative that the radio spectrum in the Kingdom of Bahrain should be used efficiently and effectively wherever possible and that spectrum hoarding should be avoided.

Question 1

TRA is of the view that the current framework for spectrum management will be found inadequate with respect to proactively identifying the future demand for radio frequency spectrum. In defining a new framework and spectrum release plan TRA intends to take into account: the future shape of radiocommunications; international developments; the encouragement of investment; strategic considerations; fair compensation for the community; and the avoidance of hoarding spectrum. TRA invites comment with respect to the factors to be considered in designing a Spectrum Release Plan for the Kingdom of Bahrain.

SPECTRUM RIGHTS

24. A frequency assignment gives the assignee the right to use the prescribed spectrum resource for the specified period stated in the frequency licence, which is normally one year. However where the frequency licence is associated with a service licence the spectrum assignment normally lasts for the full duration of the service licence. Spectrum fees are always payable on an annual basis.
25. Article 51 of the Law permits the TRA to modify the conditions of a frequency licence. In such circumstances the TRA would announce such a matter in the Official Gazette at least thirty days before the amendment.
26. Article 51 of the Law also provides the TRA with the right to revoke a frequency licence and reclaim frequencies before its expiry if the Licensee:
 - consents to the revocation,
 - is in material breach of the Law,
 - has an associated service licence which has expired or has been revoked,
 - has been declared bankrupt or
 - has ceased trading.
27. There are a number of specialised frequency licences currently in use including the ship station licence, aircraft station licence and the amateur licence. In addition, there are a number of applications where a generic frequency licence is issued. This generic licence has stood the test of time but the TRA believes that the document might benefit from review and amendment.
28. There is at present no explicit policy concerning the circumstances when the conditions of a frequency licence might be amended or what constitutes a material breach of the Law or licensing conditions. Furthermore, a period of 30 days could be considered rather a short period of time for an assignee to effect alternative telecommunications arrangements. Because radiocommunications equipment and receivers generally have an economic life somewhere between 5 and 10 years, the lack of certainty as to how such a statutory power might be exercised by the TRA during the period of a frequency assignment, could be problematical for some spectrum assignees.
29. Since modifying a spectrum assignment during the licence period may impact significantly the original expectation that the spectrum assignee might have had with respect to the either the services or the term of the licence, this could have

a material impact on the potential return on investment made by the assignee. Wherever feasible TRA would provide sufficient notice of impending changes.

30. In order to provide certainty to licensees TRA will make every effort to minimise the need to modify or withdraw frequencies assigned to a licensee during the term of the licence. Where possible TRA will limit modification or withdrawal of frequency licences to circumstances where public interest, governmental policy or international obligations so require, or where interference between legitimate spectrum users, render it necessary to exercise such powers. TRA also proposes that there should be minimum notice periods provided to affected spectrum assignees to enable them to plan ahead. Such a minimum period of notice would also apply to any timeframe required under Article 5 of Regulation 3 of 2008, Regulation on the Migration of Users or Services from, or within Frequency Bands¹¹.
31. Further to a general review of the licensing conditions attached to a Generic Frequency Licence i.e. not a Frequency Licence attached to a Service Licence, TRA proposes a number of editorial and more substantive amendments.
32. TRA is also considering whether it would be preferable to place and maintain frequency licensing conditions on the TRA web-site. If such an approach was adopted, the licence document in future would include only information which is specific to an individual licence. The information that could be included in a revised Generic Frequency Licence as well as associated licensing conditions is attached at Annex 2.

Question 2

TRA is minded to revise and modify the Generic Frequency Licence, as well as removing and relocating licences' terms and conditions to TRA's web-site, rather than maintaining them in a hard-copy format, attached to each and every licence. The licence's terms and conditions would be incorporated by Regulation into the Generic Frequency Licence. Both the draft future Generic Frequency Licence and the draft terms and conditions text are attached in Annex 2. TRA therefore invites comments on the proposed text modifications in Annex 2 and the intention of locating the

licensing conditions on the TRA Website

Question 3

TRA plans to introduce a minimum notice period if frequency assignments are subject to modification or withdrawal. What are your suggestions with respect to an appropriate minimum notice period?

SPECTRUM MIGRATION (REFARMING)

33. Spectrum refarming is the physical process by which a regulatory authority recovers spectrum from its existing users for the purpose of reassignment, either for new uses, or for the introduction of new spectrally efficient technology. The process of spectrum refarming commences once a frequency band has been identified for redevelopment and firm proposals exist to either remove the existing occupants, or restructure the band. It is completed when the existing users have implemented the necessary changes and complied with any associated conditions (e.g. co-ordination in a replacement frequency band).
34. Spectrum migration for telecommunications licensees in the Kingdom is addressed in Regulation No. 3 of 2008 in accordance with Sections 3 (c) (1) and 3 (c) (11) of the Law. This Regulation describes the current migration process, compensation (see Footnote 11 above) and enforcement. Regulation No. 3 does not however address the migration and compensation of non telecommunications spectrum users to which the Law does not apply to such spectrum.
35. Refarming is a long standing and frequently used frequency management tool for the strategic planning of spectrum usage with the primary objective of securing efficient spectrum use, as well as (in many cases) international spectrum harmonisation. In most cases such migrations can be effected naturally, taking account of equipment age and replacement value, especially in the case of long term international planning decisions, such as the change from analogue to digital terrestrial television broadcasting at VHF and UHF.
36. The new element that is brought into the discussion in the context of refarming is whether the current arrangements for refarming and migration are sufficiently comprehensive and how spectrum refarming will be funded, particularly when spectrum users not licensed by TRA and outside the jurisdiction of the Law are involved. Although it may be questioned whether such questions should be raised by the TRA, the Authority believes it to be proper to include such issues in this document since a key purpose of this Consultation is to ascertain the future spectrum requirements of the telecommunications sector and to be in a position to provide this information to the SSCC. Subsequently it should be possible to establish national spectrum priorities. The role that Administrative Incentive

Pricing (AIP)¹² and spectrum trading¹³ may have in the Kingdom, in future years may also be pertinent. Any future implementation of AIP would supplement the TRA's principles for establishing the schedule of fees to be charged for radio spectrum licensing. The current fees are contained in the 2009 TRA Schedule of Fees¹⁴ published on the TRA web-site, which is subject to change from time to time.

37. TRA considers refarming to be a solution of last resort once alternative solutions have been thoroughly explored including the possibility of sharing frequencies and utilising innovative technologies which facilitate spectrum sharing. TRA considers that sharing generally improves frequency efficiency and furthermore avoids costs associated with refarming for existing frequency users. In addition, as mentioned previously the implementation of a refarming programme may be considered an unwelcome change in the predictability of the spectrum usage environment by some spectrum users, particularly those which are not impacted by TRA Regulation 3 of 2008.
38. Both time and transparency can also impact the costs associated with any refarming exercise. For example:
- when decisions taken at, an ITU World Radiocommunication Conference (WRC) have an implementation period, which is greater than any minimum notice period stated in the Generic Frequency Licence, decisions on associated band refarming and the transfer of existing users could be taken by the TRA without the need for financial compensation;

¹² Administrative Incentive Pricing (AIP) is a fee charged to users of the spectrum to encourage them to make economically efficient use of the spectrum. The fee is usually based on the opportunity costs of the use of spectrum. Opportunity costs can be based *inter alia* on the value of the spectrum to a user in comparison with another service or the additional costs a user would incur if the service had to be provided by other means.

¹³ Spectrum Trading, where permitted, allows a purchaser of spectrum to acquire the spectrum needed from another licensee at a mutually acceptable price. Trading is capable of relieving congestion and eliminating artificial scarcities of spectrum, as well as unlocking the potential to implement new technologies.

¹⁴ <http://www.tra.org.bh/en/pdf/TRAScheduleoffeesFinalV1.pdf>

- if regulatory authorities are transparent with respect to decisions that may trigger changes to the NFP then licensees can make more informed investment decisions and where necessary divert investment to the development of services in spectrum ranges that are less likely to be subject to refarming and more likely to have a longer commercial life.
39. AIP, if implemented in the future, could also be used to facilitate the refarming process, by reducing the cost of spectrum to where refarmed services would be transferred, whilst increasing the cost of spectrum which has to be vacated.
40. A similar role could be played by a secondary trading market, if permitted. It is then possible for licence holders to sell their usage rights to others, whose use would be in conformity with the new frequency plan, which could make refarming more acceptable and easier to accomplish. Furthermore, the question of who pays is solved automatically.

Question 4

In addition to the current migration policy in Regulation No. 3 of 2008 and in co-operation with the SSCC should a policy on spectrum refarming and spectrum migration be evolved, which will establish policy and compensation procedures for all spectrum users in the Kingdom?

Financial Compensation

41. When time and transparency cannot solve the issues, because spectrum refarming has to take place in a relatively short period of time the issue of possible financial compensation of existing users arises.
42. Whilst TRA Regulation 3 of 2008 already contains a framework for compensation this only applies to those users which are subject to the Telecommunications Law. This section therefore addresses the matter more generally as such arrangements may not be appropriate for spectrum users which are not subject to the Telecommunications Law.
43. Four alternative funding mechanisms are discussed below.

TRA Directly Funds (TDF)

44. The current compensation mechanism in Regulation 3 of 2008 envisages that TRA directly funds refarming initiatives following a Compensation Determination, subsequent to a Compensation Request from a licensee, which has been required to migrate. Only non-avoidable directly incurred costs may be considered for compensation. In this case all licensees pay these indirect costs. The advantage of such an approach is that a large group of contributors is involved in raising the necessary funds e.g. all licensees. The disadvantage is that it leads to higher overall costs to be attributed to TRA. Furthermore, those users which are not subject to the Telecommunications Law do not contribute to TRA's central fund.

Existing User Pays (EUP)

45. EUP schemes require the incumbent user to finance its migration to make way for a new incoming user. The advantage of this mechanism is that discussions or disputes concerning the calculation of refarming costs are likely to be minimal. On the other hand, this approach may have the disadvantage that a decision to migrate users in this manner is more likely to be the subject of a legal challenge.
46. Depending on the nature of the service to be transferred the advance notice period ranges between 3 and 10 years. If these were telecommunications services it would theoretically be possible for TRA to use Administrative Incentive Pricing (AIP) techniques to support such a migration. A typical example would be an identified need to refarm a sub-band in the UHF range with a 5 year notice to quit period. During this period the licence cost in the form of spectrum fees for the band to which the services would move are lowered, which in turn would support the refarming process.

New Entrant Pays (NEP)

47. NEP funding mechanisms require the new entrant for which the frequencies are being vacated to pay the costs associated with the migration. Since this approach does not rely on the Telecommunications Law it may be more appropriate than the TDF and EUP mechanisms described above when users not subject to the Telecommunications Law are involved. In this case the new entrant would pay the costs of relocating the existing user. The main advantage

of an NEP approach is that spectrum identified for a new service is freed when needed for the new service. The disadvantage is that a new operator may have to pay higher costs for spectrum locally than in a neighbouring country or region. This could influence competition within the region, when for example GCC regulators might be attempting to develop a level playing field for new telecommunications entrants.

48. When compensation for existing users is a condition within an auction process, the bids for spectrum will likely be lower and refarming as a result would in practice be paid by the Regulator or the Government.
49. The NEP system has been used in several countries for particular services where a speedy migration was necessary. Sometimes the total costs of migrating equipment and users to an alternative band have been paid. These costs, although complex to calculate, can be calculated on the basis of objective parameters. If however a cost related to the loss of spectrum is to be paid, an agreement is required between the parties concerned on the parameters to be used for the calculation of theoretical spectrum value. Furthermore, disputes might arise between existing and new users and as a consequence the Regulator may be called to mediate, which would then lead to additional administrative costs.

National Refarming Fund (NRF)

50. A national refarming fund would essentially be similar to a universal service fund to provide finance for telecommunications services in rural areas. A NRF could be established in various ways. New entrants might be required to contribute to the fund or it may be financed by all licence holders. It could also be funded by the receipts from auctions or other spectrum pricing methods. In some countries the NRF has been established and underwritten by the Finance Ministry. The NRF could also be established by combinations of any of the aforementioned.
51. A NRF would have the advantage that it would be possible to spread the costs over a large group of contributors. When spectrum-pricing surpluses flow into such a fund these will contribute directly to the spectrum management process.
52. The disadvantage is that the establishment of a NRF in the Kingdom underwritten by Government is likely to require a change in the Law accompanied by a general desire to make such a change. On the other hand TRA may be able to contribute to a NRF from licensing receipts, however if there

were significant calls on the NRF over a short period other means of compensating licensees may be required.

53. The management of a NRF might also become an administrative burden for TRA and the very existence of the fund might lead to more claims than expected. An alternative might be to administer the NRF from the SSCC with the additional involvement of operators and local industry as appropriate. Involvement of the SSCC could be particularly pertinent as radiocommunications services falling outside the legal definition of 'telecommunications' could be candidates for compensation.

Question 5

Whilst TRA is of the opinion that TDF is the most expedient form of rearming compensation mechanism it recognizes the deficiencies of the approach with respect to users not subject to the Telecommunications Law, since such users would also be not subject to Regulation No. 3 of 2008. TRA invites comments on how best to incorporate such users into a rearming compensation scheme and the appropriate minimum notice period(s) to be applied to rearming.

SPECTRUM RIGHTS AT THE END OF THE LICENSING AND ASSIGNMENT PERIOD

54. There is often an unwritten presumption by licensees that if they operate in accordance with prescribed licensing conditions then the right to use previously assigned spectrum will be renewed, unless there are good reasons to the contrary (legitimate expectation of licence renewal). This presumption is particularly so in the case of annual spectrum licences since in most cases the licensing environment does not change significantly from year-to-year. However, the situation is less clear when the annual spectrum licence is associated with a longer duration service licence.
55. There are economic justifications for giving renewal rights for spectrum assignments. A more certain and renewable spectrum right should help spectrum assignees avoid facing the uncertainty of whether or not to make new investments for facilities or services close to the expiry of their current spectrum assignments, when there is a justifiable need to do so. It would also help assignees secure financing for the investments. In addition spectrum licences associated with service licences, with renewable rights should be capable of realising higher prices when auctioned.
56. After a consideration of the issues TRA is of the opinion that on-balance the situation should remain that there should be no legitimate expectation by licensees for a continuation of the right to use spectrum at the end of a spectrum licence and the assignment's expiry.
57. However, for spectrum licences associated with service licences where substantial investment in the underlying infrastructure is required, TRA is of the opinion that a sufficiently long notice period should be provided to licensees, which will signal the intentions of TRA prior to the expiry of the spectrum assignment and licence.

Question 6

TRA is of the opinion that there should be no legitimate expectation of licence renewal on expiry of a spectrum assignment provided that sufficient notice of the intentions of TRA is provided. TRA invites comments on the concept of no automatic or legitimate expectation for spectrum assignment renewal as well as views concerning an appropriate period of notice prior to the expiry of a service licence with associated spectrum assignments.

CURRENT TELECOMMUNICATIONS SPECTRUM ALLOCATION AND POLICY PLAN (SAPP)

58. In accordance with the Telecommunications SPP of 2006, the following table (Table 1) represents the current telecommunications policy:

Band	Range	Potential Service(s)	Purpose & Number of licences	Proposed Licence Mechanism	Proposed Date for granting the licence(s)
350MHz	348.55-348.8125 MHz	"Walkie-Talkie"	Light licensing	Light licensing	Not available yet
410-430MHz 8 MHz for public services 1 MHz for private PMR	Needs coordination between the stakeholders of spectrum as this band is used by all licensees. A migration plan therefore needed (412.45 MHz -412.95 MHz (Mobile to BS) paired with (422.45 MHz -422.95 MHz (BS to Mobile)	Commercial TETRA PMR	One public licence As much as possible	Auction FCFS	TBD Available
450MHz (2*7.2 MHz)	450-457.2 MHz paired with 460-467.2 MHz	CDMA or GSM	one public mobile licence	Auction	TBD
450MHz (2*7.2 MHz)	450 -457.2 MHz paired with 460-467.2 MHz	Flash OFDM	One	Auction	TBD
850MHz (2*10 MHz)	824-834 MHz paired with 869-879 MHz	CDMA or GSM	one public mobile licence	Auction	TBD
900MHz (2x5.6MHz)	909.4-915 MHz paired with 954.4-960 MHz	GSM	One public mobile licence	Auction	2*5.6 has been awarded for the 3 rd mobile operator
1800MHz	1735 MHz – 1760 MHz paired with 1830 MHz – 1855 MHz (2* 15 MHz) 1780 MHz – 1785 MHz paired with 1875 MHz –	CDMA or GSM	TBD	Auction	2*15 has been awarded for the 3 rd mobile operator

Public consultation to ascertain potential future demand for Radio Spectrum Frequencies in the Kingdom of Bahrain

Band	Range	Potential Service(s)	Purpose & Number of licences	Proposed Licence Mechanism	Proposed Date for granting the licence(s)
	1880 MHz (2* 5 MHz)				
1900MHz ¹⁵	2 x 25 MHz (1875 – 1900 MHz paired with 1955 – 1980 MHz) 2 x 5 MHz (1905 – 1910 MHz paired with 1990 – 1995 MHz).	CDMA	TBD	TBD	TBD
1900MHz to 2200MHz	2 x 30 MHz (1950 – 1970 MHz paired with 2140 – 2170 MHz) FDD 1 x 10 MHz (1910 – 1920 MHz) TDD	3G	two public mobile licences	Auction	2*15 MHz and 1*5 have been awarded to the 3 rd mobile operator
2.4GHz	2400 – 2483.5 MHz	WiFi &/or WiMAX &/or SRDs	Light licensing	Light licensing	Available
3.5GHz	2*90 MHz (3.410-3.500 GHz) and (3.500 - 3.590 GHz)	NFWS	Two	Auction	2 licences have been awarded in January 2007
5 GHz ¹⁶	Band A 5150 – 5250 MHz Band A 5250 – 5350 MHz Band C 5725 – 5850 MHz	WiFi and/or WiMAX and/or SRDs	Light licensing	Light licensing	Available
10GHz	10.21-10.25 GHz paired with 10.56 – 10.60 GHz (2*40 MHz)	FWA	One	Auction	TBD
26GHz	27.55 - 27.65 GHz paired with 28.63 - 28.73 GHz (2*100 MHz)	FWA	One	Auction	TBD
28GHz	24.77 - 24.87 GHz paired	FWA	Reserved for future	TBD	TBD

¹⁵ Overlaps with the 1800 MHz and 3G available bands

¹⁶The frequency band 5470 to 5725 MHz is allocated solely for government use within the Kingdom of Bahrain.

Public consultation to ascertain potential future demand for Radio Spectrum Frequencies in the Kingdom of Bahrain

Band	Range	Potential Service(s)	Purpose & Number of licences	Proposed Licence Mechanism	Proposed Date for granting the licence(s)
	with 25.85 - 25.95 GHz		use		
40GHz	40.5 - 43.5 GHz	FWA	Reserved for future use	TBD	TBD

Table 1 – Current Spectrum Allocation Policy Plan (SAPP)

59. The 2006 SAPP identified a number of bands for various radiocommunication systems, which have so far not been implemented. These are shown in Table 1 above and generally have the designation 'TBD' (to be decided) in the third column of Table 1.
60. The first band in this category is 410 – 430 MHz, which in 2006 was identified as a candidate for commercial TETRA services with one public licence on offer. Since 2006, little interest has been shown in the Kingdom of Bahrain concerning the provision of 400 MHz trunked mobile services. Furthermore, TRA's policy of technology neutrality means that other mobile technologies could also be considered for trunked mobile services in this band.
61. In 2006 the band 450 – 457.2 MHz paired with 460 – 467.2 MHz was envisaged to accommodate 2 public mobile licences and three different technologies were postulated. At the ITU World Radiocommunication Conference in 2007 the band 450 – 470 MHz was identified (in addition to a number of others) for IMT systems. However such an identification does not prohibit the use of these frequency bands for other applications in accordance with the Kingdom's NFP. Similarly to the band 410 – 430 MHz, TRA has not received any interest within the Kingdom for public mobile licences for the band 450 – 470 MHz.
62. Two 10 MHz bands separated by 45 MHz, 824 – 834 MHz and 869 – 879 MHz were identified in 2006 for an additional public mobile operator. The lower band now falls in the band identified to provide services resulting from the digital dividend; see paragraphs 92 to 96 below. In addition the band 869 – 879 MHz is not without difficulties.
63. 869 – 870 MHz falls within the band 862 – 870 MHz, which in many parts of the World has been designated for SRDs. This is true as well in the Kingdom; reference the 2009 version of the NFP, which in the remarks column identifies the band 862 – 870 MHz for such devices.
64. In paragraphs 89 and 90 the bands 876 – 880 MHz paired with 921 – 925 MHz are identified as a possible candidate for the GCC railway project. If this project

comes to fruition and GSM-R, or a successor technology utilising these bands, is chosen there is an immediate conflict if a public mobile system was to be licensed within the band 876 – 879 MHz. In these circumstances the TRA is currently not in favour of the former proposal for a public mobile licence at 850 MHz.

65. Also in the 2006 SAPP, bands at 10 GHz, 26 GHz, 28 GHz and 40 GHz have been reserved for Fixed Wireless Access (FWA). Although in the case of 10 GHz and 26 GHz the licence award process has been decided, no action has so far been taken in setting a date for the granting of licences. Indeed the sector has not been particularly vocal so far in requesting TRA to commence the licensing process.
66. On the other hand, since 2006 TRA has as indicated in Table 1, granted a 3rd mobile licence in Bahrain and accordingly has assigned the following spectrum:
 - 2x5.6 MHz for GSM900 in the 900 MHz band
 - 2x15 MHz for GSM1800 in the 1800MHz band
 - 2x15 MHz and 1x5 MHz for IMT in the band 1900 – 2200 MHz
67. As per the procedure for the introduction of new technologies and services in the Telecommunications SPP, discussed in paragraph 9 of this document (Sections 3.1.1, 3.1.2, 3.1.3, 3.2 and 3.5 of the Telecommunications SPP), TRA has assigned the band 1790 – 1800 MHz to the winner of the GSM 1800 MHz Guard Band Auction. Fixed and Nomadic services can be provided using this spectrum.
68. There are also a number of LF, MF, HF, VHF, UHF and SHF frequency bands allocated for commercial/private aeronautical and maritime mobile use for which the TRA is the licensing authority.
69. Furthermore, subsequent to the revision of the NFP earlier in 2009 the TRA is in the course of revising the licensing arrangements for the amateur and amateur-satellite services in the Kingdom, which inter alia will release a number of new small frequency slots for such applications, in line with international trends, in the range 135.7 kHz to 248 GHz.
70. The following bands in Table 2 below are available in Bahrain for fixed link applications that will be used mainly for back-haul purposes. A number of these bands are also available for fixed-satellite applications to provide telecommunications services to earth stations by means of artificial earth satellites.

Public consultation to ascertain potential future demand for Radio Spectrum Frequencies in the Kingdom of Bahrain

FREQ BAND (GHz)	FREQUENCY RANGE (GHz)	CHANNEL BANDWIDTH (MHz)	TECHNICAL REFERENCES (BAND PLAN)
4	3.6 to 4.2	20, 40	CEPT/ERC/REC 12-08 - Annex A - Part 1
Lower 6	5.925 to 6.425	29.65	CEPT/ERC/REC 14-01 - Annex 1
Upper 6	6.425 to 7.11	20, 40	CEPT/ERC/REC 14-02 E - Annex 1
7	7.11 to 7.75	1.75, 3.5, 7, 14, 28	CEPT/ERC/REC 02-06 - Annex 1
8	7.9 to 8.4	1.75, 3.5, 7, 14, 28	CEPT/ERC/REC 02-06 - Annex 2
11	10.7 to 11.7	40	CEPT/ERC/REC 12-06 E
13	12.75 to 13.25	1.75, 3.5, 7, 14, 28, 56	CEPT/ERC/REC 12-02 E
15	14.5 to 15.35	1.75, 3.5, 7, 14, 28, 56	CEPT/ERC/REC 12-07 E
18	17.7 to 19.7	1.75, 3.5, 7, 14, 28, 56	CEPT/ERC/REC 12-03 E - Annex A
23	21.2 to 23.6	3.5, 7, 14, 28, 56, 112	ITU-R F.637 Annex 1
27	24.25 to 29.5	3.5, 7, 14, 28, 56, 112	CEPT/ERC/REC 13-02 E - Annex A + B
32	31.8 to 33.4	3.5, 7, 14, 28, 56	CEPT/ERC/REC 01-02
38	37 to 39.5	3.5, 7, 14, 28, 56, 140	CEPT/ERC/REC 12-01 E
52	51.4 to 52.6	3.5, 7, 14, 28, 56, 140	CEPT/ERC/REC 01-02
57	55.78 to 57.0	3.5, 7, 14, 28, 56	CEPT/ERC/REC 12-12 E Annex B
58	57.0 to 59.0	50, 100	CEPT/ERC/REC 12-09 E
80	71.125 GHz to 75.875 GHz and 81.125 GHz to 85.875 GHz	250	CEPT/ERC/REC 05-07

Table 2

71. In the fixed service bands detailed in Table 2 the TRA has already initiated a study in the SSCC with the goal of ascertaining whether efficient and effective use is being made of the spectrum, especially in the bands below 10 GHz.

Question 7

TRA invites comment on the potential licensing and use of the bands 410 – 430 MHz and 450 – 470MHz for public (commercial) mobile services in the bands 410 – 430 MHz or 450 – 470 MHz?

Question 8

TRA invites comments on the potential designation of all or parts of the band 450 – 470 MHz for ITU designated IMT services?

Question 9

TRA is of the opinion that proposals for a licence in the bands 824 – 834 MHz and 869 – 879 MHz should be abandoned in view of digital dividend studies, SRD developments and a possible GSM-R requirement. TRA invites comments on the future uses of these bands

Question 10

TRA invites comments on the potential future uses of spectrum bands currently used for FWA systems in the Kingdom, in particular should spectrum at 10 GHz, 26 GHz, 28 GHz and 40 GHz be maintained for FWA licences or should it be considered for alternative applications, which are in accordance with the NFP?

Question 11

TRA invites comments relating to any other of the data provided in Table 1 and Table 2?

SPECTRUM AVAILABILITY

72. In the commercial sector, the ability to access spectrum is critical for entry into the relevant ICT market by any new player or any existing operator wanting to enhance an existing service or deploy new technology. Hence, the supply of spectrum is crucial in many cases and can affect business decisions.
73. A lack of transparency in the future supply of spectrum hinders the industry from making informed investment decisions. One means of overcoming this lack of transparency would be to develop and publish spectrum release plans. Such plans can give commercial users advance notice of what spectrum will be released for use over a given time period so that they can make informed choices about infrastructure investment, service development and which bands they may wish to prepare bids for.
74. As mentioned in paragraphs 58 to 71 above, TRA is also the licensing authority for some other telecommunications users; the aviation and maritime industries being examples where the availability of radiocommunications is vital for safety of life and radio-navigation purposes. TRA also licences professional mobile radio services, where two way radio is often used by the construction industry for safety of life communications on large civil engineering projects. Added to these are the small and medium enterprises which use radio as a cost effective tool in their day-to-day business.
75. TRA is also the licensing authority for some hobby applications e.g. amateur radio.
76. Now that the overall policy framework for managing the radio spectrum in the Kingdom of Bahrain has been established under the auspices of the SSCC and the mechanism for revising and maintaining the NFP has been agreed, TRA now believes it should publish a Telecommunications Spectrum Release Plan (TSRP) for the next number of years addressing the supply of spectrum for telecommunications through transparent, open and non-discriminatory processes.
77. In drawing up the plan, TRA considers that a number of factors, including the availability of spectrum for assignment, international spectrum allocations, technology and equipment availability, feedback and proposals from Industry as well as any policy objectives and strategies must be taken into account.
78. Once established the TSRP could be updated on a rolling basis taking into account the latest developments, so that industry and users will always have visibility of likely spectrum availability over an agreed time frame.

79. It should be noted that the TSRP will be provided for information purposes only and would not bind TRA in respect of any assignment, allocation or licensing processes or indeed any other regulatory mechanism. This is because unforeseen developments may require TRA to deviate from the TSRP. Furthermore, TRA may conduct separate detailed consultation exercises concerning the release of individual frequency bands.

Question 12

TRA consider it appropriate to publish a non-binding Telecommunications Spectrum Release Plan (TSRP) covering spectrum suitable for all sectors managed by the TRA. TRA invite comments on the proposed TSRP contents and review period.

ADDITIONAL CANDIDATE BANDS IDENTIFIED FOR INCLUSION IN THE TSRP

80. In addition to the current SPP, TRA through its participation at SSCC meetings and its involvement in the development of the NFP has identified a number of bands (see Table 3 below) which appear to be of interest or potential interest to telecommunications users.

Band	Range	Proposed Service(s)	Purpose & Number of licences	Proposed Licence Mechanism	Remarks
Amateur 600m	495-505 kHz	Amateur Experimental	N/A	Amateur Licence Special Permit	See NFP BHR3 Needs discussing at SSCC
Amateur 60m	5250-5450 kHz Secondary status and/or channels within band.	Amateur Experimental	N/A	Amateur Licence Special Permit	See NFP BHR3 Needs discussing at SSCC
Amateur 4m	69.95-70.5 MHz Slots within band. Dependent on current usage.	Amateur Experimental	N/A	Amateur Licence Special Permit	See NFP BHR3 Needs discussing at SSCC
Private Maritime	157.45-157.95 MHz 162.05-162.55 MHz	Operational Commercial	N/A	Private Maritime Licence – On request	See NFP BHR10
446 MHz	8 channels of 12.5 kHz between 446 MHz and 446.1 MHz for analogue service and/or 8 channels of 12.5 kHz or 16 channels of 6.25 kHz between 446.1 and 446.2 MHz for digital service.	“Walkie-Talkie”	Light licensing	Light licensing	Needs discussing at SSCC
GSM-R	Lower extension of GSM 900 MHz frequencies 876 MHz — 880 MHz: (uplink) 921 MHz — 925 MHz: (downlink)	GSM-R	TBD	TBD	GCC Railway Project. Decision 2011
790 – 862 MHz	Digital Dividend (Converged Services) TBD	LTE	TBD	TBD	
2.3 GHz	2.3 – 2.4 GHz	FWA	TBD	TBD	TBD
2.6 GHz	2.5 – 2.69 GHz	FWA/LTE	TBD	TBD	TBD

Public consultation to ascertain potential future demand for Radio Spectrum Frequencies in the Kingdom of Bahrain

Band	Range	Proposed Service(s)	Purpose & Number of licences	Proposed Licence Mechanism	Remarks
60 GHz	57-66 GHz	SRDs & Point to point	Light licensing	Light licensing	Discussion required at SSCC
75/85 GHz	71.125-75.875 GHz Paired with 81.125-85.875 GHz	Point to point	Heavier light licensing	Heavier light licensing	Discussion required at SSCC

Table 3

81. The first three entries in Table 3 address the possibility of additional MF, HF and VHF allocations for the amateur service and result from an entry in the NFP inviting the SSCC to agree to release all or part of these bands for amateur experimentation. Radio amateurs conduct experiments in radio-wave propagation and radiocommunications on a regular basis and it is understood that providing spectrum at 500 kHz, 5 MHz and 70 MHz in the Kingdom of Bahrain would facilitate the global understanding of certain propagation phenomena.
82. The former distress and calling radio-telegraphy frequency of 500 kHz and the associated guard-band is generally unused following the removal of telegraphy from the Global Maritime Distress and Safety System (GMDSS). Whilst a permanent international allocation to the amateur service in this frequency band is an agenda item for ITU WRC-12, TRA supports the view that spectrum usage should be maximised in an efficient and effective manner, whenever possible and would not oppose early access to the frequencies identified, subject to review following WRC-12. The lower frequency bands are of particular interest in respect of investigating long distance propagation events.
83. In terms of research into ionospheric propagation phenomena, it is understood that there is a current need for usable spectrum around 5 MHz for experimentation in a frequency allocation that is also available to the amateur service in other countries. A number of countries around the World have limited access to spectrum in the band 5 250 – 5 450 kHz. Spectrum in the vicinity of 5 000 kHz is near optimum to carry out propagation and antenna investigations aimed at improving the understanding of Near Vertical Incidence Skywave (NVIS) propagation.
84. In a growing number of European countries as well as two African countries including Croatia, Czech Republic, Finland, Germany, Ireland, Norway, Portugal, South Africa, Slovakia, Slovenia, Spain, and the United Kingdom, the amateur

service has been provided with access to all or part(s) of the band 69.95 – 70.5 MHz in order to conduct propagation experiments. From a propagation standpoint, 70 MHz appears to be at the currently known extent of F2 ionospheric (sky wave) propagation at peaks in the (circa) 11 year solar cycle, whilst during summer months multi-hop sporadic E propagation is extensive. This places the band in a unique part of the radio spectrum and for this reason some access for experimentation seems justified, provided such use is compatible with other uses of the spectrum. The TRA therefore believes that a limited amateur transmitting facility of at least 100 kHz ideally centred on 70.2 MHz (the centre of activity) in the band 69.95-70.5 MHz should therefore be considered.

85. Appendix 18 of the ITU Radio Regulations identifies the sub-bands 156-157.45 MHz and 160.6-162.05 MHz specifically for the maritime mobile service with 156.8 MHz identified for distress and safety purposes. The number of channels in Appendix 18 for the international maritime VHF service seems to be currently just, or almost sufficient, taking into account that an increasing number of ships are using national or regional cellular mobile systems for some part of their commercial communications.
86. The idea of introducing a private maritime band also seems worthy of consideration. TRA believes that the bands 157.45-157.95 MHz paired with 162.05-162.55 MHz could be considered for designation as Bahraini /GCC private maritime frequencies.
87. The system known in Europe as PMR 446 is a hand-portable short range communication system, which provides a basic but effective radio service for both business and non business users. It is ideal for providing communication over short distances; such as within office buildings, factories and building sites. The original analogue system provides for 8, 12.5 kHz channels in the band 446.0 – 446.1 MHz whilst the newer digital system can be configured for 8, 12.5 kHz or 16, 6.25 kHz channels in the band 446.1 – 446.2 MHz.
88. TRA believes that such a system operating under the light licensing regime would be of benefit to the telecommunications sector. However to implement PMR 446 in the Kingdom of Bahrain would likely require some frequencies to be refarmed. There are additional concerns that such hand-held equipment, easily accessible to the general public, would facilitate illegal activities and therefore lightly-licensed hand-held, 'walkie-talkie' equipment should not be permitted in the Kingdom.

89. GSM-R, (Global System for Mobile Communications - Railway or GSM-Railway) is an international wireless communications standard for railway communication and applications. A sub-system of European Rail Traffic Management System (ERTMS), it is used for communication between train and railway regulation control centres. The system is based on GSM and EIRENE - MORANE specifications which guarantee performance at speeds up to 500 km/h without any communication loss.
90. 2 x 4 MHz at the LF end of the E-GSM band is the band harmonised by the International Railway Union (UIC) for railway applications. The GCC is examining a BHD 4 billion scheme to build a high-speed rail network between Kuwait and Muscat in Oman, and onwards to the Yemeni border. Though a final decision to proceed would not be taken until 2011, if agreed the new network could be operational as early as 2017. In the meantime construction on the causeway that will link Qatar with Bahrain is expected to start by the first quarter of 2010. The four-lane road bridge is expected to be completed in 2013 and the two railway lines by 2015 and will eventually connect to the planned GCC rail network. Plans for the GCC line involve more than 2000 km of track running from Kuwait City to Muscat (and Yemen) via Saudi Arabia, Bahrain, Qatar and the UAE. It therefore seems appropriate to ensure that this frequency band could be utilised for the railway system in the Kingdom before 2015.
91. The remaining bands below 3 GHz depicted in Table 3 relate to spectrum identified as appropriate for IMT systems in the ITU Radio Regulations. The ITU conference WARC-92, decided on mobile allocations identified for IMT (also known as 3G) in the 2 GHz band (the so called core-band). WRC-2000 made further identifications for IMT at 2.6 GHz. WRC-2007 made provision for IMT at 3.4 GHz and TRA has already awarded licences.
92. WRC-2007 also identified spectrum for IMT in two additional bands
- 790–862 MHz in ITU Regions 1 (Africa, CIS, Europe and Middle East) and 3 (Asia Pacific area including Iran) and
 - 2.3–2.4 GHz
93. The band 698–862 MHz was also identified at WRC -2007 for IMT in Region 2 (North and South America) and nine countries of Region 3 (Asia Pacific).
94. There are currently 4 operators with systems based on IMT technologies licensed to provide telecommunications services in various frequency bands in the Kingdom of Bahrain, these are Batelco, Mena, STC and Zain. Following WRC-07 there is a need to consider whether it would be in the national interest

- to consider licensing additional operators on a technology neutral basis in spectrum at 800 MHz and/or 2.3 GHz.
95. The digital dividend arising from the transition from analogue to digital television broadcasting in the band 470 – 862 MHz not later than the ITU deadline of 2015, is a unique opportunity to meet any additional demand for radio spectrum, particularly to allow new wireless services such as the next generation of mobile broadband and IMT, as well as to support the continued development of terrestrial broadcasting. It can therefore contribute significantly to economic growth in the Kingdom and satisfy some important social, cultural and economic needs.
96. As stated in paragraph 92, the band 790 – 862 MHz has been determined at the international level as a candidate band for new wireless services subsequent to the digital dividend being realised. The implementation of such services in the Kingdom will be dependent on the refarming of the spectrum and the implementation of digital television services in the Kingdom and neighbouring countries.
97. The band 2.3 – 2.4 GHz, identified as an IMT band at WRC-07 is currently occupied by non telecommunications services in the Kingdom and thus commercial exploitation for IMT services would probably not be feasible without a considerable amount of refarming.
98. The band 2.5 – 2.69 GHz was identified at ITU WRC-2000 as designated spectrum for IMT, more specifically as an extension band for third generation mobile services. Latterly most regulatory authorities, the TRA included have adopted a more technology neutral approach to the band with the addition of further technologies to the IMT family in 2007.
99. Similarly to the band 2.3–2.4 GHz discussed in paragraph 97 above, due to the current usage of the spectrum, it is not possible to utilise the band 2.5-2.69 GHz for telecommunications including commercial IMT services. Again, subject to responses to this consultative document, refarming may be an option if this band should be included in the TSRP.
100. New 60 GHz technologies are now starting to emerge that can utilise the band 57- 66 GHz spectrum which can take advantage of the high gaseous attenuation (oxygen absorption) exhibited at these frequencies to provide high speed data transmission (100 Mbits/sec and above) over short hop link lengths (typically <1 km link lengths at high availability) with minimal risk of interference.

101. Short Range Devices at 57-66 GHz are typically used in Wi-Fi applications. They also include technologies such as automation systems and the wireless distribution of high definition video to for example television screens avoiding unsightly cables. Spectrum in this range may also be attractive for mass market applications, where the very high data rates available may facilitate innovative in-home wireless network opportunities. In addition this frequency band is becoming the subject of increased interest for higher power Fixed Wireless Systems.
102. Spectrum in the range from 71-86 GHz is also of increasing interest to service providers and systems designers because of the favourable propagation resulting from a reduction in oxygen absorption attenuation when compared with 60 GHz. Further, larger bandwidths are available for carrying communications. The possible use of highly directional/high gain antennas of relatively small size together with the available bandwidth could support applications such as extremely-high-speed data transmission over significant hop lengths, while offering a reduced likely-hood of harmful interference occurring.
103. A slightly heavier than the current “light licensing” regime normally operated by the TRA might be envisaged. The position and characteristics of the stations would be recorded on a database on a first-come first-served basis, with responsibility for implementing subsequent assignments falling to potential users to ensure compatibility with previously notified stations.

Question 13

TRA invites comments on its proposal, subject to SSCC approval, to:

- **Offer amateur licensees in the Kingdom additional spectrum at 500 kHz, 5.3 MHz and 70 MHz in order to participate in propagation experiments.**
- **Introduce a band at 157.45-157.95 MHz paired with 162.05-162.55 MHz for private maritime applications.**
- **Seek to introduce a lightly licensed short range communications system based on internationally available hand-held equipment, ideally at 446 MHz.**
- **Reserve the GSM-R frequency bands at 900 MHz for possible use in relation to the GCC railway project and review the situation in 2011.**
- **Determine whether spectrum gained as a result of the transition from analogue to digital terrestrial television should be used for**

broadcasting, fixed, mobile (IMT), converged services or other applications.

Question 14

There remain concerns about PMR446 (or similar equipment) being used for antisocial or illegal activities, TRA invites comments on how these may be overcome.

Question 15

TRA invites comments on the consideration that services currently operating at 2.3 GHz and 2.6 GHz might be refarmed to provide additional spectrum for IMT systems.

Question 16

TRA invites comments on its proposal to provide the band 57-66 GHz for short range and fixed wireless systems within the current light licensing regime.

Question 17

TRA invites comments on its proposal to make available the band 71-86 GHz for fixed wireless systems using a modified light licensing regime, as described above

GENERAL COMMENTS

104. General comments or suggestions are also welcome on the current SPP (see paragraphs 9 and 10 of this document) as well as the proposed spectrum bands mentioned in paragraphs 80 to 103 of this document.
105. Respondents are also welcome to propose additional frequency bands or telecommunications applications that should be available for use in the Kingdom of Bahrain. The provision of such information would enable TRA to assess the desirability and form that any appropriate spectrum allocation or assignment should take.

Question 18

Do you have any proposals for additional frequency bands or telecommunications applications?

Please note. All proposals should include the following information:

- **The proposed frequency band(s);**
- **The bandwidth required;**
- **Details of the service(s) which could be provided in the proposed frequency bands;**
- **The proposed number of licences;**
- **The proposed licensing mechanism; and**
- **Any other comments or suggestions.**

NEXT STEPS

106. This consultation is intended to further develop spectrum policy in the Kingdom and improve the predictability of the regulator's decisions related to spectrum management. It should increase the confidence of industry in making informed investment decisions, hence facilitating the introduction of new and innovative communications services in the Kingdom, for the overall benefit of the community.
107. It should be appreciated that consultations on and formulation of detailed spectrum release arrangements will take time. It should also be realised that particularly radical suggestions by respondents, such as for example the introduction of secondary trading of spectrum, might require the Law, Regulations and Licences to be suitably amended.

108. Meanwhile, communications technologies and markets continue to develop; the TRA therefore undertakes to review its spectrum policy and management framework in a timely and appropriate manner.
109. The proposals contained in this consultation paper are TRA's preliminary views only. TRA looks forward to submissions from all stakeholders and other interested parties in order to further develop concepts, proposals and regulations as appropriate.
110. Subsequent to the closure of the Consultation period, TRA will publish a Report on its findings in respect of the responses received to all of the questions posed. TRA will additionally provide details of the frequency bands that it will invite the SSCC to consider making available for telecommunications in future. Once this process has been completed and subject to the findings of this Consultation process and the SSCC, a Spectrum Release Plan may be published, detailing the frequency bands to be included, the timetable for release and the mechanism for reviewing and modifying the Plan.

ROLE OF THIS DOCUMENT

111. Information received in response to this document may be used by TRA in the preparation of a Telecommunications Spectrum Release Plan. However, it does not constitute an offer or invitation to participate in the bidding for any spectrum or licences, nor does it constitute the basis of any contract which may be concluded in relation to any bidding exercise or in respect of any assignment of spectrum. Further, this invitation to comment does not represent any decision of the TRA. Those issues remain subject to consideration. In addition this invitation should not be construed as indicating that TRA has formed any opinion or decision on any portion of the radio frequency spectrum. This document shall not bind TRA to assign any spectrum, or to grant any licence.

Spectrum Policy and Planning

Report on the Implementation of the Joint Policy Issued by the Telecommunications Regulatory Authority (TRA) and the Ministry of Transportation (MoT) of the Kingdom of Bahrain

Purpose: To provide information concerning the 2006 spectrum policy and planning document

1. Introduction

The developments in the telecommunications sector and the demand for spectrum by licensees and prospective licensees, to provide for new or more cost-effective services, necessitated a review in 2006 of the availability and usage of spectrum in the Kingdom of Bahrain. A Spectrum Policy and Planning (SPP) document was prepared jointly by the TRA and the Ministry of Transportation (MoT). Based on the responses of stakeholders to a consultation process, the resulting Plan defined the overall principles of spectrum management policy in the Kingdom.

However since publication, a number of initiatives related to the spectrum used for telecommunications have necessitated changes to the policy detailed in the SPP.

The TRA has therefore developed this Report which highlights the key changes introduced in the telecommunications sector. In addition, since publication in 2006 the TRA has received a number of requests to utilize spectrum in bands not currently allocated for the assignment of frequencies for telecommunications applications. The TRA has as a consequence decided to initiate in the last quarter of 2009 a public consultation exercise, which has been designed, amongst other things to identify additional spectrum that can be provided for the sector and an associated timescale for release and licensing.

This Report should be read in conjunction with the SPP document [Joint Policy Issued by the Telecommunications Regulatory Authority \(TRA\) and the Ministry of Transportation \(MoT\)](#) 27 June 2006.

2. Spectrum Allocation and Assignment

The Minister of Cabinet Affairs, the Minister responsible for the Telecommunications Sector following a consideration of the Telecommunications Law, the National Telecommunications Plan and in particular Resolution No. (4) of 2008 with respect to the Adoption of Spectrum Planning and Allocation Policies, established a Spectrum Strategy and Co-ordination Committee (SSCC) in late 2008. Resolution No. (5) of 2008 addresses this matter. Both Resolutions No. 4¹⁷ and No. 5¹⁸ are provided on the TRA web-site <http://www.tra.org.bh> for information.

¹⁷ http://www.tra.org.bh/en/pdf/NationalSpectrumPlanning_and_AllocationPolicy-MinisterialOrder4-English.pdf

¹⁸

http://www.tra.org.bh/en/pdf/ResolutionNo5of2008with_respect_toSSCCEnglish.pdf

Spectrum Policy and Planning - Report

The SSCC facilitates coordination of spectrum requirements and supports the development and maintenance of the National Frequency Plan (NFP) for all radio spectrum resources in the Kingdom, especially to meet the following objectives:

1. Satisfy the spectrum requirements of sector members including those responsible for national security and defence;
2. Support the introduction of more spectrally efficient technologies, including the timely introduction of digitised broadcasting networks;
3. Satisfy the requirements of international obligations and treaties;
4. Support economic growth and create employment;
5. Meet the needs of civil aviation and the maritime industries;
6. Provide for competitive telecommunication infrastructures through free and fair processes;
7. Introduce future generations of public and private mobile technologies;
8. Satisfy the spectrum requirements for internationally provided radio navigation services e.g. Galileo and GPS;
9. Facilitate the rollout of broadband telecommunications networks;
10. Facilitate regionally and globally harmonised frequencies for the PPDR (Public Protection and Disaster Relief) system, in order to help rescue and emergency teams communicate with each other,
11. Stimulate technological innovation and competitiveness in a technology neutral fashion;
12. Introduce new spectrum management techniques, where appropriate e.g. spectrum commons and spectrum property rights and trading etc;
13. Provide spectrum for rural telecommunications with a particular emphasis on the provision of spectrum for telecommunications services for educational (including art and culture) and other public interest (including health and emergency) purposes.

The Minister responsible for the telecommunications sector approved a revised NFP in November 2009. This was developed and approved by the SSCC earlier in the year. The 2009 NFP replaces the version developed following the ITU World Radiocommunication Conference (WRC) in the year 2000 and addresses, in addition to other matters, the results of subsequent WRCs in 2003 and 2007.

3. Developments in specific frequency bands

- Some changes have been made in spectrum below 200 MHz arising from the revision of the NFP in 2008/2009.
- The TRA continues to recognise a requirement for cost effective semi-professional hand held equipment which might be the subject to a light licensing regime. However some agencies within the Kingdom continue to have concerns about such a development. The TRA will investigate whether the spectrum identified in Europe for a digital version of PMR446 can be made available in the Kingdom of Bahrain.

Spectrum Policy and Planning - Report

- GSM900 and GSM1800 spectrum has been awarded to STC, the third mobile operator. The extended EGSM900 band is currently used by STC and Zain.
- DECT, cordless telecommunications conforming to European standards is tolerated by the TRA in the band 1880 – 1900 MHz. However this band has not as yet been added to the light licensing regime.
- In the 3.5 GHz band two National Fixed Wireless Services (NFWS) licences each comprising 2x45 MHz per licence were awarded to Mena Telecom and Zain.
- In the 26 GHz band the SPP stated that TRA and MoT will allocate and assign 2 x 100 MHz of spectrum (paired) for one FWA licence between 27.55 - 27.65 GHz and 27.63 - 27.73 GHz. However the band 27.63 – 27.73 GHz was incorrectly stated and should read 28.63 – 28.73 GHz.

4. Certification

The TRA prepared a revised certification regime in early 2009 based on a requirement for a declaration of conformity from a manufacturer or importer that equipment to be utilised in Bahrain conforms to appropriate standards. It is envisaged that this regulation will be published in the last quarter of 2009 or first quarter of 2010.

5. Spectrum pricing

The key principles for establishing the schedule of fees to be charged for radio spectrum licensing, as well as the current fees in place have been modified since 2006. They are contained in the 2009 TRA Schedule of Fees published on the TRA web-site, which is subject to change from time to time.

ANNEX 2

APPENDIX 1 OF ANNEX 2

The following text is the Authority's first proposal for the information which might be incorporated into a generic licence document. The 'Frequency Licence - General Provisions and Conditions' which would be published in a regulation made available on <http://www.tra.org.bh>, would incorporate these provisions and conditions by reference into the Frequency Licence. The proposed conditions are attached as Appendix 2 of Annex 2.

LICENCE TO OPERATE RADIOCOMMUNICATIONS EQUIPMENT¹⁹

- 1.1 The contents of the 'Frequency Licence - General Provisions and Conditions' Regulation [X] of [DD.MM.YYYY] published on <http://www.tra.org.bh> are incorporated into and form part of the terms, provisions and limitations of this Frequency Licence²⁰.

1. Licensee

1.1.	Full name of licensee (Company or person)	
1.2.	CR or CPR number (as appropriate)	
1.3.	Address	
1.4.	Telephone/Fax/E-mail	
1.5.	Name of contact person – if different to 1.1 above	
1.6.	Telephone/Fax/E-mail	
1.7.	Invoice Address – if different from 1.3. above	

¹⁹ If any clause is not pertinent to the licence or licence class in question the word 'NONE' is entered in the applicable box.

²⁰ The provisions and conditions applicable to all classes of amateur licence are contained in Regulation [Y] of [DD.MM.YYYY] published on <http://www.tra.org.bh> detailing the specific provisions and conditions applicable to holders of licences for the operation of amateur and amateur-satellite stations.

1.8	Licence Reference Number	
1.9	Date of Issue	
1.10	Licence Renewal Date	

2. General

2.1	Licence Type and Class	
2.2.	System and Coverage	
2.3.	Station Identification – Call-Sign	
2.4.	Other Identification Requirements	

3. Main or 1st Link Station (or refer to attached Schedule)

3. Main or 1st Link Station (or refer to attached Schedule)		Station A
3.1.	Location name or reference. If the station is on an aircraft or ship (but is not an amateur station) the name and/or number of the vessel shall define the location of the station.	
3.2.	Address of station location if different from 1.2 above	
3.3.	Geographical coordinates (°, min, sec)	
3.4.	Assigned Frequency(s) and Tolerance	
3.5.	Allocated Frequency Band	
3.6.	Nominal Maximum Transmitter Power ²¹ (dBW)	
3.7.	Maximum Antenna Gain (dBi) and Polarisation	
3.8.	Height of Antenna above sea level (m)	
3.9.	Azimuth of maximum radiation (°)	
3.10.	Class of Emission, Occupied Bandwidth (including any guard-band) or Channel Bandwidth	
3.11.	Additional Provisions	

4. 2nd Link Station (or refer to attached Schedule ²²)

		Station B
4.1.	Location name or reference.	
4.2.	Address of station location	
	Geographical coordinates (°, min, sec)	
4.3.	Assigned Frequency(s) and Tolerance	
4.4.	Nominal Maximum Transmitter Power (dBW)	
4.5.	Maximum Antenna Gain (dBi) and Polarisation	
4.6.	Height of antenna above sea level (m)	
4.7.	Azimuth of maximum radiation (°)	
4.8.	Class of Emission, Occupied Bandwidth (including any guard-band) or Channel Bandwidth	

The Telecommunications Regulatory Authority (the “**Authority**”) hereby grants this Frequency Licence (the “**frequency licence**”), under the Telecommunications Law promulgated by Legislative Decree No. 48 of 2002 (the “**Telecommunications Law**”), by which the Authority authorises the licensee to establish, install and use apparatus and radio equipment and assigns the radio frequency spectrum described in the body of this licence or in any attached Schedule (the “**Assigned Radio Frequency Spectrum**”).

Issued on behalf of the General Director, Telecommunications Regulatory Authority this licence is renewed annually on receipt of the applicable licence fee referred to in section 11 of the Frequency Licence - General Provisions and Conditions published on the TRA web-site <http://www.tra.org.bh>.

²² Section 4 is only applicable in the case of a point to point fixed link or similar application.

FREQUENCY LICENCE, GENERAL PROVISIONS AND CONDITIONS

The following text based on the current Frequency Licence is the Authority's first proposal for a General Provisions and Conditions document, which would be published on the Authority's web-site and would be incorporated by reference into the Frequency Licence described in Appendix 1 of Annex 2.

1. Introduction

A frequency licence (the "Frequency Licence") issued by the Telecommunications Regulatory Authority (the "Authority") under the Telecommunications Law promulgated by Legislative Decree No. 48 of 2002 (the "Telecommunications Law") and any regulations issued hereunder, authorises the Licensee to establish and use stations or install or use apparatus and radio equipment, subject to the terms, provisions and limitations of the Frequency Licence.

The terms contained in this 'General Provisions and Conditions' document are incorporated into and form part of the terms, provisions and limitations of each Frequency Licence to which this document applies.

2. Definitions

For the purposes of a Frequency Licence and these General Provisions and Conditions:

(a) A meaning or definition provided for any word, phrase or expression under the Telecommunications Law shall also be applicable to such word, phrase or expression in the licence and these General Provisions and Conditions.

(b) The following terms and expressions shall have the following meanings:

"Affiliate" means, as used with respect to any person, any other person directly or indirectly controlling, controlled by, or under common control with, that person. In the case where one person owns, directly or indirectly, 50% or more of the share capital, voting rights, securities or other ownership interest of another person, both such persons shall be deemed an affiliate;

"Apparatus" means any **equipment** that is either radio equipment or accessory equipment or both.

“Control” means, as applied to any person, the possession, directly or indirectly, of the power to direct or cause the direction of the management of that person, whether through ownership, voting or other ownership interest, whether by control or otherwise and **“controlling”** and **“controlled”** shall be construed accordingly;

“Force majeure” means any event beyond the reasonable control of the Licensee, including but not limited to fire, storm earthquake, flood or other extreme weather conditions, acts of God, failure or shortage of power supplies, lightning, war, military operations, acts of terrorism or riot;

“Interference” means the effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a **radiocommunication** system , manifested by any performance degradation , misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy; and

“Harmful Interference” means **interference** which endangers the functioning of a radionavigation service or other safety services or seriously degrades, obstructs or repeatedly interrupts a **radiocommunication service** operating in accordance with the Kingdom’s National Frequency Plan.

“Radiocommunication” means telecommunication by means of radio waves, which are electromagnetic waves or frequencies propagated in space without artificial guide.

“Radiocommunication Service” means a service involving the transmission or emission and/or reception of radio waves for specific telecommunication purposes.

“Radio Equipment” means a product, or relevant component thereof, capable of communication by means of the emission and/or reception of radio waves utilising the spectrum allocated to terrestrial and/or space **radiocommunication**.

“Station” means **apparatus** or **radio equipment** comprising one or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a **radiocommunication service**.

3. Exercise of Rights; Sub-Contracting

A Frequency Licence may not be transferred, however without prejudice to section 50.1 and 50.2 of the Telecommunications Law and subject to section

7 of this licence, the Licensee may, with the prior written approval of the Authority, exercise its rights under this frequency licence through an affiliate or sub-contract to another person; provided, however, that the Licensee shall remain the effective user of the assigned radio frequency spectrum and continue to be fully liable for any obligation arising in relation to the provision of any such licensed activity. The Authority may revoke its approval at any time by providing reasonable advance notice to the Licensee in writing. The prior written approval of the Authority shall not be required if such an affiliate is and remains wholly-owned by the Licensee, provided always that the Authority shall be notified of such an arrangement.

4. Use of Radio Frequency Spectrum

4.1 The Licensee shall ensure that the apparatus and radio equipment associated with each Frequency Licence is established, installed, maintained and used only in accordance with the provisions specified in the Frequency Licence and any attached schedules. Any proposal to amend any detail specified in the Frequency Licence or attached schedules shall be agreed with the Authority in advance and implemented only after the Frequency Licence has been varied or reissued accordingly.

4.2 The Licensee shall ensure that the apparatus, radio equipment or station is used only by persons who are authorised by the Licensee and have been notified to the Authority, and that such persons are made aware of, and of the requirement to comply with, the terms, provisions, limitations and conditions of the Frequency Licence.

4.3 Where a Licensee has been provided with radio frequency spectrum on a regional or national basis, the precise geographical location of each station and the frequencies utilised at that station shall be provided to the Authority during the first week of June of each year.

4.4 Without derogating from the provisions of section 47 of the Telecommunications Law, the Licensee may be required to migrate from the assigned frequencies detailed in the Frequency Licence in accordance with requirements specified by the Authority, in relation thereto, by way of Regulation 3 of 2008.

4.5 The Licensee shall ensure that non-ionising radiation emissions from each radio installation which it operates under its Frequency Licence(s) complies with current and any future limits set by the International

Commission for Non-Ionising Radiation Protection (ICNIRP) and any radiation emission standards adopted and implemented in the Kingdom of Bahrain.

5. Harmful Interference

5.1 Without derogating from section 49 of the Telecommunications Law, the Licensee shall take all necessary steps to ensure that the use of the assigned radio frequency Spectrum does not cause Harmful Interference to other radiocommunications stations and telecommunications networks.

5.2 Where applicable, the Licensee shall take all appropriate measures to ensure that its radiocommunications stations, and apparatus and radio equipment comprised therein, have the appropriate and necessary immunity from harmful electromagnetic disturbances and interference, which may be caused by radiocommunications stations and telecommunications networks, operating in close proximity to the Licensee's apparatus, radio equipment or station.

5.3 The Licensee shall where appropriate co-operate fully with the Authority in order to assist in the co-ordination of frequencies authorised in the Frequency Licence, for the purposes of protection from Harmful Interference and the avoidance of Harmful Interference to the radiocommunication services of neighbouring countries.

5.4 Subject to applicable law and this section 5, the use of any part of the assigned radio frequency spectrum to mitigate the likelihood of Harmful Interference occurring (including the provision of guard band(s)) shall be at the discretion of the Licensee.

5.5 Without derogating from the Licensee's ultimate rights under section 14.2 of these General Provisions and Conditions, the Licensee shall take all reasonable and necessary steps to ensure that any Harmful Interference experienced from a source within the Kingdom of Bahrain is resolved amicably between the concerned parties within 15 days of the interference being detected and brought to the relevant party's or parties' attention. The Licensee shall notify the Authority as soon as practicable after it experiences prolonged Harmful Interference, and shall keep the Authority informed of any steps taken to resolve the interference and the results obtained thereafter.

5.6 Where Harmful Interference problems have not been resolved amicably between the Licensee and the other party or parties within 15 days of detection and notification of the interference to the other party or parties,

either the Licensee or the other party or parties may refer the matter to the Authority.

5.7 Without prejudice to section 72 of the Telecommunications Law, the Authority shall investigate the matter and issue a decision, determination or order with respect thereto.

5.8 The Authority may direct the Licensee to take such action as may be necessary to resolve a case of Harmful Interference as soon as possible.

6. Interoperability and Technical Standards

The Licensee shall comply with relevant regulations and technical specifications issued by the Authority in order to maximise the use of the spectrum, minimise the occurrence of Harmful Interference and ensure the interoperability of licensed services where appropriate.

7. Radio Equipment

7.1 The Licensee shall ensure that the radio equipment comprised in any of its radiocommunications stations is Type Approved by the Authority and at all times complies with all applicable emission standards and technical specifications or requirements specified by the Authority, from time to time, in relation thereto.

7.2 Where applicable, the licensee shall ensure that radio equipment and stations are operated within the assigned radio frequency spectrum and are not used for unlawful purposes or misused in any way.

8. Radio Frequency Spectrum Trading

The Licensee shall not, except with the prior written approval of the Authority, assign, transfer, trade, sell or otherwise dispose of the whole or any part of the rights, privileges, duties and/or obligations under a Frequency Licence to any other person or persons.

9. Radio Frequency Spectrum Sharing

The Licensee shall not, except with the prior written approval of the Authority or in accordance with section 3 of these General Provisions and Conditions, authorise a third party to operate the apparatus, radio equipment or station within the assigned radio frequency spectrum.

10. Requirement to Provide Information and Inspection

10.1 Without derogating from section 53 and 77 of the Telecommunications Law, the Licensee is required to maintain such information as will enable the Authority to carry out its functions under the Telecommunications Law in such manner as the Authority may from time to time request. The Authority shall have the right to request the Licensee to submit periodic reports, statistics and other data as well as request additional information in order to effectively supervise and enforce the terms of a Frequency Licence, the provisions of the Telecommunications Law and the regulations issued thereunder.

10.2 Without derogating from section 77 of the Telecommunications Law, the Licensee shall permit a person authorised by the Authority to have access to any of its apparatus, radio equipment and stations and to inspect or test the said apparatus, radio equipment or stations at any reasonable time or whenever an emergency situation exists, at any time, for the purpose of verifying compliance with the terms of a Frequency Licence, or investigating a source of Harmful Interference.

11. Frequency Licence Fees

11.1 The fee for a Frequency Licence shall be in accordance with the schedule of fees published from time to time by TRA and available on the Authority's web-site <http://www.tra.org.bh>. This may be different to the fee specified on the Frequency Licence itself or in a Schedule associated with the Frequency Licence.

11.2 The applicable Frequency Licence fee shall be paid to the Authority in Bahraini currency before the issue or renewal of a Frequency Licence.

12. Modification, Revocation and Termination

12.1 Without derogating from section 51 of the Telecommunications Law, a Frequency Licence and these General Provisions and Conditions may be modified in any of the following ways at any time:

- (a) A written agreement between the Authority and the Licensee; or
- (b) By the Authority, if the Authority determines that a modification is necessary to make these General Provisions and Conditions consistent with current spectrum management requirements or to the extent necessitated by

technological developments, provided that the Authority shall have consulted with Licensees.

12.2 The Authority may revoke any Frequency Licence in accordance with section 51 of the Telecommunications Law.

12.3 A Frequency Licence shall terminate upon the expiry of its term, however the Frequency Licence may at the discretion of the Authority continue in force, subject to the issue of a renewal notice and payment of the fees referred to in section 11 above, until such time that the Frequency Licence is revoked by the Authority in accordance with section 12.4.

12.4 As described in section 12.3, there shall be no automatic right to renewal of a Frequency Licence.

13. Force Majeure

13.1 If the Licensee is prevented from performing any of its obligations under a Frequency Licence because of force majeure the Licensee shall notify the Authority of the obligations it is prevented from performing as soon as practicable after it becomes aware or reasonably should become aware of such force majeure.

13.2 The Authority shall suspend the obligations referred to in section 13.1 and the Licensee shall not be liable to perform such obligations, for so long as the force majeure continues, only if and to the extent that the inability to perform could not have been prevented by taking steps specifically required under the Telecommunications Law or the Frequency Licence, or other reasonable precautions.

14. Dispute Resolution

14.1 All disputes between the Licensee and the Authority arising from a Frequency Licence shall be resolved in accordance with the provisions of Chapter 16 of the Telecommunications Law.

14.2 The courts of the Kingdom of Bahrain shall have jurisdiction over any dispute between a Licensee and other Licensees arising from licensed telecommunications activities, provided, however, that a party to such a dispute may require the dispute to be referred to arbitration, in which case, unless the parties agree otherwise and provided that such agreement is not contrary to Chapter 7 of the Civil and Commercial Procedural Law of 1971,

the provisions of sections 67 to 71 of the Telecommunications Law shall apply subject to any necessary changes having been made.

15. Notices

15.1 All notices from the Licensee to the Authority and vice versa shall be in writing and sent by registered mail with acknowledgement of delivery to the following addresses:

(a) if to the Licensee, then to the address stated in the Licence document ;

and

(b) if to the Authority to PO Box 10353, Manama, Kingdom of Bahrain.

15.2 Either party may change its postal address by notifying the other party in writing at least fifteen (15) days before such a change takes effect.

ANNEX 3 GLOSSARY OF TERMS

3G	Third Generation (Mobile Service)
4G	Fourth Generation (Mobile Service)
AIP	Administrative Incentive Pricing
BHR	Abbreviation of Kingdom of Bahrain
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications administrations
CIS	Commonwealth of Independent States
CPR	Central Population Register
CR	Commercial Registration
DSL	Digital Subscriber Line
DVD	Digital Video Disc
E-Tag	Electronic Tag
ERC	European Radiocommunications Committee (of CEPT)
ERTMS	European Rail Traffic Management System
EUP	Existing User Pays
F2	Second F Layer (of Ionosphere)
FCFS	First Come First Served
FM	Frequency Modulation
FPLMTS	Future Public Land Mobile Telecommunications System
FWA	Fixed Wireless Access
GCC	Gulf Co-operation Council
GHz	1,000,000,000 Hz
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GSM	Global System for Mobile
GSM-R	GSM Railways
HF	High Frequency

Hz	Basic unit of frequency – 1 cycle per second
ICT	<i>Information and Communication Technologies</i>
IMT	International Mobile Telecommunications
ITU	International Telecommunication Union
kHz	1000 Hz (1 thousand)
km	kilometres
LTE	Long Term Evolution
MF	Medium Frequency
MHz	1000000 Hz (1 million)
MoT	Ministry of Transportation
NEP	New Entrant Pays
NFP	National Frequency Plan
NFWS	National Fixed Wireless Services
NRF	National Refarming Fund
NSP	National Spectrum Policy
NVIS	Near Vertical Incidence Skywave
OFDM	Orthogonal Frequency Division Multiplexing
PMR	Professional Mobile Radio
PO	Post Office
REC	Recommendation
RFID	Radio Frequency Identification
SAPP	Spectrum Allocation and Policy Plan
SPP	Spectrum Policy and Planning
SRD	Short Range Device
SSCC	Spectrum Strategy and Co-ordination Committee
STC	Saudi Telecom Company
TBD	To Be Decided
TDF	TRA Directly Funds
TETRA	Terrestrial Trunked Radio
TRA	Telecommunications Regulatory Authority

TSRP	Telecommunications Spectrum Release Plan
TV	Television
UAE	United Arab Emirates
UHF	Ultra High Frequency
UIC	International Railway Union
UWB	Ultra Wide Band
VHF	Very High Frequency
WARC	World Administrative Radiocommunication Conference (of ITU)
Wi-Fi	Wireless Fidelity
WiMax	Worldwide Interoperability for Microwave Access
WRC	World Radiocommunication Conference