TELECOMMUNICATIONS REGULATORY COMMISSION

VIRGIN ISLANDS

SPECTRUM MANAGEMENT FRAMEWORK - FINAL STATEMENT INCLUDING REPORT ON PUBLIC CONSULTATION

October 2011

Reference Number: _____

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Introduction[1]

0.1. The Telecommunications Regulatory Commission (TRC) published a consultation document on the Virgin Islands Spectrum Management Framework on its website (www.trc.vg) on 30th May 2011 and invited responses from the public by 26 August 2011. The TRC received three responses from three licensed public suppliers: CCT, Digicel and LIME (the responses are published separately on the TRC's website). An interactive seminar open to interested parties on the consultation document was given by the TRC on June 1st 2011. The findings and proposed recommendations were presented and discussed and attendees had the opportunity to pose questions and raise concerns to help them prepare responses. The TRC would like to thank the respondents for their constructive inputs.

0.2. This final document sets out the TRC's position on the framework for spectrum management in the Virgin Islands (VI), summarising the points made by the three respondents and the TRC's position with regard to such points. Actions for addressing these issues are identified and are summarised in the accompanying final version of an Action Plan.

0.3. The TRC's position supports the proposed spectrum policy of the Virgin Islands which is published separately. The local and international context for considering spectrum management issues is described below.

1. Local context

1.1. The VI is a British overseas territory. It comprises many (over 50) islands though the population of 29,000 or so inhabitants[2] is concentrated on four islands -Tortola, Virgin Gorda, Anegada, and Jost Van Dyke. The territory's location in the Eastern Caribbean means that the communications infrastructure needs to be robust in periods of heavy rainfall and hurricanes. The VI is 22 miles from the US Virgin Islands (US VI) and 60 miles from Puerto Rico and there is spill over of wireless services to/from these territories.

1.2. Around 60% of the population comprises expatriates who come to the VI for work. The VI is relatively affluent with an average GDP/capita of $30,341[3] and attracts a large number of tourists. In 2009 there were around 857,000 visitors to the VI, 62% of whom arrived on cruise ships[4]. Tourism and the international financial services sector are the mainstays of the local economy[5]. The communications needs of the country are therefore greater than suggested by the population estimates, and international traffic, including international roaming, is an important source of revenues to the communications operators. Efficient operation of maritime and aeronautical services is also important for the local economy. At any time there could be a significant number of private boat owners, cruise ships, chartered boats and ferries sailing in the VI's waters.

[1] Disclaimer: All references to frequency assignments, allocations or similar terms in this document should not be interpreted as granting and confirming any legal right of access to the frequencies mentioned (and in most cases should be considered as simple references to the actual declared usage of spectrum), except where such a right is given in a frequency authorisation issued by the TRC.

[2] The Development Planning Unit estimates that in 2009 the population totalled 28,882 of whom 17,423 are expatriates (60%) and 11,459 local (40%).

[3] http://www.dpu.gov.vg/images/dpu_pdf/Economic%20Review%202009.pdf

[4] http://www.dpu.gov.vg/images/dpu_pdf/Monthly%20Tourism%20Summary%20Report%20December%202009%20-%20Final.pdf

[5] http://www.dpu.gov.vg/images/dpu_pdf/Economic%20Review%202009.pdf

1.3. The small size of the VI means the TRC has limited resources for spectrum management. The proposed framework has taken this into account by seeking solutions to issues that minimise administrative overheads whilst still permitting effective spectrum management.

2. International trends in spectrum management

2.1. Economic growth in modern economies is increasingly supported by information and communications technology, including wireless communications. Effective radio spectrum management is therefore economically and socially important in a growing range of communications, navigation and radio location activities. This has been recognised in policies developed by many governments, and recent examples include the FCC's National Broadband Plan and the European Digital Agenda and Radio Spectrum Policy Plan.

2.2. The way in which spectrum is managed has been changing as a result of technology change and increasing competition for the spectrum resource from different users and applications. Whereas traditionally the command and control approach to spectrum management has been the model of choice, this model is today coming under increasing pressure. Steps are being taken to reduce the involvement of the state and to let market mechanisms and users themselves govern the many aspects of spectrum use. The key changes that have been introduced (to a varying degree in different countries) involve:

- Increased transparency in spectrum management decisions, greater provision of information on available spectrum and the regulators' future plans (e.g. for future releases) to users and formalisation of all user's rights (including government and commercial users).
- Liberalisation of choices over how spectrum is used, whereby spectrum licensees may be free to decide which technology to use, subject to meeting specified technical constraints on emissions, and which services to provide, subject to meeting minimum service requirements.
- The use of market mechanisms such as spectrum trading and auctions to allow spectrum rights to be assigned to the users who value the spectrum most, and to encourage more efficient spectrum use. The administrative pricing of spectrum by the regulator is used in cases where market mechanisms may not be appropriate to encourage more efficient spectrum use.
- A presumption in favour of exempting services from licensing, or adoption of "light licensing" regimes wherever this is practical, subject to the need to avoid harmful interference.

2.3. Such policies have been introduced in a range of countries including the UK and the EU, more widely, North America, Australia, and New Zealand as well as in some countries in the Caribbean[6], Latin America and Asia. Experience in these countries has informed the spectrum management framework proposed for the VI.

[6] For example the Bahamas, Trinidad and Tobago, Barbados and Jamaica have all published spectrum plans. In addition the Eastern Caribbean Telecommunications Authority (ECTEL) has published a spectrum plan for Commonwealth of Dominica, Grenada, St Kitts and Nevis, St Lucia and St Vincent and the Grenadines.

Spectrum management framework

3. Policy objectives and functions

a) Current situation

3.1. The legal framework for spectrum policy and management is given in the Telecommunications Act (2006) – "the Act". Under the Act the Minister is responsible for developing and reviewing telecommunications policies and international matters including international, regional and bilateral frequency co-ordination (Section 4 of the Act). The TRC advises the Minister on policy matters. The TRC shall submit a policy to the Minister and shall implement a position statement and action plan without prejudice to the policy the Minister may issue.

3.2. The TRC has responsibility for managing the spectrum and determining applications for and monitoring and enforcing licences and frequency authorisations. The Act variously refers to the objectives the TRC is to take into account in carrying out these functions including:

- To promote the economic, orderly and efficient utilisation of frequencies (Section 34 (1), 36(c))
- To ensure fair competition among licensees (Section 6 (d))
- The public interest (Sections 21 (c), 23 (d))
- Requirements in respect of national security (Section 35 (2))
- Relevant regional and international agreements and standards, including ITU Treaties (Section 36 (d-f).

3.3. Specific functions in respect of spectrum management the TRC is expected to undertake include:

- Development of a Spectrum Plan that will be published and will describe spectrum allocations; how spectrum shall be used; and the procedures used to assign frequency bands.
- The allocation and reallocation of spectrum.
- The determination of frequency authorisations and the monitoring and enforcements of licence or authorisation conditions.

3.4. In carrying out these functions the TRC seeks to support relevant national telecommunications, broadcasting, transport and security policies. The TRC's vision indicates that in respect of telecommunications policy it seeks to enable the provision of the "best telecommunications infrastructure and services in the region in terms of innovation, quality, choice and competitive pricing" and its mission is "to enable and facilitate the availability and affordability of adequate telecommunications infrastructure and services with the view to ensure the long term benefit to the residents and businesses in the Virgin Islands."[7] Spectrum management has a role to play in achieving these objectives by providing a vital input to the delivery of low cost and universal communications services and to provide a back up to wired networks in case of natural disasters.

[7] http://www.trc.vg/attachments/028_Work_Programme_2010-2011_final_approved.pdf

b) Spectrum policy objectives

3.5. The Spectrum Policy provides a clear statement of objectives from which a more detailed spectrum management framework can be derived. Specifically the TRC suggests that these objectives should be:

- To promote the economic and socially efficient use of radio spectrum, such that
  - The public interest is served; and
  - Competition between licensees is promoted.
- To take into account reasonable requirements for spectrum in respect of national security.
- To comply with relevant regional and international agreements and standards, including ITU Treaties.

3.6. These objectives have guided the development of the TRC's position on a spectrum management framework for the VI.

4. Spectrum allocation

Current situation

4.1. In most countries spectrum allocations are recorded in a National Frequency Allocation Table (NFAT). The NFAT provides a living record of allocations as documented in the ITU Radio Regulations (and relevant footnotes) but with more detail on the actual use of bands at a national level. Sometimes the NFAT includes other relevant information such as channel plans, technical conditions or local regulatory restrictions. For example the UK Frequency Allocation Table[8] has a Comments column and Annexes containing details of national use and technical conditions and the Portuguese Frequency Allocation Table[9] also indicates details of national use and relevant technical details (in a Notes column). This national information goes beyond what is recorded in the ITU Radio Regulations and is useful to spectrum users wanting to deploy services and to manufacturers seeking to develop or test radio equipment.

4.2. The VI does not have a NFAT however its general policy is to follow the ITU Allocation Plan for Region 2 (the Americas) together with, where appropriate, certain elements of Region 1 (Europe, Africa and the Middle East) allocations. This has been a deliberate policy in the cellular mobile bands, so that roaming for visitors from both regions can be supported. In the bands used by land mobile and microwave links a mix of US and European equipment is purchased by users and bands for both regions are used as the TRC has sought to accommodate users' requests in this situation.

4.3. As a small territory the VI has little choice but to follow internationally agreed allocations. Furthermore the proximity of the US VI means that there are advantages in harmonising with the US allocations to avoid harmful interference and to make more efficient use of the spectrum. However, currently there are no formal agreements with the US for sharing bands, so interference may still occur even when the US band plan is adopted. The issue of international co-ordination and problems with interference from the US VI was mentioned frequently in stakeholder interviews. The absence of bi-lateral co-ordination

[8] http://stakeholders.ofcom.org.uk/spectrum/spectrum-management/UK-FAT-Table-2010/

[9] http://www.anacom.pt/streaming/NFAP2009_2010_uk.pdf?contentId=1022890&field=ATTACHED_FILE

with the US in particular means there is a risk that early deployment of systems in the US VI could block opportunities for the VI to use spectrum.

4.4. The VI has visitors from both Europe and North America which means it is economically advantageous to provide for some Region 1 allocations particularly for public mobile services. The VI has therefore assigned frequencies to mobile operators in the European and North American frequency bands. Conflicts between allocations in the two regions arise. Users need to be aware of such allocations as they can mean equipment purchased may not work in the VI. For example, the GSM 900 band (880-915/925-960 MHz) overlaps with the US licence exempt allocation at 902-928 MHz[10]. If equipment made for this band is used in the VI it is likely to suffer interference from licensed GSM mobile services[11] and vice versa.

4.5. Table 2-1 summarises available information on the allocated use and number of assignments in frequency ranges up to 14 GHz, the Primary Region 2 allocation taken from the ITU Radio Regulations. As can be seen from Table 2-1 many bands are lightly used (e.g. in the land mobile bands over 95% of the channels are vacant). This has implications for the way frequencies are assigned and spectrum fees, both of which are discussed further below.

Table 2-1: Overview of current spectrum allocations and assignments

Frequency range (MHz)	ITU Region 2 Primary Allocation	VI use	Number of channels assigned (channel bandwidth where available is in brackets)	Comments
0.325-0.405	Radio navigation – aeronautical	Radio navigation	1	
0.525-1.610	Broadcasting	AM radio	1 (9 kHz)	There are 3 applications for additional frequencies
2.5-26.2	Various Fixed bands	Emergency beacons	13	Uncertain whether any of these assignments are active
76-88	Broadcasting – TV	TV	0	Channel 5 (76-82MHz) is registered at the ITU. Interest in running digital TV from local channel providers
88-108	Broadcasting – Radio	FM Radio	7 (200kHz)	There are 6 applications for additional frequencies.
108-117	Aeronautical Radio navigation	Aeronautical Radio navigation	0	International band

[10] Title 47, Code of Federal Regulations, Part 15 Radio Frequency Devices, Section 15.245

[11] One interviewee noted that they experienced interference when they tried to deploy spread spectrum equipment in this band.

Frequency range (MHz)	ITU Region 2 Primary Allocation	VI use	Number of channels assigned (channel bandwidth where available is in brackets)	Comments
117-137	Aeronautical Mobile	VHF communications	9 (25 kHz)	International band
138-144	Mobile, Fixed, Radiolocation	Land mobile	10 (25 kHz)	Mix of government and commercial users UK band plan is 138-174 MHz & US band is 150-174 MHz[12]
144-146	Amateur	Land mobile	2 (25 kHz)	
146-148	Amateur	Land mobile	1 (25 kHz)	Fire service
148-174	Fixed, Mobile (some maritime mobile)	Land mobile	~180 (25 kHz)	Mix of government and commercial users Likely some assignments are not used.
174-216	Broadcasting - TV	None	0	
216-400	Fixed, Mobile, some Satellite bands	None	0	
400-406	Meteorology, Space, earth exploration	None	0	
406-410	Fixed, Mobile	None	0	
410-430	Fixed, Mobile	None	0	
430-440	Radiolocation	None	0	
440-450	Fixed, mobile,	Land mobile	24 (25 kHz)	All simplex 25 kHz channels
450-470	Fixed, mobile	Land mobile	41(25 kHz)	Mix of simplex and duplex 25 kHz channels US band is 453-512 MHz
470-512	Broadcasting	Land mobile	2 (25 kHz)	
512-698	Broadcasting – TV	None		
698-806	Broadcasting Mobile	None		In the US this band is used for LTE mobile services as well as TV broadcasting
806-890	Fixed, Mobile, Broadcasting	Vsat/fixed link Cellular Mobile	2 VSAT 2 cellular operators assigned blocks for GSM850	GSM850 services are assigned 2x23 MHz in the band 824-892 MHz No vacant GSM850 frequencies

[12] http://www.gpo.gov/fdsys/pkg/CFR-2009-title47-vol5/pdf/CFR-2009-title47-vol5-part90.pdf

Frequency range (MHz)	ITU Region 2 Primary Allocation	VI use	Number of channels assigned (channel bandwidth where available is in brackets)	Comments
890-902	Mobile	Cellular mobile	2 cellular operators assigned blocks	GSM850 & GSM900 services occupy the entire band.
902-928	Fixed (ISM band)	Cellular mobile	1 cellular operator assigned a block	GSM900 in 902-915 MHz. No vacant GSM 900 frequencies
928-960	Fixed, Mobile	Cellular mobile	1 cellular operator assigned a block	GSM900 in 937-960 MHz. No vacant GSM900 frequencies
960-1215	Aeronautical Radio navigation	Aeronautical Radio navigation	None	Internationally harmonised band
1215-1429	Earth exploration, radio navigation, Satellite, Space research	None	None	
1429-1452	Fixed, Mobile	Fixed	1	
1452-1492	Fixed, Mobile Broadcasting	Fixed	9	LIME links
1492-1525	Fixed, Mobile	Fixed	7	LIME links
1525-1710	Various bands for mobile satellite, radio astronomy, meteorology etc	None		
1710-1990	Fixed, Mobile	Cellular mobile, Fixed links	30 MHz assigned for GSM1800; 90 MHz assigned for GSM1900 5 fixed link assignments	GSM1800, GSM1900, some fixed links
1990-2500	Fixed, Mobile and some satellite and space allocations	Fixed links ISM band	25 fixed link assignments	Fixed links Wi-Fi at 2.4 GHz
2500-2690	Fixed, mobile	Fixed, Mobile	10 frequencies assigned (total of 33 MHz)	Assignment to CCT for WiMAX[13]
2690-2700	Earth exploration, space research, radio astronomy	None		

[13] The frequencies assigned are temporary at present.

Frequency range (MHz)	ITU Region 2 Primary Allocation	VI use	Number of channels assigned (channel bandwidth where available is in brackets)	Comments
2700-3400	Radiolocation	Radiolocation		Internationally harmonised band
3400-3800	Fixed, Fixed satellite	Fixed		
3800-4200	Fixed, Fixed satellite	Fixed satellite	1	
.....				No allocations
5725-5850	Licence exempt/ISM	Licence exempt[14]/ISM		Fixed links in this band
5925-8400	Fixed, Fixed satellite; meteorology, space exploration	Fixed	32	Numerous fixed links. Note US band at these frequencies only covers 6525-6875 MHz[15].
.....				No allocations
10,700-11,700	Fixed, Fixed satellite, Mobile	Fixed	8	Numerous links Aligns with US fixed microwave band.
.....				No allocations
14,000 – 14,500	Fixed, Fixed satellite	Fixed link	1	Link assigned for outside broadcast use.

4.6. Currently there is no separate policy in respect of band plans and rules about guard bands and power limits. The situation in the VI is that:

- Blocks of spectrum are assigned to mobile operators and they generally follow the internationally harmonised band plan.
- For broadcasting, the VI has specific frequencies registered at the ITU and as such follows the internationally agreed band plan for Region 2.
- Aeronautical and maritime frequencies are in internationally harmonised bands and frequency use follows the international plans in each case.
- For land mobile a spacing of 25 kHz has been chosen.
- No specific band plan has been applied to the fixed link or fixed satellite bands.

[14] The status of licence exempt bands is discussed further below.

[15] http://wireless.fcc.gov/cgi-bin/wtbbye.pl?http://www.gpo.gov/fdsys/pkg/CFR-2009-title47-vol5/pdf/CFR-2009-title47-vol5-part101.pdf

Issues

4.7. In relation to allocation of spectrum the TRC has identified the following major needs to be addressed:

- Establishing an allocation policy including an approach to dealing with conflicts between Region 1 and Region 2 allocations;
- Developing a NFAT;
- Strengthening bilateral discussions required for international co-ordination with neighbours (especially the US).

4.8. The main allocation issues raised by stakeholders concerned the release of additional bands as well as currently unassigned and/or re-assigned frequencies within bands already used to meet their future spectrum demands. These issues are addressed in Sections 3 and 4 of this document under the discussion of specific services.

Allocation policy

4.9. In respect of the high level allocation policy, the TRC considers that given the VI's location there should be a presumption that allocations will follow the Region 2 plan unless there are overriding economic or social reasons to do otherwise. For example, there are good economic reasons to adopt Region 1 allocations for mobile services in addition to Region 2 allocations so as to be able to provide services for tourists and other visitors from Europe. In adopting this view it must be recognised that there is a cost, namely that equipment made for the Region 2 allocation will not always be able to be used in the VI without the risk of interference (e.g. equipment made for the 902-928 MHz licence exempt band in Region 2). Hence the benefits of deviating from the Region 2 allocations need to be weighed against the potential costs and ways of circumventing any problems identified.

4.10. ***RSM1: The TRC proposes that given its location in Region 2 and the proximity of the US the VI should follow Region 2 allocations unless it is in the Territory's economic or social interest to do otherwise.*** For example, occasionally an allocation from another Region (usually Region 1) may better serve the local market as has been the case in the mobile bands.

4.11. The main other need related to allocations is a need to develop a NFAT. ***RSM2: The TRC will prepare an NFAT. Initially this work will be focused on the main bands allocated to cellular mobile and wireless broadband access services. Other bands will be classified in the NFAT in due course.***

Question 1: Do you agree with the TRC's proposal to follow Region 2 allocations unless it is in the territory's interest to do otherwise?

Question 2: Do you agree that the TRC should first concentrate on bands allocated to cellular mobile and wireless broadband access services when developing a NFAT?

Operator Responses

4.12. All three respondents agreed with proposal RSM1. CCT emphasised the need to continue with both Region 1 and 2 allocations in future as needed. LIME and Digicel agreed that work on the NFAT should focus on bands allocated to cellular and wireless broadband services, and emphasised that release of spectrum for these services should not wait until completion of the entire NFAT. CCT disagreed with

this proposal and suggested that "the TRC should first concentrate on the assignment of bands for new services".

TRC Response

4.13. The TRC would like to clarify that

- It will continue with both Region 1 and 2 allocations in future where this best serves the interests of the VI
- The proposed work on the NFAT for bands that will be allocated to cellular and wireless broadband services will build on the frequency specific analysis given in this statement and is a necessary prerequisite to identifying the frequencies and band plans that will be released in future for cellular and wireless broadband services.

The TRC therefore proposes to adopt RSM1 and RSM2.

Band plans

4.14. Once the allocated use of bands is clear it is necessary to specify technical parameters for use of those bands. These include not only the permitted emission levels but also in some cases the relevant channel plans.[16] It will generally be the case that the VI will be able to use the same plan as that in the US/Europe (if following a US/European allocation).

4.15. RSM3: The TRC will determine the key technical parameters governing use of bands in the NFAT including where appropriate the relevant US/European/Asian band plan where the choice depends largely on the respective regional allocation being adopted. Priority will be given to the main bands allocated to cellular mobile and wireless access services.

Question 3: Do you have a view on the band plans that should be adopted in specific frequency bands?

Operator Responses

4.16. The operators made the following points:

- CCT responded that "band plans should not disturb the existing networks which are functioning without issues".
- Digicel supported the use of the US Band Plan for 700 MHz
- LIME did not provide a specific view on band plans but noted that "they should be put in place".

TRC Response

4.17. The TRC's proposals for specific band plans are given in Section 13. It should be noted these will not result in impacts on existing networks.

[16] While in Europe there was an aspiration to rely only on a set of parameters that described the emissions into neighbouring frequencies/areas (i.e. masks) but this has not proved feasible on its own, in the sense that it can lead in inefficient spectrum use (because channel size affects these emissions). See for example, CEPT Report 19, October 2008.

Licence exempt allocations

4.18. So far no bands have been designated as licence exempt under Regulations. There are numerous such bands in the US, Europe and other regions and the most important of these are:

- 902-928 MHz which is used for amongst other things RFIDs[17] and other point to point (ptp) and point to multipoint (ptmp) systems
- 2400-2483.5 MHz, 5170-5330 MHz, 5470-5725 MHz and 5725-5850 MHz used for Wi-Fi and other point to point and point to multipoint systems

4.19. The 908-925 MHz band overlaps with the GSM900 bands. This is also the case in other countries that have deployed cellular mobile services in both the 850 MHz and 900 MHz e.g. Australia, Hong Kong. In these countries the approach has been to restrict the licence exempt use to a subset of the US band – for example, 918-926 MHz in Australia[18] and 915-925 MHz in Hong Kong[19].

4.20. CB radio use at 27 MHz is now licence exempt in the US and the UK. This has the obvious benefits of reducing costs to users and the regulator with no recognized consumer downsides and so should be implemented in the VI.

4.21. In future additional bands may need to be designated as licence exempt as new applications are developed (e.g. there is work being undertaken on new medical applications for which the US has proposed a number of frequency bands[20]).

4.22. RSM4: The TRC proposes as far as possible to harmonise with the US allocations for licence exempt use as set out in the provisions of the Code of Federal Regulations 47 Part 15.[21] Where conflicts with the US allocations occur, the TRC will look to precedents in other countries that use a mix of Region 1 and Region 2 allocations, such as other countries in the Caribbean or in Asia. In the specific case of the 902-928 MHz licence exempt band, it is proposed to adopt a narrower frequency range e.g. 916-928 MHz as this has been found to be adequate in other countries such as Hong Kong and Australia. CB radio use is proposed to be made licence exempt in the VI.

Question 4: Do you have any comments on the TRC's proposals for harmonisation of licence exempt allocations and for making CB radio licence exempt?

Operator Responses

4.23. LIME has no objection to the TRC's approach and Digicel has no comments. CCT noted that the TRC should take account of any possible impacts of the 916-928 MHz exemption on other use in the 900 MHz range.

TRC Response

4.24. As TRC has already noted the 916-928 MHz allocation has been found to work well in other countries such as Australia and Hong Kong where there are cellular services at 900 MHz. TRC therefore proposes to adopt RSM4.

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[17] RFID: Radio Frequency Identification – a system that uses wireless communication to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking

[18] Note AUS 32 of the Australian National Frequency Allocation Table http://www.acma.gov.au/WEB/STANDARD/pc=PC_2713

[19] Note J of the Hong Kong Frequency Allocation Table, http://www.ofta.gov.hk/en/freq-spec/FreqTable.pdf

[20] http://mobihealthnews.com/3078/fcc-proposes-rules-for-body-area-networks-mban/US WMTS at 608-614, 1395-1400 and1427-1432. ; http://www.cs.wright.edu/~mote-network/files/ban-single-space.pdf

[21] The analogous European regulation is ERC Recommendation 70-03, Relating to the use of Short Range Devices (SRD), http://www.ero.dk/documentation/docs/docfiles.asp?docid=1622&wd=N

Co-ordination

4.25. One issue that was frequently mentioned by stakeholders was the need to co-ordinate allocations and assignments with the US, so as to avoid harmful interference. This could be assisted by periodic engagement with FCC officials on an informal basis.

4.26. ***RSM5: The TRC will seek to initiate a regular dialogue with FCC representatives in the region to address co-ordination of spectrum use, unintentional international roaming (when a VI mobile customer "locks onto" a strong signal from a base station in the US VI and vice versa) and any other issues as they arise.***

Question 5: Are there any specific issues you think should be raised in the proposed discussions with the FCC?

Operator Responses

4.27. CCT and LIME suggested that TRC should raise issues concerning the very detrimental effect of high power cellular and WiMAX signals coming from the US VI. In addition CCT noted the need for co-ordination in the relevant bands and emission agreements for mobile and broadband carriers trying to offer cross border carriage.

TRC Response

4.28. The TRC will raise these issues when it meets with the FCC.

5. Assignment policy

a) Current situation

5.1. To date frequencies have been assigned using a first come, first served (FCFS) approach. This approach works well when there is no shortage of spectrum because all needs can be met. If a spectrum band is or is likely to become congested (i.e. demand exceeds available supply) then competitive processes (such as auctions or tenders) can yield better outcomes than FCFS in the sense that spectrum is more likely to be awarded to those that value it the most or can deliver most benefit to the community. Competitive approaches, if well conducted, may also be regarded as fairer (i.e. less discriminatory) and more likely to promote competition in telecommunications service markets.

5.2. The assignment of frequencies to mobile services was determined through the liberalisation process. In particular a study concluded that the market could support four operators. Licences were awarded directly (without a price for the spectrum though all operators pay a revenue royalty) to LIME, CCT and Digicel, though in some bands spectrum has been reserved for a fourth operator. Spectrum for mobile and wireless broadband services has been directly assigned to the three operators without specific coverage or usage obligations. Some allocations that were initially given to CCT were transferred to LIME, but those early and especially first to the market tend to have the largest and most desirable frequency allocations. This is seen by the new entrants as giving some operators an undue competitive advantage. The fact that the spectrum has been assigned at no cost compounds the problem as the incumbent operator has no incentive to give up unused spectrum.

5.3. The Act anticipates that the Spectrum Plan shall set out the procedures for assigning spectrum and states (Section 34) that these procedures may include:

- By auction
- By tender
- At a fixed price
- On a first come first served basis or
- On other stated criteria.

5.4. Applications for authorisations are to be determined on an objective, transparent and non-discriminatory basis (Section 19). If they are refused the applicant is to be notified in writing, with the TRC giving reasons for refusal (Section 19 (6)). These provisions of the Act have not yet been developed into detailed procedures.

b) Issues

5.5. It is important to have a clear assignment policy covering all frequency bands. In particular there is a need for a policy to assign frequencies in bands where there is competing demand for spectrum i.e. in bands assigned for cellular mobile and possibly also in the AM and FM radio bands.

5.6. The pros and cons of different assignment approaches (building on the candidates listed in the Act) are given in Table 2-2. The fixed price option is interpreted to mean direct award to an applicant at a given price. Note that for any of the competitive processes (tender or auction) there will be a pre-qualification phase to ensure that only eligible bidders compete for the licence.

Approach in bands used by private services

5.7. First come first served is generally used for assigning spectrum used for private applications (e.g. fixed links, land mobile radio) as demand appears intermittently over time and is often for small amounts of spectrum (e.g. one 2x25 kHz channel), meaning that competitions are often not practical and/or are too costly to run given the requirement. If congestion is unlikely and there are no other policy considerations, then first come first served with fees at levels that recover spectrum management costs should be applied. If congestion is thought likely to occur in future then licence fees should be set at a higher level to reflect the opportunity cost of the spectrum.

5.8. Other ways to reduce congestion such as making assignments on a localised basis should be explored where feasible and if frequencies become less plentiful. Implementation of this approach requires the use of planning tools. TRC does not have these tools at present and current usage would not appear to warrant them in the near term.

Approach in bands used for telecommunications and broadcasting services

5.9. For spectrum used to provide public services – broadcasting, cellular mobile, wireless broadband - competitive assignment processes are typically used to provide an objective and fair basis for awarding spectrum.

5.10. As indicated in Table 2-2, the choice is between auctions and some form of comparative tender.

Table 2-2: Pros and cons of different assignment processes

Approach	Advantages	Disadvantages
FCFS with or without fixed price	Simple to administer Works well when supply is plentiful	Cannot deal with situation where demand exceeds supply, unless price is set to ration demand May be inefficient as first comer may not be highest value user of the spectrum May lead to distortions in competition Opaque in the sense that competitors may not know applications are being made and assignments granted though this concern can be addressed by publishing this information
Auction	Transparent - there is a single criterion for award. Efficient – awards to those who value spectrum most Delivers good outcomes for consumers Can be simple or complex to administer depending on design – simple sealed bid auctions have lower cost than multi-round and combinatorial auctions. Can get spectrum to market quickly Revenue for government	Can be difficult to take account of qualitative factors, though some can be built into qualification criteria and licence conditions Can be complex to administer – depends on the design May lead to concentrations of spectrum to those with most money but this concern can be addressed through spectrum caps/reservations
Comparative tender – with or without a fixed price plus qualitative criteria	Allows non-financial aspects to be taken into account Administrative costs similar to or more than those of a simple auction If a price is applied, this can help incentivise efficient use and ensure spectrum goes to those who value it most as well as generate revenue for government	Tender results may be contested as there is an inevitable element of subjectivity in evaluating quality of the bids. This problem may be somewhat mitigated by introducing quantitative elements to the bid e.g. coverage, price to customers, but these may not be easy to enforce if tenderers over bid[22]. Can be inefficient – award to those who promise most with no assurance of delivery. Strong enforcement of non-price criteria required to address this issue (e.g. through bonds) Setting an appropriate fixed price may not be straightforward.
Direct assignment with or without a fixed price	Simple to administer Price could encourage more efficient use of spectrum Revenue for government	May be seen as discriminatory or unfair depending on criteria for deciding who is awarded spectrum Setting an appropriate fixed price may not be straightforward.

[22] This issue is less likely to arise with pre-qualification requirements as these are usually set at levels that most licensees in the market can achieve.

c) General considerations

5.11. Well designed and transparent auctions and competitive tenders can both work well in terms of assigning spectrum relatively quickly with low administrative costs, facilitating competition and delivering service coverage and quality objectives. It is sometimes alleged that auctions raise prices and reduce service delivery, but academic analysis shows that this is not the case.[23]

5.12. Auctions have been found to be more efficient, transparent and timely than comparative tenders[24]. They also work better than comparative tenders when small blocks of "spare" spectrum in mobile bands are released, for the simple reason that there is often no basis for a comparative process. It is for all these reasons that auctions have been adopted to assign spectrum for a wide range of frequency bands in many countries around the world. Examples in the region are US VI licences as part of wider US auctions for numerous bands, Trinidad and Tobago (700MHz, 1900 MHz, 2.3 GHz, 2.5 GHz), Honduras (1900 MHz), Panama (1900 MHz) and a proposed auction in the Bahamas (700 MHz). In Europe, auctions have been used in numerous countries (e.g. in Austria, Bulgaria, Czech Republic, Denmark, Germany, Ireland, Italy, Netherlands, Norway, Sweden, UK) and are now used or proposed in countries that have historically used a tender approach e.g. Belgium, Finland, France, Spain, Switzerland and Portugal for 800 MHz and 2.6 GHz bands.

5.13. However, the choice between an auction and a comparative tender depends on the relative importance of achieving the following objectives:

- Achieving efficient spectrum use – this suggests use of a price mechanism such as an auction or a tender with a price
- Ensuring that spectrum makes a contribution to the public finances – this suggests use of a price mechanism such as an auction or a tender with a price
- Achieving coverage and service quality objectives e.g. for broadband services – this suggest a tender or an auction with minimum coverage and service requirements. The obligations may impose additional costs on the operators and so requirements would need to be written into licences to help ensure they are met. This can be aided by the use of financial incentives and penalties, such as forfeitable performance bonds or fines if the licensee does not meet its licence obligations.
- Promoting competition – this may be facilitated by an auction with caps on the amounts a single operator can buy.
- Administrative simplicity and speed – the simplest approach is direct award on an equal basis to incumbent operators. Relatively simple auctions and competitive tenders can also be designed, so long as the spectrum is pre-packaged and the criteria used in the tender are easy to assess.
- The balance between achieving these objectives will vary from case to case so some flexibility in approach needs to be preserved.

5.14. A compromise position is given by a tender including both price and social objectives. There are several ways this could be implemented:

[23] Does spectrum auctioning harm consumers? Lessons from 3G licensing, M Park, SW Lee and YJ Choi, Information Economics and Policy, forthcoming 2011.

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

- Bid both price and approach to meeting service related objectives. This would require making transparent in advance how the two aspects of the bid would be counted. For example, they could each have different weights and the values added together or service related bids could be given a multiplier value which would be applied to the money bid. The latter approach was used in the recent award of a fourth 3G licence of 2x5 MHz of 2.1 GHz spectrum in France[25].
- Set a price and only ask for bids for service related objectives. The difficulty is in setting the right price as benchmarks from elsewhere may be unreliable. The French experience here is also instructive. The Government repeatedly set the price too high and so it took over 9 years to tender the fourth 3G licence.

5.15. If service quality is not expected to be a major differentiator and all bidders are expected to meet thresholds in terms of their business plan and technical offering, then the only feasible option (apart from direct award and lotteries[26]) is to auction the spectrum. This conclusion may also apply if small blocks of spectrum are being released for an existing service (e.g. remaining blocks in bands that are already used), as in this instance it is unlikely to be practical to attach coverage and other such variable obligations to the spectrum being released.

d) Application to the VI

5.16. The key considerations in the VI are as follows:

- The liberalisation policy for accommodating up to four mobile operators
- Promoting competition between the three existing wireless operators
- Need to ensure coverage of mobile/wireless broadband services to at least the four main islands and to foster local radio and TV services
- Uncertainty over the appropriate price for spectrum and/or the level of service related obligations that the market might be able to support whilst still remaining competitive
- Spectrum policy objectives in respect of promoting efficiency and making a contribution to the public finances given in the Telecommunications Liberalisation Policy 2006 (para 8.11.2).
- The need to keep the process simple and low cost for government and bidders, given the small size of the market and the lack of local experience in running competitive processes.

5.17. In the case of spectrum used for mobile or wireless broadband where competition for licences is anticipated the TRC plans to adopt the following approach:

- The spectrum packages offered are decided by TRC based on views expressed to it by industry.
- The TRC pre-specifies the minimum mandatory service obligations (e.g. coverage, site sharing and any other criteria all bidders should meet) and bidders are asked to make offers above these minima.

[25] http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1278&tx_gsactualite_pi1[annee]=&tx_gsactualite_pi1[theme]=&tx_gsactualite_pi1[motscle]=&tx_gsactualite_pi1[backID]=26&cHash=360be91214

[26] Lotteries were used in the US but were not considered successful. There were thousands of applications and winners often on-sold licences at considerable profit without adding any value.

- Bidders are also asked for money bids. The TRC specifies how the money bids and bids in respect of service obligations will be assessed.

5.18. For broadcasting services, service characteristics are likely to be of overwhelming importance in which case a comparative tender with a minimal price would be more appropriate than a tender involving both price and service characteristics.

- Possible criteria for licence tenders or thresholds for an auction include some or all of the following:
- Financial and technical capability and resources of the bidder are shown to be sufficient to run a successful business
- Minimising the environmental intrusion of infrastructure
- Credibility of the business plan and related to this whether the bidder demonstrates a good understanding of the market (e.g. audience preferences, willingness to pay for services)
- Impact on competition
- In the case of broadcasting, uniqueness of the proposed services and the amount of original content
- Geographic coverage of the services (indoor and outdoor)
- Service quality e.g. in the case of broadband services this could be indicated by planned maximum download and upload speeds and any minimum or guaranteed speed that might be offered
- The applicant is a belonger or a belonger company and of good standing

5.19. RSM6: The TRC proposes to adopt the following assignment policy:

- ***Where spectrum congestion is unlikely and/or demand for assignments occurs intermittently and is for small amounts of spectrum a first come first served approach (possibly with a fixed fee) is used to assign spectrum.***
- ***Where congestion is likely and spectrum is used to deliver services to the general public, use of a simple (e.g. sealed bid) auction possibly also with bids on service aspects (and a minimum level of service obligations) where the TRC will determine the relative weighting given to money bids and service attributes.***
- ***Where congestion is likely but competitive award processes are not necessary or feasible (e.g. where entry is unlikely) or could cause significant disruption (e.g. at the end of the licence term for mobile, broadcasting and BWA services) then direct award with a fixed fee will be considered.***

Question 6: Do you have any comments on the TRC's proposed assignment policy?

Operator responses

5.20. The operators made the following very different responses in respect of TRC's proposals for assignment of new frequencies:

- CCT suggested that existing operators should have priority in the assignment of new frequencies and if they were not interested then frequencies should be assigned to new operators on a first come, first served basis.

- Digicel was opposed to a sealed bid auction, on the grounds that this would result in high prices for spectrum, but favoured a process involving a pre-qualification stage and then a beauty contest with the allocation of spectrum at a price that recovers the cost of administering the spectrum
- LIME did not object to TRC's assignment policy but stated that "much of the detail" needed to be articulated more clearly by the TRC.

Digicel also noted that existing licences should be renewed "on request at the end of the licence period, unless there is an imbalance of spectrum between direct competitors".

TRC Response

5.21. The TRC has taken account of the operators' responses and proposes to adopt a flexible policy that allows it to determine the method of assignment on a case by case basis, taking account of demand for licences, overall public policy objectives and any costs of disruption to existing licensees or impacts on final consumers.

For example, where there is competition between applicants for a specific block of spectrum then a competitive process (e.g. auction or beauty contest) may be adopted. However, in cases where demand does not exceed supply or where a competitive process may be disruptive (e.g. at licence renewal) then the TRC is likely to assign licences on a first come first served or direct award basis.

6. Licensing

a) Current situation

Who is licensed?

6.1. The Act provides for all radio frequency use to be authorised (Section 19 (1)) except in the case of Crown bodies or if specifically exempted under Regulations (Section 19 (10)). Some UK public bodies (in particular some Government Departments) are Crown bodies.[27] The main upshot of this is that the TRC has no right to licence their spectrum use in the VI. Crown bodies are also exempt from licensing in the UK but under the Communications Act 2003 Ofcom may issue a "licence like" authorisation – termed Recognised Spectrum Access (RSA) – to give Crown bodies certainty over their spectrum rights and also so that these rights may be traded[28].

6.2. In the VI no Regulations designating bands as licence exempt have been made so far.

6.3. Many users of spectrum are licensed under the Licences and Fees Order July 1977 (under the 1951 Telecommunications Act) and generally have an annual duration and are typically renewed on payment of licence fees. Some but not all public sector spectrum use is licensed.

6.4. Access to spectrum for cellular mobile operators is given by their unitary licences, where Annex 6 specifies (often in general terms) the frequencies they are entitled to use, i.e. there is no separate authorisation for frequency use. Annex 6 of some unitary licences does not explicitly identify which frequencies a licence holder has access to but rather simply says access to the 850/900 MHz and 1800/1900 MHz bands should be granted to four licensees.

[27] Not all public bodies are Crown bodies. A list of Crown bodies is given at: http://www.opsi.gov.uk/advice/crown-copyright/uk-crown-bodies.htm.

[28] This is discussed in Spectrum Framework Review for the Public Sector, Ofcom, January 2008 http://stakeholders.ofcom.org.uk/binaries/consultations/sfrps/statement/statement.pdf

Data on licensed and other use

6.5. Government users are expected to apply to TRC for access to radio frequencies and where applications are granted this use is recorded in the assignment spreadsheet. However, in practice not all government use has been captured in this way yet.

6.6. Monitoring equipment has been purchased. This equipment will be used for undertaking a spectrum audit and for investigating interference complaints. This TRC is in the process of making arrangements for installation of the equipment. Currently the TRC uses a hand-held spectrum analyser.

Tradability

6.7. Authorisations may be transferred to third parties subject to the TRC's approval (Section 20 of the Act). The TRC has not so far had any applications for spectrum trades, though the spectrum is in principle tradable.

Licence renewal, revocation or suspension

6.8. Licences or authorisations may be amended where this is necessary to meet the objectives of the Act or to serve the public interest or where occasioned by force majeure, national security considerations, changes to national legislation or the implementation of international obligations (Section 23). Before amending a licence the TRC must give the licensee adequate advance notice in writing (at least 90 days) and the licensee may make a written statement of objections.

6.9. The Act also sets out the process for licence renewal (or not) (Section 24) and licence suspension or termination (Sections 35 and 76). In the case of public suppliers whose licences are not going to be renewed the TRC must give at least 3 years notice before the licence expires. A process which allows written objections to the TRC's proposal is set out in the Act.

6.10. Where licences are terminated because a frequency band is being reallocated the TRC must take account of the matters listed in Section 36 of the Act[29]. Under Section 76 licences may be terminated or suspended if the licensee has failed to commence or ceased to carry on the business for which the licence was authorised. Licences may be suspended if the licensee is in breach of its licence conditions such that enforcement action could be taken by the TRC. The Act sets out the process for termination or suspension of licences requiring at least 90 days notice and allowing the licensee to present its views including a written statement of objections. The TRC has not yet applied these procedures.

b) Issues

6.11. There is a need to complete and verify a record of frequency authorisations and/or use in the case of government users to assist with interference management and spectrum coordination and to ensure comprehensive spectrum management.

6.12. RSM7: The TRC will complete and verify a database of assignments. This will involve a range of actions including:

- ***Auditing the data in the assignment spreadsheet by checking the assignments against the licence records, contacting the recorded licensee to check whether the information held by TRC is correct and gathering further information where this is missing***

[29] Namely the objectives of the Act, the impact of the spectrum plan on existing and future use, the efficient use of spectrum, applicable regional or international agreements, standards and arrangements, and other relevant matters.

- ***Visiting the sites where equipment is recorded as being located to check whether systems are operational or not, and to determine whether other systems are operating at these sites***
- ***Adding to the licence database known assignments from data contained in licences.***
- ***Collecting and adding technical details relevant to the assignment and licence identifiers (licence number and licensee number) to the database. At a minimum the technical details will include the frequency range assigned, the power and location of transmitters.***
- ***Collecting information from all government users on their current spectrum use (including technical characteristics) with a view to both recording and licensing this use.***
- ***When the fixed station monitoring system is installed, using this together with the handheld analyser to check whether use of particular bands corresponds to that expected from the database and if not to investigate any anomalies.***

6.13. This is a substantial task, and priority bands for starting the audit are discussed in the Action Plan.

6.14. The TRC will need a frequency licensing database in which the licence data can be recorded. There are a number of vendors of such systems, and the TRC has started looking at possible options. Ideally the licensing system would generate licences and invoices and there would be an interface that would allow TRC to crosscheck the information against any monitoring data collected. ***RSM8: The TRC plans to acquire frequency licence database software.***

6.15. All spectrum use that is not specifically exempted should be licensed or authorised.

6.16. ***RSM9: The TRC proposes to issue authorisations for all government use of spectrum so that all spectrum bands can be managed effectively and users' rights are clear.*** This appears to be the intent of the Telecommunications Act which only exempts UK Crown bodies. At present use of spectrum by UK Crown Bodies (e.g. the Royal Navy) is managed through informal co-ordination. This is effective and will be continued.

6.17. RSM10: In the case of unitary licence holders there is a need to formalise the recording of their spectrum access rights. Two ways this could be done are:

- ***Option 1: Attaching a schedule to the unitary licence that records the details of all spectrum assigned to the operators and technical limitations on the use of that spectrum***
- ***Option 2: Specifically authorising the use of the spectrum through a frequency authorisation as is anticipated in the Act.***

The second approach has advantages in terms of providing greater clarity over the rights of unitary licence holders. The TRC plans to adopt the second approach.

6.18. The second approach could make spectrum trading simpler as it is clear that it is the frequency authorisation that changes hands and not part of the unitary licence. Providing the option of trading involves relatively little cost – an administrative procedure – it has the potential to offer the benefits of more efficient spectrum allocation between users and reduced regulatory intervention in managing the balance of spectrum holdings between different users. It is for this reason that the European Union, the US and a number of other countries have put in place regulatory arrangements to allow trading to occur.[30]

[30] Enabling Efficient Wireless Communications: The Role of Secondary Spectrum Markets, Mayo and Wallsten, June 2009; Selling the airwaves – spectrum trading in practice, http://www.sunriseconsultants.com/spectrum.html

6.19. In the VI trades are permitted subject to the TRC's consent. There would be benefits to specifying a process for giving or refusing consent to trades. This would require the TRC to specify:

- The information to be provided. For example, the names and contact details for the parties to the trade and details of the spectrum to be traded (e.g. frequencies, geographic coverage, authorisation number). If an authorisation is only part traded — a description of that part is required (latitude, longitude, upper and lower frequencies).
- The timescales for giving approval or not.
- The conditions under which approvals might not be granted.

6.20. In other jurisdictions only trades that are likely to give rise to competition concerns (e.g. changes in spectrum holdings between mobile operators) involve long approval processes. Otherwise short processes apply.

6.21. Spectrum trading needs a complete record of spectrum assignments. This record or register provides the definitive statement of the entitlements of different parties. As a first step all the assignments to mobile operators will be recorded in frequency authorisations and once this is been completed these frequencies would be made tradable subject to a review of any competition concerns.

6.22. RSM11: The TRC does not propose to implement a comprehensive framework for spectrum trading at present. This issue will be reviewed once the TRC has completed a frequency licence database. In the short term the TRC will 1) ensure assignments to mobile and wireless broadband operators are accurately recorded and 2) indicate the information required and timescales for approving any applications to trade this spectrum.

Question 7: Are there any comments on the TRC's proposals to issue frequency authorisations to government users and unitary licence holders for their spectrum access and to take an incremental approach to spectrum trading?

Operator responses

6.23. Digicel and LIME did not have any objection to the TRC's proposals.

6.24. CCT made the following comments:

- "its existing spectrum authorisations are valid and effective" but if TRC has a different view it should simply confirm the current spectrum authorisation
- Authorisations to government users should be delayed until their potential use of commercial networks is settled.
- Action on trading should be delayed and handled on an individual and mutually agreeable basis.

TRC Response

6.25. The TRC notes that at present operators' access to spectrum is not recorded in frequency authorisations (as given under Section 19 of the Act) and as discussed above there are benefits in providing this clarity. Much of government spectrum use cannot be practically redeployed to commercial networks (e.g. aeronautical and maritime use) and there is a need to regularise the current situation in respect of other uses as it may take some time (if ever) before migration to commercial networks is a practical alternative to the existing situation. As noted the TRC does not plan any immediate action on spectrum trading.

6.26. The TRC proposes to adopt RSM 7-11.

7. Fees

a) Current situation

Fees for spectrum used in private applications and broadcast networks

7.1. The Telecommunications (Licences and Fees) Order (CAP. 171) of July 1977 sets out licence fees that apply to different types of licence, including licences that involve use of radio frequencies. Some of these licences are intended to indicate competency and others authorise use of equipment and radio frequencies. Table 2-3 gives the fees for the different licence categories and also indicates types of licence where no fee applies. The total revenues raised from spectrum fees are estimated to be about $50,000 for 2010/11 as compared with around $2 million expected from the 3% revenue levy on unitary licence holders.

7.2. The key points to observe are:

- No fees are charged for spectrum use by the public sector. Thus the fees below only apply to commercial users in the various categories.
- No fees are paid for access to spectrum for fixed links or fixed satellite services.
- Users of land mobile systems must pay a fee for the transmitting station and each mobile. Charges based on the number of mobiles give no incentive to use spectrum efficiently, because the sums paid are not related to the amount of spectrum assigned.
- Citizens' Band radio is licensed and a fee charged. In many countries this use of spectrum has been deregulated and made licence exempt (e.g. the UK[31] and the US[32]).

Table 2-3: Licence categories and fees in the VI

Licence categories	Annual Licence Fees	Comment
Maritime		
Ship radio communications licence	$30	
Marine Telecommunications Operating Licence A – General	$20	Concerned with competency
Marine Telecommunications Operating Licence B – Restricted	$10	Concerned with competency
Marine Telegraph Operating Licence (first class, second class, special class)	$10 each	Concerned with competency
Aeronautical		

[31] http://stakeholders.ofcom.org.uk/binaries/consultations/exemption/statement/statement.pdf

[32] http://wireless.fcc.gov/services/index.htm?job=service_home&id=cb

Licence categories	Annual Licence Fees	Comment
Aeronautical telecommunications licence (Radio Telephone)	$20	Permits ground to air communications by airlines wishing to communicate with their planes
Aircraft station licence	$30	Licences all radio equipment on board aircraft registered in the VI
Private telecommunications licence	$35	Concerned with competency of the operator of an aeronautical telecommunications licence
Business radio		
Business land station	$35	Licences use of a transmitter
Business mobile station	$35	Paid per mobile used
Business coast station	$35	Licences shore to ship communications by charter operators etc
Amateur	$20 ($15 examination fee)	
Fixed service	0	Not included in the Order
Broadcast – audiovisual and sound	$2,000	
Citizens' Band	$10	

Source: The Telecommunications (Licences and fees) order made July 12, 1977 under Section 6 of the Telecommunications Act.

7.3. The following table compares fees in the VI with those in some other Caribbean countries. This is based on a search of regulators' websites. While in some cases it can be difficult to make a like- for-like comparison with fees in the VI, the main points suggested by the comparison are:

- Other regulators tend to relate fees more closely to spectrum occupied
- Other regulators charge application fees as well as annual fees
- Other regulators set fees for fixed services – links and satellite use
- The rates vary between countries.

Table 2-4: Licence fees in several Caribbean countries ($US)

Licence categories	VI	Bahamas	Barbados	Jamaica	Trinidad & Tobago
Ship radio licence	$30	$30-150	0	$23	$30
Aeronautical telecommunications licence (Radio Telephone)	$20	$300	0	$29	$100
Business radio			Bandwidth less than 1MHz		

Licence categories	VI	Bahamas	Barbados	Jamaica	Trinidad & Tobago
Business land station	$35	$250 per 25kHz	$250/25 KHz Bandwidth>1 MHz $10,000 for first MHz and $250 for each subsequent MHz	$29-260 depending on frequency and power	$8 per 2x1 kHz
Business mobile station	$35	-		-	-
Trunked radio	$35	$390-1300/2x125kHz		$29-260 depending on frequency and power	$8 per 2x1 kHz
Amateur	$20 ($15 examination fee)	$25	0	0	$15
Fixed links	0	Depends on bandwidth $450/50kHz link - $12000/30 MHz link	$250	Depends on bandwidth from $100/MHz	$600 per 2xMHz
Fixed satellite	0	Vsat - $500 Dish > 3m $4500	Formula where basic fee is $250[33]	VSAT is $5,000 Earth station $10,000	$600 per 2x1 MHz
Broadcast – audiovisual and sound	$2,000	$500/200 kHz for FM radio $3000/6MHz TV channel	Not known	$500	$4/kHz for TV and $40/kHz for FM radio
Citizen Band	$10		0	-	$15

Fees for spectrum used in public networks

7.4. All public suppliers, including mobile operators and broadband service licensees, pay 3% of their revenues to the TRC. Because these fees are paid regardless of their spectrum holdings they face no incentive to use spectrum efficiently. However, there is provision for fees for spectrum access to be paid on an annual basis in the unitary licences. The relevant licence condition requires that "such fees shall be reasonable in comparison with international standards and will be applied in a fair and equitable manner to all Operators using the spectrum" (Article 5.3, Unitary Licences).

7.5. To gain some perspective on comparable fees that apply internationally the TRC has gathered information of fees and auction prices paid by mobile operators elsewhere in the Caribbean. Some examples are given in Table 2-5 and Table 2-6 below. As can be seen from Table 2-5 the auction values span a wide range from $0.01-$1/MHz/population (for licences with duration of at least 10 years) which in the VI translates into about $300-30,000/MHz.

[33] See p75 of the Spectrum Handbook, 2006

Table 2-5: Spectrum auction results in Caribbean – lump sum values for licence term

Frequency range	Country	Auction date	Value/MHz/pop	Licence duration
700	Trinidad and Tobago	05-Oct-07	USD 0.0297	10 years
700	Trinidad and Tobago	03-Apr-09	USD 0.0288	10 years
800	Trinidad and Tobago	23-Jun-05	USD 0.1295	10 years
1900	Trinidad and Tobago	23-Jun-05	USD 0.1295	10 years
1900	Honduras	19-Dec-07	USD 0.2676	25 years
1900	Panama	07-May-08	USD 0.8842	20 years
2300	Trinidad and Tobago	03-Apr-09	USD 0.0035	10 years
2500	Trinidad and Tobago	03-Apr-09	USD 0.0346	10 years

Source: Regulator and operator websites

7.6. The information in Table 2-6 shows that annual licence fees tend to be less than $0.1/MHz/pop which in the VI translates to annual fees of $3,000/MHz.

Table 2-6: Annual fees paid by mobile operator by frequency band in the Caribbean

Frequency range	Country	Annual licence fee	Value/MHz/pop
800	Bahamas	BSD 300	USD 0.0321
800	Barbados	BBD 750,000	USD 0.0505
800	Trinidad and Tobago	TTD 542,160	USD 0.0341
800	Turks and Caicos Islands	USD 30,000	USD 0.1275
900	Barbados	BBD 1,500,000	USD 0.0821
900	Trinidad and Tobago	TTD 542,160	USD 0.0341
900	Turks and Caicos Islands	USD 30,000	USD 0.1275
1800	Barbados	BBD 1,500,000	USD 0.0876
1800	Trinidad and Tobago	TTD 542,160	USD 0.0341
1800	Turks and Caicos Islands	USD 40,000	USD 0.1700
1900	Bahamas	BSD 50,000	USD 0.0160
1900	Barbados	BBD 2,250,000	USD 0.0481
1900	Trinidad and Tobago	TTD 542,160	USD 0.0341
1900	Turks and Caicos Islands	USD 78,000	USD 0.6630
2100	Bahamas	BSD 3,000	USD 0.0019
2300	Bahamas	BSD 3,000	USD 0.0019
2500	Bahamas	BSD 800	USD 0.0004
All cellular radio telephone services			

Frequency range	Country	Annual licence fee	Value/MHz/pop
for transmitter operating 5 channels or less per cell site	Jamaica	JMD 1,000,000	NA
for transmitter operating 10 channels or less per cell site	Jamaica	JMD 2,000,000	NA
for transmitter operating more than 10 channels per cell site	Jamaica	JMD 4,000,000	NA
substitute licence	Jamaica	JMD 10,000	NA

Source: Regulator and operator websites

b) Issues

7.7. Stakeholders did not offer any views on the fees currently charged, though the mobile operators indicated that the industry had a limited ability to pay for spectrum and this should be recognised.

7.8. The low level of fees means there is no financial incentive for efficient spectrum use. Furthermore spectrum fees do not cover the TRC's costs of managing the spectrum.

7.9. The issues to be considered are:

- Should spectrum fees be applied where there are none at present i.e. for spectrum used by Unitary Licence holders, government users and fixed service users?
- Should spectrum fee levels be changed? If so what should be basis of any changes?

Should fees be applied to all users?

7.10. If frequencies are available at no cost users have incentives to request spectrum assignments even when they are not necessarily needed, to hoard spectrum already assigned (and thereby exclude other competitors and possibly more effective users who might be able to generate more value from access to the resource) and to use lobbying or similar methods to get spectrum reassigned to them from other users. While in principle hoarding might be controlled by monitoring the extent of spectrum use and revoking licences where they are not used, this is a resource intensive and slow approach to managing this issue, as it is never cut and dried what constitutes legitimate "use". The process can be dragged out over a long time through regulatory and legal appeals.

7.11. It is for these reasons that in many countries spectrum fees are applied to commercial users and increasingly to government users. At a minimum these fees are set at levels required to recover the regulator's cost of managing the spectrum. In bands where spectrum is plentiful incentives for efficient use do not need to be as strong as in bands where demand exceeds supply because no user is excluded as a result of inefficient use. However, it is good practice for users to incur at least some cost so they have an incentive to return unused spectrum.

7.12. RSM12: The TRC proposes that all users including government be subject to spectrum fees in the longer term, though the priority at present is to apply fees to commercial users including mobile operators and fixed service users.

How should fees be set?

7.13. The current fees do not relate the fee to the amount of spectrum occupied or the extent of sharing of frequencies. However, this relationship is necessary if users are to have an incentive to keep their demands to the amount of spectrum required for efficient operation.

7.14. RSM13: To provide incentives for efficient frequency use in future spectrum fees should be related to the:

- ***Quantity of spectrum used (i.e. number of kHz or MHz)***
- ***Extent of geographic sharing of the frequencies i.e. discounts are applied where frequencies are shared within the Territory***
- ***Duration of use.***

In aggregate fees will be set at levels that at a minimum recover the TRC's costs of managing the spectrum and at a maximum are equal to the opportunity cost of spectrum.

7.15. To set fees above cost recovery levels in a way that promotes economic efficiency involves determining the opportunity cost of spectrum. This is the value of the opportunity denied to others if a frequency is assigned to a particular user. Market prices reflect opportunity costs. To mimic market prices through the setting of administratively determined prices involves a considerable effort in terms of modelling based on an assessment of how users value access to spectrum. In the UK this approach has been applied since 1998 – the resulting prices are termed administrative incentive pricing (AIP)[34]. The Australian[35] and the Hong Kong regulators[36] are considering a similar approach, and numerous other regulators seek to apply fees above cost recovery levels to incentivise efficient use, though the basis for these fees is often rather opaque.

7.16. In view of the relatively plentiful supply of spectrum in the VI fees above cost recovery levels may only be justified in bands harmonised for mobile, fixed broadband and possibly also AM and FM radio services, as this is where there is most competition for licences. Setting fees based on opportunity cost is a resource intensive activity. To keep TRC's workload manageable these fees could be set based on benchmarks from around the region, adjusted for population and cost of living (for example via the Purchasing Power Parity exchange rate), subject to a minimum level required to recover TRC's spectrum management costs. If fees are applied to spectrum used by mobile services then TRC might do this on a revenue neutral basis i.e. by reducing the royalty percentage and taking account of any likely immediate change in spectrum use.

7.17. RSM14: To promote efficient spectrum use fees in congested frequency bands should be set based on opportunity cost. Such fees might be set through an auction or administratively. In the latter case the TRC proposes that such fees are based on benchmarks from around the region, adjusted for population and cost of living (for example via the Purchasing Power Parity exchange rate). At a

[34] For an assessment of the policy see "Policy Evaluation Report: AIP", Ofcom, 2009 http://stakeholders.ofcom.org.uk/market-data-research/spectrum-research/policy_report/

[35] http://www.acma.gov.au/WEB/STANDARD/pc=PC_311707

[36] http://www.ofta.gov.hk/en/press_rel/2010/Nov_2010_r2.html

minimum such fees will recover TRC's spectrum management costs. If fees are applied to existing spectrum used by unitary licence holders then the TRC might wish to do this on a revenue neutral basis i.e. by proposing a reduction in the royalty percentage[37] and taking account of any likely immediate change in spectrum use.

7.18. Fees for spectrum used for fixed microwave links might be set at a level to encourage operators to use wired connections to their most important base station sites so services would be more resilient when hurricanes occur. To do this, fees would need to be set so that operators found use of wired infrastructure to be less expensive than installing fixed links. This risks having the effect of discouraging use of fixed links at less important sites and simply raising operators' costs unnecessarily. A more appropriate way forward would be to require operators to have back up of wired communications at key sites and to set cost recovery fees for licences for fixed microwave links.

Question 8: Do you have any comments on the TRC's proposals in respect of applying spectrum fees to all authorised spectrum use and on the proposed basis for setting these fees so as to promote efficient spectrum use (RSM13 and 14)?

Operator responses

7.19. The operators had differing views on fees. Digicel and LIME were broadly supportive of the TRC's approach so long as the changes proposed were revenue neutral. LIME suggested there should be a separate consultation on the detail of the proposals. CCT was strongly opposed to the proposals on the grounds they would have a "huge impact on the financials of the existing operators".

TRC response

7.20. The CCT response does not appear to have taken account of the TRC's proposal for changes to be revenue neutral (i.e. to be offset by a reduction in the royalty percentage). The TRC therefore would not expect there to be a negative initial impact on the operators' financial situation as suggested by CCT. The TRC expects that at a minimum spectrum fees should cover its administrative costs. The TRC will however, consult separately on any new fees proposals.

8. Interference management and enforcement

8.1. Discussions with stakeholders revealed relatively few complaints concerning interference between licensed systems in the VI. Most concerns related to interference that was thought to come from frequency use in the US. As spectrum use in the VI grows interference issues may arise more frequently. To address these issues a monitoring system is needed. Furthermore, co-ordination with local FCC offices in the region needs to be strengthened.

8.2. Harmful interference is avoided through a series of regulatory measures including:

- Specifying the technical conditions that govern the use of different frequency bands, including channel plans and spectrum masks
- Requiring the use of equipment approved in either Europe or the US
- Planning spectrum assignments using engineering tools

[37] Under the Act the royalty percentage can only changed via a Regulation.

- Undertaking investigations and if necessary enforcement action when harmful interference is experienced.

8.3. The TRC has decided to install a fixed monitoring station to support the creation of an accurate licence database and to deal with day to day interference issues. This will be implemented as a matter of priority.

8.4. As the VI is a small territory it uses technical conditions and equipment approved in other jurisdictions (i.e. North America and Europe). The TRC does not have any planning tools though in the past it has investigated the possibility of using SMS4D issued by the ITU. The usefulness of a planning tool is likely to be limited in the short term. However, a planning tool would help with co-ordination with the US (e.g. in the AM and FM frequency bands) and enable more efficient spectrum use. While the plentiful supply of spectrum may suggest there is no pressing need to acquire planning tools they could be required in time as spectrum use grows and the TRC will need to try and reuse frequencies locally.

8.5. RSM15*: The *TRC will proceed with implementing a fixed monitoring system as a matter of priority.

8.6. ***RSM16: The TRC will investigate possible options for procuring a planning tool. This is not an immediate need and will be undertaken after actions to improve the quality of the assignment data are implemented.***

9. Stakeholder interaction

9.1. At present the TRC conducts bi-lateral discussions with users but does not hold regular meetings with all stakeholders. Numerous regulators[38] organise such meetings and/or have stakeholder advisory groups to**:**

- Test out ideas with and inform users of their thinking
- Draw on the expertise of users
- Discuss technical issues for which wider public consultation is not suitable
- Make users aware of each others' concerns – share experiences

9.2. In the course in preparation of this document several productive meetings with groups of stakeholders were held, at which issues of common concern were discussed.

9.3. RSM17: The TRC proposes to hold an annual meeting with all users to update them on its plans in relation to spectrum matters for the year ahead and to discuss current spectrum policy issues in the VI and elsewhere. In addition there could be value in holding occasional meetings with groups of users facing a common issue and/or with shared interests (e.g. Government users) in response to specific issues.

Question 9: Do you see more value in holding user meetings with the TRC on a regular basis or only as the need arises?

[38] For example in Hong Kong the regulator has a radio spectrum advisory committee http://www.ofta.gov.hk/en/ad-comm/rsac/main.html; in Australia similar arrangements apply (see http://www.acma.gov.au/WEB/STANDARD/pc=PC_2701) and in the UK there are stakeholder groups for each main service (see for example the following website for the business radio interest group http://stakeholders.ofcom.org.uk/spectrum/spectrum-industry-groups/business-radio-interest-group/).

Operator responses

9.4. The operators variously suggested meetings on a quarterly, annual and as needed basis.

TRC response

9.5. The TRC proposes to start by putting in place annual meetings.

Meeting spectrum demand – public mobile and wireless broadband

10. Introduction

10.1. This section addresses spectrum issues for cellular mobile and wireless broadband services. The current situation is described and the key issues to be addressed identified. The main focus is on meeting future requirements for spectrum to support fixed and mobile broadband services to meet the goals of stimulating the deployment of affordable widely available fixed and mobile broadband services and in ensuring that every capable operator has access to enough spectrum to operate efficiently.

a) The market

10.2. The key characteristics of the mobile and broadband markets as of 2009[39] were as follows:

- There are three mobile operators and mobile penetration is high at 183%[40].
- 84% of subscribers are prepaid.[41]
- Fixed broadband penetration at 25% of the population and 39% of households[42] is on the low side relative to OECD countries (see Figure 3-1) although high compared to some other Caribbean islands (see Figure 3-2).

10.3. To date no 3G or other broadband mobile systems have been installed in the Virgin Islands. The fastest data rates available are from EDGE technology introduced into GSM systems and EVDO Rev.0 deployed at 850 MHz by the only current CDMA operator CCT.

10.4. Broadband wireless access is offered by CCT in the 2.5 GHz band using WiMAX 802.16d equipment. This fixed service is competitive with the DSL fixed broadband service offered by LIME. However, the WiMAX service has limited coverage at this point and the number of users is relatively small compared to a number of DSL connections.

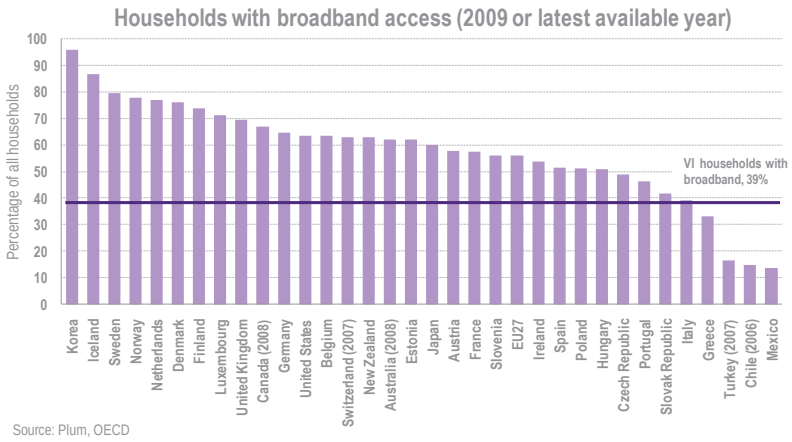
[39] These are the latest available data.

[40] This is active subscribers as a percentage of the population. These estimates are derived from the latest figures reported to the TRC by the three mobile operators providing service.

[41] Annual Report and Analysis of Competitive Market Conditions with respect to Mobile Wireless, including Commercial Mobile Services, Fourteenth Report, May 2010 FCC 10-81 http://wireless.fcc.gov/index.htm?job=cmrs_reports

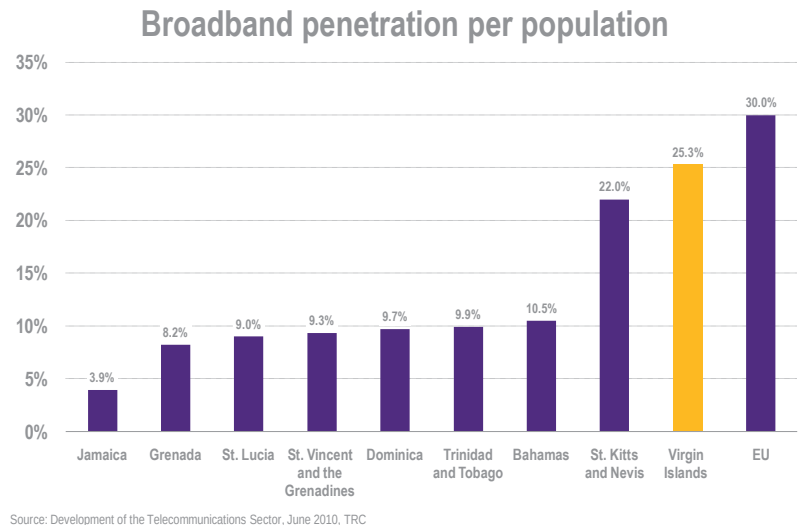
[42] http://www.trc.vg/attachments/020_020_Stats_062010_updated.pdf

Figure 3-1:



Source: Plum, OECD

Figure 3-2:



Source: Development of the Telecommunications Sector, June 2010, TRC

10.5. The pricing of broadband services offered in the Virgin Islands is high by international standards, even allowing for its relatively high cost of living and small size and topography. This may reflect in part the costs of wholesale international connectivity (as there is only one supplier) and the impact of this situation on competition and the total costs of broadband.

10.6. Broadband competition will be enhanced when the new owner of BVI Cable TV (since March 1st, 2011) invests in digitisation of its network. This investment will allow cable modem-based two-way broadband access services to be delivered. In addition extensions to the coverage of fixed wireless broadband services and the advent of mobile broadband services could also strengthen competition in the broadband market in the Virgin Islands. The latter requires operators to invest in new technology and/or acquire additional spectrum for mobile broadband services.

b) Frequency allocations and assignments

10.7. The current frequency assignments of the three cellular operators are shown in Table 3-1. There is a mixture of ITU Region 2 and Region 1 bands for mobile services to cater for visitors from both regions. One consequence of this pragmatic approach to frequency allocations is that not all the frequencies in these bands are available in practice, since there is some overlap between the bands in the two Regions – Figure 3-3 and Figure 3-4.

10.8. The current spectrum holdings of the three mobile operators are very dissimilar especially below 1 GHz. This distribution is the legacy of FCFS (First Come, First Served) spectrum assignments, and the earlier monopoly structure of the mobile market, as well as the fact that spectrum was assigned for free. At the time of initial market liberalization CCT was obliged to transfer 18 MHz of its 850 MHz spectrum to LIME.

Table 3-1: Current Frequency Assignments of Mobile Operators

Operator	850 Band, MHz (Americas)	900 Band, MHz (Europe)	1800 Band, MHz (Europe)	1900 Band, MHz (Americas)	Total MHz
CCT	28 MHz (2x14); 824-838,869-883	46 MHz (2x23); 892-915,937-960	-	30 MHz (2x15); 1850-1865,1930-1945	106
LIME	18 MHz (2x9); 838-847,883-892	-	-	30 MHz (2x15); 1895-1910,1975-1990	48
Digicel	-	-	30 MHz (2x15); 1710-1725,1805-1820	30 MHz(2x15); 1880-1895,1960-1975	60

Figure 3-3:

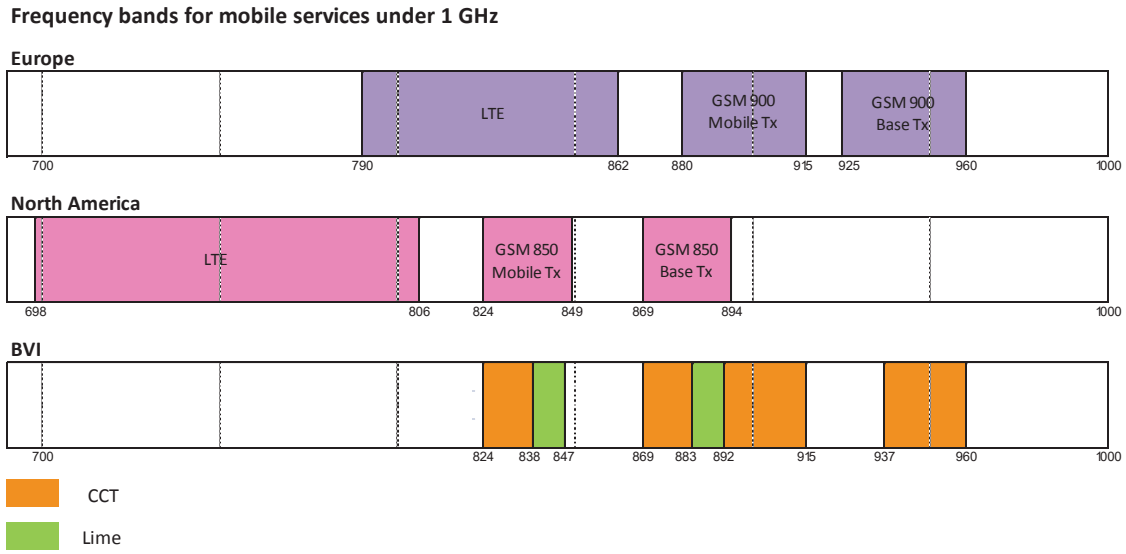
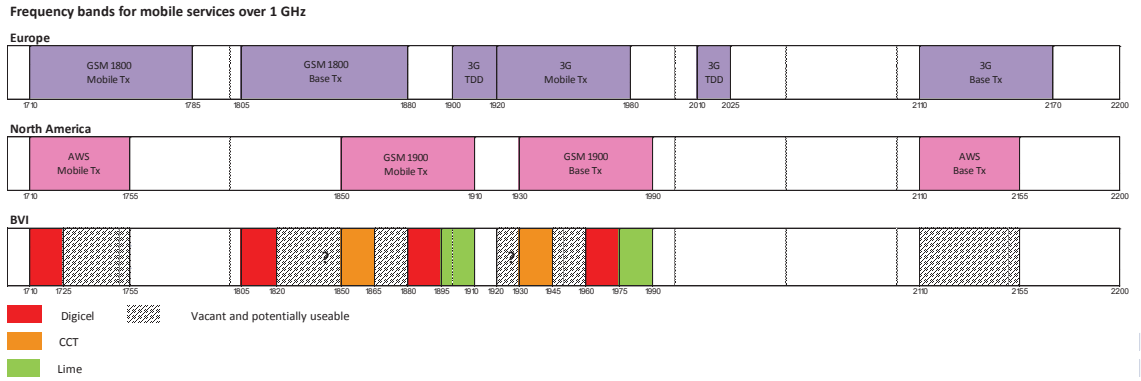


Figure 3-4:



10.9. The key points to note about the frequency assignments are:

- There are no unassigned frequencies in either the 850 MHz or 900MHz bands because of overlaps between the bands[43]. Also Digicel has no assignment below 1 GHz, while CCT has 80% of the frequencies assigned there.
- CCT has been assigned all available GSM 900 spectrum. Use of the frequencies (by mobile transmissions) towards the bottom of this allocation are likely to cause interference to mobiles in receive mode using the 850 MHz band[44].
- There are vacant frequencies that could be assigned in the GSM 1800 and the GSM 1900 bands. However use of frequencies by mobile transmissions above 1850 MHz could cause interference to mobiles in receive mode below 1850 MHz.

[43] This overlap also excludes the possibility of exploiting the Extended GSM-900 Band, in which the lower half is extended by 10 MHz to 880 MHz.

[44] There is also a risk of interference between transmitters though this could be mitigated through use of filters and judicious location of transmitters that can be coordinated between operators. We note that in Hong Kong where both the 850MHz and the 900 MHz bands are used there is a 2.5MHz guard band between the two allocations.

- No assignments have been made for the European 3G (1.9/2.1 GHz) or the US AWS (1.7/2.1 GHz) bands, though there are vacant frequencies that could in principle be assigned. In the case of the European 3G band the vacant spectrum from 1920-1930 MHz may suffer interference from the adjacent 1900 MHz base station transmissions.
- The 700 MHz LTE band is vacant in the Virgin Islands.
- The base station transmit segment of the European 800 MHz LTE band overlaps completely with the GSM850 band meaning that this European LTE band cannot be used in the Virgin Islands (see Figure 3-5).

Figure 3-5: Preferred frequency harmonisation arrangement for 790-862 MHz band in Europe

790-791	791-796	796-801	801-806	806-811	811-816	816-821	821-832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						Duplex gap	Uplink					
1 MHz	30 MHz (6 blocks of 5 MHz)						11 MHz	30 MHz (6 blocks of 5 MHz)					

Source: Annex 1, ECC Decision of 30 October 2009 on harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz, ECC/DEC/(09)03

10.10. In addition, it is current policy to reserve spectrum in some bands (e.g. GSM1800 and GSM1900) for a fourth operator.

c) Demand for additional spectrum

10.11. The total amount of spectrum already assigned for mobile services in the Virgin Islands is 214 MHz, not including the 2.5 GHz frequencies now used only for fixed WiMAX, in which mobile systems (mobile WiMAX or TDD-LTE) could be deployed later. This amount of spectrum should be adequate, if used efficiently and effectively, to meet anticipated mobile traffic demands even if they grow rapidly, provided that new broadband technologies are deployed (i.e. EVDO Rev. A, HSPA/HSPA+, and LTE) in a timely manner. This finding can be inferred from Table 3- which shows the current spectrum holdings of major mobile operators in the US, as well as the prevailing situation there for public safety uses. The table also shows the proportion of operators' and public safety users' spectrum holdings in which broadband systems could and already have been deployed.[45] It can be seen that AT&T and Verizon have less spectrum than CCT while currently serving well over 90 million mobile customers each in the US, many of whom live in much more densely populated areas than the Virgin Islands.

[45] Public safety assignments are unsatisfactory from the perspective of satisfying future broadband data and video needs, but as discussed in 3.2.2 decisions about future assignments for these vital purposes still have to be made in the US as well as Europe.

Table 3-2: Spectrum by Band: Average per US network operator in 100 top major markets

Band /Operator	450 MHz	700 MHz	800/850 MHz	1900 MHz	AWS (1.7/2.1 GHz)	2.5 GHz	Total	% Broadband capable
AT&T	0	26[1]	25	34	12	0	97	100%
Verizon	0	32	25	21	13	0	91	100%
T-Mobile	0	0	0	27	27	0	54	100%
Sprint/Nextel	0	0	17	36	0	0	53	100%
Clearwire	0	0	0	0	0	150	150	100%
Public Safety[2]	3.7	24	9.5	0	0	0	37.2	30%

Notes: 1. Includes the 6 MHz channel being acquired by AT&T from Qualcomm
2. Public safety also uses frequencies at 30 and 150 MHz

10.12. However, mobile operators in the Virgin Islands have expressed interest in acquiring additional spectrum and this could enable them to offer services of better quality and at lower cost than would otherwise be the case. Various past submissions made to TRC indicate the following demands for more spectrum (more details are given in Table 3-):

- 850/900 MHz bands from operators other than CCT.
- Additional spectrum at 1800 and 1900 MHz to provide capacity for traffic growth and in one case HSPA/3G services and roaming for CDMA2000-only subscribers visiting from the US. If enough spectrum is made available even deployment of LTE may be economically attractive, as has already begun in the 1800 MHz band in Hong Kong and Poland and has been announced in Australia.
- Spectrum at 2.1GHz (European core 3G band) to be compatible with 3G frequencies used by mobile broadband roamers from Europe. No request was expressed for frequencies in the AWS band, which is the corresponding band for 3G networks in the Americas[46].
- 700 MHz and/or 2.5 GHz spectrum to provide LTE services.
- Frequencies that could be used to support WiMAX from one or more bands including 2.3, 2.5 and 3.5GHz (the 2.3 GHz band is most suitable for unpaired or TDD-LTE as is foreseen in India and China)
- 24 MHz in the UHF band between 470-698 MHz to deliver mobile TV broadcast services.

10.13. There are three main motivations for these demands, namely:

- To support new mobile broadband services using 3G and LTE technologies while having sufficient frequencies to continue supporting customers that use only 2G services (with 2G-only handsets). In other jurisdictions where mobile broadband networks have been widely deployed usage of broadband applications and services is already dominating the total volume of mobile traffic[47]. It is now possible to upgrade to 3G and/or LTE services in bands traditionally used for 2G services. For example, HSPA technology can be deployed in the 850 and/or 900 MHz bands provided an operator has a 2x5 MHz block.

[46] A notable exception being Brazil which has allocated the European 1800 MHz and 2.1 GHz bands for mobile services.

[47] See for example, "Mobile data surpasses voice," http://www.ericsson.com/news/1396928

- To reduce the costs of delivering mobile broadband services (including uni-cast and broadcast services) by using frequencies below rather than above 1 GHz. The better propagation characteristics of frequencies below 1 GHz mean fewer base stations need to be deployed to provide wide area coverage and ensure good in-building penetration. The issue of indoor coverage applies equally to the Virgin Islands as elsewhere in the world, although in terms of coverage islands in the Virgin Islands are not large and range is more limited by mountainous terrain in some directions than by the range of wireless signals. However propagation range over water is important to serve shipboard users (on yachts and other craft).
- To support roaming primarily from Europe (at 900 MHz and 2.1 GHz) and the US (at 1900 MHz in addition to the roaming at 850 MHz already provided) – additional 1900 MHz frequencies are requested to enable future broadband roaming.

10.14. It is important to note that under their current licences unitary licence holders do not make a specific payment for spectrum they are assigned. Additional payments arise indirectly if additional revenues are earned from the spectrum – each operator pays a fee set at 3% of its revenues. This means operators have no financial incentive to moderate their demand for spectrum.

d) Summary of issues

10.15. The main issue that needs to be addressed is: how should operators' demands for additional spectrum be met? Possible options involve both release of vacant spectrum and potentially reallocating existing assignments to give each operator a more balanced portfolio of frequencies.

10.16. Specific issues concern:

- Assignment of vacant spectrum in bands already used (1800 and 1900 MHz only, since all available spectrum at 850 and 900 MHz is already assigned).
- Refarming of spectrum at 850/900 MHz spectrum between operators to achieve a more even balance of holdings in this frequency range - potentially for competitive reasons and to encourage low cost deployment of mobile broadband services.
- Release of new spectrum bands for fixed and mobile broadband services, notably 700 MHz and 2500 MHz.
- Establishment of incentives for efficient spectrum use, such as fees, and/or obligations placed on operators to provide a specified level of service and/or coverage.
- Assignments of UHF spectrum for mobile TV services. These are addressed in conjunction with decisions about TV broadcasting in Section 4.4.

10.17. The sections below address these issues. First the international context is considered in terms of device and equipment availability for different technologies and different bands as this affects the relative attractiveness and timing of the bands for supplying mobile broadband services.

11. Equipment and device availability internationally

11.1. In light of the growing importance and demand for mobile broadband services the status of broadband equipment, devices and services available in the frequency bands used in the Virgin Islands has to be taken into account. Quadband (850/900/1800/1900 MHz) mobile handsets are generally available, so

the mix of frequencies used in the Virgin Islands clearly covers the needs of both US and European visitors for narrowband services. Furthermore broadband systems and services are already widely deployed in these geographies as follows:

- HSPA/HSPA+: 850/900/1900/2100 MHz – and multi-frequency HSPA mobile devices are common (e.g. Apple iPhone 4)
- EVDO-Rev. A: 850/1900 MHz (US and other Americas only).

11.2. In addition, first next generation (beyond HSPA) LTE services at 1800 MHz have already been launched in Hong Kong and Poland, while Finnish operators expect to deploy LTE in this band in 2012, and Telstra has (February, 2011) announced an LTE rollout in Australia at 1800 MHz by the end of 2011[48]. In the US and Canada broadband systems (HSPA/HSPA+) are now widely deployed at both 850 and 1900 MHz frequencies, and in Europe it is now permitted to deploy HSPA at 900 and 1800 MHz. HSPA 900 MHz support has been growing, and a few HSPA commercial networks already launched in this band in Europe, although not HSPA at 1800 MHz (the first such network is likely to be launched by Orange in France after a reportedly successful trial with Ericsson). In fact the momentum towards deploying LTE at 1800 MHz is more widespread than that for HSPA in this band.

11.3. In addition the deployment of LTE networks has begun at 2500 MHz in Europe (Scandinavia) and in the two digital dividend bands of 700 MHz in the US (Verizon Wireless), and 800 MHz in Germany.[49]

11.4. As of early 2011 over eight hundred (817) tri-band HSPA devices 850/1900/2100 MHz (excluding notebooks and e-book readers) were available for global roaming, according to the Global Mobile Suppliers Association[50]. Furthermore the roadmap for the multi-mode, multi-frequency Gobi wireless chipset from Qualcomm that is embedded in a large number of notebooks and wireless modems includes LTE (various versions backwards compatible with HSPA+), as well as HSPA. In addition to the early support of HSPA in three bands (850/1900/2100 MHz) Gobi will cover additional bands as significant HSPA networks become common at their frequencies (e.g. refarmed 900 MHz). New versions of HSPA (HSPA+ and DC (dual carrier)-HSPA+) are also targeted[51].

11.5. The conclusion from this review of commercially available mobile broadband networks, equipment, and devices and expected global developments, is that so long as operators have a minimum of 2x5 MHz in one or more of the 850, 900, 1800, 1900, and 2100 MHz bands they could provide narrowband and broadband mobile services to US- (including CDMA2000- only[52] as well as GSM/WCDMA customers) and Europe-based visitors, as well as to residents. Furthermore frequencies in the 2500 MHz band will be able to provide additional roaming capacity to broadband users from both Europe and the US[53] and in

[48] "1800 MHz – The LTE spectrum band that was almost forgotten", http://www.facebook.com/note.php?note_id=165336656829103&comments

[49] "Verizon Wireless Unveils Suite Of 4G LTE Smartphones, Tablets, A MiFi, Hotspot And Notebooks ", http://news.vzw.com/news/2011/01/pr2011-01-06n.html; "TeliaSonera launches world's first commercial LTE network", http://www.totaltele.com/view.aspx?ID=451548; "Deutsche Telekom and Vodafone Germany Begin LTE Price War", http://www.i-policy.org/2010/12/deutsche-telekom-and-vodafone-germany-begin-lte-price-war.html

[50] http://www.gsacom.com/downloads/pdf/GSM_3G_WCDMA_HSPA_LTE_Fact_Sheet_020311.php4

[51] "Qualcomm adds LTE to Gobi roadmap", http://www.rethink-wireless.com/2010/03/25/qualcomm-adds-lte-gobi-roadmap.htm

[52] CDMA2000 EV-DO Rev. A can be deployed in bandwidths of 1.25 MHz; a difference between CDMA2000 and HSPA is that the former does not permit simultaneous voice and data usage, while the latter does

[53] The current dominance of WiMAX in the 2500 MHz band in the US is likely to be short lived as its major proponents (Sprint and its majority-owned subsidiary Clearwire) accept the inevitability of the much larger emerging LTE ecosystem; "Sprint could deploy LTE nationwide by year-end 2013", http://www.fiercewireless.com/story/sprint-could-deploy-lte-nationwide-year-end-2013/2011-03-02#ixzz1GOf1u6A1

the 700 MHz band roaming capacity to US visitors as broadband services at these frequencies acquire more customers in their respective home locations.

12. Options for future assignment of spectrum in bands already used

12.1. The key objectives of the re-assignment of existing frequencies and the assignment of new frequencies to mobile operators in the Virgin Islands are to enable efficient operators to provide mobile services to their customers, both voice/SMS and broadband, that are affordable, competitively supplied and widely available within the Virgin Islands and offshore (i.e. broad coverage). It is also important that the market offers easy to use roaming for visitors from the US and Europe with their respective domestic mobile devices. Activities in this assignment/re-assignment process include: (1) Reducing or eliminating the current substantial disparities in the spectrum holdings of the three existing mobile operators, and (2) Assigning adequate, including new bandwidth under conditions that stimulate and require operators' deployment of mobile broadband services.

a) Releasing spectrum above 1 GHz

12.2. Table 3-3 shows the bands in which operators have expressed demand for more spectrum, the amounts requested and three potential supply options for frequencies above 1 GHz. There would have to be significant refarming or re-assignment of frequencies in the 850 and 900 MHz bands if all requests in these bands are to be satisfied. This is discussed separately in the next subsection.

12.3. The three supply options:

- Span the range of possible situations
- Seek to minimize changes in existing holdings at 1800 and 1900 MHz, and
- Assume that no specific provision is made for a fourth operator, though there may be spare spectrum to meet this requirement[54].

12.4. The key points to note about the options are:

- In Option 1: All demands are met and there is 2x25 MHz at 1800 MHz and 2x10 MHz at 1900 MHz for a fourth operator. There is probably only sufficient spectrum for one operator using the European 3G band, as some of the 2x10 MHz available is likely to suffer interference from the adjacent GSM1900 use.
- In Option 2: The demand for 1900 MHz spectrum is not met and one operator (CCT) must move frequencies to release spectrum for European 3G. There is sufficient spectrum for a fourth operator at 1800 MHz and 2.1 GHz, but not at 1900 MHz. Option 2 is heavily biased in favour of Europe-compatible rather than US-compatible frequencies, yet the great majority of visitors to the Virgin Islands are based in the US and Canada. In addition, there is a risk of interference from US VI to European 3G services using frequencies beyond the initial 2x10 MHz in the band.
- In Option 3: This makes provision for an operator to access AWS frequencies, although no operator has expressed demand for these frequencies. This is done at the expense of GSM1800 band where there is excess supply of spectrum (2x25 MHz) although some of this may need to be reserved for a fourth operator.

[54] Furthermore, competitive assignment processes would not be *a priori* limited to existing mobile operators.

Table 3-3: Requests for additional spectrum from mobile operators and potential supply options for bands already used

Frequency band	Quantity requested	Supply Option – 1	Supply Option -2	Supply Option- 3
850 MHz	Two requests for 2x 5 MHz each to provide 3G services[2]	Since all frequencies in these two bands are currently assigned, refarming/ re-assignment of frequencies among operators would be required to meet any of these requests and/or support a fourth operator.		
900 MHz	2x 5MHz			
GSM1800	2x 5MHz	2x30 MHz	2x30 MHz	2x15 MHz
PCS 1900	2x 5MHz	2x15 MHz	0	2x15 MHz
European 2.1 GHz band	2x 5MHz	2x10 MHz	2x25 MHz	2x10 MHz
AWS – US	0	None	None	2x15 MHz

- *These requests are based on documents submitted by the three operators to the TRC and interviews with them held in November-December 2010. Except where noted each request identified was made by one operator.*
- *All requests were submitted in an environment in which no costs or conditions are attached to licenses for frequencies hence it is not possible to judge the relative priority or level of commitment of the requesters, which should be determined as a result of the consultation on the spectrum framework and action plan.*
- *The longer term possibility of LTE deployments at 850 MHz as equipment becomes available was also identified by one operator*

12.5. ***RMB1: The TRC proposes to release frequencies in the 1800, 1900, and 2100 MHz bands (as indicated in Supply Option 1) on the grounds that this meets all expressed demand and makes some provision for a fourth operator. These frequencies would be made available in a competitive process to current operators and potential new entrants. Spectrum for a fourth operator could be provided either through a specific set-aside for new entrants or the imposition of an aggregate spectrum cap on each of the three incumbents.***

Question 10: Is there interest in access to the 1800 MHz, 1900 MHz and 2100 MHz frequency bands (as indicated by Supply Option 1) or should an alternative frequencies be considered for release? Answers should take account of later proposals to apply coverage obligations and offer the spectrum on a competitive basis.

Operator Responses

12.6. The operators indicated interest in all of the available bands.

TRC Response

12.7. For the TRC response see the discussion in Section 16.

b) Refarming frequencies at 850 MHz and 900 MHz

12.8. It is well known that frequency bands below 1 GHz are significantly more valuable than those above 1 GHz because of their superior propagation characteristics for the economics of network deployments in coverage-limited deployments and greater penetration of buildings to offer higher quality in building coverage (which is particularly important for broadband services where signal degradation can lead to loss of the service). It is for these reasons that regulators in many other countries have sought to make

allocations below 1 GHz more even across competitors as a pro-competitive and/or public interest measure[55]:

- In various European countries the 900 MHz licences have been restructured to support a 5MHz channel raster (to accommodate broadband services) and release frequencies for an operator that does not have spectrum below 1 GHz. Frequencies have been or are expected to be relinquished by those with the largest holdings (e.g. Belgium, France, Sweden, Finland, Spain, Switzerland), often as the national regulator authorizes these holders of once exclusively GSM licences to refarm their spectrum with broadband systems
- In some other countries the allocation of frequencies below 1 GHz (in the 800 MHz and 900 MHz bands) are to be decided through an auction in which there are caps on the amount of spectrum an operator may hold (e.g. Ireland, Netherlands, and in the recent German auction of 800 MHz in which the two larger holders of 900 MHz spectrum were limited in the amount of 800 MHz bandwidth they could acquire).

12.9. The approaches of spectrum caps or required return of some spectrum have not been adopted in the US where generally the threshold for regulatory intervention into such matters is higher compared to Europe.

12.10. Auction results also provide evidence of the greater value of frequencies below 1 GHz as compared with those above 1GHz. The best recent of example of this is given by the German auction in 2010 – Table 3- summarises the relative price per MHz pop by frequency band.

Table 3-4: German auction values for various IMT bands

Band & configuration	Price/ MHz (€ million)	Relative price, assuming 800 MHz =1
800 MHz (FDD)	59.608	1.000
1.8 GHz (FDD)	2.609	0.044
2.1 GHZ (FDD)	8.790	0.147
2.1 GHz (TDD)	0.596	0.010
2.5 GHz (FDD)	1.841	0.031
2.5 GHz (TDD)	1.730	0.029

Source: http://www2.bundesnetzagentur.de/frequenzversteigerung2010/ergebnisse.html

12.11. The value of the longer propagation range of lower frequencies may be limited in the Virgin Islands by its small size and mountainous terrain. Nevertheless as a minimum these frequencies enable a greater range for serving users offshore (e.g. on boats and yachts) and enhance the attractiveness and quality of mobile broadband services accessed by users when indoors. It is therefore not surprising that operators with no or little spectrum below 1 GHz in the Virgin Islands are seeking additional frequencies at 850 and 900 MHz.

12.12. There are good public interest reasons (i.e. to promote competition and allow lower cost deployment of mobile broadband services by all operators) for wanting to assign other operators 5MHz blocks of spectrum at 850 and 900 MHz. To meet these demands CCT, which currently occupies the entire 900 MHz band and most of the 850 MHz band (some of its 850 MHz frequencies were taken back and

[55] The European experience is reviewed in http://www.comreg.ie/_fileupload/publications/ComReg0999.pdf and http://www.comreg.ie/_fileupload/publications/ComReg1071.pdf

assigned to LIME at the time of initial market liberalization), would need to relinquish use of some spectrum.

12.13. CCT's current spectrum holdings as shown in Table 3-1 already amount to just over one-third of the total bandwidth available in the four existing mobile bands in the Virgin Islands. Hence, given the provision in the unitary licences that spectrum in these four bands will be shared among four operators, there is a basis for reviewing current spectrum holdings by CCT. Furthermore, it would also be reasonable to suggest that CCT should be entitled to acquire any more spectrum only if it is willing to give up some of its current holdings at 850 and/or 900 MHz. Otherwise its current competitors, let alone a potential fourth operator, will be at an economic and operational disadvantage that is not in the public interest. This disadvantage will arise or persist as a consequence of a situation in which CCT's competitors will have access to much smaller spectrum resources than CCT for their deployments of mobile broadband networks, a deficiency which may be unreasonably difficult to overcome no matter how great these competitors' capabilities are in other critical aspects of a mobile business. Spectrum caps could be one way to address CCT's spectrum advantages.

12.14. RMB2: The TRC intends to reassign frequencies in the 850 and 900 MHz bands.

Question 11: Do you have any comments on the benefits and costs of reassigning frequencies currently held by CCT in the 850 and 900 MHz bands to other operators seeking access to these frequencies? Please indicate the amount of spectrum in each frequency band, if any, you think should be reassigned.

Operator responses

12.15. Digicel and LIME were in favour of reallocation of spectrum in the 850MHz and 900 MHz bands in order to "level" the competitive playing field. Digicel requested 2x10 MHz at 900 MHz and LIME requested 2x3.5 MHz at 850 MHz. CCT was opposed to any change in the current allocations on the grounds that they would result in "substantial damage to CCT and its business".

TRC Response

12.16. For the TRC response see the discussion in Section 16.

13. Release of new spectrum at 700 MHz and 2.5 GHz

a) Introduction

13.1. Elsewhere in the world a number of new bands are being released on a harmonised basis for the next generation of mobile broadband services – namely LTE.

13.2. LTE equipment is already available at 700MHz and 2.5 GHz (and at 1800 MHz, as well as the AWS band and very soon in TDD mode at 2.3 GHz) and it is expected that LTE equipment and devices will become available at a later date for 850/900 MHz frequencies. But for now growing numbers of operators across the world are deploying already widely available HSPA/HSPA+ broadband systems in these last two bands. In their most advanced versions these WCDMA-based systems offer as much spectral efficiency as contemporary LTE systems when both are deployed in 5MHz channels as are required for HSPA which has only been developed to operate in paired mode. In contrast LTE has been specified to be much more flexible than HSPA since it can be deployed in paired or unpaired channels, with widths that range from 1.4 up to 20 MHz, and even 40 and 100 MHz in the future LTE-Advanced specification.

13.3. Based upon mobile broadband spectrum allocations in Regions 1 and 2, the majority of bandwidth in new bands available for future mobile use lie in the 700 MHz and 2500 MHz bands, which can respectively augment frequencies an operator already has or will acquire in the 850/900 MHz and 1800/1900 MHz bands. The 700 MHz band is seen as valuable for broadband services because of its properties of superior in-building penetration and range, while the 2.5 GHz band offers the highest capacity (it has a total of 190 MHz) for providing broadband in the most densely populated areas where traffic volumes per km^2 are highest. This band also has the merit of being likely to be the most common band for mobile broadband services on a global basis, which will facilitate global roaming with a single device. Thus the 700 and 2500 MHz bands are complementary in terms of where they can be most valuable to operators.

13.4. In addition the 2.3 GHz band has been released in Asia for LTE services and the 3.5 GHz band is a popular WiMAX band supporting both fixed and emerging more recently mobile wireless broadband services. The 450 MHz band is also internationally harmonised for mobile broadband services, but is not widely used because of the limited bandwidth available and significant use of this band by analogue land mobile systems in many countries.

13.5. The demand for the different frequency bands as expressed by existing operators is as shown in Table 3-. The approach to be taken in each band is discussed in the sub-sections below.

Table 3-5: Demand for frequencies in the 700MHz, 2500 MHz, 2300 MHz and 3500MHz bands

Frequency band	Service to be offered and Quantity requested	Potential spectrum supply in Virgin Islands	Issues
450 MHz	None	Some of this band, but there is use by analogue land mobile systems	Relatively small amount of spectrum in the band (450-470 MHz).
700 MHz	Two operators expressed interest for LTE deployments. Amounts required unspecified.	Entire band (698-806 MHz)	Choice of band plan
2500 MHz	One operator expressed interest for TDD WiMAX broadband service to residential customers 25 or 50 MHz, depending on expected number of customers	Entire band (2500-2690 MHz) less assignment of some 30MHz to CCT. May be some fixed link assignments still to be cleared	Choice of band plan, taking note that this is the first and likely only major band for mobile services to be common across much (even most) of Europe and the Americas
2300 MHz	Same as at 2500 MHz – described as a less preferable band for this service	2300-2390 MHz May be some fixed link assignments to be cleared	
3500 MHz	One operator expressed interest for broadband services for 2x28 MHz - less preferable for this service would be 3300 or 3600 MHz frequencies	3400-3600 MHz vacant	

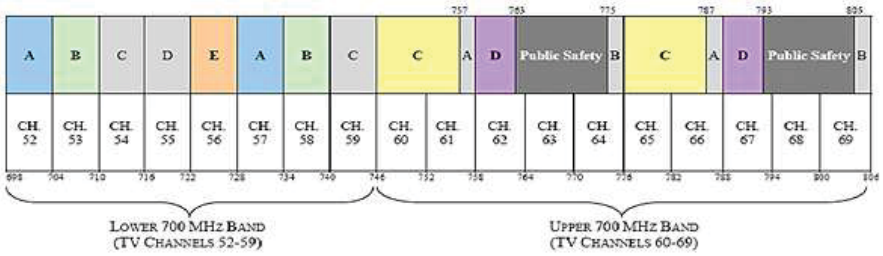
b) The 700 MHz ("digital dividend") band

13.6. The situation of the 700 MHz ("digital dividend") band is different from that of other new bands for mobile services as a consequence of:

- The TV broadcasting legacy of these frequencies, and in particular the 6MHz channel widths in the Americas that are inconsistent with the 5 MHz blocks for which mobile equipment is developed worldwide; and
- Specific significant disadvantages of the 700 MHz band plan adopted in the US, the first country in the Americas to make the transition to digital broadcasting that is a prerequisite for making this new spectrum available for mobile services.

13.7. There are several alternatives for 700MHz band plans, and in the Americas outside the US including the Caribbean, their long term structure has not been firmly established. These frequencies are not on a path to be harmonized across ITU Regions or even within Region 2 (Americas). Options based on band plans that are being supported elsewhere include the US 700 MHz band plan as shown here.

Figure 3-6: US 700 MHz Band Plan



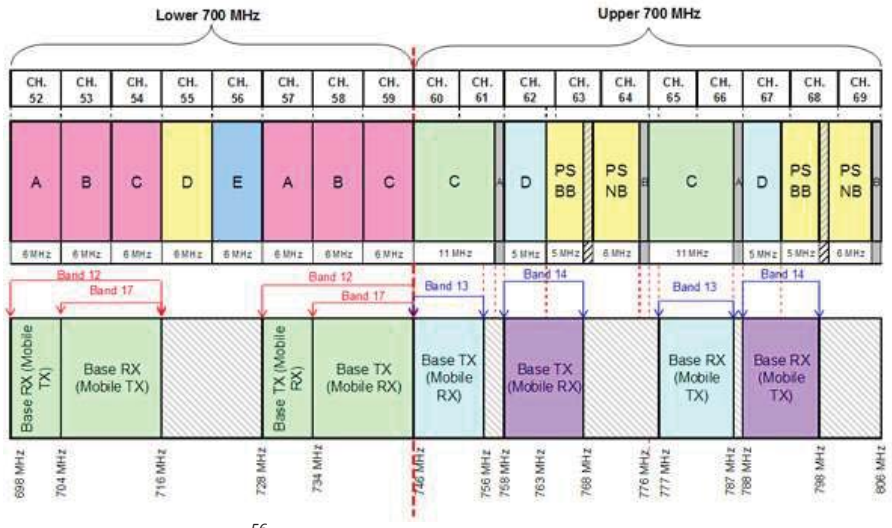
Block	Frequencies (MHz)	Bandwidth	Pairing	Area Type	Licenses
A	698-704, 728-734	12 MHz	2 x 6 MHz	EA	176
B	704-710, 734-740	12 MHz	2 x 6 MHz	CMA	734
C	710-716, 740-746	12 MHz	2 x 6 MHz	CMA	734
D	716-722	6 MHz	unpaired	EAG	6
E	722-728	6 MHz	unpaired	EA	176
C	746-757, 776-787	22 MHz	2 x 11 MHz	REAG	12
A	757-758, 787-788	2 MHz	2 x 1 MHz	MEA	52
D	758-763, 788-793	10 MHz	2 x 5 MHz	Nationwide	1 *
B	775-776, 805-806	2 MHz	2 x 1 MHz	MEA	52

* Subject to conditions respecting a public/private partnership.

Source: FCC - the highlighted text indicates the frequencies auctioned prior to the FCC Auction 73 in 2008

13.8. One disadvantage of this plan, which includes both paired and unpaired spectrum and is based on a 6 MHz channel grid, is that it does not conform in some respects to the equipment being developed according to the specifications of the 3GPP group, as shown in Figure 3-7.

Figure 3-7: Comparison of US 700 MHz Band Plan with 3GPP Technical Specifications



Source: Industry Canada[56]

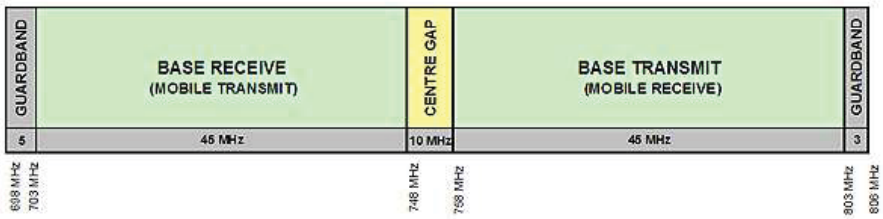
13.9. Equipment currently available for this band uses 5 MHz and 10 MHz channel bandwidths. Therefore, 5 MHz in each 6 MHz block and 10 MHz in each 11 MHz block will be used. As a result, 8 MHz of the total paired spectrum would not be effectively used.

13.10. This issue has been recently addressed by Industry Canada which pointed out that although this band plan is suitable for the US, it presents a few challenges for Canada and several interference issues. In the United States, portions of the Lower 700 MHz band were auctioned while broadcasters using 6 MHz channel widths were still in operation in other parts of the band. So as noted the lower 700 MHz band (and, to some extent, the upper 700 MHz band) was structured around a 6 MHz channel grid. Although the 6 MHz channel grid ensured compatibility with the previous broadcasting use of the band, the new broadband mobile technologies being deployed in this band are predominantly based on 5 MHz channel widths and multiples thereof (although LTE as noted is more flexible in this respect). Since the deployment of mobile broadband systems in Canada will take place only after the completion of the digital TV transition in this frequency range, the 6 MHz channels present a challenge from the perspective of effective spectrum utilization. Over the entire 700 MHz band, as much as 12 MHz of spectrum would not be used effectively by new broadband technologies.

13.11. Industry Canada has proposed two variations of the 700 MHz US band plan that aim at improving overall spectrum usage by making as much use as possible of 10 MHz and 5+5 MHz blocks. It has also suggested the option of adopting the APT (Asia Pacific Telecommunity) band plan (Figure 3-8) for paired operation which is also receiving attention in some Latin American countries. Large markets in Asia Pacific (ITU Region 3) will ensure that equipment and devices developed for this band plan will enjoy substantial economies of scale if and once it is adopted there.

[56] Industry Canada, "Consultation on a Policy and Technical Framework for the 700 MHz Band and Aspects Related to Commercial Mobile Spectrum", November 30, 2010, http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/smse018e.pdf/$FILE/smse018e.pdf (links to reply comments can also be found here)

Figure 3-8: Asia Pacific Telecommunity 700 MHz Band Plan



Source: Industry Canada (ibid.)

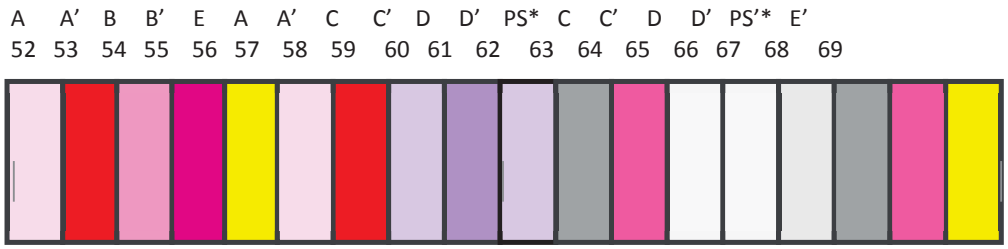
13.12. The bulk of the comments recently received (February 28, 2011) to Industry Canada's public consultation recommended adoption of the US band plan on the grounds of compatibility for cross-border roaming (the most important international roaming requirement for Canadians) and more importantly the availability of equipment in the short term that has been and is being developed, and begun to be sold in this large market. At the same time the comments acknowledge the superiority of other band plans for the long term and the expectation that equipment developed for other large markets than the US (e.g. in Asia) according to 3GPP specifications may prove to be more economical in the longer term. Another theme in the comments includes the opinion that it is premature to reach a decision on how to licence spectrum in this band for public safety and emergency services given the considerable uncertainty that prevails in the US for the allocation of 700 MHz frequencies to these services after the failure to award the D block in the FCC's 2008 Auction 73.

13.13. Other observations about attitudes to the 700 MHz spectrum that are relevant to the Virgin Islands include the submissions of LIME, Digicel and others to public consultations on this band held in the Bahamas and the Cayman Islands and by ECTEL (Eastern Caribbean Telecommunications Authority)[57]. ECTEL and the Cayman Islands proposed a 700 MHz band plan based on eighteen 6 MHz channels between 698-806 MHz (Figure 3-9). While Digicel offered no objection to this plan, LIME criticized it on the grounds that adopting the US band plan would allow for more rapid time-to-market and ensure early availability of economical equipment developed for the large US market. LIME also stated that if a more traditional, i.e. broadcasting era, channelization with equal width channels were to be used then it should preferably be structured with 5 MHz, not 6 MHz channels.

13.14. Mindful of the disadvantages of the US band plan and the fact that it was formulated in response to circumstances that are very US-specific, countries in Latin America are paying attention to the band plans proposed by in Asia (by the Asia-Pacific Telecommunity) that will likely enjoy economies of scale comparable to the US market in the long term. Furthermore these plans will support more efficient use of the spectrum, not only thanks to its 5 MHz channels but also because it may permit more efficient LTE deployments in wide channel widths.

[57] URCA Consultation Document ECS 23/2010, "Opening New Spectrum Bands", October 2010, http://www.urcabahamas.bs/download/065211200.pdf; ICTA, "A Policy for the Assignment of 700 MHz Spectrum", (Ref: CD 2009-3), May 2009, http://www.icta.ky/docs/700MHz/CD%282009%293_700_MHz_Spectrum.pdf;

Figure 3-9: ECTEL's 700 MHz Band Plan



*Public (and private) safety network
PS' and PS (6 MHz each) – 764-770 and 794-800 MHz respectively
A (2x6 MHz) – 698-704 and 728-734 MHz
A' (2x6 MHz) – 704-710 and 734-740 MHz
B' (6 MHz) – 716-722 MHz
E (6 MHz) – 722-728 MHz
E' (6 MHz) – 800-806 MHz
C (2x6 MHz) – 740-746 and 770-776 MHz
C' (2x6 MHz) – 746-752 and 776-782 MHz
D (2x6 MHz) –752-758 and 782-788 MHz
D' (2x6 MHz) -758-764 and 788-794 MHz
Source: ECTEL

13.15. The 700 (or 800 in Europe) MHz band is viewed as complementary to 2.5 GHz and other higher frequencies for mobile broadband deployments because of its long propagation range for rural areas, and hence will be included in multi-band devices for use within these regions and by intercontinental roamers. However the question is whether there is a sufficient need for this new mobile spectrum in the Virgin Islands that it is worthwhile to adopt the US band plan because there are devices and equipment available for use in the short term. Services based on LTE deployed at some frequencies in the 700 MHz band based on the US band plan have just been launched on a large scale by Verizon Wireless in the US so that equipment and devices for 700 MHz are now becoming available.

13.16. However, the US 700 MHz band is in a unique situation. Unlike other bands it includes more than one band class, and devices designed to operate in one class do not work in the other classes. The 3GPP standards group created four different band classes within 700 MHz: band class 12, 13, 14 and 17 as shown in Figure 3-7. This situation arose as a result of somewhat complex and technical details of radio wave propagation and interference. Thus roaming between networks operating in different 700 MHz band classes will not be possible until multi-class devices incorporating more than one 700 MHz radio become available. Additional costs and other disadvantages are incurred as more radios are added, initially requiring more than one wireless chipset although eventually single chipset multi-radio solutions will be implemented. But currently (mid-2011) these multi-class 700 MHz devices are not available in the US since the first 700 MHz devices were only specified by the two major US operators (Verizon and AT&T) for their respective classes. Verizon acquired most of the FCC's 700 MHz C Block spectrum (which lies in band class 13), and many of AT&T's 700 MHz licenses sit in the lower C and B Blocks (which lie in band class 17). A number of smaller operators acquired 700 MHz spectrum licenses in the Lower A, B and C Blocks, which lie in band class 12. Single class 700 MHz devices developed for Verizon will not work on AT&T's 700 MHz frequencies and vice versa, and neither will work in Band 12.

13.17. Thus operators in the Virgin Islands which wish to launch service at 700 MHz in the near future will prefer to acquire either Band 13 or Band 17 frequencies in this band where the first devices are already (Band 13) on the market or (Band 17) about to be launched. Roaming at 700 MHz between the US and

the Virgin Islands would therefore be limited, perhaps for the next two to three years, in terms of the number or pairs of operators in both countries which can establish such roaming arrangements. Both members of each pair would have to operate in the same band class, until multi-class and ultimately so-called "full spectrum" devices, capable of operating throughout the 700 MHz band, are brought to market. Also of course 700 MHz devices would not be compatible or interoperable across the 700 MHz networks of operators in the Virgin Islands occupying different band classes.

13.18. The 700 MHz US band plan is not ideal as discussed above. It is however preferable for the Virgin Islands since it is the plan adopted in the US for which equipment is already becoming available for the networks now being deployed there.

13.19. In contrast to many other countries in the Americas, the 700 MHz band in the Virgin Islands is not occupied by broadcast channels. Furthermore this band has already been cleared of broadcast users for mobile services in the USVI and Puerto Rico as a result of the digital transition completed in the US in mid-2009. Hence the Virgin Islands could initiate a move to prepare the ground for assigning 700 MHz frequencies in a competitive or comparative process open in principle to both existing operators and new entrants who demonstrate their intent and ability to make use of them to deploy affordable and widely accessible mobile broadband services.

13.20. RMB3: The TRC proposes to release spectrum at 700 MHz based on the US band plan and with spectrum set aside for public safety and emergency services to await its allocation in the US. The TRC wishes to gauge interest in release of the band in this consultation.

c) The 2.5 GHz band

13.21. The 2.5GHz band is being actively used and/or considered for use for mobile broadband services in countries from the US to Scandinavia and Canada to Brazil and Hong Kong. Both mobile WiMAX (unpaired spectrum only) and LTE (paired and unpaired spectrum) equipment and devices are becoming increasingly available for this band. The main issue that needs to be decided is the band plan to adopt.

13.22. The options for the 2.5 GHz band plan are shown in Figure 3-10 (the ITU Options) and Figure 3-11 (the current US band plan). No country is giving any consideration to ITU Option 2, which depends on a frequency allocation in another band to complement its mid-band, so the choices in practice lie between Options 1 and 3. The US band plan is a slight variant of Option 3 with however channel widths that differ from that (5MHz) for which IMT mobile broadband equipment is developed by vendors worldwide, in that as in ITU Option 3 the FCC allows operators to deploy either FDD and/or TDD systems as they see fit anywhere within the band, subject to meeting interference requirements. However, there has been a growing movement toward adopting Option 1, not only in Europe but also in the Americas, e.g. Canada, Brazil, Colombia, Chile and elsewhere, with the benefit of maximizing the economies of scale of equipment and devices developed for this band plan.

Figure 3-10: ITU Recommendations for the 2.5 GHz Band (ITU-R M.1036-3)

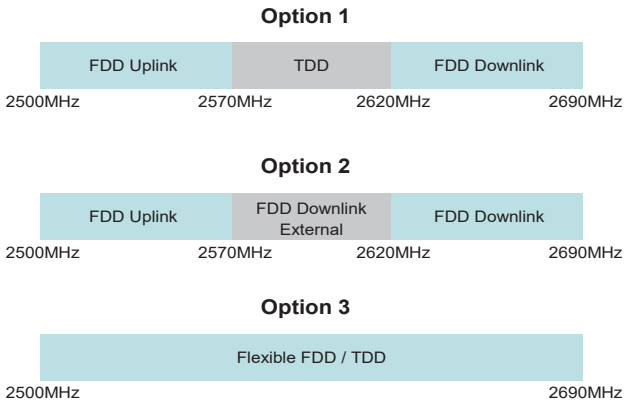
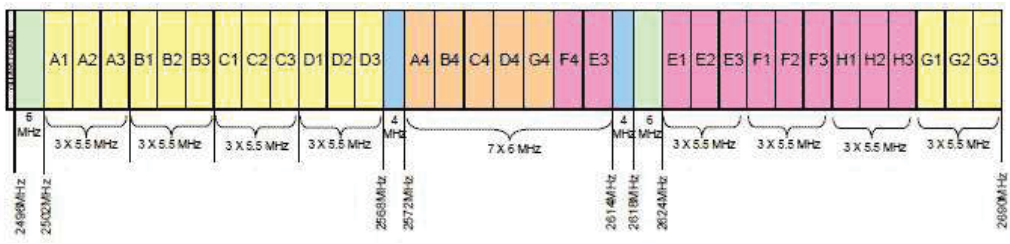


Figure 3-11:US 2.5 GHz Band Plan



13.23. Most countries, including Canada[58] and major Latin American nations[59] as well as Europe, seem unlikely to follow the US band plan at these frequencies, preferring an alternative plan, namely ITU Option 1, which includes 140 MHz (2x70) of paired spectrum and 50 MHz of unpaired spectrum in the mid-band of 2570-2620 MHz. Furthermore the ultimate operational configuration of this band in the US may change in the next few years. Its major occupant Clearwire which so far has deployed unpaired mobile WiMAX networks, is considering adding and possibly eventually migrating to LTE, including both FDD (frequency division duplex, paired) and TDD (time division duplex, unpaired) systems[60]. For financial reasons the fates of Clearwire and its spectrum holdings are also uncertain, which further complicates the challenge of forecasting how the 2.5 GHz band will eventually be exploited in the US.

13.24. In the Virgin Islands this band is so far only being used by CCT for fixed wireless-based services exploiting fixed WiMAX technology (802.16d), which is not compatible with mobile WiMAX (802.16e). As of early 2011 CCT was using a number of non-contiguous channels at different frequencies at various locations within the Virgin Islands. These channels range from 2,506 to 2,670 MHz under a temporary authorization as a fix around interference issues encountered in channels between 2,661 and 2,686 MHz that CCT had been exploiting earlier. None of these earlier channels and only some of CCT's temporary channels lie within the mid-band of the ITU Option 1 plan for this band. The unpaired frequencies currently used by CCT in this band will be moved permanently to the mid-band range (2570-2620 MHz). This move will be planned and implemented to enable the assignment of additional 2.5 GHz frequencies according to the ITU Option 1 band plan.

[58] "Decisions on the Transition to Broadband Radio Service (BRS) in the Band 2500-2690 MHz and Consultation on Changes Related to the Band Plan," http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09893.html#a8.2

[59] "Brazil opens up 2.5 GHz for mobile broadband in Brazil", http://www.totaltele.com/view.aspx?ID=458091

[60] "Clearwire Announces New 4G LTE Technology Trials Expected to Yield Unmatched Wireless Speeds in the U.S." http://corporate.clearwire.com/releasedetail.cfm?ReleaseID=551055

13.25. RMB4: The TRC proposes to release spectrum at 2500 MHz based on the ITU Option 1 band plan as this will enjoy the greatest economies of scale for LTE equipment. The TRC wishes to gauge interest in release of the band in this consultation.

d) 2.3 GHz band

13.26. The 2.3 GHz band was mentioned by one stakeholder in reference to domestic WiMAX services. The 2.3 GHz band will be extensively used in Asia for TDD LTE services (e.g. Korea, India, China). The Asia-Pacific Telecommunity recommends unpaired allocations of spectrum within the band.

13.27. The frequency range 2300 to 2400 MHz is identified across Europe for mobile applications, airborne telemetry, amateur use and PMSE applications (wireless cameras and video links). Many European nations do not favour its use for mobile services. The EC Radio Spectrum Policy Group makes no mention of the band in its final position paper on wireless broadband, and the CEPT recently declined to make an ECC Recommendation or Decision concerning allocation of parts of the band for mobile services. Many European countries including France, Germany and Austria are heavily reliant on the band for airborne telemetry and further 12 administrations have indicated that they would face serious difficulty in allocating part of the band for mobile services. However, Ireland has consulted on the possible release of the band and the Ministry of Defence in the UK may also release part of the band in future.[61] There are isolated deployments of the 2.3 GHz band for fixed wireless access in the Americas (e.g. the Cayman Islands and Alaska). However the availability of this band for commercial mobile services in the Americas is very limited and variable. In the US, part of the band is available for public mobile use and 2 x 15 MHz was auctioned in 2001 for Wireless Communications Services (WCS). However Federal agencies use the 2.3 GHz band from 2310-2400 GHz for various applications, including the military, the Department of Energy, the National Science Foundation (NSF) and others. Telemetry and radar are among the applications, e.g. an NSF radar at 2370-2390MHz in Puerto Rico for extra-terrestrial exploration. The NTIA is investigating the potential to release a further 30MHz from the band for WCS, however, there is no certainty that this will occur.[62]

13.28. Hence the value of 2.3 GHz as an imminent band for public mobile telecommunications in the Virgin Islands is likely to be limited, despite its important role in Asia, especially given the availability of 2.5 GHz for this purpose. The 2.5 GHz band is likely to offer more than enough bandwidth for the purposes of the Virgin Islands for the next five to ten years, a rapidly growing portfolio of equipment and devices, and the expectation that it will be able to accommodate broadband roamers from both North America and Europe as an increasing number of 2.5 GHz networks are deployed in these two regions.

13.29. ***RMB5: The release of the 2.3 GHz band will be considered after the release of frequencies at 2.5 GHz band, as the latter is much better positioned to meet mobile broadband capacity requirements in the Virgin Islands.***

[61] The Enabling UK Growth – Releasing public spectrum, DCMS, March 2011, http://www.dcms.gov.uk/images/publications/Spectrum_Release.pdf

[62] See Table 2-1, Plan and timetable to make available 500 MHZ of spectrum for wireless broadband, US Department of Commerce, October 2010.

e) 3.5 GHz band

13.30. The 3.5 GHz band is a major target of WiMAX deployments, initially the fixed version 802.16d and now with greater intensity the mobile version 802.16e[63], particularly in countries with little wired infrastructure. In the Virgin Islands some interest has been expressed in the 3.5 GHz band by operators wishing to provide wireless broadband services that are in principle competitive with DSL-based broadband access, with a focus on business and institutional customers.

13.31. However, globally the 3.5GHz band is in a state of transition and flux with regard to its band plan and the technologies that will be deployed in it. It is therefore premature to reach a decision about its long term structure in the Virgin Islands. As noted operators in many countries in Asia, Europe and elsewhere have deployed WiMAX systems. Increasingly these systems have been mobile-capable (802.16e) rather than the fixed version (802.16d), although the band is not as attractive for mobile services as lower frequencies, thanks to the greater economies of scale enjoyed by mobile WiMAX equipment and devices. While some of these WiMAX operators have had a degree of success, others are struggling. Their prospects are questionable in light of the uncertain future of the WiMAX ecosystem faced with competition in wireless broadband from the 3GPP's HSPA/HSPA+ and in the longer term LTE, which is receiving much greater R&D resources from technology developers and achieving much wider coverage worldwide[64].

13.32. Hence, operators that have deployed mobile WiMAX at 3.5 GHz are looking into their network evolution towards LTE. Similar issues of migration to LTE are being addressed by mobile WiMAX operators in the 2.5 GHz and 2.3 GHz bands. Contrary to some reports this evolution or migration, despite significant technological similarities between mobile WiMAX and LTE, is *not* a relatively simple matter of software upgrades or modifications. When a migration path to LTE may become available, what costs would be entailed, and how to minimize them are questions that have not yet been addressed comprehensively. A comprehensive migration strategy has to encompass customers as well as technical and engineering aspects. For example, it has to address the issues of how (for example with parallel LTE and WiMAX deployments) and how long it will be reasonable to let existing customers continue to use WiMAX-based services (especially if they do not require or expect full mobility) and when and how to migrate them to LTE-based services.

13.33. One aspect of the uncertainty which is currently affecting equipment device vendors, operators, and regulators is the unknown future of band design for 3.5 GHz, and whether there will be one or a fragmented set of multiple nationally defined bands that may complicate the efforts of technology developers. Alternatives being considered include keeping the 3.5 GHz band in an all-TDD (unpaired) channel structure or migrating towards a combination of FDD and TDD channels as is the case with the 2.5 GHz band in its ITU Option 1 plan that is being adopted in a growing number of countries across the globe.

[63] 802.16e is not compatible with its fixed predecessor (it uses a different air interface) but its greater volumes makes it increasingly attractive compared to the former even for deployment to provide fixed services, thanks to the lower prices of consumer equipment that are enabled by its larger economies of scale.

[64] WiMAX's principal champion Intel now puts much greater priority on LTE than WiMAX technology. Intel sold the 50 MHz of TDD spectrum it won in a 2.6 GHz spectrum auction in Sweden for WiMAX to the mobile operator "3" Sweden which will be deploying TD-LTE instead. Also, Intel acquired the wireless chipset business of Infineon. The second largest mobile WiMAX operator in the world, Yota (Russia) has decided to migrate to LTE, and even the largest such operator Clearwire in the US is in severe financial difficulty and carrying out trials of LTE, both FDD and TDD.

13.34. Analyses into the future of the 3.5 GHz band and the future path for the technologies deployed at these frequencies are illustrated in publications from 3GPP and the European Commission.[65]

13.35. RMB6: There may be reasons not to make decisions about the 3.5 GHz band until after there is greater clarity in the band structure and technology paths that will be adopted by major WiMAX 3.5 GHz operators elsewhere (e.g. in Europe and North America). Nevertheless the TRC would like to gauge the level and type of interest in use of the 3.5 GHz band by both small as well as the large operators. Respondents should address the following issues:

- ***a. Options for the band plan***
- ***b. Alternative license blocks and bandwidth that each operator would prefer for LTE and/or other broadband deployment within this band plan***
- ***c. Procedure and fees for acquiring these licences***
- ***d. Obligations associated with these licences, ensuring that the significant population centres are covered within a specified time after the licenses are awarded by mobile broadband networks.***

If there is any interest in use of this band in the near term, then prospective applicants should note that any current use may be changed with appropriate notice when or if a band plan is decided with which it conflicts.

f) 450 MHz band

13.36. Another band that has been used in some parts of the world for mobile services is the 450 MHz band (450-470 MHz), which has been exploited to a significant degree for mobile services especially in Northern and Eastern Europe. Current systems generally use CDMA technology and in future LTE may be deployed at these frequencies.

13.37. However in the US and the Virgin Islands the 450 MHz band would only become available if it were vacated by current users, which include Public Safety and Industrial/Business. Since no interest in the 450 MHz band has been expressed by mobile operators, and it is not a band that is of interest to any significant source of roamers in the Virgin Islands, there is no reason to consider it for the mobile sector in the Virgin Islands.

13.38. RMB7: The 450 MHz band will be not considered for use by public mobile services in the VI for the time being.

Question 12: What is your interest in the use of the 700 MHz, 2500MHz and 3500 MHz bands? In responding please indicate your views on:

a. Options for the band plan

b. Alternative licence blocks and bandwidth that each operator would prefer for LTE and/or other broadband deployment within this band plan, taking account of the obstacles to interoperability between the various band classes in the US band plan

[65] 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; UMTS-LTE 3500 MHz Work Item Technical Report (Release 10), January, 2011; http://www.slideshare.net/zahidtg/3gpp-tr-37801-umtslte-3500-mhz-work-item-technical-report; European Commission Decision 2008/411/EC for the identification of the band 3.4-3.8 GHz for BWA applications supports the introduction of Mobility in the band 3.4-3.6 GHz and 3.6-3.8 GHz - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:144:0077:0081:EN:PDF; Malaysia's P1 to deploy TD-LTE, http://www.telecomasia.net/content/malaysias-p1-deploy-td-lte

c. Procedure and fees for acquiring these licences

d. Obligations associated with these licenses, including those related to ensuring that the significant population centres are covered within a specified time after the licenses are awarded by mobile broadband networks.

Question 13: Do you agree with the TRC's proposals to consider the potential release of spectrum at 2300 MHz and 450 MHz after release of the 700 MHz and 2500 MHz bands? Are there other bands that should be considered? If you suggest additional bands should be released, please provide information for such bands according to the points outlined in Question 12.

Operator responses

13.39. The operators indicated most interest in the 700 MHz band, however, there was also interested in frequencies at 2.5 GHz and 3.5 GHz. All operators agreed with the TRC's approach to 2300 MHz and 450 MHz bands.

The operators' views and TRC's response on licensing procedures and fees are given in answer to questions 6 and 8 respectively.

In respect of rollout obligations LIME asked that they should be reasonable given market uncertainties, and therefore confined to the main population centres. Digicel was opposed to such obligations because of uncertainties concerning the viability of the service and the likelihood that competition would be the driver of coverage. CCT did not express a view.

TRC Response

13.40. The TRC's proposals in respect of spectrum release are given in Section 16.

13.41. It is not realistic to expect to be able to implement all the possibilities for assigning additional spectrum to operators at the same time or at the same pace. They will take different times to be completed and will encounter uncertainties and potential obstacles with different characteristics.

13.42. The proposed sequence of activities is:

- Release of new spectrum

Principal challenges and potential causes of delay: Identification and management of any interference issues with the US; Ensuring frequencies are fully cleared for mobile broadband

- Refarming of 850/900 MHz frequencies

Principal challenges and potential causes of delay: Reluctance from CCT to returning some spectrum; Establishment of coordinated spectrum policy for all frequencies below 1GHz

- Award and use of currently vacant frequencies at 1800/1900 MHz/2100MHz

Principal challenges and potential causes of delay: Availability of mobile broadband equipment and devices for 1800 MHz and management of interference with the US at 1900 MHz.

Question 14: The TRC welcomes comments on its preferred sequencing of actions to meet the requests of operators for additional spectrum, namely (i) Release of 700 MHz, 2500 MHz and 3500 MHz (if there is demand expressed in this consultation) bands, (ii) Refarming of 850/900 MHz frequencies, and (iii) Assignment of vacant frequencies at 1800/1900 MHz/2100MHz.

Operator responses

13.43. Digicel agreed with the order. CCT agreed with the order except that they opposed the refarming of 850/900 MHz bands. By contrast LIME wanted this action to be undertaken first, followed by assignment of vacant frequencies at 1800/1900/2100 MHZ and then release of spectrum at 700, 2500 and 3500 MHz.

TRC Response

13.44. See Section 16 for the TRC's response.

14. Spectrum caps

14.1. As additional spectrum is released the issue of spectrum caps as a means of ensuring a competitive balance between operators arises. Such caps are widely used as a measure to maintain or promote competition in mobile markets because they are simple to implement. Caps should be set "generously" so that successful operators have sufficient spectrum to efficiently grow their business and taking account of technology developments. The TRC has balanced competition benefits from having low caps against the need to provide operators with sufficient spectrum to meet consumer demand for wider bandwidth services and high quality and more generally to grow their businesses.[66]

14.2. The spectrum cap would apply at the point new spectrum is released (and potentially for some time thereafter). For example at the time the 700 MHz spectrum is released first there could be a cap on:

- Spectrum held by an operator below 1 GHz i.e. in the 700, 850 and 900 MHz bands (in light of their good propagation characteristics of these bands). There is a total of around 158 MHz available.[67] It would seem appropriate to make provision for three players suggesting a cap of around 60 MHz.
- Spectrum held by an operator for all bands then available (i.e. up to and including the 2.5 GHz band). There is a total of 550 MHz available. It would seem prudent to allow for the possibility of a fourth player suggesting a cap of around 170 MHz.

14.3. RMB8: The TRC will consider setting caps on the spectrum holdings of mobile operators at the time new frequency bands and/or vacant spectrum is released and to provide a guide to industry in the case of mergers, acquisitions or trades. The TRC proposes that these caps apply to holdings of the most desirable spectrum (i.e. at lower frequency ranges) and to holdings of all available spectrum up to and including 2.5 GHz. In choosing the level of caps the TRC has been mindful of the need to give successful businesses scope to grow, technology developments and the benefits from promoting competition in mobile and broadband markets. It is proposed that a cap of around 60 MHz applies to each operator's spectrum holdings below 1 GHz and a cap of 170MHz applies to all spectrum holdings up to and including 2.5 GHz.

Question 15: Should TRC apply spectrum caps when releasing additional spectrum? If so at what level and for what frequencies should they be set? Should spectrum be set aside for a fourth operator? The TRC welcomes comments on the following proposals for spectrum caps and suggestions for alternatives with reasons: (i) 60 MHz for any one operator's total spectrum holdings in all bands below 1 GHz; and (ii) 170 MHz for any one operator's total spectrum holdings in all bands at frequencies up to and including 2.5 GHz.

[66] International evidence is given in "Mobile Broadband, Competition and Spectrum Caps, A D Little for the GSM Association, January 2009.

[67] 86 MHz at 850 and 900 MHz and 72 MHz at 700 MHz, assuming US public safety bands are excluded.

Operator responses

14.4. CCT and LIME opposed the setting of any spectrum caps because they judged that they are unnecessary as three operators are sufficient to deliver competition in such a small market as the VI. Digicel did not express a view but proposed the principle that "no operator should be afforded, to the extent reasonably possible, a commercial or cost advantage over its direct competitors in terms of rolling out a network in the BVI, by means of its spectrum allocation". LIME also commented on the need for the TRC to intervene in the case of CCT's legacy assignment of "an inordinate amount of 850 and 900 MHz spectrum".

TRC Response

14.5. The TRC proposes to apply the proposed spectrum caps when releasing additional spectrum in order to address the imbalance in existing spectrum holdings at 850/900 MHz and to allow for provision for a fourth operator should government wish to adopt this policy. At present TRC has no plans to issue a fourth Unitary licence.

15. Spectrum fees and other licence conditions

15.1. Unitary licence holders currently have no financial incentive to moderate their demand for spectrum or use their existing holdings efficiently. The TRC suggested in Section 2.5 (RSM12, 13 and 14) that frequency authorisation holders should pay fees related to the amount of spectrum they hold and should reflect the opportunity cost of the spectrum. Benchmarks from the region provide a good starting point for setting fees administratively or the fees could be set through an auction.

15.2. If fees are to be introduced then they should be established taking account of the following considerations:

- The purpose of the fees should be clearly articulated, such as to cover the costs of spectrum management and regulation (to the extent these are not covered by other fees levied on operators), to promote efficient spectrum use and/or to provide a reasonable return to Virgin Islanders for granting exclusive use of a shared, publicly owned resource.
- They should take account of any mandatory obligations placed on operators
- New fees might be phased in for frequencies already held so as to give operators time to adjust to this change.

It is possible that if fees are applied, some of the demands for additional spectrum expressed by operators will moderate.

15.3. A second consideration common to all options is what conditions should be attached to in future to the ways in which spectrum licenses are exploited (or not).The traditional FCFS practice provides no incentives for operators to use spectrum efficiently, or indeed at all, and they incur no penalties if they hoard the spectrum. Hoarding prevents other operators with possibly stronger capabilities and business plans from exploiting the frequencies involved to deploy competitive and innovative services that subscribers may find attractive.

15.4. One mechanism that could encourage more efficient use of spectrum in future is a coverage obligation. These obligations help ensure that spectrum is used to deploy services of benefit to Virgin Islands customers, which is particularly important for the highly prized frequencies below 1 GHz. The German auction of 800 MHz frequencies in May, 2010 provides an example – even though Germany is a very

different environment than the Virgin Islands - of how coverage obligations can be used to achieve public policy goals, in this case to make broadband services as widely accessible as possible. While normally for commercial reasons mobile operators roll out networks first where there is the greatest density of population and of likely users to maximize the return on their investment – which would be Road Town in the case of the Virgin Islands - in Germany operators must first build 800 MHz coverage for 90% of the population in villages of not more than 5,000 inhabitants, in phase 2 towns from 5,000 to 20,000, and in phase 3 towns from 20,000 to 50,000. Only in phase 4 can this spectrum be utilised in large cities. A comparable approach in the Virgin Islands would require coverage that would begin with Anegada and only reach Tortola in its last stage.

15.5. Alternatively, conditions could seek to achieve coverage of most people at a specified level of service. For example, in the UK 3G licences now contain the following condition:[68]

"*by the 30th June 2013 the licensee must provide an electronic communications network that is capable of providing mobile telecommunications services to an area within which at least 90% of the population of the United Kingdom lives and with a 90% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 768kbps in a lightly loaded cell*"

15.6. Specific coverage obligations in the Virgin Islands will be need to be developed so that they achieve local objectives in respect of broadband roll-out and performance (e.g. in terms of speeds) of the networks that are deployed. This is to ensure that licence holders who can choose from a range of technologies (from so-called 2G to 3G to 3.xG to 4G) that are now available for deployment in several bands do contribute to meeting the goal of providing universal broadband coverage within the Virgin Islands. In addition, in order to minimize the overall costs of future mobile broadband deployments operators should be required as a condition of their licences to share their infrastructure with competitors, a practice that is already established in the Virgin Islands with existing mobile networks.

15.7. RMB9: The TRC proposes to introduce conditions in all future frequency authorisations for cellular mobile and wireless broadband operators that provide incentives for efficient usage of spectrum and discourage them from acquiring and holding spectrum for which they have no defined or foreseeable need. These conditions will include obligations with respect to coverage, and commitments to the performance of the services offered to customers and penalties if the obligations are not met, as well as to sharing infrastructure under reasonable, non-discriminatory conditions to minimize the costs of network deployments for all operators.

Question 16: Do you have any specific comments on proposals for coverage and service obligations that may be attached to new spectrum releases? Are there any other aspects of service provision which TRC should consider as potential licence conditions?

Operator responses

15.8. Digicel and CCT opposed coverage obligations, while LIME did not express a view.

TRC Response

15.9. The TRC's proposals for coverage obligations are intended to support public policy objectives in respect of broadband roll-out. Such obligations have been attached to licences for spectrum released to support LTE services in numerous other countries. The TRC may therefore set such obligations, although in doing so it will take account of the need not to place an undue financial burden on the industry and the small

[68] http://stakeholders.ofcom.org.uk/consultations/2100-MHz-Third-Generation-Mobile/

size of the VI market. The detail will be presented in the documentation issued for the spectrum release.

16. TRC proposals for spectrum release

16.1. The TRC's decisions concerning spectrum release have been guided by the following considerations:

1. The primary goal of spectrum releases is to ensure that the spectrum allocated will be exploited in a timely and efficient way by operators who acquire it to deliver new and improved services (notably broadband) that generate the greatest foreseeable value for their users and the economy and society of the VI
2. Operators who acquire spectrum should be financially and technically capable as well as committed and motivated to achieving this primary goal. Operators should not expect that they have a permanent right to hold spectrum if they fail or are unable to exploit it.
3. Changes in spectrum assignments and policy that are introduced should not cause unreasonable disruptions or harm by virtue of their timing and scope to the plans and operations of existing operators that were established on the basis of reasonable expectations about market conditions that applied prior to these changes.
4. However changes in spectrum policy and management such as those proposed below will be introduced to take advantage of technological progress and respond to changes in users' demands and expectations, subject to reasonable evidence that they are needed to support the goal embodied in the first principle which will not otherwise be satisfied.

16.2. Therefore, the TRC proposes the following sequence of actions to meet the requests of operators for additional spectrum, namely (i) Release of 700 MHz and 2500 MHz bands, (ii) Refarming of 850/900 MHz frequencies, (iii) Assignment of vacant frequencies at 1800/1900 MHz/2100MHz, and (iv) Release of 2300 MHz and 450 MHz bands.

16.3. The TRC proposes to adopt RMB8 for spectrum caps

16.4. The TRC has decided, based on the operators' expressions of interest in the 700 MHZ and 2500 MHz bands, that it will assign the 700 MHz and 2500MHz spectrum by direct award and licensees shall pay fees that recover administrative costs.

Meeting spectrum demand – private applications and broadcasting

17. Introduction

17.1. This section addresses current spectrum use and future requirements for the following services:

- Land mobile
- Fixed links
- Broadcasting
- Maritime and aeronautical
- Satellite
- Amateur
- Test and development

18. Land mobile services

a) Current situation

18.1. Land mobile services are used by both commercial and government organisations. Commercial users include security firms, hotels and maritime companies. Government users include the public safety services (police, ambulance and fire), DDM, utilities, customs, and the port and airport. These users operate their own analogue simplex or duplex systems. There is no interoperability between the different agencies except when they all use DDM equipment in times of emergency. We understand that some services do not have the resources to maintain their land mobile system and so they now use cellular mobile though this does not always give them adequate coverage.

18.2. The bands used by land mobile services are at VHF (most users) and UHF (mainly the emergency services). All assignments are 25 kHz bandwidth and there is a single user per frequency i.e. no geographic sharing. There are many vacant frequencies.

18.3. The frequency bands used in the VI overlap with US and UK bands as follows:

- 138-174 MHz is used at VHF: This overlaps with the US band[69] 150-173 MHz and the UK bands[70] 138-165 MHz (VHF mid-band) and 165-173 MHz (VHF high band)
- 440-512 MHz is used at UHF which overlaps with the US band 450-512 MHz and the UK bands 425-450 MHz (UHF 1) and 453-466 MHz (UHF 2).

[69] The US VHF and UHF bands for both commercial and public safety land mobile use are as follows: 30-50 MHz, 72-76 MHz, 150-173 MHz, 216-222 MHz, 406-416 MHz, 450-512 MHz, 806-824 MHz and 851-869 MHz. In addition public safety has access to: 763-775 MHz and 793-805 MHz. For future requirements see http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf

[70] In the UK the following land mobile bands are used: 55.75-68 MHz (VHF Band 1); 68.1-87.5 MHz (VHF Low Band); 138-165 MHz (VHF mid-band); 165-173 MHz (VHF high band); 177-208 MHz (VHF Band III); 425-450 MHz (UHF 1); 453-466 MHz (UHF 2). Emergency services applications use 380-385/390-395 MHz and 412-414/422-424 MHz (Airwave); Ministry of Health allocation at 420 – 422 MHz.

b) Future requirements

18.4. Land mobile systems elsewhere are starting to migrate to digital operation so as to support data transmissions. In time this can be expected to happen in the VI. Elsewhere demand for spectrum from commercial land mobile services is relatively static as a result of competition from cellular services. The main growth area concerns use by government users and utilities, particularly for public safety and disaster management.

18.5. In the VI there have been discussions about setting up a common land mobile network for all government users much as exists for the provision of fixed services. This would facilitate interoperability between services and potentially offer an enhanced service at least cost. Ideally this new network would:

- Use digital technology so that voice and data communications can be carried
- Have sufficient bandwidth to support video and other broadband traffic
- Use relatively low frequencies – below 1 GHz - to provide good coverage at low cost

18.6. Use of frequencies that are harmonised with those used in North America might also offer benefits of interoperability though this is a lesser consideration to achieving a system that meets the VI's needs.

18.7. There are currently debates in both the Europe and the US about how to accommodate growth in demand for spectrum to meet the growing needs of public safety users. The main focus of these debates has been in relation to demand for additional spectrum for broadband applications. The current situation in each case is as follows:

- In Europe the following requirements have been identified as being required for public safety and disaster relief[71]: 2 x 3 MHz for narrowband, 2 x 3 MHz for wideband and 2x10 MHz for broadband services. The frequencies would ideally be in the 400 MHz (380-470 MHz) range to allow reuse of existing infrastructure and give the required coverage. But there is limited spectrum availability in this range and so spectrum for broadband may be located in a separate frequency range from that for wideband and narrowband which may be met in current allocations. Frequencies at 700 MHz and 800 MHz could in principle be used for mobile broadband services to give wide area coverage and higher frequencies (in the 1-4 GHz range) are also being examined to provide capacity in major urban areas.[72]
- In the US the FCC has required all public safety users with systems at 700 MHz to adopt LTE as a common technology platform. This is an important step towards implementing an interoperable nationwide, broadband Public Safety Network in the 700 MHz Band. [73] President Obama has announced that "D Block" 2x 5MHz at 700 MHz (the so called "D" block – 758-763/788-793 MHz) would be reserved and prioritized for public safety and not auctioned as called for under existing law.[74] The block will be combined with other spectrum allocated to public safety services to support a national network using 758-768 MHz/788-798 MHz. In addition, options for using additional capacity on commercial networks in times of major disasters have been assessed by the

[71] ETSI TR 102 628 v1.1.1 2010-08

[72] European and Global Harmonisation of Spectrum for Public Protection and Disaster Relief (PPDR), presentation to ECC, WIK and Aegis, November 2010 based on a study conducted for the German BMWi.

[73] FCC-11-6A1, 26 January 2011

[74] http://www.whitehouse.gov/the-press-office/2011/02/10/president-obama-details-plan-win-future-through-expanded-wireless-access

FCC.[75] However, no decisions have been made yet and the timetable for making decisions is uncertain.

18.8. In the VI there are a number of frequency bands that could be used to meet public sector needs, including:

- Various bands in the 380-500 MHz and 800 MHz range which could be used to meet requirements for an interoperable digital network carrying voice and broadband data traffic. These frequency ranges are attractive because of their good coverage and low deployment cost. Some government services found insufficient coverage is provided by a cellular service at 850/900 MHz, which may suggest that frequencies in the 380-500 MHz range are more suitable. These frequencies are used by emergency services in other regions (the US and Europe) and in Europe there is continued interest in finding frequencies in this range for broadband services for the emergency services.
- Bands at 700 MHz for a broadband network, perhaps using LTE technology. This would give the potential to use equipment that is interoperable with US public safety services and possibly allow for interoperability with commercial LTE networks when they appear. But it may compromise the allocation of this spectrum to commercial public mobile services. Equipment to meet the needs of the emergency services in this band may also take some time to appear. Comments on the 700 MHz public consultation in Canada refer to the considerable uncertainty in the US regarding D Block spectrum, and the lack of an ecosystem for this spectrum. Any decision about licensing of 700 MHz spectrum for public safety and emergency services should wait until the situation in the US is clarified. However in the meantime it would be prudent for the TRC to reserve the frequencies earmarked in the US (i.e. 758-768 MHz/788-798 MHz) for the emergency services.

18.9. In some countries (e.g. the US) public safety users have dedicated blocks of spectrum reserved for their land mobile services. This can aid interoperability and gives government users certainty over their future allocations, which is particularly important if spectrum is in short supply. Spectrum is relatively plentiful in the VI and there would be costs to moving all government users to one or more frequency block. Hence the TRC does not propose to aggregate historic assignments however there would be merit in implementing such a policy for future assignments.

18.10. There could be significant benefits from the public safety services making increasing use of future commercial mobile networks for carrying broadband traffic. This could mean public safety services avoid expenditures on their own dedicated networks, make use of consumer friendly and low cost mobile broadband devices and benefit from increased functionality that can be offered by new commercial broadband services. The mobile operators gain additional business but may need to enable their networks to give priority to public safety traffic. This arrangement could be an interim measure until public safety services deploy their own networks, a replacement for a dedicated public safety network or could be used for traffic overspill at times when the public safety network cannot meet all demands. Public safety services would need priority over other traffic in times of emergency which should be feasible in operational terms. Although the operational implications have not yet been proven in other countries, use of commercial networks could offer significant financial benefits to both the emergency services and mobile operators which is an important consideration given the small size of the VI population.

18.11. ***RLM1: The TRC will continue a dialogue with government users concerning the frequency bands and technologies they wish to use in future for mobile services so that it can reserve one or more blocks of***

[75] http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-%28obi%29-technical-paper-broadband-network-cost-model-basis-for-public-funding-essential-to-bringing-nationwide-interoperable-communications-to-americas-first-responders.pdf; the FCC also produced a white paper in June 2010 on this issue.

frequencies for these users (at VHF and/or UHF). In particular the TRC would like to pursue the option of using commercial networks for carrying government mobile broadband traffic. However, in any case, the TRC plans to reserve the frequencies earmarked in the US (i.e. 758-768 MHz/788-798 MHz) for an emergency services broadband network but will not assign this spectrum until decisions are about whether commercial networks can be used in the VI.

18.12. RLM2: When assigning 700 MHz spectrum the TRC will review applications taking into consideration applicants' intentions to take account of the special requirements of public safety services when designing their networks.

Question 17: Do government users and other interested parties have comments about future technologies and frequency bands suitable for delivery of digital communications services (including broadband) for the emergency services in the VI?

Question 18: Do you have views on whether government users should use commercial networks to meet their future needs for mobile broadband and the implications for the way mobile operators deploy their networks?

Operator responses

18.13. There were no comments from CCT or Digicel in respect of Question 17 but LIME suggested that to facilitate search and rescue efforts the VI should adopt Location Services when an emergency call is made from a mobile phone.

18.14. In relation to Question 18 the operators were generally supportive of the use of commercial networks, though as LIME indicated in its response the precise terms and conditions for giving priority to public safety traffic would need to be developed.

TRC Response

18.15. The TRC proposes to adopt RLM1 and RLM2. The issue raised by LIME concerning Location Services is beyond the scope of this consultation however, the TRC will raise it in future discussions with the emergency services.

19. Fixed services

a) Current situation

19.1. Fixed microwave links are used for connectivity to the islands and to provide access to remote locations, backhaul and backbone capacity on islands. The main users at present are the fixed and mobile operators and the Department of Information Technology (for the government network). Utilities and DDM also have requirements for narrow band telemetry for monitoring purposes (e.g. collecting data from weather stations and for network monitoring). Some government authorities used spread spectrum systems at 900 MHz and these suffered interference, probably from GSM 900MHz as the US spread spectrum band (which is licence exempt) at 902-928 MHz overlaps with the GSM900 frequencies. Deployment of microwave links is often much cheaper than using leased line services provided by LIME. This is partly because fixed licensees do not pay fees for use of spectrum, and may also be influenced by the level of prices of LIME's services.

19.2. The main bands in which licensed fixed microwave links operate in the VI are as follows: 1452-1525 MHz, 5925-8400 MHz and 10.7-11.7 GHz. In addition there is use of the 5.8 GHz band for fixed links.

Users in this band have suffered interference. If international precedent is followed access to this band should be on a licence exempt basis in which case users would not be offered interference protection.

19.3. The frequency ranges up to 14 GHz that are used in the VI cover both the US[76] and European microwave bands[77]. In particular the US licences links in various frequency ranges from 1.8 GHz to 2.5 GHz, and at 5.925-6.875 GHz, 10.7-11.7 GHz and 12.2-13.25 GHz. In Europe fixed microwave services have allocations in various bands in the 1350-2500 MHz range[78] and at 3800-4200MHz, 5925-7075/7125 MHz, 7125-8500MHz, 10-10.68 GHz, 10.7-11.7 GHz and 12.75-13.25 GHz.

19.4. The US and European frequency plans also contain many frequency bands for microwave links and fixed satellite services at and above 14 GHz. In the VI there is no use of frequency bands above 14 GHz at present, as rainfall attenuation makes these bands less suitable for long distance links.

19.5. Assignments recorded in TRC's database are made on a national basis. The TRC does not at present have sufficient information on the bandwidth of assignments nor does it have the planning tools required to make geographically shared assignments without the risk of causing harmful interference. To avoid interference fixed link assignments are given wide frequency separation.

b) Future requirements

19.6. Demand for spectrum for fixed links for backhaul and backbone networks is likely to grow in the next five or so years as mobile and fixed wireless broadband services are rolled out and the speed of DSL services is increased. Fixed and mobile operators and government users all indicated they would be seeking additional spectrum to support long haul and shorter links within the VI and for international links to the US VI. To accommodate this growth in demand the TRC will:

- Gather the necessary data (e.g. technical data and customer information from copies of licences issued and discussions with users) to compile an audited database of assignments, so that new frequency assignments can be made without the risk of interference to existing users
- Determine the frequency ranges it wishes to make available to each of the main users (i.e. the fixed and mobile operators and the Department of Information Technology) on the basis of the frequencies available and the users specific requirements
- Engage with the FCC locally to establish an approach to facilitate the deployment of international fixed links. In other countries with near neighbours an applicant for an international fixed link only deals with its national regulator. The national regulator makes the necessary arrangements with the regulator in the neighbouring country to obtain a licence for the link in that country.
- Consider whether to assign the main users blocks of spectrum and, if not, whether to make contiguous assignments rather than disparate assignments across the bands. Digicel has been assigned a block of 7 GHz spectrum which it self-manages and CCT has been assigned a national assignment of 2x14 MHz for deployment of point to point fixed links for backhaul from its WiMAX service, while all other fixed link assignments are made on a link by link basis. It is often the case

[76] The US bands are listed on pp 26-27 of 47 Code of Federal Regulations Part 101

[77] ECC Report 3, Fixed service in Europe, Current use and future trends post 2002, February 2002. This report is in the process of being updated see http://www.pts.se/upload/Remisser/2010/frageformular-ero.pdf

[78] 1350-1375/1492-1517MHz, 1375-1400/1427-1452 MHz, 2025-2120/2200-2290 MHz. The latter band is mainly for military use of tactical radio relay links. ECC Report 3, Fixed service in Europe, Current use and future trends post 2002, February 2002. This report is in the process of being updated see http://www.pts.se/upload/Remisser/2010/frageformular-ero.pdf

that users can make more efficient use of the spectrum when it is self managed because they are better able to control the interference environment.

The first two of these actions are already taken into account in proposals for the creation of the NFAT, the spectrum audit and the publication of channel plans.

19.7. RF1: As part of TRC's engagement with the FCC the TRC will seek to put in place procedures for obtaining the US frequency licences necessary to implement international fixed links.

19.8. ***RF2: If there is demand from major users the TRC proposes to assign them blocks of spectrum for fixed links that they would self manage (e.g. blocks of 2x112 MHz which would allow multiple channels to be deployed at one site). In deciding the size of any blocks TRC will be mindful of the need to accommodate multiple competing fixed and mobile operators in particular frequency ranges. Users will be required to justify additional requirements. They would also need to notify the TRC of the frequencies and sites used a before site can be established or frequency is used in order to ensure appropriate management of the spectrum.***

19.9. In addition, some government users expressed interest in fixed links for telemetry purposes. In the US and Europe these applications typically use bands that are allocated to land mobile services. For example the US frequency bands include: 72-76 MHz, 154 MHz, 173 MHz, 216-220 MHz, 220-222MHz, 450-470 MHz and 1427-1435 MHz[79]. The TRC will be consulting with users on which bands to release for telemetry services.

19.10. The BVI Electricity Corporation may also have a future requirement for spectrum to support smart meters and more automated control of its network (so called smart grids). At present there is no international consensus about the frequency bands and technologies that might be used for these applications, though generally utilities are looking for frequency bands below 2 GHz because of the coverage advantages offered by these frequencies.

19.11. RF3: The TRC will wait to see what decisions are taken in the US[80] and Europe concerning spectrum allocations for smart grids and smart meters. The current uncertainty about which bands will be used means it is not possible to reserve spectrum for this application at present.

Question 19: Are better procedures required for obtaining licences necessary to implement international fixed links?

Question 20: Is there any interest from fixed link users in having access to block assignments? If so, which frequency bands would be preferred?

Question 21: Do you have any views on the frequencies that might in future be used in the VI to support smart meters and smart grids?

Operator responses

19.12. The operators agreed with the TRC's proposals to engage with the FCC to improve procedures for obtaining licences for international fixed links. CCT suggested that these licences should result in lower prices for international connectivity and offer wholesale access on a non-discriminatory basis.

19.13. The operators were interested in having block assignments for fixed links.

19.14. The operators did not have views on frequencies for smart grids.

[79] Section 90.238, 47 CFR Part 90

[80] See http://www.utc.org/utc/utility-spectrum-crisis-critical-need-enable-smart-grids

TRC response

19.15. The TRC will adopt the three proposals (RF1-3) in this area.

20. Broadcasting

20.1. Assignments to broadcasting services in the allocated bands and indications of future demand expressed by market players are listed in Table 4-1.

Table 4-1: Current situation and future demand for broadcasting frequencies

Allocation	Number of assignments/maximum available	Future demand
AM radio	1	3 applications
FM radio	6 active, 3 dormant and 3 unused frequencies registered at ITU but some may suffer interference from US	6 applications
TV – VHF	No assignments. Channel 5 is available for VI 76-82 MHz,	Possibly from local broadcasters for digital TV services
TV – UHF	No assignments.	Possibly from local broadcasters for digital TV services

a) Radio

20.2. There is strong demand for AM and FM radio licences and there are potentially 6 frequencies available for use in the VI though the potential for interference to 3 of these frequencies needs to be established. The TRC proposes to release frequencies by conducting a tender process (if the demand exceeds supply) for the award of AM and FM licences that take account of the applicants' proposed business and service plans, so that licences are awarded to applicants with the best chance of being commercially viable and meeting public policy objectives in respect of local content and ownership, service coverage, competition and diversity of services.

20.3. RB1: To accommodate demand for AM and FM radio licences, the TRC proposes to:

- ***Assess the available supply frequencies in the FM and AM bands taking account of international coordination requirements.***
- ***Ask for expressions of interest for the frequencies where applicants must demonstrate that they are technically and financially competent, their facilities will have the minimum possible environmental impact, and they are belongers or a belonger company and of good standing.***
- ***Where the demand for spectrum exceeds its availability, award licences based on a formal competitive process based on the following criteria: impact on competition; uniqueness of the proposed services; amount of original VI content; efficiency of spectrum use (including maximum use of the resource and time to commence broadcasting).***

Question 22: Do you have any comments on the proposed approached to assigning AM and FM radio licences, including the nature and relative importance of the proposed award criteria?

TRC Response

20.4. No comments were expressed by the operators and so the TRC will adopt the proposed approach.

b) TV

20.5. BVI Cable TV currently has most of the TV market (together with illegal satellite reception). There is no terrestrial TV broadcasting however there is one assignment registered at the ITU in VHF - none have been registered at UHF. The number of frequencies at VHF and UHF potentially available to the VI is currently not known by the TRC. In this regard the VI should take account of plans in the US to reallocate frequencies above 572 MHz from TV broadcasting to mobile broadband services once these become FCC policy.[81]

20.6. Demand for frequencies to provide TV services has been expressed by local channels and a mobile operator who wishes to provide mobile TV services. The markets for both services are highly uncertain.

20.7. In respect of digital terrestrial TV services, there are a number of obstacles to achieving audiences large enough to make services viable including:

- Houses in the VI do not have terrestrial antennas. Householders would need to find the content attractive enough to make purchase of antennas (and set top boxes for digital to analogue conversion) worthwhile.
- A competing satellite service that can be legally received in the VI might be provided in future by satellite direct-to-home TV. However, it may be possible to require the satellite provider to install a terrestrial antenna together with a satellite antenna. This would have the advantage of ensuring local channels are available to all households, regardless of whether they used satellite, cable or terrestrial reception.
- The advertising market is rather small.

20.8. In respect of mobile TV services commercial deployments have failed in many parts of the world including the US and in Europe (e.g. the UK). One organisation has requested 24 MHz of spectrum for mobile TV services in the UHF band. This amount of bandwidth is unusually large, given for example that in the US Qualcomm's now abandoned[82] mobile TV MediaFLO venture delivered about 20 channels of programming in one 6 MHz channel.

20.9. Any award of frequencies for mobile TV in the VI should be coordinated with and take account of requests for frequencies for DTT (digital terrestrial transmission) TV broadcasts and of the use of UHF channels by TV broadcasters in the USVI and Puerto Rico which might interfere and be interfered with by mobile TV transmitters in the VI.

20.10. RB2: The TRC plans to:

- ***Establish the availability of frequencies at VHF and UHF, taking account of US plans to reallocate the 600 MHz band from TV broadcasting to mobile broadband;***
- ***Invite expressions of interest from potential TV broadcasters and mobile operators to operate terrestrial digital TV services and mobile TV services respectively in the VI. The expressions of interest should include an indication of the number of frequencies required, the bandwidth of***

[81] http://files.ctia.org/pdf/CTIA_CEA_TV_Spectrum_Whitepaper_Summary.pdf

[82] "Qualcomm Shutting Down MediaFLO USA", http://www.roundbox.com/blog/?p=83

transmissions, the nature of services to be offered, an indication of the potential service viability and evidence of the applicants' technical and financial capability.

Question 23: Do you have any comments on the proposed approached to assigning spectrum for TV broadcasting services?

TRC Response

20.11. No comments were expressed by the operators and so the TRC will adopt the proposed approach.

21. Maritime and aeronautical

21.1. Maritime and aeronautical use of spectrum is confined to the internationally harmonised frequency bands. The main issue identified here concerns the lack of discipline by the maritime community concerning their use of ship to shore communications channels. There is a great deal of use of the distress and safety channel (channel 16) for non-emergency communications. The TRC's approach to this issue is to educate ship owners about the importance of not using this channel for routine communications. This involves requiring applicants for ships' licences to undertake a course in short range communications and asking the charter companies to move to working channels when they receive non-distress calls from boats on channel 16.

21.2. There is likely to be growing demand for assignments from the maritime and aeronautical community to support broadband and other data transmission requirements. It can be expected that in the VI as elsewhere the needs of the maritime and aeronautical communities will be met from within the bands that are internationally harmonised for these services. For example, the main source of additional demand for aeronautical applications is terrestrial and satellite communications to support unmanned aeronautical vehicles (UAVs). The specific requirement given in Agenda Item 1.3 (WRC-12) is for 34 MHz for terrestrial communications and 56 MHz for satellite communications. It is expected these requirements will be met in existing aeronautical allocations, for example 960-1164 MHz and the 5000-5150MHz band.

21.3. The Act exempts the UK Navy from any licensing requirements, although they normally notify the TRC of their requirements when in port. It is clearly helpful for this practice to continue so that TRC can identify any potential problems and harmful interference to spectrum users is avoided or limited.

21.4. It is important that the internationally harmonised bands for aeronautical and maritime services continue to be protected and that in future they are specified in the national frequency allocation table.

22. Satellite

a) Current situation

22.1. The main use of satellite services is VSAT and satellite earth stations. VSAT services are used to gather data from weather stations and other remote monitoring sites and there are a small number of VSAT users at C band (e.g. DDM, LIME) for communications purposes. BVI Cable TV operates satellite earth stations in C band.

22.2. There are no broadcast satellite services directed towards to the VI, however, an orbital slot is recorded for the VI for satellite broadcasting with the frequency channels specified in Appendix 30 (for downlinks at 12 GHz) and Appendix 30a (for a feeder link at 17 GHz) of the ITU Radio Regulations.

22.3. In addition, the TRC could file satellite orbital slot applications on behalf of satellite operators through Ofcom. This must be done through Ofcom because they are the VI's ITU representative. If this action was taken by the TRC then Ofcom would undertake due diligence to check the validity of the application before making a filing with the ITU.

b) Issues

22.4. No issues were identified in the discussions with stakeholders or in the assessment of the current situation.

22.5. In the future the TRC could seek to attract satellite applications to provide a broadcast satellite service using its ITU allocation or could indicate to satellite operators that it was willing to file orbital slot applications on behalf of operators. This would require the TRC to have resources to check the quality of the submissions before they are passed on to Ofcom. The TRC considers that this is not an immediate priority given the resources required to address more immediate needs in respect of mobile and broadband wireless services.

22.6. RS1: In the medium term (once more immediate spectrum management priorities have been completed) the TRC will consider seeking to attract satellite applications to provide a broadcast satellite service using its ITU allocation and indicate to satellite operators that it is willing to file orbital slot applications.

Question 24: Is there any immediate interest in providing satellite services through filings in the VI?

Operator responses

22.7. LIME expressed interest in operating VSAT services to corporate and SME customers.

TRC response

22.8. LIME may already apply to TRC for VSAT authorisations.

23. Amateur

23.1. Amateurs in the VI use the US amateur bands. There are 4 amateurs in the VI and several others who wish to become certificated. The amateurs are satisfied with their current frequency allocations and do not anticipating needing additional frequencies.

23.2. The main issues concerning amateur use arise from the arrangements for licensing individuals which are set out in the Telecommunications Rules, June 1951, made under the Telecommunications Act 1951 (CAP 171). In particular the Rules

- Require all applicants for an amateur telecommunications licence to have competence in the theory and use of the Morse Code.
- Define 3 classes of amateur telecommunications station – general, novice and VHF

23.3. Other jurisdictions, such as the Canada, US and the UK, have dropped requirements in respect of Morse Code as it is no longer in use. In the US amateurs can also apply for club licences. There is demand for this type of licence in the VI.

23.4. RA1: The TRC plans to offer club licences on similar terms to those that attach to US club licences.

23.5. RA2: The TRC plans to remove requirements on amateurs for Morse Code competence.

Question 25: Are there any comments on TRC's proposals to simplify the licensing of amateurs in the VI (RA1, RA2)?

Operator responses

23.6. It was suggested that amateur spectrum use should be monitored to ensure their spectrum use is responsible and does not cause interference to other users.

TRC Response

23.7. The TRC will take this into account in its interference monitoring activities.

24. Test and development uses

24.1. Manufacturers and operators need vacant spectrum in which to test equipment in a real life situation. Some administrations issue temporary test and development licences for this purpose[83]. In countries with plentiful spectrum, such as the VI, the availability of these licences has the benefit of attracting high value economic activity. The potential downside with issuing such licences is that they may be used (inappropriately) to launch commercial services and it can then be difficult to remove what was intended to be only a temporary licence. It is important therefore that the licence is not used to test the commercial feasibility of new applications.

24.2. To facilitate the issue of test and development licences the TRC would advertise their availability on its website. The TRC would also have to be confident that it has an accurate record of current assignments before issuing any such licences otherwise there would be a risk of harmful interference.

24.3. RTD1: The TRC may develop conditions required to implement test and development licences. These conditions will need to address the licence duration, fees and arrangements for modification, suspension and revocation of the licence. Such licences will only be issued in bands that have been audited (to ensure harmful interference does not occur) and where there is likely to be surplus spectrum.

Question 26: Is there any immediate requirement for test and development licences in the VI? If so, examples of applications that might be tested would be appreciated?

Operator responses

24.4. One operator indicated interest in test and development licences.

TRC response

24.5. The TRC will discuss this possibility further with the relevant operator.

[83] See for example the arrangements in Ireland http://www.comreg.ie/radio_spectrum/wireless_test_and_trail_licensing.541.545.html

Glossary

Acronym	Meaning
AM	Amplitude modulation
ARPU	Average revenue per user
VI	Virgin Islands
BWA	Broadband Wireless Access
CB	Citizens' Band
CDMA	Code division multiplex access
DDM	Department of Disaster Management (VI Government)
ECC	European Communications Committee (formerly the European Radiocommunications Committee)
ECTEL	Eastern Caribbean Telecommunications Authority
EU	European Union
EVDO	Evolution data optimised (Rev 0, Rev A)
FCC	Federal Communications Commission (US)
FCFS	First come first served
FDD	Frequency division duplex
FM	Frequency modulation
GSM	Global system for mobile communications - originally from Groupe Spécial Mobile
HSPA	High speed packet access – a mobile broadband technology now being widely deployed
ITU	International Telecommunications Union
LTE	Long term evolution – the next generation mobile broadband technology beyond HSPA
MLS	Microwave Landing System
NFAT	National frequency allocation table
Ofcom	Office of communications regulator (UK)
RFID	Radio Frequency Identification – a system that uses wireless communication to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking
RSA	Recognised spectrum access
TDD	Time division duplex
US VI	United States Virgin Islands
Vsat	Very small aperture terminal (satellite earth station)
WCDMA	Wideband code division multiplex access
Wi-Fi	Wireless Fidelity

Acronym	Meaning
WiMAX	Worldwide Interoperability for Microwave Access – a wireless broadband technology offered in incompatible versions for fixed and mobile access; the mobile version competes with HSPA and LTE.
WRC – 12	World Radio Conference 2012