Commission

Spectrum Management Framework Review 2017

Consultation Document

Consultation

Publication date: [01 September 2017]

Closing date for responses: [29 September]

Reference Number: 1/2017

About this document[1]

In May 2011, the Telecommunications Regulatory Commission of the Virgin Islands ("Commission") published the Virgin Islands Spectrum Management Framework ("SMF") on its website (www.trc.vg). This set out the Commission's position on spectrum management in the Virgin Islands, covering matters such as spectrum allocations, spectrum assignments, licensing requirements and associated fees, and interference management and enforcement. It also contains an assessment of the demand for mobile, wireless broadband, broadcasting and private applications over the short to medium term and how any incremental demand would be considered by the Commission.

It is important that the SMF remains up-to-date and forward looking. Given the elapsed time since the development of the initial SMF, the Commission has commenced a review of the framework with a view to updating it, where necessary, to reflect key international and domestic developments.

In this document, the Commission sets out: in this document.

- a revised, draft SMF;
- a draft Implementation Plan outlining how it will give effect to the actions identified in the draft SMF; and
- a draft National Frequency Allocation Tables ("NFAT") which records all spectrum allocations in the Virgin Islands.

These documents build on the Commission's assessment of domestic and global trends in spectrum management, stakeholder meetings conducted at the beginning of the review process and an assessment of additional information provided to the Commission by service providers.

The Commission now wishes to consult with interested parties on its draft SMF, draft Implementation Plan and draft NFAT. Once the Commission has received and considered responses to this consultative process, it will issue a final SMF, Implementation Plan and NFAT, taking into account, so far as possible, the relevant responses received to this consultation.

[1] Disclaimer: All references to frequency assignments, allocations or similar terms in this document should not be interpreted as granting and or 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 formal frequency authorisation issued by the Commission.

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Instructions for submitting a response

The Commission invites comments on this consultation document from all interested parties. To facilitate this, the Commission has set out 25 specific consultation questions on the key matters covered in the draft SMF. Each respondent should include a completed cover sheet (set out on the next page) as part of its consultation response to the Commission.

Comments should be submitted by 29 September 2017 in line with the guidelines for conducting consultations set out in the Telecommunications Code (Part 1) (Public Consultations and Public Hearings) Guidelines, 2012. The Commission reserves the right not to consider any responses submitted after this date.

Preferably, responses to this document should be sent by email to consultations@trc.vg (indicating the subject): "*Consultation on the Spectrum Management Framework Review 2017*". Alternatively, the responses may be sent to the address (or the number) below:

Consultation on the Spectrum Management Framework Review 2017 – Telecommunications Regulatory Commission P.O. Box 4401 or 27 Fish Lock Road, 3rd Floor Road Town, Tortola, British Virgin Islands VG 1110 Fax: (284) 494 6786.

Responses should include:

In the case of responses from corporate bodies (legal persons):

- the name of the company/institution/association/other organisation;
- the name of a principal contact person; and
- full contact details (physical address, postal address, telephone number, fax number and email address).

In the case of responses from individual (natural) persons:

- the name of the person; and
- full contact details (including email).

In the interest of transparency, the Commission will normally make all submissions received available to public, subject to the confidentiality of the information received. The Commission will evaluate requests for confidentiality according to relevant legal principles.

[2] http://www.trc.vg/attachments/030_G00349_SI%20No%20100%20of%202010%20-%20Telecommunications%20Code%20(Part%201)%20(Public%20Consultations%20and%20Public%20Hearings)%20Guidelines,%202010.pdf20Telecommunications%20Code%20%28Part%201%29%20%28Public%20Consultations%20and%20Public%20Hearings%29%20Guidelines,%202010.pdf

Respondents are required to clearly mark any information included in their submission which they consider to be confidential, and provide reasons why that information should be treated as such. Where information claimed to be confidential is included in a submission, respondents are required to provide both a confidential and a non-confidential version of their submission. The Commission will determine whether information claimed to be confidential is to be treated as such and, if so, will not publish that information. In respect of information that is determined to be non-confidential, the Commission may publish or refrain from publishing such information at its sole discretion.

Once the Commission has received and considered responses to this consultative process, it will issue a final SMF (including a report on the consultation) which will be published on the Commission's website.

Cover sheet for response to a Commission consultation

BASIC DETAILS

Consultation title:
To (Commission Contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below which part of your response you consider is confidential, giving your reasons why

Nothing	Name/contact details/job title
Whole response	Organisation
Part of the response	Details of Confidential Information

If you want part of your response, your name or your organisation not to be published, we can still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that the Commission can publish. However, in supplying this response, I understand that the Commission may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, the Commission can disregard any standard email text about not disclosing email contents and attachments.

The Commission seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name Signed (if hard copy)

Consultation questions

Please see below for a list of 25 questions, which are stated throughout the document. These are placed here so that you can know in advance what to expect through the document as you think on your considered responses.

1. Do you agree with the Commission's overview of the key developments in the Virgin Islands communications markets and international trends in spectrum management? If not, please elaborate on any further, relevant developments which need to be considered in this review and how these should be taken into account.

2. Do you agree with the stated objectives of this SMF? If not, please explain which further objectives should be considered and why.

3. Do you agree with the Commission's position on promoting efficient use of spectrum and how this is reflected in this SMF? If not, please explain why not and what alternative approaches to promote efficient use of spectrum should be adopted.

4. Do you agree with the Commission's proposals (i) to follow, in principle, US band plans and (ii) to complete spectrum agreements with the US Virgin Islands? If not, please provide further information as to your reasoning for disagreement.

5. Do you have a view on the band plans that should be adopted in specific frequency bands? Please explain your response.

6. Do you agree with the Commission's proposal on licence exempt bands? If not, please propose an alternative to licence exempt bands, and set out why you consider the alternative to be preferable to the Commission's proposals.

7. Do you agree with the spectrum bands the Commission proposes to release in Phase 1 of its spectrum release plan? If so, please comment on whether the three bands should be offered at the same time or sequentially? If not at the same time, in which sequence should they be released? Please also comment on the importance of including the (entire) 2300 MHz band within Phase 1 and how cross-border interference can be best managed within this band.

8. Do you agree with the proposed spectrum bands the Commission proposes to release in Phase 2 of its spectrum release plan? If so, please comment on whether the three bands should be offered at the same time or sequentially? If not at the same time, in which sequence should they be released?

9. Do you have any views on which band plan the Commission should prescribe for the 3.4 – 3.8 GHz band? Explain why. Also, in your view, when would this spectrum be required?

10. What position should the Commission take with respect to the deployment of LTE (and later possibly 5G technology) in the 5 GHz band? Would any specific measures be required to protect other license exempt use in the 5 GHz band? In your view, when would this 5 GHz spectrum be required?

11. In your views, are there any further spectrum bands beyond those specified in Phases 1 to 3 of the spectrum release plan which should be released for mobile services within the relevant period? Please elaborate on the requirement justifying early release of other bands for mobile services.

12. Do you agree with the Commission's preliminary view as to how it will assign spectrum under this SMF? If not, please explain what alternative you would suggest.

13. Do you agree with the Commission's proposals to assign contiguous mobile spectrum in new assignment rounds? If not, please explain why you disagree.

14. Do you agree with the Commission's preliminary proposals to revise the existing spectrum caps (including the removal of the global spectrum cap)?

15. Do you agree with the Commission's plan to issue frequency authorisations for all government use of spectrum?

16. Would you be interested in test and development licences, and if so, what tests and in which bands?

17. Do you agree with the Commission's proposal to introduce spectrum trading formally in the Virgin Islands? If not, please explain why you disagree with this proposal.

18. Do you agree with the Commission's preliminary proposal for the review process of spectrum trading applications? If not, please provide detailed comments on how the Commission's proposal can be improved.

19. Do you agree with the Commission's preliminary position to impose coverage obligations, minimum speed and other quality of service requirements and "use it or lose it" clauses in future spectrum licences?

20. Do you agree with the Commission's preliminary position to retain the current provisions for licence renewal, revocation or suspensions?

21. Do you agree with the Commission's preliminary intention on the need to apply annual licence fees to fixed wireless licences, fixed satellite service licences and public sector users of spectrum/radio frequency going forward? Do you agree with the Commission's preliminary intention to apply annual fees on all current mobile spectrum authorisations (i.e., including those awarded before 2016)? If you disagree, please provide a clear justification for your objection.

22. Do you agree with the Commission's preliminary view on the need for and approach to incentive spectrum pricing for existing high value spectrum holdings? If not, please provide reasons and alternative methods of encouraging efficient use of spectrum.

23. Do you agree with the Commission's preliminary view to complete a frequency coordination agreement with the US Virgin Islands on mobile communications in the short term? Do you see the necessity of completing frequency coordination agreements with neighbouring countries on frequency bands for other uses?

24. In your view, is the interference issue with the unauthorised use of European DECT systems sufficiently resolved at the moment? If not, what additional measures should be taken?
Are you currently confronted with any other interference issues? If so, please specify exactly which bands and/or users or uses your issues relate to.
Would you agree with the Commission restricting the ISM 902 – 928 MHz to 915 – 928 MHz? If not, why?

25. Do you agree with the proposed implementation plan for the revised SMF, including the proposed timing? If not, please explain and justify what amendments you propose to the current plan.

Glossary/Interpretations

In this document, unless the context otherwise require, the listed abbreviations are to be read as having the meanings referenced below.

Abbreviations	Meaning
AM	Amplitude Modulation (broadcast)
AWS	Advanced Wireless Services
CBRS	Citizens' Broadband Radio Service
CAGR	Compounded Annual Growth Rate
DECT	Digital Enhanced Cordless Telecommunications
DL	Down Link (of Base Station)
DTT	Digital Terrestrial Television
ECTEL	Eastern Caribbean Telecommunications Authority
EU	European Union
FCC	Federal Communications Commission (US)
FCFS	First Come First Served
FDD	Frequency Division Duplex
FM	Frequency Modulation (broadcast)
GDP	Gross Domestic Product
GSA	Global Mobile Suppliers Association
GSM	Global System for Mobile Communications
GSMA	GSM Association
HCM	Harmonized Calculation Method (European)
HSPA	High Speed Packet Access High Speed Packet Access plus (mobile broadband technology provided by 3G networks)
HSPA^{+}	High Speed Packet Access plus (mobile broadband technology provided by 3G networks)
ICAO	International Civil Aviation Organization
IMT-2000	International Mobile Telecommunications 2000 (3G)
IMT-2000 advanced	International Mobile Telecommunications 2000 (4G)
IoT	Internet of Things
ISM	Industrial Scientific Medical (radio communication services)

Abbreviations	Meaning
ITU	International Telecommunications Union
LTE	Long Term Evolution (4G);
LTE-U	LTE-Unlicensed
LTE-LAA	LTE-License Assisted Access
M2M	Machine to Machine (communications)
NCC	Network Colour Code (GSM)
NFAT	National Frequency Allocation Table
Ofcom	Office of communications regulator (UK)
PCI	Physical-layer Cell Identities (LTE)
RATG	Radio Access Technology Group (of the ITU)
RX	Receiver
SMF	Spectrum Management Framework
2011 SMF	Initial SMF prepared and published by the Commission in May 2011
TDD	Time Division Duplex
TX	Transmitter
UL	Up Link (of Base Station)
UMTS	Universal Mobile Telecommunications System (3G)
UE	User Equipment
e-UTRA	Evolved Universal Terrestrial Radio Access
VNI	Visual Networking Index
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WRC	World Radio Conference
3GPP	3rd Generation Partnership Project

Part A: Context and objectives of this review process[3]

The Commission's decision to review the SMF has been driven by three key factors. These are summarised below and then described in more detail in the remainder of this section, alongside a statement of the key objectives of the revised SMF and an overview of the remainder of this document.

Key points:

- Demand for mobile spectrum in the Virgin Islands is expected to increase significantly. This is in line with global trends in mobile spectrum. This will require more spectrum to be released for mobile services, in addition to that released in the 700 MHz, 1900 MHz and AWS-1 (2100 MHz / 1700 MHz) bands in 2016.
- Due to the growing demand for spectrum, a critical role for any spectrum manager, such as the Commission, is to ensure that new mobile spectrum bands are put into productive use as soon as reasonably possible. The Commission wishes to will promote and ensure the efficient use of all spectrum and spectrum holdings, which is paramount for all spectrum holdings, while ensuring that the overall economy benefits from that spectrum.
- Both cross-border and, to a lesser extent, domestic interference remain a concern for mobile network operators in the Virgin Islands. As such, this will require continued action by the Commission to reduce such interference going forward.

The review of the 2011 SMF aims to ensure that the framework for managing spectrum remains up-to-date, is in line with international practice, takes into account the local market environment, and will maximise the benefits generated by spectrum for the Virgin Islands economy and society.

1. Background

In reviewing the framework, the Commission has taken account of local factors, recent developments in the communications sector affecting the demand for spectrum (from both a global and local perspective) and trends in spectrum management. The particular factors that the Commission has had regard to are described below.

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1.1 Local context

The Virgin Islands is a British overseas territory, which comprise over 50 islands, with a population of around 30,000 to 35,000 inhabitants concentrated on the four main islands of Tortola, Virgin Gorda, Anegada and Jost Van Dyke. The Territory's location in the Eastern Caribbean and resultant susceptibility to varying weather patterns means that the communications infrastructure must be robust in periods of heavy rainfall and hurricanes.

The Virgin Islands is a relatively affluent country with an average GDP/capita of $32,420 and attracts large numbers of tourists, annually. In 2016 there were around 1,248,000 visitors to the Virgin Islands, 56% of whom arrived on cruise ships. Tourism and the international financial services sector are the mainstays of the local economy. The communications needs of the country are therefore greater than suggested by the population estimates. International traffic, including 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 boats, cruise ships, chartered boats and ferries sailing in the Virgin Island's waters. The use of unlicensed European radio (DECT) equipment by some cruise ships has also resulted in interference with certain spectrum used by mobile network operators in the Virgin Islands. Additionally, given its proximity to the US Virgin Islands (less than 20 miles away) and Puerto Rico (60 miles away), the Virgin Islands experiences a spill over of wireless services to/from these Territories.

Although the small size of the Virgin Islands' population is not a direct indication of communications services usage, it does translate to limited resources for spectrum management. The proposed framework has taken this into account by seeking solutions to issues that minimise administrative overheads whilst still promoting effective spectrum management by the Commission.

1.2 Recent developments in the communications sector

There have been several developments in the Virgin Islands communications sector and more widely since publication of the SMF in 2011 which are relevant to spectrum management. These developments are described in this section, focusing first on global demand trends and how this is likely to impact the Virgin Islands, before turning to other, more specific local matters.

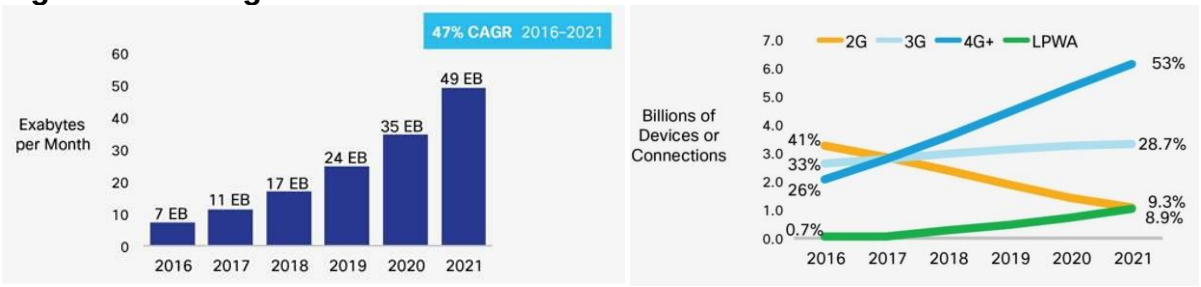
Demand trends

Mobile communications services are a particularly important element of communications services in the Virgin Islands. Take-up of mobile communications

services exceeded 185% of the total population in late 2016[4], a result of (i) local demand, (ii) demand from the large number of tourists who visit the Islands, and (iii) the maritime needs of vessels in the surrounding waters. As the primary user of high value, relatively scarce low frequency spectrum, the demand for mobile services is a key parameter to take into account in the SMF. This is particularly so, given the importance of an efficient and effective mobile market to consumers in the Virgin Islands and the Islands' broader economy.

This high level of demand for mobile services is expected to continue in the future, with demand for mobile data services in particular projected to increase significantly. This is both, due to growth of the number of mobile broadband customers as well as due to the growth of data traffic per user, as users access more data rich content and the number of connected devices and Internet of Things (IoT) uses grows. This trend is not limited to the Virgin Islands, as illustrated by the Cisco global Visual Networking Index (VNI), set out in Figure 1 below. The Cisco VNI further projects a compounded annual growth rate (CAGR) in average mobile traffic per user of 30% for Latin America and 42% for North America between 2016 and 2022.

Figure 1: Cisco global VNI



Source: Cisco VNI Mobile 2017, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html

To an extent, the impact of this growth in mobile traffic on the demand for spectrum will be offset by a shift to more spectrally efficient networks. In particular, mobile network operators are also seeing a strong shift from traffic being carried on GSM and 3G (UMTS/HSPA/HSPA+)) networks towards LTE. In many countries, the number of LTE users has already overtaken the number of UMTS/HSPA/HSPA+) users[5]. As a result, some mobile network operators (e.g. in the US, Australia and Singapore) have already phased out GSM networks, whilst others (.e.g. in Taiwan) are scheduled to phase out GSM this year. This has important implications for spectrum management and the demand for spectrum, given the much greater spectral efficiency of LTE

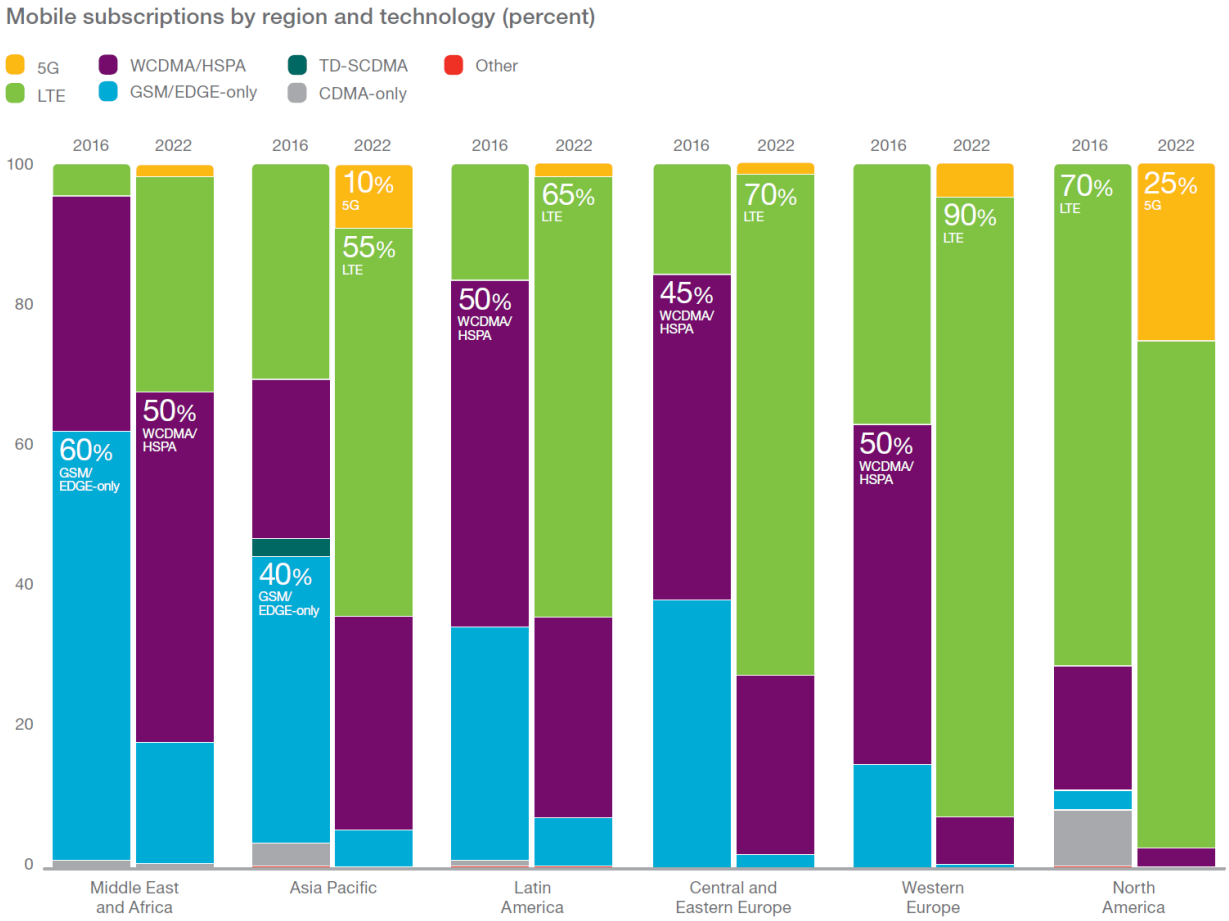
[4] Source: Telegeography

[5] Early 4G markets such as South Korea, Australia and the US have the highest 4G-LTE adoption rates – all above 60% of total connections at the end of 2016. Source: GSMA Intelligence at https://www.gsmaintelligence.com/research/2017/04/uneven-4g-adoption-has-implications-for-5g-outlook/618

networks (i.e., the much greater ability of an LTE network to carry a given amount of data with less spectrum than a GSM or UMTS network).

Given the size of the Virgin Islands, there are no external third party forecasts for the local growth in data traffic and the take-up of LTE. In developing the SMF, the Commission has therefore examined regional forecasts for both North America (where the advanced market means that rapid take-up of LTE is forecasted) and Latin America, were the migration to LTE is more dependent on the availability of affordable, low cost devices. As shown in Figure 2**:** below, according to Ericsson's Mobility Report, by 2022 almost all mobile devices in North America will be on 4G and 5G networks, whereas in Latin America, only 65% will be on LTE, with a very small proportion of 5G devices. The Commission expects, therefore, that a majority of users in the Virgin Islands will be on LTE by 2022.

Figure 2: Mobile subscription split by region and technology



Source: Ericsson Mobility Report, June 2017

The Commission considers that the Virgin Islands is likely to lie somewhere in-between the North-American trends and the Latin American trends. This is supported by high level traffic forecasts provided by the mobile network operators in the Virgin Islands.

As such, it is clear that the SMF needs to cater for rapidly increasing volumes of traffic on mobile networks. In the Commission's view, this will require both promoting the switch to LTE networks to enable an efficient transport of the data traffic, as well as further release of mobile spectrum.

Spectrum Award 2016

To support the provision of high speed mobile broadband services using LTE technology, the 2011 SMF proposed that the Commission should grant additional spectrum to service providers. Hence, on August 23, 2016, the Commission awarded CCT, Digicel and Flow spectrum in the 700 MHz, 1900 MHz and AWS-1 (2100 MHz / 1700 MHz) bands, following the conclusion of its 'Spectrum Award 2016' process.[6]

As part of its review of the 2011 SMF, the Commission has taken this spectrum award into account and has considered its impact thereof on current spectrum holdings, the incremental need for the release of further spectrum, the required level of any spectrum caps, and so on.

Interference

Interference from the US Virgin Islands and other neighbouring islands remains an issue for mobile network operators in the Virgin Islands. In addition, one operator has raised concerns about cruise ships and yachts using (licence exempt) European DECT systems on spectrum in the 1880 – 1900 MHz[7] when in Virgin Islands waters, causing interference in the 1900 MHz spectrum band for mobile services.

The Commission has considered both of these issues as part of its review of the SMF, with a view to identifying possible measures to mitigate both types of interference in addition to procedures already in place for alleviating interference from DECT systems.

The structure of the telecommunications sector

There are currently three mobile network operators in the Virgin Islands (CCT, Digicel and Flow).

The Commission does not believe that it should promote further entry into the mobile sector at this time. This position is supported by the overall size of the Virgin Islands economy, and trends in mobile markets elsewhere. This notwithstanding, the

[6] http://www.trc.vg/images/attachments/Press_Releases_2016/Announcement%20of%20the%20Grant%20of%20Spectrum%20in%20the%20Spectrum%20Award%202016(1).pdf

[7] This DECT frequency band (1880 MHz–1900 MHz) is used in all countries in Europe. Outside Europe, it is used in most of Asia, Australia and South America. In the US the frequency band 1920 – 1930 MHz is used.

Commission remains open to entrants who can add to sustainable competition in the sector and meet all the applicable licensing requirements. As such, whilst there remain three viable mobile network operators, the Commission will not seek (during the period governed by the new SMF) to actively promote further entry by, for example, setting aside spectrum for a new entrant.

The Commission does, however, believe that having three viable mobile network operators is important for ensuring effective competition and high quality consumer outcomes in the mobile sector. It has therefore prepared this draft SMF with these principles in mind.

1.3 International trends in spectrum management

The Commission's revisions to the SMF also reflect recent global trends in spectrum management. The specific trends the Commission has considered are described below.

Release of new spectrum bands

As the demand for wireless data continues to grow, so too does the demand for spectrum. New technologies like LTE-Advanced, 5G, Digital Terrestrial Television (DDT), the IoT sector and bandwidth hungry services like streaming high quality video, will further increase the demand for spectrum.

Whilst the focus of the preceding section has been on mobile communications, this is not the only use for spectrum. Indeed, radio spectrum also plays a vital role in provisioning a broad variety of private and governmental radio-communications services, as well as AM-FM radio broadcast services and in many countries, digital terrestrial TV (DTT) services. However, spectrum is a finite resource. As such, he Commission needs to take decisions about how it can be most efficiently allocated (i.e., to the maximum benefit of the economy and society), whilst also ensuring that spectrum licensees have the right incentives to use their individual spectrum holdings efficiently. Effective radio spectrum management is therefore economically and socially of utmost important.

The growing demand for spectrum is putting pressure on spectrum managers to find solutions to ensure the unrestricted long term growth of services through the allocation of new bands and ensuring that existing spectrum allocations are used as efficiently as possible. In the long run the amount of spectrum available for radio communications services is finite. In the short run, the available supply, at least for a given service, can be increased, as technological developments allow spectrum to be used more efficiently and allow new bands to be opened up. Consequently, the Commission must ensure that these new bands are put into productive use as soon as reasonably

possible, in a way which promotes the efficient use of the spectrum and which ensures that the overall economy benefits from that spectrum. This has been reflected in the Commission's proposed spectrum release plan, set out in Part E below.

Principles of spectrum management

The way in which spectrum is managed has been changing as a result of developments in technology and increasing competition for the spectrum resource, both from different users and uses. Whereas in the past the command and control approach to spectrum management has been the model of choice, today in most countries the market is increasingly used to identify the most efficient uses of spectrum, alongside various aspects of self-regulation.

For example, SMFs now typically incorporate some or all of the following principles:

- **Transparency**. This means giving transparency on spectrum management policies and decisions, greater provision of information on available spectrum and the regulators' future plans (e.g. for future releases of spectrum bands) to users and formalisation of all user's rights and obligations (including government and commercial users).
- **Technology neutrality**. Spectrum licences are increasingly awarded on a basis of technology neutrality. This means licensees are free to decide which (i) technology to use, subject to meeting specified technical constraints on emissions to avoid harmful interference, and (ii) services to provide, subject to meeting minimum requirements regarding quality of service.[8]
- **Market mechanism**. The use of market mechanisms such as auctions and spectrum trading to assign spectrum are increasingly common. Such mechanisms can enable spectrum rights to be assigned to the users who value the spectrum most, and hence to encourage more efficient spectrum use. Alongside market based mechanisms to award spectrum, administrative incentive pricing can also be used to ensure that spectrum continues to be used in the most efficient way, even after its initial allocation.
- **Flexible spectrum use**. There is an increasing presumption in favour of exempting spectrum use from licensing, or adopting "light licensing" regimes wherever this is practical, subject to the need to avoid harmful interference.

8 Technology neutrality is one of the key principles of the European regulatory framework for electronic communications. The principle was first introduced in 2002, and reinforced in 2009 with the revised EU telecoms legislation. Since the 2009 revisions, all spectrum licenses in Europe are technology neutral, see https://ec.europa.eu/digital-single-market/en/content/easier-access-radio-spectrum-eus-electronic-communications-framework.

- **Spectrum sharing**. Spectrum accessed on a shared basis, both for indoor and outdoor use is being promoted in order to cope with the significant growth in demand for mobile broadband and wireless data capacity.
- **Timely availability**. This relates to facilitating timely introduction of new applications and technology like 5G, while protecting existing services from harmful interference.
- **Affordable and fair spectrum access**. This means ensuring that spectrum policy does not create undue barriers to new wireless entrants to the market or promoting the development of wireless technologies and sustainable and effective competition, to the benefit of end users and the national economy.
- **Quality and speed of service**. To ensure any assigned spectrum is used efficiently and benefits consumers it is common to include minimum quality of service and speed requirements on spectrum licences.

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[9], Latin America and Asia. In drafting its revised SMF, the Commission has therefore had regard to the experience in these countries. It considers that all of these principles are also valid in the Virgin Islands.

Question 1: Do you agree with the Commission's overview of the key developments in the Virgin Islands communications markets and international trends in spectrum management? If not, please elaborate on any further, relevant developments which need to be considered in this review and how these should be taken into account.

2. Objectives of this Spectrum Management Framework

The 2011 SMF was developed in 2009/2010 and was based on the best information available at the time on the current and future demand for spectrum by operators and other stakeholders in the Virgin Islands. However, the communications sector is a dynamic market and it is common to review spectrum management periodically to ensure it remains reflective of the market environment and expected developments in the near future.

9 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.

The Commission has therefore embarked on this review to ensure that its framework for managing spectrum is up-to-date, in line with international best practice, and will maximise the benefits generated by spectrum for the Virgin Islands economy and society.

The revised SMF arising from this review will therefore update the current framework, taking into account lessons learned from that framework and recent developments including but not limited to those discussed above. It further identifies the expected incremental demand for spectrum over the next five years and puts forward a plan to release spectrum to meet such demand.

As part of this review, the Commission has also assessed areas not addressed in implementing the recommendations/actions set out in the 2011 SMF. For example, one of the recommendations in the 2011 SMF was to develop a NFAT, which provides a record of allocations for all frequencies and therefore provides clarity on exactly which bands are used by which applications. The Commission has now developed a draft NFAT which forms part of the policy being established in this revised SMF which will establish the spectrum plan required by section 34 of the Act and is appended to this document for your consideration.

In addition to setting out revisions to its 2011 SMF, the Commission has developed a draft plan for those actions it will take both now and in the next few years to ensure that the principles and aims of the revised framework are fully and effectively implemented. The Implementation Plan provides these details, along with a provisional timescale for implementation.

Question 2: Do you agree with the stated objectives of this SMF? If not, please explain which further objectives should be considered and why.

3. Structure of this document

The remainder of this document is structured as follows:

- Part B presents the legal and policy framework for spectrum management and allocation in the Virgin Islands.
- Part C to I then set out the revised draft spectrum management framework. In particular:
    - Part C and D contain the spectrum allocation and spectrum band planning;
    - Part E presents the Commission's preliminary views on the expected demand for mobile spectrum going forward and any resulting need to release additional spectrum;

- Part F discusses spectrum assignments;
- Part G presents the authorisation and licencing requirements;
- Part H discusses spectrum pricing and annual spectrum licence fees; and
- Part I covers interference issues.

- A draft Implementation Plan for all actions discussed in Part C to I is then presented in Part J.

Part B: Legal and policy framework for spectrum management and allocation

This section sets out the legal and policy framework for managing and allocating spectrum in the Virgin Islands. This has been adhered to in preparation of the revised SMF.

1. Legal framework

The legal framework for spectrum policy and management is given in the Telecommunications Act, 2006 ("Act"). Under the Act the Minister of Communications and Works ("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 Commission advises the Minister on policy matters. The Commission makes recommendations to the Minister and implements a position statement and action plan.

The Commission 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 Commission 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).

Specific functions in respect of spectrum management the Commission 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.

In carrying out these functions, the Commission seeks to support relevant national telecommunications, broadcasting, transport and security policies. The Commission's

mission is to promote value, choice, innovation, quality and competitive pricing for consumers and businesses by promoting investment, effective competition, informed choice and the opportunity to have access to a wide range of telecommunications services. 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.

2. Policy objectives and functions

In March 2011, the Commission published its "*Spectrum Policy for the British Virgin Islands*"[10]. This policy document was developed in parallel to the 2011 SMF and will also govern this SMF.

The Spectrum Policy derives from the objectives specified in the Act and forms part of the Telecommunications Policy. The overriding objective of this Policy is "*to create the circumstances for a fully effective and successful telecommunications sector in the BVI, delivering excellent value for money to users and maximising the contribution of the sector to the economy*".[11]

The Policy provides a clear statement of objectives from which a more detailed spectrum management framework can be derived. Specifically these objectives are:

- 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 requirements for spectrum in respect of national security.
- To comply with relevant regional and international agreements and standards, including ITU Treaties.

The Commission is satisfied that these objectives continue to be relevant. It has, therefore, used these objectives to again guide the development of a revised spectrum management framework for the Virgin Islands.

2.1 Promoting efficient use of spectrum

[10] Available at: http://www.trc.vg/images/attachments/014_BVI%20Spectrum%20Policy%20document%2022%20March%202011%20(Final)%20(2).pdf

[11] Telecommunications Liberalisation in the Virgin Islands, 10 January 2007

One of the key policy principles set out in the Spectrum Policy is to provide "*all users with incentives and opportunities to make the most productive use of spectrum. This means that the TRC should release spectrum in a timely manner and users should have incentives to make efficient use of spectrum."*[12]

Given the overall finite nature of spectrum and the fact that spectrum represents an essential input into several commercial and public services, the Commission considers it as important to ensure that assigned spectrum is used efficiently.

This is reflected in several parts of this SMF and the wider legal and regulatory framework for the sector. In particular:

- As set out in Part III, section 20(2) of the Act allows for secondary trading) of spectrum rights amongst licensees, subject to the Commission's approval, in case any licensee wishes to trade its usage rights to specific spectrum with another party. It further allows licensees to exchange specific spectrum lots assigned to them in order to improve their efficient use of these assignments, with the prior consent of the Commission.
- The Act further allows the Commission to take enforcement action against a licenced operator in case there is evidence that the licensee is not complying with the terms of its frequency authorisation or any instructions issued by the Commission in relation to the efficient use of spectrum.
- Any future spectrum licences for mobile services will also include, amongst others, minimum **quality of service obligations**. This is to ensure that consumers in the Virgin Islands benefit from the delivery of high quality mobile services over the assigned spectrum.
- The Commission will review the **spectrum fee regime** in the Virgin Islands and proposes to make a number of changes to that regime, to ensure that it incentivises the efficient use of spectrum.

Question 3: Do you agree with the Commission's position on promoting efficient use of spectrum and how this is reflected in this SMF? If not, please explain why not and what alternative approaches to promote efficient use of spectrum should be adopted.

[12] Page 5

Part C: Spectrum allocation

This section of the SMF describes the current allocation of spectrum in the Virgin Islands and in particular, considers the development of a NFAT. It then describes the pertinent issues arising, and expected to arise over the next years, in the Virgin Islands with regards to allocating spectrum to different uses, followed by proposals for how spectrum allocations will be managed by the Commission in the future.

Key points:

- The Commission has now prepared a draft NFAT, using the ITU Radio Regulations as a template. The draft NFAT can be reviewed as part of this consultation process.
- The Virgin Islands have historically followed a mix of band plans, combining those adopted in the US and Europe. Going forward, the Commission proposes to follow US band plans unless it is in the Territory's economic or social interest to do otherwise.
- The Commission will commence bilateral negotiations with the US about the actual and planned use of frequency bands for mobile communications, TV and FM broadcasting. Its objective in these negotiations will be to close formal agreements to further reduce the risk of harmful interference in the future.

1. Developing a NFAT for the Virgin Islands

In most countries spectrum allocations[13] are recorded in a NFAT. The NFAT provides a record of allocations as documented in the ITU Radio Regulations (and relevant footnotes), but with more detail on how actual frequency bands are used at a national level.

In general, countries do have some flexibility with national allocations while maintaining conformity with the ITU Radio Regulations. This is especially the case where a frequency band is allocated to several radio communications services by the ITU, in which case the national government may select which of those services may

[13] The ITU has defined allocation as follows. Allocation (of a frequency band): Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. Next to Allocation the ITU uses the terms Allotment and Assignment. Allotment (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions. Assignment (of a radio frequency or radio frequency channel): Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. Allocation refers to Radio Communication Services, Allotment to areas or countries and assignment to users of the spectrum (radio stations).

operate in its territory or may decide to split the band into sub-bands, each allocated to one or more services.[14]

NFATs must be reviewed regularly and, when necessary, be updated to keep pace with technology and changing demands. In most countries, a general review is coordinated with changes to the ITU Regulations (i.e. in general every three to four years, in line with the cycles of the ITU World Radio Conferences, where the ITU reviews its Radio Regulations).

Sometimes, NFATs may also include other relevant information such as national responsibilities regarding planning, administering, assigning or using the allocation, channel plans, technical conditions or local regulatory restrictions.[15] For example:

- The UK Frequency Allocation Table has a 'national footnote' column, which indicates the main organisation responsible for planning, administering, assigning or using the allocation.[16]
- The Bahraini NFAT provides more details of utilisation and some additional information on the band plans that are used.[17]
- The Portuguese Frequency Allocation Table also indicates details of main national applications and relevant technical details (in a Notes column).[18] 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.
- The US NFAT shows a division between a Federal and Non-Federal table and provides information on the FCC rules that apply to a band.[19]

Most countries, however, have developed a NFAT using a similar format, with the ITU Radio Regulations as a template, including the relevant footnotes and then showing the national use alongside this. The Commission has also used this format to develop its NFAT, a first draft of which is attached to this document.

As a small territory, the Virgin Islands has little choice but to follow internationally agreed spectrum allocations. And, as set out in the draft NFAT attached to this Framework, the general approach to spectrum allocation in the Virgin Islands has been to follow the ITU Allocation Plan for Region 2[20] (the Americas). As is the case in many relatively small countries, the available spectrum for the Virgin Islands, except for

[14] Countries might deviate from article 5 of the Radio Regulations as long as this will not create harmful interference to neighbouring countries and they cannot claim protection from harmful interference coming from their neighbouring countries.
[15] See https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/Feb-SMS4DC-Pacific/NTFA.pdf
[16] See https://www.ofcom.org.uk/spectrum/information/uk-fat
[17] See http://www.tra.org.bh/media/document/The%202009%20National%20Frequency%20Plan.pdf
[18] See http://www.anacom.pt/streaming/NFAP2009_2010_uk.pdf?contentId=1022890&field=ATTACHED_FILE
[19] See https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf
[20] On https://www.itu.int/net/ITU-R/index.asp?category=information&rlink=emergency-bands&lang=en an overview of the 3 ITU Regions is shown.

mobile communications, is lightly used. In what follows, therefore, the Commission focuses on the allocation of spectrum to mobile communications.

1.1 Spectrum allocation for mobile communication services in the Virgin Islands

The Virgin Islands has so far followed a mix of band plans, based on those in ITU Region 2 (US) and ITU Region 1 (Europe, Africa and the Middle East).

Following the ITU Allocation Plan for Region 2 has been beneficial to the Virgin Islands. This is because the proximity of the US Virgin Islands to the Virgin Islands means that there are advantages in harmonising with band plans used in the US as a means to limit harmful interference and to make more efficient use of the spectrum. However, as set out in Part D.3 below, following US band plans, as is the common practice in the Virgin Islands, does not, on its own, resolve the interference issues between the US Virgin Islands and Virgin Islands. The Commission will therefore be seeking to complete an agreement with the US Virgin Islands on the use of specific frequencies, both to limit continuing interference and to ensure that the early deployment of systems in the US Virgin Islands does not block opportunities for the Virgin Islands to use spectrum. The Commission's objectives for such an agreement are described in more detail in Part J below.

In some cases, the Virgin Islands is also using band plans which are more commonly used in other regions, notably, ITU Region 1. This has been a deliberate policy in some of the bands for mobile communications (e.g. parts of the 900 MHz and 1800 MHz bands[21]) so that roaming for visitors from both ITU Regions can be supported. However, the following developments point to the Virgin Islands no longer needing to use band plans more common in ITU Region 1.

- Due to the pace of international harmonization of frequency bands for mobile communications within the framework of 3GPP[22] and increased intelligence in handsets, international roaming no longer requires the use of European band plans.
- Many devices sold in the US also support the popular global band plans while devices sold in Europe typically support at least some of the specific US band plans to enable roaming in the US.[23]

[21] A combination of certain European / Asian / Latin American mobile band plans and certain US mobile band plans is called a mixed band plan. In mixed bands plans there should be sufficient spectrum space (guard bands) between the UP Link of a European / Asian / Latin American band and the Down Link of a US band.
[22] See http://www.3gpp.org/about-3gpp/about-3gpp. Within the framework of 3GPP currently 71 different frequency bands ('band classes') are defined of which some of them are partially overlapping.
[23] See for instance https://www.apple.com/iphone/LTE/ and https://www.frequencycheck.com/models/AabYB/samsung-sm-g950f-galaxy-s8-td-lte-samsung-dream regarding the LTE bands that are supported by the iPhone7 and Samsung S8.

. However, the Commission notes that the low-cost devices which are often focussed on the large and emerging markets (such as China, India, Brazil, Indonesia, etc.) typically support the popular global band plans, but may not support the special US band plans. Therefore, by continuing to retain some flexibility around specific band plans used within Europe and/or Asia, the Commission ensures that consumers in the Virgin Islands are able to access the greater range of low cost handsets available in that region.

Ongoing interference issues

A drawback for the Virgin Islands of using band plans that are common within Europe as well as band plans used in the US is that it can lead to conflicts between these band plans, meaning that harmful interference can occur. For example, the GSM 900 band (880-915/925-960 MHz) overlaps with the US licence exempt allocation at 902-928 MHz for ISM equipment[24]. If ISM equipment made for this band is used in the Virgin Islands it is likely to suffer interference from licensed GSM mobile services[25] and vice versa. Despite this risk, the Commission notes that during stakeholder interviews, the current user of this band did not mention interference with this ISM band as a problem.

Interference might also arise between the Down Link (DL) of the 850 MHz band and the Up Link (UL) of the 900 MHz band. For this reason a guard band of around 3 MHz could be created between the higher edge of the 850 MHz UL band and the lower edge of the 900 MHz DL band. Currently there is no specific policy in the Virgin Islands in respect to guard bands and power limits. However, there is an expectation that all licensee operate within their spectrum assignments, rather than to the end point. This is to reduce interference with neighbouring assignments. For LTE, relevant band classes and common carrier bandwidths are used as defined by 3GPP. There are no separate guard bands. Instead, guard bands fall within the assigned spectrum. This means that, should a guard band be required (i.e., when combining two "conflicting" band plans, or when using TDD bands), mobile network operators have to decide amongst themselves how much guard band is used and which operator provides how much of the guard band.[26]. The Commission notes that during its recent stakeholder meetings, the current user of this band did not mention DL-UL interference as a problem.

1.2 Spectrum allocation for other services

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

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

[26] Part of the 3 MHz guard band referred to above could be used by the current user of this band not close to 850 MHz base stations and indoor applications without protection.

As set out above, other spectrum allocations in the Virgin Islands are lightly used. This is further detailed in the draft NFAT attached. In summary:

- For broadcasting, the Virgin Islands have specific frequencies registered at the ITU and as such follow the internationally agreed band plan for Region 2. The spectrum for analogue and digital TV has not been assigned.
- 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.
- The band plans for the fixed link and fixed satellite bands are based upon ITU guidelines; however, no specific band plan has been applied to the fixed link and fixed satellite bands in the Virgin Islands.
- In the bands currently 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 Commission has sought to accommodate users' requests.

2. Issues identified

The Commission has identified three issues relating to spectrum allocations that need to be addressed:

1. Establish an allocation policy including an approach to dealing with conflicts between band plans commonly used in Europe / Asia /Latin America ('rest of the world') and band plans commonly used in the US;
2. Strengthen bilateral discussions required for international co-ordination with neighbours (especially the US) and completing formal agreements about the actual and planned use of frequency bands for mobile communications, TV and FM broadcasting.
3. Consider merits of guard bands to address the interference problems on down and up links (referred to above).

3. Proposed amendments / next steps

In respect of the high-level allocation policy, the Commission considers that given the Virgin Island's geographical location there should be a presumption that allocations will follow the US band plans unless there are overriding economic or social reasons to follow band plans which are used in other parts of the world. For example, there are good economic reasons to adopt European band plans for mobile services as has already been done in case of the 900 and 1800 MHz band in addition to US band plans. This is because it:

- Increases slightly the available spectrum for mobile communications,[27]
- Enables roamers to use older mobile phones (as opposed to newer mobile handsets that do not need band plans from Europe / Asia / Latin America to roam[28]) and; most importantly,
- Allows mobile network operators in the Virgin Islands to make use of the global ecosystem for low-cost devices which are broadly available in the major emerging markets. Indeed, the Commission notes that in the global adoption of the APT 700 band plan in most of Asia, Central and South America, as well as in Europe, Africa and the Middle-East, access to low-cost device ecosystems through band plan harmonisation was an important policy consideration.[29]

However, given the increased risks of interference arising from this approach, it is important that the benefits of deviating from the US band plan are, on a case by case basis, weighed against the potential costs of circumventing any problems identified.

Given the above, the Commission proposes that:

1 Given its proximity to the US, the Virgin Islands should follow US band plans unless it is in the Territory's economic or social interest to do otherwise. For example, occasionally a band plan from another Region (usually a band plan adopted in Europe but also used in major emerging markets) may better serve the local market, as has been the case in the mobile bands. For the avoidance of doubt, therefore, the Commission does not intend to seek to harmonise all Virgin Islands band plans with those of the US.

2. The Commission will commence bilateral negotiations with the US Virgin Islands about the actual and planned use of frequency bands for mobile communications, TV and FM broadcasting and close formal agreements. This is discussed further in Part J of the draft SMF.

Concerning the need for guard bands in the 850/900 MHz bands, as the current user of this band has not raised DL-UL interference as a problem, the Commission's preliminarily concludes that there is currently no need to develop a specific policy on guard bands. However, when designing future spectrum assignments, the Commission will address the topic of guard bands, block edge masks, filters and synchronization of receivers in the case of TDD spectrum.

[27] Currently the US band plans and European /Asian / Latin American band plans are more and more overlapping so there will be hardly any increase in available spectrum by following multiple band plans.
[28] See for instance https://www.apple.com/iphone/LTE/ and https://www.frequencycheck.com/models/AabYB/samsung-sm-g950f-galaxy-s8-td-lte-samsung-dream regarding the LTE bands that are supported by the iPhone7 and Samsung S8.
[29] https://telsoc.org/sites/default/files/tja/pdf/56-611-1-pb.pdf , The APT Frequency Arrangement in the 700 MHz:
Reflections on the International Spectrum Management Regime, September 2016

Question 4: Do you agree with the Commission's proposals (i) to follow, in principle, US band plans and (ii) to complete spectrum agreements with the US Virgin Islands? If not, please provide further information as to your reasoning for disagreement.

Part D: Spectrum band planning

In this section of the draft SMF, the Commission presents international trends in spectrum allocation and spectrum band planning. Again, and for the reasons set out previously, it focuses on spectrum for mobile communications and within this, particularly for LTE. It then turns to the treatment of licence exempt spectrum. For other uses of the spectrum,[30] common global practices[31] will be adhered to as much as possible.

[30] such as, for example, AM-broadcasting, aeronautical and maritime related spectrum

[31] such as the Rio de Janeiro 1981/1988 AM-plan, the frequency plans of the International Civil Aviation Organization (ICAO) and the frequency plans of the ITU

Key points:

- More and more frequency bands are being allocated to LTE (and 5G) mobile services by the global standards development organisation 3GPP. There are currently close to 60 different LTE frequency bands ('band classes'), of which some are overlapping. There is further a clear trend internationally to use higher frequency bands for LTE (such as, the 3.4 GHz, 3.7/3.8 GHz and 5 GHz bands) and to use TDD (instead of FDD).
- From those bands which have been allocated by 3GPP to LTE services, national authorities (such as the Commission) can elect the most appropriate bands to be assigned to mobile network operators in their own jurisdiction, taking into account their legacy assignments. As the chipsets in devices are able to process increasing numbers of LTE bands, it is less important whether these bands are US bands, European bands or bands used in other parts of the world. This provides national authorities with more flexibility on the choice of band plans in each country, as there is no need any more to have particular band plans in place for international roaming purposes. This is of particular importance to the Virgin Islands given its high share of international tourists and expatriates.
- Given the geographic proximity to the US, the Commission proposes to follow, in principle, the US band plans unless band plans from other regions are more spectrum efficient and possible cross-border interference can be minimised.
- Some LTE band classes have larger ecosystems of devices than others. This will impact the value of and, thus, likely release date for each band class, with the Commission placing its initial focus on releasing band classes with large device ecosystems. This is reflected in the Commission's proposed spectrum release plan, presented in Part E below).
- Licence exempt frequencies are gaining importance due to increasing use of wireless consumer electronics and to facilitate innovation. It is important to tailor some of the licence exempt bands to the specific situation in the Virgin Islands. The Commission will prepare and consult on its proposed policy on licence exempt bands and use separately.

1. Spectrum band planning for mobile communications

Spectrum allocations for mobile communications are further detailed by 3GPP[32]. Within the framework of this global standard development organisation, detailed specifications on evolved Universal Terrestrial Radio Access (e-UTRA) and radio transmission and reception of User Equipment (UE) are developed / being developed

[32] http://www.3gpp.org

for LTE and 5G. To date, 3GPP has defined the frequency bands for LTE, of which some are overlapping. Some of these bands are exclusively used in the US, others in Europe or Asia.

3GPP provides a complete overview of all the LTE band plans in 3GPP 36.104. The following table provides an overview of all standardised LTE band plans. In considering its own plans for allocating and releasing additional spectrum for mobile communications services, the Commission, however, also believes it is important to examine the availability of devices in each band and the general preference shown by operators and regulators in other countries towards particular bands. This is because, if consumers in the Virgin Islands are to benefit from the allocation of additional spectrum to mobile services, it is important that sufficient numbers of low cost devices are available to be used on those bands. This will, at least in part, be driven by the popularity of the different bands to network equipment vendors, operators and policymakers. Thus, in what follows, the Commission also presents information on the availability of devices and the uptake of different band plans elsewhere in the region.

Table 1: Overview of all standardised LTE band plans

E-UTRA Operating Band	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode
	F_{UL_low} – F_{UL_high}	F_{DL_low} – F_{DL_high}	
1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD
3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	FDD
4	1710 MHz – 1755 MHz	2110 MHz – 2155 MHz	FDD
5	824 MHz – 849 MHz	869 MHz – 894MHz	FDD
6 (NOTE 1)	830 MHz – 840 MHz	875 MHz – 885 MHz	FDD
7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	FDD
8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
9	1749.9 MHz – 1784.9 MHz	1844.9 MHz – 1879.9 MHz	FDD
10	1710 MHz – 1770 MHz	2110 MHz – 2170 MHz	FDD
11	1427.9 MHz – 1447.9 MHz	1475.9 MHz – 1495.9 MHz	FDD
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
15	Reserved	Reserved	FDD
16	Reserved	Reserved	FDD
17	704 MHz – 716 MHz	734 MHz – 746 MHz	FDD
18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD
19	830 MHz – 845 MHz	875 MHz – 890 MHz	FDD
20	832 MHz – 862 MHz	791 MHz – 821 MHz	
21	1447.9 MHz – 1462.9 MHz	1495.9 MHz – 1510.9 MHz	FDD
22	3410 MHz – 3490 MHz	3510 MHz – 3590 MHz	FDD
23[1]	2000 MHz – 2020 MHz	2180 MHz – 2200 MHz	FDD
24	1626.5 MHz – 1660.5 MHz	1525 MHz – 1559 MHz	FDD
25	1850 MHz – 1915 MHz	1930 MHz – 1995 MHz	FDD
26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
27	807 MHz – 824 MHz	852 MHz – 869 MHz	FDD
28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
29	N/A	717 MHz – 728 MHz	FDD (NOTE 2)
30	2305 MHz – 2315 MHz	2350 MHz – 2360 MHz	FDD
31	452.5 MHz – 457.5 MHz	462.5 MHz 467.5 MHz	FDD
32	N/A	1452 MHz – 1496 MHz	FDD (NOTE 2)
33	1900 MHz – 1920 MHz	1900 MHz – 1920 MHz	TDD
34	2010 MHz – 2025 MHz	2010 MHz – 2025 MHz	TDD
35	1850 MHz – 1910 MHz	1850 MHz – 1910 MHz	TDD
36	1930 MHz – 1990 MHz	1930 MHz – 1990 MHz	TDD
37	1910 MHz – 1930 MHz	1910 MHz – 1930 MHz	TDD
38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	TDD
39	1880 MHz – 1920 MHz	1880 MHz – 1920 MHz	TDD
40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	TDD
41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
42	3400 MHz – 3600 MHz	3400 MHz – 3600 MHz	TDD
43	3600 MHz – 3800 MHz	3600 MHz – 3800 MHz	TDD
44	703 MHz – 803 MHz	703 MHz – 803 MHz	TDD
45	1447 MHz – 1467 MHz	1447 MHz – 1467 MHz	TDD
46	5150 MHz – 5925 MHz	5150 MHz – 5925 MHz	TDD (NOTE 3, NOTE 4)
47	5855 MHz – 5925 MHz	5855 MHz – 5925 MHz	TDD
48	3550 MHz – 3700 MHz	3550 MHz – 3700 MHz	TDD
65	1920 MHz – 2010 MHz	2110 MHz – 2200 MHz	FDD
66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	FDD (NOTE 5)

1900 MHz
1800 MHz
AWS
850 MHz
2.6 GHz
Extended 850
2.6 GHz (TDD)
2.3 GHz (TDD)
2.6 GHz (US/Sprint TDD)

67	N/A	738 MHz – 758 MHz	FDD (NOTE 2)
68	698 MHz – 728 MHz	753 MHz – 783 MHz	FDD
69	N/A	2570 MHz – 2620 MHz	FDD (NOTE 2)
70	1695 MHz – 1710 MHz	1995 MHz – 2020 MHz	FDD[6]

NOTE 1: Band 6, 23 are not applicable for LTE.
NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.
NOTE 3: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3.
NOTE 4: Band 46 is divided into four sub-bands as in Table 5.5-1A.
NOTE 5: The range 2180 – 2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured.
NOTE 6: The range 2010-2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 300 MHz. The range 2005-2020 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured and TX-RX separation is 295 MHz.
NOTE 7: Void

Source: 3GPP TS 36.104 V14.4.0 (2017-06)

Note: LTE Band 71 is the US 600 MHz band plan, 663 – 698 MHz up and 617 – 652 MHz down and in the process of being standardised

However, not all of these band plans have a similar ecosystem. In terms of the device market, the availability of LTE devices per band is reported by the Global mobile Suppliers Association (GSACOM)[33] to be as per Table 2. This clearly shows that considerably more devices have been developed to operate in the 1800 MHz band, with relatively few devices for US specific bands (700 MHz band and AWS bands) and for relatively new LTE bands.

Table 2: Availability of LTE devices per band

LTE FDD	
1800 MHz band 3	4,305 devices
2600 MHz band 7	3,891 devices
2100 MHz band 1	3,408 devices
800 MHz band 20	2,378 devices
800/1800/2600 tri-band	2,261 devices
850 MHz band 5	1,927 devices
AWS band 4	1,776 devices
900 MHz band 8	1,701 devices
1900 MHz band 2	1,538 devices
700 MHz band 17	1,382 devices
700 MHz band 13	743 devices
APT700 band 29	550 devices
700 MHz band 12	470 devices
1900 MHz band 25	336 devices
LTE TDD	
2300 MHz band 40	2,161 devices
2600 MHz band 38	1,720 devices
2600 MHz band 41	1,599 devices
1900 MHz band 39	1,358 devices

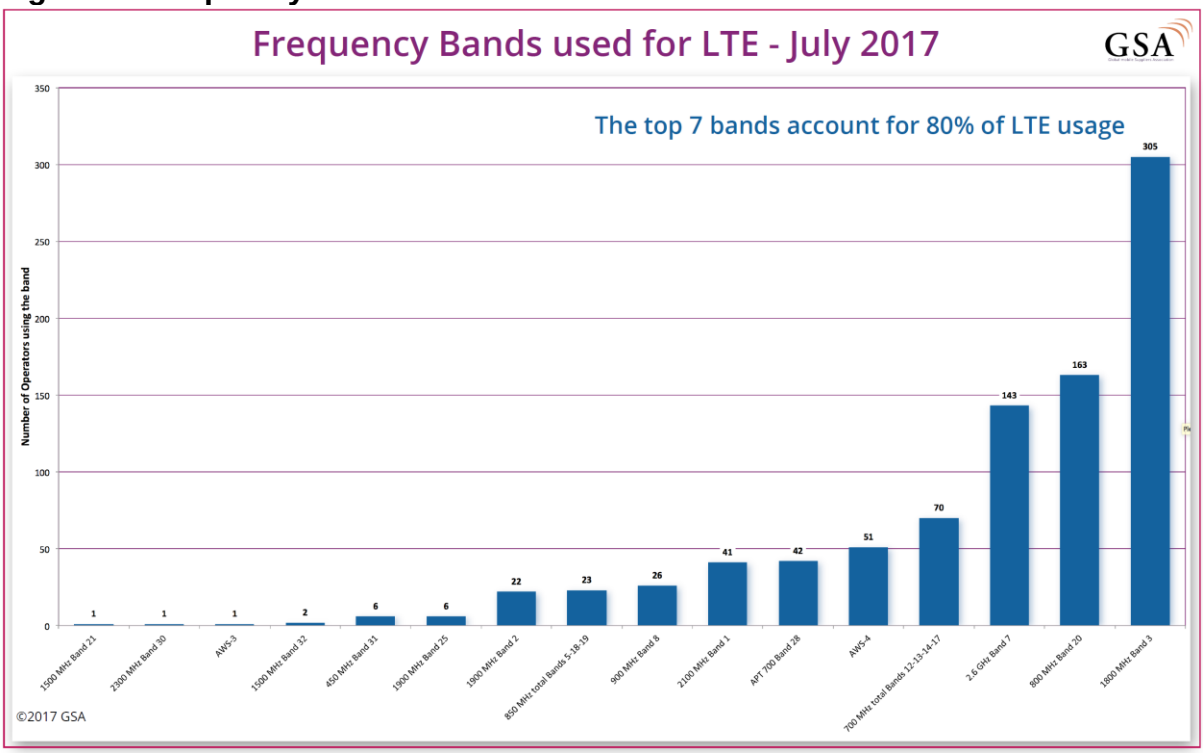
[33] https://gsacom.com

3500 MHz band 42	96 devices
3600 MHz band 43	76 devices

Source: GSACOM, Status of the LTE Ecosystem, January 13, 2017

In terms of network deployments the GSACOM reports that band 3, the 1800 MHz band (as assigned in the Virgin Islands), band 7 (2.6 GHz FDD) and band 20 (800 MHz) have been deployed in most networks around the world. Unsurprisingly, this is consistent with the availability of devices (i.e., the three most popular bands for network deployment are also the three most popular bands for devices). It does, however, point to the importance to the Commission (subject to any interference concerns), of coordinating band plans in the Virgin Islands with those popular in other jurisdictions.

Figure 3: Frequency bands used for LTE



Source: GSACOM, July 2017

When focusing on spectrum allocation in the South and Central American region, it is clear that regulators have tended to apply a mix of US band plans and "Rest of the World" band plans. For example:

- The band plans for the 850, 1900 MHz and AWS bands are aligned with the US band plans. Other band plans are aligned with the "Rest of the World" band plans such as the 900, 1800 and 2100 MHz bands

- The 700 MHz band plan in most of South and Central America follows the LTE band plan 28 (APT 700 like Asia, Europe, Middle-East) instead of the fragmented FCC 700 MHz band plans (12,13, 14 and 17)
- The 2.5 GHz band often follows the 2x70 MHz FDD and 50 MHz TDD band plan instead of the Sprint US band plan, which uses the full band for TDD.

Indeed, within the Caribbean, a similar mix of band plans is being observed, with aspects from both the US ecosystem as well as the much larger global ecosystem of the "Rest of the World". This is illustrated below in Figure 4.

Figure 4: Overview of band plans across Latin America and the Caribbean

	450 MHz	750 MHz	800 MHz*	850 MHz	900 MHz	1.7/2.1 GHz (AWS)	AWS-3	1.8 GHz	1.9 GHz	1.9/2.1 GHz	2.5 GHz**
Argentina		■	■	■	■	■			■		■
Bolivia		■		■		■			■		
Brazil	■	■	■	■	■			■		■	■
Chile		■	■	■		■			■		■
Colombia				■		■			■		■
Costa Rica				■				■		■	■
Ecuador		■		■		■			■		
El Salvador				■	■				■		
Guatemala				■		■			■		
Mexico		■	■	■		■	■		■		■
Nicaragua		■		■		■		■	■		
Panama		■		■					■		
Paraguay		■		■	■	■			■		
Peru		■		■	■	■			■		
Dom Rep.				■	■	■		■	■		
Uruguay				■	■	■		■	■	■	
Venezuela				■	■	■		■	■		■

* In Brazil, one operator was granted permission to use the 850 MHz band for mobile services. In Argentina, there is a provider with 800 MHz spectrum that is expected to launch mobile services. In Mexico, a new 800 MHz band was approved for use of mobile broadband services.

** In Argentina, a provider has been authorised to use the 900 MHz and 2.5 GHz services for mobile services. In Mexico, a mobile operator was authorised to indirectly use the 2.5 GHz concession of a fixed operator. In Peru, a mobile operator acquired the 2.5 GHz spectrum concessions of another operator.

Source: Analysis of ITU Spectrum Recommendations in Latin America. 5G Americas, June 2017

1.1 The use of higher frequency spectrum bands for mobile services

There is also an increasing recognition, internationally, that higher bands could also be used to deliver mobile services. Most notably:

- The **3.4 – 3.7/3.8 GHz bands** are on the horizon for LTE and early 5G. The ITU World Radiocommunication Conference 2015 (WRC 2015[34]) has, at a more or less global scale, made the 3.5 GHz band available for mobile services. The US has actively opened opportunities for LTE use in the 3.5 GHz band using a shared spectrum approach called CBRS (Citizens Broadband Radio Service). Other countries are also making the 3.5 GHz band available for LTE and 5G. Early deployment of 5G NR (New Radio) is envisioned in that band. The GSA (Global mobile Suppliers Association) expects the 3.5 GHz

[34] http://www.itu.int/en/ITU-R/conferences/wrc/2015/Pages/default.aspx

band to become the primary 5G band below 6 GHz. So a broader device market for the 3.5 GHz band should be anticipated.

- LTE in the **5 GHz band** (typically used for "unlicensed spectrum" such as, for WiFi, among other uses) is becoming an option and some new devices already support this. Variants such as LTE-U (Unlicensed), LTE-LAA (License Assisted Access) and Multefire have been specified and are in trial deployments.
- mm-wave frequencies such as **26-28 GHz and above** are on the horizon for 5G deployments, especially for short range applications as in smart cities and self-driving cars, as these higher bands are still available and can provide high data rates.

1.2 The Commission's proposed way forward on spectrum band planning for mobile communications services

In principle, the Commission proposes that the Virgin Islands will continue to follow the US band plans unless band plans from Region 1 are more spectrum efficient and possible interference from neighbouring countries can be minimized through using Region 1.

- For instance, LTE band 40 (a common TDD band in Europe) consists of 100 MHz of spectrum, while LTE band 30 (a common FDD LTE band in the US), consists of only 2 x 10 MHz of spectrum. Given this, the majority of countries around the world have opted to use Band 40, meaning that support for Band 30 is fairly limited. As such, the Commission is also inclined to follow the band plan for LTE band 40.
- Similarly, Band 7 (2.6 GHz FDD) has a very strong ecosystem in terms of devices and networks compared to the more US/Sprint specific Band 41 (2.6 GHz TDD) and so again, the Commission would likely favour the use of band 7, rather than band 41.

As individual bands are released by the Commission, it will confirm its proposed plan for each band.

Once the allocated use of bands is clear, the Commission will specify boundaries / parameters for the use of those bands. These will include not only the permitted emission levels but also, in some cases, the relevant channel plans.[35] In general, the Commission will follow the same plan parameters as that in the US/Europe (depending on the band plan the Commission is applying).

[35] 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.

The Commission will determine the key parameters governing the use of bands in the NFAT, including where appropriate the relevant US/European/Asian band plans adopted. Priority will be given to the main bands allocated to cellular mobile and wireless access services.

Question 5: Do you have a view on the band plans that should be adopted in specific frequency bands? Please explain your response.

2. Licence exempt bands

Licence exempt bands are important since a lot of consumer electronics operate in these bands. Allowing licence exempt use of spectrum also allows for innovation, both for consumers and business applications alike. Well-known examples of licence exempt bands are the 2.4 GHz band (used among others for WiFi, Bluetooth, cordless phones, etc.) and the 5 GHz band (used among others for WiFi).

However, there are also familiar issues with equipment which is available licence exempt elsewhere in the world, but which interferes with the mobile bands used in the Virgin Islands, such as European DECT in 1880-1900 MHz, which overlaps with the 1900 MHz mobile band.

Indeed, the Commission's band planning for mobile will impact which alternative bands can be used for license exempt devices. In particular:

- The 1900 MHz mobile band conflicts with European DECT 1880-1900 MHz;
- The 900 MHz mobile band conflicts with the US ISM band from 902-928 MHz since there is an overlap from 902 to 915 MHz;
- The extended 850 MHz band (band 26) conflicts with the European 868 MHz band for license exempt applications; and
- The 2100/1900 MHz mobile band, which overlaps with the 1900 / AWS band and is currently not used in the Virgin Islands, conflicts with US DECT 6 in 1920-1930 MHz.

Therefore, in order to avoid harmful interference between mobile bands and licence exempt bands, the Commission proposes the following:

- To prohibit unlicensed use in the 868 MHz band,
- To limit unlicensed use in the 902 – 928 MHz band to 915 – 928 MHz; and
- To allow unlicensed use for DECT in the 1920 – 1930 MHz band only.

The Commission will draft a separate document on licence exempt uses, other than the ones mentioned above, on which it will consult stakeholders in due course.

Question 6: Do you agree with the Commission's proposal on licence exempt bands? If not, please propose an alternative to licence exempt bands, and set out why you consider the alternative to be preferable to the Commission's proposal.

Part E: Meeting future spectrum demand – Mobile and wireless broadband services

In this section the Commission sets out its proposals for releasing additional spectrum to support the provision of best in class mobile and wireless broadband services in the Virgin Islands. It begins by setting out its plans for which spectrum bands should be released for mobile communications, followed by spectrum for non-mobile services. It concludes by outlining the Commission's draft spectrum release plan.

Key points:

- Given the continuing growth in mobile data usage, most countries are making additional spectrum available for mobile communications services. On average over 1,000 MHz of mobile spectrum will be available (in total) in most countries in the short term.
- In the Virgin Islands, 430 MHz has been made available for mobile communications services (across all three mobile network operators) to date.
- Based on the Commission's initial assessment, a significant amount of spectrum is available to meet future demand for mobile spectrum in the Virgin Islands. This is particularly the case for spectrum that can be used to provide capacity (i.e. above 1 GHz). Spectrum for coverage purposes (i.e. sub 1 GHz) remains relatively scarce, but additional sub 1 GHz spectrum is still available in the Virgin Islands. Overall, the total amount of spectrum available to the mobile operators in the Virgin Islands can be doubled over the next few years. This should allow all mobile operators to meet their spectrum demand.
- Given this, the Commission is putting forward a multi-staged spectrum release plan, setting out the timings and scope of future spectrum releases in the Virgin Islands over the next five years. Details on each award process will be published and consulted upon closer to the time of the relevant release.

1. Mobile Communications

Due to the continuous growth of traffic (as set out in Part B.1.2), the Commission recognises that there is a need to release additional spectrum to the mobile network operators in the market.

At the moment, the three mobile network operators have the spectrum assignments as set out in Table 3, below.

Table 3: Current spectrum holdings of CCT, Digicel and Flow

Sub 1 GHz Bands

700 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
17	704 - 716	734 - 746	2 x 12	Flow
13	776 - 787	746 - 757	2 x 11	Digicel

850 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
5	824 - 838	869 - 883	2 x 14	CCT
5	838 - 846.8	883 - 891.8	2 x 8.8	Flow

900 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
8	892 - 915	937 - 960	2 x 23	CCT
			A total of 2 x 68.8 MHz	**137.6 MHz**

Above 1 GHz Bands

1800 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
3	1710 - 1725	1805 - 1820	2 x 15	Digicel

AWS-1

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
4	1725 - 1740	2125 - 2140	2 x 15	Digicel
4	1740 - 1755	2140 - 2155	2 x 15	Flow

1900 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
2	1850 - 1880	1930 - 1960	2 x 30	CCT
2	1880 - 1895	1960 – 1975	2 x 15	Digicel
2	1895 - 1910	1975 – 1990	2 x 15	Flow

2500 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
41 or 38	2572 - 2602		30	CCT

3500 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder
22 or 42	3475 - 3500	3575 - 3600	2 x 25[36]	CCT
			A total of 2 x 130 + 30 MHz	**290 MHz**

This spectrum is used by the licensees to provide 2G, 3G and 4G services, with the spectrum in the 2500 MHz and 3500 MHz bands used for WiMAX and fixed links. In total, the licensees have access to approximately 430 MHz of spectrum across these bands.

In determining the additional spectrum that should be released to the mobile licensees, the Commission considers it is important to note that services currently provided over 2G, 3G and WiMAX networks, as well as fixed links, could all be migrated to LTE. Given the much greater spectral efficiency of LTE and the continuous improvements of spectrum efficiency,[37] such a migration could free up considerable amounts of the

[36] The Commission notes that in the 3500 MHz band, CCT has been assigned discrete channels for fixed links (rather than a contiguous block of 2x25 MHz of spectrum).

[37] The spectrum efficiency of LTE technology is increasing at a high pace, for example by using 4 x 4 Multiple Input Multiple Output (MIMO) technology, massive MIMO technology and 256 Quadrature Amplitude

spectrum presently held by the mobile network operators, and hence accommodate part of the demand for more spectrum.

Nevertheless it is inevitable that more spectrum will be needed at a certain moment in time. This can be seen in the EU where they will, in the near term, make available 1,200 MHz of spectrum, the US 835 MHz, Australia 1,138 MHz, Japan 920 MHz and South Korea 981 MHz[38]. Indeed, the ITU[39] and GSMA have predicted that in the vast majority of countries by the year 2020, between 1,200 MHz and 1,900 MHz of mobile spectrum will be needed for RATG1 (Pre-IMT systems, IMT-2000 and its enhancements) and RATG2 (IMT-2000 Advanced).

Table 4: Total spectrum requirements for both RATG 1 and RATG 2 in the year 2020

	Total spectrum requirements for RATG 1	Total spectrum requirements for RATG 2	Total spectrum requirements RATGs 1 and 2
Lower user density	440 MHz	900 MHz	1,340 MHz
Higher user density	540 MHz	1,420 MHz	1,960 MHz

Source: ITU-R M.2290-0

The Commission believes that these trends in the demand for mobile spectrum will apply similarly in the Virgin Islands as in other countries. Therefore, in order to facilitate the further roll-out of high speed mobile broadband in the Virgin Islands, the Commission recognises that it will need to be ready to make approximately 700 – 1,000 MHz of spectrum available for mobile communications services in the coming years.

The Commission has therefore reviewed the availability of spectrum bands in the Virgin Islands, taking into account its findings on spectrum band plans in other jurisdictions, as set out in the preceding Part of this Framework. Based upon this, it concludes that there is sufficient available spectrum in the Virgin Islands to support the expected demand for mobile services, particularly with regards to the spectrum above 1 GHz There may also still be some excess demand for sub 1 GHz spectrum.

Modulation (QAM) technology, which implies that more capacity can be provided with the same amount of spectrum and the same number of base stations. See also http://www.5gamericas.org/files/3214/8833/1313/3GPP_Rel_13_15_Final_to_Upload_2.28.17_AB.pdf

[38] See https://circabc.europa.eu/.../RSPG16-006final_RSPP_opinion.pdf

[39] ITU-R M.2290-0

For sub 1 GHz spectrum, the Commission has identified that the spectrum bands listed in Table 5 below, can be assigned to mobile communications operators in the short term.

Table 5: Sub 1 GHz bands available for mobile use

700 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
12	698 - 704	728 - 734	2 x 6	Unassigned	A 5 MHz carrier suits; used in US by T-Mobile and US Cellular (and other smaller operators)
14	788 – 798	758 – 768	2 x 10	Unassigned	
29	717 - 728				Supplementary Down Link

850 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
26	814 - 824	859 - 869	2 x 10	Unassigned	In the US used by Sprint

450 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
31	452.5 - 457.5	462.5 - 467.5	2 x 5	Unassigned	Not in LTE chipset iPhone/Samsung yet. Can be used for MyFi, dongles.

600 MHz

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
71	663 - 698	617 - 652	2 x 35	Unassigned	Recently auctioned in US (March 2017)
LTE band class	**UL (MHz)**	**DL (MHz)**	**Total (MHz)**	**Holder**	**Remarks**
27	807 - 814	852 - 859	2 x 7	Unassigned	Band is wider but overlaps band 26

For spectrum above 1 GHz, the Commission has identified that the spectrum bands listed in Table 6 below can be made available for mobile communications operators.

Table 6: Supra 1 GHz bands available for mobile use

1500 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
32	1452 - 1496		44	Unassigned	Supplemental downlink capacity

AWS related

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
66	1755 - 1780	2155 - 2180	2 x 25	Unassigned	On top of band class 4
70	1695 - 1710	1995 - 2010	2 x 15	Unassigned	Below band class 4
25	1910 – 1915	1990 – 1995	2 x 5	Unassigned	Upper part band class 25

2300 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
40	2300 - 2400		100	Unassigned	

2500 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
7	2500 - 2570	2620 - 2690	2 x 70	Unassigned	FDD; most popular band; most devices available
38	2602 - 2620		28	Unassigned	TDD

3400 - 3800 MHz band[40]

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
22 or 42	3410 - 3475	3510 - 3575	2 x 65	Unassigned	FDD
42	3400 - 3600		200	Unassigned	TDD; requires refarming of assigned FDD spectrum CCT
43	3600 - 3800		200	Unassigned	TDD
48	3550 -3700		150	Unassigned	US Citizens Band Radio Systems. Requires refarming of assigned FDD spectrum CCT. Band Class 48 falls completely within band class 42 and 43.

5 GHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks
46	5150 - 5925		775		License exempt in many countries

Of the bands above 1 GHz, none are currently assigned, except for the 2500 and 3500 MHz bands, in which CCT currently holds spectrum assignments (2572 – 2602 MHz TDD and 3475 – 3500 MHz and 3575 – 3600 MHz FDD). All remaining spectrum in these bands can still be assigned.

In addition, the Commission notes that the 26 – 28 GHz band and even higher bands can also be made available, as currently there are no users in these bands. The 3.4 – 3.8 GHz and the 26 – 28 GHz are expected to be 5G bands.

2. Non-mobile service related use

Based on its review of the current used on non-mobile service related use the Commission has not identified any other potential spectrum uses where it considers that demand is likely to exceed supply. This is to be expected given the small scale of the Virgin Islands, the minute number of other users and uses of the spectrum and given that the Commission only has to follow the developments in Region 2.

However, the Commission does consider that it would be appropriate to register the DTT frequencies in the Virgin Islands. This would be in the lower part of the UHF band

[40] This is a band that will be allocated to 5G in Europe and the US.

(470 – 608 MHz[41]). Whilst at the moment, there is no demand for a DTT service, the Commission is aware that this could change in the future. Furthermore, these registrations can be used in negotiations with the neighbouring countries for trade-off purposes. In preparation for this, the Commission will share with the US and other relevant neighbouring countries' authorities its intention to use the 600 MHz for mobile services, which is likely to be compatible with the relevant US band plans.

Finally, the Commission acknowledges that there is a demand for block allocations of microwave spectrum in order to let operators plan their own microwaves. Given the availability of microwave spectrum in the Virgin Islands, this demand could be fulfilled in available frequency bands. The Commission will therefore draft a technical plan for these block assignments, in due course, as indicated in the Implementation Plan

3. Spectrum release plan

Having considered the availability of spectrum for mobile communications services, the Commission proposes, after requisite international coordination, to release additional spectrum in three phases. Such a phased approach is in line with international practice and aims to provide clarity and transparency to the market on the timing and scope of future spectrum releases in the Virgin Islands.

Please note, however, that the spectrum that the Commission proposes to release in each of the phases set out below is based upon the current spectrum holdings and availability in each band. The Commission will review and confirm these proposals when commencing the relevant award process, taking into account recent national and international developments as well as the outcome of previous award phases.

3.1 Phase 1

In Phase 1, the Commission intends to release additional spectrum in the bands above 1 GHz, focusing on the assignment of bands which are already in common use elsewhere and hence for which a significant number of devices are already available. The particular bands the Commission is considering to include in this Phase are set out in the following tables.

Table 7: Additional spectrum available in the AWS band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
66	1755 - 1780	2155 - 2180	2 x 25	On top of band 4

[41] See page 4 of https://transition.fcc.gov/oet/ea/presentations/files/may17/40-Licensed-Panel-Intro-600-MHz-%26-Wireless-Microphones-AR-Final.pdf

LTE band class 25	1910 – 1915	1990 – 1995	2 x 5	Upper part of band 25

This band, called AWS-3 in the US, can be considered as an extension of the existing AWS band. Since the band has been auctioned in US, there is an ecosystem of devices available as well.

Table 8: Additional spectrum available in the 2500 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
7	2500 - 2570	2620 - 2690	2 x 70	FDD; very popular band; Band with one of the largest number of devices available

The 2500 MHz band is globally available and has a very strong ecosystem. After the 1800 MHz band, this is the band with the largest number of devices which support it.

Table 9: Additional spectrum available in the 2300 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
40	2300 - 2400		100	

The 2300 MHz band is also a popular band and has a strong ecosystem in terms of devices. However, the Commission notes that 25 MHz (i.e., 2320 – 2345 MHz) of this band might be used for satellite radio systems in the US Virgin Islands. As such, assigning the entire band for mobile use could result in cross-border interference for these services from the Virgin Islands. Going forward this matter could form part of the cross-border spectrum management discussions between the Commission and the US FCC (see Part I) or to consider allowing its use but with reduced power levels.

Jointly, assigning these three bands will add up to 290 MHz to the available mobile spectrum and therefore enable the mobile network operators to deploy cost-effective mobile broadband capacity. Additionally, given the nature of the bands it will be possible for the Commission to grant large, contiguous assignments in a single band, thereby allowing the operators to provide high capacity cost-efficiently.

Question 7: Do you agree with the spectrum bands the Commission proposes to release in Phase 1 of its spectrum release plan? If so, please comment on whether the three bands should be offered at the same time or sequentially? If not at the same time, in which sequence should they be released?

Please also comment on the importance of including the (entire) 2300 MHz band within Phase 1 and how cross-border interference can be best managed within this band.

3.2 Phase 2

In Phase 2, the Commission will focus on releasing more sub 1 GHz spectrum. The main bands it intends to release during this Phase are band 26 (extended 850 MHz), the part of band 12 which does not overlap with band 17 and Band 29 (FCC 700 MHz Block D and E). The details of these bands are shown below.

In all of these bands, some devices already exist, although not to the same extent as for those bands that are proposed for release in Phase 1. The Commission further intends that band 14 should be kept in reserve for future Public Protection and Disaster Relief (PPDR) services.

Table 10: Additional spectrum available in the 700 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
12	698 - 704	728 - 734	2 x 6	Part of band 12 which doesn't overlap with band 17
29	717-728		11	Supplementary Down Link (FCC block D and E)

Table 11: Additional spectrum available in the 850 MHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
26	814 - 824	859 - 869	2 x 10	Part of band 26 which does not overlap with band 5

The Commission has also considered alternative bands to be released during this Phase (in particular the 450 and 600 MHz bands):

- With regards to the 600 MHz band, the Commission notes that this does not have a device ecosystem yet, although T-Mobile US has announced early

availability of 600 MHz devices, and release is therefore anticipated at a later point in time. Given this uncertainty regarding the device ecosystem, however, the Commission does not anticipate including this in Phase 2 of its spectrum release plan.

- The LTE 450 MHz band 31 has seen some take-up in, among others, Brazil and Scandinavia but the ecosystem is still in an early stage, focussed on specific niche markets but without broader adoption in smartphones for the consumer mass market. The Commission will assess the demand and possible types of use for this band before including it in its spectrum release plan.

Question 8: Do you agree with the proposed spectrum bands the Commission proposes to release in Phase 2 of its spectrum release plan? If so, please comment on whether the three bands should be offered at the same time or sequentially? If not at the same time, in which sequence should they be released?

3.3 Phase 3

As the Commission has noted above, there is also considerable interest in the 3.4 – 3.8 GHz band. This is due to the large amount of spectrum available in the band, the global trend towards making this band available and the expectation of early 5G availability in this band[42]. Within the region, the Commission notes that the focus is on the 3.4 – 3.7 GHz part of this band. Although there are currently multiple band plan options available, the Commission considers that two of those band plan options are most likely to gather broader support:

- Band 42 and 43, in many countries around the world; and
- Band 48, US CBRS band.

The Commission will therefore keep developments in this band under review, with a view to assigning this spectrum to mobile communications operators once the most appropriate band plan becomes clear and devices are readily available.

Table 12: Additional spectrum available in the 3400-3800 MHz band[43]

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Holder	Remarks

[42] GSACOM, The Future of IMT in the 3300-4200 MHz Frequency Range, June 2017
[43] This is a band that will be allocated to 5G in Europe and the US.

42	3400 - 3600	200	Unassigned except 2 x 25 MHz to CCT	TDD. For full assignment of this band refarming of the assigned FDD spectrum to CCT is required
43	3600 - 3800	200	Unassigned	TDD
48	3550 -3700	150	Unassigned	US Citizens Band Radio Systems. Requires refarming of assigned FDD spectrum to CCT.

Question 9: Do you have any views on which band plan the Commission should prescribe for the 3.4 – 3.8 GHz band? Explain why. Also, in your view, when would this spectrum be required?

3.4 Future phases

The Commission will also continue to explore the possible release of other bands, such as the 450 MHz, 600 MHz bands (covered above), the L-band (1500 MHz band) and future mm-spectrum. However the release of these bands is anticipated further into the future and so does not form part of this spectrum release plan.

In addition, the Commission also seeks the views of stakeholders on its strategy for the 5 GHz band. This is because it notes that the 5 GHz band offers a lot of spectrum and different models to use that spectrum. For example, the main technological options available today are:

- LTE-U (LTE-Unlicensed), as being trialled in the US by some operators;
- LTE-LAA (LTE License Assisted Access), as being preferred as a more WiFi friendly deployment model and sometimes a regulatory prerequisite for the use of licence exempt spectrum in the 5 GHz for; and
- MULTEFIRE, a technology which was promoted by Qualcomm to enable stand-alone LTE deployments in the 5 GHz band.

Table 13: Additional spectrum available in the 5 GHz band

LTE band class	UL (MHz)	DL (MHz)	Total (MHz)	Remarks
46	5150 - 5925		775	License exempt in many countries, including the US

Some devices which can be used in band 46 have already been released.

Question 10: What position should the Commission take with respect to the deployment of LTE (and later possibly 5G technology) in the 5 GHz band? Would any specific measures be required to protect other license exempt use in the 5 GHz band? In your view, when would this 5 GHz spectrum be required?

Question 11: In your views, are there any further spectrum bands beyond those specified in Phases 1 to 3 of the spectrum release plan which should be released for mobile services within the relevant period? Please elaborate on the requirement justifying early release of other bands for mobile services.

Part F: Spectrum assignment

In the previous sections of the draft SMF, the Commission has set out how it will determine the allocation of spectrum to particular uses and its plans to allocate more spectrum for the provision of mobile communications services in particular. In this section, the Commission turns to how it will assign this spectrum to individual licensees.

Key points:

- The Commission has developed a formal, phased approach to awarding mobile spectrum, as set out in its spectrum release plan.
- Any mobile spectrum being released as part of the spectrum release plan (discussed in the previous section) will be released via a comparative tender process (e.g. an award process, like that of the Spectrum Award 2016) or an auction. The exact format will be confirmed as part of an up-front public consultation prior to each release.
- Given the regular release of mobile spectrum foreseen under the spectrum release plan, the Commission does not expect to receive or process any ad hoc requests for mobile spectrum in the near future.
- Following the completion of Phase 1 of the spectrum release plan, the Commission intends to remove the existing global spectrum caps (i.e. limiting the total amount of spectrum any licensee can hold). However, the Commission will continue to impose a spectrum cap on sub 1 GHz bands. This cap will increase incrementally to 2x37 MHz, then 2x40 MHz and finally 2x50 MHz over the course of the spectrum release plan.

1. Assignment policy

In 2011, the Commission decided to adopt a flexible assignment policy that allows it to determine the method of assignment on a case-by-case basis. Factors that the Commission would take into account in spectrum assignment include of the demand for the particular spectrum, overall public policy objectives, the costs of any potential disruption to existing licensees (for example, if a licensee's spectrum assignment changes) and the impact on final consumers.

As an overarching principle in this review, the approach taken to assigning spectrum will depend on whether there is, or is likely to be, excess demand for the spectrum in question (i.e., whether the demand for the spectrum exceeds the amount of spectrum to be released).

- Where there is excess demand, there is a greater need to ensure that the relevant spectrum is assigned in a fair, transparent and efficient manner. This

is to ensure that the party which values it most (and hence which should put the spectrum to most efficient use) will be assigned the spectrum at a price reflecting the economic value of the spectrum, subject to this assignment not resulting in any distortionary effects on competition in the relevant market. As such, any assignment of spectrum for which there is excess demand is likely to require careful planning and design. This is particularly the case when several lots of spectrum are assigned at the same time.[44]

- In absence of excess demand for the relevant spectrum, there is commonly less need for a complex assignment process. This is particularly the case where only a small amount of the overall available spectrum in the relevant band is made available. As such, these assignments can often be executed more quickly and may not require any stakeholder consultation and detailed design stage.

In general, the Commission believes that the principles it applies when determining how to assign a given spectrum band have changed. It considers there is a need to distinguish between two forms of spectrum assignments:

- **Planned, commission led assignment**. The Commission has developed a formal, phased approach to awarding mobile spectrum (i.e. the spectrum release plan set out Part E). As part of its spectrum release plan discussed above, the Commission has identified specific frequency bands which will be released over the next five years. For each planned assignment, the Commission will determine the appropriate assignment format, based upon the options set out below, and design the overall award process, including the appropriate steps and timings thereof. The Commission will then consult with relevant stakeholders on its proposed assignment process.
- **Ad hoc, application based assignment.** In general, the Commission would expect the vast majority of spectrum assignments to fall into the first category. However, further to the above, there may be ad hoc requests from interested parties to obtain a spectrum authorisation/licence. Where such applications arise, the Commission will review each application and determine the relevant next steps, based on the options below. This may involve consulting with relevant stakeholders, in cases where the Commission considers this is necessary to assess the merits of the application (including any impact on the communications market or the Virgin Islands economy). In most cases, the Commission would expect that such requests would relate to spectrum where demand does not exceed

[44] The Commission recognises that there can be cases where it is not necessarily efficient to award spectrum to the party valuing it the most. For example, this could be the case if that party places a premium on the spectrum because, by winning the spectrum, it will be able to develop, or further exploit, a dominant position in a relevant market, to the ultimate detriment of competition and consumers.

supply, or where a (potential) licensee is looking to trial a new technology or service.

For the avoidance of doubt, the Commission would not expect to receive ad hoc requests for spectrum for the provision of mobile communications services and where it does, it would be minded to refer the applicant to its spectrum release plan. Furthermore, with the exception for testing licences, the Commission does not expect any ad hoc requests for mobile spectrum in the near future, given the spectrum release plan, as the plan should provide all licenced operators regular opportunities to obtain additional mobile spectrum as well as clarity on the amount of spectrum being released and the timings thereof. In making any ad hoc requests, an applicant would therefore have to provide a full justification for why the Commission's spectrum release plan is not sufficient to meet the applicant's spectrum needs. Such requests may also be subject to public consultation as part of the Commission's assessment on whether the ad hoc spectrum release is in the interest of the consumers of the Virgin Islands.

2. Common approaches to assign spectrum

Section 34 of the Act anticipates that a spectrum plan shall set out the procedures for assigning spectrum and states that these procedures may include: (i) auctions, (ii) tenders, (iii) fixed price assignments (i.e. direct award to an applicant at a given price), (iv) first come first served basis, or (v) other stated criteria.

Further, section 19 of the Act states that applications for spectrum authorisations are to be determined on an objective, transparent and non-discriminatory basis. If they are refused, the applicant is to be notified in writing, with the Commission giving reasons for refusing their application.

Whilst the Act lists four possible approaches to assigning spectrum, the Commission considers that in reality, these can be captured within three main approaches:

- **First come first served assignments (FCFS).** This is the simplest form of assignment, where the Commission will review an application made by a party for a spectrum licence and award the licence to the relevant party. Such an award will be subject to the application meeting the minimum requirement for spectrum holders and the Commission being comfortable that the award of the licence will meet the needs of the Virgin Islands economy and consumers. This may imply the Commission also setting a fixed price for the licence.
- **Comparative tender**. During a comparative tender (or "beauty contest"), the Commission would develop a set of criteria against which it would judge competing bids for the spectrum licences, which may, or may not, include the amount each applicant is willing to pay. It would publish these criteria in

advance, together with a ‘scoring scheme’ describing how the Commission would select winning bids. It would then invite interested parties to submit bids for the licences, describing how their bids would meet the Commission’s criteria. Such criteria could cover both technical and financial components, quality of service and including the amount a party is prepared to pay for a licence and level of performance bond or guarantee. The Commission may decide to set a fixed or minimum price for each licence in advance.

- **Auction.** In an auction, eligible parties submit financial offers for the spectrum licences, based on pre-defined rules. Auctions can take a number of forms, for example covering a single round or multiple rounds. The successful parties are those who place the highest bid (or bids) for the licences. There may also be a prequalification phase to ensure that only eligible bidders compete for the licence (i.e., a hybrid version of the comparative tender and auction). The Commission may also decide to set a minimum (reserve) price for each spectrum licence.

Table 14 presents the main advantages and disadvantages of these different assignment approaches. Based on this, the Commission considers that:

- **FCFS assignments** are best suited for spectrum awards where there is limited competing demand for the spectrum and/or the simplicity and speed of the award is more important than ensuring an award at the efficient price level. This is most relevant to spectrum bands where demand does not exceed supply and licences involving small amounts of spectrum, spectrum in less valuable bands and/or spectrum for use by public authorities.
- **Comparative tenders** or **auctions** are required where the demand for the spectrum exceeds its supply and the relevant spectrum is of high economic value to the users. As such, this requires the design of a tailored award process, which is transparent, builds on international precedent, and allows the Commission to award the spectrum to the party that will make most efficient use of the spectrum. This is most relevant to licences involving a large amount of spectrum, spectrum in high value bands (i.e. spectrum used for commercial purposes, such as the provisioning of mobile, fixed wireless broadband or broadcasting services). The choice between a comparative tender and auction depends on the need for transparency, the importance of efficient price revelation and the range of spectrum being awarded.

Table 14: Review of different assignment processes

Approach	Advantages	Disadvantages
FCFS assignment	• Simple to administer and quick to complete • Limited burden on applicant • Can be full transparency on price for spectrum licence • Works well when supply is plentiful (demand is less than supply) and/or for awards of small amounts of, low value spectrum.	• 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 • Does not reveal the economic value of the spectrum and setting an appropriate fixed price may not be straightforward • May lead to distortions in competition due to first mover advantage • Not transparent as competitors may not know applications are being made and assignments granted, though this concern can be addressed by publishing this information.
Comparative tender	• Allows non-financial aspects to be taken into account • Enables the Commission to require non-price commitments from applicants in line with policy objectives for the market (e.g. coverage, speed, quality of service, etc.) • Can facilitate efficient spectrum use as well as generate revenue for government, depending on how the price is set.	• Higher resource and time requirements than FCFS assignments and more similar to those of an auction • Tender results may be contested as there is an element of subjectivity in evaluating non-financial aspects of the bids. However, this problem may be somewhat mitigated by introducing measurable evaluation criteria which are published in advance • May not reveal full economic value of the spectrum • Requires strong enforcement of non-price commitments to ensure these are delivered (e.g. through bonds and licence conditions).

Approach	Advantages	Disadvantages
Auction	• High degree of transparency - there is a single criterion for award and award process and rules are commonly consulted on • Enables efficient price revelation – awards to those who value spectrum most as well as generating revenue for government • Can be simple or complex to administer depending on design – simple sealed bid auctions have lower cost than multi-round and combinatorial auctions • Allows auctioneer to award individual spectrum lots, multiple lots across different bands and pre-packaged spectrum licences • In line with international precedent (i.e. increasing trend for mobile spectrum to be awarded by auctions).	• Can be complex and costly to administer – depends on the design • Can be difficult to take account of qualitative factors, though some can be built into pre-qualification criteria and licence conditions • Risk of winner's curse[45] • May lead to concentrations of spectrum to those with most money, but this concern can be addressed through spectrum caps/reservations.

The Commission recognises 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. This is most likely to be in bands assigned for cellular mobile and possibly also in the AM and FM radio bands. However, as set out in Part F.1 above, it is important to adopt a flexible assignment policy that allows the Commission to determine the method of assignment on a case-by-case basis. As such, the 2011 SMF set out key principles that guide the Commission's decision on the appropriate assignment process:

1. **Approach in bands used by private services and/or for non-commercial public services**. Where demand for assignments occurs intermittently and is for small amounts of spectrum (e.g. one 2x25 kHz channel), a first come first served approach (possibly with a fixed fee) is used to assign spectrum. This is most likely the case for spectrum assignments in bands used by private services / applications (e.g. fixed links, land mobile radio) and/or for non-commercial public services (e.g. emergency services, police, ports authority, etc.).

[45] This implies that the winner of the auction pays a price which exceeds its valuation of the spectrum being allocated.

a. If congestion is unlikely and there are no other policy considerations, then licence fees should be set at levels that recover spectrum management costs only.

b. If congestion is thought as likely to occur in the future then licence fees should be set at a higher level to reflect the opportunity cost of the spectrum.

2. **Approach in bands used for communication services to the general public**. For spectrum used to provide broadcasting, cellular mobile and wireless broadband services, competitive assignment processes should be used to provide an objective and fair basis for awarding spectrum.

    a. Where congestion is likely and spectrum is used to deliver services to the general public, use of a simple (e.g. sealed bid) auction is preferred, possibly also with bids on service aspects (and a minimum level of service obligations) where the Commission will determine the relative weighting given to financial bids and service attributes. However, awarding multiple spectrum lots rather than pre-defined spectrum licences is likely to require more complex auction formats.

    b. Where congestion is likely but competitive award processes could cause significant disruption (e.g. at the end of the licence term for mobile, broadcasting and broadband wireless access services) then direct award of that spectrum (e.g., to the existing user) will be considered, for a price to be determined by the Commission.

    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 Commission is likely to assign licences on a first come first served basis.

The Commission considers these key principles for determining the assignment mechanism remain appropriate going forward and therefore it does not propose to amend these principles. It will, however, as set out in Part G of this draft SMF, ensure that any spectrum assignment process also ensures the delivery of high quality services, to as a broad a segment of the Virgin Islands population as possible.

Question 12: Do you agree with the Commission's preliminary view as to how it will assign spectrum under this SMF? If not, please explain what alternative you would suggest.

3. Technical assignment issues

The Commission notes two key issues regarding the assignment of spectrum for mobile communications.

- **Interference between DL and UL**. In case of interference problems between the Down Link (DL) of one system and the Up Link (UL) of another system (e.g. the DL 850 MHz and UL 900 MHz see also Part D), the Commission could impose a block edge mask to additionally suppress spurious emissions outside the assigned band on the DL side and to impose the use of filters to avoid blocking effects on the receivers on the UL side. In case of future assignments the Commission should address the topic of guard bands, block edge masks, filters and synchronization of receivers in case of TDD spectrum up-front.
- **Assigning contiguous spectrum.** For mobile network operators, it is cost-efficient to have relatively large contiguous spectrum assignments in a particular band. For example it is more efficient to have 2x20 MHz in either the 1900 MHz or the AWS band instead of 2x10 MHz in the 1900 MHz band and 2x10 MHz in the AWS band. The first variant requires one Remote Radio Unit and one set of antenna ports to deliver the service while the second variant requires twice as much hardware to provide about the same capacity. Contiguous spectrum also allows operators to make use of large and/or more carriers in one band (e.g. of 20 MHz) and thus enables them to provide high data rates in a more cost efficient manner than aggregating a number of smaller carriers. Given this and taking into consideration the current spectrum holdings of the three mobile network operators, the industry might benefit from some consolidation of spectrum holdings into contiguous blocks within particular LTE bands instead of having a relatively small assignment in each band. However, the Commission recognises that imposing consolidation on the current spectrum holdings to achieve contiguous spectrum holding is likely to be difficult and disruptive for the market. As such, the Commission considers it sufficient to facilitate mobile network operators to achieve contiguous holdings on a voluntary basis or based on spectrum trading. The Commission will then aim to assign contiguous LTE spectrum to mobile network operators in future spectrum awards.

Given the above, the Commission proposes that:

1. In case of adjacent DL and UL assignments to different operators, the Commission will consult upon topics such as guard bands, block edge masks, filters and synchronization of receivers (in case of TDD spectrum).
2. The Commission will aim to assign contiguous LTE spectrum to mobile network operators in future spectrum awards and allow mobile network operators to trade (part of their) current fragmented spectrum holdings in order to realize contiguous blocks in one or more bands.

Question 13: Do you agree with the Commission's proposals to assign contiguous mobile spectrum in new assignment rounds? If not, please explain why you disagree.

4. Spectrum caps

As additional spectrum is released, spectrum caps have been widely used as a means of ensuring a competitive balance between operators. Spectrum caps can also promote the efficient use of existing spectrum holdings. However, these caps can restrict the ability of mobile network operators to flexibly acquire spectrum in such a way as to enable them to meet their demand. If an operator is unable to acquire spectrum to meet demand for its mobile services it can mean that its costs may be increased (relative to its costs absent any spectrum cap), particularly in areas of its network which are congested, or its quality of service declines. However, this potential cost must be considered against the potential gain of avoiding distortions to downstream competition which may arise from a significant concentration of spectrum.

Recognising this, in 2011 the Commission set spectrum caps for each mobile network operator. In doing so, the Commission balanced competitive benefits from having low caps against the need to provide operators with sufficient spectrum to meet consumer demand for wider bandwidth, high quality services and more generally, sufficient spectrum to grow their businesses. At the time, the following spectrum caps were set and these remain in place to date:

- **Global cap of 170 MHz of total paired spectrum held by an operator for all bands then available (i.e. up to and including the 2.5 GHz band).** At the time, this was derived on the basis of the total available spectrum in these bands.
- **A sub-cap of 60 MHz of total paired spectrum held by an operator below 1 GHz (i.e. in the 700, 850 and 900 MHz bands),** in light of the good propagation characteristics and particular scarcity of these bands. This was derived on the basis of the total available spectrum in the 700, 850 and 900 MHz bands. At the time, a cap of 60 MHz was considered appropriate to make provision for three market players and to enable each to successfully grow its business, whilst still allowing for some competition for this spectrum (i.e., as there was not sufficient spectrum to enable all three to operate at the cap).

These spectrum caps applied to the spectrum award in 2016. At the time, the Commission stated that it would review the need for and level of spectrum caps further when updating the SMF.

The Commission does not see a need at this point in time to continue to apply the cap on global spectrum holdings (i.e. including spectrum holdings above 1 GHz) beyond

the timeframe at which additional spectrum above 1 GHz is released. This is because the current spectrum holdings in the bands above 1 GHz are more symmetric across the three mobile network operators and because there is a significant amount of additional spectrum which will be made available under the Commission's release plan. This means that in the long term there is unlikely to be an excess demand for spectrum in these bands, even if an additional player sought to enter the market. The Commission will review and confirm this position as part of the process of designing the upcoming spectrum assignments.

The Commission is, however, not aware of any developments since 2011 which would change the need for spectrum caps on sub 1 GHz holdings. This spectrum remains highly important to mobile network operators now and going forward, both to enable the wide area coverage at the lowest possible cost and to support in-building coverage. In addition, this spectrum remains in limited supply (even when including the sub 1 GHz spectrum included in the Commission's spectrum release plan, as set out in Part F). In addition, the Commission notes that there continues to be a significant asymmetry in sub 1 GHz spectrum holdings across the three mobile network operators, with CCT currently holding twice as much spectrum as Digicel (see Table 3 in Part F.1).

Clearly, however, it is appropriate to revise the level of this cap as new sub 1 GHz spectrum is released and indeed, even before that new spectrum is released, to ensure that none of the current licensees breaches the cap. The Commission therefore proposes to amend the spectrum cap as follows:

- Prior to the award of additional sub 1 GHz spectrum, no licensee shall be eligible to hold more than 2x37 MHz of sub 1 GHz spectrum. In reality, this means that no licensee will be able to hold more sub 1 GHz spectrum than CCT's current holding.
- Following the release of the remaining 700 MHz and 850 MHz spectrum (i.e., Phase 2 of the Commission's proposed spectrum release plan), no licensee shall be eligible to hold more than 80 MHz of sub 1 GHz spectrum (i.e., a cap of 2x40 MHz would apply during the Phase 2 award process).
- Following the further release of 450 MHz and/or 600 MHz spectrum (assuming The Commission goes ahead with assigning this after the release of the remaining spectrum in the 700, 850 and 900 MHz bands), no licensee will be eligible to hold more than 100 MHz of sub 1 GHz spectrum (i.e., a cap of 2x50 MHz would apply during that award process).

In the Commission's view, spectrum caps at this level will properly reflect the scarcity of spectrum at sub 1 GHz, whilst ensuring sufficient spectrum for three viable mobile network operators. This will allow the Commission to promote some degree of spectrum symmetry, but without artificially imposing symmetry where this may not be

the most efficient outcome for the market. For the avoidance of doubt, these spectrum caps will continue to apply in the event of changes in the structure of the sector.

Question 14: Do you agree with the Commission's preliminary proposals to revise existing spectrum caps (including the removal of the global spectrum cap)?

Part G: Spectrum authorisation / licensing

This section sets out the authorisation and licence requirements for radio frequency use and how frequency authorisations may be traded, renewed, revoked or suspended.

Key points:

- As soon as practicably possible, the Commission will issue frequency authorisations for all government use of spectrum.
- To facilitate further research and development in the Virgin Islands the Commission is minded to introduce test and development licences for non-commercial use.
- As part of its overall drive for enhancing efficient use of spectrum, the Commission will formally introduce spectrum trading in the Virgin Islands and has set out further details on its proposed process for reviewing spectrum trading applications.
- To facilitate efficient spectrum use (including ensuring that any spectrum is used to the benefits of consumers in the Virgin Islands), the Commission proposes to impose coverage obligations, quality of service requirements, minimum speed requirements and a "use it or lose it" clause in future mobile spectrum licences.

1. Authorisation / License requirements

Section 19 (1) and (10) of the Act provides for all radio frequency use to be authorised, except in the case of Crown bodies or if specifically exempted under Regulations. Some UK public bodies (in particular some Government Departments) are Crown bodies.[46] This means the Commission has no right to licence their spectrum use in the Virgin Islands. 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.

In the Virgin Islands no regulations designating bands as licence exempt have been made so far. However, as set out in Part E.1 above, the Commission will prepare a separate policy document on licence exempt bands in due course.

Many users of spectrum are licensed under the Licences and Fees Order July 1977 (under the 1951 Telecommunications Act). These licences generally have an annual

[46] A list of Crown bodies is given at: http://www.nationalarchives.gov.uk/information-management/re-using-public-sector-information/uk-government-licensing-framework/crown-copyright/uk-crown-bodies

duration and are typically renewed on payment of licence fees. This also holds, for example, for spectrum used for fixed wireless connections.

All of the mobile network operators have Frequency Authorisations covering the spectrum they have been licenced to use.

The Commission notes that the unitary licences of all three mobile network operators will expire in 2022. In line with the requirements of the Act, the Commission will commence the renewal process of these licences in 2019. When doing so, the Commission will consider the merits of tying the renewal process with the Phase 2 of the spectrum release plan, discussed in Part E above.

All public sector users of spectrum require a licence (frequency authorisation) and users are expected to apply to the Commission for access to radio frequencies. Where applications are granted, this use is recorded by the Commission. However, in practice not all public sector use has been captured in this way yet.

Given this situation, the 2011 SMF recognised the 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. Whilst frequency authorisations have now been issued to unitary licensees, the Commission is still in the process of verifying the government's use of frequency and will issue authorisations for all government use of spectrum accordingly once this process is completed. This will ensure that all spectrum use that is not specifically exempted should be licensed or authorised, such that all spectrum bands can be managed effectively and users' rights are clear. The only exception to this will be the use of spectrum by UK Crown Bodies (e.g. the Royal Navy) which is presently managed through informal co-ordination. This is effective and will be continued.

Question 15: Do you agree with the Commission's plan to issue frequency authorisations for all government use of spectrum?

1.1 Test and development licences for non-commercial use

In many countries there are special test and development licenses for non-commercial use[47]. Usually there are two different types of licences available under the test and development licence category:[48]

[47] See for instance https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences/spectrum-demand-requests

[48] See for instance http://www.motc.gov.qa/en/documents/document/guidelines-test-development-radio-spectrum-licenses

- Test and Development for research purposes: A licence which is intended to be used for test and development specifically for research purposes, such as the development of new equipment and technologies and academic and scientific investigations and measurements.
- Test and Development for trialling or demonstrating: A licence which is intended to allow the licensee to use spectrum on a non-commercial, non- permanent basis to trial or demonstrate a new system / service or a radio technology.

Such licences are temporary and do not give any guarantee of the future availability of the same or alternative frequencies.

At the moment, the Commission has no policy regarding the assignment of spectrum for test and development purposes nor are there specific licences for this category. The Commission is very keen to see further research and development in the Virgin Islands and as such, would be interested in the industry's views on the merits of such test and development licences.

Question 165: Would you be interested in test and development licences, and if so, what tests and in which bands?

1.2 Spectrum trading

Section 20 of the Act states that spectrum authorisations may be transferred to third parties subject to the Commission's approval. However, the Commission has not so far had any applications for spectrum trades.

In 2011, the Commission recognised the benefits of specifying a process for giving or refusing consent to trades. However, in line with industry feedback, it did not at the time propose to implement a comprehensive framework for spectrum trading as this required a complete record of spectrum assignments. Instead it proposed to record all assignments to mobile network operators in frequency authorisations and once this had been completed, to allow these frequencies to be traded, subject to a review of any competition concerns. Given that the issuance of frequency authorisations to mobile network operators is complete, this constraint to spectrum trading no longer applies.

The Commission continues to believe that spectrum trading can be efficiency enhancing and should be supported, where it does not raise competition concerns. At the same time, it is aware of a number of (non-regulatory) barriers to trading and so is committed to reducing these barriers, with a view to encouraging efficient trading. One particular barrier is that currently, there is a lack of clarity over the process the

Commission will apply when reviewing trades. It therefore takes this opportunity to set out, below, the framework it will apply in assessing applications to trade.

Question 17: Do you agree with the Commission's proposal to introduce spectrum trading formally in the Virgin Islands? If not, please explain why you disagree with this proposal.

Information requirements for spectrum trading applications

To facilitate spectrum trading, the Commission will develop a spectrum trading application form and publish this on its website once the SMF review process has been completed. This will cover, amongst others, the information that applicants to any trade will be required to provide, namely:

1. Licence holder detail (company name and contact details)
2. Proposed transferee details (company name, legal entity and contact details)
3. Licence/Authorisation details (authorisation reference number and type of licence/authorisation)
4. Description of transfer
    - Type of transfer (full / partial transfer of rights and obligations);
    - If it is a partial transfer, a description of what part is required (latitude, longitude, upper and lower frequencies).
5. Timing of transfer (immediate; specific date in future)
6. Price to be paid for spectrum transfer
7. Signed declarations from licence holder and transferee, stating the transfer has been mutually agreed on the terms set out, is compliant with the legal and regulatory framework, does not breach any relevant spectrum caps and will not result in the substantial lessening of competition in a given market.

Application process

Table 15 below sets out the proposed steps the Commission would follow in reviewing any spectrum trading applications.

In determining whether or not to consent to a proposed transfer (i.e. process step 3), the Commission will take into account whether:

- The current licence holder is in breach of the terms of the Act, its licence, the Regulations, the Telecommunications Code and any instructions issued by the

Commission or any relevant regulation under which the rights and obligations are to be transferred;

- The transferee is able to meet the terms, provisions and limitations of the spectrum licence/authorisation which is to be granted as a result of the transfer;
- The transferee is able to meet any eligibility criteria relating to the class of wireless telegraphy licence to be transferred;
- It is requisite or expedient to refuse consent to the transfer:
    - in the interests of national security;
    - for the purposes of complying with an international obligation or any international agreement or arrangement; or
    - because the transfer may lead to competition concerns in the relevant market.

Given the importance of spectrum to the provision of mobile and other wireless services, any potential spectrum trade involving mobile or other high value spectrum will require the Commission to assess the potential for the proposed spectrum transfer to distort competition in the relevant downstream markets (i.e. process steps 4/5). This will usually take account of, amongst others: (i) the potential impact of the transfer on competition, which, depending on the circumstances, might include the possible impact on prices, on service quality and on innovation; possible changes to the competitive landscape arising from the trade; (ii) likely prospects for competition with and without the trade; and (iii) efficiencies and other benefits, including for citizens and consumers, that might arise from the trade.

The overall timescale for the review process will depend upon the completeness of the application, the timely and constructive responses by all parties to any information requests and the complexity of the spectrum trade (including the need for any competition assessments). However, the Commission will aim to complete the application review process in a timely manner. In particular:

- For applications which are complete and which do not require a competition assessment, the Commission will aim to complete the approval process within 20 working days of receipt of the application.
- For applications which are complete and which require a competition assessment, the Commission will aim to complete the initial competition assessments (i.e., up to the end of Step 4 in the table below) within 30 working days, although some cases may take longer. Further detailed competition assessments are likely to take up to four months, but may take longer depending on complexity.

Table 15: Overview of proposed spectrum trading application review process

Step	Party	Action
1	Licence holder	The licence holder submits the duly completed spectrum trading application form, signed by the licence holder and transferee.
2	The Commission	The Commission assesses the information provided on the form and considers whether further information is required in order to consent to the transfer.
3	The Commission	The Commission checks that none of the circumstances in which transfers are not authorised apply. If this is the case, The Commission will publish a notice on its website setting out the details of the proposed trade.
4	The Commission	In case the application involves spectrum used for mobile services or other high value spectrum, the Commission will conduct an initial assessment of whether the proposed transfer raises sufficient competition issues to require further analysis: ▪ If this is required, the Commission will initiate the detailed competition assessment, including a detailed information request to all relevant parties (step 5 below) ▪ If this is not required, the Commission will inform both parties of its decision about consent on the application (step 6 below).
5	The Commission	If there is a need for a detailed competition assessment, the Commission will ask the parties to provide their analysis and evidence to support the approval of the trade. The Commission will also invite further comments from third parties which may result in conducting a public consultation.
6	The Commission	The Commission will inform both parties to the transfer of its decision. If a trade is refused, the Commission will make clear the grounds on which consent has been withheld.
7	Licence holder & the Commission	The transfer is executed. The original licence holder surrenders the authorisation to the Commission and the Commission issues a new authorisation or amended authorisation to reflect the terms of the trade.

Question 18: Do you agree with the Commission's preliminary proposal for the review process of spectrum trading applications? If not, please provide detailed comments on how the Commission's proposal can be improved.

1.3 Licence obligations to facilitate wider policy objectives

It is common for mobile (operating or spectrum) licences to contain obligations for the licence holder to achieve certain network coverage levels within a given period and/or to meet minimum quality of service requirements. This is to ensure that the assigned spectrum is used to deliver high quality services to consumers and the wider economy.

The Commission considers this is also relevant and necessary in the context of the Virgin Islands economy, in line with the spectrum policy objectives set out in Part C.2. As such, the Commission imposed coverage obligations and quality of service requirements on licensees as part of the 2016 Spectrum Award and is intending to impose similar requirements when releasing additional spectrum for mobile communications services.

The Commission believes that it may also need to take further action to ensure that assigned spectrum is used efficiently. One way to achieve this is for the Commission, as part of the general conditions of frequency authorisations, to retain the right to revoke authorisations, for all or parts of the assigned spectrum, in case there is evidence that the licensee is not utilising the allocated spectrum in line with the terms of authorisation (i.e., "use it or lose it" clause). Again, the Commission sees merit in retaining these conditions in future spectrum assignments.

Question 19: Do you agree with the Commission's preliminary position to impose coverage obligations, minimum speed and other quality of service requirements and "use it or lose it" clauses in future spectrum licences?

1.4 Licence renewal, revocation or suspensions

Licences or authorisations may be amended where this is necessary to meet the objectives of the Act, to serve the public interest or where occasioned by force majeure, national security considerations, changes to national legislation or the implementation of international obligations.[49] Licences may be amended by agreement between the Commission and the licensee under section 23 (1) of the Act or by complying with section 23 (3) of the Act. Under section 23 (3), the Commission

[49] Section 23 of the Act

must give the licensee adequate advance notice in writing (at least 90 days) and the licensee may make a written statement of objections.

The Act also sets out the process for licences to be renewed (or not),[50] as well as the suspension or termination of licences.[51] In the case of public suppliers whose licences are not going to be renewed, the Commission must give at least three (3) years notice before the licence expires (assuming there is no breach). The Act also sets out a process which allows written objections to the Commission's proposal.

Where licences are terminated because a frequency band is being reallocated, the Commission must take account of the matters listed in Section 36 of the Act. Under Section 76 of the Act, 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 Commission.

The Commission sees no need to amend the above or to take any specific actions on this matter at this point in time.

Question 20: Do you agree with the Commission's preliminary position to retain the current provisions for licence renewal, revocation or suspensions?

[50] Section 24 of the Act

[51] Sections 35 and 76 of the Act

Part H: Spectrum pricing and licence fees

Below the Commission sets out its proposed approach to determining the need for and level of administrative spectrum licence fees as well as incentive-based spectrum prices. Both of these types of charges can be important to ensure an efficient use of spectrum to the benefit of the overall society, but have different objectives and applications.

There is a general need to ensure spectrum is used efficiently and to the benefit of society. Charging users for spectrum allocated to them can incentivise an efficient use of spectrum, by taking into account the opportunity cost to society of the spectrum.

Given this, spectrum charges overall should:

- Cover the costs of the spectrum management activity borne by the spectrum management authority or regulators;
- Ensure the efficient use of spectrum resources; and
- Maximise the economic benefits to the country from use of the spectrum resource.

Annual licences fees commonly aim to achieve the first objective above, with spectrum pricing addressing the remaining two points for high value spectrum only (i.e. where demand exceeds supply).

Currently, most public and commercial users of spectrum or radio frequencies pay an annual licence fee to the Commission. As set out below, these fees (including their level) were established as part of the Telecommunications (Licences and Fees) Order (CAP. 171) of July 1977. The Commission has also recently issued frequency authorisations to all mobile network operators which contain provision for an annual fee. Whilst most spectrum users currently contribute to the administrative cost of the Commission of managing spectrum, no user is paying fees in line with the opportunity costs of their spectrum holdings. As discussed further in Part I.2 below, this could result in inefficient use of spectrum.

1. Annual licence fees

The activities associated with issuing a licence and undertaking the regular spectrum management functions impose direct costs on the Commission. As such, administrative costs associated with spectrum assignments and monitoring should be recovered from all parties who are assigned spectrum. This is commonly achieved based on an annual licence fee. These fees, which include the costs of issuing, maintaining data, spectrum monitoring and enforcing the conditions of individual licences/authorisations, must be set at a level sufficient to recover the costs of spectrum management. Some costs are common to a band or to a radio service (such

as band planning), whereas others are common to a group of frequency bands and some, such as management overheads, will apply to all spectrum holders.

The Telecommunications (Licences and Fees) Order (CAP. 171) of July 1977 sets out annual licence fees that apply to different types of licences, 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. These annual licence fees, which are summarised in the table below, remain in place to date. These are also available on the Commission's website.[52]

Mobile network operators pay an annual fee of $1,400 per MHz of total frequency spectrum assigned to them over the 15 years of each Frequency Authorisation granted in relation to the 2016 Spectrum Award. This fee reflects the costs of awarding and managing the spectrum. Frequency authorisations have now also been issued to each of the operators for the period of their Unitary Licence reflecting their pre-2016 spectrum allocations, with these authorisations again including provisions for an annual fee. However, to date, no annual fees have been imposed in relation to these authorisations.

Table 16: Annual Licence Fees

Radio type	Annual fee	Radio type	Annual fee
Aeronautical		**Amateur Radio** License (plus exam fee $15)	$20
Aeronautical Radio Telephone	$20	**Business Radio** - Land station, mobile station, coast	$35
Aircraft Station	$30	**Citizens' Band Radio**	$10
Private telecommunications license	$35	**Broadcast** - Audio visual and sound	$2,000
Maritime			
Marine Radio Telephone - General	$20		
Marine Radio Telephone - Restricted (captain license)	$10		

52 http://www.trc.vg/images/attachments/Licencing/Radio%20Licensing%20Application%20Forms/016_Telecommunications%20Annual%20License%20Fees1.pdf

Marine Radio Telegraph - First, Second and Special Class	$10		
Ship Radio communications licence	$30		

The spectrum fees set out in Table 16 have been in place since 1977. The Commission sees merits in reviewing the level of these fees and has embarked on such a review, taking into account, amongst others, the level of fees for these licences charged elsewhere across the region and the Commission's ongoing cost of spectrum management. The preliminary results from this review and any proposed amendments to the annual licence fees will be subject to public consultation in due course.

As recognised in the 2011 SMF, there are currently no annual licence fees applicable to fixed wireless licences, fixed satellite service licences and public sector users of spectrum/radio frequency. Going forward, the Commission sees merits in imposing annual licence fees on those users as well. In line with the current annual licence fees for other spectrum users, these fees will be set to allow the Commission to recover its ongoing costs of spectrum management. This is to ensure the Commission can recover the cost of spectrum management functions across all users of spectrum. The Commission will consult on the proposed level of these fees as part of the consultation on spectrum licence fees referred to in the preceding paragraph. This will also include annual fees on all current mobile spectrum authorisations (i.e., imposing annual fees on all spectrum holdings, including those awarded before 2016).

Question 21: Do you agree with the Commission's preliminary view on the need to apply annual licence fees to fixed wireless licences, fixed satellite service licences and public sector users of spectrum/radio frequency going forward?

Do you agree with the Commission's preliminary intention to apply annual fees on all current mobile spectrum authorisations (i.e., including those awarded before 2016)? If you disagree, please provide a clear justification for your objection.

2. Spectrum pricing

Whilst it is beneficial to society and the Virgin Islands' economy to enhance the use of spectrum to deliver services to end users, it is equally important to ensure that any assigned spectrum is used efficiently. This is because certain parts of the spectrum are a scarce resource and thus have an opportunity cost to society if not used in an efficient manner.

The efficient use of spectrum can be facilitated by means of:

- the allocation of spectrum to individual uses (i.e. the band plans set out in Part D above); and/or
- the assignment of allocated spectrum to individual users.

As the allocation of spectrum (i.e. the band plans) is governed largely by international practice, the Commission does not believe there is a role for spectrum pricing in encouraging an efficient allocation of high value mobile spectrum in the Virgin Islands.

However, the assignment of spectrum within bands could potentially benefit from the setting of spectrum fees which encourage efficient use. This is particularly the case for high value spectrum, such as mobile and fixed wireless spectrum, due to the high opportunity costs of such spectrum. In particular, for mobile and fixed wireless network operators, spectrum constitutes an essential input. As part of their network planning decisions, they commonly face a trade-off between utilising more spectrum or investing into more physical network infrastructure.[53] Unless the operator factors in the opportunity cost associated with any additional spectrum, it is likely to demand more spectrum than socially optimal (i.e. resulting in an inefficient use of spectrum).

The opportunity cost can be reflected in the spectrum award process. For example, as part of an auction or comparative tender process, the Commission can set a reserve price equal to its estimate of the opportunity cost of the marginal block of spectrum. This would ensure that the spectrum is only assigned where a bidder values it at least as much as the opportunity cost. This is an approach commonly adopted in other jurisdictions and the Commission will consider this in future spectrum awards.

However, this approach has not been applied in the Virgin Islands to date. Rather, the spectrum currently assigned to mobile network operators in the Virgin Islands was either allocated to them or awarded based on a fee set to cover the administrative cost of the award only. Whilst mobile network operators pay as part of their unitary licence requirements a royalty charge (equal to 3% of gross revenues), this levy is not linked to their spectrum holdings. This is also the case for the industry levy currently being implemented by the Commission.

As such, the Commission considers it important to ensure, through other routes, that existing spectrum use is not inefficient and where it judges that it is, to encourage actively a more efficient assignment of that spectrum. For the avoidance of doubt, the need for the efficient use of spectrum is most important for spectrum where demand is likely to continue to exceed supply (i.e., sub 1 GHz mobile spectrum,). In all other cases, The Commission considers the there is no need to set a spectrum price (because opportunity cost will be zero, given that spectrum use is not supply constrained).

[53] The Commission notes that there is no perfect trade-off between these two inputs. However, if a licensee has more spectrum assigned to it, its incremental cost of additional coverage or network capacity is likely to be lower than the cost faced by an equivalent licensee with access to less spectrum.

The Commission considers that there are three options to achieve this:

1. **Commission imposed solution.** Under this approach, the Commission would judge whether any assigned spectrum is not used efficiently and where it judges this to be the case, revoke the licensee's right to use that spectrum or enforce refarming of it. This is a very intrusive measure and requires The Commission to determine when there is a need to intervene, thus creating potentially significant uncertainty in the market. There is also a high risk of this process being challenged in court. As such, this is not currently the Commission's preferred solution.
2. **Market led solution via spectrum trading**. If spectrum authorisations are tradable amongst licensees, this should encourage licensees to trade any spectrum where another (potential) licensee places a higher value on that spectrum. The Commission is already encouraging spectrum trading and has published further information on the application process in Part G.1.1 above. However, international precedent suggests that spectrum trading is often limited, for example because licensees may be reluctant to take part in trades with commercial rivals. The Commission therefore does not consider that allowing spectrum trading will, on its own, guarantee the efficient use of existing mobile spectrum assignments.
3. **Incentive pricing principles**. Incentive pricing involves approximating the spectrum prices that might emerge in a market context. This method is often referred to as 'administered incentive pricing' because prices are set: (i) by the regulator reflecting the opportunity cost of spectrum while incorporating potential 'incentive' properties; and (ii) at a level reflecting the scarcity of spectrum, while encouraging efficient use.

   The economic rationale of incentive pricing is twofold. Firstly, a licensee with unused spectrum is incentivised to return or trade any unused spectrum rather than pay the charge. Secondly, because a licensee would pay a lower fee by using spectrum more efficiently (i.e., by using less spectrum), that user has the incentive to adopt more spectrum-efficient operations. In the Commission's estimation, the appropriate level of price pressure could be created at a price that reflects opportunity cost. This can be found by estimating the value of spectrum in its next best use or the extra costs which would be incurred if it were not available to provide the service for which it is currently employed, so the service had to be produced with less spectrum.
   As such, under this approach the Commission would introduce annual charges for the assigned spectrum which would aim to encourage licensees to return any spectrum for which their private value is below the level of the fee (i.e., where their private value of the spectrum is below the opportunity cost of that spectrum in its current use). To achieve this, the charges would have to be set close to the economic value of the spectrum (i.e. the opportunity cost to society of using the spectrum alternatively).

The Commission considers that Option 3 represents the most suitable approach. Given the current assignment and expected future release of mobile spectrum, the Commission believes there is a need only to apply incentive pricing to sub 1 GHz spectrum (due to the prevailing excess demand for spectrum in these bands and current asymmetry in sub 1 GHz spectrum holdings in the Virgin Islands). However, in doing so, the Commission will remain cognisant of existing and proposed levies and fees imposed on mobile network operators (i.e., royalties and industry levy). For the avoidance of doubt, any incentive pricing is not aimed at increasing the overall fee-burden on the mobile network operators, but to facilitate an efficient use of high value spectrum. As part of the implementation process, the Commission will consult on an approach to determining the opportunity cost of spectrum. This is likely to require information on the relationship between network costs and spectrum assignments or, alternatively, international benchmarks of spectrum valuations, suitably adjusted for the Virgin Islands.

Question 22: Do you agree with the Commission's preliminary view on the need for and approach to incentive spectrum pricing for existing high value spectrum holdings? If not, please provide reasons and alternative methods of encouraging efficient use of spectrum.

Part I: Interference

Interference is defined as the effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information, which could be extracted in the absence of such unwanted energy[54].

The ITU has defined three types of interference:

1. Permissible interference: Observed or predicted interference which complies with quantitative interference and sharing criteria contained in the ITU Radio Regulations or in ITU-R Recommendations or in special agreements as provided for in these Regulations.
2. Accepted interference: Interference at a higher level than that defined as permissible interference and which has been agreed upon between two or more administrations without prejudice to other administrations.
3. Harmful interference: Interference which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service, operating in accordance with Radio Regulations.

In the sections below the Commission focuses on harmful interference.

1. Cross-border interference

Generally, cross-border interference can occur in the mobile bands, television bands and sound broadcasting bands. To prevent or limit this, most countries negotiate spectrum agreements or Memoranda of Understanding (MoU) with their neighbouring countries. These agreements formally coordinate the use of specific frequencies (both to optimise the use of spectrum resources in border areas and to reduce problems of harmful interference) and manage interference.

That is, these agreements seek to find a balanced solution between:

- On the one hand, minimising harmful emissions coming from the neighbouring territories. These harmful emissions may cause harmful interference, harmful coverage (for example, meaning that customers in one territory accidentally roam on a network based in the neighbouring territory, despite not being in that territory) or may prevent an Administration from utilising /allocating portions of its national spectrum; and
- On the other hand, defining satisfactory frequency-usage conditions for operators to operate their networks, while maintaining a good quality of service and good coverage upon the national territory.

[54] https://www.itu.int/en/ITU-R/terrestrial/workshops/RRS-15-Asia/Documents/Harmful%20Interference.pdf

This leads countries to accept and agree upon a certain level of interference (i.e., "accepted interference") and/or a certain level of coverage from neighbouring countries.

International Coordination procedures are based on the principle of equitable access to the spectrum resource.

The Commission recognises that in the Virgin Islands, cross-border interference is an issue, particularly in the mobile bands. For example, during interviews, various stakeholders complained about harmful interference coming from the US Virgin Islands. At the moment, there is no frequency coordination agreement between the Virgin Islands and the US Virgin Islands and other neighbouring countries. However, the Commission considers that it would be highly desirable to complete an agreement regarding mobile communications and to see whether such agreements have to be completed for other uses of the spectrum. As such, the Commission is actively reaching out to the relevant authorities in the US to negotiate such an agreement. In setting out its position for reaching such an agreement, the Commission proposes to be guided, wherever possible, by the principles of the EU HCM-agreement[55], which sets out principles which are widely adopted in international frequency coordination agreements. It does, however, welcome the views of stakeholders on the key positions it should adopt in these negotiations.

The Commission notes that an International Coordination Agreement would typically arrange the following:

- In compatible bands (i.e., where the same band plan is used on both sides of the border):
    - Field strength levels and/or rules in terms of antenna orientation
    - For the GSM component of the agreement, a partition has to be made in preferential and non-preferential frequencies and parties have to agree upon the preferential frequencies to be used and the associated field strength levels (at the border line, at the coast line or xx km across the border line) and/or rules applicable for preferential and non-preferential frequencies in order to avoid interference and intentional coverage of the other territory. Preferential frequencies can be used to cover up to the border while non-preferential frequency cannot. Non-preferential frequencies can be used further away from the border as long as they do not interfere with the preferential use the same frequency by operators in the neighbouring country. Details about the permissible coverage will be arranged in the agreement. The agreement would also typically coordinate Network Colour Codes (NCC), a unique identifier of the Mobile Network Operator, as these codes have to be different for the

[55] See http://www.hcm-agreement.eu/http/englisch/verwaltung/index_europakarte.htm

operators using the same frequencies on each side of an international border.[56]

- That for the 3G component of the agreement, the agreement would need to set out the preferential scrambling codes each jurisdiction will use in the border area. These codes are used to distinguish between different cells (transmitters), in preferential and non-preferential codes. However, both jurisdictions will be able to use the same field strength level at the border.
- For the LTE component of the agreement, both jurisdictions can again have the same field strength level at the border. However the agreement will need to divide the Physical-layer Cell Identities (PCI) in preferential and non-preferential PCIs.

- In non-compatible bands (i.e., where different band plans are used on either side of the border):
  - Field strength levels and/or rules in terms of antenna orientation should be agreed upon to minimise interference
  - Which band plan is used up to which frequency. Base-station transmitter (TX) and base-station receiver (RX) situations on near frequencies must be avoided since such cases can easily lead to interference even at distances of 100km or more (and sometimes much more under typical tropospheric ducting conditions as have been observed in the Caribbean).

For non-mobile International Frequency Coordination, such as for example for FM and TV broadcasting, often the key broadcast locations and the frequencies to be used at those locations should be coordinated to avoid harmful interference.

Question 23: Do you agree with the Commission's preliminary view to complete a frequency coordination agreement with US Virgin Islands on mobile communications in the short term? Do you see the necessity of completing frequency coordination agreements with neighbouring countries on frequency bands for other uses?

[56] The Network Colour Code, also called the Public Land Mobile Network (PLMN) colour code, is a part of the Base Station Identity Code (BSIC) and identifies the operator. The BSIC is used in GSM to uniquely identify a base station within a particular geographic area. Unique identification of a base station is of particular importance in border areas, where at both sides of the border different operators might use the same Broadcast Control Channel (BCCH) frequency. See also https://www.gsma.com/newsroom/wp-content/uploads/2013/10/TS.25-v1.0.pdf

2. Domestic interference

The Commission is aware that there are currently issues of interference between the European DECT systems used on cruise-ships and mega-yachts (1880 – 1900 MHz) and the 1900 MHz band, especially the current frequency assignments of in the Up Link 1880 – 1895 MHz and to a lesser extent, the Up Link 1895 – 1910 MHz. Using European DECT systems in Region 2 is illegal. [57] The Commission is putting great efforts in communicating this with shipping companies in order to resolve this interference issue. The following is a summary of actions taken by the Commission in this regard:

- Document of advice to marine vessels was created. This document contains specific information on gaining authorisation (or exemption) for the use of spectrum in Territorial waters, as well as a strict prohibit against use of frequencies in the DECT bands. This document is dispatched to boat owners in advance of their arrival in the Virgin Islands;
- Brochure on harmful interference and the Commission's role in managing the spectrum was created. It also contains key facts on compliance with the Act and frequencies that are already in use in the Virgin Islands and thus particularly prohibited. This is also sent to agents and boat owners in advance of their arrival in the Territory;
- Delegated Authority, pursuant to section 22 of the Act, has been gained from the Ministry of Communications and Works for the Commission to issue exemptions to marine vessels who operate on a valid authority or frequency authorisation issued elsewhere in accordance with international agreements. Accordingly, a system has been created within the Commission for consideration of and issuance of exemptions;
- Posters and Notices were created and posted at various ports of entry in the Virgin Islands prohibiting use of the spectrum in the Virgin Islands without authorisation by the Commission;
- Questionnaires were created for boat owners to complete in advance of their arrival in the Virgin Islands, in order to know what equipment type their vessel carries and which frequencies they would like to use. This is combined with an application for authorisation (or exemption) to use radio frequencies, which the Commission would then approve or reject, accordingly;
- Public Service announcements were audio recorded and played on various radio stations, including marine stations. Written announcements were also placed online.

[57] See for instance https://transition.fcc.gov/eb/fieldadvis/ForeignVes.pdf

As set out in preceding sections, the Virgin Islands currently uses a band plan in the 900 MHz band common in Region 1 countries. However, in the US, this band is allocated to ISM (902 – 928 MHz). The Commission is aware that this might lead to harmful interference from ISM applications to mobile network operators. During recent stakeholder meetings, this was not raised as a problem. However, the Commission will continue to monitor the situation and take appropriate actions against illegal use. If this nevertheless appears to be a problem then the Commission might consider limiting use of the sub band 915 – 928 MHz instead of the overall band. Other countries like Australia, Brazil, Russia, Peru, the UK, Indonesia, Japan, South Korea, Singapore and Taiwan are also implementing restrictions on the use of this ISM-band[58].

Question 24:

In your view, is the interference issue with the unauthorised use of European DECT systems sufficiently resolved at the moment? If not, what additional measures should be taken?

Are you currently confronted with any other interference issues? If so, please specify exactly which bands and/or users or uses your issues relate to.

Would you agree with the Commission restricting the ISM 902 – 928 MHz to 915 – 928 MHz? If not, why not.

[58] See for instance https://www.gs1.org/docs/epc/uhf_regulations.pdf

Part J: Implementation plan

The draft SMF contains a set of proposed actions for the Commission to take forward over the next three to five years in order to implement the key issues and policies set out in Part C to J of this document.

The table below summarises these proposed actions and provides a sequencing of activities. Please note that this draft implementation plan will be updated based on stakeholder feedback on the draft SMF as well as the feedback on the draft implementation plan itself.

Table 17: Draft implementation plan

Year	Activity	Dependencies
2017	Publish final SMF 2017, NFAT and implementation plan Commence formal discussions with US Virgin Islands officials on frequency coordination agreement on mobile communications Continue discussions / coordination with Government on the monitoring and enforcing the ban of unlicensed DECT systems within the Virgin Islands territories	Need for further actions depends on consultation responses to Question 22
Year	**Activity**	**Dependencies**
2018	Publish draft findings of the annual frequency/spectrum licence fee review process for public consultation	
	Publish final, revised annual frequency/spectrum licence fees	
	Issue Frequency Authorisations for Government users of spectrum	
	Consult on policy for Implementation of block assignment of microwave spectrum to mobile network operators	
	Close frequency coordination agreement with US Virgin Islands on mobile communications Publish draft spectrum trading process regulation / rules for public consultation	
	Issue final spectrum trading process regulation / rules Issue policy/regulation on licence exempt bands in line with the final SMF 2017	

Year	Activity	Dependencies
	Issue further details and consult on proposed assignment process for the release of Phase 1 spectrum (i.e., AWS band, 2300 MHz and 2500 MHz)	
	Conduct assignment of Phase 1 spectrum (i.e., AWS band, 2300 MHz and 2500 MHz)	Depends on outcome of consultation process above
Year	**Activity**	**Dependencies**
2019	Commence formal discussions on frequency coordination agreement with neighbouring countries on non-mobile communication uses	Need for further actions depends on consultation responses to Question 23
	Commence process for renewal of Unitary Licences and frequency authorisations Publish policy on LTE on 5 GHz	
	Issue further details and consult on proposed assignment process for the release of Phase 2 LTE spectrum (i.e., 700 and 850 MHz)	
	Conduct assignment of Phase 2 LTE spectrum (i.e., 700 and 850 MHz	Depends on outcome of consultation process above
Year	**Activity**	**Dependencies**
2020	Issue further details and consult on proposed assignment process for the release of Phase 3 spectrum (i.e., 3400-3800 MHz)	
	Conduct assignment of Phase 3 spectrum (i.e., 700 and 850 MHz)	Depends on outcome of consultation process above
Year	**Activity**	**Dependencies**
2021		
Year	**Activity**	**Dependencies**
2022	Commence review process of SMF 2017	

Question 25: Do you agree with the proposed implementation plan for the revised SMF, including the proposed timing? If not, please explain and justify what amendments you propose to the current plan.