



Authorisation Framework for the Accommodation of White Space Radiocommunications Devices

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1 Introduction

1.1 Rationale

There is high demand for spectrum for fixed and mobile broadband, fuelled by the rapidly increasing demand for broadband connectivity and ubiquitous mobility. As a result, the search for more spectrum to facilitate broadband development is growing. Additionally, there is burgeoning interest in innovative ways to use available spectrum. One such way is the use of unassigned or underutilised spectrum (hereafter called “white spaces”), which has led to the development of related emerging technologies and devices.

White space devices (WSDs) operate on those white spaces. They are used to provide broadband connectivity as well as support other emerging technologies such as machine-to-machine (M2M) communications, in frequency bands not currently allocated for use by mainstream fixed and mobile broadband technologies. WSDs are authorised to operate in a manner that does not cause harmful interference to incumbent radiocommunications services within the same frequency band. Consequently, WSDs present an alternative to mainstream technologies used to provide broadband services and associated spectrum bands that may be heavily utilised.

The Telecommunications Authority of Trinidad and Tobago (the Authority) has received expressions of interest for the use of WSDs. Trinidad and Tobago can benefit from WSD technology to provide broadband and other innovative services to underserved areas.

1.2 Purpose

The Authority’s *Authorisation Framework for the Accommodation of White Space Devices* (the Framework) outlines the technical and operational rules for the deployment of WSDs in Trinidad and Tobago. The Framework:

- i. protects incumbent services operating in bands that will be made available for WSD operations.
- ii. reassures potential users that a carefully planned and regulated environment has been created for the deployment of WSDs.

The Framework is a subset of the *National Spectrum Plan* (ver. 1) (TATT 2008). The *National Spectrum Plan* (TATT 2008) provides a framework to regulate the efficient use of spectrum, in an orderly manner, in accordance with the Authority’s mandate.

1.3 Background

Globally, spectrum is carefully managed by regulators through a national frequency allocation table, guided by Article 5 of the International Telecommunication Union Radiocommunication Sector (ITU-R) Radio Regulations (2016). The national frequency allocation table divides radio frequency spectrum into bands, which are allocated for radiocommunications services identified as either primary or secondary services. Thereafter, assignment plans are developed based on these allocations and they outline how spectrum will be assigned to stations of a particular radiocommunications service.

The Authority currently employs two processes for assigning spectrum: a general application process where spectrum is assigned on a first come, first served basis; and a selective process using competitive mechanisms such as auctions or beauty contests. With both processes, assignments are made to stations of primary services and secondary services.

The traditional approach to spectrum management limits interference to users of spectrum. Frequency bands are allocated to specific radiocommunications services, and sharing mechanisms are implemented when multiple services are allocated to the same band. WSDs typically access spectrum in a manner that differs from the traditional approach to spectrum management. WSDs utilise an approach known as dynamic spectrum access (DSA). DSA is a body of spectrum access approaches that allow for spectrum sharing (Min Song 2002). Using DSA approaches, WSDs opportunistically access spectrum that may be available at a particular location or at a particular time, in bands currently allocated to other radiocommunications services.

The non-traditional spectrum access of WSD technology is the main driver for the development of this Framework. The aim is to ensure that the operation of incumbent services is not disrupted by harmful interference from WSDs and to reassure both incumbent operators and potential users of WSDs that a regulated environment has been created for the deployment of WSDs.

1.4 Framework Objectives

This Framework:

- i. identifies the frequency bands that can accommodate WSDs.
- ii. establishes rules for the operation of WSDs in Trinidad and Tobago.
- iii. sets rules for the approval of database administrators to operate in Trinidad and Tobago.
- iv. establishes a regulatory framework for licensing WSDs.

1.5 Relevant Legislation

The sections of the Telecommunications Act, Chap. 47:31 that inform this Framework are:

Section (18)(1)(i):

“Subject to the provisions of this Act, the Authority may exercise such functions and powers as are imposed on it by this Act and in particular –

Plan, supervise, regulate and manage the use of the radio frequency spectrum, including –

- (i) the licensing and registration of radio frequencies and call signs to be used by all stations operating in Trinidad and Tobago or on any ship, aircraft, or other vessel or satellite registered in Trinidad and Tobago;
- (ii) the allocation, assignment and reallocation or reassignment of frequency bands where necessary.”

Section 21(1):

“No person shall operate a public telecommunications network, provide a public telecommunications service or broadcasting service, without a concession granted by the Minister.”

Section 36(1):

“No person shall –

- (a) establish, operate or use a radio-communication service;
- (b) install, operate or use any radio transmitting equipment; or
- (c) establish, operate or use any radio-communication service on board any ship, aircraft, or other vessel in the territorial waters or territorial airspace of Trinidad and Tobago, other than a ship of war or a military aircraft or satellite registered in Trinidad and Tobago

without a licence granted by the Authority”

Section 41(1):

“The Authority shall regulate the use of the spectrum in order to promote the economic and orderly utilisation of frequencies for the operation of all means of telecommunications and to recover the cost incurred in the management of the spectrum.”

Section 41(2):

“The Authority shall develop a spectrum plan in order to regulate the use of the spectrum.”

Section 41(3):

“The National Spectrum Plan shall be made available to the public in the manner prescribed by the Authority.”

Section 41(4):

“The National Spectrum Plan shall state how the spectrum shall be used and the procedures for licensing frequency bands.”

1.6 Review Cycle

This document will be revised periodically to meet changing needs, taking account of technological advancements. The Authority will review this Framework as necessary, and in consultation with stakeholders, to ensure that it is guided by relevant policy guidelines and objectives.

Questions or concerns regarding the maintenance of this Framework may be directed to the Authority via e-mail to info@tatt.org.tt.

1.7 Consultation Process

The Authority sought, in accordance with its [*Procedures for Consultation in the Telecommunications Sector of Trinidad and Tobago*](#) (ver. 2.0, 2010), the views of the general public and industry stakeholders on the second draft of this document, which was published on July 12, 2017, with an initial closing date of August 9, 2017 that was extended to August 23, 2017.

The comments and recommendations received from the second round of consultation and the Authority’s decisions on these comments and recommendations have been compiled in the Decisions on Recommendations (DoRs) in Annex II.

The following revisions to the second consultative document were made, based on comments and recommendations received from the second consultative round:

1. Clarification on the shared use of assigned channels to WSDs in section 3.1
2. Clarification on the application of out-of-band emission limits and a new rule for the variation of antenna gain in section 3.4
3. Clarification on the approval process of the database administrator in section 3.5.2

1.8 Other Relevant Documents

Other relevant policies, plans and regulations to be read along with this Framework include:

- i. [Authorisation Framework for the Telecommunications and Broadcasting Sectors of Trinidad and Tobago](#) (ver. 0.5, 2005)
- ii. [Recommendations for Spectrum Management Policy](#) (ver. 0.5, 2005)
- iii. [National Spectrum Plan](#) (ver. 1, 2008)
- iv. [Trinidad and Tobago Frequency Allocation Table](#) (9 kHz – 1000 GHz) (ver. 2, 2010)
- v. [Class Licensing Regime](#) (ver. 1 2008)
- vi. [Equipment Standardisation and Certification Framework for the Telecommunications and Broadcasting Sectors of Trinidad and Tobago](#) (ver. 1, 2008)

1.9 Definitions

Closed user group: a group of persons, who have a common business or other economic interest other than the provision of a telecommunications service (Telecommunications Act Chap. 47:31)

Closed user group service: a telecommunications service, used by a closed user group, operated without interconnection to a public telecommunications network (Telecommunications Act Chap. 47:31)

Equivalent isotropic radiated power (EIRP): the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain) (ITU-R 2016)

Fixed white space device: a WSD that transmits and/or receives radiocommunications signals at a specified fixed location (CFR 2016)

Geolocation database: a database system approved by the Authority that provides white space devices with operational parameters, such as available channels and maximum permitted power (ETSI 2014)

Harmful interference: interference which endangers the functioning of telecommunications so as to impede, degrade, obstruct or interrupt a telecommunications service (Telecommunications Act Chap. 47:31)

Mobile white space device: a WSD that transmits and/or receives radiocommunications signal at an unspecified location that changes during or between operations (CFR 2016)

Primary service: a radiocommunications service for which stations can claim protection from harmful interference from stations of a secondary service (ITU-R 2016)

Private telecommunications service: a telecommunications service used within one enterprise or its affiliates, to satisfy its or their internal needs and operated without any interconnection to a public telecommunications network (Telecommunications Act Chap. 47:31)

Public telecommunications network: a telecommunications network used to provide a public telecommunications service (Telecommunications Act Chap. 47:31)

Public telecommunications service: a telecommunications service, including a public telephone service, offered to members of the general public, whereby one user can communicate with any other user in real time, regardless of the technology used to provide such service (Telecommunications Act Chap. 47:31)

Secondary service: a radiocommunications service for which stations shall cause harmful interference to stations of primary services and cannot claim protection from interference from stations of primary services (ITU-R 2016)

Spectrum sensing: the process by which a WSD monitors a channel to detect whether the channel is occupied by a radio signal of an incumbent radiocommunications service (CFR 2016)

Station: one or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service (ITU-R 2016)

Television white space (TVWS): the portion of the television broadcasting band, 54 – 72 MHz, 76 – 88 MHz and 470 – 698 MHz in ITU-R Region 2, that is made available for the operation of WSDs (DSA 2016)

Value added service: a service, other than a public telecommunications service that, using a telecommunications service, provides or modifies content and applications not associated with the telecommunications service (Telecommunications Act Chap. 47:31)

White space: unassigned or unutilised spectrum at a particular location or at a particular time (DSA 2016)

White space device (WSD): a cognitive radio device that operates on white spaces (ETSI 2014)

2 Overview of White Space Devices

In formulating this Framework, existing WSD regulations and operations from several jurisdictions were investigated, as follows:

- i. Canada (IC 2016)
- ii. New Zealand (RSM 2014)
- iii. Singapore (IMDA 2016)
- iv. The United Kingdom (Ofcom 2015)
- v. The United States of America (CFR 2016)

The Authority also considered similar works undertaken within the Caribbean, such as the Caribbean Telecommunications Union report entitled, *TV White Space Management and Regulation Report (CTU 2015)*.

2.1 Operation of White Space Devices

This section provides a brief overview of the operation of WSDs that were considered in developing this Framework.

2.1.1 Categories of Devices

Two categories of WSDs have been authorised in other jurisdictions, namely, fixed WSDs and mobile WSDs. In these jurisdictions, different WSD categories required different rules to ensure interference free operations.

2.1.2 White Space Access Mechanisms

White space access mechanisms may only be required where WSDs utilise white spaces within bands with a significant number of assignments. White space access mechanisms determine:

- i. frequency channels that are available for use by a WSD at its geographic location.
- ii. other operational parameters, such as validity period and maximum permitted transmit power, at which the WSD can operate in a manner that will not cause harmful interference to incumbent services.

A white space access mechanism may not be required where white spaces are in a band that is largely unassigned, and where contiguous spectrum is made available for WSD operations. In such a situation, WSDs may operate using traditional approaches to spectrum management, such as the assignment of individual channels either for exclusive use or for location based operations, where frequency reuse is applied. New Zealand uses this approach in its interim arrangements for the licensing of WSDs (RSM 2014).

There are two white space access mechanisms: spectrum sensing and geolocation database.

2.1.2.1 Spectrum Sensing

Spectrum sensing is the mechanism through which the WSDs determine available channels by scanning a band to check for signals from incumbent services. Spectrum-sensing WSDs use algorithms to detect signals based on specific characteristics of the expected signals in the band. Therefore, the sensing capabilities of WSDs are based on algorithms designed to detect signals, given the standards implemented in the jurisdiction.

Spectrum-sensing WSDs also determine operating parameters in order to avoid causing harmful interference to the incumbent services. The operating parameters of the spectrum-sensing WSDs are built-in at the time of manufacture and certified to meet minimum sensing-detection thresholds and operation criteria, based on the standards of the signals used in the jurisdiction (DSA 2016; Kocks et al 2012).

The spectrum-sensing mechanism is still being developed and has not been used in any pilot to date. However, there are countries that have made provisions for the operation of devices that rely on this spectrum access mechanism in their regulations (FCC 2016; DSA 2016).

2.1.2.2 Geolocation Database

A geolocation database is the mechanism through which WSDs must query an authorised database to obtain information on available channels and other operating parameters relevant to the location of the WSDs. This access mechanism has been implemented in the TV bands in the US, the UK and Singapore (DSA 2016).

Both fixed and mobile WSDs can operate with the geolocation database access mechanism and WSD deployments can be either standalone or networked. Standalone WSDs, whether fixed or mobile, are required to have the capability to query geolocation databases. For networked deployments, at least one mobile or fixed WSD is required to communicate with geolocation databases. This WSD is called the master WSD. It acts as a base station or access point to control other fixed or mobile WSDs, referred to as slave WSDs. WSDs communicate with a geolocation database using the Internet over a medium other than the spectrum they are attempting to access, such as a cellular mobile data connection (Webb 2013).

In jurisdictions similar to Trinidad and Tobago, where spectrum cannot be exclusively assigned for use by WSDs, geolocation databases are inherent to the design and functionality of WSDs. In addition, they have a significant role in managing the operations of WSDs; they ensure WSDs operate in accordance with the technical and operational limits necessary to protect primary and secondary radiocommunications services in the bands in which WSDs operate.

2.1.3 Geolocation Databases and Exchanges with White Space Devices

Once a WSD establishes communication with a geolocation database, it must report its device parameters to the database. The database then determines the operational parameters for the WSD using coexistence rules. The operational parameters communicated to the WSD are usually valid for a specific period.

Device parameters that are reported to the database vary across jurisdictions. The three device parameters at a minimum that are reported are:

- i. Location
- ii. Location uncertainty
- iii. Antenna height (fixed WSDs only)

The three operational parameters, at a minimum, that are reported to the querying WSD are:

- i. Available channels
- ii. Maximum permitted power
- iii. Channel validity period

A WSD may receive one or more sets of operational parameters from the geolocation database. If the WSD has multiple options from which to choose, it selects a channel and the associated maximum permitted power, and operates. Depending on the jurisdiction, WSDs are required to report channel usage parameters to the geolocation database. Channel usage parameters to be reported may include:

- i. Channels to be used by the WSD
- ii. Maximum expected transmit power

In the various jurisdictions, WSDs are required to poll the geolocation database to verify if their operational parameters are still valid. The maximum time between polls varies significantly between the jurisdictions. For fixed WSDs in the US, the polling period is at least once every 24 hours. In Singapore, it is at a maximum every six hours. In the UK, Ofcom allows the geolocation database to determine the polling period, as part of its operational parameters.

2.1.4 Administration of Geolocation Databases

The geolocation database administrator can be the regulator, another public sector entity or one or more private sector entities. All existing regulations, in jurisdictions that have implemented the geolocation database access mechanism, designate database administration to one or multiple private sector entities.

The role of the database administrator is to oversee and manage operations of the database with respect to:

- i. determining and providing, upon request, accurate operational parameters in a non-discriminatory manner, in accordance with established coexistence rules.
- ii. registering WSDs.
- iii. establishing processes for the exchange of information with the regulator.
- iv. ensuring all communications with WSDs are secure.
- v. ensuring all information stored in the database is secure.

There are two approaches to authorising database administrators in jurisdictions with regulations. With the first approach, the administrators are simply designated by the regulator, without a licence: the authorisation instrument may take the form of an agreement. This approach also does not require administrators to pay a fee to operate the geolocation database. The alternative is licenced database administrators who pay a licence fee to administer a geolocation database (DSA 2016).

In some of the jurisdictions researched, database administrators may charge fees for providing operational parameters as well as for value-added services, such as priority access and access to clearer channels.

2.2 Frequency Bands and Coexistence Planning

This section provides an overview of the frequency bands in which WSDs are authorised to operate in the jurisdictions that were investigated.

2.2.1 Television White Space Band

The television white space (TVWS) band refers to the portions in the band allocated to television broadcasting services (TV) that are available for WSD operations. The TVWS band is preferred because:

- i. its propagation characteristics can support WSD applications.
- ii. the locations of TV broadcast transmitters are fixed, with usually fixed operational parameters, making coverage relatively predictable.
- iii. the TV broadcast band is underutilised in many countries.

This band has been used to pilot WSDs applications throughout the world, mainly using the geolocation database access mechanism.

The TV band in ITU-R Region 2 is split into two ranges — very high frequency (VHF) and ultra high frequency (UHF). The VHF ranges extend from 54 to 88 MHz and from 174 to 216 MHz. The UHF range extends from 470 to 698 MHz. The channel plan for the TV band in ITU-R

Region 2 shown in Table 1, which is applicable to Trinidad and Tobago, is based on a 6 MHz channel bandwidth.

Table 1: ITU-R Region 2 TV Broadcasting Services Channel Plan

Channel	Frequency Range (MHz)
2	54 – 60
4	66 – 72
5 – 6	76 – 88
7 – 13	174 – 216
14 – 20	470 – 512
21 – 51	512 – 698

When WSD operations are accommodated in the TVWS band, incumbent services are protected by coexistence rules developed by the regulator. Typical services that require protection in this band are:

- i. Analogue and digital terrestrial TV broadcasting services
- ii. Fixed broadcast auxiliary service links services
- iii. Wireless microphones
- iv. Land mobile services
- v. Radio astronomy services

Coexistence rules are used to determine the operational parameters of WSDs and are developed based on the incumbent services using the band. Rules and approaches, therefore, vary among jurisdictions.

2.2.2 The 3.6 GHz Band

The 3.6 GHz band, 3550 – 3700 MHz, is the other band where white spaces have been made available to WSDs. The Federal Communications Commission (FCC) has identified this band for the operation of Citizens Broadband Radio Service (CBRS) in the *Code of Federal Regulations* (CFR) Title 47 Part 96, with a three-tiered licensing approach (FCC 2016). The three tiers are:

- i. Incumbent access: military radar, FSS and other grandfather wireless broadband licensees to continue operations in the 3650 – 3700 MHz band
- ii. Priority access: Operators will be assigned a non-renewable licence for use of 10 MHz within the 3550 – 3650 MHz portion of the band.
- iii. General authorised access: flexible access to the band permitted for any portion of the band not assigned to higher-tier users

General authorised access citizen broadband radio devices (CBRDs) use an access mechanism similar to geolocation databases called the spectrum access system (SAS). The SAS provides

CBRDs with operational parameters based on channel usage by higher-tiered licensees. White space operations in this band have only been adopted in the US (FCC 2016).

2.3 Licensing of White Space Devices

There are three approaches to the licensing of WSDs — licence exempt, licence shared access and individual licence.

2.3.1 Licence Exempt

The licence exempt approach is the approach to licensing devices considered to be mass market and low-interference potential. This approach has been adopted by the US, the UK and Singapore (FCC 2016). Licence exempt devices are allowed to operate without an individual licence, once they conform to established general operating parameters. In Trinidad and Tobago, this licensing terminology does not form part of the regulatory regime. However, devices that are licence exempt in other jurisdictions can be authorised using the *Class Licensing Regime*, where a blanket licence (class licence) is issued for a class of device. A class licence authorises the use of all devices within a particular type, based on specified operating parameters outlined in the class licence.

2.3.2 Licence Shared Access

Licence shared access (LSA) is a spectrum authorising approach that allows spectrum sharing between incumbent service providers and new service providers in assigned frequencies. Spectrum that is already assigned, or is expected to be assigned to incumbent users, is made available for licensing to new service providers. LSA relies on spectrum sharing rules that guarantee access to spectrum and protection from harmful interference for both incumbent and new services. With this approach, secondary use and opportunistic access will not be applicable conditions for the use of spectrum by WSDs (Faussurier 2014).

2.3.3 Individual Licence

Individual licence is the approach for authorising spectrum use exclusively, either within a specified area or nationwide. This approach also excludes secondary use and opportunistic access to licensing the operation of WSDs. It is most appropriate in jurisdictions where spectrum will be available exclusively for WSD operations as minimal coexistence planning is needed to protect incumbent operators in the band. New Zealand adopted this approach in its interim arrangements for the licensing of WSDs (RSM 2014).

3 Framework for Authorisation of White Space Radiocommunications Devices

3.1 Frequency Bands

WSD operations will be allowed in the bands allocated for the provision of TV in Trinidad and Tobago. WSD operations will be limited to selected channels in the UHF TV band, 470 – 698 MHz, because of the high utilisation of the channels in the VHF TV band. Channels will be made available to WSDs in accordance with the existing TV assignment channel plan, which is based on a 6 MHz channel bandwidth.

The TV UHF band, 470 – 698 MHz, spans four frequency ranges in the Trinidad and Tobago Frequency Allocation Table (9 kHz and 1000 GHz) (TATT 2009), which is guided by the ITU-R Radio Regulations Table of Frequency Allocations for ITU-R Region 2. The ranges and associated assigned radio services are stated in Table 2.

Table 2: Radio Services Assigned in the Band 470 – 698 MHz (TATT 2009)

Frequency Range (MHz)	Trinidad and Tobago Assigned Radio Services
470 – 512	Primary Services: Broadcasting, Fixed and Land Mobile
512 – 608	Primary Service: Broadcasting
608 – 614	Primary Service: Broadcasting
614 – 698	Primary Service: Broadcasting Secondary Services (Fixed and Mobile)

Table 2 lists the primary and secondary radio services that will be afforded protection from harmful interference caused by the operations of WSDs.

Frequency assignments have been made to analogue free-to-air TV within the range 470 – 608 MHz. Frequency allocations have been made to fixed services within the range 614 – 698 MHz and frequency assignments have been made therein to permit wireless subscription TV as a broadband wireless access (BWA) service. The technology employed to offer BWA subscription TV in this frequency band is also employed for digital free-to-air TV broadcasting services. Therefore, consideration given to digital free-to-air TV in this Framework shall also be applicable to BWA subscription TV.

The channels assigned to WSDs will be shared amongst all users. WSDs will not have exclusive access to any assigned channel.

Rules:

1. *WSD operations shall only be allowed on selected channels, prescribed by the Authority, in the UHF television broadcasting band — 470 – 698 MHz.*
2. *The channel(s) assigned to WSDs shall utilise a 6 MHz channel bandwidth, in accordance with the Authority’s television broadcasting service channel assignment plan.*
3. *WSDs shall be allowed to aggregate two or more 6 MHz channels.*
4. *Broadband wireless access subscription TV broadcasting service shall be considered in the same manner as digital free-to-air TV broadcasting service, in relation to the operation of WSDs.*
5. *WSDs shall not have exclusive access to any assigned channel. The assigned channels to WSDs shall be available to all users on a shared basis.*

3.2 White Space Access Mechanism

The geolocation database approach has been implemented in deployments in other jurisdictions, including trials and pilots, and is considered to be the more viable option for managing access to white spaces. Therefore, this is the approach that will be adopted in Trinidad and Tobago.

Geolocation databases will play a significant role in managing the operations of WSDs, in accordance with the rules of this Framework. In particular, the geolocation database will ensure WSDs operate in accordance with technical and operational limits necessary to protect primary and secondary radiocommunications services in the UHF TV broadcasting band.

The Authority recognises the potential of spectrum sensing as an access mechanism as well and will monitor its deployment in other jurisdictions. The Authority may, in the future, include spectrum sensing as an alternative access mechanism.

Rule:

6. *The geolocation database approach shall be adopted as the white space access mechanism in Trinidad and Tobago.*

3.3 White Space Devices

3.3.1 Categories of Devices

Both fixed and mobile devices can operate using a geolocation database as the access mechanism for white space spectrum. However, considering the current device ecosystem, the expected applications of WSDs in Trinidad and Tobago and the need to protect incumbent service providers, only fixed WSDs will be allowed at this time.

WSDs must have the ability to query geolocation databases over the Internet, using a medium other than the white space spectrum to which it is attempting to gain access.

The Authority recognises that mobile WSDs can operate with this access mechanism and that there is potential for applications using mobile devices. The Authority may consider allowing mobile WSDs in Trinidad and Tobago in the future.

Rules:

7. *Only fixed WSDs shall be allowed to operate in Trinidad and Tobago.*
8. *Fixed WSDs shall have the following capabilities:*
 - i. *The ability to query geolocation databases*
 - ii. *The ability to connect to the Internet using a medium, other than the white space it is trying to access, to communicate with geolocation databases*

3.3.2 Geolocation Database Access Requirements

WSDs will transmit using white spaces only after they have received operational parameters from a geolocation database. They are only permitted to operate in accordance with operational parameters provided by a geolocation database. They will query a geolocation database for operational parameters by sending their device parameters. Device parameters will include, at a minimum, a WSD's:

- i. Location and location accuracy
- ii. Antenna height above ground level
- iii. Serial number

The geolocation database will respond to the WSD with operational parameters, which will include, at a minimum:

- i. Available channels
- ii. Maximum permitted power
- iii. Channel validity period

A WSD is required to notify its geolocation database of its channel usage parameters, which will include at a minimum:

- i. Channels to be used by the WSD
- ii. Maximum expected transmit power

A WSD is required to notify its geolocation database of its channel usage parameters upon receiving operational parameters and not during operation. It is also required to query a geolocation database for operational parameters when:

- i. Activating from a power-off state
- ii. The channel validity period expires.

WSDs must poll a geolocation database at least once every 24 hours to verify that their operational parameters continue to be valid. They must adjust their operating power to a permissible level if the geolocation database indicates that its operating channel is no longer available at the current operating level.

WSDs must also cease transmission if the geolocation database indicates its operating channel is no longer available or if the geolocation database becomes unavailable.

If a WSD does not have a direct connection to the Internet, it can only operate as a slave WSD. It will query a geolocation database for operational parameters via a master WSD, by transmitting to the master WSD on either the channel the master WSD is transmitting on or on a channel the master WSD indicates is available for use. On receiving operational parameters from the geolocation database, the slave WSD will only use the channels that the database indicates are available for it to use.

Rules:

9. *WSDs shall only transmit using white spaces after they have received operational parameters from a geolocation database.*
10. *WSDs shall only operate in accordance with operational parameters received from a geolocation database.*
11. *WSDs shall query a geolocation database with the following device parameters:*
 - i. *Location and location accuracy*
 - ii. *Antenna height above ground level*
 - iii. *Serial number*
12. *WSDs shall query a geolocation database for the following operational parameters:*
 - i. *Available channels*
 - ii. *Maximum permitted power*

iii. Channel validity period

13. WSDs shall notify its geolocation database of its channel usage parameters, which will include, at a minimum;

- i. Channels to be used by the WSD.*
- ii. Maximum expected transmit power.*

14. WSDs shall notify its geolocation database of its channel usage parameters on receiving operational parameters from the geolocation database and not during operation.

15. WSDs shall query the database for operational parameters when:

- i. Activating from a power-off state.*
- ii. When the channel validity period expires.*

16. WSDs shall poll a geolocation database once every 24 hours to verify that their operational parameters continue to be valid, and make adjustments as indicated by the geolocation database.

17. WSDs shall cease operation in any of the following situations:

- i. The database indicates the channel is no longer available.*
- ii. The database becomes unavailable.*

18. When a WSD does not have a direct connection to the Internet, it shall operate as a slave WSD and a master WSD will query the geolocation database on its behalf.

3.3.3 Security Requirements

WSDs shall utilise mechanisms to ensure that they communicate only with approved geolocation databases when querying available channels and identifying other operational parameters. WSDs must also employ mechanisms that secure communication with approved geolocation databases and with other WSDs, preventing unauthorised interception of data transmitted. Mechanisms shall also be implemented to prevent operational parameters from being manually modified.

Rule:

19. WSDs shall utilise adequate mechanisms to ensure:

- i. Communication for the purpose of obtaining available channels and other operational parameters takes place with only approved geolocation databases.*
- ii. Communications and interactions with geolocation databases or other WSDs are secure.*
- iii. Prevention of any unauthorised modification of operational parameters provided by a geolocation database.*

3.4 Coexistence of Services

In Trinidad and Tobago, digital and analogue free-to-air TV broadcasting services operate within the band 470 – 698 MHz. These are the services for which coexistence rules are needed. WSDs will be required to operate in a manner that does not cause harmful interference to TV broadcasting services, and shall not claim protection from harmful interference.

Given the small geographic area of Trinidad and Tobago, channels currently assigned to digital and analogue TV broadcasters in the TV broadcasting band will not be made available for the operation of WSDs. WSDs will be allowed to operate on channels adjacent to those assigned to digital and analogue TV broadcasters, for which operational parameters are listed in Tables 3 and 4, respectively.

When a WSD operates on a channel that is adjacent to both analogue and digital services, it must comply with the operational limits for coexistence with digital service.

Table 3: Adjacent Channel Limits for Digital TV Broadcasting Services

Operational Parameters	1 st Adjacent	2 nd Adjacent	3 rd Adjacent and greater
Maximum EIRP	16 dBm	20 dBm	36 dBm
Maximum RF output	10 dBm	14 dBm	30 dBm
Maximum antenna gain	6 dBi (For every dBi gain above the maximum value, the maximum RF output power shall be reduced by 1 dB.)		
Out-of-band emission limit (100 kHz)	-62.8 dBm	-58.8 dBm	-42.8 dBm

Table 4: Adjacent Channel Limits for Analogue TV Broadcasting Services

Operational Parameters	1 st Adjacent	2 nd Adjacent and Greater
Maximum EIRP	20 dBm	36 dBm
Maximum RF output	14 dBm	30 dBm
Maximum antenna gain	6 dBi (For every dBi gain above the maximum value, the maximum RF output power shall be reduced by 1 dB.)	
Out-of-band emission limit (100 kHz)	-58.8 dBm	-42.8 dBm

The values in Tables 3 and 4 are maximum values. Where the maximum permissible operating power is not necessary to achieve successful communication, WSDs shall implement transmit power control to limit operating power to the minimum necessary to achieve successful communication.

The out-of-band emission limit applies to the 100 kHz immediately adjacent to the channel used by the WSD and every subsequent 100 kHz block of spectrum. The maximum RF output power measured in any 100 kHz shall not be greater than the limit identified in Tables 3 and 4.

Rules:

20. *WSDs shall not be allowed to operate on channels assigned to authorised digital and analogue free-to-air TV broadcasters.*
21. *WSDs shall not operate in a manner that causes harmful interference to authorised digital and analogue free-to-air TV broadcasting services, and shall not claim protection from harmful interference from other authorised users.*
22. *WSD operations shall be allowed on channels adjacent to channels assigned to digital TV broadcasters, with the following technical limits:*
 - i. *For 1st adjacent channel:*
 - a. *Maximum EIRP 16 dBm*
 - b. *Maximum antenna gain: 6 dBi*
 - c. *Out-of-band emission limit: -62.8 dBm*
 - ii. *For 2nd adjacent channel:*
 - a. *Maximum EIRP 20 dBm*
 - b. *Maximum antenna gain: 6 dBi*
 - c. *Out-of-band emission limit: -58.8 dBm*
 - iii. *For 3rd adjacent channel and greater:*
 - a. *Maximum EIRP: 36 dBm*
 - b. *Maximum antenna gain: 6 dBi*
 - c. *Out-of-band emission limit: -42.8 dBm*
23. *WSD operations shall be allowed on channels adjacent to channels assigned to analogue TV broadcasters, with the following technical limits:*
 - i. *For 1st adjacent channel:*
 - a. *Maximum EIRP 20 dBm*
 - b. *Maximum antenna gain: 6 dBi*
 - c. *Out-of-band emission limit: -58.8 dBm*
 - ii. *For 2nd adjacent channel and greater:*
 - a. *Maximum EIRP: 36 dBm*
 - b. *Maximum antenna gain: 6 dBi*
 - c. *Out-of-band emission limit: -42.8 dBm*
24. *For every dBi gain above the maximum value, the maximum RF output power shall be reduced by 1 dB.*

25. WSDs shall implement transmit power control to limit operating power to the minimum level necessary to achieve successful communication.

3.5 Geolocation Databases

3.5.1 Functions of Geolocation Databases

Geolocation databases will make operational parameters available to registered WSDs, in accordance with the technical rules set out in this framework and as prescribed by the Authority.

In making operational parameters available to a WSD, the geolocation database shall ensure that all communications and interactions between the WSD and itself include adequate security measures, such that unauthorised parties cannot access or alter the geolocation database or the operational parameters sent to WSDs, or otherwise affect the database system or WSDs in performing their intending functions or in providing adequate interference protection to authorised services in the TV broadcasting band.

The Authority will make available to database administrators a list of registered WSDs, a list of the channels available for WSD operations, the maximum permissible power for each available channel, and the associated channel validity period, at a minimum, as set out in Schedule B of the *Schedule of Devices Eligible for Use under a Class Licence*.

The Authority will update the list of available channels, associated power limits and the channel validity period as the channels available to WSDs change.

Rules:

- 26. Geolocation databases shall, upon request, supply available channels and other operational parameters to WSDs, in accordance with the rules set out in this Framework and as prescribed by the Authority.*
- 27. Geolocation databases shall only supply operational parameters to WSDs that are registered with the Authority.*
- 28. A geolocation database shall implement adequate security mechanisms to ensure all communications and interactions between itself and WSDs are secure and that unauthorised parties cannot access or alter the geolocation database or the operational parameters sent to WSDs.*

3.5.2 Approval of the Geolocation Database Administrator

The jurisdictions considered in formulating this Framework have adopted the approach of private sector entities to administer geolocation databases. Notwithstanding this position, the Authority recognises that a public sector entity may also have an interest in the administration of a geolocation database. Therefore, the Authority will approve one or more public and/or private sector entities to provide geolocation database services in Trinidad and Tobago.

An entity interested in becoming a database administrator in Trinidad and Tobago will be required to apply to the Authority for approval. A database administrator who successfully demonstrates that its geolocation database is capable of providing the services as identified in section 3.5.1, will be approved by the Authority.

On approval, the database administrator will be required to enter into an agreement with the Authority. The terms and conditions of the agreement shall include but not be limited to the:

- i. responsibilities of the database administrator, and in particular, its responsibility to provide database services to all WSD users in a non-discriminatory manner.
- ii. obligation of the database administrator to provide unencumbered access to WSDs and to inform the Authority where such access will not be available.
- iii. exchange of information between the database administrator and the Authority.
- iv. Authority's discretion to review draft agreements between the database administrator and users of WSDs.
- v. ability of the Authority to prescribe changes to the operational parameters.
- vi. proposed charge by the database administrator for use of its services, such charge to be set in accordance with the established guidelines of the Authority.
- vii. grounds for termination of the agreement and removal of a database administrator from the approved list of geolocation databases.

Approved database administrators will be listed in Schedule B of the *Schedule of Devices Eligible for Use under a Class Licence*.

Rules:

29. Geolocation databases shall be administered by one or more private or public sector entities.

30. A database administrator shall apply to the Authority for approval to provide geolocation database services in Trinidad and Tobago.

31. Database administrators shall enter into an agreement with the Authority, on approval of their application to provide geolocation database services.

32. Approved database administrators shall be listed in Schedule B of the Schedule of Devices Eligible for Use under a Class Licence.

3.6 Types of Networks that Employ White Space Devices

WSDs may be utilised in public telecommunications networks and networks that provide closed user group, private telecommunications and value-added services.

A concession is required when WSDs are used for the operation of a public telecommunications network. The public telecommunications network can thereafter be used for the provision of a public telecommunications service or subscription broadcasting service.

The operator or owner of a telecommunications network that uses WSDs solely for the provision of closed user group, private telecommunications or value-added services does not require a concession.

WSDs used in all the above-mentioned scenarios must be licensed in accordance with section 3.7 of this Framework.

Rules:

33. A concession shall be required when WSDs are used in the operation of a public telecommunications network.

34. An operator or owner of a telecommunications network that uses WSDs solely for the provision of closed user group, private telecommunications or value-added services, shall not require a concession.

3.7 Licensing of White Space Devices

Considering the administrative and financial implications of the various licensing options for the operation of WSDs, the Authority believes that a light-handed regulatory approach is best suited for the authorisation of WSDs. Therefore, WSDs shall be licensed in accordance with the *Class Licensing Regime*, as consistent with the jurisdictions researched herein. All WSDs will be required to operate in accordance with the general terms and conditions prescribed by the *Class Licensing Regime*. The maximum technical and operating limits identified in the *Schedule of Devices Eligible for Use under a Class Licence* for the use of these devices shall conform to those limits identified within this Framework.

In order for a WSD to be authorised for use in Trinidad and Tobago, it shall be first certified to be in conformance with the technical and operating limits prescribed by the class licence. The

certification process shall be in accordance with the [Equipment Standardisation and Certification Framework for the Telecommunications and Broadcasting Sectors of Trinidad and Tobago \(Ver. 1.0, 2008\)](#).

Furthermore, all WSDs will be required to register with the Authority, in accordance with Section 3.4 of the *Class Licensing Regime*. Registration is required when the WSD is first installed and when the location of the WSD changes. The Authority currently records the location of registered devices in the degrees, minutes and seconds format, rounded to the nearest second. The location of a WSD is considered changed when the coordinate location changes by at least one second.

Rules:

35. *All white space radiocommunications devices shall be authorised in accordance with the Class Licensing Regime.*
36. *All WSDs shall be certified to conform to the technical and operating limits as are identified in the Schedule of Devices Eligible for Use under a Class Licence.*
37. *All WSDs shall be registered with the Authority, in accordance with section 3.4 of the Class Licensing Regime.*
38. *WSDs shall be registered:*
 - i. *when first installed.*
 - ii. *when their locations change, i.e. when their coordinate location changes by at least one second, using the degrees, minutes and seconds format.*

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Annex I – Decisions on Recommendations Matrix for First Consultation Round

Matrix is attached separately.

Annex II – Decisions on Recommendations Matrix for Second Consultation Round

Matrix is attached separately.