



**Consultative Document**

**Framework for the Authorisation of  
Standalone Ancillary Terrestrial  
Component (ATC) Systems**

**(Version 0.2)**

**(Second of Two Rounds)**

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## Abbreviations

ATC	ancillary terrestrial component
CDMA	code division multiple access
CGC	complementary ground component
FCC	Federal Communications Commission
GMPCS	global mobile personal communications by satellite
ISED	Innovation, Science and Economic Development Canada
MSS	mobile-satellite service
NOS	network operating system
TDD	time division duplex
TTFAT	Trinidad and Tobago Frequency Allocation Table

# 1 Introduction

## 1.1 Background

Ancillary Terrestrial Component (ATC) technology is the use of terrestrial facilities licensed to the operator of a Mobile-Satellite Service (MSS) system for the provision of terrestrial communications, reusing frequencies assigned for its MSS operations<sup>1</sup>. According to Article 1.25 of the International Telecommunication Union's Radio Regulations, MSS is a radio-communications service:

- (i) between mobile earth stations and one or more space stations, or between space stations used by this service.
  
- (ii) between mobile earth stations by means of one or more space stations.

MSS facilitates two-way voice and data communication for global users, including in remote locations, using handhelds or laptop-size terminal units. However, MSS is affected by the attenuation caused by shadowing in urban areas and within houses and buildings. Conventional ATC systems enable MSS operators to integrate terrestrial services into their satellite networks using their assigned frequencies, to augment coverage in areas where their satellite signals are largely unavailable. Contemporary ATC systems provide standalone wireless connectivity, where standalone refers to providing communications separate from the MSS and not limited to improving the MSS services offerings.

The Telecommunications Authority of Trinidad and Tobago (the Authority) has noted the authorisation of ATC systems in other jurisdictions for low-power private networks in the frequency band 2483.5–2500 MHz. This frequency band has been allocated for MSS in the Trinidad and Tobago Frequency Allocation Table (TTFAT).

Through this document, *Framework for the Authorisation of Standalone Ancillary Terrestrial Component (ATC) Systems* (the Framework), the Authority presents its position on ATC authorisation that will guide its consideration of requests to deploy ATC systems over 16.5 MHz of MSS spectrum in the 2.4 GHz S-band (2483.5–2500 MHz), to support private small cell and enterprise networks.

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<sup>1</sup> FCC Report and Order, dated 23<sup>rd</sup> December 2016 in the matter of Terrestrial Use of the 2473- 2495 MHz Band for the Low-Power Mobile Broadband Networks

## 1.2 Purpose

The purpose of this Framework is to guide the authorisation of standalone ATC systems in Trinidad and Tobago within the 2.4 GHz S-band (2483.5–2500 MHz) spectrum allocated for MSS based on defined technical and regulatory provisions. The authorisation of standalone ATC systems will enhance wireless connectivity in Trinidad and Tobago for private use.

## 1.3 Objectives

The Framework addresses:

1. The authorisation of standalone low-power ATC systems
2. ATC licences, fees and annual reporting
3. Technical considerations for the authorisation of ATC
4. Measures needed to protect services which share the 2.4 GHz S-band with ATC systems

## 1.4 Scope

This Framework presents the authorisation approach taken in other jurisdictions and specifies the key technical and regulatory requirements for the authorisation and operation of standalone ATC systems in the 2.4 GHz S-band in Trinidad and Tobago. This document forms part of the Authority's Spectrum Management Framework which serves to allow use of the radiofrequency spectrum in the S-band without causing harmful interference to services that use the same or adjacent bands. It provides guidance and direction for the authorisation of ATC radiocommunications systems by the Authority under its existing legislation, regulations and procedures.

It does not address the authorisation of MSS in Trinidad and Tobago, the provision of public mobile telecommunications services in this band using ATC systems, or the operation of ATC systems in other MSS bands.

## 1.5 Relevant Legislation

The following sections of the Telecommunications Act, Chap. 47:31 (the Act) inform this document:

### Section 18 (1):

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 –

- (i) 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
  
- (o) test and certify telecommunications equipment, subject to section 48(3), to ensure compliance with —
  - (i) international standards; and
  - (ii) environmental health and safety standards, including electro-magnetic radiation and emissions.

### Section 36 (1):

No person shall –

1. establish, operate or use a radio-communication service;
2. install, operate or use any radio transmitting equipment; or
3. 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.

- (2) The Authority shall develop a spectrum plan in order to regulate the use of the spectrum.
- (3) The National Spectrum Plan shall be made available to the public in the manner prescribed by the Authority.
- (4) The National Spectrum Plan shall state how the spectrum shall be used and the procedures for licensing frequency bands.
- (5) The procedures referred to in subsection (4) may include, but are not limited to -
  - (a) procedures for licensing frequency bands by auction;
  - (b) procedures for licensing frequency bands by tender;
  - (c) procedures for licensing frequency bands at a fixed price; or
  - (d) procedures for licensing frequency bands on stated criteria.

Section 42:

- (1) Subject to subsection (2), the Authority may, in accordance with the spectrum plan allocate and re-allocate frequency bands.
- (2) In the allocation or assignment and re-allocation or reassignment of frequency bands by the Authority priority shall be given to the needs of the State in respect of matters of national security.

## 1.6 Other Relevant Documentation

Other relevant policies, plans and regulations, currently in effect, to be read along with this document, include:

1. *The Trinidad and Tobago Frequency Allocation Table (8.3 kHz–3000 GHz) (TTFAT)*
2. *Spectrum Management Framework*
3. *Spectrum Plan for the Accommodation of Broadband Wireless Access Services*
4. *Maximum Permissible Exposure Limits for Radio Frequency Radiation in Trinidad and Tobago*
5. *Schedule of Devices Eligible for Use Under a Class Licence*

These documents can be found on the Authority's website, [www.tatt.org.tt](http://www.tatt.org.tt)



## 1.7 Review Cycle

To keep pace with technological advancements and taking into consideration suggestions for modification submitted by stakeholders or members of the public, the Authority will periodically review this document, in consultation with stakeholders, to ensure that it is guided by updated policies and objectives. This Framework may be reviewed every four years or at any earlier time at the discretion of the Authority based on proposals for modification submitted by stakeholders or members of the public or changes in international regulations.

Questions or concerns regarding the maintenance of this document may be directed to the Authority via email at [policy@tatt.org.tt](mailto:policy@tatt.org.tt).

## 1.8 Consultation Process

In accordance with its *Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago* (ver. 7.0, 2021) (Consultation Procedures), the Authority will seek the views and opinions of stakeholders and the general public regarding the proposals made herein. Consideration will be given to the comments and recommendations made during the consultation process, and the document will be revised accordingly.

In December 2023, version 0.1 of the Framework was released for the first of two rounds of public consultation for a period of six weeks, which was extended for a further three weeks. The decisions on recommendations (DORs) matrix for the first round of public consultation is attached as Appendix I. The following modifications were made to the Framework based on the comments received from the consultation:

1. Section 1.1 (Background) has been revised to provide clarity on the difference between conventional ATC and standalone ATC.
2. The Purpose, subsection 1.2, Objectives, subsection 1.3 and Scope, subsection 1.4 have been updated.
3. Subsection 2.6, Other Administrations was added to highlight other jurisdictions that authorised ATC.
4. A new policy statement (#2) was added to preclude the deployment of standalone, low-power ATC systems to support standard public commercial mobile services.
5. Subsection 3.2 has been revised for clarity.

6. Subsection 3.2, MSS Conditions for the Authorisation of ATC Systems was added as this is a requirement for the authorisation of ATC systems.

The document will be issued for the second of two rounds of public consultation for at least four weeks. Comments should be submitted to consultation [@tatt.org.tt](mailto:consultation@tatt.org.tt) or mailed to:

Telecommunications Authority of Trinidad and Tobago  
5, Eighth Avenue Extension, off Twelfth Street,  
Barataria, Trinidad and Tobago

## 2 Global Authorisation of ATC Systems

Historically, ATC systems have been recognised as terrestrial communications network infrastructure that complements and operates as part of an integrated MSS system<sup>2</sup> to enhance the availability of the satellite offering. The terrestrial component, or fixed base station, of an ATC network, is controlled by the satellite resource and network management system of the satellite operator and uses the same authorised frequency band as the associated operating MSS system.

ATC applications have evolved significantly since their introduction as an integrated part of an MSS offering. Newer, standalone, data-focused ATC applications have emerged that support the Internet of Things (IoT), and the deployment of small cells in mobile networks and private LTE networks in the same frequency bands as satellite systems. Standalone ATC systems refer to ATC systems that operate separately from MSS in terms of service offerings and operation, and not being solely used to augment the services delivered by satellite. Notwithstanding the independence of newer standalone applications, these systems are still referred to as ATC due to the reuse of the frequencies of the MSS system and the requirement for coordination with the MSS system to mitigate harmful interference.

Since the adoption of rules in various jurisdictions allowing for the introduction of ATC systems in MSS spectrum, ATC operations have been restricted to a portion of the Big LEO<sup>3</sup> bands<sup>4</sup>, to protect co-channel and adjacent-channel licensees from harmful interference. ATC operations cannot share spectrum with other terrestrial services and are not entitled to interference coordination with broadband wireless access (BWA) services. As such, sufficient separation between ATC services and primary BWA operations in adjacent spectrum is maintained. The approaches adopted by various administrations in authorising ATC systems are reviewed in the following sections.

### 2.1 Federal Communications Commission (FCC), USA

In 2003, the Federal Communications Commission (FCC) adopted its *ATC Report and Order*, permitting MSS licensees to seek authorisation to implement ATC systems for integration into MSS networks for public and private services. In the Big LEO bands, the FCC limited traditional ATC operations to 1610–1615.5 MHz, 1621.35–1626.5 MHz in the L-band, and 2492.5–2498

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<sup>2</sup> The term “integrated MSS system” refers to an MSS offering that uses ATC systems to augment its performance.

<sup>3</sup> Low Earth orbit (LEO), as the name suggests, is an orbit that is relatively close to Earth’s surface. It is normally at an altitude of less than 1000 km but could be as low as 160 km above Earth – which is low compared to other orbits, but still very far above Earth’s surface.

<sup>4</sup> The term “Big LEO bands” refers to the 1.6–2.4 GHz bands. In general, the Big LEO MSS systems rely on uplinks within the 1610–1626.5 MHz band and downlinks in the 2483.5–2500 MHz band.

MHz in the S-band, and to the specific frequencies authorised for use by MSS licensees. Subsequently, in 2004, the FCC shifted the S-band ATC block to 2487.5–2493 MHz to ensure that ATC spectrum band would not overlap with the fixed and mobile services allocation in the 2495–2500 MHz band.

Globalstar holds a space station licence for its 1.6–2.4 GHz MSS system, providing voice and data services in the United States and abroad via non-geostationary orbit satellites. In 2006, subject to conditions, the International Bureau of the FCC assigned the 1610–1615.5 MHz frequency band for Globalstar’s traditional ATC mobile terminal transmission, and the 2487.5–2493 MHz band for Globalstar’s ATC base station transmission.

In a report and order released in April 2008, the FCC adopted the proposed rule change and, accordingly, proposed to modify Globalstar’s ATC licence, to expand the spectrum assigned for traditional ATC operation to the 1610–1617.775 MHz and 2483.5–2495 MHz bands, for a total ATC spectrum bandwidth of 19.275 MHz (FCC, 2008). Globalstar’s ATC authorisation was subsequently modified to allow operation in those wider frequency bands.

The FCC tentatively concluded that ATC is not feasible in the L-band spectrum Globalstar shares with Iridium, at 1617.775–1618.725 MHz, and that ATC cannot share spectrum with co-primary fixed and mobile services in the 2495–2500 MHz segment of the S-band.

In its 2016 Report and Order FCC 16-181, the FCC modified the rules for the operation of ATCs for the sole MSS system in the Big LEO S-band. The rule changes adopted therein removed the existing ATC “gating” criteria, thereby enabling Globalstar to seek authorisation from the FCC to deploy terrestrial low-power broadband private networks using its licensed spectrum in the 2483.5–2495 MHz band. On 8<sup>th</sup> August 2017, Globalstar officially announced that the FCC had issued licences authorising its terrestrial low-power broadband services over its satellite spectrum in that band.

## 2.2 Innovation, Science and Economic Development Canada (ISED), Canada

In its application to ISED, dated April 2019, Globalstar Canada requested authorisation to provide ATC mobile services in the 2483.5–2500 MHz frequency range independent of its MSS offering. It also requested that ISED modify certain requirements and adopt operational requirements and technical rules similar to those identified by the FCC in its 2016 Report and Order FCC 16-181. Adopting these rules and operational requirements would allow Globalstar Canada to provide low-power ancillary terrestrial mobile services using its licensed MSS spectrum.

Globalstar Canada stated its commitment to continue providing MSS with its second-generation satellite system, noting that the ATC system is ancillary to MSS. ATC systems provide Globalstar

Canada with an opportunity to make more efficient use of primary MSS spectrum, through the coordinated deployment of both satellite and terrestrial services.

In its report in 2020, *Decision on Globalstar Canada's Application for Ancillary Terrestrial Component (ATC) Authority in the 2.4 GHz Band (2483.5–2500 MHz)*, 2020, ISED noted that the rules in the 2004 ATC policy (RP-023) had been developed based on the situation at the time, among them the status of ATC as an integral part of MSS and the expected use of dual-mode terminals. While some of the rules for the 2 GHz band were removed in 2014, they remained applicable to the 2.4 GHz band. In its decision, ISED stated that the ATC system proposed by Globalstar Canada would operate at low power to support small cell private applications and would preclude the deployment of standard commercial mobile services. The low-power ATC use allows both MSS and terrestrial systems to thrive in the band in a complementary manner without harmful interference.

Given the evolution of ATC since 2004, in November 2020, ISED granted authorisation to Globalstar Canada's low-power ATC operations, with the following decisions:

1. ISED will grant authorization to Globalstar Canada to operate only low-power ATC in the 2.4 GHz band, through a spectrum licence with a set of technical, policy and licence conditions as outlined in its Decision.
2. The licensee must comply on an ongoing basis with all principles outlined in the ATC policy (RP-023), including the requirement to maintain MSS, except for the following:
  - a) ISED will remove the dual-mode user equipment requirement for Globalstar Canada in the 2.4 GHz band, and
  - b) ISED will allow Globalstar Canada to deploy a stand-alone, low-power ATC system in the 2.4 GHz band subject to the conditions in its Decision.

### 2.3 Botswana Communications Regulatory Authority (BOCRA), Botswana

In 2017, the Botswana Communications Regulatory Authority (BOCRA) granted Globalstar's Botswana subsidiary the authority to use 16.5 MHz of S-band spectrum at 2483.5–2500 MHz for terrestrial mobile broadband (public or private) services, in partnership with licensed operators in Botswana. Globalstar filed its application for terrestrial authority in early 2017 and BOCRA accelerated its review to authorise the use of the S-band. With this approval, Botswana became the first country outside of the US to approve Globalstar's terrestrial S-band authority and the first country to approve the authority over 16.5 MHz across Globalstar's licensed 2.4 GHz holdings.

BOCRA stated that the terrestrial network operations will be based on the deployment of LTE small cell low-power networks that will operate in its dedicated spectrum.

## 2.4 National Telecommunications Agency (Anatel), Brazil

In 2020, Globalstar announced that the National Telecommunications Agency of Brazil (Anatel) had authorised its deployment of ATC services in the 2.4 GHz band. The authorisation corresponds to 3GPP's band 53 specification and supports the ecosystem of devices and infrastructure available.

Considering the feedback received from public consultation, published in the Official Gazette on 15<sup>th</sup> July 2020, Anatel approved the technical and operational requirements for the use of the 2485–2495 MHz band by stations in the private limited service (SLP) and authorised Globalstar to operate low power SLP systems.

## 2.5 Secretariat of State for Telecommunications and Digital Infrastructures, Spain

On 30<sup>th</sup> August 2021, Globalstar Communications Spain submitted a request to the Secretary of State for Telecommunications and Digital Infrastructures for authorisation to deploy an auxiliary terrestrial network, which is effectively ATC infrastructure, in the 2483.5–2495 MHz band, that enhances the MSS authorised in the same band.

Considering the established Decision 626/2008/EC of the European Parliament and other applicable laws and regulations, the Secretariat of State granted Globalstar Communications Spain a concession for the private use of the 2483.5–2495 MHz band for a ground auxiliary network as complementary to the MSS. This authorisation only enables the enhancement of the availability and quality of the public MSS and is not intended to support independent communication.

## 2.6 Other Administrations

The following administrations have also authorised the operation of ATC systems in the S-band (2483.5–2495 MHz) for the provision of *private* low-power terrestrial LTE services in the oil and gas sector, mining sector, agricultural, industrial and conservation operations:

1. The Independent Communications Authority of the Republic of South Africa (ICASA)
2. The Autorité de Régulation des Communications Électroniques et des Postes (ARCEP) of Gabon
3. The Instituto Nacional das Comunicações de Moçambique (INCM) of Mozambique

4. The Communications Authority of Kenya
5. The Rwanda Space Agency and the Rwanda Utilities Regulatory Authority of Rwanda
6. The Communications Regulatory Authority of Namibia

### 3 Authorisation of Standalone ATC Systems in Trinidad and Tobago

Conditions for authorisation to operate standalone ATC systems using spectrum in the 2.4 GHz band (2483.5–2500 MHz) shall include:

1. Low-power ATC Operation
2. Requirement for MSS authorisation
3. ATC systems licences, fees and annual reporting
4. Technical operating parameters for ATC systems

#### 3.1 Low-Power ATC Operation

ATC systems are used primarily to support the private small cell enterprise networks often requested by business and commercial customers, such as those in mining, oil and gas, port management, utilities and manufacturing. The Authority also notes the use and benefits of ATC applications for providing capacity to support the deployment of additional services such as IoT and fifth generation (5G) telecommunications services.

Guided by the authorisation approaches taken by the administrations outlined in section 2, the Authority can accommodate low-power ATC service in the 2483.5–2495 MHz band in Trinidad and Tobago. The use of spectrum in the 2483.5–2495 MHz band would allow the offering of high-capacity ATC services, while ensuring that sufficient separation between BWA (2496–2690 MHz) operations and ATC services in the adjacent spectrum is maintained.

ATC systems can operate at low power to support small cell applications, which precludes the deployment of standard public commercial mobile services. Low-power ATC systems allow both MSS and terrestrial systems to thrive in the same band in a complementary manner. (ISED 2020).

#### ***Policy Statements on the Authorisation of ATC Systems***

- 1. The Authority shall authorise the deployment of standalone, low-power ATC systems in Trinidad and Tobago for private or closed user group use.*
- 2. Standalone, low-power ATC systems shall not be deployed to provide public telecommunications services.*



### 3.2 Requirement for MSS Authorisation

As ATC systems can be offered concurrently with MSS, to ensure such systems do not cause harmful interference to MSS, authorisation for ATC operation is conditional on licensees having MSS authorisation from a recognised ITU administration, as the MSS satellite footprint covers Trinidad and Tobago.

ATC authorisation shall be valid until the end of the term of the related MSS authorisation, the discontinuation of the MSS service, or the expiration of an ATC spectrum licence, whichever comes first.

#### *Policy Statements on the Authorisation of ATC Systems*

- 3. ATC authorisation shall be conditional upon applicants having valid MSS authorisation from a recognised ITU administration and an MSS service footprint that covers Trinidad and Tobago. Authorisation would be valid until the end of the term of the related MSS authorisation, the discontinuation of the MSS service, or the expiration of an ATC station licence, whichever comes first.*

### 3.3 ATC Systems Licences, Fees and Annual Reporting

ISED, as per its report, *Decision on Globalstar Canada's Application for Ancillary Terrestrial Component (ATC) Authority in the 2.4 GHz Band (2483.5–2500 MHz)*, 2020, issues spectrum licences for ATC systems which are subject to spectrum licence fees. Since ISED has not yet established fees specifically for spectrum licences for ATC systems, as an interim measure, it proposed site-specific radio station licences and associated fees prior to the deployment of each installation.

In requesting information and consulting with other administrations, the Authority is mindful that any fundamental changes or differences from FCC or ISED authorisation could substantially delay the provision of services in Trinidad and Tobago. Therefore, the Authority shall adopt a licensing approach that is consistent with those of the FCC, ISED and falls within its legislative regime.

In the absence of defined spectrum licence fees for ATC systems, a point-to-multipoint station licence shall be issued for the operation of low-power ATC services for each base station and will be subject to spectrum fees, in keeping with the *Telecommunications (Fees) Regulations, 2006*. The licence shall have an annual reporting requirement that would oblige ATC operators to provide summary information on the number and locations of base stations operating.

The use of the 2483.5–2500 MHz band for ATC operation is not identified in a footnote in the TTFAT. Consistent with its Consultation Procedures, the Authority shall update the TTFAT in keeping with its *Consultation Procedures* to include a footnote to permit standalone ATC operations in the 2.4 GHz S-band, in conjunction with the operation of MSS systems, subject to the Authority’s rules for ATC systems and all other applicable conditions and provisions of the global MSS authorisation.

#### ***Policy Statements on the Authorisation of ATC Systems***

- 4. The Authority shall issue a point-to-multipoint station licence for the operation of an ATC base station, which shall be subject to licence fees, in keeping with the Telecommunications (Fees) Regulations, 2006.*
- 5. An ATC point-to-multipoint station licence shall have an annual reporting requirement that would oblige ATC licensees to provide summary information on the number and locations of base stations operating.*
- 6. The Authority shall update the TTFAT in keeping with its Consultation Procedures to include a footnote to permit standalone ATC operations in the 2.4 GHz S-band, in conjunction with the operation of MSS covering Trinidad and Tobago.*

### 3.4 Technical Operating Parameters for ATC Systems

ATC authorisation in the 2.4 GHz S-band has been granted under US rules (FCC §25.149(a)(2)(iii)) and the 3GPP Band 53 specification, both of which only cover the 2483.5–2495 MHz band. The Authority shall align ATC authorisation in Trinidad and Tobago with the standalone ATC ecosystem, which meets the 3GPP Band 53 specification and adheres to the relevant US rules. This also addresses concerns regarding potential adjacent band interference. While MSS is allocated in the 2483.5–2500 MHz band in the TTFAT, low-power ATC operations shall be restricted to 11.5 MHz of MSS spectrum, in accordance with the 3GPP Band 53 specification (2483.5–2495 MHz).

In Trinidad and Tobago, BWA systems are allocated spectrum above 2496 MHz, providing a 1 MHz guard band between ATC (2483.5–2495 MHz) and BWA (2496–2690 MHz), but spectrum assignment for BWA commences at 2500 MHz. The Authority notes that ATC operations cannot share spectrum with other terrestrial services and that frequency separation is necessary to ensure

compatibility between ATC and BWA systems. Notwithstanding, a full 5 MHz frequency separation may not be warranted, given the low-power operation of ATC systems.

The Authority shall maintain the 5 MHz frequency separation until such time that relevant studies have determined the appropriate frequency separation that will ensure the coexistence of ATC and BWA systems. Further authorisation of ATC systems in the 2495–2500 MHz frequency range shall be considered when a wider time division duplex (TDD) channel is standardised by 3GPP. The Authority also notes that ATC systems may exist in other MSS frequency bands. As their deployment matures, the Authority shall consult with stakeholders on their authorisation in those bands.

The use of a network operating system (NOS) facilitates the deployment of standalone ATC systems without impacting MSS or other primary services in adjacent bands. For the purpose of interference mitigation, the Authority will require ATC licensees to operate an NOS, in accordance with the [FCC §25.149](#) rules, as well as ISED's [technical and operational requirements](#) for low-power ATC systems, which are attached as Appendix I.

#### ***Policy Statements on the Authorisation of ATC Systems***

- 7. The Authority may authorise the deployment of standalone, low-power ATC systems in the 3GPP Band 53 specification (2483.5–2495 MHz) for private or closed user group use, in keeping with the adopted FCC §25.149 rules and ISED's technical and operational requirements for low-power ATC systems.*
- 8. Further ATC authorisation in the 2.4 GHz S-band may be granted in the 2495–2500 MHz frequency band, should a wider TDD channel be standardised by 3GPP in the future.*
- 9. For the purpose of interference mitigation, the Authority shall require that ATC licensees operate a NOS, in accordance with the licensing conditions specified in Appendix I.*
- 10. ATC systems should neither cause harmful interference to, nor claim protection from, any MSS or other primary services operating in accordance with local and international regulations.*

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# Appendix I: Licensing Conditions for the Low-Power Ancillary Terrestrial Component (ATC) Spectrum Licence (ISED 2020)

## 1. Technical and Operational Requirements

Specifically, the 2.4 GHz low-power ATC system must meet the following technical and operational requirements:

- a) The ATC equipment shall operate in the 2483.5–2495 MHz band only, unless otherwise authorised.
- b) The transmitted signal shall be digitally modulated.
- c) The 6 dB bandwidth<sup>5</sup> shall be at least 500 kHz<sup>6</sup>.
- d) The output power of the fixed transmitter shall not exceed 0 dBW.
- e) The maximum equivalent isotropically radiated power (EIRP) shall not exceed 6 dBW.
- f) The equipment's maximum power spectral density conducted to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
- g) For the unwanted emissions below 2483.5 MHz, the ATC system's transmitter power, P (Watt), shall be attenuated by at least:
  - i.  $40 + 10 \log(P)$  dB at the channel edge at 2483.5 MHz
  - ii.  $43 + 10 \log(P)$  dB at 5 MHz from the channel edge
  - iii.  $55 + 10 \log(P)$  dB at X MHz from the channel edge  
where X is the greater of 6 MHz or the actual emission bandwidth.
- h) For the unwanted emissions above 2495 MHz, the ATC system's transmitter power, P (Watt), shall be attenuated by at least:
  - i.  $43 + 10 \log(P)$  dB on all frequencies between the channel edge at 2495 MHz and X MHz from this channel edge

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<sup>5</sup> The "6 dB bandwidth" (ITU-R SM.328 (§ 1.8)) is defined as the width of a frequency band, such that, beyond its lower and upper limits, any discrete spectrum component or continuous spectral power density is at least 6 dB lower than a predetermined 0 dB reference level.

<sup>6</sup> FCC §15.247 states that, for systems using digital modulation, the minimum 6 dB bandwidth shall be at least 500 kHz.

- ii.  $55 + 10 \log(P)$  dB on all frequencies more than X MHz from this channel edge where X is the greater of 6 MHz or the actual emission bandwidth.
- i) Notwithstanding the above requirements, the EIRP density<sup>7</sup> of the ATC system's unwanted emissions shall not exceed:
  - i. -44.1 dBW/30 kHz measured from the edge of the equipment channel bandwidth.
  - ii. -70 dBW/MHz for broadband emissions and -80 dBW/kHz for discrete emissions in the band 1559–1610 MHz.
- j) Compliance with these limits in i) may be based on the use of a measurement resolution bandwidth of at least 1% of the occupied bandwidth. If 1% of the occupied bandwidth is less than 1 MHz, the power measured shall be integrated over the required measurement bandwidth of 1 MHz.
- k) The 2.4 GHz low-power ATC system meeting the technical requirements in this section may operate in non-forward-band mode.
- l) The 2.4 GHz low-power ATC system meeting the technical requirements in this section is not required to use dual-mode<sup>8</sup> user equipment.
- m) The ATC licensee shall utilise a network operating system (NOS) consisting of a network management system located at an operations centre or centres. The NOS shall have the technical capability to address and resolve interference issues relating to the licensee's network operations, by:
  - i. reducing operational power.
  - ii. adjusting operational frequencies.
  - iii. shutting off operations.
  - iv. any other appropriate means.

The NOS shall also have the ability to resolve interference from the terrestrial low-power network to the licensee's MSS operations, and to authorise access points to the network, which in turn may authorise access to the network by end-user devices.

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<sup>7</sup> EIRP density is the amount of power that is radiated by a satellite in a given area, and it is a key factor in determining the quality of service that a satellite can provide (Marcin Frackiewicz, TS2 Space, 2023).

<sup>8</sup> Dual mode allows for the use of handsets/user terminals that can communicate with the MSS network in the 1610–1615.5 MHz frequency band for mobile terminal transmission and the ATC network in the 2487.5–2493 MHz band for ATC base station transmission.

- n) All access points operating in the 2483.5–2495 MHz band shall only operate when authorised by the ATC licensee’s NOS, and all client devices operating in the 2483.5–2495 MHz band shall only operate when under the control of such access points.
- o) The ATC operation must not constrain the deployment of the MSS satellite networks associated with this licence.

## **2. Domestic and International Coordination**

Where applicable, licensees must use their best efforts to enter into mutually acceptable agreements with other parties to facilitate the reasonable and timely development of their respective systems, and to coordinate with other licensed users in Trinidad and Tobago and internationally.

Licensees must comply with the obligations arising from current and future frequency coordination agreements between Trinidad and Tobago and other countries, and shall be required to provide information on, or take action to implement, these obligations, as indicated in any applicable spectrum plan.