



Consultative Document

on the

**Spectrum Plan for the
Accommodation of Non-Terrestrial
Networks**

(First of Two Rounds)

(Version 0.1)

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Abbreviations

3GPP	3 rd Generation Partnership Project
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
FSS	fixed satellite service
GHz	gigahertz
HAPS	high-altitude platform station
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union Radiocommunication Bureau
kHz	kilohertz
MHz	megahertz
MSS	mobile satellite service
NSP	National Spectrum Plan
NTN	non-terrestrial network
TTFAT	Trinidad and Tobago Frequency Allocation Table
WRC-07	World Radiocommunication Conference 2007
WRC-15	World Radiocommunication Conference 2015

Definitions

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)

Effective radiated power (ERP) (in a given direction): the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction (ITU-R 2016)

Fixed satellite service (FSS): a radiocommunications service between earth stations at given positions, when one or more satellites are used. The given position may be a specified fixed point or any fixed point within specified areas. In some cases, this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service. The fixed-satellite service may also include feeder links for other space radiocommunications services (ITU-R 2020).

Geostationary Earth orbit: The orbit of a geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator (ITU-R 2020).

High-altitude platform station (HAPS): a station on an object at an altitude of 20 to 50 km and a specified, nominal, fixed point relative to the Earth (ITU-R 2020).

Mobile satellite service (MSS): is a radiocommunications service that operates between mobile earth stations and one or more space stations, or between space stations used by this service (ITU-R 2020)

Non-geostationary Earth orbit: occupy a range of orbital positions (low Earth orbit (LEO) satellites are located between 700km-1,500km from the Earth, medium Earth orbit (MEO) satellites are located at 10,000km from the Earth), and do not maintain a stationary position, but instead move in relation to the Earth's surface. A constellation of multiple non-geostationary satellites is necessary to carry service as they move over the horizon, requiring handover management to ensure service continuity (ITU 2020).

Radio regulations (RR): part of the administrative regulations of the legal framework of ITU that govern the global use of radio-frequency spectrum and satellite orbits. These have international treaty status and are thus binding on ITU member states (ITU 2020).

User equipment (UE): a device allowing a user access to network services (3GPP 1999).

1 Introduction

1.1 Background

The Telecommunications Authority of Trinidad and Tobago (the Authority) is mandated by the Telecommunications Act, Chap. 47:31 (the Act), under section 41(1), to:

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.

This mandate extends to non-terrestrial networks (NTNs) owned and operated by international satellite operators and provides telecommunications services to stations located in the territory of Trinidad and Tobago, inclusive of its territorial waters and airspace. NTN are wireless communication systems that operate above the Earth's surface, involving high-altitude platform stations (HAPS)¹, unmanned aerial vehicles (UAVs²) such as balloons, drones, etc. and satellites in geostationary Earth orbit (GEO), medium Earth orbit (MEO) and low Earth orbit (LEO), or a combination of these elements.

LEO satellites provide the foundation for many NTN use cases. They offer the advantage of lower latency than MEO or GEO satellites due to the shorter distance to Earth, that can support real-time NTN applications. NTN can extend the coverage of terrestrial networks to remote and underserved regions such as rural areas, islands and isolated communities, providing satellite-to-handset capabilities for cellular phones and other user devices onboard ships at sea and aircraft in flight. Machine-to-machine (M2M) applications for agriculture, transportation, environmental monitoring, and asset tracking are also all supported by NTN's ubiquitous and reliable connectivity.

Apart from the orbit type, another factor to consider for NTN implementation is the frequency of operation. NTN spectrum can span frequencies from the L-band (1.52 – 1.66 GHz) to the Ka-band (17 – 30 GHz). Not all frequencies are ideally suited or even available, depending on regulations within a given region or country. Consequently, the 2 GHz band is considered for NTN operation in Trinidad and Tobago in this document, as the Authority must assign spectrum for the NTN operator to provide its services.

¹ Defined by the International Telecommunication Union (ITU) in the Radio Regulations (RR) as "a station on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth" ITU_R 2020).

² UAV is a broad range of deployments including drones, balloons and kites

The spectrum used by NTN is allocated in Article 5 of the International Telecommunication Union (ITU) Radio Regulations for satellite and terrestrial services. An enabling spectrum plan can make spectrum available to enhance the delivery of emerging radiocommunications services in the 2 GHz S-band, where multiple NTNs may operate and can be licensed. Accordingly, the Authority is developing this *Spectrum Plan for the Accommodation for Non-Terrestrial Networks* to accommodate the operation of NTNs in Trinidad and Tobago.

1.2 Purpose

The purpose of this *Spectrum Plan for the Accommodation of Non-Terrestrial Networks* (the Plan) is to prescribe the frequency planning principles, assignment plans, spectrum caps and associated conditions to be adopted by the Authority for the operation of NTNs in the 2 GHz band. In this band, these principles, plans and conditions are necessary as the Authority must assign specific spectrum to each NTN operator that intends to provide services in Trinidad and Tobago.

1.3 Objectives

The Plan:

1. reviews and considers the global and national environment, including market and sector interests for the accommodation of NTN services in the MSS bands.
2. identifies the frequency range in the 2 GHz S-band, assignment plans and spectrum caps that will be allocated for the operation of NTNs that will allow for the coexistence with public mobile services in the 1900 MHz and advanced wireless services (AWS) bands.
3. outlines the licensing process for the assignment of frequency ranges, as well as any specific licensing conditions.
4. defines the technical operating conditions and specifications to be imposed on the licensed radiocommunications systems in the allocated frequency range.

1.4 Scope

This Plan is a subset of the *National Spectrum Plan* (NSP) that serves as the instrument for regulating the use of spectrum, in an orderly, efficient manner, in accordance with the Authority's mandate under the Act. It specifies how suitable spectrum in the 2 GHz (2005 – 2020/2185 – 2200

MHz) band will be allocated for use by NTN under existing legislation and procedures. This Plan has been developed in keeping with the principles of the *Spectrum Management Framework* (October 2022).

This Plan specifies the frequency assignment plan within the 2 GHz band and how they will be licensed to concessionaires. This Plan accommodates the operation of NTN for the provision of public telecommunications services. This Plan does not address the allocation and licensing of spectrum bands for terrestrial networks, including public mobile networks, fixed wireless access and private mobile networks, nor the provision of domestic mobile services using direct-to-device techniques.

1.5 Relevant Legislation

The following sections of the Act guide the development of this Plan:

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 –

- a) 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;
- b) 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) Subject to subsection (2), 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 vessels 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 Other Relevant Documents

Other relevant policies, plans and regulations developed by the Authority currently in effect, to be read along with this Plan, include:

1. *Authorisation Framework for the Telecommunications and Broadcasting Sectors of Trinidad and Tobago* (TATT, 2005)
2. *Spectrum Management Framework* (TATT, 2022)
3. *National Spectrum Plan* (TATT, 2008)

4. *Trinidad and Tobago Frequency Allocation Table (8.3 kHz–3000 GHz)* (TATT, 2019)

These documents can be found on the Authority’s website, www.tatt.org.tt.

1.7 Review Cycle

This Plan will be reviewed every four years to meet changing needs, taking into account technological advancements and regional allocations, but it may be reviewed at any time, at the discretion of the Authority, or based on proposals for immediate modification submitted by stakeholders or members of the public. The Authority will review this document and, if necessary, make modifications, in consultation with stakeholders, to ensure the Plan is guided by appropriate policy guidelines and objectives.

Questions or concerns regarding the maintenance of the Plan may be directed to the Authority via email at consultation@tatt.org.tt.

1.8 Consultation Process

In accordance with its *Procedures for Consultation in the Telecommunications and Broadcasting Sectors of Trinidad and Tobago* (TATT 2021), the Authority will seek the views of stakeholders and the public on this Plan. The Plan will undergo two rounds of public consultation. Each round shall be at least four weeks in duration. Comments from each round will be reviewed and incorporated where necessary, relevant and useful to the development of the local telecommunications sector.

2 Considerations for the Accommodation of Non-Terrestrial Networks in the 2 GHz Band

2.1 The Global Environment

The International Telecommunication Union (ITU) oversees the allocation of the radio frequencies required to meet the continuously evolving needs of the satellite industry. In recent years, NTN's have gained prominence due to their dynamic market, technical offerings, and commercial approaches. Third Generation Partnership Project (3GPP) release 17 introduces new radio technologies, such as enhanced mobile broadband (eMBB) and ultra-reliable low latency communications (URLLC) to provide higher throughput, lower latency, and more reliable communications, and support NTN's. The NTN capabilities introduced in release 17 allow for the serving of several vertical markets³ by LEOs and GEOs, including:

1. Internet of Things (IoT) connectivity (e.g., precision farming, sensing, fleet management, and critical infrastructure, such as oil and gas via remote monitoring)
2. Low-data-rate applications offering emergency messaging
3. Data services

According to 5G Americas and Next Generation Mobile Networks (NGMN), 3GPP's Narrowband-Internet of Things (NB-IoT) over NTN, due to its interoperability, will be the predominant technology for satellite-based IoT connectivity. The 3GPP release 18 standard marks the first instance where Long Term Evolution (LTE) and New Radio (NR) standards explicitly incorporate support for NTN's, expanding the reach of IoT and enhanced machine-type communications (eMTC) devices beyond terrestrial constraints.

A 3GPP NTN solution can be delivered using a single network that comprises both terrestrial and non-terrestrial components. Additionally, the fifth generation (5G) IoT ecosystem is expected to develop significantly, where devices will seamlessly connect to both terrestrial networks and NTN's. This would enable satellite operators to provide affordable satellite communication that inherently performs better compared to the bulky and expensive terminals used in non-3GPP legacy mobile satellite service (MSS) systems. NTN's enable service providers to operate in otherwise untapped markets and offer premium services beyond the capabilities of traditional terrestrial networks. NTN's satisfy the increasing demand for data and ubiquitous coverage,

³A vertical market consists of customers in a narrow industry group, in contrast to a horizontal market, which comprises players from a variety of industries. Companies in a vertical market create goods and services that serve a designated niche of either business customers or consumers.

transmitting and receiving more information through satellite networks for meaningful and universal communications.

2.2 NTN Frequency Bands

3GPP has defined the frequency bands in Table 1 for the communication by NTN with user equipment (3GPP 2024):

Table 1. 3GPP NTN Frequency Bands

NTN Band	Spectrum Range	Satellite Band
n256	1.98 – 2.2 GHz	S-Band
n255	1.525 – 1.6605 GHz	L-Band
n254	1.610 – 2.5 GHz	L-Band, S-Band
n510, n511, n512	17.3 – 20.2 GHz/ 27.5 – 30 GHz	Ka Band

As NTNs operating in the 1.98 – 2.2 GHz require spectrum assignment at a national level, the Authority shall define the frequency assignment plan that will be used to accommodate the operation of NTNs in this band in Trinidad and Tobago.

Band n256 was selected by 3GPP because of its MSS allocation in the ITU regions; its benefit of symmetrically paired bands that can be exploited in frequency division duplex (FDD)⁴; and support from the industry. Since the 3GPP release 17, myriads of new satellite technologies have been adopted to operate in the MSS allocation, resulting in satellite providers expressing interest in the S-band.

The 1.9/2.1 GHz MSS band, also referred to as the S-band, as shown in Table 2, encompasses a range of services designed to extend connectivity to mobile devices and vehicles in unserved and underserved areas. It acts as a conduit for new and existing technologies, providing services such as voice, data, and messaging in efforts to bridge the digital gap.

One of the main challenges that must be addressed in the development of NTNs is the issue of the interference that can arise if the same spectrum is used for both terrestrial and satellite systems. The ITU Radiocommunication Regulations defines standards to mitigate harmful interference between GSO MSS networks sharing a common frequency band. Article 9 of the Radio Regulation contains the procedures for effecting coordination with, or obtaining the agreement of, other

⁴ FDD is a technique that uses separate frequency bands for uplink (user device to base station) and downlink (base station to user device).

administrations. However, as the services of a 3GPP NTN solution are currently deployed through specific spectrum for NTNs, there is minimal risk of interference.

Table 2. 2 GHz frequency bands allocated to MSS

Band (MHz)	Allocation	Relevant Footnotes
1930 – 1970	Mobile-satellite (Earth-to-space)	N/A
1980 – 2010	Mobile-satellite (Earth-to-space)	5.351A, 5.389A, 5.389B
2010 – 2025		5.389C, 5.389E
2120 – 2160	Mobile-satellite (space-to-Earth)	N/A
2160 – 2170	Mobile-satellite (space-to-Earth)	5.389C, 5.389E
2170 – 2200		5.351A, 5.389A

2.3 National Considerations

In Trinidad and Tobago, MSS is predominantly in the L-band (1.5/1.6 GHz), with services like satellite telephony, telemetry, positioning and maritime safety information. In all cases, user terminals have been class-licensed, except for maritime safety equipment, where the user terminals are licensed as part of the ship station’s authorisation. With the increasing deployment of NTNs on a non-exclusive basis, and the advancement of additional services in the 2 GHz band, additional spectrum planning and coordination are required at the national level, to ensure interference-free access to spectrum in the MSS bands by NTN operators.

To adequately plan and optimally allocate the use of the 2 GHz MSS band, the Authority considered:

1. the frequency bands allocated to mobile service, in accordance with ITU-R Region 2 *Table of Frequency Allocations* and the *Trinidad and Tobago Frequency Allocation Table* (TTFAT).
2. the spectrum used for licensed public mobile telecommunications services in Trinidad and Tobago.
3. the appropriate licensing method for the assignment of spectrum to users.
4. the spectrum required to facilitate the development of telecommunications infrastructure and the fulfilment of the National Strategy for a DigitalTT 2023 – 2026, currently under development.

These considerations are summarised in Table 3.

Table 3. Frequency allocations for MSS networks in the TTFAT

Trinidad and Tobago Frequency Allocation Table (TTFAT)	Current Spectrum Availability
<p>The frequency range 1930 – 1970 MHz is allocated in TTFAT to mobile-satellite (Earth-to-space) as secondary service, and to fixed and mobile services as the primary service.</p>	<p>1930 – 1970 MHz is part of the 1900 MHz band that is allocated to public mobile services, with the two existing operators assigned spectrum in this band.</p>
<p>The frequency range 1980 – 2010 MHz is allocated in TTFAT to mobile-satellite (Earth-to-space) as a co-primary service with fixed and mobile services.</p>	<p>1980 – 1995 MHz is part of the 1900 MHz band that is allocated to public mobile services, with the two existing operators assigned spectrum in this band.</p> <p>1995 – 2010 MHz is unassigned and available for NTN for MSS.</p>
<p>The frequency range 2010 – 2025 MHz is allocated in TTFAT to mobile-satellite (Earth-to-space) as a co-primary service with fixed and mobile services.</p>	<p>2010 – 2025 MHz is unassigned and available for NTN for MSS.</p>
<p>The frequency range 2120 – 2160 MHz is allocated in TTFAT to mobile-satellite (space-to-Earth) as secondary service, and to fixed and mobile services as the primary service.</p>	<p>2120 – 2160 MHz is part of the 1.7/2.1 GHz band that is allocated to public mobile services, with the two existing operators assigned spectrum in this band.</p>
<p>The frequency range 2160 – 2170 MHz is allocated in TTFAT to mobile-satellite (space-to-Earth) as a co-primary service with fixed and mobile services.</p>	<p>2160 – 2170 MHz is part of the 1.7/2.1 GHz band that is allocated to public mobile services, with the two existing operators assigned spectrum in this band.</p>
<p>The frequency range 2170 – 2200 MHz is allocated in TTFAT to mobile-satellite (space-to-Earth) as a co-primary service with fixed and mobile services.</p>	<p>2170 – 2180 MHz is part of the 1.7/2.1 GHz band that is allocated to public mobile services, with the two existing operators assigned spectrum in this band.</p> <p>2180 – 2200 MHz is unassigned and available for NTN for MSS.</p>

The Authority will complete monitoring exercises by December 2025 to verify that spectrum in the 1995 – 2025 MHz and 2180 – 2200 MHz bands are free from harmful interference before assigning spectrum in these bands. The Authority is cognizant that the *ITU-R Radio Regulations* articulate the procedures by which countries can establish frequency coordination, issue notification, and address harmful interference across borders should there be a need. The Authority will be guided by these procedures should the need arise, which will enable and facilitate coordination with neighbouring countries.

3 Frequency Planning Principles

The following principles undergird the frequency assignment plan for the accommodation of NTN in the 2 GHz band in Trinidad and Tobago:

1. The adopted frequency assignment plan for a specified band shall follow the relevant ITU-R recommendations and take into consideration the predominant frequency assignment plan utilised by MSS and the available MSS spectrum in Trinidad and Tobago.
2. All frequency assignment plans shall have a reference channel bandwidth that serves as the minimum assignable channel bandwidth. Frequency channels that require larger bandwidths can be achieved by concatenating multiple non-contiguous frequency channels of the reference channel bandwidth, which would equate to contiguous spectrum. All assignments to an operator shall be contiguous as far as possible.
3. Frequency assignments shall be made in accordance with the licensing process, as established by the Authority.
4. The frequency assignment plans are limited to the FDD mode of operation.
5. The frequency spectrum blocks or channels in a frequency assignment plan incorporate any necessary guard bands.
6. A spectrum cap shall be instituted to limit the quantum of spectrum assigned to an individual licensee. The spectrum cap is the maximum quantum of spectrum that can be assigned to an individual licensee in a specified frequency band.
7. A licensee shall utilise the spectrum assigned in a manner that does not cause harmful interference to any other licensee. The licensee shall employ in-band guard bands to mitigate harmful interference.

4 Frequency Assignment for Non-Terrestrial Networks in the 2 GHz Band

Outside of the frequency ranges identified in the TTFAT (Table 3) for public mobile services, the remaining 2 GHz S-band spectrum (2005 – 2020/2185 – 2200 MHz) is subdivided into frequency channels, predicated on the type(s) of technologies that can be employed, which inform the frequency assignment plan. This frequency assignment plan aims to maximise the efficient use of the allocated spectrum.

The following three subsections outline the frequency assignment plan, the recommended licensing process and conditions, and the technical operating conditions and specifications for the radiocommunications systems operating in the stated frequency band. The actual availability of frequency channels will be determined following a spectrum audit, prior to the implementation of the licensing process for the frequency band.

4.1 Frequency Assignment Plan

The channel assignment plan outlined in Table 4 shall be adopted for the 2 GHz band and shall accommodate only the FDD mode of operation. The assignment plan is based on 3GPP’s band n256 and the FCC’s MSS 2 GHz band plan. Both plans accommodate the FDD mode of operation but with different duplex spacings. 3GPP’s n256 has a duplex spacing of 190 MHz, while the FCC’s band plan can accommodate a duplex spacing of 165 – 195 MHz. Channels 1 to 5 are based on n256 and channels 6 to 15 are based on the FCC’s band plan.

The adoption of a channel assignment plan based on 3GPP’s band n256 and the FCC’s MSS 2 GHz band accommodates a wider range of NTN systems that support duplex spacings from both band plans.

Table 4. Frequency assignment plan for 2 GHz band

Band	Frequency Range/MHz		Block Name
	Mobile Station Transmit	Base Station Transmit	
2 GHz (2/2.2 GHz)	2005 – 2006	2195 – 2196	1
	2006 – 2007	2196 – 2197	2
	2007 – 2008	2197 – 2198	3
	2008 – 2009	2198 – 2199	4
	2009 – 2010	2199 – 2200	5
	2010 – 2011	2185 – 2186	6
	2011 – 2012	2186 – 2187	7

Band	Frequency Range/MHz		Block Name
	Mobile Station Transmit	Base Station Transmit	
	2012 – 2013	2187 – 2188	8
	2013 – 2014	2188 – 2189	9
	2014 – 2015	2189 – 2190	10
	2015 – 2016	2190 – 2191	11
	2016 – 2017	2191 – 2192	12
	2017 – 2018	2192 – 2193	13
	2019 – 2019	2193 – 2194	14
	2019 – 2020	2194 – 2195	15

4.2 Licensing Process and Conditions

The rules for licensing are as follows:

1. If the spectrum is to be used for the operation of a public telecommunications network, a Type 1 concession will be a prerequisite for the assignment of the spectrum.
2. The licensing of spectrum in the 2 GHz band for NTN shall be for the operation of public international telecommunications networks.
3. A point-to-multipoint spectrum licence shall be granted by the Authority in order for spectrum in the 2 GHz band to be assigned. The minimum assignment shall be 2 MHz (i.e., 2 x 1 MHz).
4. The assignment of spectrum shall be via first come first served or a competitive licensing process, based on demand for this spectrum, as determined by the Authority.
5. The allocated spectrum in the 2 GHz band shall be licensed in accordance with the frequency assignment plan (as seen in Table 4).
6. The spectrum cap for the 2 GHz band shall be 10 MHz (i.e. 2 x 5 MHz).
7. An established agreement between the NTN operator and a local terrestrial network operator is a prerequisite for the assignment of spectrum in the 2 GHz Band.
8. All NTNs authorised for operation will be registered in Trinidad and Tobago.

4.3 Technical Operating Conditions and Specifications

To operate NTN in the 2 GHz band (2005 – 2020/2185 – 2200 MHz), licensees shall not exceed the maximum technical operating conditions and specifications identified in Table 5.

Table 5. Maximum technical operating specifications for NTN in the 2 GHz band⁵

Parameter	Constraint/Maximum Value	Comments
Nominal user equivalent isotropic radiated power (EIRP)	User terminal 10.9 dBW	Maximum power permitted for the user terminal
Modulation scheme	Digital	Any digital modulation technique, e.g., QPSK and BPSK
Out-of-band emission limits	- 13 dBm	These limits shall not be exceeded for MSS/NTN systems.

Notwithstanding the parameters identified in Table 5, amended or additional technical operating conditions may be instituted in accordance with the Act. These revisions shall be identified in the schedule of the licence document for the specific radiocommunications technology deployed.

⁵ These specifications were developed in accordance with the ITU-R M.1184-3, ITU-R SM.1541 and Code of Federal Regulations, Title 47, Part 25 (i.e., FCC Rules).

References

- 3GPP. 2024. 3GPP TS 38.101-5 version 18.5.0 Release 18, 5G, NR User Equipment (UE) radio transmission and reception. *Technical Specification, France: 3GPP.*
- 3GPP. 1999. Definition of the UE. TSG-SA (SP-99493). *Document for Information, Austin, USA: 3GPP.*
- Americas, 5G. 2023. Update on 5G Non-Terrestrial Networks. <https://www.5gamericas.org/update-on-5g-non-terrestrial-networks/>.
- FCC. 2024. Code Of Federal Regulations. <https://www.ecfr.gov/current/title-47/chapter-I/subchapter-B/part-25#25.202>.
- ITU. 2002. Mobile -satellite service (MSS) Handbook. www.itu.int/publications.
- . 2020. Radio Regulations. <https://www.itu.int/pub/R-REG-RR-2020>.
- . 2016. Radio Regulations. <https://www.itu.int/pub/R-REG-RR-2016>.
- ITU-R. 2018. Technical requirements of mobile satellite systems in frequency bands below 3GHz for use in developing criteria for sharing between the mobile satellite service (MSS) and other services. <https://www.itu.int/rec/R-REC-M.1343/en>.
- NGMN. 2019. Non-Terrestrial Networks position Paper. <https://www.ngmn.org/wp-content/uploads/191209-NGMN-Non-Terrestrial-Networks-Position-Paper-r1-1.pdf>.