TECHNICAL REPORT ON GLOBALSTAR'S DEPLOYMENT OF ANCILLARY TERRESTRIAL NETWORKS OF THE

MOBILE SATELLITE SERVICE

November 11, 2022

CONTENTS

1. EXECUTIVE SUMMARY

This document has been prepared by Globalstar Europe SAS (“GESAS”), a wholly owned subsidiary of Globalstar, Inc. (“Globalstar”),[1] to brief EETT and support the application for authorization of use of the 2483.5 - 2500 MHz frequency band for **the deployment of ancillary terrestrial networks of the mobile satellite service**, spectrum currently in use by Globalstar for Mobile Satellite Services (“MSS”) in Greece.

Globalstar is a US publicly traded company (NYSE: GSAT) duly registered in the State of Delaware. It owns and operates a Low Earth Orbit (“LEO”) satellite system providing near global coverage (“Globalstar System”). Founded in 1995, [redacted]

The Globalstar System consists of three separate components: (1) a constellation of LEO satellites, consisting of a combination of first-generation HIBLEO-4 satellites notified by the Administration of the U.S.A to the International Telecommunications Union (“ITU”) and second-generation HIBLEO-X satellites notified by the Administration of France.; (2) a global network of gateway Earth Stations; and (3) mobile devices and terminals used by millions of customers to meet their communications needs.[2]

[redacted]

Further, as part of its continuing commitment to improving communications for consumers around the world, Globalstar has invested in the development of a terrestrial network architecture designed to function as an Ancillary Terrestrial Component (ATC) for its Mobile Satellite Services (MSS) in the 2.4 GHz band. This terrestrial cell technology allows a series of essential applications to improve both performance and coverage, taking advantage of efficient use of the spectrum, controlling network deployment costs, and achieving better services for customers with end-to-end connectivity primarily for data applications.

[redacted]

[1] Globalstar Europe S.A.S. is 100% owned by the company Mobile Satellite Services, B.V. (The Netherlands), which is in turn 100% owned by Globalstar Netherlands, B.V. (Netherlands), which in turn is 100% owned by Globalstar International, L.L.C. (Delaware), which in turn is 100% owned by Globalstar, Inc. (Delaware). Globalstar System discussed further herein.

[2] The Globalstar System is discussed further in Section 2 below.

In Europe, Globalstar has worked within the context of the CEPT to complete a technical review regarding ancillary terrestrial services in this same spectrum band, resulting in CEPT's issuance of ECC Report 325 in April of 2021.

In addition to the above regulatory work, Globalstar has also worked to create a viable ecosystem of terrestrial equipment and devices to operate over this spectrum band. In December 2018, the Third Generation Partnership Project ("3GPP") approved a global standard for terrestrial use of Globalstar's spectrum at 2483.5-2495 MHz. Globalstar completed infrastructure 3GPP approval in December 2018. On March 23, 2020, Globalstar announced that the 3GPP has approved the 5G standard of Globalstar's Band 53, which is designated n53.

[redacted]

Equally important, in February 2021, Globalstar announced that Qualcomm Inc. has included Globalstar's Band n53 in its new 5G X65 modem. The X65 is Qualcomm's flagship 5G modem and adds global 5G band support for n53. Apple's newest iPhone 14 also includes support for band n53.

[redacted]

While this document focuses on the need of deploying low power terrestrial networks to complement the mobile satellite service, thus, making up a Globalstar mobile satellite system, it is worth stating that the deployment of the terrestrial component will not impede the continuation of the mobile satellite service operation.

There are several reasons justifying the need of the terrestrial component (ATC) to complement the MSS. Among them:

- <u>Line of sight.</u> The connectivity of most user devices with the satellite requires line of sight between the device on the ground and the space station. In the case of GEO satellites, this visibility can be achieved from a terminal with direct and focused beams towards the orbital position of the corresponding space station, which translates into certain azimuth and elevation angles for each geographical location of the coverage area. In the case of connectivity from a user terminal in the Mobile Satellite Service (MSS) with a space station belonging to a constellation of NGSO satellites, the visibility between terminals using omni-directional antennas must be achieved for a full azimuth range (0-360°) and a range of elevation angles above the horizon between 10 and 90°.
- <u>Bandwidth requirements.</u> Satellite systems in the mobile-satellite service are narrow-band (compared to satellite systems in the fixed-satellite service). Satellites have coverage beams that illuminate large geographic areas. The satellite transponders carry traffic from any location. Unfortunately, traffic does not originate in a homogeneous or balanced way from different geographical areas, so a permanent or temporary demand for high traffic in a single

geographical area (compared to the capacity of the transponder) can saturate the capacity of the entire satellite in any area illuminated by the beam. It is for this reason, the diversion of traffic through ancillary systems in areas of high concentrated demand, allows the satellite to maintain its availability for the rest of the area covered by the beam.

- New emerging connectivity. Since the inception of narrowband voice and data services, the current demand is for the connectivity of people, devices, and machines on an ongoing basis, which Globalstar offers as Global IoT connectivity. Users must stay connected end-to-end anywhere on the planet with a homogeneous quality of service and guaranteeing the availability of the service even in remote, indoor or urban areas.

[redacted]

This need for the operation of an ancillary terrestrial component of a mobile satellite network has been supported and recognized by various administrations. In the global context, the FCC from the U.S., Canada, and South Africa, among other countries, have already authorized the deployment of ATC networks in their countries. A thorough compatibility study has been carried out within CEPT, finding its conclusions in Report 325 of the ECC and inviting national administrations to establish their appropriate national regulatory frameworks.

[redacted]

The technical characteristics of the ATC S-band are further explained in Section 4.2. The operation of the ATC will respect the current Art 5 Radio Regulation allocations and although it will work as a terrestrial mobile service, it will not be an independent service but a part of the overall Globalstar mobile satellite system. As the CEPT Report 325 has studied, the simultaneous operation of ATC and Globalstar MSS will be subject to interference which can be mitigated via a proposed intra-system coordination which Globalstar can guarantee via its Network Operations Control system, taking care of the operation of the satellite and the terrestrial ancillary component.

Section 5.3 proposes an authorization set of conditions for the operation of the Ancillary Terrestrial Component.

2. THE GLOBALSTAR SYSTEM

The Space Segment

The Globalstar constellation is made up of non-geostationary orbit satellites (NGEO) that operate in 8 orbital planes equally spaced around the Equator at an inclination of 52° and an altitude of 1414 kilometers. This configuration of the constellation provides almost complete coverage of the planet, except for the extreme polar regions.

Figure 1 Globalstar Gateway Ground Stations

Originally licensed by the FCC in 1995, the first generation constellation was notified to the ITU by the US administration. The second-generation constellation was deployed by Globalstar in 2010 and was notified to ITU by the French Administration. Using a "bent-pipe" transponder architecture, Globalstar satellites apply proven technology to provide global communications coverage, providing fast switching and ensuring low latencies for voice and data communications.

Globalstar´s satellites operate in the Mobile Satellite Services (MSS) band, which is a global allocation enabling small hand-held devices with omni-directional antennas to connect directly with the satellites. Each satellite is equipped with multiple receivers and transmitters, making use of the spectrum assignments registered with the ITU by Globalstar in the C, L and S bands.

[redacted]

The Ground Segment

The Globalstar System utilizes a unique "bent-pipe" architecture whereby the satellites "hear" and transmit data traffic between Globalstar's mobile terminals and a global network of gateway Earth

Stations.

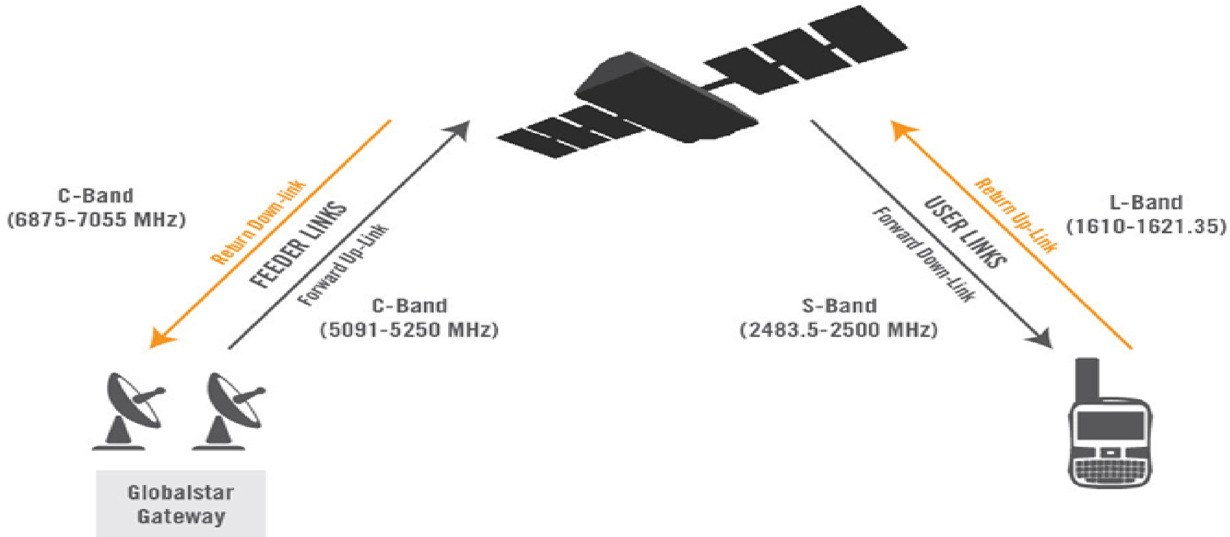

Figure 2 Overall spectrum usage of Globalstar network

[redacted]

[redacted]

[redacted]

[redacted]

Globalstar Devices and Services

Globalstar has focused its products and services on individual consumer and commercial industrial applications. Unlike most satellite segment operators, which focus on wholesale capacity agreements with terrestrial segment resellers (such as VSAT operators), Globalstar achieves affordable prices and rapid service integration by avoiding complex supply chains.

Globalstar's MSS are delivered to consumers through user terminals designed primarily by Globalstar, offering a wide range of applications. [redacted]

Relative to Satellite Phone offers or even compared to VSAT capacity costs, these prices are significantly more affordable.

[redacted]

[redacted]

Overall, Globalstar has distinguished itself for more than 20 years as the only operator in the consumer-centric satellite segment, providing essential services to hundreds of thousands of individuals and businesses. [redacted]

This report describes the technical and functional characteristics of the Globalstar ATC, the justification of the need for its use as a complement to the Mobile Satellite Service network and the proposed operating conditions.

2.1 Reference documents

Reference	Title	Document	Date
RD 1	Radio Regulation	Radio Regulations of the International Telecommunication Union	2020
RD 2	CMR 2019	Final Acts of the 2019 World Radiocommunication Conference	2019
RD 3	National Frequency Band Allocation Regulation	Table of Frequency Allocations[4]	2021
RD 4	CEPT report 325	Compatibility and technical feasibility of coexistence studies for the potential introduction of new terrestrial applications operating in the 2483.5-2500 MHz frequency band with existing services /applications in the same band and adjacent bands	April 23rd, 2021
RD 5	3GPP TR 36.791	Evolved Universal Terrestrial Radio Access (E-UTRA) 2.4 GHz Time Division Duplex (TDD)	2019
RD 6	3GPP TS 36.101	Minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE).	2021

[4][https://www.eett.gr/opencms/export/sites/default/admin/downloads/telec/elliniki_nomothesia/ypourgikes_apofaseis/FEK6474_B_EKKZS_2021.pdf] National Frequency Band Allocation Regulation (hereinafter EKKZS, as per its Greek initials) published in the Government Gazette (Decision ref. no. OIK 46171 EΞ 2021) (GG' 6474/B/31.12.2021).

RD 7	3 GPP TS 38.101 V17.2.0 (2021-06)	3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (Release 17)	2021
RD 8	document number C (2008) 2625	2008/477/EC: Commission Decision of 13 June 2008 on the harmonisation of the 2500 - 2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community	2008

2.2 Abbreviations and acronyms used

Abbreviation	Definition
3GPP	3rd Generation Partnership Project
ATC	Ancillary Terrestrial Component
BR	ITU Radiocommunication Bureau
BS	Base Station
CEPT	Europe Post and Telegraph Conference
CMR	World Radiocommunication Conference
ECC	Electronic Communications Committee
EKKZS	National Frequency Band Allocation Regulation
E-UTRA	Evolved UMTS Terrestrial Radio Access
FCC	Federal Communications Commission
FDM	Frequency Division Multiplexing
GBO	Globalstar Business Office
GDN	Globalstar Data Network
GEO	Geostationary Orbit
GPR/WPR	Radars for probing floors and walls
GPS	Global Positioning and Navigation System
GSM	Global System for Mobile Communications
ICM	Industrial, Scientific and Medical
ISM/WLAN	Industrial, Scientific Medical / Wireless Local Area Network
IMS	Internet Protocol Multimedia Subsystem
IoT	Internet of Things
KO	Kick Off
LEO	Low Earth Orbit
LHCP	Left-Hand Circular Polarization
LNA	Low Noise Receiver-Amplifier
log	Decimal Logarithm
LoS	Line of Sight
LP-AMI	Low Power Active Medical Implant
LTE	Long Term Evolution
M2M	Machine to Machine

MEO	Medium Earth Orbit
MME	Mobility Management Entity
MSS	Mobile Satellite Service
NGEO	Non-Geostationary
NOC	Network Operating Center
NOS	Network Operations System
NTN	Non-Terrestrial Networks
PIRE	Equivalent Isotropic Radiated Power
PLMN	Public Land Mobile Network
PMSE	Generation of Special Event Programs
PSTN	Public Switched Telephone Network
RDSS	Satellite Radiodetermination Service
RAS	Radio Astronomy Service
RHCP	Right-Hand Circular Polarization
RLAN	Local Area Radio Network
RPC	Conference Preparatory Meeting
RR	Radio Regulations
RTC	Switched Telephone Network
SIP	Session Initiation Protocol
SLA	Service Level Agreement
RR	Radio Regulations
SSPA	Solid State Power Amplifier
SCADA	Supervisory Control and Data Acquisition
SMS	Short Message System
SSO	Solar Synchronous Orbit
TDD	Time Division Access System
TR	Technical Report
TT&C	Telemetry, Telecommand and Monitoring
UE	User Terminal
UIT	International Telecommunication Union
UPS	Uninterruptible power supply
VAR	Value Added Resellers
WAN	Wide Area Network

3. GLOBALSTAR SERVICE LICENSES IN GREECE

The spectrum concession request for ATC is a terrestrial complementary component to the Mobile Satellite Service in the L and S bands which is license exempt in Greece.

[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

It is worth highlighting the importance of Globalstar's mobile satellite service in the operations of many Greek entities and agencies.

[redacted]

4. NEED FOR TERRESTRIAL ANCILLARY COMPONENT (ATC) OPERATION IN S BAND

As is well known, the connectivity of any user device with the satellite requires line of sight between the device on the ground and the space station. In the case of GEO satellites, this visibility can be achieved from a terminal of the earth station located in an outer zone with direct visibility towards the orbital position of the corresponding space station, which translates into the visible release of a certain azimuth and elevation angle for each geographical location of the Greek territory. In the case of connectivity from a user terminal with a space station belonging to a constellation of satellites, the visibility between terminals must be achieved for a full azimuth range

(0-360°) and a range of elevation angles above the horizon between 10 and 90°.

In addition to the line-of-sight effect, satellite systems in the mobile-satellite service are narrow-band (compared to satellite systems in the fixed-satellite service). Satellites have coverage beams that illuminate large geographic areas. The satellite transponders carry traffic from any location. Unfortunately, traffic does not originate in a homogeneous or balanced way from different geographical areas, so a permanent or temporary demand for high traffic in a single geographical area (compared to the capacity of the transponder) can saturate the capacity of the entire satellite in any area illuminated by the beam. It is for this reason, the assignment of traffic through ancillary terrestrial component in areas of high concentrated demand, allows the satellite to maintain its availability for the rest of the area covered by the beam, avoiding saturation of the transponder from one single high demand area. Consequently, the ATC will increase the capacity of the satellite component, not acting as a pure repeater of satellite signals.

It is obvious from the above that, if the visibility of the user terminal communication on the ground with the GEO satellite is limited, said connectivity of the user terminal on the ground with the NGEO satellite constellation is extraordinarily more limited.

[redacted]

[redacted]

4.1 Evolution of the needs of Globalstar users

[redacted]

[redacted]

[redacted]

The alternative of commercial agreements between operators that can serve the user locally is impractical as it would require dozens of independent contracts and devices that can operate in different frequency bands. The impact of being able to intelligently use band 53 for satellite and terrestrial component opens new opportunities for global services to logistics and supply chains, allowing the monitoring of equipment / products / assets from factory to transport and installation through a single device with a single contract and a global reach.

This need for the operation of an ancillary terrestrial component of a mobile satellite network has been supported and recognized by various administrations. In the global context, the FCC from the U.S., Canada, and South Africa, among other countries, have already authorized the deployment of ATC networks in their countries. A thorough compatibility study has been carried out within CEPT, finding its conclusions in Report 325 of the ECC and inviting national administrations to establish their appropriate national regulatory frameworks.

In summary, the use of ATC as part of the mobile satellite system allows the deployment of small terrestrial cells that allow increasing the network capacity locally in areas of high traffic congestion or indoor or urban areas with difficult satellite coverage.

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

The geographical dimension of the networks can vary. The proposed ATC with a transmit power e.i.r.p. of up to 4 W for outdoor operation can allow for micro-cells deployment with typical cell radius from 200 m to 1500 m and pico-cells deployment with typical cell radius up to 200 m.". In the initial case of network deployment in Greece, [redacted]

- [redacted]
- [redacted]
- [redacted]

[redacted]

Regarding the availability of the satellite constellation, the different concept of GSO versus NGSO should be noted. While an ATC network would depend on a space station of a GSO network and any failure in the space station would affect the whole network, in the case of a NGSO constellation, any failure in one single space station would certainly impact on the quality of the MSS service, but the overall satellite component of the NGSO network would continue providing the service. Consequently, the risk that a failure in a space station would create periods of time where there would not be satellite component service while ATC would still be operational, is non existing for the NGSO as the failure of a space station would not impede the continuation of hybrid service between the remaining space stations of the NGSO constellation and the ATC.

4.2 Technical characteristics of the ATC S-band terrestrial component

The following figure summarize the frequency bands used by the Globalstar mobile satellite system

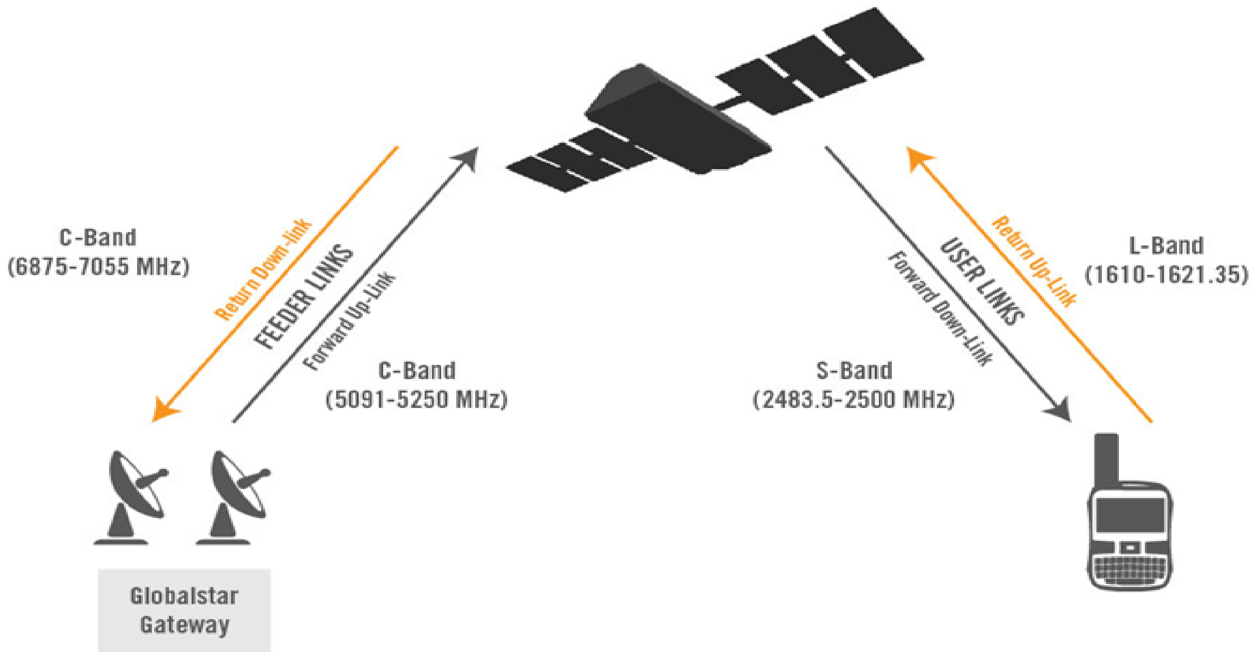

Figure 6 Description of the forward and return links and spectrum used by Globalstar

The forward and return links are described below.

➢ **Forward Link: From Gateway to User**

- C band 5091 to 5250MHz from Gateway to Satellite (connection link), forward link
  - 5091 to 5096MHz, for the Telemetry and Telecommand subsystem.
  - 5096 to 5250MHz, for user traffic through 8 channels of left circular polarization (LHCP) and 8 channels of right circular polarization (RHCP)
- S band 2483.5 to 2500MHz, from Satellite to User Terminal through 16 beams with left circular polarization (LHCP)

➢ **Return Link: From User to Gateway**

- L band 1610 to 1621.35MHz from User Terminal to Satellite, through 16 beams with left circular polarization (LHCP)
- C band 6875 to 7055MHz from Satellite to Gateway (connection link), Return
  - 6875 to 6900MHz, for the Telemetry and Telecommand subsystem.
  - 6900 to 7055MHz, for user traffic through 8 channels of left circular polarization (LHCP) and 8 channels of right circular polarization (RHCP).

Globalstar's ATC low power network is based on the following parameters:

1. Operating band: 2483.5-2495 MHz.
2. Type of transmitted signal: digitally modulated. Access is based on time division between the base station and the user terminal (TDD).
3. The maximum transmit power is not more than 1 W with a peak EIRP of not more than 6 dBW.

4. The maximum power spectral density delivered to the antenna is not greater than 8 dBm in any 3 kHz band during any continuous transmission time interval.
5. Emissions below the 2483.5 MHz frequency are attenuated below the transmitter power (P) measured in watts by a factor of at least:
   a. 40 + 10 log (P) dB at the edge of the channel at 2483.5 MHz,
   b. 43 + 10 log (P) dB at 5 MHz from the edge of the channel, and
   c. 55 + 10 log (P) dB at X MHz from channel edge
   d. where X is the greater value between 6 MHz or the value of the actual emission bandwidth
6. Emissions above the 2495 MHz frequency are attenuated below the transmitter power (P) measured in watts by a factor of at least:
   - 43 + 10 log (P) dB at all frequencies between the 2495 MHz channel edge and X MHz from this channel edge and
   - 55 + 10 log (P) dB at all frequencies above X MHz from this edge of the channel, where X is the greater of 6 MHz or the actual emission bandwidth.
7. Compliance with these rules can be verified by using measurement instrumentation employing a resolution bandwidth of 1 MHz or higher.
8. The characteristics of the frequency channelling will follow the 3GPP TS 36.101, TS 38.101[5] standards. These standards include the band 2483.5 - 2495 MHz and is known as band n53, supporting 1.4 MHz, 3 MHz, 5 MHz and 10 MHz channelling.
9. In addition, the levels of out of band emissions in the frequency range above 2500 MHz are limited to those defined by the RD 8[6] (-45 dBm/MHz).

Regarding the user terminals to be deployed for the communications in the ATC, the initial phases will rely on specific terminals for communications only with the ATC Base Stations (BS). [redacted]

[redacted]

Globalstar Mobile Satellite System Interference Mitigation Mechanisms

[5] 3GPP TS 36.101 V17.2.0 (2021-06). Section 5.6 of the technical standard defines the channeling and guard band.

[6] 2008/477/EC: Commission Decision of 13 June 2008 on the harmonisation of the 2500 - 2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

As will be indicated later, there is a risk of interference between the ancillary terrestrial component and the operation of the user terminals of the satellite network of the mobile-satellite service. That is why Globalstar maintains ongoing network and user monitoring of both the satellite network and the terrestrial component and operationally allocates resources according to capacity needs, which evolve over time.

It is very important to note that the bandwidth available for the satellite in the downlink in the S band is 16.5 MHz (2483.5 - 2500 MHz), which provides capacity to users equipped with a satellite user terminal. At this bandwidth, the ATC terrestrial component will use a variable sub-band that will be used for the terrestrial component in variable manner according to the geographic area served. Examples of combined satellite network and ATC network operation are presented below in Figures 7 and 8.

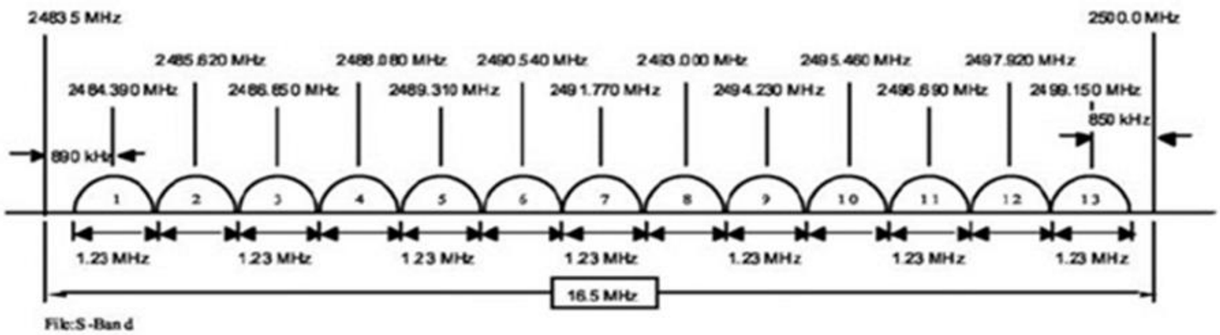

Figure 7 Channelling of frequencies of the Mobile Satellite Service

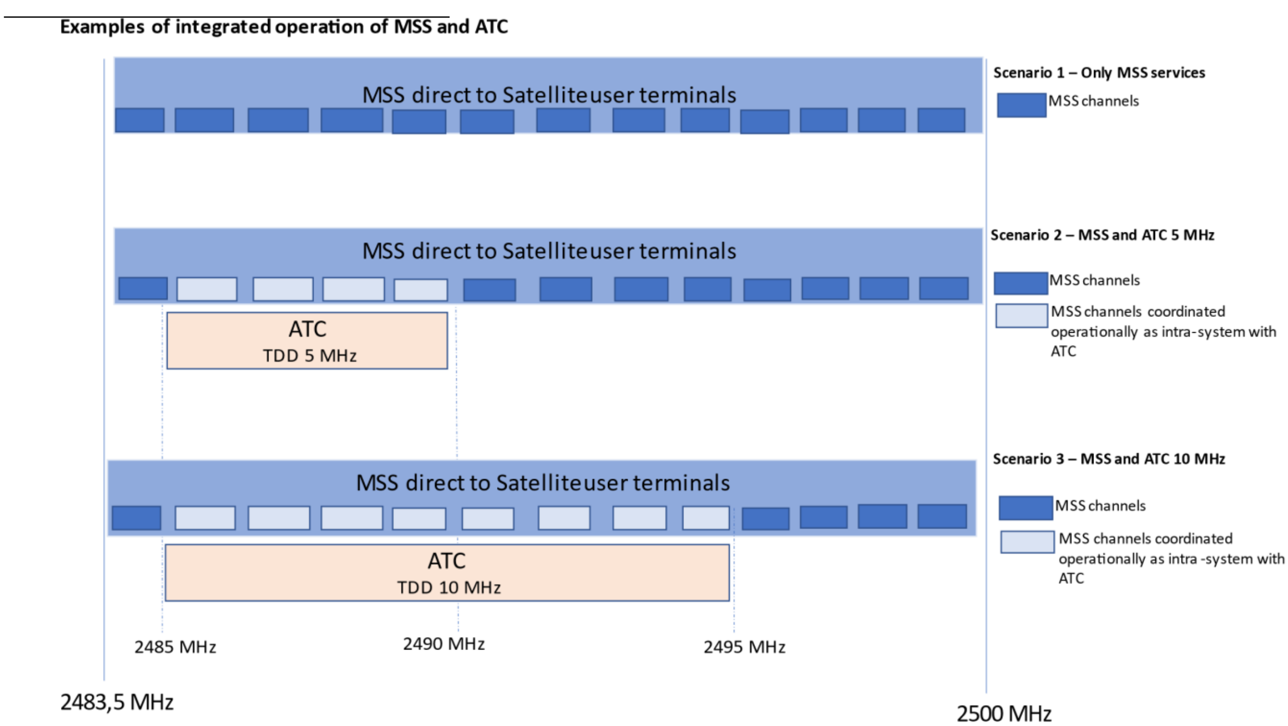

Figure 8 Combined SMS and ATC operation scenarios

As can be seen in the representative examples of operation, the channels of the satellite network will continue to operate even if the ATC component is implemented in some geographical area.

The dark blue symbol refers to nominal MSS channels without the need to take into account the ATC operation in any area. The light blue symbol refers to MSS channels that will take into account the operation in some areas of the ATC component in such a way that roaming between MSS and ATC channels can be efficiently exploited when the user terminal enters an area covered by ATC, or through proper channel coding in such a way that the satellite terminal can allow operation under an internal level of interference from an operating ATC cell.

A very important aspect to ensure the compatibility of the operation of the ATC channel with the MSS channels is that the ATC out-of-band emissions are sufficiently attenuated (by means of emission filtering systems) in such a way that the intra-interference noise level of the ATC system on the reception of MSS user terminals is sufficiently mitigated. This aspect has required the corresponding innovation and improvement of the base stations of the Globalstar terrestrial component, making them specific for the ATC deployment environment in the Globalstar mobile satellite system.

The compatible operating scenario between ATC and MSS, under the control of the Globalstar operating system, is achieved by incorporating selective filters in the transmission of ATC base stations that reduce levels, if necessary, even more than the rejection level already defined in the 3GPP specification for the b53 / n53 band, which already requires a rejection of 45 dB with respect to the in-band power level. This same adjacent channel rejection is also required for the user terminal, at a level of 30 dB. The insertion of these filters in both the ATC base station and the ATC user terminal will introduce a degradation (insertion loss) of the order of 2 dB.

[redacted]

In addition to the operational description of frequencies indicated in Figures 7 and 8, the following table delves into the needs of internal coordination between ATC and satellite according to geographic locations and frequency overlap.

Internal MSS and ATC coordination needs depending on overlaps in frequency channels and operation in the same or different geographical areas			
Stage	MSS and ATC Operation frequencies	Operations overlap in the same ATC operational geographical area	Internal coordination needs
#1	MSS channels other than ATC operating sub-band	No	No restrictions for any service
#2	MSS channels other than ATC operating sub-band	Yes	No restrictions for any service
#3	MSS channels overlapping in	No	No restrictions for any service

	frequency with the ATC operating sub-band		
#4	MSS channels overlapping in frequency with the ATC operating sub-band	Yes	Various coordination options: - Priority to MSS operation on all channels, including the possibility of disconnecting ATC. - Priority to MSS operation in part of the channels, including the possibility of disconnecting ATC. - Priority to MSS operation in part of the channels, including the possibility of reducing the ATC bandwidth. - Modification of the MSS channel characteristics to assume the interference from ATC and continue with the MSS service - Switching between MSS and ATC channels for devices equipped with dual satellite and terrestrial operation.

Figure 9 SMS and ATC internal coordination scenarios

It should be noted that Globalstar's mobile satellite service network uses the L-band for the uplink and provision of simplex services. Globalstar's ATC service (operating in S-band) will not affect Globalstar's unidirectional (simplex) services, that is, those provided by "SPOT" asset tracking/monitoring and emergency devices. Simplex communication does not use S-band satellite-to-ground frequencies that are shared with the Globalstar terrestrial service. Globalstar simplex services will continue to be provided wherever satellite service is currently available.

Regarding the progressive deployment of S-band ATC, they are considered in various environments with the aim of ensuring continuous communication. Globalstar's intelligent communication methods operating both networks will be based on the characteristics of the service provided by ATC in each specific geographical area.

[redacted]

[redacted]

To achieve effective interference-free coordination between ATC and satellite network services as described above, it is necessary for Globalstar to deploy and maintain the ATC component, ensuring management of intra-system interference.

5. APPLICABLE REGULATORY FRAMEWORK

The request for a public concession for the private use of the radioelectric public domain in favor of Globalstar is framed in the following regulations:

- ITU Radio Regulations, version 2020.
- Greek National Frequency Band Allocation Regulation, 2021 (EKKZS)
- Greek National Regulation on the Conditions of Use of Radio spectrum, 2021[7]

5.1 ITU Globalstar satellite networks

The Globalstar satellite network to be used for the deployment of the terrestrial component is based on a non-geostationary satellite constellations notified to the International Telecommunications Union (ITU) via the USA Administration (network file HIBLEO-4) and via the French Administration (HIBLEO-X). The main applicable Special Sections of the Section II Preface of the ITU BR IFIC are:

- 2909 of 26.11.2019 HIBLEO-X
- 2890 of 05.03.2019 HIBLEO-X
- 2872 of 12.06.2016 HIBLEO-x
- 2855 of 03.10.2017 HIBLEO-X
- 2795 of 26.05.2015 HIBLEO-4
- 2788 of 17.02.2015 HIBLEO-4
- 2666 of 06.04.2010 HIBLEO-4
- 2643 of 05.05.2009 HIBLEO-4

5.2 Greek National Frequency Band Allocation Regulation, 2021 (EKKZS)

According to the National Frequency Allocation Table published in 2021

Frequency band (MHz)	Allocation to services	Applications	Notes

[7][https://www.eett.gr/opencms/export/sites/default/admin/downloads/telec/apofaseis_eett/kanonistikes_apofaseis_eett/AP1004-002.pdf] EETT's Decision ref. no. 1004/002, published in the Government Gazette (GG' 4471/B/29.09.2021).

2483,5 – 2500 MHz	FIXED MOBILE MOBILE SATELLITE (space to earth) 5.351A Radiolocation 5.150, 5.371, 5.398, 5.399, 5.402, E2, E36, E59	- Radio links - ISM - Mobile applications - Mobile satellite applications - SAP/SAB - Active implantable medical devices - Medical data collection	-

Figure 10 National Frequency Allocation Table

The notes of the Radiocommunication Regulations and the Greek national regulation for frequency band allocation that apply are listed below (pages 82524 of the EKKZS).

- RR 5.150. The bands 13553-13567 kHz (center frequency 13560 kHz), 26957-27283 kHz (center frequency 27120 kHz), 40.66-40.70 MHz (center frequency 40.68 MHz), 902-928 MHz in Region 2 (center frequency 915 MHz), 2400-2500 MHz (center frequency 2450 MHz), 5725-5875 MHz (center frequency 5800 MHz) and 24-24.25 GHz (center frequency 24.125 GHz), are designated for industrial, scientific and medical applications (ICM). Radiocommunication services operating in these bands must accept the harmful interference resulting from these applications. ICM equipment operating in these bands will be subject to the provisions of No. 15.13.
- RR 5.371 In Region 1, the 1610-1626,5 MHz (Earth-to-space) and 2483,5-2500 MHz (Space-to-earth) bands are also allocated to the radiodetermination-satellite service on a secondary basis, subject to agreement obtained in accordance with No. 9.21 of the RR.
- RR 5.398 In respect of the radiodetermination-satellite service in the band 2 483.5-2 500 MHz, the provisions of No. 4.10 do not apply.
- RR 5.351 A. Regarding the use of the bands 1518-1544 MHz, 1545-1559 MHz, 1610-1645.5 MHz, 1646.5-1660.5 MHz, 1668-1675 MHz, 1980-2010 MHz, 2170-2200 MHz, 2483.5-2520 MHz and 2670-2690 MHz for the mobile satellite service, see Resolutions 212 (Rev.CMR-07) and 225 (Rev.CMR-07).
- RR 5.399. Except in the cases referred to in No. 5,401, stations of the radiodetermination-satellite service operating in the band 2483.5-2500 MHz, whose notification information has been received by the Bureau after February 17, 2012 and the service area comprising Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine will not cause harmful interference to stations of the radiolocation service operating in those countries in accordance with No. 5.398A, or they will claim protection against them. (CMR-12)
- 5.400 Different category of service: In Angola, Australia, Bangladesh, Burundi, China, Eritrea, Ethiopia, India, Islamic Republic of Iran, Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Dem. Rep. of the Congo, Syria, Sudan, Eswatini, Togo and Zambia, the frequency band 2483.5-2 500 MHz is allocated on a primary basis to the radiodetermination satellite service (see No. 5.33), subject to agreement obtained under No. 9.21 from countries not listed in this provision.
- RR 5.401. In Angola, Australia, Bangladesh, China, Eritrea, Ethiopia, India, Iran (Islamic Republic of), Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New

Guinea, Syrian Arab Republic, Dem. Rep. Of Congo, Sudan, Swaziland, Togo and Zambia, the frequency band 2 483.5-2 500 MHz was already allocated to the radiodetermination-satellite service on a primary basis prior to WRC-12, subject to agreement under No. 9.21, of the countries not listed in this number. Systems of the radiodetermination-satellite service for which the Radiocommunication Bureau has received complete coordination information before 18 February 2012 will maintain the same regulatory category as at the time of receiving the coordination request information. (CMR-15)

- RR 5.402. The use of the band 2483,5-2500 MHz by the mobile-satellite service and the radiodetermination-satellite service is subject to coordination under No. 9.11A. Administrations are urged to take all necessary measures to avoid harmful interference to the radio astronomy service from emissions in the 2483,5-2500 MHz band, especially interference caused by second harmonic radiation that would fall in the band. 4990-5000 MHz allocated to the radio astronomy service worldwide.
- RR 15.13. Section III - Interference caused by equipment intended for industrial, scientific, and medical applications. The administrations shall adopt all the practical measures necessary so that the radiation from the equipment intended for industrial, scientific, and medical applications is minimal and so that, outside the bands intended for this equipment, the level of said radiation is such that it does not cause harmful interference to the radiocommunication service and, in particular, to a radionavigation service or any other security service that operates in accordance with these Regulations.

Greek national references

- E2 In the frequency bands 9-315 kHz, 30,0-37,5 MHz, 401-402 MHz, 402-405 MHz, 405-406 MHz and 2483-2500 MHz the operation of short-range devices used as active medical devices is permitted in accordance with the provisions of the Presidential Decree 98/2017 and the Decision 2006/771/EC of the European Commission, as in force.
- E36 the frequency bands 1610-1626,5 MHz and 2483,5 - 2500 MHz are allocated for the development of Satellite Personal Communication Services in accordance with CEPT Decisions ECC/DEC/(09)02 and ECC/DEC(12)01.

  E59 In the 2483.5 - 2500 MHz frequency band, the operation of short-range devices used for medical data collection is permitted in accordance with the provisions of the presidential decree 98/2017 and the Decision 2006/771/EC of the European Commission as in force.

6. RADIO COMPATIBILITY ANALYSIS

There is a broad global consensus that the spectrum for mobile satellite applications is very limited, and the allocations of Article 5 of the Radio Regulations are not sufficient to meet the demand. This has been recognized by the World Radiocommunication Conference held in Egypt in 2019 and it was decided to include a new item on the agenda of the next Conference to be held in 2023 (item 1.18). That is why the efficient exploitation of the currently available spectrum resource is mandatory as the only practical way to improve the performance of the mobile satellite system.

Therefore, the operation of complementary terrestrial stations for added capacity to the satellite system of a mobile-satellite service is necessary requiring to ensure intra-service compatibility and also with respect to other radioelectric services.

For this compatibility analysis, several cases are distinguished:

i. Compatibility satellite network and ATC component of the same operator.
ii. Compatibility of satellite networks of different operators.
iii. ATC component compatibility and other radiocommunication services operating in the same band.

Case i) is analyzed below. Case ii) is part of the coordination procedures between different satellite networks (filings before the ITU); it should be noted that this case also raises the possibility, currently theoretical, that two mobile satellite network operators would also both deploy ATC components in the same geographical area, which should be the subject of the corresponding coordination agreements with the ITU[8]. Case iii) is studied based on the conclusions of the ECC Report 325 in the next chapter.

6.1 Analysis of the radioelectric compatibility between the satellite mobile network and the ATC component

Coordination between Globalstar's ATC and satellite services will be achieved in two ways:

- First, Globalstar will selectively deploy the ATC subrogated component geographically, and dynamically considering the need for deployment in those geographic areas where its satellite services demand maximum capacity and/or are used for emergency communications.
- Second, Globalstar will augment its existing satellite Network Operations Center (NOC) with a Network Operating System (NOS) to provide real-time control of both satellite and ATC component operations.

Globalstar's coordination approach is proactive and reactive. The selective deployment of the ATC component will proactively allow coexistence and minimize the possibility of interference in the mobile-satellite service. Globalstar's ATC component operating system will provide real-time

[8] It should be noted that the ITU foresees that satellite systems can operate under the concepts of integrated network or hybrid network. The ITU defines the integrated network as: “An integrated MSS system is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system. " On the back: “An integrated SMS system is a system that employs a satellite component and a ground station component where the ground component is complementary to the satellite component and functions as and is an integral part of the SMS system. In such systems, the terrestrial component is controlled by the satellite network and resource management system. Furthermore, the terrestrial component uses the same parts of the MSS frequency bands as the associated mobile satellite operating system”.

coordination between ground and satellite operations, should interference need to be resolved or mitigated.

Globalstar will selectively deploy its ground ATC component geographically as follows, as illustrated in Figure 10A.

- Avoiding the deployment of ATC cells in those geographic areas where their satellite downlink services are continually relied upon, for example, for emergency services.

- Implementing small cells in those geographic areas where mobile satellite services do not provide good coverage, such as inside buildings and other structures, in dense urban and / or semi-urban areas with poor satellite coverage / performance, or in areas without coverage (no visibility of the satellite constellation).

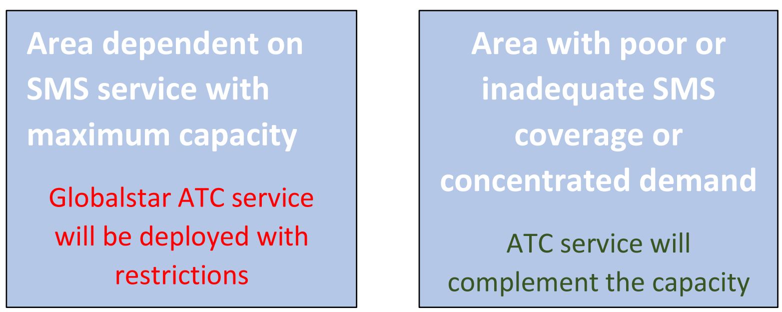

Figure 10A Selective network deployment criteria ATC

The satellite-terrestrial interference scenarios and the need for internal coordination to protect the operation of the satellite service are described below. It should be noted that the proposed ATC is based on a small cell base station, known as eNodeBs, and based on a TD-LTE transceiver network. This base station could cause interference to satellite user terminal receivers when operating in geographic proximity. Figure 11 shows this case.

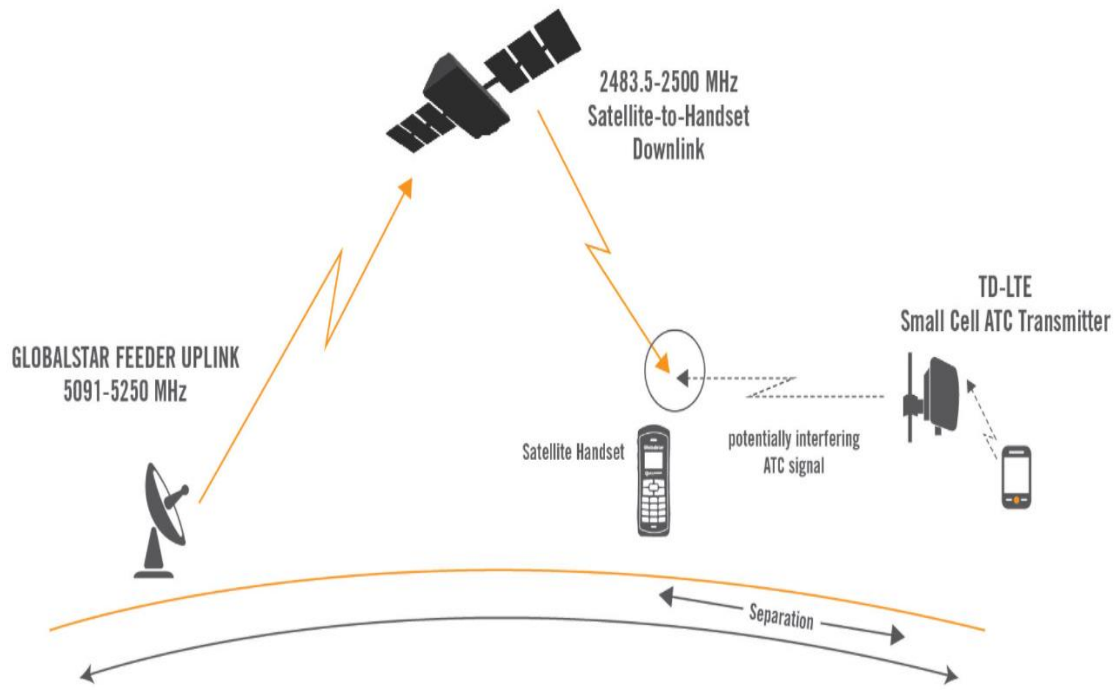

Figure 11 Scenario of potential interference from the base station transmitter eNodeB to the satellite user receiver

In this scenario, the separation distances required to avoid interference from the eNodeBs to the satellite phone on a completely overlapping channel is a function of several parameters, such as the transmit power and antenna gain of the eNodeBs, the bandwidth of the eNodeBs, the sensitivity and antenna gain of the satellite phone, the loss of propagation of the path of the interfering signal in the local environment and the reflections of the signal, as well as whether the eNodeBs is located indoor or outdoor (the satellite terminal would always be outdoor). Therefore, **internal intra-system coordination is required** to take into account the required separation between Globalstar satellite receivers and ATC network base station transmitters to protect satellite operations and allow services to coexist.

Similarly, emissions from a user terminal connected to Globalstar's ATC can also affect overlapping satellite channels if there is not enough separation distance between them. This risk of interference from the user's telephone is less important than that potentially generated by the base station of the ATC, since the ATC user terminals have lower power, are generally at a lower height and transmit with lower duty cycle. Figure 12 below shows the interference scenario generated by the terminals connected to the ATC network.

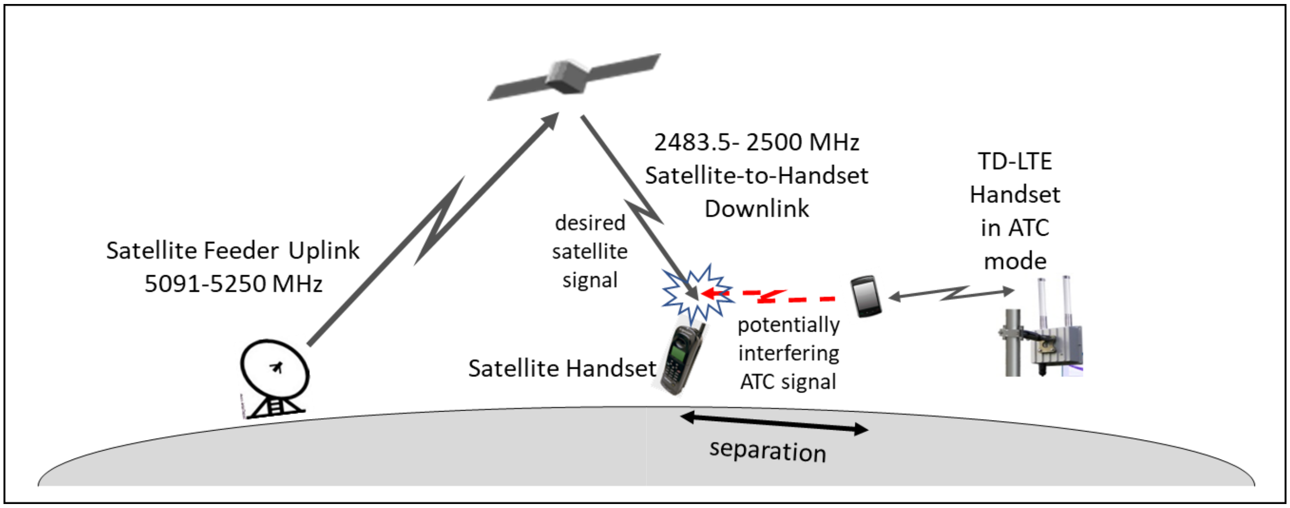

Figure 12 Scenario of possible interference from the ATC terminal to the satellite terminal receiver

As in the case of interference produced by the eNodeBs transmitter, the required separation distance between ATC user terminals and satellite terminals in an overlapping channel would depend on several factors, and **intra-system coordination between Globalstar ATC and satellite services is required** to ensure coexistence. This coordination is achieved through the proper location of the ATC base stations, as the ATC user terminals only operate within the coverage radius of the cell created by the ATC base station.

6.2 [redacted]

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6.3 ECC Report 325

The ECC Report 325[9] recently prepared by the CEPT, analyzes the compatibility and technical feasibility of coexistence for the possible introduction of new terrestrial applications in the frequency band 2483.5 - 2500 MHz with respect to existing services in the same band or in bands adjacent.

The study carried out by CEPT assumes the operation of many other radiocommunication services in the same geographical area that Globalstar's terrestrial component will operate. Among these services: other users of SMS, RDSS, PMSE, MBAN, LP-AMI, E-UTRA, ISM/WLAN and RAS.

The report's conclusions are based on the need to observe variable separation distances, according to services and scenarios. One of the main elements is that the operation of an ATC-type terrestrial system could not operate independently of the mobile satellite network, while the separation distances would be of the order of 470 m to 1.07 km. This is one of the most important conclusions of said Report since the operation of the Ancillary Terrestrial network (ATC) must be operated by the same operating entity of the corresponding satellite system, while it will be necessary to adopt measures to mitigate intra-system interference between users of the satellite terminals and the deployment and operation of the base stations and user of the ancillary terrestrial network.

In addition to the above, the Report also concludes on the need to observe separation distances between the terrestrial base stations of the terrestrial system and other services, most of which operate in the ICM band of 2400 - 2500 MHz. In general terms, the Separation distances between MSS ancillary terrestrial services and other services are:

[9] ECC Report 325. Compatibility and technical feasibility of coexistence studies for the potential introduction of new terrestrial applications operating in the 2483.5-2500 MHz frequency band with existing services / applications in the same band and adjacent bands. Approved April 23, 2021.

- With respect to RDSS: 0.4 to 8.3 km.
- With respect to RDSS Medical Body Area Network Systems (MBANS): 0.05 to 5.31 km.
- With respect to Low Power Active Medical Implant (LP-AMI): 0.01 to 0.11 km.
- With respect to outdoor PMSE: 0.5 to 38 km.
- With respect to indoor PMSE: 0.08 to 28 km.
- With respect to E-UTRA Band 7 base station (BS): 0.09 to 1 km.
- Regarding interference from E-UTRA Band 7 Base Station (BS) to ATC: 0.04 to 0.6 km.
- With respect to ISM / WLAN: 0.03 to 0.3 km.
- With respect to RAS caused by ATC second harmonic: tens of kms to more than 100 km.

After reviewing the technical studies and at the light of the expected deployment of ATC in Europe, the CEPT Working Group FM decided that harmonization of the use of the band was not necessary allowing national administrations to take appropriate measures.

6.4 Compatibility of ATC and beyond adjacent band services at 2500 MHz and above

Description of the compatibility analysis band 53 and bands 38/7

UTRA/E-UTRA Band 7 is operating FDD i.e., BSs and UEs transmit and receive in different frequency bands, with the uplink (i.e., UE to BS) and downlink (i.e., BS to UE):

- Band 7 FDD uplink: 2500 – 2570 MHz.
- Band 7 FDD downlink: 2620 – 2690 MHz (not adjacent to Globalstar ATC)
- Band 38 TDD: 2570 – 2620 MHz (i.e., the duplex gap for Band 7), and is also not adjacent to Globalstar's proposed terrestrial operations.

Since the Band 7, adjacent to Globalstar's terrestrial operations, is designated for uplink operation, only interference to the adjacent services BS receiver is a concern (since the UEs receive in a different band), produced either by the ATC BS or by the ATC User terminal. See figures below.

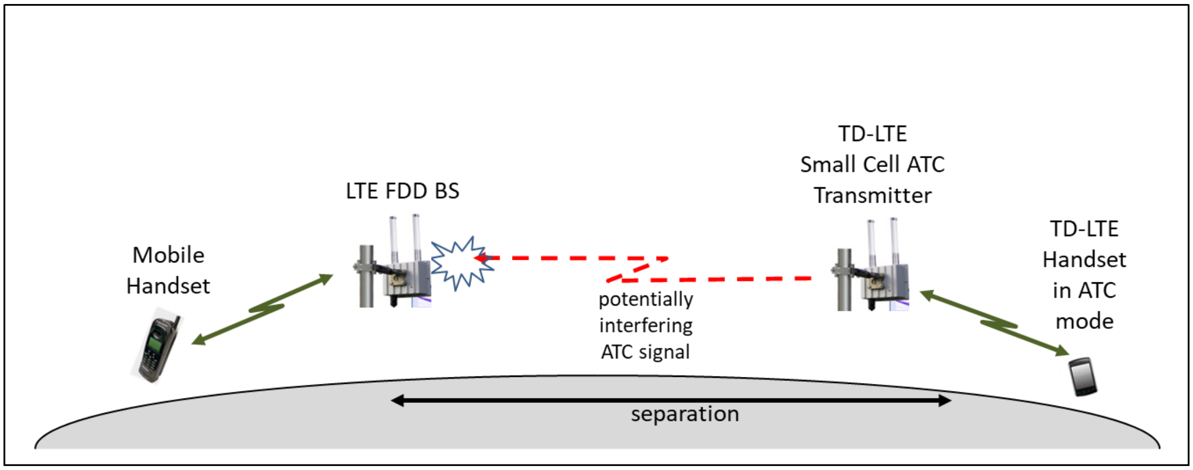

Figure 15 LTE Band 53 eNodeB interfering LTE Band 7 Base Station

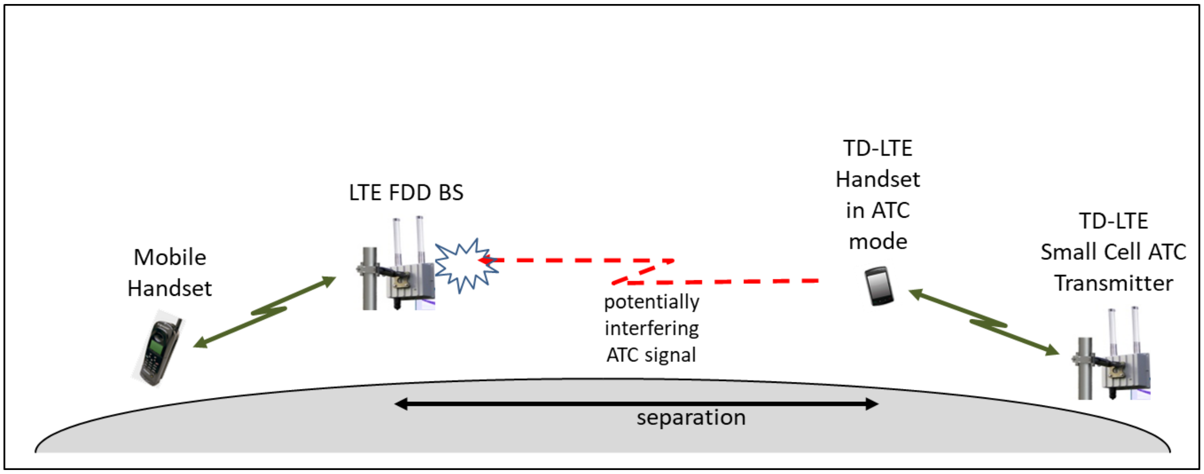

Figure 16 LTE Band 53 eNodeB interfering LTE Band 7 Base Station

Band 7 systems are based on 3GPP standard LTE, in particular, to BSs belonging to wide-area macro-cell systems, which, due to their high antenna elevations and high receive antenna gains, represent the most likely equipment to be impacted by neighboring band transmissions.

The figure below shows the spectra of the Globalstar terrestrial channel (i.e., 10 MHz bandwidth), the Band 7 channel, and the resulting OOBE into the adjacent channel.

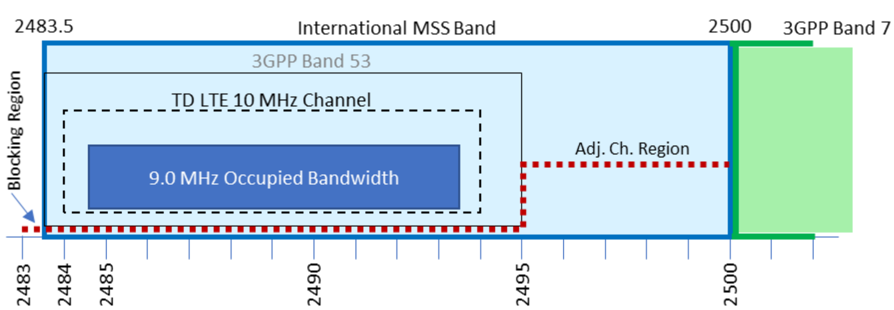

Figure 17 Globalstar's terrestrial operations

LTE specifications for BSs, as written by 3GPP, set the limits on ACLR as minimum of 45 dB below the in-channel transmit power (i.e., the OOBE power must be reduced by a factor of almost 32,000).

The scenario for a UE would be the same, except the ACLR would be 30 dB, with similar OOBE levels.

OOBE is spread over a 10 MHz channel, the absolute interference levels are slightly smaller, when considered on a per-MHz basis.

<u>Studies conducted by ECC Report 325 regarding adjacent band compatibility</u>

As previously indicated in section 6.3, a Guard Band of 5 MHz and a minimum practically achievable geographical separation of the transmitters result in a considerable reduction in potential interference level.

As per ECC report 325 already conservative assumptions:

- the separation distance is approximately 50 meters for an LTE BS (in ATC mode) deployed indoors with 250 mW EIRP,
- the separation distance is less than 1 Km suffices for an LTE BS (in ATC mode) deployed outdoors with 1 W conducted power and 6 dBi antenna gain or 4W EIRP, and
- the separation distance is approximately 100 meters for an LTE UE (in ATC mode) deployed outdoor with 250 mW EIRP.

The above results have been obtained based on worst case theoretical conditions:

- ATC BS filter rejection: real products outperform those minimum required value, but only standardized values are used in the study.
- Duty Cycle: The ATC service is time division duplex (TDD) with the transmit activity divided between the BS and UE. However, a worse case value of 100% transmit time has been used for the BS and the UE in the calculation.
- To determine the Transmitter Unwanted Emissions, “Out of Band Emission beyond adjacent channel” instead of the correct “Out of Band Emission within adjacent channel” has been chosen and result again in a worsen study case.
- EHATA median is widely used in CEPT studies including the other coexistence studies done in the same report, EHATA 95th and FSPL represent an over conservative protection with no real justification.

Under the above conditions, ECC report concludes:

Table 1: Extract from Table 78: Outdoor TS Terrestrial Deployment Separation Distances

Outdoor TS Band-width	interferer TX Parameters	TS BS Interferer Value (m)	E-UTRA UE Interferer Value (m)
10 MHz	Separation distance, EHata urban median 50th percentile (m)	970	96

Table 2: Extract from Table 79: Indoor TS Terrestrial Deployment Separation Distances for Combined

Indoor TS Band-width	interferer TX Parameters	TS BS Interferer Value (m)	E-UTRA UE Interferer Value (m)
10 MHz	Separation distance, EHata urban median 50th percentile (m)	51	56

ECC Report 325 indicates that in urban areas, separation distances calculated using FSPL is an absolute worst-case interference scenario. Separation distances will be less in urban or suburban areas where appropriate propagation using models for those areas are more accurate.

Realistic deployment scenario. ATC BS performances.

In a realistic scenario of deployment of AT BS, the following characteristics are expected:

- Low Power ATC BS e.i.r.p. outdoor / indoor: 36 dBm / 20 dBm
- ATC BS filter rejection: minimum 45 dB; actual performance: much higher than this value.
- Out of Band Emission within adjacent channel: -25 dBm with 45 dB ACLR
- Extra filtering of ATC BS emissions that will result with an Out of Band Emission within adjacent channel of -45 dBm/MHz.

The interference paths are depicted in the following figure

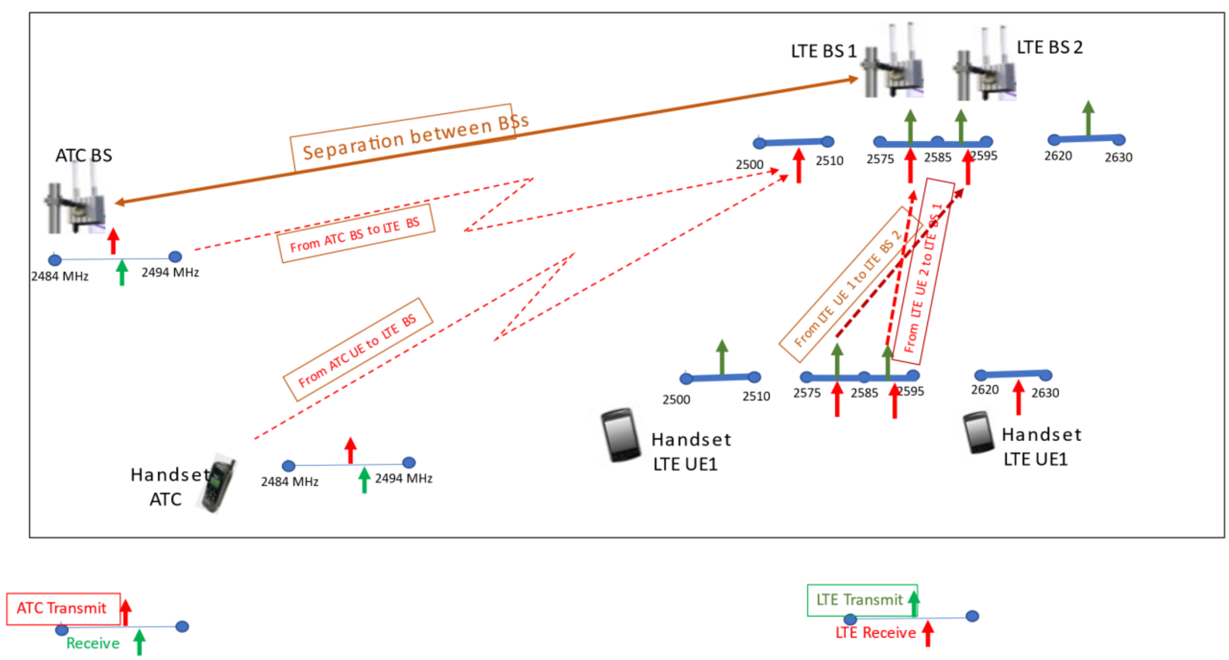

Figure 18 Interference paths ATC BS and LTE BS stations

With the above realistic assumptions, the resulting separation distances are significantly lower than those assumed for the worst case in the ECC report 325.

Bearing in mind the above conclusions, it can be stated that there is no realistic risk of interference from ATC BS to LTE BS in band 7.

The coexistence of band 38 TDD and band 7 FDD already operate without interference in Spain. To mitigate the same interference with band 7, band 38 added successfully the same 5 GHz Guard Band than for the proposed ATC band 53.

Consequently, it can be concluded that the ECC report 325 findings regarding compatibility of ATC and other services above 2500 MHz, pointing towards a need of a separation distance of some hundred meters is a theoretical outcome, not being required for real life deployments. Note the comparable and successful operation of the services operating in Band 7 and Band 38. Note also that the bandwidths used in these operating conditions is 20 MHz while Globalstar ATC bandwidth is 10 MHz, therefore, offering better roll off signals in the adjacent channel.

Furthermore, the operation of adjacent services in the 2500-2690 MHz is regulated by *COMMISSION DECISION of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community*.

This EC Decision sets the BEM requirements (Block Edge Mask) which shall be applied as an essential component of conditions necessary to ensure coexistence in the absence of bilateral or multilateral agreements between neighboring networks, without precluding less stringent technical parameters if agreed among the operators of such networks. This Decision requires Member States should ensure that network operators are free to enter into bilateral or multilateral agreements to develop less stringent technical parameters and, if agreed among all affected parties, these less stringent technical parameters may be used.

Comparing the spectrum mask of Globalstar ATC and spectrum mask of typical services operating in the adjacent band (Communications of Commission of 13th June 2008), we obtained the following:

- Achievable out of band emissions ATC BS at edge 2500 MHz: -45 dBm/MHz:
    - ATC BS EIRP spectral density in band: 36 dBm/10 MHz.
    - ATC BS ACLR adjacent at 6 MHz from center frequency: 55 + 10 log (Power in W) = 62 dB.
    - ATC BS ACLR at adjacent 11 MHz from center frequency: higher than 60 dB.
    - Resulting emissions in band 7 (at 2500 MHz): -35 dBm/10 MHz (- 45 dBm/MHz).

Consequently, the out of band emissions of ATC BS of -45 dBm/MHz are equal to the requirements established in Decision[10] for coexistence of band 7 emissions without the need of coordination. In addition to the above, Globalstar will operate its ATC with a powerful Network Operating System

[10] COMMISSION DECISION of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

(NOS) to administering the deployment and controlling its operation. Among other tools, Globalstar will operate a Geographical Information System (GIS) portal where incumbents can a) see ATC locations and associated interference heatmaps; it will allow Globalstar to identify any potential risk of interference and avoid co-location of ATC BS and LTE BS of band 7.

As indicated in the license application submitted by Globalstar ATC, **its operation will be under the basis of not creating any harmful interference and not claiming protection against interference** from adjacent band operations. Should any harmful interference be reported, Globalstar ATC BS will switch off emissions till the reported interference is investigated and mitigation measures implemented.

Conclusions

The operation of Globalstar ATC is compatible with the operations of mobile services in the adjacent bands 7 and will result with the same successful/peaceful coexistence between Band 38 TDD and Band 7 FDD currently deployed in Spain and other European countries. In order to ensure comfortable conditions for the compatible operations of ATC and other services above 2500 MHz, the ATC authorization may include a requirement, similar to BEM concept of Decision[11] of -45 dBm/MHz. This value would allow deployment of ATC BS without any coordination requirements, as per conditions established in CEPT Report 19 and EC Commission Decision of 13.06.2008. For other values of OOBE, coordination of ATC BS would be required.

7. PROPOSAL FOR THE AUTHORIZATION FRAMEWORK OF THE ANCILLARY TERRESTRIAL COMPONENT OF THE MOBILE SATELLITE SYSTEM.

EETT's EKKZS provides for the operation of the FIXED, MOBILE, MOBILE SATELLITE and RADIO DETERMINATION BY SATELLITE services, on a secondary basis, consistent with Art. 5 of the Radio Regulations. See the introduction to this section 5 for more details.
Globalstar considers that the proposed deployment of ATC network in Greece, considering such deployment will be made under the commitment of no interference and no protection, may also follow the license exempt conditions for MSS.

However, should EETT consider that an authorization is required prior deployment of ATC services in Greece, Globalstar proposes the authorization of ATC as part of its mobile satellite system, complementing the direct line of sight visibility services of the Mobile Satellite Service. The Globalstar's ATC will be operated as part of its mobile satellite system including terrestrial stations to increase the capacity and flexibility of the mobile satellite system. In addition, the ATC component might be also considered as part of a mobile service associated to a mobile satellite system. The proposed operating framework is based on the following premises:

1. The terrestrial stations of the Ancillary Terrestrial Component will operate as subrogates of the mobile satellite service under the supervision and control of the Globalstar satellite operator. Globalstar's ATC terrestrial station operation will be based on low power stations not comparable to the typical deployment coverage of other electronic communications

[11] COMMISSION DECISION of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

services. The ATC services could be dynamically suspended when operationally required to protect MSS users.

2. The spectrum used by the ATC network will be a sub-band of the spectrum (2483.5-2500 MHz), only for the S band. The ATC component is not necessary for L-band operation, as the ATC does not operate in the reception bands of the space station but in the transmission band of the space station (space-to-Earth).
3. The ATC will be based on fixed stations on the ground.
4. The ATC constitutes an integral part of the Globalstar mobile satellite system, and its operation will be controlled by the Globalstar network control center complemented by the ATC operations control center, operated by Globalstar. The ATC operations control center must be continuously operational when there are ATC operations.
5. The most advanced technology will be used for greater efficiency in the use of the spectrum, not requiring more spectrum than the operation within a sub-band of the spectrum already authorized for the mobile satellite service.
6. The main characteristics of the ATC on the ground of low power are the following:
    a. Operating band: 2485-2495 MHz.
    b. Type of transmitted signal: digitally modulated.
    c. The maximum transmit power is not more than 36dBm in the transmitted bandwidth.
    d. The maximum power spectral density delivered to the antenna is not more than 8 dBm in any 3 kHz band during any continuous transmission time interval.
    e. Emissions below the 2483.5 MHz frequency are attenuated below the transmitter power (P) measured in watts by a factor of at least:
        i. 40 + 10 log (P) dB at the edge of the channel at 2483.5 MHz,
        ii. 43 + 10 log (P) dB at 5 MHz from the edge of the channel, and
        iii. 55 + 10 log (P) dB at X MHz from channel edge
        iv. where X is the greater value between 6 MHz or the value of the actual emission bandwidth
    f. Emissions above the 2495 MHz frequency are attenuated below the transmitter power (P) measured in watts by a factor of at least:
        i. 43 + 10 log (P) dB at all frequencies between the 2495 MHz channel edge and X MHz from this channel edge and
        ii. 55 + 10 log (P) dB at all frequencies above X MHz from this edge of the channel, where X is the greater of 6 MHz or the actual emission bandwidth.
        iii. Sufficient reject to ensure a maximum level of emissions of -45 dBm/MHz in the border of the adjacent band of 2500 MHz and above[12].
    g. Compliance with these rules can be verified by using measurement instrumentation employing a resolution bandwidth of 1 MHz or higher.
7. The operation of the terrestrial stations of the ATC may increase the capacity of the mobile satellite system, expanding services and applications, particularly in environments where the satellite capacity may be saturated or the satellite coverage and / or the visibility of the satellite the constellation cannot be guaranteed.
8. The operation of terrestrial stations in the ATC will not be possible if the satellite network is not operational.

[12] Consistent with the COMMISSION DECISION of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

9. The ATC will not generate harmful interference to other primary radiocommunication services and will not claim protection against harmful interference from said other primary services.
10. Globalstar will be ready to submit an annual report to EETT indicating the number of stations on Earth and their geographic locations.
11. The authorization will not be transferable or divisible.
12. The authorization is subrogated to the operation of Mobile Satellite Service, so in its absence, the enabling title for the deployment of subrogated terrestrial stations will automatically expire.
13. Applicable conditions for the protection and coexistence with other radiocommunication services that operate in the same band of 2483.5-2500 MHz. For the operation of the ATC and ensure that the impact on other types of radio services that may operate in the same band is mitigated, Globalstar offer a point of contact so that other operators of other radio services interested in operating in this band can consult and consequently assign their operating channels at each specific moment of the operation. This service will be available directly from Globalstar, who will also inform to EETT.

8. [redacted]

[redacted]