

International Telecommunication Union

ITU-R
Radiocommunication Sector of ITU

Report ITU-R M.2459-0
(07/2019)

**Introduction of additional mobile-satellite
service systems into the Global Maritime
Distress Safety systems**

M Series
**Mobile, radiodetermination, amateur
and related satellite services**



International
Telecommunication
Union

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Reports

(Also available online at <http://www.itu.int/publ/R-REP/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management

Note: This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.

*Electronic Publication
Geneva, 2019*

© ITU 2019

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without written permission of ITU.

REPORT ITU-R M.2459-0

**Introduction of additional mobile-satellite service systems
into the Global Maritime Distress Safety systems**

(2019)

1 Introduction

World Radiocommunication Conference 2015 (WRC-15) adopted agenda item 1.8 for WRC-19, which considers possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS in accordance with Resolution **359 (Rev.WRC-15)**. This Report addresses the introduction of additional satellite systems into the GMDSS as provided in *resolves 2* of Resolution **359 (Rev.WRC-15)**.

2 Background

Resolves 2 of Resolution **359 (Rev.WRC-15)** calls for the ITU-R to conduct studies related to introduction of additional satellite systems for use in the GMDSS, including consideration of the mobile-satellite service (MSS) allocations used and the potential impact of possible modifications to the provisions of the Radio Regulations (RR) on sharing and compatibility with other services and systems in the frequency bands of interest and adjacent frequency bands.

Until 2018, only one mobile satellite system had been recognized by the International Maritime Organization (IMO) for use in the GMDSS ‘system of systems’. Advances in communications technology, the maturity of commercial satellite operations have introduced competition into the satellite sector, and the deployment of non-geostationary satellite constellations with full global coverage led the IMO to begin work to recognize additional satellite systems to the GMDSS as an urgent work item. In considering incorporation of additional satellite systems into the GMDSS the IMO recognizes the need for additional satellite resources capable of providing increased coverage and provision of maritime services.

At its 99th Meeting of the Maritime Safety Committee (MSC 99), IMO adopted Resolution MSC.451(99), “Statement Of Recognition Of Maritime Mobile Satellite Services Provided By Iridium Satellite LLC” (May 2018). The newly-recognised satellite system, operating in the frequency band 1 616-1 626.5 MHz, is now being integrated with national and regional centres supporting maritime rescue and safety information for full global operation in early 2020.

The IMO actions described above provide for the timely introduction of an additional MSS system into the GMDSS, which as a consequence lead to the need to consider modifications of the Radio Regulations.

The additional GMDSS provider, which is the subject of this Report, is expected to offer the following features:

- The ability to provide satellite coverage for GMDSS communications of the entire globe – including the critical Arctic and Antarctic (Polar) regions where there are currently no GMDSS mobile satellite communication services available;
- An “always on” system as individual satellites pass overhead approximately every five to eight minutes depending on location. The movement of the satellites along their orbit provide the user with good look angles (i.e. ability to see the satellite) in rough seas, including in northernmost and southernmost latitudes;

- Enabling both voice and data GMDSS communications in a single, small form factor maritime mobile terminal;
- Distress and safety communications provided to the Rescue Coordination Center with immediate voice communications capability, vessel identification, and a means to contact the vessel in distress;
- Providing an opportunity to have redundant communications platforms for the maritime community in the event there is a catastrophic outage which disables part, or all, of one MSS satellite-based GMDSS provider or the other; (for example, many commercial airplanes are equipped with aeronautical terminals from multiple providers for redundancy purposes and the same option would be available for ships);
- The ability to integrate with vessel “digital bridge” systems consolidating equipment and displays for the crew to monitor, while eliminating clutter on the bridge.

3 The use of an additional MSS system for GMDSS

Report ITU-R M.2369 – Use of non-geostationary orbit mobile satellite systems to enhance maritime safety, provides information on the characteristics of the enhanced services that can support GMDSS, as described below.

The referenced Report also provides information related to the potential for mobile satellite communication systems to enhance maritime radiocommunication in geographically-remote regions where reliable terrestrial maritime radiocommunication is not feasible.

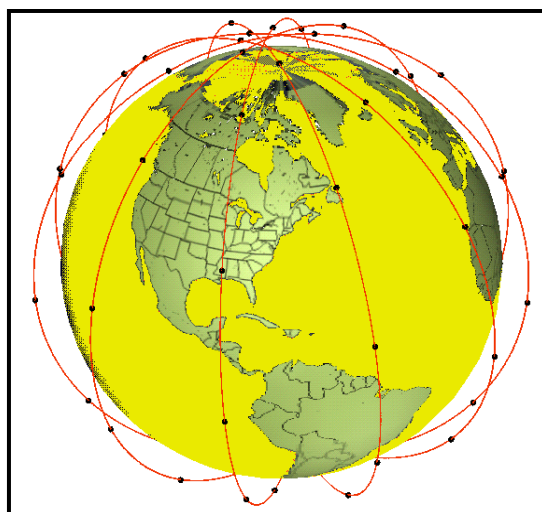
3.1 Description of an additional MSS system to support GMDSS

One system has been recognised by the IMO for recognition to provide GMDSS has assignments for MSS frequencies in the frequency range 1 616-1 626.5 MHz, which is part of the frequency band 1 613.8-1 626.5 MHz allocated to the MSS.

This allocation is already being utilized by non-geostationary (non-GSO) MSS satellite systems that can provide global coverage and have lower latency characteristics as compared to geostationary orbit networks. One of these systems, designated “HIBLEO-2” in the ITU MIFR, provides full polar coverage, which geostationary satellite networks are unable to provide.

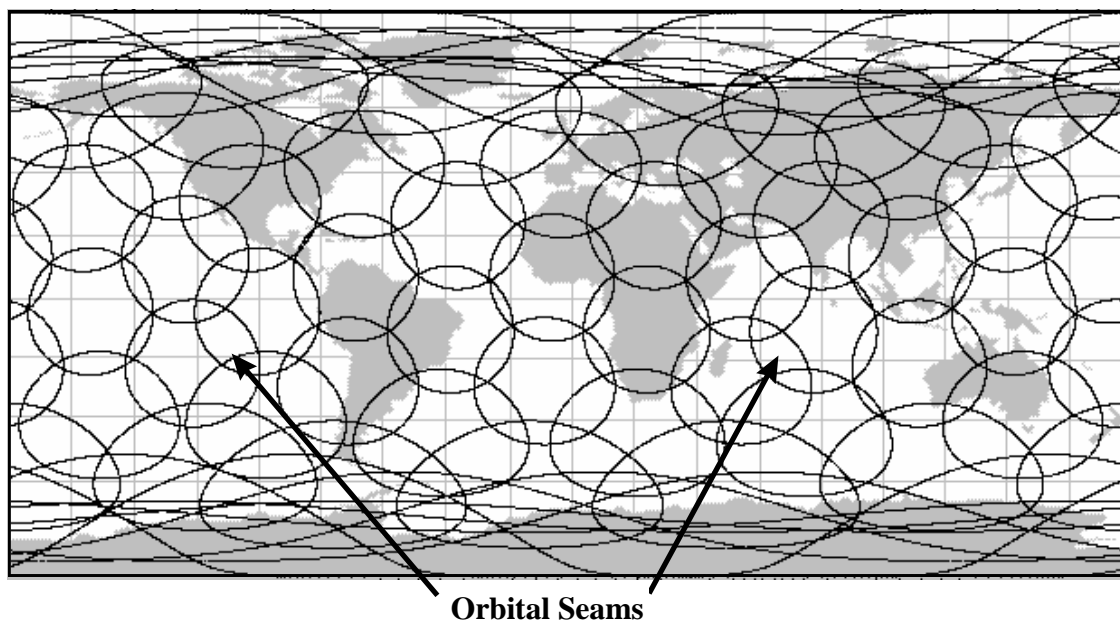
The HIBLEO-2 satellite system employs 66 low earth orbit satellites that support user-to-user, user-to-gateway, and gateway-to-gateway communications. The 66 satellites are evenly distributed in six orbital planes with an 86.4° inclination. The HIBLEO-2 satellite constellation is depicted in Fig. 1. The satellites orbit at an altitude of 780 km and have an orbital period of approximately 100 minutes 28 seconds.

FIGURE 1
HIBLEO-2 satellite constellation



The near polar orbits of the HIBLEO-2 satellite constellation provide global coverage from pole-to-pole as depicted in Fig. 2.

FIGURE 2
HIBLEO-2 satellite coverage



All communication services are provided independent of latitude and longitude position on the globe. Ship-to-shore, shore-to-ship and ship-to-ship communications are provided by a constellation of low earth orbiting satellites with overlapping coverage areas, providing ubiquitous coverage.

The first-generation constellation was implemented in 1998. It was indicated that the constellation was replaced with second-generation of satellites in early 2019. Second-generation satellites include advance technology and functionality.

Voice, broadcast data, short burst data and “push-to-talk” services are provided globally on a 24 × 7 basis. Service bearing communications is networked between the satellites in the constellation over the crosslinks. Crosslinks provide connectivity between satellites without going through a

terrestrial earth station. Data is transferred to the ground through one of the ground stations around the globe.

As mentioned above, the near polar orbits of the HIBLEO-2 satellite constellation provide global coverage from pole to pole. Further, the characteristics of this system can also be found in Report ITU-R M.2369. This Report indicates, “that the increasing global need for maritime radiocommunication for enhanced maritime safety applications, capacity concerns, and the increasing use of maritime communications further highlight the need to identify alternative means to satisfy such requirements. Such communication needs can be met by non-GSO MSS applications including a separate and independent means of alerting and distribution of maritime safety information”.

There are presently over one million users of the system.

3.2 Applications

To support distress communications in its role as GMDSS satellite service provider, the network will provide automatic recognition and routing of maritime distress and safety communications via highly reliable links. The network will automatically route all ship-shore and shore-ship distress alert calls and messages, directly to and from the associated rescue coordination centres (RCCs).

As the receding ice invites increased human activity in commercial and private ventures in Arctic waters, there is increasing demand to ensure the safety, security and stewardship of maritime activity. Tankers regularly use northern sea routes beyond the Arctic Circle which transit through the Bering Strait and Sea, and small cruise ships are pressing even further into the Arctic. The coverage afforded by the HIBLEO-2 non-GSO MSS system provides a unique capability to serve these areas via satellite. The Arctic region has been known at times for poor propagation of radio signals, geomagnetic interference, and limited satellite coverage and bandwidth. This satellite system has the capability as indicated in other sections of this Report to effectively address these requirements.

The HIBLEO-2 non-GSO MSS satellite system has supported several non-GMDSS maritime applications (supporting leisure vessels and fishing industries, as well as commercial shipping) since 1998 (see Report ITU-R M.2369).

3.3 Allocations and use by the new GMDSS satellite provider

Since WARC-92, the band 1 610-1 626.5 MHz is allocated to the mobile-satellite service (MSS) (Earth-to-space) on a primary basis, and the band 1 613.8-1 626.5 MHz to the MSS (space-to-Earth) on a secondary basis (see Table 1). Radio Regulations Article 1 indicates that the MSS is inclusive of the maritime mobile-satellite service. The HIBLEO-2 satellite system has operated within the 1 610-1 626.5 MHz band since 1998.

TABLE 1
Extract of Radio Regulations Article 5

1 610-1 660 MHz

Allocation to services		
Region 1	Region 2	Region 3
<p>1 610.6-1 613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION</p> <p>5.149 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.371 5.372</p>	<p>1 610.6-1 613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION RADIODETERMINATION- SATELLITE (Earth-to-space)</p> <p>5.149 5.341 5.364 5.366 5.367 5.368 5.370 5.372</p>	<p>1 610.6-1 613.8 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY AERONAUTICAL RADIONAVIGATION Radiodetermination-satellite (Earth-to-space)</p> <p>5.149 5.341 5.355 5.359 5.364 5.366 5.367 5.368 5.369 5.372</p>
<p>1 613.8-1 626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 5.355 5.359 5.364 5.365 5.366 5.367 5.368 5.369 5.371 5.372</p>	<p>1 613.8-1 626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION RADIODETERMINATION- SATELLITE (Earth-to-space) Mobile-satellite (space-to-Earth) 5.208B</p> <p>5.341 5.364 5.365 5.366 5.367 5.368 5.370 5.372</p>	<p>1 613.8-1 626.5 MOBILE-SATELLITE (Earth-to-space) 5.351A AERONAUTICAL RADIONAVIGATION Mobile-satellite (space-to-Earth) 5.208B Radiodetermination-satellite (Earth-to-space)</p> <p>5.341 5.355 5.359 5.364 5.365 5.366 5.367 5.368 5.369 5.372</p>

HIBLEO-2, HIBLEO-X and HIBLEO-4 are the only notified non-GSO MSS systems which currently operate in the frequency band 1 610-1 626.5 MHz. GMDSS will operate within assignments for which the host mobile-satellite system has been co-ordinated and properly authorized, noting RR No. 4.9. It should be noted that several GSO MSS/RDSS satellite networks operate uplinks in the same frequency band (see Recommendation ITU-R M.1184-3).

HIBLEO-2 is currently authorized by its notifying administration to operate its space segment in the band 1 618.725-1 626.5 MHz in the (Earth-to-space) and (space-to-Earth) directions. HIBLEO-4 is authorized by the same notifying administration to operate its space segment in the (Earth-to-space) direction in the 1 610-1 617.775 MHz frequency band. Moreover, the same administration has authorized both HIBLEO-2 and HIBLEO-4 to share the 1 617.775-1 618.725 MHz frequency band for their space segments. HIBLEO-X is authorized by another notifying Administration to operate in the (Earth-to-space) direction in the 1 610-1 621.35 MHz frequency range. HIBLEO-X is not yet coordinated with HIBLEO-2.

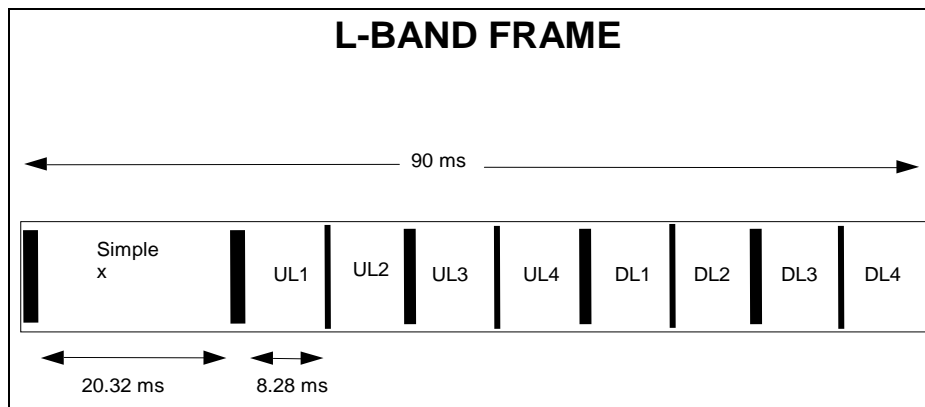
3.4 Particularities of the HIBLEO-2 signal

HIBLEO-2 is designed to operate in up to 10.5 MHz of spectrum in the band 1 616-1 626.5 MHz and utilizes time division multiple access (TDMA) technology for satellite access using bi-directional

service link transmissions. The HIBLEO-2 system was initially authorised to operate within the band 1 621.35-1 626.5 MHz, but has additionally been authorised in a number of countries worldwide to operate down to 1 617.775 MHz.

HIBLEO-2 user terminals employ a time-division duplex (TDD) approach where they transmit and receive in an allotted time window within the frame structure. The TDD structure is built on a 90 ms frame and is composed of a 20.32 ms downlink simplex time slot, followed by four 8.28 ms up-link time slots and four 8.28 ms down-link time slots, with some guard times interspersed as is depicted in Fig. 4. Since the system is using TDD, the subscriber units transmit and receive in the same frequency band. The access technology is a Frequency Division Multiple Access/Time Division Multiple Access (FDMA/TDMA) method whereby a user terminal is assigned a channel composed of a specific frequency and time slot in any particular beam. Channel assignments may be changed across cell/ beam boundaries (and across satellite handover) and are controlled by the satellite.

FIGURE 4
HIBLEO-2 frame structure



In 2007, CEPT developed ECC Report 95¹ on sharing between MSS systems using TDMA and MSS systems using CDMA in the band 1 610-1 626.5 MHz.

The ECC Report concluded that the more appropriate way to achieve compatibility between MSS systems using CDMA and MSS systems using TDMA is the frequency separation of these systems.

The conclusion of ECC Report 95 is consistent with the frequency segmentation and separation conditions of authorizations granted in 2008 to HIBLEO-2 and HIBLEO-4 satellite systems by their notifying Administration but does not consider the authorization given to HIBLEO-X, for the band 1 610-1 621.35 MHz, by its notifying administration.

4 Regulatory provisions

In this Report there are some texts which were not agreed upon due to the fact that there are sensitive regulatory issues concerning GMDSS which are within the purview of WRC to decide and some of them have been included in the CPM Report to WRC-19.

4.1 MSS allocations and constraints

Within the frequency range of interest, there is an MSS primary allocation (Earth-to-space) in 1 610-1 626.5 MHz and an MSS secondary allocation (space-to-Earth) in 1 613.8-1 626.5 MHz.

¹ ECC Report 95: <http://www.eroocdb.dk/Docs/doc98/official/pdf/ECCREP095.PDF>.

The frequencies for distress and safety communications for the GMDSS are listed in Table 15-2 of Appendix **15 (Rev.WRC-15)** of the Radio Regulations. It is to be noted that all listed frequencies and frequency bands are allocated on a primary basis to the mobile, maritime mobile, aeronautical mobile and mobile-satellite services. Distress and safety communications for the GMDSS are considered to fall under the definition for a safety service. Safety services require special measures to ensure a reliable communication and their freedom from harmful interference (see RR No. **4.10**). The frequency band 1 610-1 626.5 MHz is not listed in RR Appendix **15**.

In respect of use of the primary (Earth-to-space) allocation, MSS satellite systems in the band 1 610-1 626.5 MHz are subject to frequency co-ordination with the primary services in the same band under relevant provisions of RR Articles **9** and **11**. (See also RR No. **5.364**.) In respect of use of the secondary (space-to-Earth) allocation, MSS satellite systems in the band 1 613.8-1 626.5 MHz are also subject to frequency co-ordination with the secondary services in the same band under relevant provisions of RR Articles **9** and **11** as indicated in RR No. **5.365** before the present associated Rules of Procedure, and included primary services in the band. Specifically, RR No. **9.11A** calls for coordination between geostationary and non-geostationary satellite networks with the exception of coordination between earth stations operating in the opposite direction of transmission.

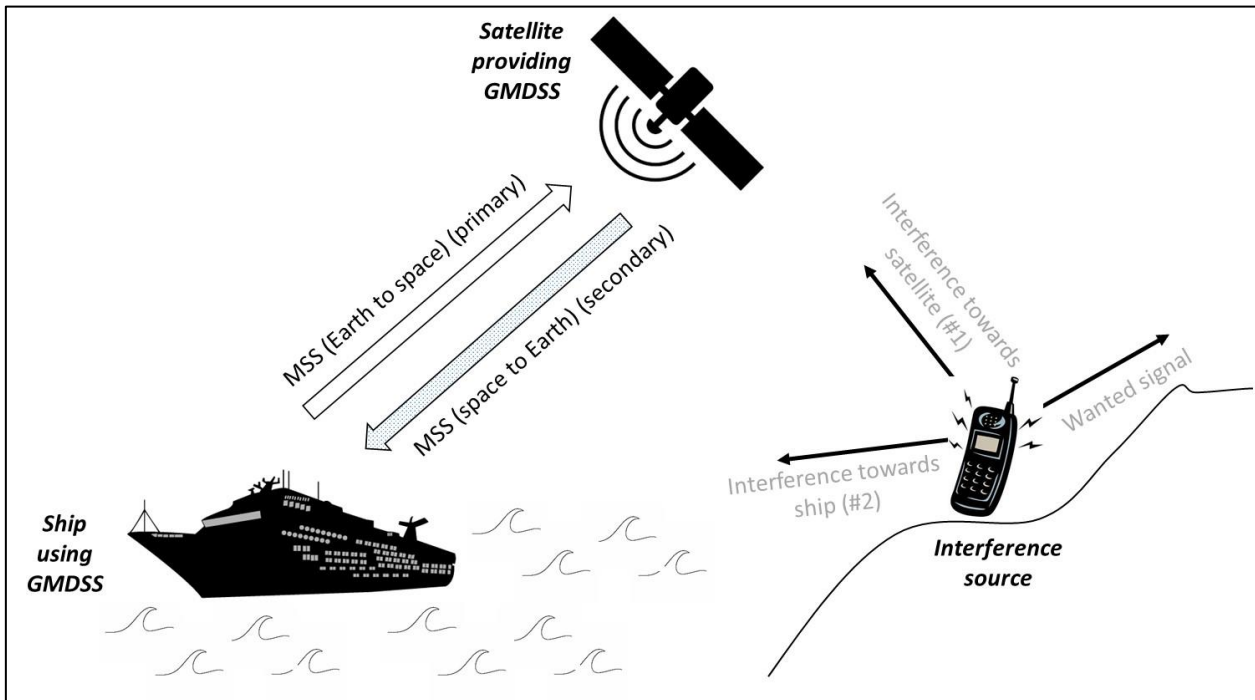
The HIBLEO-2 service links (both uplink and downlink) have been coordinated as required under the relevant provisions of the Radio Regulations and associated Rules of Procedures in force at the time, and subsequently notified and registered in the ITU-R MIFR in October 1995. (The provisions were subsequently re-ordered by a WRC, and appear today as RR No. **9.11A**). The MSS downlinks (except for AMS(R)S) are recorded as having secondary status and cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date. Another MSS system (HIBLEO-4/HIBLEO-X) is filed in this band. The HIBLEO-4 system has a small frequency overlap for which coordination with the HIBLEO-2 system has not occurred (see § 3.3). The filings of HIBLEO-2 pre-date those of HIBLEO-4 and HIBLEO-X, and thus the HIBLEO-2 uplinks are afforded protection from interference from HIBLEO-4/HIBLEO-X. Any new MSS system will have to successfully coordinate, taking into account the above mentioned procedures, with this ITU filing to be able to begin operations in this frequency band.

Some GSO satellite networks have been notified for the frequency band 1 610-1 626.5 MHz for MSS (Earth-to-space) and recorded in the MIFR under RR No. **11.41**. The assignments recorded under RR No. **11.41** must not cause harmful interference to any assignments which was the basis of the unfavourable finding. However, the MSS (space-to-Earth) allocation has a secondary status in RR Article **5**, and cannot directly claim protection from harmful interference caused by GSO MSS (Earth-to-space) assignments of other systems, assuming that the GSO network could operate without causing interference into non-GSO MSS Earth-to-space assignments with an earlier date of priority.

The view was expressed that, because the HIBLEO-2 filing predates those of other MSS networks and because the subscriber units transmit and receive in the same frequency band (Time Division Duplex), the secondary downlinks do not suffer harmful interference due to protection afforded to the primary uplinks in the 1 616-1 626.5 MHz range. To illustrate this point, Fig. 5 shows a potential interference scenario, in which an MSS interference source (an MES in another MSS system) is transmitting on a frequency overlapping with the HIBLEO-2 recorded assignments. The “interference source” must protect the operation of HIBLEO-2 in the Earth-to-space direction (MSS primary allocation) under the Radio Regulations, due to the recording of that system in the Master Register – shown as interference path #1 in the Figure. It is a well-established coordination approach for mobile satellite systems to use frequency segmentation in order to have two MSS systems coexist within the same geographical areas. This is because the majority of MSS terminals offer minimal antenna discrimination towards other MSS satellites with visibility towards the MSS terminal's location. As such, by protection of the HIBLEO-2 frequency assignments in the Earth-to-space direction, in other words by providing protection on HIBLEO-2 assigned frequencies, the “interference source” will

simultaneously provide some protection to the same frequency assignments in the space-to-Earth direction (MSS secondary allocation) – shown as interference path #2 in Fig. 5.

FIGURE 5
Depiction of non-GSO MSS systems interference scenario



A second view was expressed that since synchronization and the channel assignments mentioned above are managed by the satellite, it is vital for the function of user terminals that the downlink can be received without interruption, something that cannot be ensured within a secondary allocation, in particular if the operation of this satellite system downlink has a status of “non-interference, non-protection” vis-a-vis any primary service within the same band and in adjacent bands. In order to reflect the new GMDSS frequencies in the Radio Regulations, the frequency band to be used by this system must be entered into RR Appendix 15. Taking into account the special measures required ensuring the freedom from harmful interference and the secondary allocation in the Radio Regulations, a secondary allocation is not compatible with a safety service like the GMDSS.

4.2 Radio astronomy service (RAS)

The radio astronomy service (RAS) in the 1 610.6-1 613.8 MHz band had reported, starting in 1998, experiencing harmful interference from MSS operations in the adjacent band 1 613.8-1 626.5 MHz, despite the application of RR No. 5.372. This interference has been reported to the ITU^{2,3}, and is also documented in ECC Reports (171 and 226⁴). It has also been reported by the responsible

² See [WRC-15, Report of the Director on the activities of the Radiocommunication Sector, Addendum 1, No. 7.4.2.3.](#)

³ See [ITU-R RRB 17.1 Document \[2\].](#)

⁴ ECC Report 171: <http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP171.PDF>.
ECC Report 226: <http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP226.PDF>.

administration⁵ that measures⁶ have been taken that, in its view, will resolve the interference. Measurements by a satellite monitoring station participating in the international monitoring system⁷ to verify the effectiveness of these measures are ongoing.

With regard to the above, Resolution **359 (WRC-15)** invites *WRC-19* to consider the protection of the RAS in accordance with RR No. **5.372** as provided in *recognizing e*). Some administrations have already applied domestic regulatory measures to protect the radio astronomy service in the frequency band 1 610.6-1 613.8 MHz.

4.3 Aeronautical mobile-satellite (Route) service (AMS(R)S)

The band 1 610-1 626.5 MHz is also allocated on a primary basis to the AMS(R)S, through RR No. **5.367** subject to the coordination provisions of RR No. **9.21**. The International Civil Aviation Organization (ICAO) has adopted Standards and Recommended Practices (SARPs) for providing AMS(R)S in the 1 610-1 626.5 MHz band. The HIBLEO-2 system operates aeronautical safety services within its authorized frequency band of operation.

RR No. **5.368** appears to be inconsistent with other provisions in this band, and implies that the frequency band 1 610-1 626.5 MHz is not intended to be used for a safety service under RDSS and MSS and cannot be subject to special protection from harmful interference under RR No. **4.10**. However, RR No. **5.367** states: “The frequency band 1 610-1 626.5 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. **9.21**”. Article **1** (No. **1.36**) of the Radio Regulations defines AMS(R)S as “an aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flights primarily along national or international civil air routes”. It should be noted that the ICAO recognizes HIBLEO-2 as a satellite system supporting this service.

Modification of RR No. 5.368 may be considered necessary to ensure suitable regulatory protection for GMDSS operation through application of RR No. 4.10 to GMDSS operations within the MMSS.

4.4 Aeronautical radionavigation service (ARNS)

RR No. **5.364** references the Aeronautical Radionavigation service (ARNS) allocation (on a primary basis) in the band 1 610-1 626.5 MHz. RR No. **5.364** states:

“Stations of the mobile-satellite service shall not claim protection from stations in the aeronautical radionavigation service, [and] stations operating in accordance with the provisions of No. **5.366**”; No. **5.366** refers to reservation of the band “on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities”.

According to these provisions, the earth stations of the MSS system cannot claim protection from electronic aids for radionavigation referred to in RR No. **5.366**.

Before 1987, this band was allocated on an exclusive basis to ARNS. At ORB-87 (a world conference focussed on the revision of satellite allocations and regulations) a new allocation was added for the radio-determination satellite service (RDSS) in the band 1 610-1 626.5 MHz. An allocation to the MSS was added at WARC-92.

⁵ See [Attachments 4, 6, 7, 8, 9, 10 and 11 of RRB 17.1 Document \[2\]](#).

⁶ See [ITU-R RRB 17.1 Document \[5\]](#).

⁷ See No. **20.12** for the ITU list of international monitoring stations.

Deployment of ARNS would require ICAO to develop SARPs and approve ARNS systems. At this juncture, ICAO has not been approached to develop SARPs for ARNS in the subject band. Consequently, there are no ARNS operations in the 1 610-1 626.5 MHz band. And with AMS(R)S operating in the band pursuant to ICAO SARPS, for the foreseeable future aviation experts do not envision ARNS entering the band.

4.5 Fixed service (FS)

RR No. **5.359** provides an additional allocation to the fixed service, in a number of frequency bands including within the band 1 610-1 626.5 MHz. A view was expressed that this provision could potentially prevent the protection of GMDSS from harmful interference to MSS earth stations or space stations.

RR No. **5.359** (adopted before WARC-92) states: “*Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in these frequency bands*”. Review of the ITU MIFR reveals that there are fewer than five such FS stations that have been registered with the ITU worldwide by the countries mentioned in RR No. **5.359**. Although there may be unregistered fixed stations in operation, FS use of the 1 610-1 626.5 MHz band is thought to be light. In any event, there have been no reported issues among MSS operations and FS operations in the band, and the interference potential between MSS and FS is low.

4.6 Radiodetermination-satellite service (RDSS)

The RDSS has different RR provisions in the three ITU radio regulatory regions:

In Region 1 the only provision is RR No. **5.369** for the bands 1 610-1 626.5 MHz. This provision provides for RDSS in the listed countries on a primary basis in the Earth-to-space direction subject to agreement with countries not included in the footnote under RR No. **9.21**.

In Region 2 the RDSS is allocated on a primary basis.

In Region 3 RDSS is allocated on a secondary basis except for those countries which are listed in RR No. **5.369**.

4.7 Adjacent band assignments

The adjacent band 1 626.5-1 660.5 MHz is used for uplinks from mobile earth stations (MESs) by several GSO MSS networks around the world. This use includes the operation of MESs on ships, aircraft and on land. The lower part of this band, 1 626.5-1 645.5 MHz, is identified for use within the GMDSS in RR Appendix **15 (Rev.WRC-15)** (see Table 15-2) and accommodation of the spectrum requirements for the GMDSS in this band is afforded priority in coordination through RR No. **5.353A**. This band is used by one GSO mobile satellite system to provide services as part of the GMDSS, in accordance with IMO requirements. In addition, the band 1 626.5-1 645.5 MHz is used by non-SOLAS ships for safety related services such as priority call access to maritime rescue co-ordination centres. Ship earth stations operating in this band are also used for non-safety related communications which are important to the operation of the ship.

This current and evolving use of the band 1 626.5-1 660.5 MHz in the maritime community for GSO MSS uplinks is a potential source of interference to non-GSO ship earth stations which receive in the adjacent band 1 613.8-1 626.5 MHz. Interference could be caused due to the unwanted emissions of the transmitting GSO MES being received by the non-GSO ship earth station, or by the emissions of the transmitting GSO MES operating in adjacent bands which could result in signal overload the non-GSO ship earth station receiver. However, these systems have been in operation for some time and measures are available such that such interference is prevented, including when a GSO and non-GSO MES are installed on the same ship, or where ships operate in close proximity.

Non-GSO MES terminals planning to offer GMDSS services in the 1 616-1 626.5 MHz band should be designed and installed in such a manner as to tolerate the potential for interference from existing GSO terminals operating in the band 1 626.5-1 660.5 MHz. Representative technical characteristics for geostationary MSS systems operating in the band 1 626.5-1 660.5 MHz is provided in Recommendation ITU-R M.1184-3 – Technical characteristics of mobile satellite systems in the frequency bands below 3 GHz for use in developing criteria for sharing between the mobile-satellite service and other services. Measures are available to ensure compatible operations with existing GSO MES terminals operating in adjacent bands. Examples are: (a) provision of adequate system link margin in the design of non-GSO GMDSS compliant terminals, (b) ensuring the non-GSO GMDSS receivers are not desensitised from operation of GSO MES terminals operating in adjacent bands, (c) including adequate carrier separation of the non-GSO MSS system to 1 626.5 MHz if necessary, (d) measures taken by the terminal manufacturer to mitigate any interference through design and through equipment performance standards, and (e) guidelines for the installation of terminals on ships.

It is noted that the IMO Maritime Safety Committee (MSC) adopted Resolution MSC.434(98)⁸ which *inter alia* recommends: “In case of multiple ship earth stations operating on adjacent frequency bands, the antenna should be installed such as to ensure electromagnetic compatibility”.

4.8 Radio Regulations Appendix 15 (Rev.WRC-15) - Frequencies for distress and safety communications for the Global Maritime Distress and Safety System (GMDSS)

RR Appendix 15 (Rev.WRC-15) identifies all frequencies used for distress and safety communications by the GMDSS; Table 15-2 shows all frequencies above 30 MHz, including some used to provide satellite GMDSS. Currently, this table does not include the band 1 616-1 626.5 MHz.

The addition of this band to Table 15-2 may be necessary to ensure adequate recognition of its use for GMDSS.

Radio Regulations No. 31.2 states that any emission causing harmful interference to distress and safety communications on any of the *discrete* frequencies identified in RR Appendix 15 is prohibited. The note of Table 15-2 states that any emission capable of causing harmful interference to distress, alarm, urgency or safety communications on the frequencies denoted by an asterisk (*) is prohibited.

However, this provision does not apply to frequency ranges (see section 4.1). For example, the bands 1 530-1 544/1 626.5-1 645.5 MHz used by the current GSO GMDSS provider are identified by frequency allocation, and hence are not subject to RR No. 31.2. Frequency ranges used by additional satellite GMDSS providers recognized by the IMO may be included in the same manner.

A view was expressed that, by inserting the band 1 616-1 626.5 MHz into RR Appendix 15, the protection that would be provided by RR No. 31.2 to this band would effectively mean that those frequencies have to be treated as having a primary status, and would therefore cause inconsistencies with the coordination procedures.

A second view was expressed that inclusion of a secondary allocation into RR Appendix 15 provides no change in its allocation status.

5 Regulatory considerations for GMDSS

To support the provision of a GMDSS capability as described above a few regulatory modifications to the Radio Regulations may be considered, which are described in the CPM Report to WRC-19.

⁸ Para 5.6 of the Annex to IMO Resolution MSC.434(98), “Performance Standards for a Ship Earth Station for use in the GMDSS” (adopted Jun 2017).

6 Summary

This Report analyses the regulatory provisions that apply to a non-GSO MSS system for which the IMO recently recognised for inclusion in the GMDSS.
