



Iridium Satellite LLC

White Paper

Long Range Identification and Tracking of Ships Messaging Protocol
Standards Definition

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Revision History

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1.1	November 10, 2008	LRIT Message Types Section 2.8 added Updates to Filed Definitions in section 2.9.1

Disclaimer

Iridium Satellite LLC reserves the right to modify or change information detailed herein at any time without notice, and does not make any commitment to update the information contained herein.

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1 DOCUMENT PURPOSE, DEFINITIONS, BACKGROUND AND GENERAL LRIT INFORMATION

Long Range Identification and Tracking is a mandated requirement for all SOLAS class vessels under the provisions of the International Maritime Organization regulation V/19-1 of the International Convention of Safety of Life At Sea, 1974 as amended . [SOLAS class vessels are vessels which are required to conform to particular Safety Of Life At Sea requirements as defined by the IMO. This basically includes passenger ships, cargo ships above 300 gross tons and mobile offshore units engaged in international voyages.] The basic requirement for ships to comply with the LRIT mandate is for the ship to automatically send its geographic location information to a database, operated by the Administration under which the vessel is Flagged, once every six hours. Authorized users such as national coastguards may request the position information using an agreed framework that connects and controls all information in the Flag Administration databases.

1.1 Purpose

This document has a number of purposes including:

- The coordination of all parties involved in providing end-to-end working LRIT solutions over the Iridium system.
- Definition of a single LRIT message format or standard for all Iridium based LRIT solutions.
- Iridium specific certification requirements for approval of an Iridium/LRIT Device.
- Information for Flag States, Application Service Providers, Data Centers, and others who want to understand how to use Iridium for LRIT.
- Providing reference information for Iridium Value Added Resellers and Value Added Manufacturers to implement Field Applications that are compliant with a single standard Iridium Long Range Identification and Tracking messaging protocol as defined in this document.

This document does not exhaustively document the relevant IMO reference documents. Readers are advised to obtain such documents separately in addition to this document.

1.2 Key Terms

The following terms are used within this document:

- “ASP” means an *Application Service Provider* (as defined by the *LRIT Performance Standard*).
- “Contracting Party” means a Contracting Party to SOLAS.
- “CSP” means a *Communications Service Provider* (as defined by the *LRIT Performance Standard*). In the context of this document the CSP is Iridium.
- “Data Center” means a *Data Center* of any type defined by the *LRIT Performance Standard*. Data Centers are operated by, or on behalf of, Contracting Parties.
- “Flag Administration” means a Contracting Party operating a ship registry. Flag Administrations are responsible for ensuring ships flying their flag comply with IMO regulations pertaining to LRIT.
- “GNSS” means Global Navigation Satellite System – a standard term for satellite navigation systems providing autonomous geo-spatial positioning with global coverage.

- “GPS” means Global Positioning System – a type of GNSS.
- “IDE” means International Data Exchange
- “IMO” means the *International Maritime Organization*
- “IMO Number” means the IMO Ship Identification Number as defined by IMO Regulation XI-1/3 and IMO Assembly resolution A.600(15) on IMO ship identification number scheme.
- “Iridium” means the constellation of 66 low-Earth orbit satellites operated by Iridium Satellite, LLC; providing continuous, low latency, satellite data services on a global basis, including Sea Area A4.
- “Iridium/LRIT Device”. LRIT *Shipborne Equipment* that complies with all of the following: the *Performance Standard*, Iridium’s Requirements for SBD devices and the technical standards defined in this document.
- “LRIT” means *Long-Range Tracking and Identification*; as defined by SOLAS Chapter V Regulation 19-1.
- “MSC” means the *Maritime Safety Committee* of the IMO.
- “Performance Standard” means MSC resolution MSC.263(84). This resolution should be consulted for a full understanding of LRIT terminology and functional requirements.
- “Polar Regions” means Sea Area A4 as defined by the IMO.
- “SBD” means *Short Burst Data*, an Iridium specific packet data service.
- “Shipborne Equipment” means the equipment carried by a ship to participate in LRIT. Such equipment must comply with the *Performance Standard* and also be “Type Approved” by the relevant flag administration.
- “SOLAS” and “SOLAS Convention” mean the *International Convention for the Safety of Life at Sea, 1974, as amended*.
- “Standard-C” means a de-facto industry standard protocol for position reporting services implemented by several satellite providers, equipment vendors and software providers.
- “VAM” means an Iridium *Value Added Manufacturer*. (Or potentially a Value Added Reseller, however in the context of LRIT, a VAM or VAR manufactures one or more *Iridium/LRIT Devices*.)
- “VAR” means an Iridium *Value Added Reseller*. This is analogous to the term “ASP” within the *Performance Standard*.

1.3 Scope

This document provides technical specifications for those components of the LRIT system that are integrated with the Iridium satellite network to provide an end-to-end LRIT shipboard solution. Specifically, the:

- LRIT Shipborne Equipment
- LRIT Communication Service Provider
- LRIT Application Service Provider (or LRIT Data Center where this incorporates an ASP)

1.3.1 Audience

The intended audience for this document is:

- Iridium Value Added Manufacturers: seeking to introduce Iridium/LRIT Device(s) to the marketplace.

- Application Service Providers and Data Center operators (when incorporating an ASP). seeking to use Iridium airtime to provide LRIT compliant solutions for specific Flag Administrations.
- Flag Administrations: This document provides technical information suitable for the evaluation and Type Approval of Iridium for LRIT. Of particular note to Flag Administrations is that Iridium network is the only network that can offer a compliant solution for Polar Regions. Ships operating at high latitudes may lack effective coverage from geostationary satellite providers. Within the Polar Regions Iridium is the only network that can provide LRIT compliant service. Iridium offers the only truly global coverage suitable for LRIT - and thus it may be necessary to utilize Iridium based solutions to ensure all ships are compliant with LRIT.

1.3.2 Document Structure

The structure of this document is as follows:

- Section 1 provides an overview of the LRIT system and how Iridium provides LRIT services within that framework.
- Section 2 provides detailed technical specifications of the protocols and standards implemented by *Iridium/LRIT Devices*. All devices providing LRIT via Iridium are required by Iridium to comply with these minimum standards. Devices that do not comply will not be certified by Iridium as Iridium/LRIT Devices.

1.4 Disclaimer

Reasonable effort has been made to develop this information and include appropriate background and source material relative to LRIT. However in confirming product and service features and functions the original IMO regulations documents should be consulted and in the event of an inconsistency the IMO regulations should be used as the authoritative source.

1.5 Regulatory Background to LRIT

The requirements for LRIT are driven by the regulations developed by IMO. Knowledge of the regulations is key to understanding the requirements.

1.5.1 The International Maritime Organization

The *International Maritime Organization* (IMO) has adopted Regulation 19-1 as an amendment to the *Safety of Life at Sea Convention Chapter V*. Regulation V/19-1 provides for a *Long-range tracking and identification system for ships*.

LRIT will provide global real-time data on ship locations, at variable intervals from 15 minutes to 6 hours, via satellite transmissions from shipborne equipment.

LRIT is scheduled to commence operation on January 1st 2009 for all sea areas except Sea Area A4 and in Sea Area A4 on July 1st 2009. On these dates LRIT becomes

applicable to SOLAS ships. Additional phase in periods apply based on the date of ship construction and operating area.

SOLAS Regulation V/19-1 provides for the ongoing development of LRIT by the *Maritime Safety Committee* (MSC) of the IMO.

1.5.2 Maritime Safety Committee (MSC)

MSC has adopted several resolutions pertaining to LRIT.

Most relevant are those defining the LRIT *Performance Standard*¹. The Performance Standard defines functional requirements for each component of the LRIT system, along with general security, latency, and interfacing requirements applicable to all LRIT components.

Additionally MSC convened ad-hoc working group(s) to draft detailed LRIT technical standards. For a complete understanding of the operation of LRIT the reader is referred to the reports of the ad-hoc LRIT working groups².

1.5.3 Iridium Satellite LLC

In context of LRIT, the Iridium network is defined as a *Communications Service Provider* (CSP). The Iridium network meets or exceeds all IMO requirements specifically pertaining to a CSP.

In particular:

MSC.210(81) 4.3 “*The shipborne equipment should transmit the LRIT information using a communication system which provides coverage in all areas where the ship operates*”.

MSC.210(81) 6.1 “*Communications Service Providers (CSPs) provide services which link the various parts of the LRIT system using communications protocols in order to ensure the end-to-end secure transfer of the LRIT information. This requirement precludes the use of non-secure broadcast systems.*”

Iridium provides a low latency, highly reliable and commercially confidential transmission mechanism for LRIT Data. These features are required in order for *Application Service Providers* (ASPs) and *Data Centers* (DCs) to fulfill their obligations under SOLAS V/19-1 and as defined within the LRIT *Performance Standard*.

Iridium provides services globally including open oceans and the poles. It offers particular advantages when tracking ships operating in high latitudes (above 70 degrees North or South). In these geographic areas Iridium is the preferred, and in some cases may be the only, CSP able to satisfy the requirements of the LRIT *Performance Standard*.

The Iridium satellite constellation consists of 66 operational satellites and a number of spares. The satellites are organized into six orbital planes and are in near polar orbit at an altitude of 780 Km above the earth. The constellation architecture ensures that every location on the globe is covered by at least one satellite at all times.

The Iridium network offers a packet data type service that is well suited to the requirements of LRIT, known as Short-Burst-Data (SBD) service. SBD serves as the basis of Iridium’s LRIT Standard. For further information on SBD, and its capabilities, please refer to:

¹ Resolution MSC.263(84)..

² In particular MSC84/6/11, MSC 83/WP.6/REV1 and MSC83/6/1

- Public information: <http://www.iridium.com>
- Information for Iridium VARs and VAMs: <http://developer.iridium.com>
 - Note access is restricted to authorized customers only.

1.5.4 Reference Documents

The following documents developed under the direction of the Maritime Safety Committee of the IMO should be consulted as appropriate:

- Resolution MSC.263(84) – Revised Performance Standards and Functional Requirements for the Long Range Identification and Tracking of Ships.
- MSC_1 Circular 1257 Guidance on Survey and Compliance of Ships required to transmit LRIT information

1.6 Iridium/LRIT Implementation

The Iridium/LRIT standard meets all technical and regulatory requirements of the IMO. In addition, the Iridium LRIT standard represents an attractive option for all parties involved in implementing Iridium based LRIT. This section discusses the advantages of including Iridium within an LRIT strategy and steps to streamline its introduction.

1.6.1 Ship Owners

Ship owners have the responsibility to purchase, install, and maintain LRIT shipborne equipment.

Typical decision points for a ship owner are provided here for the benefit of Value Added Manufacturers (VAMs) developing Iridium/LRIT Devices for the merchant maritime market:

- The equipment must meet all IMO LRIT requirements and be Type Approved (at least by all Flag Administrations that the shipping company anticipates operating under). It is expected that Type Approval will not be as stringent for LRIT equipment as it is for GMDSS equipment.
- The equipment must be ruggedized for a marine environment with an operational life expectancy in excess of 10 years.
- The process for Iridium SBD Service activation and transfer of equipment is well defined. This includes transfer on sale of a ship and/or when a ship changes flag. When a ship changes Flag Administration, the geographic location information from the Iridium/LRIT Device must be sent to the new Administration in as seamless a manner as possible, while complying with IMO requirements. The process should minimize administrative overhead. The actual process still remains unclear. Clear instructions from the Flag Administrations have yet to be defined.
- The equipment must have the ability to be turned off or put into a “reduced reporting” mode (where the reporting interval is switched to once per day). The Flag Administration is required to be “notified” of these events. IMO does not standardize the mechanism but this document specifies it for consistency of operation. It is understood that the preference for changing to a reduced reporting mode be carried out by the ASP of the Flag State using an over the air command and that the change not being made directly or physically to the Iridium/LRIT Device on the ship. It is

defined that the ship's Master must make the request to the Flag Administration to enter or exit the 'reduced reporting' mode with appropriate verifiable reasons.

- It is customary for maritime safety equipment to have 3rd party certification from a reputable source. For LRIT it is understood that the ASP for a particular Flag Administration will have the authority for type approval of LRIT equipment. Ship owners can purchase Iridium/LRIT equipment confident that it complies with relevant IMO requirements and is approved for use by specific Flag Administrations.

1.6.2 Shipborne Equipment Manufacturers

All manufacturers of Iridium/LRIT Device(s) must first be contracted either as an Iridium Value Added Manufacturer (VAM) or Value Added Reseller (VAR) (Collectively referred to as VAMs from hereon.) For further information on this process please refer to:

- LRIT@iridium.com

Every Iridium/LRIT Device is required to successfully complete an Iridium specific certification process. This incorporates testing based on the Technical Standard comprising Section 2 of this document. Testing may be requested by contacting LRIT@iridium.com. Additional testing or type approval by the ASP for the Flag State may also be necessary and such testing is the responsibility of the VAM.

Once a device completes testing, Iridium will grant an Iridium/LRIT Device certification letter. Only Iridium/LRIT certified devices may be promoted, sold, and used for LRIT purposes in conjunction with the Iridium network. For a list of such approved devices, contact LRIT@iridium.com. Devices marketed without such certification are unauthorized by Iridium for LRIT. This step is necessary to assure Flag Administrations (who approve Iridium) and Ship Owners (who purchase Iridium devices) that their equipment, software and services will work seamlessly together.

It should be noted that Iridium/LRIT Devices must be commercially available in time to allow purchase decisions and installation before LRIT commences operation on 1-Jan-2009. Time is therefore of the essence for VAMs wishing to produce Shipborne equipment for LRIT use.

The Iridium/LRIT standard reflects a specific focus on interoperability. Interoperability is an expected norm within the Maritime community, for example with maritime charting, safety, communications, and safety/search-and-rescue equipment. Other IMO defined services that operate in similar areas to LRIT, such as the Automatic Identification System (AIS) and Global Maritime Distress and Safety System (GMDSS), also allow for a mixture of Shipborne and coastal equipment sourced from different vendors.

This Iridium LRIT standard provides assurances that a similar level of interoperability will exist in relation to Iridium/LRIT Devices; namely that the Shipborne equipment will work transparently with any LRIT Data Center or LRIT ASP that approves Iridium. Any alternative approach would require each VAM to approach all Flag Administrations separately for certification (and potentially each Data Center or ASP). The resulting plethora of protocols would make it unattractive for a Flag Administration to incorporate Iridium and could generally preclude certification of Iridium and Iridium/LRIT Devices.

When marketing an Iridium/LRIT Device a Developer should anticipate being asked for proof that their equipment is LRIT compliant, and recognized as such, by the relevant Flag Administration(s). Adopting this Iridium/LRIT standard allows a Developer to leverage Iridium's efforts in seeking Type Approval for LRIT from major Flag Administrations.

1.6.3 Application Service Providers & Data Center Operators

To utilize Iridium LRIT services, a Data Center must receive LRIT Data from ships transmitting via the Iridium satellite network.

A Data Center may accomplish this directly, or by using an Application Service Provider (ASP). LRIT Application Service Providers or Data Centers are required to become an Iridium VAR in order to provision appropriate Iridium services for the ships transmitting LRIT information over the Iridium network. For further information on this process please refer to:

- LRIT@iridium.com

This Iridium/LRIT standard has specific features to streamline the process of integrating Iridium; in particular an emphasis on following de-facto industry standards.

Section 2 provides detailed information on the integration process.

1.6.3.1 Note on Existing or planned proprietary maritime position reporting solutions

Iridium VARs may have developed commercial tracking systems for a variety of reasons. However the *Performance Standards*, MSC263(84), specifically require that the LRIT data from the ship travel directly from the Communications Service Provider (i.e. Iridium) to the ASP. It is not possible for a VARs own data center to supply LRIT information to an ASP.

1.6.4 Flag Administrations

Flag Administrations are responsible for the airtime costs associated with the operation of the LRIT system (through contracts with Data Center and/or Application Service Providers).

Iridium offers very competitive rates for LRIT airtime. By incorporating Iridium into the list of Type Approved devices a Flag Administration can comply with all geographic coverage requirements of LRIT including Sea Area A4 which is not covered by other networks. Additionally, Iridium's equipment costs are generally significantly less than similar equipment on other satellite networks.

Iridium will certify that a VAM's Iridium/LRIT Device is compliant with the protocol outlined in Section 2.0. Specific Type Approval of the Iridium/LRIT Device should follow specific Flag Administration requirements and procedures for LRIT equipment.

Integration of Iridium/LRIT devices with the Flag Administration's Data Center is very straightforward using Iridium's standard delivery interfaces via email and IP Socket connections.

1.7 Provisioning and Transfer of Iridium/LRIT Devices

SOLAS V/19-1 requires that ships report to the Data Center designated by the Flag Administration for the ship (via an Application Service Provider where appropriate). The transfer of the data is controlled by the Iridium provisioning process. The process for activating and deactivating Iridium/LRIT Devices is based on standard processes for activating any Iridium SBD device.

As ships often change flag the recipient of the LRIT data for a given ship may change at the same time. In such a case timely deactivation of the Iridium/LRIT Device by the

current ASP is necessary for timely reactivation by the new ASP for the new Flag Administration to receive timely LRIT information.

Iridium will work directly with ASPs that have signed agreements with Iridium to implement a process to enable timely transfer of Iridium/LRIT Devices from one ASP to a new ASP subject to appropriate documentation being available.

1.7.1 ASPs as Iridium Value Added Resellers

For the purposes of LRIT Iridium will sign service agreements with ASPs. Such agreements would result in the ASP becoming an Iridium Value Added Reseller or VAR in Iridium parlance.

Internally, Iridium operates a provisioning system known as SPNET. This is a web based system used for activating, deactivating and suspending units. Each VAR is given access to SPNET and conducts its own provisioning. Each Flag State Administration's ships are provisioned by the designated ASP in a separate and specific Flag State account on SPNET. There shall be no co-mingling of different Administrations registered ships in the same SPNET account.

An Application Service Provider (ASP) or Data Center (DC) appointed by a Flag Administration must notify Iridium of its appointment. Iridium can be contacted via LRIT@iridium.com. The entity must be an Iridium Value Added Reseller and have established billing arrangements with Iridium.

Proof of authorization to act for the Flag Administration is required by Iridium from the ASP or DC. This must be in the form of a duly authorized original letter from the Flag Administration appointing the VAR to receive LRIT Data.

Upon confirmation that an application is valid, Iridium will provide access to the SPNET account for the particular Flag State to the ASP (or Data Center). The ASP is then responsible for configuring the units in SPNET to send LRIT data for all ships to the relevant computer system. The VAR will receive LRIT Data and may alter the reporting interval or poll Iridium/LRIT Devices of that flag in accordance with the protocol defined in Section 2.

All airtime billing from Iridium will be to the account of the appropriate VAR.

A VAR wishing to withdraw its LRIT VAR status must notify Iridium in writing with at least 30 days notice. The request should state the Flag Administration(s) the removal request pertains to. The VAR remains liable for all airtime until the request is received and acknowledged by Iridium.

Iridium identifies each transceiver unit by its IMEI number (International Mobile Equipment Identity). The IMEI is a permanent identification number that cannot be changed.

1.7.2 Flag Administrations

As stated in MSC.263(84) Paragraph 1.4:

"Each Administration should provide to the LRIT Data Centre it has selected, a list of the ships entitled to fly its flag, which are required to transmit LRIT information, together with other salient details and should update, without undue delay, such lists as and when changes occur. Ships

should only transmit the LRIT information to the LRIT Data Centre selected by their Administration."

On this basis the VAR will be provided with an updated list of ships entitled to fly the flag of any Administration(s) that it acts on behalf of. A Flag Administration should ensure its Data Center has the relevant list of ships and information sufficient to make clear that the Ship is using Iridium as its Communications Service Provider (CSP).

1.7.3 Activation

Iridium/LRIT Devices are sold by VAMs, either directly or through whatever channel or reseller network the VAM elects to use. It is recommended that ASPs select a preferred vendor in order to minimize overhead costs of maintaining relationships with more than one vendor. However there is no requirement to do so.

After installation on-board a ship, the VAM or ship's Master must report the following information to the correct VAR (ASP), for the Flag Administration under which the ship is registered, to enable the VAR (ASP) to properly activate the device:

- Serial Number of the Equipment – IMEI number
- IMO Number of the Ship
- Current Flag of Registration of the Ship

The VAR will use the Iridium SPNET provisioning tool to complete the activation step based on the IMEI number.

1.7.4 Deactivation

When a ship owner becomes aware that a specific ship no longer wishes to use an Iridium/LRIT Device it should notify the correct VAR (ASP) for the current Flag Administration in order for the device to be deactivated for LRIT tracking.

The following information must be supplied:

- Serial Number of the Equipment – IMEI Number
- IMO Number of the Ship
- Current Flag of Registration of the Ship (if known)

The VAR will use the Iridium provisioning tool to complete the deactivation step.

1.7.5 Repair or Replacement of Equipment

When an Iridium/LRIT Device is changed or replaced, the old IMEI is replaced with the new IMEI in SPNET using the standard IMEI swap process for SBD transceivers. This process is preferred as it maintains all other aspects of the provisioning, such as destinations for delivery of LRIT messages.

At any point in time one Iridium/LRIT Device can be registered against a given IMO Number. Duplicate or multiple registrations are not acceptable. The VAR is responsible for maintaining a single registration per IMO Number.

1.7.6 Change of Flag

In the normal course of business a ship may change from one Flag State administration to another. When a VAR (ASP) receives a request to change to a different Flag Administration, the two relevant VARs (ASPs) must initiate the request to transfer an Iridium LRIT/Device from the original flag to the new one. An Iridium SBD unit can only be provisioned under one account at any one time.

In order to change Flags, the currently provisioned unit must first be deactivated by the current ASP before it can be reactivated under a new Flag's ASP.

If the VAR happens to provision for more than one Flag Administration, it must ensure that the unit is provisioned in the correct account

1.7.6.1 **Request for Transfer**

When a ship requests Transfer from one Flag to another, the ship must request the transfer from the VAR currently providing the Iridium service for the current Flag Administration to the new Flag Administration. The ship should also contact the VAR for the new Flag Administration to request activation under that Flag. The ship should provide the following information:

- IMO Number of the Ship
- New Flag Administration
- Current Flag Administration
- IMEI of transceiver

The VAR for the current Flag Administration confirms the information from the Ship and deactivates the ship from that Administrations account on Iridium.

The VAR for the current Flag Administration then forwards the Ship information to the new VAR for the new Flag Administration and confirms to the new Flag Administration that the Ship's Iridium/LRIT equipment is ready for re-activation.

The VAR for the new Flag Administration, verifies the ship information and that the current Flag Administration has deactivated the Iridium/LRIT equipment. The VAR then re-activates the Iridium/LRIT Device and directs the LRIT information to the new destination.

If a transfer is requested but the ship has not been released by the former flag, a request will be generated to both ASPs asking for review of the status of the ship (to prompt the correct ASP to release the ship if it has indeed changed flag).

2 IRIDIUM LRIT STANDARD MESSAGE FORMAT

2.1 Version

Iridium LRIT Standard 1.0.0

2.2 Standards Incorporated by Reference

- The Iridium LRIT Standard has been developed in compliance with IMO requirements from SOLAS V/19-1 and the LRIT *Performance Standard*. It is assumed that readers are familiar with these documents and related LRIT working group papers produced by the Maritime Safety Committee (MSC) of the IMO.
- The Iridium LRIT Standard is based on the Short-Burst-Data (SBD) service offered by Iridium. It is assumed that readers are familiar with the detailed technical operation of the SBD service and the Iridium network.

2.3 SOLAS Chapter V Regulation 19-1 Requirements

The following requirements pertaining to LRIT shipborne equipment are given in SOLAS Chapter V Regulation 19-1.

Paragraph 1.5, in relevant part, requires that:

“... ships shall automatically transmit the following long-range identification and tracking information:

- .1 the identity of the ship;*
- .2 the position of the ship (latitude and longitude); and*
- .3 the date and time of the position provided”*

Paragraph 1.6; requires that:

“Systems and equipment used to meet the requirements of this regulation shall conform to performance standards and functional requirements⁽⁴⁾ not inferior to those adopted by the Organization. Any shipboard equipment shall be of a type approved by the Administration.

⁽⁴⁾ Refer to the Performance standards and functional requirements for the long-range identification and tracking of ships, adopted by the Maritime Safety Committee of the Organization by resolution MSC.210(81).”

Paragraph 1.7; requires that:

"Systems and equipment used to meet the requirements of this regulation shall be capable of being switched off on board or be capable of ceasing the distribution of long-range identification and tracking information:

.1 where international agreements, rules or standards provide for the protection of navigational information; or

.2 in exceptional circumstances and for the shortest duration possible where the operation is considered by the master to compromise the safety or security of the ship. In such a case, the master shall inform the Administration without undue delay and make an entry in the record of navigational activities and incidents maintained in accordance with regulation 28 setting out the reasons for the decision and indicating the period during which the system or equipment was switched off."

Paragraph 14; states that:

"The Maritime Safety Committee shall determine the criteria, procedures and arrangements for the establishment, review and audit of the provision of long-range identification and tracking information to Contracting Governments pursuant to the provisions of this regulation."

2.4 LRIT Performance Standard Requirements

MSC.210(81), as amended by MSC.254(83) and subsequently completely replaced by MSC.254(84), provides that all LRIT shipborne equipment should meet certain minimum requirements and that *Communications Service Providers* (CSPs) and *Application Service Providers* (ASPs) should meet certain minimum requirements in the transfer and handling of the LRIT Data.

Please Note: All references within the LRIT Performance Standard that use the term “should” are to be considered mandatory when applied here in the context of the Iridium LRIT Standard.

Relevant Requirements from the LRIT Performance Standard are:

Paragraph 4.1:

“In addition to the general requirements contained in Assembly resolution A.694(17) on Recommendations on general requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids, the shipborne equipment should comply with the following minimum requirements:

- .1 be capable of automatically and without human intervention on board the ship transmitting the ship’s LRIT information at 6-hour intervals to an LRIT Data Centre;*
- .2 be capable of being configured remotely to transmit LRIT information at variable intervals;*
- .3 be capable of transmitting LRIT information following receipt of polling commands;*
- .4 interface directly to the shipborne global navigation satellite system equipment, or have internal positioning capability;*
- .5 be supplied with energy from the main and emergency source of electrical power⁽²⁾;*
- .6 be tested for electromagnetic compatibility taking into account the recommendations⁽³⁾ developed by the Organization.*

⁽²⁾ This provision should not apply to ships using for the transmission of LRIT information any of the radio communication equipment provided for compliance with the provisions of chapter IV. In such cases, the shipborne equipment should be provided with sources of energy as specified in regulation IV/13.

⁽³⁾ Refer to the Assembly resolution A.813(19) on General requirements for electromagnetic compatibility of all electrical and electronic ship’s equipment.”

Paragraph 4.2:

“In addition to the provisions specified in paragraph 4.1 above, the shipborne equipment should provide the functionality specified in table 1.”

TABLE 1
DATA TO BE TRANSMITTED FROM THE SHIPBORNE EQUIPMENT

Parameter	Comments
Shipborne Equipment Identifier	The identifier used by the shipborne equipment
Positional Data	<p>The GNSS position (latitude and longitude) of the ship (based on the WGS84 datum).</p> <p><i>Position:</i> The equipment should be capable of transmitting the GNSS position (latitude and longitude) of the ship (based on WGS84 datum) as prescribed by regulation V/19-1, without human interaction on board the ship.</p> <p><i>On-demand⁽¹⁾</i> position reports: The equipment should be capable of responding to a request to transmit LRIT information on demand without human interaction onboard the ship, irrespective of where the ship is located.</p> <p><i>Pre-scheduled⁽²⁾</i> position reports: The equipment should be capable of being remotely configured to transmit LRIT information at intervals ranging from a minimum of 15 min to periods of 6 h to the LRIT Data Centre, irrespective of where the ship is located and without human interaction on board the ship.</p>
Time Stamp 1	The date and time ⁽³⁾ associated with the GNSS position. The equipment should be capable of transmitting the time ⁽³⁾ associated with the GNSS position with each transmission of LRIT information.

- (1) On-demand position reports means transmission of LRIT information as a result of either receipt of polling command or of remote configuration of the equipment so as to transmit at interval other than the preset ones.
- (2) Pre-scheduled position reports means transmission of LRIT information at the preset transmit intervals.
- (3) All times should be indicated as Coordinated Universal Time (UTC).

Paragraph 4.3

“The shipborne equipment should transmit the LRIT information using a communication system which provides coverage in all areas where the ship operates.”

Paragraph 4.4:

“The shipborne equipment should be set to automatically transmit the ship’s LRIT information at 6-hour intervals to the LRIT Data Centre identified by the Administration, unless the LRIT Data User requesting the provision of LRIT information specifies a more frequent transmission interval.”

Paragraph 4.4.1:

“When a ship is undergoing repairs in dry-dock or in port or is laid up for a long period, the master or the Administration may reduce the frequency of the transmission LRIT information to one report every 24-hour period, or may temporarily stop the transmission of such information.”

Paragraph 5.3:

“An ASP function should:

- .1 provide a communication protocol interface between the Communication Service Providers and the LRIT Data Centre to enable the following minimum functionality:*
 - .1 remote integration of the shipborne equipment into an LRIT Data Centre;*
 - .2 automatic configuration of transmission of LRIT information;*
 - .3 automatic modification of the interval of transmission of LRIT information;*
 - .4 automatic suspension of transmission of LRIT information;*
 - .5 on demand transmission of LRIT information; and*
 - .6 automatic recovery and management of transmission of LRIT information;*
- .2 provide an integrated transaction management system for the monitoring of LRIT information throughput and routing; and*
- .3 ensure that LRIT information is collected, stored and routed in a reliable and secure manner.”*

Paragraph 6.1

“Communications Service Providers (CSPs) provide services which link the various parts of the LRIT system using communications protocols in order to ensure the end-to-end secure transfer of the LRIT information. This requirement precludes the use of non-secure broadcast systems.”

2.5 Latency and Response Times

The Iridium network under normal operating circumstances meets the requirements for latency and response times.

Scheduled positions reports from Iridium/LRIT equipment shall, under normal operation, take less than 1 minute to traverse from the Iridium/LRIT equipment to the Iridium network Gateway. Polled position reports and remote requests for changes to the reporting period shall take less than 5 minutes.

2.6 Network Retries

Each LRIT message should attempt to be sent up to three times by the Iridium/LRIT Device in the event that a transmission is reported by the network or transceiver to have failed to be correctly received by the Iridium Gateway.

2.7 Iridium SBD Network Interface

Iridium provides two transport or network interfaces for transferring SBD messages between the ASP and the Iridium Gateway. One is as a binary attachment to an email message and the second is using an IP Socket connection (DirectIP). ASPs are able to configure either email or DirectIP using the SPNet online provisioning tool without making modifications to the Iridium/LRIT Device. ASPs are able to provision up to five (5) different destinations per IMEI. The different destinations permit the same message to be delivered to back up servers at no additional cost.

A third party offers an Iridium network interface to Inmarsat C compatibility server capability. This could be useful to ASPs with limited resources or numbers of ships utilizing Iridium. Please contact LRIT@iridium.com if you would like further information.

2.8 LRIT Message Types

There are two general types of LRIT messages supported by Iridium; position reports and configuration messages. The LRIT position reports are generated by the vessel, either by a periodic or unsolicited event at the vessel or a command from the ASP. The position report also contains event flags which convey status and event information to the ASP. These are MO-SBD only. The configuration messages can be both MO and MT messages. The ASP sends MT configuration message sends commands and configuration information to the LRIT device. The LRIT device processes the configuration information and, if required, responds with a MO message containing the updated configuration parameters. The same data structure is used for the MO and MT configuration messages.

2.8.1 LRIT Position Report

The LRIT Position Report is used by the device to send GNSS position information and status at routine intervals, upon request or when an event occurs that indicates a possible technical failure with the unit (to assist with troubleshooting):

2.8.2 LRIT Configuration Messages

The LRIT Configuration Command is used to request the device configuration, change parameters, and/or request a polled (current) position report. When sending the command the packet can be a

minimum of two bytes; all other fields are assumed zero filled if not present. A request configuration and/or poll command are optimally efficient (2 bytes each).

2.8.2.1 **Read Device Configuration**

To read the device configuration without making changes; set the change flags to zero (SI, SO, ST, SD) and the "A" (Ack) flag to one. This will return the current settings as a Configuration Report Packet.

2.8.2.2 **Parameter Update**

To update one or more parameters; set the appropriate SI, SO, ST and/or SD flags and issue a command to the device with the appropriate fields populated and the "A" (Ack) flag set. This will update the selected configuration fields, then return the new device configuration as a Configuration Report Packet by way of acknowledgement that the changes were successful.

2.8.2.3 **Poll for Position Report**

If set to one, the "P" (Poll) flag will request the current GNSS position of the device. This will be returned as an LRIT Position Report. If only a position report is being requested, and no other changes are being made, it is acceptable to set the "A" (Ack) flag to zero. Otherwise the "A" (Ack) flag should be set to one so that the configuration change(s) can be confirmed.

2.8.2.4 **ASP Program-Stop Command**

The ASP can remotely command the LRIT device to stop sending position reports. The ASP sends a configuration command to the LRIT device with the "ST" (Set Timer) field set to a one and the "T" (Timer), Reporting Interval set to zero. The "A" (Ack) flag should be set to one so that the configuration change(s) can be confirmed. NOTE: This is a 'Normal' reporting interval and the "D" (Reduced) field should be set to zero.

2.9 Short Burst Data LRIT Message Data Structure

The following section defines the Data Structure used to communicate with an *Iridium/LRIT Device*. The following guidance is applicable when interpreting the protocol:

- The IMEI of the Iridium/LRIT Device is used to identify the transceiver (and by extension the ship). Full details on SBD are available in the Iridium SBD Developers Guide documentation. The SBD IMEI constitutes the "*Shipborne Equipment Identifier*," as required by the LRIT *Performance Standard*, and is not further discussed here.
- All bytes and bit fields shown zero relative
- All fields place the most significant bit first
- All references are in decimal (base 10); unless prefixed with "\$" to denote hexadecimal (base 16) notation.
- All references to "the device" refer to the *Iridium/LRIT Device*.

2.9.1 LRIT Position Report

The LRIT Position Report Data Structure defines the format and the content of the position reports sent from the LRIT device to the ASP. These are MO-SBD messages only.

Packet Structure

Byte/Bit	7	6	5	4	3	2	1	0
00	H ₇	H ₆	H ₅	H ₄	H ₃	H ₂	H ₁	H ₀
01	M ₁	M ₀	LtH	LtD ₆	LtD ₅	LtD ₄	LtD ₃	LtD ₂
02	LtD ₁	LtD ₀	LtM ₅	LtM ₄	LtM ₃	LtM ₂	LtM ₁	LtM ₀
03	LtS ₄	LtS ₃	LtS ₂	LtS ₁	LtS ₀	LgH	LgD ₇	LgD ₆
04	LgD ₅	LgD ₄	LgD ₃	LgD ₂	LgD ₁	LgD ₀	LgM ₅	LgM ₄
05	LgM ₃	LgM ₂	LgM ₁	LgM ₀	LgS ₄	LgS ₃	LgS ₂	LgS ₁
06	LgS ₀	E ₆	E ₅	E ₄	E ₃	E ₂	E ₁	E ₀
07	TCm	Td ₄	Td ₃	Td ₂	Td ₁	Td ₀	Th ₄	Th ₃
08	Th ₂	Th ₁	Th ₀	Tm ₄	Tm ₃	Tm ₂	Tm ₁	Tm ₀
09	R	R	R	R	R	R	R	R

Field Definitions

Field	Bits	Comments
H	8	Header: \$F0 (<i>other values reserved for vendor specific use</i>)
M	2	Message: Position Report (Value=1)
LtH	1	Latitude: Hemisphere (0=North 1=South)
LtD	7	Latitude: Degrees (0-90)
LtM	6	Latitude: Whole Minutes (0-59)
LtS	5	Latitude: Decimal Minutes, 0.04 Minute steps (0-24)
LgH	1	Longitude: Hemisphere (0=East 1=West)
LgD	8	Longitude: Degrees (0-179)
LgM	6	Longitude: Whole Minutes (0-59)
LgS	5	Longitude: Decimal Minutes, 0.04 Minute steps (0-24)
E	7	Event: Event Code (refer to Event table)
TCm	1	Time: Month (0=this month)
Td	5	Time: Day of Month (1=31)
Th	5	Time: Hour (0-23)
Tm	5	Time: Minutes, in 2 Minute Increments (0-29)
R	8	Reserved: Set to \$00

- All Iridium/LRIT Devices must include an internal GNSS receiver (i.e. an integrated GPS receiver). Optionally, an external GNSS port may be provided and configured as the primary GNSS source for operation of the device (for example if a DGPS receiver is available). However; if the external navigation solution is not valid the device must automatically use its internal GNSS solution instead.
- All dates & times are expressed in UTC (GMT) and must be sourced from the GNSS navigation solution.

- All coordinates are expressed with respect to the WGS84 datum and must be sourced from the GNSS navigation solution.

Event Codes

Value	Name	Description
88	Polled Position	All responses to a requested (non-interval) Position Report must use this event code.
11	Interval Position	All routine (interval) triggered Position Reports must use this event code.
64	Power On	Following the loss of power, and upon restoration of power and after obtaining a valid GNSS solution, the device must transmit a Position Report with this event code.
65	Power Off	Immediately prior to a planned power down the device must transmit a Position Report with this event code.
68	Antenna Disconnect	Immediately following restoration of the antenna connection, after detection of a failure in the antenna or cabling, the device must transmit a Position Report with this event code.
69	Iridium Signal Loss	Immediately following restoration of Iridium signal, following its loss for more than [1] hour, the device must transmit a Position Report with this event code.
91	GNSS Failure	In the event that a valid GNSS navigation solution is unavailable for more than [1] hour the device must respond by setting this event code and returning the last-known-valid GNSS solutions in any Position Report.
82	Reduced : Enter	Upon activation by the Master, or remotely, of reduced reporting mode (once per 24 hours per Paragraph 4.4.1 of the Performance Standard) the device shall transmit this Event Code with a Position Report.
87	Reduced : Exit	Upon deactivation by the master of reduced reporting (return to normal interval reporting) the device shall transmit this Event Code with a Position Report.

All devices must send a Position Report packet via SBD upon each and every occurrence of the following:

- At the intervals specified Status Report (default=360 minutes). Refer to the LRIT Configuration Report for details.
- Whenever an Update Position is Remotely Requested ("polled"). Refer to the LRIT Configuration Report for details.
- Whenever an Event in the Event Code table is triggered.

2.9.2 LRIT Configuration Command

The LRIT Configuration Message Data Structure defines the format and the content for the MT configuration and command messages and the MO messages that report the device configuration. The LRIT device returns the device configuration in response to a 'Read Device Configuration' command and when the "A" (Ack) flag is set in the MT message.

Packet Structure

Byte/Bit	7	6	5	4	3	2	1	0
00	H ₇	H ₆	H ₅	H ₄	H ₃	H ₂	H ₁	H ₀
01	M ₁	M ₀	P	SI	SO	ST	SD	A
02	I ₂₃	I ₂₂	I ₂₁	I ₂₀	I ₁₉	I ₁₈	I ₁₇	I ₁₆
03	I ₁₅	I ₁₄	I ₁₃	I ₁₂	I ₁₁	I ₁₀	I ₉	I ₈
04	I ₇	I ₆	I ₅	I ₄	I ₃	I ₂	I ₁	I ₀
05	O ₁₂	O ₁₁	O ₁₀	O ₉	O ₈	O ₇	O ₆	O ₅
06	O ₄	O ₃	O ₂	O ₁	O ₀	T ₁₂	T ₁₁	T ₁₀
07	T ₉	T ₈	T ₇	T ₆	T ₅	T ₄	T ₃	T ₂
08	T ₁	T ₁₀	D	R	R	R	R	R
09	V ₇	V ₆	V ₅	V ₄	V ₃	V ₂	V ₁	V ₀

Field Definitions

Field	Bits	Values
H	8	Header: \$F0 (<i>other values reserved for vendor specific use</i>)
M	2	Message: Status Report (Value=3)
P	1	Poll Position: 1=Request Polled Position, 0=(none)
SI	1	Set IMO: 1=Set IMO#, 0=Leave Unchanged
SO	1	Set Offset: 1=Set Offset, 0=Leave Unchanged
ST	1	Set Timer: 1=Set Timer, 0=Leave Unchanged
SD	1	Set Reduced: 1=Set Reduced Mode, 0=Leave Unchanged
A	1	Ack: 1=Respond with a Status Report (confirming changes)
I	24	IMO#: IMO Number of ship (0000000-9999999)
O	13	Offset: Offset from midnight for interval reports
T	13	Timer: Reporting Interval (see below)
D	1	Reduced: 1=Reduced (24hr) Reporting, 0=(Normal)
V	8	Version: Manufacturer and Firmware Version of Device

2.9.2.1 Read Device Configuration

To read the device configuration without making changes; set the change flags to zero (SI,SO,ST,SD) and the "A" (Ack) flag to one. This will return the current settings as a Configuration Report Packet.

2.9.2.2 Parameter Update

To update one or more parameters; set the appropriate SI, SO, ST and/or SD flags and issue a command to the device with the appropriate fields populated and the "A" (Ack) flag set. This will

update the selected configuration fields, then return the new device configuration as a Configuration Report Packet by way of acknowledgement that the changes were successful.

2.9.2.3 **Poll for Position Report**

If set to one, the "P" (Poll) flag will request the current GNSS position of the device. This will be returned as an LRIT Position Report. If only a position report is being requested, and no other changes are being made, it is acceptable to set the "A" (Ack) flag to zero. Otherwise the "A" (Ack) flag should be set to one so that the configuration change(s) can be confirmed.

Packet Structure

Field Definitions

Further Information on Field Definitions

Field		Comments
H M P SI SO ST SD A I	Header:	The intent is to define specific standard message formats for interoperability. The first 4 bits are reserved for Iridium defined message formats. The last four bits will be used by VARs to define their own message formats in future services.
	Message:	
	Poll Position:	
	Set IMO:	
	Set Offset:	
	Set Timer:	
	Set Reduced:	
	Ack:	
	IMO#:	
	Offset:	This offset should be set differently for each ship in order to ensure that traffic is distributed randomly throughout the day and not bunched at particular hours. The offset is the number of increments of one (1) minutes. The VAM application should randomize plus or minus 30 seconds around this time.
T D V	Timer:	Reporting Interval: The number of increments of one (1) minutes that the Iridium/LRIT Device should report its position on. E.g. Every hour = 60 x 1 minutes , so the time would be set to 60.
	Reduced:	When set (ie D=1) then the Timer Reporting Interval is overridden. When not set (i.e. D=0) then the interval at which the LRIT position is reported is set by the Timer field.
	Version:	The intent is for ASPs to be able to ascertain over the air which manufacturer's product is installed on the ship and what the firmware revision is. This is particularly useful when a ship changes Flag. The first 4 bits are the manufacturer code and the last four are the firmware version. <ul style="list-style-type: none"> • Manufacturer Codes are set by Iridium. VAMs should request their code from LRIT@iridium.com • Firmware Codes are set by the individual VAM. • Default manufacturer and firmware code is '\$FF'