CHAPTER 29

POSITION REPORTING SYSTEMS

INTRODUCTION

2900. Purpose

The purpose of position reporting systems is to monitor vessel positions and inform authorities and other vessels of an emergency or distress at sea so that a response can be coordinated among those best able to help. It is important that distress information be immediately available to Search and Rescue (SAR) coordinators so that assistance can be obtained with the least delay. Establishing communications is sometimes difficult even when automatic alarms are used, and determination of SAR capabilities and intentions of vessels is time-consuming, unless the essential information has been made readily available beforehand by their participation in a position reporting system.

The Convention on Safety of Life at Sea (SOLAS) obligates the master of any vessel who becomes aware of a distress incident to proceed to the emergency and assist until other aid is at hand or until released by the distressed vessel. Other international treaties and conventions impose the same requirement. Position reporting systems permit determination of the most appropriate early assistance, provide the means for a timely resolution of distress cases, and enable vessels responding to distress calls to continue their passage with a minimum amount of delay.

Other resolutions recommend that governments encourage participation in position reporting schemes by ensuring that no costs are incurred by the vessel for participation.

There are currently many position reporting systems in operation throughout the world. The particulars of each system are given in publications of the International Maritime Organization (IMO). Masters of vessels making offshore passages are requested by the U.S. Coast Guard to always participate in the AMVER System and to participate in the other systems when in the areas covered by them.

AMVER

2901. The Automated Mutual-Assistance Vessel Rescue System (AMVER)

AMVER, operated by the United States Coast Guard, is an international maritime mutual assistance program which assists search and rescue efforts in many offshore areas of the world. Merchant ships of all nations making offshore passages are encouraged to send movement (sailing) reports and periodic position reports voluntarily to the AMVER Center in New York via selected radio stations. Information from these reports is entered into a computer which maintains dead reckoning positions for the vessels.

Information concerning the predicted location and SAR characteristics of each vessel is available upon request to recognized SAR agencies of any nation or to vessels needing assistance. Predicted locations are disclosed only for reasons related to marine safety.

Messages sent within the AMVER System are at no cost to the ship or owner. Benefits to shipping include: (1) improved chances of aid in emergencies, (2) reduced number of calls for assistance to vessels not favorably located, and (3) reduced time lost for vessels responding to calls for assistance. An AMVER participant is under no greater obligation to render assistance during an emergency than a non-participating vessel.

All AMVER messages are addressed to Coast Guard, New York, regardless of the station to which the message is delivered, except those sent to Canadian stations which should be addressed to AMVER Halifax or AMVER Vancouver. This avoids incurring charges to the vessel.

In addition to the information calculated from sailing plans and position reports, the AMVER Center stores data on the characteristics of vessels. This includes the following: vessel name; international call sign; nation of registry; owner or operator; type of rig; type of propulsion; gross tonnage; length; normal cruising speed; radio schedule; radio facilities; radio telephone installed; surface search radar installed; doctor normally carried. Vessels can assist the AMVER Center in keeping this data accurate by sending a complete report by message, letter, or by completing a SAR Information Questionnaire available from AMVER, and sending corrections as the characteristics change. Corrections may be included in regular AMVER reports as remarks.

For AMVER participants bound for U.S. ports there is an additional benefit. AMVER messages which include the necessary information are considered to meet the requirements of 33 CFR 161 (Notice of arrival).

2902. AMVER System Communications Network

An extensive radio network supports the AMVER system. Propagation conditions, location of vessel, and message density will normally determine which station should be contacted to establish communications. To ensure that no charge is applied, all AMVER messages should be passed through specified radio

stations. Those which currently accept AMVER messages and apply to coastal station, ship station, or landline charge are listed in each issue of the AMVER Bulletin, together with respective call sign, location, frequency bands, and hours of guard. Although AMVER messages may be sent through other stations, the Coast Guard cannot reimburse the sender for any charges.

2903. The AMVER Bulletin

The **AMVER Bulletin**, published quarterly by the U.S. Coast Guard, provides information on the operation of the AMVER System of general interest to the mariner. It also provides up-to-date information on the AMVER communications network and Radio Wave Propagation Charts which indicate recommended frequencies for contacting U.S. coast radio stations participating in the AMVER System, according to the time of day and the season of the year.

2904. AMVER Participation

Instructions guiding participation in the AMVER System are available in the following languages: Chinese, Danish, Dutch, English, French, German, Greek, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish and Swedish. The AMVER Users Manual is available from: Commander, Atlantic Area, U.S. Coast Guard, Governors Island, NY, 10004; Commander Pacific Area, U.S. Coast Guard, Government Island, Alameda, CA 94501; and at U.S. Coast Guard District Offices, Marine Safety Offices, Marine Inspection Offices and Captain of the Port Offices in major U.S. ports. Requests for instructions should state the language desired if other than English.

Search and Rescue operation procedures are contained in the *Merchant Ship Search and Rescue Manual* (MERSAR) published by the International Maritime Organization (IMO). U.S. flag vessels may obtain a copy of MERSAR from local Coast Guard Marine Safety Offices and Marine Inspection Offices or by writing to U.S. Coast Guard (G-OSR), Washington, DC 20593. Other flag vessels may purchase MERSAR directly from IMO.

In connection with a vessel's first AMVER-plotted voyage, the master is requested to complete a questionnaire providing the radio watch schedule, available medical and communications facilities, and other useful characteristics. Stored in the AMVER computer, this information can be electronically processed in an emergency, while a position is calculated.

Any vessel of any nation departing on an offshore passage of 24 hours duration or greater is encouraged to become a participant in the AMVER System by sending appropriate AMVER messages in one of several formats. The messages may be transmitted at any convenient time as long as the information is accurate.

There are five types of AMVER Reports.

1. Sailing Plan.
2. Departure Report.
3. Arrival Report.
4. Position Report.
5. Deviation Reports.

AMVER permits sailing plan and departure information to be combined into a single report. It also accepts sailing plan information separately.

Only the above five types of AMVER messages require specific formats. (See DMAHTC *Pub. 117, Radio Navigational Aids*). Other messages relating to a vessel's AMVER participation or data, such as facts on her SAR capabilities, may also be sent via the AMVER communications network.

Additional information concerning the AMVER System may be obtained by writing to: Commandant, U.S. Coast Guard, Washington, DC 20590, or by writing or visiting Commander, Atlantic Area, U.S. Coast Guard, Governors Island, New York, NY 10004. The AMVER System in the Pacific is coordinated by Commander, Pacific Area, U.S. Coast Guard, Government Island, Alameda, CA 94501.

Other countries such as Canada are a formal part of the AMVER System and provide radio stations for relay of AMVER reports, as well as coordinating rescue efforts in certain regions. Applicable instructions have been promulgated by official publications of the participating countries.

2905. AMVER Reporting Required

The U.S. Maritime Administration regulations state that certain U.S. flag vessels and foreign flag "War Risk" vessels must report and regularly update their voyages to the AMVER Center. This reporting is required of the following: (a) U.S. flag vessels of 1,000 tons or greater, operating in foreign commerce; (b) foreign flag vessels of 1,000 gross tons or greater, for which an Interim War Risk Insurance Binder has been issued under the provisions of Title XII, Merchant Marine Act, 1936.

2906. AMVER Plot Information

The information stored in the computer can be used to provide several types of display according to the needs of controllers at Rescue Coordination Centers. The surface picture (SURPIC) can be displayed as a **Radius SURPIC** (Figure 2906a). When requesting a Radius SURPIC, the controller specifies the date and time, a latitude and longitude to mark the center (P), the radius (in nautical miles) that the SURPIC should cover (R), and whether the names of all ships are desired (or only those with doctors, or perhaps those heading either east or west).

A Radius SURPIC may be requested for any radius from 1 to 999 miles. A sample request is as follows:

"REQUEST 062100Z RADIUS SURPIC OF DOCTORSHIPS WITHIN 800 MILES OF 43.6N 030.2W FOR MEDICAL EVALUATION M/V SEVEN SEAS."

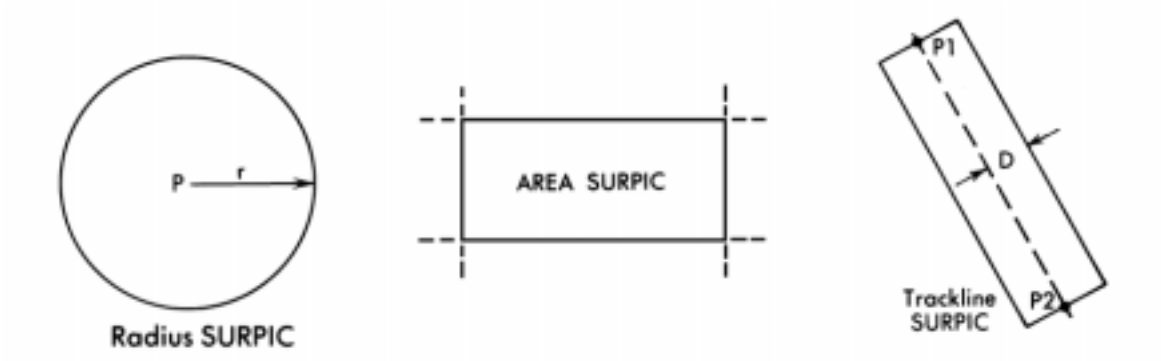

Figure 2906a. Radius SURPIC, Area SURPIC, and Trackine SURPIC.

The **Area SURPIC** is obtained by specifying the date, time, and two latitudes and two longitudes. The controller can limit the ships to be listed as with the Radius SURPIC. There is no maximum or minimum size limitation on an Area SURPIC.

A sample Area SURPIC request is as follows:

"REQUEST 151300Z AREA SURPIC OF WESTBOUND SHIPS FROM 43N TO 31N LATITUDE AND FROM 130W TO 150W LONGITUDE FOR SHIP DISTRESS M/V EVENING SUN LOCATION 37N, 140W."

The **Trackline SURPIC** is obtained by specifying the date and time, two points (P1 and P2), whether the trackline should be rhumb line or great circle, what the half-width (D) coverage should be (in nautical miles), and whether all ships are desired (or only doctor ships, or just those east or westbound). The half-width (D) specified should not exceed 100 miles. When received, the SURPIC will list ships in order from P1 to P2. There is no maximum or minimum distance between P1 and P2.

A sample Trackline SURPIC request is as follows:

"REQUEST 310100Z GREAT CIRCLE TRACKLINE SURPIC OF ALL SHIPS WITHIN 50 MILES OF A LINE FROM 20.1N 150.2W TO 21.5N 158.0W FOR AIRCRAFT PRECAUTION."

A **Location Vessel** is used to determine the location of a specific ship. It permits a controller to determine the DR position of an AMVER participant wherever located.

A sample Location Vessel request is as follows:

"REQUEST PRESENT POSITION, COURSE, AND SPEED OF M/V POLARIS"

A Radius SURPIC as it would be received by a rescue center, listing all ships within a 200-mile radius of 26.2N, 179.9W, is shown in Figure 2906b.

2907. Uses Of AMVER Plot Information

An example of the use of a Radius SURPIC is depicted in Figure 2907. In this situation rescue authorities believe that a ship in distress, or her survivors, will be found in the rectangular area. The Rescue Coordination Center requests a listing of all eastbound ships within 100 miles of a carefully chosen position. Once this list is received by the Rescue Coordination Center a few moments later, messages can be prepared for satellite transmission to each vessel, or arrangements made to contact them by radio.

Each ship contacted may be asked to sail a rhumb line between two specified points, one at the beginning of the search area and one at the end. By carefully assigning ships to areas of needed coverage, very little time need be lost from the sailing schedule of each cooperating ship. Those ships joining the search would report their positions every few hours to the Rescue Coordination Center, together with weather data and any significant sightings. In order to achieve saturation coverage, a westbound SURPIC at the

Name	*Call sign*	*Position*	*Course*	*Speed*	*SAR data*	*Destination and ETA*	
CHILE MARU	JAYU	26.2 N 179.9E	C294	12.5K	H 1 6 R T X Z	KOBE	11
CPA 258 DEG. 012 MI. 032000Z							
WILYAMA	LKBD	24.8N 179.1W	C106	14.0K	H X R T V X Z	BALBOA	21
CPA 152 DEG. 092 MI. 032000Z							
PRES CLEVELAND	WITM	25.5N 177.0W	C284	19.3K	H 2 4 R D T X Z S	YKHAMA	08
CPA 265 WILL PASS WITHIN 10 MI 040430Z							
AENEAS	GMRT	25.9N 176.9E	C285	16.0K	H 8 R N V X Z	YKHAMA	10
CPA 265 DEG. 175 MI. 03200Z							

Figure 2906b. Radius SURPIC as received by a rescue center.

eastern extremity of the search area would also be used.

The Trackline SURPIC is most commonly used as a precautionary measure for aircraft. Rarely, if ever, is a major airliner forced to ditch at sea anymore. But occasions sometimes arise where a plane loses of one or more of its engines. A Trackline SURPIC, provided from the point of difficulty to the destination, provides the pilot with the added assurance of knowing the positions of vessels beneath him and that they have been alerted. SURPIC's have been used successfully to save the lives of pilots of small aircraft.

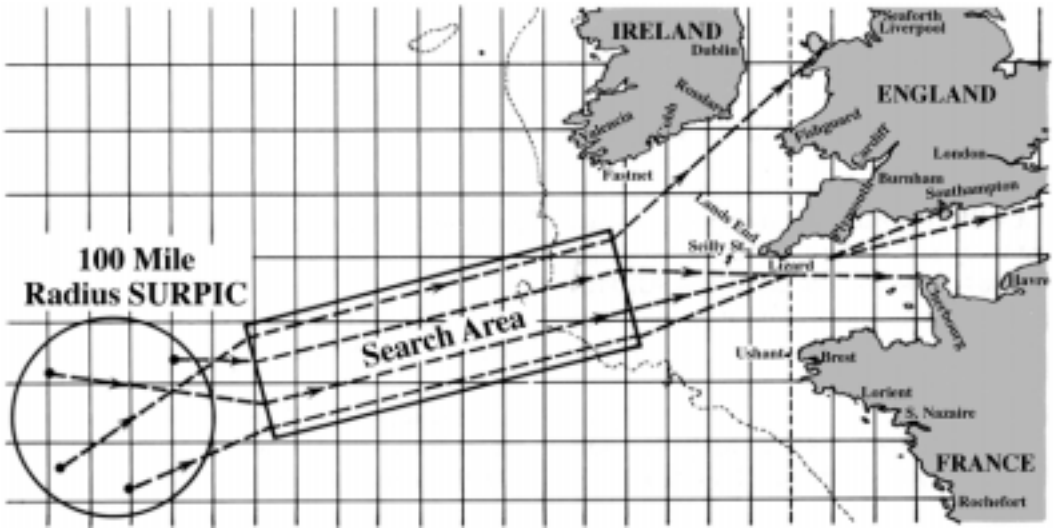

Figure 2907. Use of radius SURPIC.

EMERGENCY POSITION INDICATING RADIOBEACONS (EPIRB'S)

2908. Description And Capabilities

Emergency Position Indicating Radiobeacons (EPIRB's), devices which cost from $200 to over $1500, are designed to save lives by automatically alerting rescue authorities and indicating the distress location. EPIRB types are described below:

121.5/243 MHz EPIRB's (Class A, B, S): These are the most common and least expensive type of EPIRB, designed to be detected by overflying commercial or military aircraft. Satellites were designed to detect these EPIRB's but are limited for the following reasons:

1. Satellite detection range is limited for these EPIRB's (satellites must be within line of sight of both the EPIRB and a ground terminal for detection to occur).
2. EPIRB design and frequency congestion cause them to be subject to a high false alert/false alarm rate (over 99%); consequently, confirmation is re-

Type	Frequency	Description
Class A	121.5/243 MHz	Float-free, automatic activating, detectable by aircraft and satellite. Coverage limited (see Figure 2908).
Class B	121.5/243 MHz	Manually activated version of Class A.
Class C	VHF Ch. 15/16	Manually activated, operates on maritime channels only. Not detectable by satellite.
Class S	121.5/243 MHz	Similar to Class B, except that it floats, or is an integral part of a survival craft.
Category I	121.5/406 MHz	Float-free, automatically activated. Detectable by satellite anywhere in the world.
Category II	121.5/406 MHz	Similar to Category I, except manually activated.

Figure 2908a. EPIRB classifications.

Feature	*121.5/406 MHz EPIRB*	*121.5/243 MHz EPIRB*
Frequencies	406.025 MHz (locating) 121.500 MHz (homing)	121.500 MHz (civilian) 243.000 MHz (military)
Primary Function	Satellite alerting, locating, identification of distressed vessels.	Transmission of distress signal to passing aircraft and ships.
Distress Confirmation	Positive identification of coded beacon; each beacon signal is a coded, unique signal with registration data (vessel name, description, and telephone number ashore, assisting in confirmation).	Virtually impossible; no coded information, beacons often incompatible with satellites; impossible to know if signals are from EPIRB, ELT, or non-beacon source.
Signal	Pulse digital, providing accurate beacon location and vital information on distressed vessel.	Continuous signal allows satellite locating at reduced accuracy; close range homing.
Signal Quality	Excellent; exclusive use of 406 MHz for distress beacons; no problems with false alerts from non-beacon sources.	Relatively poor; high number of false alarms caused by other transmitters in the 121.5 MHz band.
Satellite Coverage	Global coverage, worldwide detection; satellite retains beacon data until next earth station comes into view.	Both beacon and LUT must be within coverage of satellite; detection limited to line of sight.
Operational Time	48 hrs. at -20°C.	48 hrs. at -20°C.
Output Power	5 watts at 406 MHz, .025 watts at 121.5 MHz.	0.1 watts average.
Strobe Light	High intensity strobe helps in visually locating search target.	None.
Location Accuracy (Search Area) and Time Required	1 to 3 miles (10.8 sq. miles); accurate position on first satellite overflight enables rapid SAR response, often within 30 min.	10 to 20 miles (486 sq. miles); SAR forces must wait for second system alert to determine final position before responding (1 to 3 hr. delay).

Figure 2908b. Summary comparison of 121.5/406 MHz and 121.5/243 MHz EPIRB's.

quired before SAR forces can be deployed;

3. EPIRB's manufactured before October 1988 may have design or construction problems (e.g. some models will leak and cease operating when immersed in water) or may not be detectable by satellite.

Class C EPIRB's: These are manually activated devices intended for pleasure craft which do not venture far offshore, and for vessels on the Great Lakes. They transmit a short burst on VHF-FM 156.8 MHz (Ch. 16) and a longer homing signal on 156.75 MHz (Ch. 15). Their usefulness depends upon a coast station or another vessel guarding channel 16 and recognizing the brief, recurring tone as an EPIRB. Class C EPIRB's are not recognized outside of the United States. Class C EPIRB's cannot be manufactured or sold in the United States after February 1995. Class C EPIRB's installed on board vessel's prior to February 1995 may be utilized until 1 February 1999 and not thereafter.

406 MHz EPIRB's (Category I, II): The 406 MHz EPIRB was designed to operate with satellites. Its signal allows a satellite local user terminal to locate the EPIRB (much more accurately than 121.5/243 MHz devices) and identify the vessel (the signal is encoded with the vessel's identity) anywhere in the world. There is no range limitation. These devices also include a 121.5 MHz homing signal, allowing aircraft and rescue vessels to quickly find the vessel in distress. These are the only type of EPIRB which must be tested by Coast Guard-approved independent laboratories before they can be sold for use within the United States.

An automatically activated, float-free version of this EPIRB has been required on SOLAS vessels (cargo ships over 300 tons and passenger ships on international voyages)

since 1 August 1993. The Coast Guard requires U.S. commercial fishing vessels to carry this device (unless they carry a Class A EPIRB), and will require the same for other U.S. commercial uninspected vessels which travel more than 3 miles offshore.

Mariners should be aware of the differences between capabilities of 121.5/243 MHz and 121.5/406 MHz EPIRB's, as they have implications for alerting and locating of distress sites, as well as response by SAR forces. The advantages of 121.5/406 MHz devices are substantial, and are further enhanced by EPIRB-transmitted registration data on the carrying vessel. Owners of 121.5/406 MHz EPIRB's furnish registration information about their vessel, survival gear, and emergency points of contact ashore, all of which greatly enhance the response. The database for U.S. vessels is maintained by the National Oceanographic and Atmospheric Administration, and is accessed worldwide by SAR authorities to facilitate SAR response.

2909. Testing EPIRB's

EPIRB owners should periodically check for water tightness, battery expiration date, and signal presence. FCC rules allow Class A, B, and S EPIRB's to be turned on briefly (for three audio sweeps, or 1 second only) during the first 5 minutes of any hour. Signal presence can be detected by an FM radio tuned to 99.5 MHz, or an AM radio tuned to any vacant frequency and located close to an EPIRB. FCC rules allow Class C EPIRB's to be tested within the first 5 minutes of any hour, for not more than 10 seconds. Class C EPIRB's can be detected by a marine radio tuned to channel 15 or 16. All 121.5/406 MHz EPIRB's have a self-test function that should be used in accordance with manufacturers' instructions at least monthly.

2910. The COSPAS/SARSAT System

COSPAS is a Russian acronym for "Space System for Search of Distressed Vessels"; SARSAT signifies "Search And Rescue Satellite-Aided Tracking." COSPAS-SARSAT is an international satellite-based search and rescue system established by the U.S., Russia, Canada, and France to locate emergency radiobeacons transmitting on the frequencies 121.5, 243, and 406 MHz. Since its inception, the COSPAS-SARSAT system (SARSAT satellite only) has contributed to saving over 3000 lives.

The USCG receives data from MRCC stations and SAR Points of Contact (SPOC). See Figure 2910.

2911. Operation Of The COSPAS/SARSAT System

If an EPIRB is activated, COSPAS/SARSAT picks up the signal, locates the source and passes the information to a land station. From there, the information is relayed, either via coast radio or satellite, to Rescue Coordination Centers, rescue vessels and nearby ships. This constitutes a one-way only communications system, from the EPIRB via the satellite to the rescuers. It employs low altitude, near polar orbiting satellites and by exploiting the Doppler principle, locates the transmitting EPIRB within about two miles. Due to the low polar orbit, there may by a delay in receiving the distress message unless the footprint of the satellite is simultaneously in view with a monitoring station. However, unlike SafetyNET, worldwide coverage is provided.

As a satellite approaches a transmitting EPIRB, the frequency of the signals it receives is higher than that being transmitted; when the satellite has passed the EPIRB, the received frequency is lower. This creates a notable Doppler shift. Calculations which take into account the earth's rota-

Country	*Location*	*Designator*	*Status*
Australia	Canberra	AUMCC	In Operation
Brazil	San Paulo	BBMCC	Under Test
Canada	Trenton	CMCC	In Operation
Chile	Santiago	CHMCC	Under Test
France	Toulouse	FMCC	In Operation
Hong Kong	Hong Kong	HKMCC	In Operation
India	Bangalore	INMCC	In Operation
Indonesia	Jakarta	IONCC	Under Test
ITDC	Taipei	TAMCC	TBD
Japan	Tokyo	JAMCC	In Operation
New Zealand			In Operation
Norway	Bodo	NMCC	In Operation
Pakistan	Lahore	PAMCC	—
Singapore	Singapore	SIMCC	—
Spain	Maspalomas	SPMCC	In Operation
Russian Federation	Moscow	CMC	In Operation
United Kingdom	Plymouth	UKMCC	In Operation
United States	Suitland	USMCC	In Operation

Figure 2910. Participants in COSPAS/SARSAT system.

tion and other factors then determine the location of the EPIRB.

The 406 MHz EPIRB's incorporate an identification code. Once the satellite receives the beacon's signals, the Doppler shift is measured and the beacon's digital data is recovered from the signal. The information is time-lagged, formatted as digital data and transferred to the repeater downlink for real time transmission to any local user terminal. The digital data coded into each 406 MHz EPIRB's memory provides distress information to SAR authorities for more rapid and efficient rescue. The data includes a maritime identification digit (MID, a 3 digit number identifying the administrative country) and either a ship station identifier (SSI, a 6 digit number assigned to specific ships), a ship radio call sign or a serial number to identify the ship in distress.

With the INMARSAT E satellite EPIRB's, coverage does not extend to very high latitudes, but within the coverage area the satellite connection is instantaneous. However, to establish the EPIRB's position, an interface with a GPS receiver or other sensor is needed.

2912. Alarm, Warning, And Alerting Signals

For MF (i.e. 2182 kHz), the EPIRB signal consists of either (1) a keyed emission modulated by a tone of 1280 Hz to 1320 Hz with alternating periods of emission and silence of 1 to 1.2 seconds each; or (2) the radiotelephone alarm signal followed by Morse code B (— • • •) and/or the call sign of the transmitting ship, sent by keying a carrier modulated by a tone of 1300 Hz or 2200 Hz. For VHF (i.e. 121.5 MHz and 243 MHz), the signal characteristics are in accordance with the specifications of Appendix 37A of the ITU Radio Regulations. For 156.525 MHz and UHF (i.e. 406 MHz to 406.1 MHz and 1645.5 MHz to 1646.5 MHz), the signal characteristics are in accordance with CCIR recommendations.

The purpose of these signals is to help determine the position of survivors for SAR operations. They indicate that one or more persons are in distress, may no longer be aboard a ship or aircraft, and may not have a receiver available.

Any vessel or aircraft receiving an EPIRB signal while no distress or urgent traffic is being passed shall initiate a distress message on the assumption that the EPIRB sending station is unable to transmit a distress message. The keying cycles for MF EPIRB's may be interrupted for speech transmission.