

# RADIO NAVIGATIONAL AIDS

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**IMPORTANT**  
**THIS PUBLICATION SHOULD  
BE CORRECTED EACH WEEK  
FROM THE  
NOTICE TO MARINERS**



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# CHAPTER 1

## RADIO DIRECTION FINDER AND RADAR STATIONS

### PART I RADIO DIRECTION FINDER STATIONS

#### 100A. General

Radio bearings may be employed for fixing a ship's position in the same manner as other lines of position if due regard is given to the facts that they, like other lines of position, may not be absolutely accurate, and that the bearings are portions of great circles, not rhumb lines.

Radio bearings are obtained using radio direction finder sets installed on either shore stations or ships, and also by certain special radiobeacons.

Radio direction finder (RDF) stations are equipped with apparatus for determining the direction of radio signals transmitted by ships and other stations.

**SECTOR OF CALIBRATION:** The sector of calibration of a direction finder station is the sector around the receiving coil in which the deviation of radio bearings is known. In this book, the sectors are measured clockwise from 000° (true north) to 359° and are given from the station to seaward. Bearings which do not fall within the sector of calibration of the station should be considered unreliable.

#### 100B. Accuracy of Bearings Furnished by Direction Finding Stations

The bearings obtained by RDF stations and reported to ships are corrected for all determinable errors except the difference between a great circle and a rhumb line (See sec. 100F.) and are normally accurate within 2° for distances under 150 miles. However, this error may be increased by various circumstances, some of which are:

**STRENGTH OF SIGNALS:** The most accurate bearings result from ships whose signals are steady, clear, and strong. If the signals are too weak, accurate bearings cannot be obtained.

**TRANSMITTER ADJUSTMENT:** The transmitter of the ship requesting bearings should be tuned carefully to the frequency of the station. If the tuning is off, it will be difficult for the station to obtain bearings sufficiently accurate for navigational purposes.

**COASTAL REFRACTION (LAND EFFECT):** Bearings which cut an intervening coastline at an oblique angle, or cross high intervening land, may produce errors of 4° to 5°. RDF stations normally know the sectors in which such refraction may be expected. Such sectors may not be included in the published sectors of calibration or may be marked "sectors of uncertain calibration."

**SUNRISE, SUNSET, OR NIGHT EFFECTS:** Bearings obtained from about half an hour before sunset to about half an hour after sunrise are occasionally unreliable because of the polarization error introduced. Changes in the intensity of the signals received occur at sunset and sunrise.

**CAUTION:** When RDF stations use such words as doubtful, approximate, second-class, or the equivalents in foreign languages, the bearings reported must be treated with suspicion as considerable error may exist.

**DANGER FROM RECIPROCAL BEARINGS:** When a single station furnishes a bearing, there is a possibility of an error of approximately 180°, as the operator at the station cannot always determine on which side of the station the ship lies. Certain direction finder stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings may differ by approximately 180° and whichever bearing is suitable should be used.

**CAUTION:** Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearings should never attempt to correct these bearings by applying a correction of 180°, as such a correction would not include the proper correction for deviation at the direction finder station. An error as large as 30° may be introduced by an arbitrary correction of 180°. Ships receiving bearings requiring an approximate 180° correction should request both bearings from the direction finder station.

#### 100C. Obligations of Administrations Operating Direction Finding Stations

The obligations of RDF station operators are given in Article 35 of the manual for use by the Maritime Mobile Satellite Services of the International Telecommunications Union (1992). They include the following:

- Effective and regular service should be maintained, but no responsibility is accepted for these services.
- Serviced stations shall be advised of doubtful or unreliable observations.
- RDF station operators shall make daily notification of any temporary modifications or irregularities in service. Permanent modifications shall be published as soon as possible in the relevant notices to mariners.
- All RDF stations shall be able to take bearings on 410 kHz and 500 kHz.



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- When RDF service is provided in authorized bands between 1605 kHz and 2850 kHz, RDF stations providing that service should be able to take bearings on 2182 kHz.
- When RDF service is provided in the bands between 156 MHz and 174 MHz, the RDF station should be able to take bearings on VHF 156.8 MHz and VHF digital selective calling frequency 156.525 MHz.

### 100D. Procedure to Obtain Radio Direction Finder Bearings and Positions

**TO OBTAIN A BEARING:** The vessel should call the RDF station or the RDF control station on the designated watch frequency. Depending on the type of information wanted, the vessel should transmit the appropriate service abbreviation(s):

- QTE: What is the true bearing from you (or designated vessel)?
- QTH: Follows the above abbreviation when the request is made to a mobile RDF station.

The vessel should also indicate the frequency it will use to enable its bearing to be taken.

The RDF station called should request the vessel to transmit for the bearing by means of the service abbreviation QTG (Will you send two dashes of ten seconds each (or carrier) followed by your call sign (repeated \_\_\_ times) on \_\_\_ kHz (or MHz)?).

After shifting, if necessary, to the new transmitting frequency, the vessel should transmit as instructed by the RDF station.

The RDF station should determine the direction, sense (if possible), and classification of the bearing and transmit to the vessel in the following order:

- QTE.
- Three digits indicating true bearing in degrees from the RDF station.

- Class of bearing.
- Time of observation.
- If the RDF station is mobile, its own position preceded by QTH.

When the vessel has received this information, it should repeat it back, if considered necessary for confirmation. The RDF station should confirm or correct the information. When the RDF station is sure the information has been correctly received, it will transmit AR (end of transmission). The vessel will respond with AR.

Unless otherwise indicated, the vessel may assume that the sense of the bearing was indicated. If not, the RDF station should indicate this or report the bearing and its reciprocal.

**CLASSIFICATION OF BEARINGS:** To estimate the accuracy and determine the corresponding class of a bearing:

- An operator should generally, and particularly in the maritime mobile RDF service on frequencies below 3000 kHz, give the observational characteristics of bearings shown in the table below.
- The RDF station, when facilities and time permit, may take into account the probability of error in the bearing. A bearing is considered as belonging to a particular class if there is a probability of less than 1 in 20 that the bearing error would exceed the numerical values specified for that class in the table below. This probability should be determined from an analysis of the five components that make up the total variance of the bearing (instrumental, site, propagation, random sampling and observational components).

**TO OBTAIN A POSITION (DETERMINED BY TWO OR MORE RDF STATIONS ORGANIZED AS A GROUP):** The vessel should call the RDF control station and transmit QTF (Will you give me my position according to the bearings taken by the RDF stations you control?).

The control station shall reply and, when the RDF stations

### Classification of Bearings

Class	Bearing Error (Degrees)	Observational Characteristics					
		Signal Strength	Bearing Indication	Fading	Interference	Bearing Swing (Degrees)	Duration of Observation
A	$\pm 2^\circ$	very good or good	definite (sharp null)	negligible	negligible	less than $3^\circ$	adequate
B	$\pm 5^\circ$	fairly good	blurred	slight	slight	more than $3^\circ$ less than $5^\circ$	short
C	$\pm 10^\circ$	weak	severely blurred	severe	strong	more than $5^\circ$ less than $10^\circ$	very short
D	more than $\pm 10^\circ$	scarcely perceptible	ill-defined	very severe	very strong	more than $10^\circ$	inadequate