

In an effort to operate the marine radio beacon service more efficiently and effectively, and with a view toward the best interests and safety of the mariner, representatives of the Department of Transport, Canada, and representatives of the U.S. Coast Guard, Department of the Treasury, United States, have adopted the general principles listed below for the operation and the coordination of marine radio beacons of Canada and the United States. This Memorandum of Understanding supersedes the *General Principles Recommended for the Coordination of the Marine Radio Beacons of the United States and Canada* agreed upon by representatives of the Department of Marine, Canada, and the Lighthouse Service, Department of Commerce, United States in 1935 and revised in 1939.

Definitions:

The following terms when used herein are defined as follows:

Continuously Sequenced Radio Beacons - several beacons operating in sequence on the same frequency with the sequence being repeated continually.

Continuously Operating Radio Beacon - a single beacon on a frequency not sharing time and operating without interruption.

Marine Marker Radio Beacon - a continuously operating radio beacon of approximately ten (10) miles service range.

Warning Beacon - an auxiliary radio beacon of short range, modulated by a warbling note, at the same location and operating on the same frequency during the minute immediately following the main radio beacon to warn vessels of proximity to a lightship.

Agency - Canada - The Department of Transport
United States - The United States Coast Guard.

1. Operation of Continuously Sequenced Radio Beacons

Marine radio beacons in the same general geographical area, except those operating continuously, will be divided into groups of up to six beacons transmitting on a single frequency. Each radio beacon will transmit for one minute out of each 6 minute period in sequence with the other beacons of the group regardless of weather conditions. If less than six radio beacons are assigned to a group, one or more of the beacons may transmit during two of the six one-minute periods. Sequenced radio beacons will no longer be available for continuous operation for calibration purposes.

Grouping of marine radio beacons on the same frequency, irrespective of country, may be made where such grouping is desirable and agreeable to both Agencies. Groups should, however, consist of stations belonging to one country insofar as practical.

2. Operation of Continuous Radio Beacons

Recognizing that great improvements in spectrum utilization can be achieved by the time-sharing of frequencies used by marine radio beacons and that this manner of operation is sufficient for the needs of the maritime radionavigation service operating in the 285 kc/s to 325 kc/s band, every effort should be made to restrict the use of this band to radio beacons operating in this manner.

However, an exception to the above may be permitted where maritime and aeronautical requirements for radio beacons of substantially equal range exist at the same location, and where such location is in an area such that a continuously operating radio beacon will not preclude the future accommodation of the reasonably anticipated marine radio beacon requirements in that area.

It is recognized that there might be other circumstances which would indicate the desirability of operating a marine radio beacon on a continuous basis, but such a requirement is secondary to the needs of the regular system, and is subject to adjustment to meet future requirements of the regular maritime radionavigation service.

3. Characteristics of Emitted Signal

In order to extend the usefulness of marine radio beacons to the increasing number of vessels equipped with automatic direction finders and manual direction finders equipped with beat frequency oscillators, radio beacons should be converted to provide a continuous-carrier with tone-keyed modulation. A modulation percentage of 65 to 70 percent is adopted as standard. A modulation standard of 1020 ± 50 cps is agreed upon with the understanding that a different modulation tone may be desirable at some locations.

It is considered desirable to adopt a common U.S. - Canadian aural characteristic. While this does not appear feasible at the present time, efforts to arrive at a mutually agreed upon characteristic should be continued.

For the present, the characteristics of the transmitted signal of sequenced and continuously operating radio beacons, except marine marker radio beacons, shall be a simple combination of dots and dashes or of either of these alone, with optional long dashes, superimposed on a continuous carrier during the period of transmission. The characteristics of the transmitted signal of a marine marker radio beacon shall be a series of one-half ($\frac{1}{2}$) second dashes for $13\frac{1}{2}$ seconds, silent $1\frac{1}{2}$ seconds, superimposed on a continuous carrier with station identification being achieved by carrier frequency only. The transmitted signal of a warning beacon shall be a continuous warbling note of alternating 1020 and 750 ± 50 cps tones, superimposed on a continuous carrier.

4. Frequency Usage

All marine radio beacons will, where possible, operate on one of the twenty even numbered frequencies in the band 285 to 325 kc/s. Assignment of adjacent channels or repetition of an assignment will be made on the basis of radiated signal strength and geographic separation. For the present it is agreed that an undesired co-channel signal shall be at least 28 dB below the desired signal at the extremity of the advertised service range of the desired signal. The following values are accepted as the standard of selectivity of direction finders for the reduction of the co-channel protection ratio which is applicable in the case of an off-channel assignment and will be used when making radio beacon assignments:

Frequency deviation from resonant frequency	DB below resonance response
± 2 kc/s	3
± 3 kc/s	12
± 4 kc/s	25
± 6 kc/s	50
± 9 kc/s	70
± 12 kc/s	80

Future consideration should be given to the revision of these values in the light of spectrum requirements and technical improvements.

No new stations of other services shall be permitted to use any frequency in the band 285 to 325 kc/s unless it is first established that such use would not result in harmful interference to the accurate and successful working of the maritime radionavigation service. Wherever possible, existing stations of other services operating in the band 285 to 325 kc/s, which have an influence in the maritime areas, should be transferred to frequencies outside of that band. In addition, consideration should be given to limiting the power of stations on the adjacent band edges where these affect the maritime radionavigation service.

Prior to establishment of new radio beacons or changes to existing stations situated within interference range of the United States - Canada borders and within the band 285 to 325 kc/s, the proposed establishment or change shall be co-ordinated on an Agency-to-Agency basis. The information to be given for co-ordination purposes shall include:

- (a) frequency
- (b) station and location (latitude and longitude)
- (c) service range
- (d) identification characteristics
- (e) timing (sequence assignment)

Conditions of harmful interference, out-of-tolerance conditions, or other malfunctions noted by one Agency should be referred to the other Agency.

5. Rating, Power and Range

Pursuant to the *Radio Regulations* adopted by the 1959 ITU Conference, the daylight service range of marine radio beacons should be based on a field strength of 50 microvolts per metre at the limit of the service range for radio beacons north of 40°N. The designation of marine radio beacons is changed to service range in miles in lieu of Class A, B, or C.

Marine marker radio beacons, previously designated as Class D radio beacons, generally will not exceed 50 microvolts per metre in signal strength at 10 miles for all latitudes. The service range of radio beacons, except marine marker radio beacons, should be adjusted to the minimum required. The ranges may be in increments of 5 miles up to 100 mile range and in increments of 25 miles beyond 100 mile range. Radiated radio beacon power should be adjusted to provide the required service range, should not exceed the required level and should be the minimum consistent with the operational needs of the mariner.

6. Transmitting Equipment

All radio beacon emissions shall occupy the minimum practical frequency spectrum and shall have the inherent carrier frequency stability necessary to conform to the standards of the *Radio Regulations* (Geneva 1959) which is .01%.

Dual-carrier emission has been adopted by the U.S.C.G. as a means toward greater utilization of the frequency spectrum. The adoption of this technique by the Department of Transport will be considered.

7. Direction Finder Performance Standards

Manufacturers and users should be encouraged to use direction finders having better selectivity and sensitivity. Recommended standards which will be protected in the present-day assignment of frequencies shall be the selectivity characteristics adopted in item 4. However, industry and the mariner should be informed that future system planning will be based upon a tightened direction finder selectivity specification as follows:

Frequency deviation from resonant frequency	DB below resonance response
± 1 kc/s	3 maximum
± 3 kc/s	30 minimum
± 6 kc/s	70 minimum
± 8 kc/s	80 minimum

The sensitivity of direction finders should be adequate for taking a satisfactory bearing using a signal as low as 50 microvolts per metre with a margin of 6 dB to allow for equipment degradation.

8. Distance Finding System

Distance finding, a system of transmitting synchronized sound and radio signals, should be used only at those stations where a definite requirement exists.

9. Monitoring of Marine Radio Beacons

In order to assure that marine radio beacons operate at full efficiency and in accordance with their advertised characteristics, it is desirable that a program for regular monitoring of each radio beacon be established and maintained. Monitoring may be performed either by personnel assigned to perform this task or by automatic indicating equipment, both of which are capable of detecting and reporting radio beacon malfunctions. The monitoring program should be capable of detecting and reporting out of sequence operation, off frequency operation, keying defects and significant changes in field intensity and modulation percentage with respect to the preset levels.

COMMANDANT
U.S. COAST GUARD
E.J. ROLAND

DEPUTY MINISTER
OF TRANSPORT

April 18, 1962

August 22, 1962

Date of this Memorandum is the date of final signature: August 22, 1962