RECOMMENDATION ITU-R M.824-2[*]

TECHNICAL PARAMETERS OF RADAR BEACONS (RACONS)

(1992-1994-1995)

Summary

Radar beacons are in common use in the maritime radionavigation service and in limited use in the aeronautical radionavigation service. This Recommendation sets out the technical parameters for:

– a general purpose maritime radar beacon,

– a user-selectable maritime radar beacon,

– an aeronautical fixed-frequency radar beacon.

The ITU Radiocommunication Assembly,

considering

a) that shipborne radars in the maritime radionavigation service operate in the bands 2 900-3 100 MHz and 9 320 (9 300 from 1 January, 2001)-9 500 MHz;

b) that aeronautical mobile radars operate in the band 9 300-9 500 MHz;

c) that maritime radar beacons (maritime racons) which operate in the frequency bands 2 900-3 100 MHz and 9 320 (9 300 from 1 January, 2001)-9 500 MHz are of two types, general purpose and user selectable;

d) that the use of fixed-frequency racons is not permitted in the band 9 320-9 500 MHz;

e) that in the band 9 300-9 320 MHz the use of shipborne radars in the radionavigation service is not permitted until 1 January 2001 with a view to accommodating existing aeronautical fixed-frequency racons in this band;

f) that the use of the band 9 300-9 500 MHz by the aeronautical radionavigation service is limited to airborne weather radars and ground-based radars. In addition, ground-based fixed-frequency radar beacons in the aeronautical radionavigation service are permitted in the band 9 300-9 320 MHz on condition that harmful interference is not caused to the maritime radionavigation service. In the band 9 300-9 500 MHz, ground-based radars used for meteorological purposes have priority over other radiolocation devices,

recommends

1 that the technical parameters for general purpose maritime radar beacons, user-selectable maritime radar beacons, and general purpose ground based aeronautical fixed-frequency radar beacons, should be in accordance with Annexes 1, 2 and 3, respectively.

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[*] This Recommendation should be brought to the attention of the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the World Meteorological Organization (WMO) and the International Association of Lighthouse Authorities (IALA).

ANNEX 1

Technical parameters for a general purpose maritime radar beacon (racon)

Item	Parameters	Specifications
1. Antenna	Polarization	In the 3 GHz band, suitable for responding to radars using horizontal polarization and to radars using vertical polarization In the 9 GHz band, suitable for responding to radars using horizontal polarization
2. Receiver	Frequency band	2 900-3 100 MHz and/or 9 300 to 9 500 MHz (9 300-9 320 MHz from 1 January, 2001)
	Blocking period	≤ 100 µs after end of response
	Primary radar pulse length gating	≥ 0.05 µs
3. Transmitter	Frequency	Transmission should occur: – either on the frequency of the interrogating signal with a frequency matching accuracy of ± 3.5 MHz for interrogating signals with a duration of less than 200 ns, or, with a frequency matching accuracy of ± 1.5 MHz for pulses with a duration equal to or more than 200 ns – or by a series of sweeps covering the entire frequency band of the receiver in which the signal was received. Where the transmission consists of a series of sweeps, the form of the sweep shall be sawtooth and should have a slew rate of between 60 s and 120 s per 200 MHz
4. Response	Delay after receipt of interrogation	Normally not more than 0.7 µs
	Form of identification	Identification coding should normally be in the form of a Morse letter. The identification coding used should be as described in appropriate navigational publications The identification coding should comprise the full length of the radar beacon response and, where a Morse letter is used, the response should be divided with a ratio of one dash equal to three dots and one dot equal to one space. The coding should normally commence with a dash
	Duration	The duration of the response should be approximately 20% of the maximum range requirement of the particular radar beacon, or should not exceed five miles, whichever is the lower value. In certain cases, the duration of the response may be adjusted to suit the operational requirements for the particular radar beacon (see Note 1)

NOTE 1 – Characteristics for antenna aperture and gain, receiver sensitivity, transmitter power, racon response duration, frequency agile racon on/off time, and side-lobe suppression should be determined by Administrations.

ANNEX 2

Technical parameters for user selectable maritime radar beacons (racons) (non-commanded and commanded systems)

1   Introduction

The non-commanded system requires a relatively simple additive modification to the maritime shipborne radar to provide a "racon only" output which is available for processing and display in a variety of ways. It is the preferred system for general use.

The commanded system provides a "radar only" as well as a "racon only" output. Generally, it requires significant modification to the basic parameters of the shipborne radar. Its use may be justified in special circumstances.

2 Non-commanded system

The User Selectable Included Frequency Agile Racon (USIFAR) has a response that is frequency modulated by a simple tone but is otherwise in accordance with the requirements for the response of the general purpose racon (see Annex 1).

The normal (general-purpose) service is provided by the carrier of the FM spectrum, and the secondary service by either full FM reception of the response or narrow-band reception of the first sidebands.

2.1 Technical parameters

FM parameters suitable for either option are:

‒ modulation frequency: 25 MHz;

– modulation index near unity to give carrier to first sidebands ratio of 6 dB.

3 Commanded system

The Interrogated Time Offset Frequency Agile Racon (ITOFAR) can be controlled by the radar operator to give a frequency agile response with or without time offset. Upon reception of normal radar pulses the ITOFAR responds without time offset, i.e. responds as a normal frequency agile radar beacon.

The ITOFAR gives a frequency agile response with time offset upon reception of a specific radar p.r.i. (pulse repetition interval, inverse to p.r.f.) or rather a p.r.i. belonging to a set of well-defined p.r.i.'s dedicated to the time offset response mode.

The technical parameters for p.r.i.'s to be used for activation of the different radar beacon services is given in Table 1. The time offset response is one of these services.

Eight p.r.i.'s are allocated to each service to permit a random staggering for clutter suppression and for isolation of simultaneous radar activations.

TABLE 1

Command protocol of interrogation p.r.i.'s for ITOFAR systems

Parameters	Specifications
Interrogating signal	A series of pulses with an interval between each pulse (or p.r.i.) of: $(747.000 + (n \times 8/3))$ μs ± 0.1 μs where n is a number between 0 and 7 inclusive, selected at random for each pulse, except that no two consecutive pulses should use the same number
Response – Delay after receipt of interrogating signal – Form of identification	 The response shall be transmitted 375 μs $\pm$ 0.7 μs after receipt of interrogating signal The identification coding should be the same as that used in the normal response of the racon

NOTE 1 – Time offset response may be used to meet other operational requirements by varying the p.r.i. of the interrogating signal as follows:

$$p.r.i. = (747.000 + m/3 + (n \times 8/3)) \text{ μs} \pm 0.1 \text{ μs}$$

where:

n : a number between 0 and 7 inclusive, selected at random for each pulse, except that no two consecutive pulses should use the same number

m : a number from 1 to 7 allocated for the particular operational requirement.

ANNEX 3

Technical parameters for a general purpose ground-based aeronautical fixed-frequency radar beacon

Transmitter:

Frequency:	9 310 MHz
Necessary bandwidth (allowing for frequency tolerance of ±3 MHz):	12 MHz
Power (measured at antenna terminals):	50 W
Form of identification:	15 digital codes
Overall length of transmission:	15.5 μs

Receiver:

Passband:	9 370 to 9 380 MHz
Sensitivity:	−55 dBm
Maximum blocking period:	25 μs
Pulse length discrimination:	2.35 ± 0.3 μs
Fixed delay in response:	4.7 ± 0.1 μs

Antenna:

Gain:	0 dB minimum
Beamwidth:	Azimuth: 360°
	Elevation: 30°
Polarization:	Horizontal

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