RECOMMENDATION ITU-R M.1313-1*

TECHNICAL CHARACTERISTICS OF MARITIME RADIONAVIGATION RADARS

(Question ITU-R 35/8)

(1997-2000)

The ITU Radiocommunication Assembly,

considering

a) that maritime radar stations in the radionavigation service are operated in the 3, 5 and 9 GHz bands;

b) that the radio spectrum available for use by the radionavigation service is limited;

c) that the radionavigation service is a safety service as specified by No. S4.10 of the Radio Regulations;

d) that the necessary bandwidth of emissions from radar stations in the radionavigation service is large in order to effectively perform their function;

e) that there is increasing need for radionavigation services to be compatible with other services which share their allocated bands,

recommends

1 that the technical characteristics for maritime radars contained in Annex 1 should be used when assessing compatibility with other services.

ANNEX 1

Technical characteristics of maritime radionavigation radars**

1 Introduction

In global terms a clear distinction can be made between radars that conform to the requirements of the IMO (including those used on fishing vessels), those that are used for inland navigation (rivers) and those fitted on a voluntary basis in pleasure crafts.

In Table 1 are the comparisons of transmitter power and numbers of radars for the three categories above.

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* This Recommendation should be brought to the attention of the International Maritime Organization (IMO), the International Civil Aviation Organization (ICAO), the International Maritime Radio Committee (CIRM) and Radiocommunication Study Groups 1 and 9.

** Maritime fixed civil radars used for e.g. Vessel Traffic Services (VTS) are not considered, as their characteristics are dependent upon location and function i.e. surveillance of coastal and harbour shipping.

TABLE 1

Radar category	Peak power (kW)	Global total
IMO and fishing	≤ 75	> 300 000
River	< 10	< 20 000
Pleasure	< 5	> 500 000

The radar characteristics which effect the efficient use of the spectrum, including sharing criteria, are those associated with the radar antenna and transmitter/receiver. Most of the maritime radars use slotted array antennas, however, some of the pleasure craft radars use Yagi arrays. The characteristics of spurious emissions are not addressed in this Recommendation.

The technical characteristics for the IMO category are summarized in Table 2. They are for radars operating in the 3 GHz, 5 GHz and 9 GHz frequency bands. The range for each characteristic is expressed in the form of a maximum and minimum value.

TABLE 2

Maritime radionavigation radars (IMO category – including fishing)
Transmitter/receiver – typical characteristics

Characteristic	2 900-3 100 MHz		5 470-5 650 MHz		8 850-9 000 MHz 9 200-9 500 MHz	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Antenna (for transmission/reception)						
Beamwidth (to –3 dB) (degrees)						
Horizontal	4.0	1.0	2.6	1.0	2.3	0.75
Vertical	30.0	24.0	25.0	18.0	26.0	20.0
Sidelobe attenuation (dB)						
Within ±10°	28	23	29	23	31	23
Outside ±10°	32	31	35	31	40	30
Gain (dB)	28	26	31	28	32	27
Rotation rate (rpm)	60	20	60	14	60	20
Transmitter						
Peak power (kW)	75	30	70	50	50	5
Frequency (MHz)	3 080	3 020	5 595	5 485	9 445 ± 30	9 375 ± 30
Pulse duration[(1)] (μs)	1.2	0.05	1.5	0.07	1.2	0.03
Pulse repetition frequency[(1)] (Hz)	4 000	375	3 600	400	4 000	375
Receiver						
Intermediate frequency (IF) (MHz)	60	45	60	45	60	45
IF bandwidth (MHz)						
Short pulse	28	6	28	6	28	6
Medium/long pulse	6	2.5	6	2.5	6	2.5
Noise figure (dB)	8.5	3	8.5	3	8.5	3.5

(1) When using this Table to calculate mean power it should be noted that the maximum pulse repetition frequency is associated with the minimum pulse duration and vice versa.

Those radars that operate in the 5 GHz frequency band, represent a relatively small percentage of the global total and are generally constrained to operation in one particular geographical area.

The technical characteristics for the "river" category are summarized in Table 3 and those for the "pleasure craft" category in Table 4. In both cases the radars operate only on frequencies in the band 9 200-9 500 MHz.

TABLE 3

Maritime radionavigation radars (river category)
Transmitter/receiver – typical characteristics

Characteristic	Typical value
Antenna (for transmission/reception)	
Beamwidth (to –3 dB) (degrees)	
Horizontal	0.95
Vertical	26.0
Sidelobe attenuation (dB)	
Within ±10°	> 25
Outside ±10°	> 32
Gain (dB)	30
Rotation rate (rpm)	30
Transmitter	
Peak power (kW)	5
Frequency (MHz)	9 410 ± 30
Pulse duration (μs)(1)	0.05, 0.18, 0.5
Pulse repetition frequency (Hz)(1)	1 000-3 000
Receiver	
IF (MHz)	50
IF bandwidth (MHz)	15-25
Noise figure (dB)	6

(1) When using this Table to calculate mean power it should be noted that the maximum pulse repetition frequency is associated with the minimum pulse duration and vice versa.

TABLE 4

Maritime radionavigation radars (pleasure craft category)
Transmitter/receiver – typical characteristics

Characteristic	Maximum	Minimum
Antenna (for transmission/reception)		
Beamwidth (to –3 dB) (degrees)		
Horizontal	6.2	1.8
Vertical	30	22
Sidelobe attenuation (dB)		
Within ±10°	27	20
Outside ±10°	30	25
Gain (dB)	27	21
Rotation rate (rpm)	24	24
Transmitter		
Peak power (kW)	10	1.5
Frequency (MHz)	9 445 ± 30	9 410 ± 30
Pulse duration (μs)(1)	1.2	0.08
Pulse repetition frequency (Hz)(1)	3 600	375
Receiver		
IF (MHz)	60	45
IF bandwidth (MHz)	25	2.5
Noise figure (dB)	8	4

(1) When using this Table to calculate mean power it should be noted that the maximum pulse repetition frequency is associated with the minimum pulse duration and vice versa.

2 Interference criteria

Radionavigation systems may fail to meet their performance requirements if undesired signals inflict excessive amounts of various types of interference degradation. Dependent upon the specific interacting systems and the operational scenarios, those types may include:

– diffuse effects, e.g. desensitization or reduction of detection range, signal drop-outs and reduction of update rate;

– discrete effects, e.g. detected interference, increase of false alarm rate;

– others.

Associated with these types of degradation, the interference criteria may consist of threshold values of parameters, e.g. for a collision avoidance system:

– tolerable reduction of detection range and associated desensitization;

– tolerable missed-scan rate;

– tolerable maximum false-alarm rate.

These criteria for maritime radionavigation systems need to be developed further.