



Recommendation ITU-R M.1176-1
(02/2013)

**Technical parameters of
radar target enhancers**

M Series
**Mobile, radiodetermination, amateur
and related satellite services**

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Recommendations

(Also available online at <http://www.itu.int/publ/R-REC/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R M.1176-1*

Technical parameters of radar target enhancers

(1995-2013)

Scope

Trials of radar target enhancers have indicated that the radar returns from navigation buoys and small craft can be significantly improved by the use of such devices.

This Recommendation provides the technical parameters for radar target enhancers (RTE) operating in the frequency bands 2 900-3 100 MHz and/or 9 200-9 500 MHz.

The ITU Radiocommunication Assembly,

considering

- a) that maritime radars in the maritime radionavigation service operate in the frequency bands 2 900-3 100 MHz and 9 200-9 500 MHz;
- b) that a transponder is a device that can provide for echo enhancement with the provision that such enhancement should not significantly exceed that which could be achieved by passive means (IMO Resolution A.615(15));
- c) that the radar returns from targets such as navigation buoys and small craft can be significantly improved by the use of an active target enhancer consisting of a broadband radio-frequency amplifier, receive and transmit antennas,

noting

- a) that IMO SOLAS Chapter 5 regulation 19-2.1.7 requires, if practicable, fitting of a radar reflector to all ships and craft under 150 gross tonnage to enable detection by radar;
- b) that IMO Resolution MSC.164(78) provides performance standards for both passive and active radar reflectors,

recommends

that the technical parameters of radar target enhancers for use on navigation buoys and ships and craft under 150 gross tonnage should be in accordance with the Annex.

* This Recommendation should be brought to the attention of the International Maritime Organization (IMO), the International Standards Organization (ISO), the International Electrotechnical Commission (IEC) and the International Association of Lighthouse Authorities (IALA).

Annex

**Technical parameters of a radar target enhancer
for use on navigation buoys and small craft**

Parameters	Specifications
Polarization	In the 3 GHz band, suitable for responding to radars using horizontal polarization. In the 9 GHz band, suitable for responding to radars using horizontal polarization.
Frequency bands	2 900 to 3 100 MHz 9 200 to 9 500 MHz
Gain	To represent a radar cross-section of an RTE in unsaturated condition not less than: 0.5 m ² in the 3 GHz band 7.5 m ² in the 9 GHz band where $G = 10 \log(\sigma_{unsat}) - 20 \log(\lambda) + 10 \log(4\pi)$ $G = G_a + G_r + G_t$ G_a is the gain (dB) of the amplifier G_t is the gain (dBi) of the transmitting antenna G_r is the gain (dBi) of the receiving antenna σ_{unsat} is the radar cross-section (m ²), and λ is the wavelength (m).
Beamwidth	Horizontal: To maintain the radar cross-section over at least 280°, with nulls below this level being no greater than 10°, at least 20° apart. Vertical: To maintain the radar cross-section over ±10°(±20° for single hull sailing vessels).
Output form	The output shall be only an amplified version of the received pulse, without any form of processing except limiting. The delay and stretching of the output shall not exceed 10% of the length of the received pulse, or 10 ns whichever is greater.
e.i.r.p. at limiting level	Not greater than 10 W.