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Navigation radar used on inland waterways; Operational, functional and technical requirements

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document defines the functional and operational requirements for navigational radar installations used in inland waterways as required by CESNI ES-TRIN standard [i.1].

The present document is applicable to radar equipment and its associated primary navigational display intended for the navigation of vessels on inland waterways with the following characteristics:

- Transmitter Peak Envelope Power up to 10 kW.
- The antenna is rotating and passive.
- Unmodulated single carrier frequency only may be utilized.

The applicable frequencies of operation of this type of radio equipment are given in table 1. These frequencies are allocated to the radio navigation service, as defined in article 5 of the ITU Radio Regulations [i.4].

Table 1: Radio navigation service frequencies

	Radio navigation service frequencies
Transmit	9 300 MHz to 9 500 MHz
Receive	9 300 MHz to 9 500 MHz

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] IMCO Resolution A.278 (VIII) (1973): "Symbols for controls on marine navigational radar equipment".

[2] ISO 25862:2019: "Ships and marine technology -- Marine magnetic compasses, binnacles and azimuth reading devices".

[3] IEC EN 60945 (2002): "Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] CESNI: "European Standard laying down Technical Requirements for Inland Navigation vessels, ES-TRIN".

[i.2] Recommendation ITU-R M.824-4 (02/2013): "Technical parameters of radar beacons".

[i.3] Recommendation ITU-R M.628-5 (03/2012): "Technical characteristics for search and rescue radar transponders".

[i.4] ITU Radio Regulations (2020).

[i.5] IEC 62388 (2013): "Maritime navigation and radiocommunication equipment and systems - Shipborne radar - Performance requirements, methods of testing and required test results".

[i.6] IEC 62288 (2014): "Maritime navigation and radiocommunication equipment and systems - Presentation of navigation-related information on shipborne navigational displays - General requirements, methods of testing and required test results".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

conventional radar: radar where the output signal is generated by a magnetron, using pulsed emissions but not using frequency, phase or power modulation

FTC: function to suppress rain clutter

IR: function to suppress interference from other radars

Peak Envelope Power (PEP): average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions

NOTE: This definition is taken from ITU Radio Regulations [i.4].

Radar Cross-Section (RCS): cross-section determining the power density returned to the radar for a particular power density incident on a target

radar echo: signal reflected by a target to a radar antenna that appears in the radar video signal and radar image

radar equipment: equipment and its associated primary navigational display intended for the navigation of vessels on inland waterways

RAIN: function to suppress rain clutter, other term for FTC

SEA: sea clutter suppression, other term for STC

standard reflector: radar reflector with an equivalent Radar Cross Section (RCS) at a frequency of 9 400 MHz equal to 10 m^2

STC: function to suppress sea clutter

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dB	decibel
t	time
λ	wavelength

π	mathematical constant: 3,14159265…
ρ	reflection coefficient
σ	radar cross section

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
ACP	Azimuth Clock Pulse
AIS	Automatic Identification System
AR	Azimuthal Resolution
ARP	Azimuth Reference Pulse
AtoN	Aids to Navigation
CESNI	European Committee for drawing up standards in the field of inland navigation
COG	Course Over Ground
DC	Direct Current
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display and Information System
EN	European Norm
ES-TRIN	European Standard laying down Technical Requirements for Inland Navigation vessels
EUT	Equipment Under Test
FTC	Fast Time Constant
GNSS	Global Navigation Satellite System
IEC	International Electrotechnical Committee
IHO	International Hydrographic Organization
IMCO	Inter-Governmental Maritime Consultative Organization
IR	Interference Rejection
ISO	International Organization for Standardization
ITU-R	International Telecommunications Union - Radiocommunications
LED	Light Emitting Diode
MR	Minimum Range
P-Line	Parallel-Line
PRF	Pulse Repetition Frequency
PRT	Pulse Repetition Time
RACON	RAdar beaCON
RCS	Radar Cross-Section
RF	Radio Frequency
ROT	Rate-Of-Turn indicator
RR	Radial Resolution
SART	Search and Rescue Radar Transponder
SHM	Ships Heading Marker
SOG	Speed Over Ground
SOLAS	Safety Of Life At Sea
STC	Sensitivity Time Control
Tr	Trigger
V	Video
VRM	Variable Range Marker
WG	WaveGuide

4 General requirements

4.1 Purpose of the radar equipment

The radar equipment shall facilitate the navigation of vessels on inland waterways by providing an intelligible radar picture of their position in relation to buoys, shorelines and other navigational marks as well as enabling the reliable and timely recognition of other ships and obstructions protruding above the water surface.

4.2 Construction and design

Mechanical and electrical construction and design of the radar equipment shall be suitable for operation on board vessels navigating on inland waterways.

4.3 Operational controls

The equipment shall be designed in such a way that incorrect operation will not cause the equipment to fail.

One person shall be able to operate the radar equipment and watch the display simultaneously.

Control panel shall be provided as a separate unit. It shall contain all controls used directly for radar navigation. The use of cordless remote controls is not permitted.

The equipment shall not have more controls than are necessary for its correct operation. The design, markings and controls of the equipment shall enable simple, unambiguous and fast operation. The arrangement shall be such that the possibility of operating mistakes is minimized.

All controls shall be arranged in such a way that when a control is operated the associated indication remains visible and that the radar navigation can continue without restriction.

The effect of operation of controls shall be such that movements to the right or upwards shall have a positive effect on the manipulated variable, while movements to the left or downwards have a negative effect.

If pushbuttons are used, they shall be designed in such a way that they can also be found by touch. Moreover they shall have a noticeable pressure point (tactile feedback).

Controls to switch off the equipment shall be protected against unintentional operation.

All controls and indicators shall be equipped with a dazzle-free source of lighting suitable for use under all conditions of light which can be adjusted to zero by means of an independent control.

All controls and indicators shall be provided with symbols and/or a description in English and, if possible, switchable to the users language. Symbols shall meet the requirements of IMCO Resolution No. A.278 (VIII) [1].

The height of all indicative markings shall be at least 4 mm unless this is not technically feasible and therefore a reduction to 3 mm will be allowed.

Any functions additional to the minimum functions specified in the present document, as well as any connections for external apparatus, shall not impair the capability to meet the minimum requirements contained in the present document.

The antenna unit shall have a safety switch by means of which the transmitter and the rotator drive can be switched off. After switching the equipment to the STBY or to the ON state, a message shall occur on the display, if the safety switch is activated.

4.4 Interfaces

4.4.1 Fail safe design

All interfaces shall be designed fail safe, so that connecting, disconnecting or a failure of the connected equipment or a short circuit shall not cause any deterioration of the radar equipment performance.

4.4.2 Display of data received via interfaces

Unless otherwise specified, all information received via an interface shall be displayed outside of the radar picture. Existing requirements concerning the presentation of such received data shall be fulfilled.

4.4.3 Operation of equipment connected via interfaces

Unless otherwise specified all operation menus for equipment connected via interfaces shall be placed outside of the radar picture. Existing requirements concerning the presentation and the functionality of such menus shall be fulfilled.

4.4.4 Interpretation and presentation of data delivered via interfaces

If the radar acts as a display for an external device it shall receive and display all information including alarms or status messages concerning the quality of the input data.

4.5 Software

4.5.1 Software performance

Software used in equipment of the present document is assumed to be a safety critical part of a navigation system. Manufacturers of navigation systems shall make sure that all software components allow secure navigation in every situation. Software components have to be clearly designed by means of established software design methods and ergonomic criteria.

4.5.2 Software protection

Manufacturer shall implement provisions to protect all operational software incorporated in the equipment. Any software required in equipment to ensure operation in accordance with its equipment standard, including that for its initial activation or reactivation, shall be permanently installed within the equipment, in such a way that it is not possible for the operator to have access to this software. It shall not be possible for the operator to augment, amend or erase any software in the equipment required for operation in accordance with its equipment standard.

4.6 Equipment labelling

Each unit of the equipment including any external power supply, shall be clearly and indelibly marked on the exterior with the identification of the manufacturer, the type designation of the equipment and the serial number of the unit. All operating controls, indicators and terminals shall be clearly marked in accordance with IEC EN 60945 [3]. The compass safety distance shall be stated on the outdoor unit and on the display unit.

4.7 Operating and service manuals

A detailed operating manual and a summarized operating manual on a durable medium shall be supplied with each equipment in the language(s) of the country(ies) in which it is intended to be placed on the market.

The detailed version of the operating manual shall contain at least the following information:

- activation and operation;
- maintenance and servicing;
- instructions as to the correct technical installation;
- general safety instructions with special reminders of safety risks due to the rotating antenna, and of the power flux density of the microwave radiation compared with the actual limits;
- link to CE declaration by manufacturer; can alternatively be supplied by separate paper document.

Each detailed operating manual shall contain a manufacturer's statement to the effect that the equipment meets the requirements of the present document.

A detailed installation manual shall be provided.

Service manuals may be written in the English language only.

5 Testing requirements specifications

5.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use, but as a minimum, shall be that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

5.2 Conformance Requirements

5.2.1 Tests under extreme conditions

5.2.1.1 Performance check procedure

5.2.1.1.1 Definition

Where stated in the present document a performance check as described in this clause shall be carried out to ensure proper functionality.

5.2.1.1.2 Required test results

The following results are required:

- the warm up time shall not exceed 4 minutes;
- after switching to ON the antenna shall rotate and the transmitter functions;
- the display shall indicate the regular status of the equipment;
- the display shall be readable without any degradation;
- the operation of GAIN, TUNE, STC, FTC, EBL and VRM controls shall function correctly.

5.2.1.1.3 Conformance

The conformance tests are specified in clause 6.5.1.1.

5.2.1.2 Temperature test of the indoor unit

5.2.1.2.1 Definition

This test determines the ability of the indoor unit to work under extreme temperatures without resulting in mechanical weakness or degradation in performance.

5.2.1.2.2 Required test results

The indoor equipment shall satisfy all requirements of the performance checks as described in clause 5.2.1.1 for ambient temperatures of the indoor unit of 0 ºC and +40 ºC.

5.2.1.2.3 Conformance

The conformance tests are specified in clause 6.5.1.2.