



**Maritime low power VHF personal locating
beacons employing Digital Selective Calling (DSC);
Harmonised Standard covering the essential requirements
of article 3.2 of Directive 2014/53/EU**

Reference

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Foreword

This draft Harmonised 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.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.7] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

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):	18 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).

"must" and **"must not"** are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document lays down the minimum requirements for low power maritime personal locating beacons employing DSC signalling according to ETSI EN 300 338-6 [1], on the VHF maritime mobile frequency band channel 70. Maritime personal locating beacons employing DSC signalling also include AIS with an integrated GNSS receiver to provide the locating function according to ETSI EN 303 098 [2]. The present document incorporates the relevant provisions of the International Telecommunication Union (ITU) radio regulations [i.4] included in Recommendation ITU-R M.493-14 [3]. The present document does not cover requirements for the integrated GNSS receiver providing the locating function.

LBT (Listen Before Talk) techniques are employed to improve spectrum efficiency.

For this application, both the radiated power and the length of time of operation are limited to enable the equipment to be sufficiently small and light to be worn comfortably at all times and to limit the operating range to a local area.

The present document also specifies technical characteristics, methods of measurement and required test results.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

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

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

- [1] ETSI EN 300 338-6 (V1.1.0) (11-2016): "Technical characteristics and methods of measurement for equipment for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF mobile service; Part 6: Class M DSC".
- [2] ETSI EN 303 098 (V2.1.1) (05-2016): "Maritime low power personal locating devices employing AIS; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [3] Recommendation ITU-R M.493-14 (09/2015): "Digital selective-calling system for use in the maritime mobile service".
- [4] IMO Annex 11 - Resolution MSC.149 (77) - (adopted on 3 June 2003): "Adoption of the revised performance standards for survival craft portable two-way VHF radiotelephone apparatus".
- [5] ETSI EN 301 025 (V2.2.0) (11-2016): "VHF radiotelephone equipment for general communications and associated equipment for Class "D" Digital Selective Calling (DSC); Harmonised Standard covering the essential requirements of articles 3.2 and 3.3(g) of the Directive 2014/53/EU".
- [6] ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".

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] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] ETSI TR 100 028-1 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [i.3] ETSI TR 100 028-2 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.4] ITU-R Radio Regulations (2016).
- [i.5] ETSI TS 101 570-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Interoperability Testing for Maritime Digital Selective Calling (DSC) Radios; Part 2: Class A/B Test Descriptions".
- [i.6] ETSI TS 101 570-3 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Interoperability Testing for Maritime Digital Selective Calling (DSC) Radios; Part 3: Class D Test Descriptions".
- [i.7] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

acknowledged: automated procedure it indicates that the objective of the initial DSC message has been achieved

activation: initial triggering of the MOB device i.e. both parts of the two-step procedure are performed

active mode: activated mode, transmitting in an emergency situation

closed loop: individual transmission to own vessel

default: value selected or an action taken by the equipment software in the absence of any operator input

distress alert: name given to the single distress DSC message with the format symbol 112

distress DSC message: DSC message or acknowledgement containing the distress information

distress information: symbols within a DSC message describing a distress situation consisting of the MMSI of the vessel in distress, the nature of distress, the position of the vessel in distress, the UTC time of that position and the mode of subsequent communication

factory default: default value that is set by the manufacturer such that the field or behaviour is defined prior to any operator intervention

information characters: set of symbols in a DSC message that contains the items of interest for the recipient and is used to compute the ECC symbol that terminates the message

non distress DSC message: DSC messages or acknowledgements that do not have the format specifier or category of "distress"

open loop: transmitting to all ships (broadcast)

symbol (as part of the DSC sentence): 7 binary bits of a 10 bit DSC word that have the information content

test mode: self testing mode, an individual test call to own vessel

word (as part of the DSC sentence): used to describe the 10 binary bits that make up the coded entities of a transmitted DSC message

NOTE: The 10 bits consist of a 7 bit "symbol" that gives the information content and 3 bit error check that gives the number of 0 binary bits in the 7 bit symbol.

3.2 Symbols

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

dB	decibel
P _{Norm}	conducted power measured under normal conditions
P ₋₂₀	conducted power measured at the lower extreme temperature
P ₊₅₅	conducted power measured at the upper extreme temperature

3.3 Abbreviations

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

CIRM	Comite International Radio-Maritime
CSP	Channel SPacing
DSC	Digital Selective Calling
EN	European Norm
ERP	Effective Radiated Power
EUT	Equipment Under Test
FSK	Frequency Shift Keying
GNSS	Global Navigation Satellite System
ID	Identity
IMO	International Maritime Organization
LBT	Listen Before Talk
MMSI	Maritime Mobile Service Identity
MOB	Man Over-Board
MSC	Maritime Safety Committee
RBW	Reference BandWidth
RF	Radio Frequency
SINAD	(Signal+Noise+Distortion) to (Noise + Distortion)
UTC	Coordinated Universal Time
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

4 General requirements

4.1 Construction

4.1.1 General

The manufacturer shall declare that compliance to the requirements of this clause (clause 4) is achieved and shall provide relevant documentation.

In all respects, the mechanical and electrical design and the construction and finish of the equipment shall conform with good engineering practice.

The equipment shall be designed to minimize the risk of internal and external damage during use or stowage.

The exterior of the equipment shall have no sharp edges or projections that could easily damage inflatable rafts or injure personnel.

The general construction and method of operation shall provide a high degree of proof against inadvertent operation due to nominal levels of: magnetic influences, handling, stowage and transit, whilst still providing a simple means of operation in an emergency.

The equipment shall be portable, lightweight, compact and be designed as one integral unit. The locating beacon shall derive its energy from a battery forming a part of the equipment and incorporate a permanently attached antenna which may be either fixed length or extendible.

The locating beacon may be fitted with a test facility by which the functioning of the transmitter and battery can be easily tested without the use of any external equipment.

The equipment shall be capable of being used by an unskilled person.

The locating beacon shall be watertight.

The equipment shall not be unduly affected by sea water or oil and shall be resistant to deterioration by prolonged exposure to sunlight.

A substantial part of the equipment shall be of highly visible yellow or orange colour to assist visual location.

4.1.2 Categories of equipment

Two categories are defined:

- Category 1 locating beacons shall have sufficient positive buoyancy to float in fresh water.
- Category 2 locating beacons intended to be incorporated into or attached to a buoyancy aid are not required to float.

Category 1 beacons that can float free may have a lanyard to attach them to a person or life vest. Where a lanyard is employed it shall meet the requirements of IMO MSC 149(77) [4], paragraph 2.3.11. The user manual or instructions shall include necessary information to allow the user to properly attach the locating beacon lanyard.

The user manual or instructions for Category 2 beacons shall include necessary information to allow the user to fit or attach the locating beacon to a buoyancy aid.

4.2 Controls

The equipment shall be initially activated by the use of two simple, but independent mechanical actions, neither of which on its own shall activate the equipment. The second mechanical action may be replaced by an immersion sensor. Where the second action is replaced by an immersion sensor then the first action shall be an arm function thus to ensure the beacon is armed for automatic activation when submerged.

It shall only be possible to activate the equipment after a seal or other mechanical restraint has been removed from the first mechanical action. For beacons without an arm function it shall not be possible to reattach a removed seal or restrain. After activation it shall be simple to de-activate the equipment and the means to deactivate the equipment shall be clearly marked.

The switch that operates any test facility (see clause 4.1) shall be so designed that it returns automatically to the off-position when released.

4.3 Indicators

4.3.1 General

The equipment shall be provided with visual and, with the exception of intrinsically safe MOB devices, audible indications that show the operation of the MOB device.

4.3.2 Audible indicators

The audible indicator shall clearly distinguish the following:

- i) Initial activation of the locating beacon.
- 2) Immediately prior to the locating beacon transmitting.

4.3.3 Visual indicators

The visual indicator shall be sufficiently bright to be seen in bright sunlight and clearly distinguish the following states:

- i) The locating beacon has been activated and is transmitting in active mode.
- ii) The locating beacon has GNSS position lock and is transmitting in active mode.
- iii) The locating beacon is undergoing test and is transmitting in test mode.
- iv) The locating beacon has completed a test or has been deactivated locally.
- v) The locating beacon cannot complete a test because it has not been properly programmed with own vessel MMSI.
- vi) The locating beacon cannot complete a test because it could not obtain a GNSS position.
- vii) The locating beacon has received a DSC acknowledgement and the DSC transmitter has been deactivated remotely.

4.4 Self ID

The locating beacon shall have a freeform number identity (self ID) to distinguish it from other DSC devices.

The self ID for a personal locating beacon is 972xyyyyy, where xx = manufacturer ID 01 to 99; yyyy = the sequence number 0000 to 9999 allocated by the manufacturer. Manufacturers IDs are issued by CIRM (www.cirm.org). Manufacturers shall only use manufacturer IDs that have been issued to them by CIRM, except for training and conformance testing purposes where the ID xx=00 can be used.

After being programmed by the manufacturer, it shall not be possible for the user to change the self ID of the locating beacon.

The self ID shall be held in non-volatile memory.

4.5 Own vessel MMSI

The locating beacon shall be programmed with the MMSI of its own vessel or group.

It shall be possible for a locating beacon's own vessel MMSI to be re-programmed in the field, for example when locating beacons are moved from one vessel to be stowed on another vessel. It shall be possible for users to re-programme the own vessel MMSI without locating beacons having to be returned to the manufacturer.

The own vessel MMSI shall be held in non-volatile memory.

If the own vessel MMSI is not entered or not valid the locating beacon shall indicate this during test.

4.6 Labelling

The locating beacon shall be provided with a label, or labels, permanently affixed to the exterior of the equipment, containing the following information:

- Self ID of the equipment (see clause 4.4).
- Open loop devices shall be marked DSC-MOB-O.
- Closed loop devices shall be marked DSC-MOB-C.
- adequate instructions to enable the equipment to be activated and deactivated.
- the type of battery as specified by the manufacturer of the locating beacon.
- a warning to not block the GNSS antenna.
- the compass safe distance as measured in clause 7.10.
- A warning to the effect that the radio beacon should not be operated except in an emergency.
- the date on which the battery will need to be replaced. Simple means shall be provided for changing this date when the battery is replaced. The battery replacement date marked on the locating beacon should be the date specified in clause 4.9.1.

4.7 Instructions

Necessary operating instructions shall be provided with the equipment. These should include the following warnings:

- "WARNING - This equipment is for use in an emergency only. It is not intended for routine tracking of persons or property. This includes routine recovery of divers".
- "WARNING - If self-test is performed more frequently than once a month, then battery life may be reduced".

4.8 Position indication

DSC-MOB locating beacons use AIS-MOB functionality to indicate their current position. The equipment shall incorporate position reporting as described in clause 5.2.3 of ETSI EN 303 098 [2]. Where the requirements of clause 4 of ETSI EN 303 098 [2] conflict with the requirements of the present document, the requirements of the present document shall take precedence.

4.9 Power source

4.9.1 Battery requirements

The type of battery and designation specified by the manufacturer for use in the equipment shall be clearly and indelibly marked on the equipment.

The manufacturer should establish a useful life and an expiry date for primary (non-rechargeable) batteries. The useful life is the period of time after the date of battery manufacture that the battery will continue to meet the input power requirements of the locating beacon, over the entire specified operating temperature range. The following losses shall be included (at a temperature of $+20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$):

- a) self-testing annually with GNSS data available;
- b) self-discharge of the battery;
- c) stand-by loads.

The expiry date of the battery shall be the battery installation date plus no more than half the useful life of the battery. The battery shall have a minimum useful life of at least two years. The installation date shall be no more than one year from the date of manufacture of the battery. The battery shall be clearly and durably marked with its date of manufacture. The locating beacon shall be clearly marked with the expiry date of the battery.

4.9.2 Battery capacity

The battery, after having met the requirements of clause 4.9.1 shall have sufficient remaining capacity to power an activated locating beacon and keep it transmitting for at least 12 hours at a temperature of $-20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

4.9.3 Safety precautions

Provisions shall be made for protecting the equipment from damage due to the accidental reversal of polarity of the battery.

5 Technical requirements

5.1 General

When activated the locating beacon shall be capable of transmitting distress messages that indicate the position of a person in the water. The transmitted messages shall be compatible with Table A1-4.1, Table A1-4.3 and Table A1-4.7 of Recommendation ITU-R M.493-14 [3] DSC class-M. DSC messages are transmitted on maritime VHF channel 70 (156,525 MHz). Transmission shall only commence if the channel is not busy (Listen Before Talk). The locating beacon shall have an integral DSC receiver capable of receiving distress acknowledgements. On receipt of a properly addressed distress acknowledgement the locating beacon shall stop transmitting and indicate that the distress alert has been acknowledged.

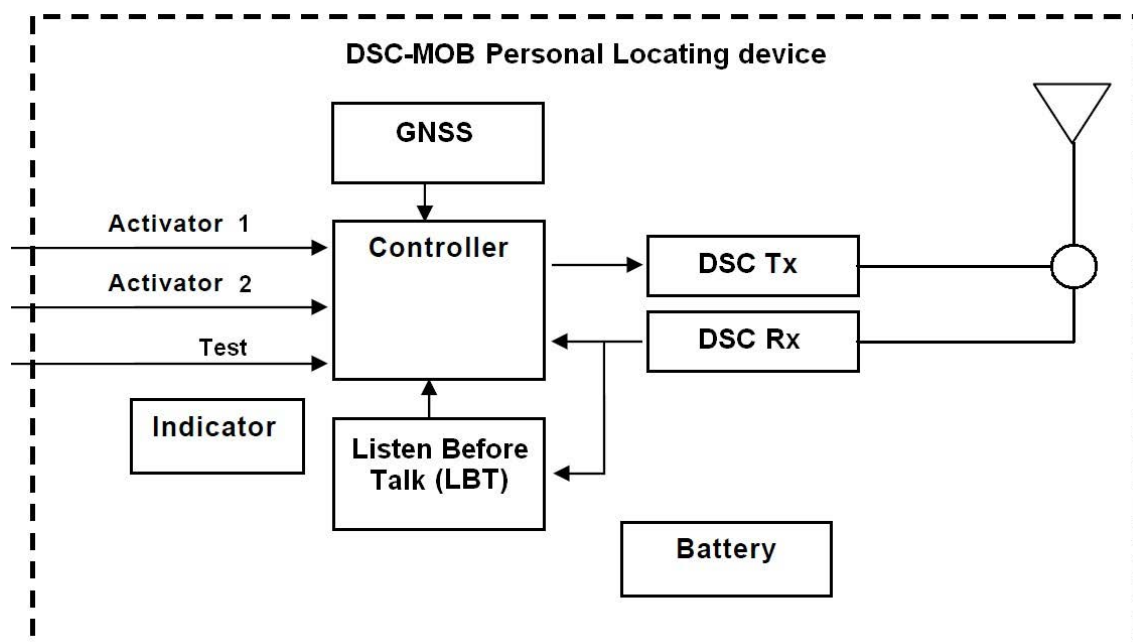


Figure 1: Functional block diagram of personal locating beacon

5.2 DSC transmission characteristics

The locating beacon transmits on marine VHF channel 70 (156,525 MHz) using DSC signalling (phase modulated G2B) as defined in clause 1.3.2 of Annex 1 of Recommendation ITU-R M.493-14 [3].

Table 1 is derived from Recommendation ITU-R M.493-14 [3] and give the parameters required for a DSC locating beacon.

Table 1: Required parameter settings

Symbol	Parameter name	Setting
CH70	Marine band channel 70	156,525 MHz
ϕM	Frequency modulation with a pre-emphasis characteristic of 6 dB/octave (phase modulation) with a modulating sub-carrier shall be used.	Pre-emphasis time constant 750 μ S
FSK	Sub-carrier modulation 1 300 Hz (Y-state) and 2 100 Hz (B-state) shall be used.	Sub-carrier tolerance ± 10 Hz
	Modulation index	2,0 $\pm$ 10 %.
	Modulation rate	1 200 baud
	Transmitter output power	100 mW to 500 mW ERP

Because DSC-MOB locating beacons transmit with significantly lower power than other DSC devices, DSC-MOB locating beacons shall first listen to the VHF channel 70 to ensure that it is not being used, before transmitting. The protocol for this is described in clause 5.1 of ETSI EN 300 338-6 [1].

5.3 DSC messages and protocols

DSC message content and use differs for active transmissions (active mode) and test transmissions (test mode). Both modes are specified in clause 5.2 of ETSI EN 300 338-6 [1].

5.4 Position indication

The locating beacon shall have an integral GNSS receiver as specified in clause 6 of ETSI EN 300 338-6 [1]. The locating beacon shall use this source to provide position information in the DSC distress messages it transmits. Locating beacons are not permitted to reply to position requests using DSC signalling, but shall instead indicate their position using AIS signalling as specified in clause 5 of ETSI EN 303 098 [2].

6 General conditions of measurement

6.1 Conformity testing

For the purpose of conformity testing clauses 6.2 to 6.6 shall apply.

6.2 Test Frequencies

Channel 70 shall be used as the test channel. Where radiated measurements are not performed in an anechoic chamber an alternative channel other than channel 70 shall be used during testing to avoid interference with live maritime systems. Where an alternative channel is used the alternative frequency used shall be within ± 1 % of 156,525 MHz and the frequency used shall be recorded

6.3 Unique identifier (self ID)

The manufacturer ID xx = 00 is reserved for training and conformance test purposes. The unique identifier used during testing to this standard shall be in the format 97200yyyy.

6.4 Artificial Antenna

Where applicable, tests shall be carried out using an artificial antenna which shall be a substantially non-reactive non-radiating load connected to the antenna connector. The Voltage Standing Wave Ratio (VSWR) at the 50 Ω connector or the manufacturer's specified test fixture shall not be greater than 1,5:1 over the frequency range of the measurement.

In the case of integral antenna equipment, if the equipment does not have an internal permanent 50 Ω connector then it is permitted to supply a second sample of the equipment with a temporary 50 Ω antenna cable and connector fitted to facilitate testing.

6.5 Normal Test Modulation

For normal test modulation, the modulation frequency shall be 1 kHz and the frequency deviation shall be ± 3 kHz.

For DSC conformance testing purposes, the equipment shall have facilities not accessible to the operator to generate a continuous B or Y signal and dot pattern.

Additionally for conformance testing, the VHF equipment shall have facilities not accessible to the operator for generating an unmodulated carrier.

6.6 Standard test signals for DSC

Standard test signals shall be as specified in clause 6.9 of ETSI EN 301 025 [5].

6.7 Determination of the DSC symbol error ratio

The method specified in clause 6.10 of ETSI EN 301 025 [5] shall be used. The manufacturer shall submit a second sample of the equipment modified to allow examination of the received and decoded DSC information when testing to the requirements of clause 9 of the present document.

6.8 Test conditions power sources and ambient temperatures

6.8.1 Normal and extreme test conditions

Conformity testing shall be carried out under normal test conditions (clause 6.9) and also where stated under extreme test conditions (clauses 6.10.1 and 6.10.2 applied simultaneously).

6.8.2 Test power sources

Where stated, the battery of the equipment shall be replaced by a test power source capable of producing normal (clause 6.9.2) and extreme test voltages as specified in clauses 6.10.2.1 and 6.10.2.2.

6.9 Normal test conditions

6.9.1 Normal temperature and humidity

Normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity, within the following ranges:

- Temperature: +15 °C to +35 °C.
- Relative humidity: 20 % to 75 %.

6.9.2 Normal test voltage

The normal test voltage shall be determined in each case and shall be the voltage corresponding to the voltage that a fresh battery gives at normal temperature and humidity at a load equal to that of the equipment when activated.

6.10 Extreme test conditions

6.10.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with the procedure specified in clause 6.10.1.1 at the lower and upper temperatures of -20 °C and +55 °C respectively except when installed within other equipment subject to more stringent temperature requirements, in which case the more stringent requirements shall apply.

The equipment shall be switched off during the temperature stabilization period.

Before tests are carried out, the equipment shall have obtained thermal balance in the test chamber and have been activated for a period of 5 minutes.

The location of the equipment under test in the climatic chamber shall not substantially influence the power output or the power consumption of the equipment under test.

6.10.2 Extreme test voltages

6.10.2.1 Upper extreme test voltage

The upper extreme test voltage shall be determined in each case and shall be the voltage corresponding to the voltage that a fresh battery gives at the upper extreme temperature with a load equal to that of the equipment when activated.

6.10.2.2 Lower extreme test voltage

The lower extreme test voltage shall be determined in each case. The equipment fitted with a primary battery shall be placed in a climatic chamber and cooled to -20 °C allowing a stabilization period of 2 hours. The equipment shall then be activated for a period of 12 hours. After this period the battery voltage shall be measured. This voltage shall be taken as the lower extreme test voltage and shall be measured before disconnecting the battery.

6.11 Reference Bandwidths for emission measurements

The reference bandwidths used shall be as stated in Tables 2 and 3 below.

Table 2: Reference bandwidths to be used for the measurement of spurious emission

Frequency range	RBW
9 kHz to 150 kHz	1 kHz
150 kHz to 30 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
1 GHz to 12,75 GHz	1 MHz

Table 3: Reference bandwidths to be used close to the wanted emission for equipment operating below 1 GHz

Frequency offset from carrier	RBW
250 % of the CSP to 100 kHz	1 kHz
100 kHz to 500 kHz	10 kHz

7 Environmental tests

7.1 Introduction

The requirements of this clause demonstrate that the equipment is capable of continuous operation under the conditions of various sea states, vibration, humidity and change of temperature likely to be experienced on a ship in which it is carried.

7.2 Procedure

Environmental tests shall be carried out before tests in respect of the other requirements in the present document are performed on the same EUT. Environmental tests may be carried out in any order but the test specified in clause 7.13 shall always be carried out last so as to detect any damage to EUT's water seals caused by the other environmental tests.

7.3 Performance check

The term performance check as used in the present document shall be that of activating the locating beacon in test mode with GNSS data available, and checking the procedure of clause 5.2 of ETSI EN 300 338-6 [1] is observed.

The performance check shall be carried out only under normal test conditions as detailed in clause 6.9.1 unless otherwise stated.

7.4 Drop test

The drop test is specified in clause 7.4 of ETSI EN 303 098 [2] with the exception that the performance check referred to shall be replaced with the performance check of the present document.

7.5 Temperature tests

The temperature tests are specified in clause 7.5 of ETSI EN 303 098 [2] with the exception that the performance check referred to shall be replaced with the performance check of the present document.

7.6 Vibration test

The vibration test is specified in clause 7.6 of ETSI EN 303 098 [2] with the exception that the performance check referred to shall be replaced with the performance check of the present document.

7.7 Corrosion test

The corrosion test is specified in clause 7.7 of ETSI EN 303 098 [2].

7.8 Thermal shock test

The thermal shock test is specified in clause 7.8 of ETSI EN 303 098 [2] with the exception that the performance check referred to shall be replaced with the performance check of the present document.

7.9 Buoyancy test

The buoyancy test is specified in clause 7.9 of ETSI EN 303 098 [2].

7.10 Compass safe distance test

The compass safe distance test is specified in clause 7.10 of ETSI EN 303 098 [2].

7.11 Solar radiation test

The solar radiation test is specified in clause 7.11 of ETSI EN 303 098 [2].

7.12 Oil resistance test

The oil resistance test is specified in clause 7.12 of ETSI EN 303 098 [2].

7.13 Protection of the transmitter

The protection of the transmitter test is specified in clause 7.13 of ETSI EN 303 098 [2] with the exception that the performance check referred to shall be replaced with the performance check of the present document.

8 Tests on the DSC transmitter

8.1 Frequency error

8.1.1 Definition

The definition in clause 8.1.1 of ETSI EN 301 025 [5] applies.

8.1.2 Method of measurement

The method of measurement described in clause 8.1.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the channel used for the test is channel 70.

8.1.3 Limit

The frequency error shall be within $\pm 1,5$ kHz.

8.2 Conducted Power

8.2.0 Purpose

The purpose of this test is to verify that the output power from the locating beacon is within limits at extreme operating temperatures.

Note that the conducted power delivered to an artificial antenna is likely to be greater than the measured ERP (see clause 8.3) where a salty man support (see clause 6.8 of ETSI TS 103 052 [6]) is used due to RF absorption of the support.

8.2.1 Definition

Conducted power is the average or mean power delivered to the artificial antenna (see clause 6.3) in the absence of modulation.

8.2.2 Method of measurement under normal test conditions

The transmitter shall be connected to an artificial antenna (see clause 6.3) and the average or mean power delivered to this artificial antenna shall be measured under normal conditions (see clause 6.9), and at the extremes of temperature (see clause 6.10.1).

The mean power under normal conditions P_{Norm} shall be measured.

The mean power under extreme conditions P_{-20} and P_{+55} shall be measured.

The differences between the normal and extreme conditions shall be determined:

$$P_{\text{diff1}} = P_{\text{Norm}} - P_{-20}$$

and

$$P_{\text{diff2}} = P_{\text{Norm}} - P_{+55}$$

8.2.3 Limit

The difference between the conducted power under extreme conditions and the conducted power under normal conditions shall be less than ± 3 dB.

8.3 Maximum Effective Radiated Power (ERP)

8.3.1 Definition

The Effective Radiated Power (ERP) is the power radiated in the direction of the maximum field strength under the specified conditions of measurements.

8.3.2 Method of measurement

The measurement is made under normal conditions (see clause 6.9).

On a test site selected from clause 5 of ETSI TS 103 052 [6], the equipment shall be placed on a support in the standard position as described in clause 6.8 of ETSI TS 103 052 [6] for equipment intended to be worn on a person, or that described in annex C of ETSI EN 303 098 [2] for equipment not intended to be worn on a person. The transmitter shall be switched on to transmit continuously without modulation.

The receiver shall be tuned to the transmitter carrier frequency. The test antenna shall be orientated for vertical polarization. The test antenna shall be raised or lowered through the specified range of heights until a maximum signal level is detected on the measuring receiver.

The transmitter shall be rotated through 360° around a vertical axis in order to find the direction of the maximum signal.

The maximum signal level detected by the measuring receiver shall be noted.

The transmitter shall be replaced by a substitution antenna as defined in clause 5.3.2 of ETSI TS 103 052 [6].

The substitution antenna shall be connected to a calibrated signal generator.

The frequency of the calibrated signal generator shall be adjusted to the transmit carrier frequency.

The input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver, if necessary.

The test antenna shall be raised or lowered through the specified range of heights to ensure that the maximum signal is received.

The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver that is equal to the level noted to that detected from the equipment under test corrected for the change in input attenuator setting of the measuring receiver.

The maximum ERP is equal to the power supplied by the signal generator, increased by the gain of the substitution antenna and corrected for the change in the attenuator.

8.3.3 Limits

The ERP shall be at least 100 mW, and not more than 500 mW.

8.4 Adjacent channel power

8.4.1 Definition

The definition in clause 8.7.1 of ETSI EN 301 025 [5] applies.

8.4.2 Method of measurement

The method of measurement described in clause 8.7.2 of ETSI EN 301 025 [5] shall be applied.

8.4.3 Limit

Adjacent channel power shall be 70 dB below the carrier power of the transmitter without any need to be below the spurious emission limit of 0,25 μ W.

8.5 Transmitter transient behaviour

8.5.1 Definition

The definition in clause 8.10.1 of ETSI EN 301 025 [5] applies.

8.5.2 Method of measurement

The method of measurement described in clause 8.10.2 of ETSI EN 301 025 [5] shall be applied.

8.5.3 Limit

Transmitter transient behaviour limit shall be as defined in clause 8.10.3 of ETSI EN 301 025 [5].

8.6 Residual modulation of the transmitter

8.6.1 Definition

The definition in clause 8.11.1 of ETSI EN 301 025 [5] applies.

8.6.2 Method of measurement

The method of measurement described in clause 8.11.2 of ETSI EN 301 025 [5] shall be applied.

8.6.3 Limit

The residual modulation shall not exceed -40 dB.

8.7 Frequency error (demodulated DSC signal)

8.7.1 Definition

The definition in clause 8.12.1 of ETSI EN 301 025 [5] applies.

8.7.2 Method of measurement

The method of measurement described in clause 8.12.2 of ETSI EN 301 025 [5] shall be applied.

8.7.3 Limit

Frequency error limit shall be as defined in clause 8.12.3 of ETSI EN 301 025 [5].

8.8 Modulation index for DSC

8.8.1 Definition

The definition in clause 8.13.1 of ETSI EN 301 025 [5] applies.

8.8.2 Method of measurement

The method of measurement described in clause 8.13.2 of ETSI EN 301 025 [5] shall be applied.

8.8.3 Limit

Modulation index limit shall be as defined in clause 8.13.3 of ETSI EN 301 025 [5].

8.9 Modulation rate for DSC

8.9.1 Definition

The definition in clause 8.14.1 of ETSI EN 301 025 [5] applies.

8.9.2 Method of measurement

The method of measurement described in clause 8.14.2 of ETSI EN 301 025 [5] shall be applied.

8.9.3 Limit

Modulation rate limit shall be as defined in clause 8.14.3 of ETSI EN 301 025 [5].

8.10 Spurious emissions

8.10.1 Definition

Emission(s) on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products, and frequency conversion products, but exclude out-of-band emissions.

8.10.2 Method of measurement

On a test site selected from clause 5 of ETSI TS 103 052 [6], the equipment shall be placed on a support in the standard position as described in clause 6.8 of ETSI TS 103 052 [6] for equipment intended to be worn on a person, or that described in annex C for equipment not intended to be worn on a person. The transmitter shall be switched on to transmit continuously without modulation.

The method of measurement described in clause 8.3 shall be used to search for spurious emissions in the frequency band 30 MHz to 2 GHz, excluding the frequency band tested in clause 8.4.

The measuring receiver shall have a bandwidth as specified in Table 2 and Table 3.

The measurement shall only be performed under normal test conditions, the locating beacon being rotated until the maximum emission is detected. The measurement is also made when the locating beacon has been activated but is not transmitting.

8.10.3 Limit

The power of any spurious emission component when transmitting shall not exceed 0,25 μ W.

The power of any spurious emission component when not transmitting shall not exceed 2 nW between 30 MHz and 1 GHz and 20 nW between 1 GHz and 2 GHz.

9 Tests on the DSC receiver

9.1 Maximum usable sensitivity

9.1.1 Definition

The definition in clause 10.1.1 of ETSI EN 301 025 [5] applies.

9.1.2 Method of measurement

The method of measurement described in clause 10.1.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.1.3 Limit

The limit as defined in clause 10.1.3 of ETSI EN 301 025 [5] shall be applied.

9.2 Co-channel rejection

9.2.1 Definition

The definition in clause 10.2.1 of ETSI EN 301 025 [5] applies.

9.2.2 Method of measurement

The method of measurement described in clause 10.2.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.2.3 Limit

The limit as defined in clause 10.2.3 of ETSI EN 301 025 [5] shall be applied.

9.3 Adjacent channel selectivity

9.3.1 Definition

The definition in clause 10.3.1 of ETSI EN 301 025 [5] applies.

9.3.2 Method of measurement

The method of measurement described in clause 10.3.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.3.3 Limit

The limit as defined in clause 10.3.3 of ETSI EN 301 025 [5] shall be applied.

9.4 Spurious response and blocking immunity

9.4.1 Definition

The definition in clause 10.4.1 of ETSI EN 301 025 [5] applies.

9.4.2 Method of measurement

The method of measurement described in clause 10.4.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.4.3 Limit

The limit as defined in clause 10.4.3 of ETSI EN 301 025 [5] shall be applied.

9.5 Intermodulation response

9.5.1 Definition

The definition in clause 10.5.1 of ETSI EN 301 025 [5] applies.

9.5.2 Method of measurement

The method of measurement described in clause 10.5.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.5.3 Limit

The limit as defined in clause 10.5.3 of ETSI EN 301 025 [5] shall be applied.

9.6 Dynamic range

9.6.1 Definition

The definition in clause 10.6.1 of ETSI EN 301 025 [5] applies.

9.6.2 Method of measurement

The method of measurement described in clause 10.6.2 of ETSI EN 301 025 [5] shall be applied, with the exception that the bit error ratio shall be determined as described in clause 6.7 of the present document.

9.6.3 Limit

The limit as defined in clause 10.6.3 of ETSI EN 301 025 [5] shall be applied.

10 Interoperability Testing

10.1 Active mode tests

10.1.1 Listen Before Talk (LBT)

10.1.1.1 Method of measurement

The measurement is made under normal conditions (see clause 6.9).

The standard test signal (see clause 6.6) shall be applied to the input of the EUT at a level of +6 dBuV.

The EUT shall be activated in active mode and transmissions from the EUT shall be recorded.

1 minute after activating the EUT a break in the standard test signal of 47 ms shall be applied.

2 minutes after activating the EUT the applying the standard test signal shall be broken off altogether.

10.1.1.2 Required Results

The following is required:

- a) No message is transmitted within the first 2 minutes following activation.
- b) The first message transmission starts within 100 ms of breaking off the standard test signal.

10.1.2 First and second individual distress relay transmissions

10.1.2.1 Method of measurement

The method is based on TD_DSC_VHF_RDA_0003 as described in ETSI TS 101 570-2 [i.5] and ETSI TS 101 570-3 [i.6].

The measurement is made under normal conditions (see clause 6.9).

The EUT shall be activated in active mode with GNSS signals present and transmissions from the EUT shall be recorded for 10 minutes.

10 seconds after transmission of each individual distress relay a DSC Distress Alert relay acknowledgment message shall be applied to the input of the EUT. The DSC message shall be formatted in accordance with Table A1-4.4, row 1 of Recommendation ITU-R M.493-14 [3] and shall be addressed with the self ID of the EUT.

10.1.2.2 Required Results

The following is required:

- a) The EUT transmits an individual distress relay within a period 10 to 30 seconds following activation and the message contains the following fields:
 - a.i) The format specifier is set to 120.
 - a.ii) The destination address MMSI is the Own vessel MMSI (clause 4.5) configured in the EUT.
 - a.iii) The category is set to 112.
 - a.iv) The Self ID is as configured in the EUT.
 - a.v) The first telecommand is set to 112.
 - a.vi) The Distress MMSI is the self ID as configured in the EUT.

- a.vii) The nature of distress is set to 110.
- a.viii) The position = 9999999999.
- a.ix) The time = 8888.
- a.x) The subsequent communications field is set to 126.
- b) On receipt of the applied first DSC Distress Alert relay acknowledgment message the EUT indicator state as specified in clause 4.3.3 is unchanged.
- c) The EUT transmits another individual distress relay within 5 minutes following activation, and the message contains the following fields:
 - c.i) The format specifier is set to 120.
 - c.ii) The destination address MMSI is the Own vessel MMSI (clause 4.5) configured in the EUT.
 - c.iii) The category is set to 112.
 - c.iv) The Self ID is as configured in the EUT.
 - c.v) The first telecommand is set to 112.
 - c.vi) The Distress MMSI is the self ID as configured in the EUT.
 - c.vii) The nature of distress is set to 110.
 - c.viii) The position = position of EUT.
 - c.ix) The time = UTC time.
 - c.x) The subsequent communications field is set to 126.
- d) On receipt of the applied second DSC Distress Alert relay acknowledgment message the EUT makes no further transmissions, disarms and displays the correct visual indicator as specified in clause 4.3.3 (vii).

10.1.3 First open loop distress transmission

10.1.3.1 Method of measurement

The method is based on TD_DSC_VHF_RDA_0002 as described in ETSI TS 101 570-2 [i.5] and ETSI TS 101 570-3 [i.6].

The measurement is made under normal conditions (see clause 6.9).

The EUT shall be activated in active mode with GNSS signals present and transmissions from the EUT shall be recorded for 30 minutes.

After receiving all the required messages from the EUT a DSC Distress Alert acknowledgement message shall be applied to the input of the EUT. The DSC message shall be formatted in accordance with Table A1-4.2, row 1 of Recommendation ITU-R M.493-14 [3] and shall be addressed with the self ID of the EUT.

10.1.3.2 Required Results

The following is required:

- a) The EUT transmits an individual distress relay within a period 10 to 30 seconds following activation.
- b) The EUT transmits one or more individual distress relay within 12 minutes following activation.
- c) The EUT transmits a distress alert after 12 minutes following activation, and the message contains the following fields:
 - c.i) The format specifier is set to 112.

- c.ii) The Self ID is as configured in the EUT.
- c.iii) The nature of distress is set to 110.
- c.iv) The distress coordinates = position of EUT.
- c.v) The time = UTC time.
- c.vi) The subsequent communications field is set to 126.
- d) On receipt of the applied DSC Distress Alert acknowledgment message the EUT makes no further transmissions, disarms and displays the correct visual indicator as specified in clause 4.3.3 (vii).

10.1.4 Open loop distress repeat transmissions

10.1.4.1 Method of measurement

The method is based on TD_DSC_VHF_RDA_0002 as described in ETSI TS 101 570-2 [i.5] and ETSI TS 101 570-3 [i.6].

The measurement is made under normal conditions (see clause 6.9).

The EUT shall be activated in active mode with GNSS signals present and shall record transmissions from the EUT for 20 minutes.

20 minutes following activation GNSS signals shall be inhibited and transmissions from the EUT shall be recorded for a further 20 minutes.

After receiving all the required messages the EUT shall be disarmed.

10.1.4.2 Required Results

The following is required:

- a) The EUT transmits an individual distress relay within a period 10 to 30 seconds following activation.
- b) The EUT transmits two or more individual distress relay within 10 minutes following activation.
- c) The EUT transmits a distress alert no sooner than 12 minutes following activation, and the message contains the following fields:
 - c.i) The format specifier is set to 112.
 - c.ii) The Self ID is as configured in the EUT.
 - c.iii) The nature of distress is set to 110.
 - c.iv) The distress coordinates = position of EUT.
 - c.v) The time = UTC time.
 - c.vi) The subsequent communications field is set to 126.
- d) The EUT continues to transmit distress alert messages with the same field settings as (c) above for the duration of the test.

10.2 Test mode tests with GNSS signals present

10.2.1 Listen Before Talk (LBT)

10.2.1.1 Method of measurement

The measurement is made under normal conditions (see clause 6.9).

The standard test signal (see clause 6.6) shall be applied to the input of the EUT at a level of +6 dBuV.

The EUT shall be activated in test mode and shall record transmissions from the EUT.

3 minutes after activating the EUT a break in the standard test signal of 190 ms shall be applied.

4 minutes after activating the EUT the standard test signal shall be broken off altogether.

10.2.1.2 Required Results

The following is required:

- a) No message is transmitted within 4 minutes following activation.
- b) The first message is transmitted within 5 minutes following activation but does not start before 200 ms after breaking off the standard test signal.

10.2.2 Test message transmission (unacknowledged)

10.2.2.1 Method of measurement

The method is based on TD_DSC_VHF_OC_0001, TD_DSC_VHF_OC_0002 as described in ETSI TS 101 570-2 [i.5] and ETSI TS 101 570-3 [i.6], TD_DSC_VHF_OC_0003 and TD_DSC_VHF_OC_0004 as described in ETSI TS 101 570-2 [i.5].

The measurement is made under normal conditions (see clause 6.9).

The EUT shall be activated in test mode with GNSS signals present and transmissions from the EUT shall be recorded for 10 minutes.

10.2.2.2 Required Results

The following is required:

- a) The EUT transmits a test message within 5 minutes after activation, and the message contains the following fields:
 - a.i) The format specifier is set to 120.
 - a.ii) The destination address MMSI is the Own vessel MMSI (see clause 4.5) configured in the EUT.
 - a.iii) The category is set to 108.
 - a.iv) The Self ID is as configured in the EUT.
 - a.v) The first telecommand is set to 118.
 - a.vi) The second telecommand is set to 118.
 - a.vii) The frequency is set to 126.
- b) The EUT indicates that the test is complete as with the correct visual indicator as specified in clause 4.3.3 (v).
- c) The EUT makes no further transmissions.

10.2.3 Test message transmission (acknowledged)

10.2.3.1 Method of measurement

The method is based on TD_DSC_VHF_OC_0001, TD_DSC_VHF_OC_0002 as described in ETSI TS 101 570-2 [i.5] and ETSI TS 101 570-3 [i.6], TD_DSC_VHF_OC_0003 and TD_DSC_VHF_OC_0004 as described in ETSI TS 101 570-2 [i.5].

The measurement is made under normal conditions (see clause 6.9).

The EUT shall be activated in test mode with GNSS signals present and transmissions from the EUT shall be recorded for 10 minutes.

On receipt of a test message from the EUT a DSC test acknowledgement message shall be applied. The DSC message shall be formatted in accordance with Table A1-4.7, row 7 of Recommendation ITU-R M.493-14 [3] and shall be addressed with the self ID of the EUT.

10.2.3.2 Required Results

The following is required:

- a) The EUT transmits a test message within 5 minutes after activation, and the message contains the following fields:
 - a.i) The format specifier is set to 120.
 - a.ii) The destination address MMSI is the Own vessel MMSI (see clause 4.5) configured in the EUT.
 - a.iii) The category is set to 108.
 - a.iv) The Self ID is as configured in the EUT.
 - a.v) The first telecommand is set to 118.
 - a.vi) The second telecommand is set to 118.
 - a.vii) The frequency is set to 126.
- b) On receipt of the applied test acknowledgment message the EUT indicates that the test is complete with the correct visual indicator as specified in clause 4.3.3 (vii).
- c) On receipt of the applied test acknowledgment message the EUT makes no further transmissions.

10.3 Test mode tests with no GNSS signals present

10.3.1 Method of measurement

The EUT shall be activated in test mode for 6 minutes with no GNSS data available and shall record transmissions.

10.3.2 Required results

The following is required:

- a) No message is transmitted and the EUT deactivates after 5 minutes.
- b) The EUT indicates that the test has been abandoned with the correct visual indicator as specified in clause 4.3.3 (vi).

11 Testing for compliance with technical requirements

11.1 Environmental conditions for testing

These shall be as described clause 6.

11.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in Table 4.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028-1[i.2] and ETSI TR 100 028-2 [i.3], in particular in annex D of the ETSI TR 100 028-2 [i.3].

Table 4 is based on such expansion factors.

Table 4: Maximum measurement uncertainty

Parameter	Maximum uncertainty
Radio Frequency (RF)	$\pm 1 \times 10^{-7}$
Radiated emission of transmitter	± 6 dB
Conducted RF power variations using a test fixture	$\pm 0,75$ dB
Maximum frequency deviation:	
- within 300 Hz to 6 kHz of modulation frequency	± 5 %
- within 6 kHz to 25 kHz of modulation frequency	± 3 dB
Deviation limitation	± 5 %
Adjacent channel power	± 5 dB
Conducted spurious emission of transmitter	± 4 dB
Audio output power	$\pm 0,5$ dB
Amplitude characteristics of receiver limiter	$\pm 1,5$ dB
Sensitivity at 20 dB SINAD	± 3 dB
Conducted emission of receiver	± 3 dB
Two-signal measurement	± 4 dB
Three-signal measurement	± 3 dB
Transmitter transient time	± 20 %
Transmitter transient frequency	± 250 Hz
LBT timing accuracy	± 5 %

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.7] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU [i.1]

Harmonised Standard ETSI EN 303 132				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Frequency error	8.1	U	
2	Conducted Power	8.2	U	
3	Effective Radiated Power (ERP)	8.3	U	
4	Adjacent channel power	8.4	U	
5	Transmitter transient behaviour	8.5	U	
6	Residual modulation of the transmitter	8.6	U	
7	Frequency error (demodulated DSC signal)	8.7	U	
8	Modulation index for DSC	8.8	U	
9	Modulation rate for DSC	8.9	U	
10	Spurious emissions	8.10	U	
11	Maximum usable sensitivity	9.1	U	
12	Co-channel rejection	9.2	U	
13	Adjacent channel selectivity	9.3	U	
14	Spurious response and blocking immunity	9.4	U	
15	Intermodulation response	9.5	U	
16	Dynamic range	9.6	U	

Key to columns:

Requirement:

- No** A unique identifier for one row of the table which may be used to identify a requirement.
- Description** A textual reference to the requirement.
- Clause Number** Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

- U/C** Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).
- Condition** Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Change History

Version	Information about changes
V1.1.1	First published version.

History

Document history			
V1.1.0	November 2016	EN Approval Procedure	AP 20170227: 2019-11-29 to 2017-02-27