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| **U.S. Radiocommunications Sector**  **Fact Sheet** | |
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| **Document Title:** Working Document Toward a Preliminary Draft New Recommendation ITU-R M.[DIGITAL-VOICE] Digital voice communications in the VHF maritime mobile band | |
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| **Purpose/Objective:** The “Working Document Toward a Preliminary Draft New Recommendation ITU-R M.[DIGITAL-VOICE]” describes the technical characteristics of a proposed new system for transmission of digital voice communications in the VHF maritime mobile band. This proposal is to upgrade the status of this recommendation. | |
| **Abstract:** This document was approved in the November 2024 meeting, and no additional revisions were proposed during the May 2025 meeting. Therefore, we request to upgrade the status of this document. | |

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| **Radiocommunication Study Groups** | A blue logo with a black background  AI-generated content may be incorrect. |
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| [] Preliminary Draft New Recommendation ITU-R M.[DIGITAL-VOICE]  **Digital voice communication in the VHF maritime mobile band** | |
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**1 Introduction**

The purpose of this document is to progress the work of the Working Document Toward a Preliminary Draft New Recommendation ITU-R M.[DIGITAL-VOICE] that describes the technical characteristics of a proposed new system for transmission of digital voice communications in the VHF maritime mobile band.

Report ITU-R M.2530-0 described candidate technologies and technical considerations for digital voice communications in the VHF maritime mobile band. The new system should be designed such that it does not utilize the channels used for the GMDSS, AIS, VDES, and safety communications, and other incumbent services. It should also be interoperable with legacy linear FM voice communications.

**2 Summary of changes**

Remove the editor’s note about SG5. Upgrade the document status to PDNR.

**3 Attachment**

The following attachment contains the proposed changes to Working Document Toward Preliminary Draft New Recommendation ITU-R M.[DIGITAL-VOICE].

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| **Radiocommunication Study Groups** |  |
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| Source : Document 5B/TEMP/52  Subject: Recommendation ITU-R M.[DIGITAL\_VOICE] | Annex 11 to Document 5B/216-E |
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| Annex 11 to Working Party 5B Chair’s Report | |
| [] preliminary draft new Recommendation ITU-R M.[DIGITAL-VOICE] | |
| Digital voice communication in the VHF maritime mobile band | |

(202X)

Scope

This recommendation describes a new technology that will permit the possible expansion of the number of VHF maritime voice channels. Studies are underway concerning operational reliability, impacts to the GMDSS, mode of operation (simplex/duplex), bandwidth, range, etc. which are the necessary objectives to determine the feasibility of implementation of digital voice radio telephony in the VHF maritime mobile band.

Keywords

Analogue communications, digital communications, migration, GMDSS, VHF radio, DSC

Abbreviations/Glossary (including terms used in the referenced Report ITU-R M.2530-0)

ACELP: Algebraic code-excited linear prediction

ADPCM: Adaptive differential pulse-code modulation

AIS: Automatic identification system

AMBE: Advanced multi-band excitation

AMR-WB: Adaptive multi-rate wideband

ASM: Application specific message

ATIS: Automatic transmitter identification system

CIRM: Comité International Radio-Maritime

CEPT: European Conference of Postal and Telecommunications Administrations

CODEC: Coder-decoder

CS-ACELP: Conjugate-structure algebraic-code excited linear prediction

DSC: Digital selective call

DMR: Digital mobile radio

DPMR: Digital private mobile radio

ETSI: European Telecommunications Standards Institute

EU: European Union

FDMA: Frequency division multiple access

FEC: Forward error correction

FRAND: Fair, reasonable and non-discriminatory

FSK: Frequency shift keying

GNSS: Global navigation satellite service

GMDSS: Global maritime distress and safety system

HF: High frequency

IALA: International Association of Marine Aids to Navigation and Lighthouse Authorities

IMO: International Maritime Organization

LD-CELP: Low delay code excited linear prediction

MF: Medium frequency

MMSI: Maritime mobile service identity

MoU: Memorandum of understanding

MSC: Maritime Safety Committee

NXDN: Next generation digital narrowband

PAMR: Public access mobile radio

PESQ: Perceptual evaluation of speech quality

PMR: Private mobile radio

POTS: Plain old telephone service

PSTN: Public switched telephone network

RAINWAT: Regional Arrangement on the Radiocommunication Service for Inland Waterways

RALCWI: Robust advanced low complexity waveform interpolation

RR: Radio Regulations

SB-ADPCM: Sub-band adaptive differential pulse code modulation

SMS: Short message service

SNR: Signal to noise ratio

SOLAS: Safety of Life at Sea

TETRA: Trans-European trunked radio system

TDMA: Time division multiple access

TCP/IP: Transmission control protocol/internet protocol

TWELP: Tri-wave excited linear prediction

Tx: Transmission

VDE: VHF data exchange

VDES: VHF data exchange system

VHF: Very high frequency

VTS: Vessel traffic service

WRC: World Radiocommunication Conference

Related ITU Recommendations and Reports

Recommendations:

[ITU-R M.493](https://www.itu.int/pub/R-REC-M.493) Digital selective-calling system for use in the maritime mobile service

[ITU-R M.541](https://www.itu.int/pub/R-REC-M.541) Operational procedures for the use of digital selective-calling equipment in the maritime mobile service

[ITU-R M.585](https://www.itu.int/pub/R-REC-M.585) Assignment and use of identities in the maritime mobile service

[ITU-R M.1084](https://www.itu.int/pub/R-REC-M.1084) Interim solutions for improved efficiency in the use of the band 156‑174 MHz by stations in the maritime mobile service

[ITU-R M.1171](https://www.itu.int/pub/R-REC-M.1171) Radiotelephony procedures in the maritime mobile service

[ITU-R M.1309](https://www.itu.int/pub/R-REC-M.1309) Digitally coded speech in the land mobile service

[ITU-R M.1808](https://www.itu.int/pub/R-REC-M.1808) Technical and operational characteristics of conventional and trunked land mobile systems operating in the mobile service allocations below 869 MHz to be used in sharing studies in bands below 960 MHz

Reports:

[ITU-R BT.2140](https://www.itu.int/pub/R-REP-BT.2140) Transition from analogue to digital terrestrial broadcasting

[ITU-R M.2010](https://www.itu.int/pub/R-REP-M.2010) Improved efficiency in the use of the band 156‑174 MHz by stations in the maritime mobile service

[ITU-R M.2231](https://www.itu.int/pub/R-REP-M.2231) Use of Appendix **18** to the Radio Regulations for the maritime mobile service

[ITU-R M.2288](https://www.itu.int/pub/R-REP-M.2288) Digital voice communication system on MF/HF radio channels of the maritime mobile service for shore-to-ship/ship-to-shore applications

[ITU-R M.2474](https://www.itu.int/pub/R-REP-M.2474) Conventional digital land mobile radio systems

[ITU-R M.2530](https://www.itu.int/pub/R-REP-M.2530) Digital voice communication in the VHF maritime frequency band

[ITU-R SM.2022](https://www.itu.int/pub/R-REP-SM.2022) The effect on digital communications systems of interference from other modulation schemes

The ITU Radiocommunication Assembly,

considering

*a)* that the International Maritime Organization (IMO) has established performance standards for shipborne radio equipment:

– Resolution A.694(17): Recommendation on General requirements for shipborne radio equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for electronic navigational aids;

– Resolution MSC.511(105): Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling;

– SOLAS regulation IV/5.1.3;

– SOLAS regulation IV 7.1.1;

– SOLAS regulation IV 7.1.2;

*b)* that the main performance standards for VHF shipborne radio installations are IMO Resolution MSC.511(105) which defines the minimal requirements for the use, availability, installation, robustness, etc. of VHF radios on board ships;

*c)* that the Radio Regulations (RR) Appendix **18** have incorporated ITU technical standards that apply to VHF marine radios: ITU-R M.493; ITU-R M.541; ITU-R M.585; ITU‑R M.1084;

*d)* that the International Electrotechnical Commission (IEC) has established test standards for compliance with technical requirements defined by IMO, ITU, and the Radio Regulations, and that these IEC standards have been incorporated in IMO carriage requirements for ships,

recognizing

*a)* that the RR Appendix **18** VHF maritime band covers the frequency ranges 156.025 to 157.425 MHz and 160.625 to 162.025 MHz and is channelized consistent with Recommendation ITU-R M.1084‑5;

*b)* that RR Appendix **18** channels between 156.025 MHz and 157.425 MHz host ship station transmissions or both ship and coast operations transmissions;

*c)* that RR Appendix **18** channels between 160.625 MHz and 162.025 MHz host coast station transmissions;

*d)* that the implementation of digital voice communications should not impair the functions of safety systems that operate in RR Appendix **18**, i.e., digital selective calling (DSC) (Channel 70), automatic identification system (AIS) (AIS 1, channel 2087 and AIS 2, channel 2088), VHF data exchange system (VDES) (refer to Appendix **18** footnote *w)*) and voice distress, search and rescue coordination (Channel 06), bridge-bridge communication (Channel 13), safety and calling communication (Channel 16), and other safety-related communications;

*e)* that some frequencies in the band used by MMS in RR Appendix **18** are allocated to the fixed and mobile services on a co-primary basis;

*f)* that existing and planned in-band and adjacent-band services should be protected from harmful interference without additional regulatory, technical, or operational constraints on these co-primary incumbent services when considering any potential modifications to MMS channelling arrangements,

recommends

1 that general elements and technical characteristics of VHF digital voice communication are contained in Annex 1;

2 that VHF digital voice communications for coast stations should not use RR Appendix **18** channels 156.025 MHz to 157.425 MHz and 160.625 MHz to 162.025 MHz if an administration has allocated these frequencies for fixed and/or mobile services;

3 that the operations of VHF digital voice communications should be compatible with and should not interfere with the operations of IMO/ITU/IEC certified marine equipment;

4 that equipment that utilizes VHF digital voice communication should comply with IMO/ITU/IEC requirements;

5 that equipment that utilizes VHF digital voice communication should use DSC for calling in accordance with IMO/ITU/IEC standards.

Annex 1  
  
Technical characteristics of the VHF digital voice   
communication operating system

# 1 General description of VHF digital voice communication system

In essence, the VHF digital voice communication system provides a means for increasing the number of available voice channels in RR Appendix **18** by multiplexing an available 25 kHz voice channel to provide four 6.25 kHz voice subchannels. The system senses the 25 kHz channel to determine availability. If the 25 kHz channel is occupied by 25 kHz voice communications, then the system considers that channel unavailable. If the 25 kHz channel is in use by digital voice communications, then the system determines which, if any, of the 6.25 kHz subchannels is available and selects an unused subchannel. The system will not implement digital voice communications on channels that are designated for safety systems in RR Appendix **18**, such as digital selective calling (DSC), automatic identification system (AIS), application specific message (ASM), VHF data exchange (VDE), voice distress, search and rescue coordination (Channel 06), bridge-bridge communication (Channel 13), safety and calling communication (Channel 16) and other safety-related communications.

# 2 Key technical characteristics

## 2.1 Simplex and duplex operation

The VHF digital voice communication system may operate in either simplex or duplex mode in accordance RR Appendix **18**.

## 2.2 Channel usage

The VHF digital voice communication system will use only those channels that are not designated for safety systems in RR Appendix **18**, such as digital selective calling (DSC), automatic identification system (AIS), application specific message (ASM), VHF data exchange (VDE), voice distress, search and rescue coordination (Channel 06), bridge-bridge communication (Channel 13), safety and calling communication (Channel 16) and other safety-related communications. VHF digital voice communications for coast stations should not use RR Appendix **18** channels 156.025 MHz to 157.425 MHz and 160.625 MHz to 162.025 MHz if an administration has allocated these frequencies for fixed and/or mobile services. RR Appendix **18** may in the future update an existing footnote to elaborate on which channels are not available for VHF digital voice communication.

### 2.2.2 Performance standards

The main performance standards for VHF shipborne radio installations are contained in IMO Resolution MSC.511(105) and in Recommendation ITU-R M.493.

These performance standards define the minimal requirements for the use, availability, installation, robustness, etc. of VHF radios on board ships.

## 2.2.3 Channel access and channel numbering

1 Channel number assignments for implementing digital voice communications with 6.25 kHz channel spacing between the four subchannels on 25 kHz channels in the VHF maritime frequency band should be in accordance with Table 1.

2 The channel centre frequency retains its channel number in the VHF maritime frequency band, and it is used exclusively for 25 kHz voice communications. Digital voice communications should not be used when the 25 kHz channel is being utilized for normal 25 kHz voice communications.

Table 1

Example of channel number assignments with 6.25 kHz channel spacing

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Channel No. (6.25 kHz spacing between subchannels) | | | | | Ship | Ship and coast | Coast |
|  |  | 801 |  |  | 156.059375 |  | 160.659375 |
|  | 701 |  |  |  | 156.053125 |  | 160.653125 |
| 01 |  |  |  |  | 156.050 |  | 160.650 |
|  | 601 |  |  |  | 156.046875 |  | 160.646875 |
|  |  | 501 |  |  | 156.040625 |  | 160.640625 |

# 3 Technical characteristics of marine VHF radios

Marine VHF radios with DSC (DSC, digital selective calling, is used for distress calling and general automated calling purposes, and it is required by most administrations) capability are divided into three main classes:

‒ Class A, mandatory carriage for ships under SOLAS Chapter IV (i.e. GMDSS)

‒ Class D, voluntary carriage by non-SOLAS ships.

‒ Class H, handheld radios for non-SOLAS voluntary carriage.

Some of these have integral Global Navigation Satellite System (GNSS)NSS, and some also have texting capability (RTCM SC123 standard).

Digital voice-capable radios would need to meet the current requirements of their respective classes.

# 4 Technical characteristics of the VHF maritime band, RR Appendix 18

The VHF maritime band covers the frequency ranges 156.025 to 157.425 MHz and 160.625 to 162.025 MHz with a gap in the middle frequency range between 157.425 and 160.625 MHz, and it is channelized in 25 kHz channels with channel numbers in two digits and four digits in accordance with Recommendation ITU-R M. 1084-5.

RR Appendix **18** contains simplex and duplex channels, and some of the duplex channels may be used in simplex mode, designated by four-digit channel numbers.

Footnotes are used in RR Appendix **18** to designate how the channels are used, for example:

‒ For DSC, Channel 70, footnotes *j)* and *f)*.

‒ For AIS, channels AIS 1 and AIS 2, footnotes *f), l),* and *p)*.

‒ For ASM and VDE (VDES), numerous channels in both the lower and upper frequency ranges, footnote *w)*.

# 5 Technical parameters

The technical parameters of the transmitting apparatus should comply with the ITU RR Appendix **18**, which has incorporated ITU technical standards that apply to VHF marine radios (ITU-R M.493; ITU-R M.541; ITU-R M.585; ITU-R M.1084).

# 6 Technical objectives for voice communication and associated digital selective calling in the VHF maritime mobile band

The following objectives should be based on the regulations for VHF DSC radios (the sources of the regulations are given in brackets):

– Should be capable of operating on single-frequency channels or on single- and two frequency channels (IMO).

– Operating in the bands 156.025 MHz to 157.425 MHz and 160.625 MHz to 162.025 MHz on single-frequency and two-frequency channels (ITU/IMO), except coast stations should not use bands 156.025 MHz to 157.425 MHz and 160.625 MHz to 162.025 MHz if an administration has allocated these frequencies for fixed and/or mobile services.

– Should provide at least three priorities of communications using voice (IMO).

– A dedicated DSC watchkeeping facility to maintain a continuous watch on Channel 70 (IMO).

– DSC facility should be capable of operating on Channel 70 (IMO).

# 7 Voice coder-decoders (CODECs)

Appendix **18** of the Radio Regulations offers channels with a spectrum bandwidth of 25 kHz for analogue speech communications. Using technologies available today this can be split up to improve the spectral efficiency by applying digital encoding techniques to the speech signals.

The VHF digital communication system uses a frequency division multiple access (FDMA) approach, splitting the 25 kHz radio channel into four separate radio channels to yield a channel bandwidth of 6.25 kHz. This technology allows for an over air data rate of 4800 bps, using 4 FSK modulation and still remaining within the adjacent channel power limits. Removing the signalling overhead, this results in a speech channel of 3 600 bps, of which approx. 1/3 is used for error correction, so that the data channel available for encoding the speech waveform is approx. 2 450 bps.

Numerous voice CODECs are available to perform this function, and one should be selected for this application. The selected CODEC should also conform to the patent policy of ITU.

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