



Recommendation ITU-R M.493-15
(01/2019)

**Digital selective-calling system for use in
the maritime mobile service**

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



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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.493-15*

Digital selective-calling system for use in the maritime mobile service

(1974-1978-1982-1986-1990-1992-1994-1995-1997-1997-2000-2004-2007-2009-2015-2019)

Scope

This Recommendation describes the digital selective-calling (DSC) system for use in the maritime mobile service covering general purpose and simplified versions of DSC equipment. A description of a generalized user interface as well as an automated procedure for the operation of shipborne equipment are also included.

Keywords

Alert, announcement, class, digital selective calling, distress, global maritime distress and safety system, maritime

Abbreviations/Glossary

AIS	Automatic identification system
ARQ	Automatic repeat request
DSC	Digital selective calling
ECC	Error check character
EPIRB	Emergency position-indicating radiobeacon
EOS	End of sequence
FEC	Forward error correction
GMDSS	Global maritime distress and safety system
HF	High frequency (band number 7, 3-30 MHz)
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
MF	Medium frequency (band number 6; 300-3 000 kHz)
MID	Maritime identification digits
MMSI	Maritime mobile service identity
MOB	Man overboard
MSC	Maritime safety committee
n/a	This field is not included in this call
NM	Nautical mile (1 NM = 1852 m)
RT	Radiotelephony
RX	Retransmission
Rx	Receive
SOLAS	International Convention for the Safety of Life at Sea

* This Recommendation should be brought to the attention of the International Maritime Organization (IMO).

TP	Telephony
TTY	Direct Printing
Tx	Transmit
UTC	Coordinated universal time
VHF	Very high frequency (band number 8, 30-300 MHz)

Related ITU Recommendations, Reports

Recommendation ITU-R M.476 – Direct-printing telegraph equipment in the maritime mobile service

Recommendation ITU-R M.541 – Operational procedures for the use of digital selective-calling equipment in the maritime mobile service

Recommendation ITU-R M.585 – Assignment and use of identities in the maritime mobile service

Recommendation ITU-R M.586 – Automated VHF/UHF maritime mobile telephone system

Recommendation ITU-R M.625 – Direct-printing telegraph equipment employing automatic identification in the maritime mobile service

Recommendation ITU-R M.689 – International maritime VHF radiotelephone system with automatic facilities based on DSC signalling format

Recommendation ITU-R M.821 – Optional expansion of the digital selective-calling system for use in the maritime mobile service

Recommendation ITU-R M.822 – Calling-channel loading for digital selective calling (DSC) for the maritime mobile service

Recommendation ITU R M.825 – Characteristics of a transponder system using digital selective calling techniques for use with vessel traffic services and ship-to-ship identification

Recommendation ITU-R M.1080 – Digital selective calling system enhancement for multiple equipment installations

Recommendation ITU R M.1081 – Automatic HF facsimile and data system for maritime mobile users

Recommendation ITU-R M.1082 – International maritime MF/HF radiotelephone system with automatic facilities based on digital selective calling signalling format

Recommendation ITU-R M.1084 – Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service

Recommendation ITU-R M.1371 – Technical characteristics for an automatic identification system using time-division multiple access in the VHF maritime mobile band

Report ITU-R M.1159 – Characteristics of an automatic identification system for VHF and UHF transmitting stations in the maritime mobile service

Report ITU-R M.1161 – Use of MF/HF DSC for automatic connection of calls in the maritime-mobile service MF and HF bands to the public switched network

The ITU Radiocommunication Assembly,

considering

a) that selective-calling in the shore-to-ship, ship-to-ship and ship-to-shore directions would expedite the handling of traffic in the maritime mobile service;

b) that the International Maritime Organization (IMO) has listed a number of operational requirements that should be taken into account when designing a general purpose selective-calling system;

- c) that Chapter IV of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requires the use of digital selective calling (DSC) for distress alerting and safety calling in the global maritime distress and safety system (GMDSS);
- d) that the narrow-band direct printing systems should comply with Recommendation ITU-R M.625;
- e) that the DSC system should be applicable to the maritime mobile service, both for international and national needs;
- f) that it is desirable that the DSC system fulfils the requirements of all types of vessels desiring to use it;
- g) that after experience gained, a need exists to reduce unnecessary alarms and simplify operation of shipborne equipment;
- h) that in certain applications there may be a need to disable DSC automatic channel switching when there is a requirement for vessels to maintain continuous radio watch on a specific radio telephony channel (e.g. port traffic control, bridge-to-bridge communications),

recommends

- 1 that devices or equipment which use DSC channels/frequencies should be in full compliance with one of the defined classes within this Recommendation;
- 2 that DSC equipment should be designed in response to the operational requirements specified within Recommendation ITU-R M.541;
- 3 that where there is a need for a general purpose DSC system, the system should be designed in accordance with the characteristics given in Annex 1;
- 4 that where there is a need for simplified versions of DSC equipment, they should be designed in accordance with Annex 2;
- 5 that shipborne DSC equipment should be designed to provide a simplified user interface, following the examples of good practice set out in Annexes 3 and 4;
- 6 that in a GMDSS coast radio station installation, sufficient geographical separation should be provided between the DSC distress channel receiver antennas and any transmitting antennas within the installation. This is to avoid any de-sensitization of the DSC distress channel receivers if any transmitter is used at full power on any designated transmit frequency other than the DSC distress frequencies.

Annex 1

General purpose equipment characteristics

1 General

1.1 The system is a synchronous system using characters composed from a ten-bit error-detecting code as listed in Table A1-1.

1.1.1 The first seven bits of the ten-bit code of Table A1-1 are information bits. Bits 8, 9 and 10 indicate, in the form of a binary number, the number of B elements that occur in the seven information bits, a Y element being a binary number 1 and a B element a binary number 0. For example, a BYY sequence for bits 8, 9 and 10 indicates 3 ($0 \times 4 + 1 \times 2 + 1 \times 1$) B elements in the associated seven information bit sequence; and a YYB sequence indicates 6 ($1 \times 4 + 1 \times 2 + 0 \times 1$) B elements in the associated seven information bit sequence. The order of transmission for the information bits is least significant bit first but for the check bits it is most significant bit first.

1.2 Time diversity is provided in the call sequence as follows:

1.2.1 Apart from the phasing characters, each character is transmitted twice in a time-spread mode; the first transmission (DX) of a specific character is followed by the transmission of four other characters before the re-transmission (RX) of that specific character takes place, allowing for a time-diversity reception interval of:

- 400 ms for HF and MF channels, and
- $33\frac{1}{3}$ ms for VHF radio-telephone channels.

1.3 The classes of emission, frequency shifts and modulation rates are as follows:

1.3.1 F1B or J2B 170 Hz and modulation rate of $100 \text{ (bit/s)} * (1 \pm 30 * 10^{-6})$ for use on HF and MF DSC calling channels. When frequency-shift keying is effected by applying audio signals to the input of single-sideband transmitters (J2B), the centre of the audio-frequency spectrum offered to the transmitter is 1 700 Hz. When a DSC call is transmitted on HF and MF working channels for public correspondence, the class of emission is J2B. In this case, audio tones with frequencies $1\,700 \text{ Hz} \pm 85 \text{ Hz}$ and modulation rate $100 \text{ (bit/s)} * (1 \pm 30 * 10^{-6})$ are used in order for the DSC call to be transmitted.

1.3.2 Frequency modulation with a pre-emphasis of 6 dB/octave (phase modulation) with frequency-shift of the modulating sub-carrier for use on VHF channels:

- frequency-shift between 1 300 and 2 100 Hz; the sub-carrier being at 1 700 Hz;
- the frequency tolerance of the 1 300 and 2 100 Hz tones is $\pm 10 \text{ Hz}$;
- the modulation rate is $1\,200 \text{ (bit/s)} * (1 \pm 30 * 10^{-6})$;
- the index of modulation is $2.0 \pm 10\%$.

1.3.3 The radio-frequency tolerances of new designs of both transmitters and receivers in the MF and HF bands should be:

- coast station: $\pm 10 \text{ Hz}$,
- ship station: $\pm 10 \text{ Hz}$,
- receiver bandwidth: should not exceed 300 Hz.

1.4 The higher frequency corresponds to the B-state and the lower frequency corresponds to the Y-state of the signal elements.

1.5 The information in the call is presented as a sequence of seven-bit combinations constituting a primary code.

1.5.1 The seven information bits of the primary code express a symbol number from 00 to 127, as shown in Table A1-1, and where:

- the symbols from 00 to 99 are used to code two decimal figures according to Table A1-2;
- the symbols from 100 to 127 are used to code service commands (see Table A1-3).

1.6 Where the distress alert repetitions described in § 11 apply, the following conditions are considered necessary:

1.6.1 the transmitter encoder must provide repetitive transmission of the call sequence in accordance with § 11; and

1.6.2 the receiver decoder should provide maximum utilization of the received signal, including use of the error-check character and by using an iterative decoding process with adequate memory provision.

1.7 When the transmission of a DSC distress alert is automatically repeated, ships' DSC equipment must be capable of automatically receiving a subsequent distress acknowledgement (see Recommendation ITU-R M.541).

TABLE A1-1

Ten-bit error-detecting code

Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10	Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10	Symbol No.	Emitted signal and bit position 1 2 3 4 5 6 7 8 9 10
00	BBBBBBBYYY	43	YYBYBYBBYY	86	BYYBYBYBY
01	YBBBBBBYYB	44	BBYYBYBYBB	87	YYYBYBYBYB
02	BYBBBBBYB	45	YBYBYBBYY	88	BBYYBYBYBB
03	YYBBBBBYBY	46	BYYBYBBYY	89	YBBYYBYBY
04	BBYBBBBYYB	47	YYYYBYBBYB	90	BYBYBYBY
05	YBYBBBBYBY	48	BBBBYYBYBY	91	YYBYBYBYB
06	BYYBBBBYBY	49	YBBYYBYBB	92	BBYYBYBY
07	YYYBBBBYBB	50	BYBBYYBYBB	93	YBYYYBYBYB
08	BBBYBBBYYB	51	YYBBYBBYY	94	BYYYYBYBYB
09	YBBYBBBYYB	52	BBYBYBYBB	95	YYYYBYBY
10	BYBYBBBYYB	53	YBYBYBBYY	96	BBBBYYBY
11	YYBYBBBYYB	54	BYYBYBBYY	97	YBBBBYYBB
12	BBYYBBBYYB	55	YYYBYBBYB	98	BYBBBBYYBB
13	YBYYBBBYYB	56	BBBYYYBYBB	99	YYBBBBYYBY
14	BYYYBBBYYB	57	YBBYYBBYY	100	BBYBBYYBB
15	YYYYBBBYY	58	BYBYYYBBYY	101	YBYBBYYBY
16	BBBBYBBYYB	59	YYBYYYBBYB	102	BYYBBYYBY
17	YBBYBBYBY	60	BBYYYYBBYY	103	YYYBBYYBYB
18	BYBBYBBYBY	61	YBYYYBYBYB	104	BBBYBYYYBB
19	YYBBYBBYBB	62	BYYYYBYBYB	105	YBBYBYBY
20	BBYBYBBYBY	63	YYYYYYBBBY	106	BYBYBYBY
21	YBYBYBBYBB	64	BBBBBBYYBY	107	YYBYBYBYB
22	BYYBYBBYBB	65	YBBBBBYBY	108	BBYYBYBY
23	YYYBYBBYY	66	BYBBBYBY	109	YBYBYBYBYB
24	BBBYBBYBY	67	YBBBBYYBB	110	BYYBYBYBYB
25	YBBYYBBYBB	68	BBYBBBYBY	111	YYYBYBYBY
26	BYBYBBYBB	69	YBYBBBYBB	112	BBBBYYYYBB
27	YYBYBBBY	70	BYYBBBYBB	113	YBBBBYYBY
28	BBYYBBYBB	71	YYBBBYBY	114	BYBBYYBY
29	BYYYYBBYY	72	BBBYBBYYBY	115	YBBYYBYBYB
30	BYYYYBBYY	73	YBBYBBYYBB	116	BBYBYYYBY
31	YYYYYBBBYB	74	BYBYBBYYBB	117	YBYBYYYBYB
32	BBBBBYBYBY	75	YYBYBBYBY	118	BYYBYYYBYB
33	YBBBBYBYBY	76	BBYYBBYYBB	119	YYYBYYYBBY
34	BYBBYBYBY	77	YBYBBYBY	120	BBBYYYBY
35	YYBBYBYBB	78	BYYBBYBY	121	YBBYYYYBYB
36	BBYBBYBYBY	79	YYYYBBYBYB	122	BYBYYYBYB
37	YBYBBYBYBB	80	BBBBBYBYBY	123	YBYYYBYBY
38	BYYBBYBYBB	81	YBBBYBYBB	124	BBYYYYBYB
39	YYYBBYBBYY	82	BYBBYBYBB	125	YBYYYBYBY
40	BBBYBYBYBY	83	YYBBYBYBY	126	BYYYYBYBY
41	YBBYBYBYBB	84	BBYBYBYBB	127	YYYYYYBBB
42	BYBYBYBYBB	85	YBYBYBYBY		

B = 0

Y = 1

Order of bit transmission: bit 1 first.

TABLE A1-2

Packing table for decimal numbers into ten-bit characters

The digits for the									
Thousands of millions D2	Hundreds of millions D1	Tens of millions D2	Millions D1	Hundreds of thousands D2	Tens of thousands D1	Thousands D2	Hundreds D1	Tens D2	Units D1
Character 5		Character 4		Character 3		Character 2		Character 1	

NOTE 1 – Character 1 is the last character transmitted.

The digit sequence D2-D1 varies from 00 to 99 inclusive in each character (character 1 to 5 inclusive). The character that represents a particular two-decimal figure is transmitted as the symbol number (see Table A1-1) that is identical to that particular two-decimal figure.

When the number consists of an odd number of decimal digits, a zero shall be added in front of the most significant position to provide an integral number of ten-bit characters.

TABLE A1-3

Use of symbol Nos 100 to 127

Symbol No.	Phasing and unique functions	Format specifier ⁽¹⁾	Category ⁽¹⁾	Nature of distress ⁽¹⁾	First telecommand ⁽¹⁾	Second telecommand ⁽¹⁾
100			Routine	Fire, explosion	F3E/G3E All modes TP	No reason given ⁽²⁾
101				Flooding	F3E/G3E duplex TP	Congestion at maritime switching centre
102		Geographical area		Collision		Busy ⁽²⁾
103		⁽³⁾	⁽³⁾	Grounding	Polling	Queue indication ⁽²⁾
104	Phasing RX-0 position			Listing, in danger of capsizing	Unable to comply	Station barred ⁽²⁾
105	Phasing RX-1 position			Sinking	End of call ⁽⁴⁾	No operator available ⁽²⁾
106	Phasing RX-2 position		⁽⁶⁾	Disabled and adrift	Data	Operator temporarily unavailable ⁽²⁾
107	Phasing RX-3 position			Undesignated distress		Equipment disabled ⁽²⁾
108	Phasing RX-4 position		Safety	Abandoning ship		Unable to use proposed channel ⁽²⁾
109	Phasing RX-5 position			Piracy/armed robbery attack	J3E TP	Unable to use proposed mode ⁽²⁾
110	Phasing RX-6 position	⁽⁵⁾	Urgency	Man overboard	Distress acknowledgement	Ships and aircraft of States not parties to an armed conflict

TABLE A1-3 (*end*)

Symbol No.	Phasing and unique functions	Format specifier ⁽¹⁾	Category ⁽¹⁾	Nature of distress ⁽¹⁾	First telecommand ⁽¹⁾	Second telecommand ⁽¹⁾
111	Phasing RX-7 position				⁽⁶⁾	Medical transports (as defined in 1949 Geneva Conventions and additional Protocols) ^A
112		Distress	Distress	EPIRB emission ^B	Distress alert relay	Pay-phone/public call office ^C
113					F1B/J2B TTY-FEC	Facsimile/data according to Recommendation ITU-R M.1081
114		Ships having common interest				
115					F1B/J2B TTY-ARQ	⁽⁶⁾
116		All ships ⁽⁷⁾			⁽⁶⁾	⁽⁶⁾
117	Ack. RQ (EOS)				⁽⁶⁾	⁽⁶⁾
118					Test	⁽⁶⁾
119					⁽⁶⁾	⁽⁶⁾
120		Individual stations			⁽⁶⁾	⁽⁶⁾
121		Reserved for national non-calling purposes e.g. Report ITU-R M.1159			Ship position or location registration updating	⁽⁶⁾
122	Ack. BQ (EOS)				⁽⁶⁾	⁽⁶⁾
123		Individual station semi-automatic/automatic service ^C			⁽⁶⁾	⁽⁶⁾
124		⁽⁵⁾			⁽⁶⁾	⁽⁶⁾
125	Phasing DX position				⁽⁶⁾	⁽⁶⁾
126	*				No information	No information
127	EOS				⁽⁶⁾	⁽⁶⁾

TP: Telephony

TTY: Direct printing

ARQ: Recommendations ITU-R M.476 or ITU-R M.625 equipment

- ⁽¹⁾ Unassigned symbols should be rejected. The DSC equipment should take no action.
- ⁽²⁾ Currently unassigned when used with first telecommands other than symbol No. 104 – for future use.
- ⁽³⁾ Used for selective call to a group of ships in a specified VTS area (Rec. ITU-R M.825). Reception of calls having format specifier 103, for (or) category shall not activate any alarms on shipborne DSC controller. Should not be used in any future expansion.
- ⁽⁴⁾ Only used for semi-automatic/automatic service.
- ⁽⁵⁾ Used in the automatic VHF/UHF service (Rec. ITU-R M.586). Should not be used in any future expansion.
- ⁽⁶⁾ Should not be used in any future expansion.
- ⁽⁷⁾ MF/HF used only for distress alert acknowledgment and coast station receive (see Table A1-4).

Notes relative to Table A1-3 (cont.):

A – NOTE – The telecommands for “Ships and aircraft of States not parties to an armed conflict” and “Medical transports (as defined in 1949 Geneva Conventions and additional Protocols)” are laid down in binding conventions and protocols which should not be touched by any change to Rec. ITU-R M.493.

B – NOTE – The VHF emergency position indicating radiobeacon (EPIRB) can be used to comply with an IMO carriage requirement – prior to deletion it should be deleted from the relevant chapter of SOLAS – this would require a new work item.

C – NOTE – The deletion of certain telecommands is a major change in the system, such as codes for the connection the fixed network information about the worldwide implementation should be sought by sending a circular letter to administrations. The result and further requests for the deletion should be brought to the attention of the IMO Correspondence Group for the revision of the GMDSS.

“*” Symbol transmitted in place of unused message information.

2 Technical format of a call sequence

2.1 The technical format of the call sequence is:

Dot patter See § 3	Phasing sequence See § 3	Call content See Tables A1-4.1 to A1-4.1.10.2	Closing sequence See §§ 9, 10 and Fig. 1
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2.2 Examples of typical call sequences and the construction of the transmission format are given in Figs 1 to 3 (see § 16.8).

2.3 The flow charts illustrating the operation of the DSC system are shown in Figs 4 and 5 (see § 16.8).

3 Dot pattern and phasing

3.1 The phasing sequence provides information to the receiver to permit correct bit phasing and unambiguous determination of the positions of the characters within a call sequence (see Note 1).

NOTE 1 – Acquisition of character synchronization should be achieved by means of character recognition rather than, for example, by recognizing a change in the dot pattern, in order to reduce false synchronization caused by a bit error in the dot pattern.

3.2 The phasing sequence consists of specific characters in the DX and RX positions transmitted alternatively. Six DX characters are transmitted.

3.2.1 The phasing character in the DX position is symbol No. 125 of Table A1-1.

3.2.2 The phasing characters in the RX position specify the start of the information sequence (i.e. the format specifier) and consist of the symbol Nos. 111, 110, 109, 108, 107, 106, 105 and 104 of Table A1-1, consecutively.

3.3 Phasing is considered to be achieved when two DXs and one RX, or two RXs and one DX, or three RXs in the appropriate DX or RX positions, respectively, are successfully received. These three phasing characters may be detected in either consecutive or non-consecutive positions but in both cases all bits of the phasing sequence should be examined for a correct 3-character pattern. A call should be rejected only if a correct pattern is not found anywhere within the phasing sequence.

3.4 To provide appropriate conditions for earlier bit synchronization and to allow for scanning methods to monitor several HF and MF frequencies by ship stations, the phasing sequence should be preceded by a dot pattern (i.e. alternating B-Y or Y-B sequence bit synchronization signals) with duration of:

3.4.1 200 bits

At HF and MF for:

- distress alerts;
- distress acknowledgements;
- distress alert relays addressed to a geographic area;
- distress alert relay acknowledgements addressed to all ships;
- all calls addressed to a ship station other than those specified in § 3.4.2.

3.4.2 20 bits

At HF and MF for:

- all acknowledgements to individual calls having format specifiers 120 and 123;
- all calling to coast stations.

At VHF for all calls.

4 Format specifier

4.1 The format specifier characters which are transmitted twice in both the DX and RX positions (see Fig. 1) are:

- symbol No. 112 for a “distress” alert; or
- symbol No. 116 for an “all ships” call; or
- symbol No. 114 for a selective call to a group of ships having a common interest (e.g. belonging to one particular country, or to a single ship owner, etc.); or
- symbol No. 120 for a selective call to a particular individual station; or
- symbol No. 102 for a selective call to a group of ships in a particular geographic area; or
- symbol No. 123 for a selective call to a particular individual station using the semi-automatic/automatic service.

4.2 It is considered that receiver decoders must detect the format specifier character twice for “distress” alerts and “all ships” calls to effectively eliminate false alerting. For other calls, the address characters provide additional protection against false alerting and, therefore, single detection of the format specifier character is considered satisfactory (see Table A1-3).

5 Address

5.1 “Distress” alerts and “all ships” calls do not have addresses since these calls are implicitly addressed to all stations (ship stations and coast stations).

5.2 For a selective call directed to an individual ship, to a coast station or to a group of stations having a common interest, the address consists of the characters corresponding to the station’s maritime identity as defined in Recommendation ITU-R M.585. The sequence consists of characters coded in accordance with Table A1-2 (see Note 1).

NOTE 1 – According to Recommendation ITU-R M.585 and RR Article 19, maritime mobile service identities are formed of a series of nine digits, consisting of three digits of the maritime identification digits (MID) and six more digits.

These identities are included in the address and self-identification parts of the call sequence and are transmitted as five characters $C_5C_4C_3C_2C_1$, comprising the ten digits of:

$$(X_1, X_2) (X_3, X_4) (X_5, X_6) (X_7, X_8) \text{ and } (X_9, X_{10})$$

respectively, whereas digit X_{10} is always the digit 0 unless the equipment is also designed in accordance with Recommendation ITU-R M.1080.

Example:

MID $X_4 X_5 X_6 X_7 X_8 X_9$ being the ship station identity is transmitted by the DSC equipment as:

$$(M, I) (D, X_4) (X_5, X_6) (X_7, X_8) (X_9, 0)$$

5.3 For a selective call directed to a group of ships in a particular geographic area a numerical geographic coordinates address consisting of ten digits (i.e. 5 characters), is constructed as follows (see Fig. 6 and Note 1):

NOTE 1 – In order to comply with commonly accepted practice, the order of entry and read-out should be: first latitude and then longitude.

- 1 the designated geographic area will be a rectangle in Mercator projection;
- 2 the upper left-hand (i.e. North-West) corner of the rectangle is the reference point for the area;
- 3 the first digit indicates the azimuth sector in which the reference point is located, as follows:
 - quadrant NE is indicated by the digit “0”,
 - quadrant NW is indicated by the digit “1”,
 - quadrant SE is indicated by the digit “2”,
 - quadrant SW is indicated by the digit “3”;
- 4 the second and third digits indicate the latitude of the reference point in tens and units of degrees;
- 5 the fourth, fifth and sixth digits indicate the longitude of the reference point in hundreds, tens and units of degrees;
- 6 the seventh and eighth digits indicate the vertical (i.e. North-to-South) side of the rectangle, $\Delta\phi$, in tens and units of degrees;
- 7 the ninth and tenth digits indicate the horizontal (i.e. West-to-East) side of the rectangle, $\Delta\lambda$, in tens and units of degrees.

6 Category

The “category” information is coded as shown in Table A1-3 and defines the degree of priority of the call sequence.

6.1 For a “distress” alert the priority is defined by the format specifier and no category information is included in the call sequence.

For distress alert relays, distress alert relay acknowledgements and distress acknowledgements the category is distress.

6.2 For safety related calls, the “category” information specifies:

- urgency; or
- safety.

6.3 For other calls, the “category” information specifies:

- routine.

7 Self-identification

7.1 The maritime identity as defined in Recommendation ITU-R M.585, coded as indicated in § 5.2 and its Note 1, is used for self-identification.

8 Messages

The messages that are included in a call sequence contain the following message elements, which are listed in the order in which they would appear in each message. All message formats are explicitly defined in Tables A1-4.1 through A1-4.11:

8.1 For a “distress” alert (see Table A1-4.1) the distress information is contained in four messages in the following order:

8.1.1 Message 1

Message 1 is the “nature of distress” message, coded as shown in Table A1-3, i.e.:

- 100 fire, explosion;
- 101 flooding;
- 102 collision;
- 103 grounding;
- 104 listing, in danger of capsizing;
- 105 sinking;
- 106 disabled and adrift;
- 107 undesignated distress;
- 108 abandoning ship;
- 109 piracy/armed robbery attack;
- 110 man overboard;
- 112 VHF emergency position-indicating radiobeacon (EPIRB) emission.

8.1.2 Message 2

Message 2 is the “distress coordinates” message, consisting of ten digits indicating the location of the vessel in distress, coded on the principles described in Table A1-2, in pairs starting from the first and second digits (see Note 1 to § 5.3):

- The first digit indicates the quadrant in which the incident has occurred, as follows:
 - quadrant NE is indicated by the digit “0”,
 - quadrant NW is indicated by the digit “1”,
 - quadrant SE is indicated by the digit “2”,
 - quadrant SW is indicated by the digit “3”.
- The next four figures indicate the latitude in degrees and minutes.
- The next five figures indicate the longitude in degrees and minutes.

- If “distress coordinates” cannot be included, or if the position information has not been updated for 23½ h, the 10 digits following the “nature of distress” should be automatically transmitted as the digit 9 repeated 10 times.

8.1.3 Message 3

Message 3 is the time indication coordinated universal time (UTC) when the coordinates were valid consisting of four digits coded on the principles described in Table A1-2, in pairs starting from the first and second digits.

- The first two digits indicate the time in hours.
- The third and fourth digits indicate the part of the hours in minutes.
- If the time cannot be included the four time indicating digits should be transmitted automatically as “8 8 8 8”.

8.1.4 Message 4

Message 4 is a single character to indicate the type of communication (telephone or FEC teleprinter) which is preferred by the station in distress for subsequent exchange of distress traffic. This character is coded as shown in Table A1-3 first telecommand.

8.2 Distress alert relay, distress alert relay acknowledgement, distress acknowledgement

For a distress alert relay, distress alert relay acknowledgement, distress acknowledgement (see Tables A1-4.2, A1-4.3 and A1-4.4) the distress information is contained in five messages in the following order:

8.2.1 Message 0

Message 0 is the maritime identity of the unit in distress as defined in Recommendation ITU-R M.585.

8.2.2 Message 1

Message 1 is the “nature of distress” message, coded as shown in Table A1-3, i.e.:

- 100 fire, explosion;
- 101 flooding;
- 102 collision;
- 103 grounding;
- 104 listing, in danger of capsizing;
- 105 sinking;
- 106 disabled and adrift;
- 107 undesignated distress;
- 108 abandoning ship;
- 109 piracy/armed robbery attack;
- 110 man overboard;
- 112 VHF emergency position-indicating radiobeacon (EPIRB) emission.

8.2.3 Message 2

Message 2 is the “distress coordinates” message, consisting of ten digits indicating the location of the vessel in distress, coded on the principles described in Table A1-2, in pairs starting from the first and second digits (see Note 1 to § 5.3):

- The first digit indicates the quadrant in which the incident has occurred, as follows:
 - quadrant NE is indicated by the digit “0”,
 - quadrant NW is indicated by the digit “1”,
 - quadrant SE is indicated by the digit “2”,
 - quadrant SW is indicated by the digit “3”.
- The next four figures indicate the latitude in degrees and minutes.
- The next five figures indicate the longitude in degrees and minutes.

If “distress coordinates” cannot be included, or if the position information has not been updated for 23½ h, the 10 digits following the “nature of distress” should be automatically transmitted as the digit 9 repeated 10 times.

8.2.4 Message 3

Message 3 is the time indication (UTC) when the coordinates were valid consisting of four digits coded on the principles described in Table A1-2, in pairs starting from the first and second digits.

- The first two digits indicate the time in hours.
- The third and fourth digits indicate the part of the hours in minutes.
- If the time cannot be included the four time indicating digits should be transmitted automatically as “8 8 8 8”.

8.2.5 Message 4

Message 4 is a single character to indicate the type of communication (telephone or FEC teleprinter) which is preferred by the station in distress for subsequent exchange of distress traffic. This character is coded as shown in Table A1-3 first telecommand.

8.3 Other types of calls

For other types of calls (see Table A1-4.5 through A1-4.11 and Figs 3 and 4) messages are included in the following order:

8.3.1 Message 1

Message 1 is the “telecommand” information and consists of two characters (first and second telecommand) coded as shown in Table A1-3:

- if no information additional to that conveyed by the first telecommand character is required, then the second telecommand signal should be symbol No. 126 (no information) (see Table A1-3);
- if no telecommand information is used, symbol No. 126 is transmitted twice;
- if the telecommand 1 is “F3E/G3E duplex TP” (symbol 101) in a request, which can be complied with, the telecommand 1 “F3E/G3E all modes TP” (symbol 100) should be used in the acknowledgement.

8.3.2 Message 2

Message 2 may contain two “channel or frequency message” elements, each of which basically consists of three characters, “character 1”, “character 2” and “character 3”, indicating the proposed working frequency (in the F1B/J2B mode the assigned frequency should be used) in multiples of 100 Hz or the channel number (coded in accordance with Table A1-5) or the ship’s position. The first frequency element (the Rx field) in the call indicates the called station receive frequency and the second frequency element (the Tx field) indicates the called station transmit frequency. In

acknowledgements the Rx and Tx fields indicate the receive and transmit frequency of the acknowledging station respectively (see also Fig. 2 and Note 1).

NOTE 1 – If only one channel or frequency message element is used, this indicates the called station receive channel or frequency or a two-frequency (paired) channel. A second channel or frequency message element may be used to designate the called station transmit channel or frequency. If the calling station indicates only the called station receive frequency (for broadcast mode transmissions) then the symbol No. 126 repeated three times (see Note 2) should be transmitted instead of the called station transmit channel or frequency message element. If no “channel or frequency message” elements are used, the symbol No. 126 is transmitted six times. For calls using the semi-automatic/automatic VHF service (see Table A1-4.10.1) then only one “channel or frequency message” element is transmitted which indicates the paired channel number. In the absence of this element the symbol No. 126 should be transmitted three times.

NOTE 2 – In the F1B/J2B mode (FEC or ARQ), if using seven-digit frequency as the working frequency, Message 2 may contain two frequency message elements as mentioned above, but each of which consists of four characters, “character 0”, “character 1”, “character 2” and “character 3” in multiples of 10 Hz (coded in accordance with Table A1-5). Additionally if the calling station indicates only the called station receive frequency of seven-digit (for broadcast mode transmissions) then the symbol No. 126 repeated four times should be transmitted instead of the called station transmit frequency message element.

8.3.2.1 Frequency information

The frequency (in the F1B/J2B mode the assigned frequency should be used) in multiples of 100 Hz or 10 Hz (see Note 2 above) may only be indicated as such when the frequency is below 30 MHz. The three characters provide for the required six decimal digits. Character 1 represents the units (U) and tens (T) of 100 Hz, character 2 the hundreds (H) and thousands (M) and character 3 the tens of thousands (TM) and hundreds of thousands (HM) of 100 Hz. For MF/HF DSC, use frequency selection mode, vice channel selection mode, to ensure international interoperability. Also, when using seven-digit frequencies, the four characters provide for the required seven decimal digits. Character 0 represents the units (U1) and tens (T1) of 10 Hz, character 1 the units (U) and tens (T) of 1 kHz, character 2 the hundreds (H) and thousands (M) and character 3 the tens of thousands (TM) of 1 kHz. However note that this four characters information is only for use of seven-digit frequencies in the F1B/J2B, i.e. it does not affect the messages for the J3E TP mode and for the F1B/J2B mode using six-digit frequencies to ensure interoperability.

8.3.2.2 Channel information

8.3.2.2.1 HF and MF channels

If the HM digit is 3, this indicates that the number represented by the digits TM, M, H, T, U, T1 and U1 is the HF/MF working channel number (either single frequency or two frequency channels). This mode should only be used for decoding received calls, to ensure interoperability with older equipment.

8.3.2.2.2 VHF channels

If the HM digit is 9, this indicates that the number represented by the values of the digits M, H, T and U is the VHF working channel number. If the M digit is 1, this indicates that the ship stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations. If the M digit is 2, this indicates that the coast stations transmitting frequency is being used as a simplex channel frequency for both ship and coast stations.

8.3.2.3 Ship's position information

For MF/HF calls, message 2 may contain the ship's position, consisting of the digit 5 repeated two times and ten digits (five characters) indicating this position, coded in accordance with § 8.1.2 (see Table A1-6).

For position requests message 2 consists of 6 no information symbols (symbol No. 126).

In acknowledgements to a call requesting ship's position (see Fig. 3d)) message 2 consists of twelve digits (six symbols), the first of which should be coded in accordance with § 8.1.2 followed by one symbol No. 126.

8.3.3 Message 3

Message 3 follows message 2 in this case and contains the time (UTC) when the coordinates were valid, coded as indicated in § 8.1.3.

Message 3 follows message 2 when using the DSC system for calls initiated by ship stations requiring a semi-automatic or automatic connection (see Table A1-4.10.1 and A1-4.10.2) and contains the public switched network number (e.g. telephone number). In this case the format specifier used is symbol No. 123.

This number is coded by up to nine symbols in a manner similar to that shown in Table A1-2, except that the first character transmitted should be either symbol No. 105 or No. 106 to indicate whether the network number contains an odd or even number of significant digits. As an example, the number 0012345 would be coded as symbol numbers 105 00 01 23 45 whereas the number 00123456 should be coded as symbol numbers 106 00 12 34 56.

8.4 Distress alert relay

For "distress alert relay" including shore-to-ship alerts, "distress alert relay acknowledgement" and "distress acknowledgement" calls, the message formats are indicated in Tables A1-4.3, A1-4.4 and A1-4.2 respectively.

When sending a distress alert on behalf of another ship which is unable to send its own alert, and where the identity of the station in distress is unknown, the distress alert relay call should contain the symbol No. 126 transmitted five times for the "identification of the station in distress".

8.5 Test calls

Test calls on the distress and safety frequencies for MF and HF and VHF channel 70 may be conducted using the test call sequence in Table A1-4.7.

8.6 Distress self-cancel operation

Distress acknowledgments where the transmitting ID and ship in distress ID are the same, the message should be interpreted as a self-cancel operation. This should be displayed on all receiving stations.

9 End of sequence

The "end of sequence" (EOS) character is transmitted three times in the DX position and once in the RX position (see Fig. 1b)). It is one of the three unique characters corresponding to symbol Nos. 117, 122 and 127 as follows:

- symbol No. 117 if the call requires acknowledgement (Acknowledge RQ), used for individual and automatic/semiautomatic calls only;
- symbol No. 122 if the sequence is an answer to a call that requires acknowledgement (Acknowledge BQ), used for individual and automatic/semiautomatic calls and all distress alert relay acknowledgements;
- symbol No. 127 for all other calls.

10 Error-check character

10.1 The error-check character (ECC) is the final character transmitted and it serves to check the entire sequence for the presence of errors which are undetected by the ten-unit error-detecting code and the time diversity employed.

10.2 The seven information bits of the ECC shall be equal to the least significant bit of the modulo-2 sums of the corresponding bits of all information characters (i.e. even vertical parity). The format specifier and the EOS characters are considered to be information characters. The phasing characters and the retransmission (RX) characters shall not be considered to be information characters. Only one format specifier character and one EOS character should be used in constructing the ECC. The ECC shall also be sent in the DX and RX positions.

10.3 Automatic acknowledgement transmissions should not start unless the ECC is received and decoded correctly. A received ECC which does not match that calculated from the received information characters may be ignored if this was due to an error detected in the ten-unit error-detecting code of the information characters which was correctable by use of the time diversity code.

10.4 The receiver decoder should provide maximum utilization of the received signal, including use of the error-check character.

11 Distress alert attempt

11.1 Distress alerts may be transmitted as a single frequency or a multi-frequency call attempt preceded by a dot pattern. MF/HF equipment should be capable of using both single and multi-frequency call attempts. Where a distress alert attempt contains more than one consecutive distress alert on the same frequency (see Recommendation ITU-R M.541), these consecutive alerts should be transmitted with no gap between the end of one call and the start of the dot pattern of the following call to enable bit synchronization to be maintained (see Fig. 1c)). Multi-frequency call attempts should always include at least the MF and HF 8 MHz band DSC distress and safety frequencies.

11.2 A distress alert should be activated only by means of a dedicated distress button which should be clearly identified and be protected against inadvertent operation. For a fixed station the protection should be a spring loaded lid or cover. For a handheld VHF the protection should be a cover or a lid which should be rapidly self-closing when unattended. The initiation of a distress alert should at least require two independent actions.

11.3 Calls with format specifier “distress” or category “distress”, “urgency” and “safety” should be initiated manually only. This applies also for ships equipped for automatic DSC operation. For automatic repetition of distress alerts see Recommendation ITU-R M.541.

11.4 Immediately following a distress alert a DSC expansion message giving enhanced position resolution according to Recommendation ITU-R M.821 should be transmitted in the following manner.

For a single frequency distress alert attempt the expansion message should be transmitted immediately after the last of five consecutive distress alerts.

For a multi-frequency distress alert attempt the expansion message should be transmitted immediately after each distress alert.

12 Shipborne human machine interface

12.1 Shipborne audible alarm

Shipborne alarms should start softly and increase in volume if not silenced by the operator. This will give the operator the opportunity to acknowledge the alarm without interrupting the ship's current communications. It should be possible for the operator to disable all audible alarms except those of category (see 6) distress and urgency.

Distress calls should have an alarm consisting of a repetition of the 2 200 Hz tone for 250 ms followed by a 1 300 Hz tone for 250 ms (two-tone alarm). This alarm occurs at the initiation of the received distress DSC automated procedure. The characteristics of this alarm should not be able to be altered.

Urgency calls should have an alarm consisting of a repetition of the 2 200 Hz tone for 250 ms followed by 250 ms period of silence. This alarm occurs at the initiation of the received non-distress DSC automated procedure when the category of the initiating DSC message is "urgency". The characteristics of this alarm should not be able to be altered.

For HF and MF distress calls, the alarm should activate only when a distress alert, distress acknowledgement, or a distress alert relay is received and the distress position is within 500 NM (926 km) of the receiving vessel's position, or if the distress position is in the polar areas (latitude greater than 70° N or 70° S). The alarm should also activate when the call is received and the distance between the vessel in distress and the receiving vessel cannot be determined.

NOTE 1 – Disabling of audible alarm does not affect handling of call.

For geographic area calls, the alarm appropriate to the category should activate when the receiving station's position is within the area specified by the call or the receiving station's position is not known. The alarm should not be activated where duplicate distress alert relay calls are received within one hour. A duplicate distress alert relay call is one having format specifier all ships or geographic area that contains identical message information, as defined in § 8.1 and an identical distress maritime mobile service identity (MMSI).

12.2 Inactivity timer

During normal operation, the equipment should include an inactivity timer to return the DSC system display to default or standby mode if the operator is in a menu where DSC call reception is disabled and does not make any selections or changes for 10 min.

12.3 Display

The presentation of information on the display should support readability from typical user positions when operating the equipment under all ambient light conditions and operational requirements likely to be experienced on the bridge of a ship¹.

It should have the means to display, in plain language, the information contained in the received call. For Class A DSC equipment, the display should have a minimum of 160 characters in two or more lines.

12.4 Maritime mobile service identity

DSC equipment should not transmit any DSC call until own ship's MMSI allocated to the ship by the relevant administration has been configured and stored in the DSC equipment. Once stored, it should

¹ See IMO MSC. 191(79) for further details.