

REPORT 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

(Question 93/8)

(1990)

1. Introduction and background

The facility for inserting the public switched network number in a Digital Selective Calling (DSC) call (see Recommendation 493, Annex I § 8.2.3) has enabled an automatic (direct-dial) telephone system to be introduced in the VHF band, using the existing Appendix 18 working channels, based on the operational procedures which are described in draft Recommendation 689.

1.2 This report examines the MF/HF situation and proposes that such an automatic system (with some modifications compared to the VHF system) may indeed be introduced on MF/HF frequencies.

2. Factors which differ between MF/HF and VHF

2.1 For an automatic system based on DSC the main factors which differ between MF/HF and VHF are as follows:

2.1.1 The modulation rate of DSC on MF/HF is 100 baud compared to 1200 baud on VHF. This results in the duration of a single DSC VHF automatic call taking a maximum of 0.633 seconds (assuming an 18 digit telephone number) whereas an equivalent call on MF/HF would take 8.2 seconds (assuming a 20-bit dot pattern and two elements in the channel/frequency message).

2.1.2 The probability of a single DSC transmission on MF/HF being received error-free by a particular receiving station will, in general, be lower than at VHF (typically 60% on HF; 95% on MF (day); 100% on VHF as given in CCIR Report 501).

2.1.3 The class of emission on MF/HF radiotelephony working channels is J3E (suppressed carrier) whereas on VHF it is F3E/G3E (i.e. a carrier is present even when the transmitter is not being modulated).

* The Director, CCIR, is requested to bring this Report, in particular section 3, to the attention of the CCITT.

2.1.4 A DSC call on an MF or HF frequency can, in general, be received at a greater distance than that over which a radiotelephony call can be received, due mainly to the narrower bandwidth of the DSC transmission, whereas on VHF the ranges of a DSC call and a radiotelephony call are substantially the same. Furthermore, the channel quality of MF and HF working channels is generally poorer than VHF channels.

2.2 These differences mean that for MF/HF operation some modifications would be needed to the operational procedures described in draft new Recommendation 689. The three main factors to be considered are: the suppressed carrier operation on MF/HF working channels; the possibility of receiving a DSC call at a distance over which a subsequent radiotelephony call could not be received; and the need to ensure that the working channel quality is adequate for the required communication.

2.3 It is also considered that the automatic DSC call repetition (in the event of an unsuccessful first call) which is included in draft new Recommendation 689 would not provide any significant benefit due to the longer duration of an MF/HF DSC call. Only manually initiated repeats are therefore proposed.

2.4 Various methods of evaluating the working channel quality may be applicable and require further study. One method could be to measure the signal-to-noise (S/N) ratio on the working channel and to compare this to the required working channel S/N ratio appropriate to the mode of communication required. Recommendation 339 (Volume III) gives typical RF S/N density ratios (dB/Hz) of various classes of emission and may be used to determine the appropriate working channel S/N ratios for the desired mode. For example, an F1B 100 baud 300 Hz bandwidth telegraphy emission (which may be considered analagous to an MF/HF DSC emission) is stated as requiring an RF S/N density ratio of 43 or 52 dB/Hz (for stable or non-diversity fading conditions respectively), whereas a corresponding J3E telephony emission for a marginally commercial grade of service is stated as requiring 56 or 61 dB/Hz (for the same conditions as above).

2.5 The fact that quality (the DSC S/N ratio) is measured only in the ship-to-shore direction presupposes a symmetrical path.

Even allowing the following assumptions:

- identical transmission and reception antenna gain at the coast station;
- identical transmission and reception antenna gain at the ship station;
- identical receiver sensitivity at both stations,

the fact nevertheless remains that:

- transmission power is higher at the coast station;
- noise is higher on board the ship.

It may be that those two phenomena more or less cancel each other out.

However, measuring the DSC S/N ratio in both directions would involve:

- increased length of the procedures;
- greater cost of equipment on board each ship.

This explains why no such procedure has been adopted.

2.6 While ship stations normally have only one radio set to cover the MF and HF frequency bands to provide the following successive functions:

- watching or calling;
- exchanging procedures;
- traffic handling,

the same does not apply to coast stations which usually have several equipments for these frequency bands.

There is no reason why the equipments at the coast station should not be specialized, some being reserved for the first two functions and all the others for traffic handling.

Omnidirectional antennas are used in HF for the first two functions but directional antennas can be used, by some coast stations, for the third.

The number of simultaneous telephone calls that can be made from the coast station is thus equal to the number of traffic equipments.

A permanent watch is kept on DSC frequencies and, when all the traffic equipments are in use, it is possible to answer a call and indicate temporary unavailability.

3. Conclusions and further study

3.1 Automatic operation on MF/HF frequencies appears to be feasible. Proposed operational procedures are given in Annex I but require further study. The extent to which these procedures may be applicable to the use of a working channel instead of a DSC calling channel could also be studied.

3.2 In particular, the need for the ship station to be able to change frequency from a DSC channel to any other working frequency in the same band within 5 seconds should be studied. A longer time, e.g. 15 seconds, may be required.

3.3 Study of a definition for the "channel engaged" signal is also desirable.

ANNEX I

OPERATIONAL PROCEDURES

1. Introduction

These procedures are initiated by using DSC on an appropriate MF or HF paired DSC calling channel and based on the technical characteristics and operational procedures detailed in Recommendations 493 and 541.

Connection to the public switched telephone network is effected using any appropriate MF or HF public correspondence working channels listed in Article 60 of the Radio Regulations without in any way impairing their use for manual operations. The same working channel can be used for both automatic and manual operation by the same coast station depending on the requirements of the ship stations.

Appendix I illustrates the timing of the call set-up, calling and acknowledgement sequences described by these procedures.

Appendix II details the required technical characteristics of the ship and coast station equipment.

2. Operational procedures in the ship-to-shore direction2.1 Ship station initiates call

2.1.1 The user aboard the ship (hereafter referred to as the user) composes the calling sequence (see Note 1) on his DSC equipment as follows:

- selects the format specifier 123 (individual station automatic/semiautomatic service);
- enters 9-digit address (identification) of required coast station;
- selects the category routine (100);
- (the ship station self-identification is entered automatically);
- selects first and second telecommands as appropriate (for a normal radiotelephone call these would be 109 (J3E) and 126 (no information) respectively);
- inserts required working frequency/ies or channel number if required or ship's position (see Note 2);
- inserts the required subscriber number (e.g. telephone number);
- selects "end of sequence" signal "RQ":

Note 1 - It is assumed that commercial equipment will be produced which simplifies the composition of the calling sequence. In practice the user should only need to key the coast station address and the required subscriber number, all other information being inserted automatically.