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MAINTENANCE OF THE INTERNATIONAL PUBLIC
TELEPHONE NETWORK

MAINTENANCE OF MARITIME SATELLITE AND DATA
TRANSMISSION SYSTEMS

Maritime systems

**GENERAL MAINTENANCE ASPECTS
OF MARITIME SATELLITE SYSTEMS**

Reedition of CCITT Recommendation M.1100 published in
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NOTES

- 1 CCITT Recommendation M.1100 was published in Fascicle IV.2 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation M.1100

GENERAL MAINTENANCE ASPECTS OF MARITIME SATELLITE SYSTEMS

1 Purpose

The purpose of this Recommendation is to describe the special maintenance procedures and facilities that are required for the maintenance of maritime satellite systems. Wherever possible the standard maintenance procedures and facilities specified in the Series M and O Recommendations should be followed for the maintenance of these systems.

2 Definitions

The following are definitions of terms used in the maintenance of maritime satellite systems.

2.1 maritime satellite system

In the Maritime Mobile-Satellite Service, all of the temporary connection between a telephone at a ship earth station and the maritime virtual switching point at a coast earth station. It comprises a *maritime satellite circuit* and a *maritime local system*. The general arrangement is shown in Figure 1/M.1100.

2.2 maritime satellite circuit

A 4-wire circuit between a maritime virtual switching point at a *coast earth station* and the 4-wire circuit test access point at a *ship earth station*, via a satellite repeater.

2.3 maritime local system

All the equipment between the 4-wire test circuit access point on a *ship earth station* and a 2-wire or 4-wire telephone served by that ship earth station. It may include 4-wire to 2-wire termination sets, echo control equipment, data interfaces, and 4-wire or 2-wire switching devices.

2.4 ship earth station (SES)

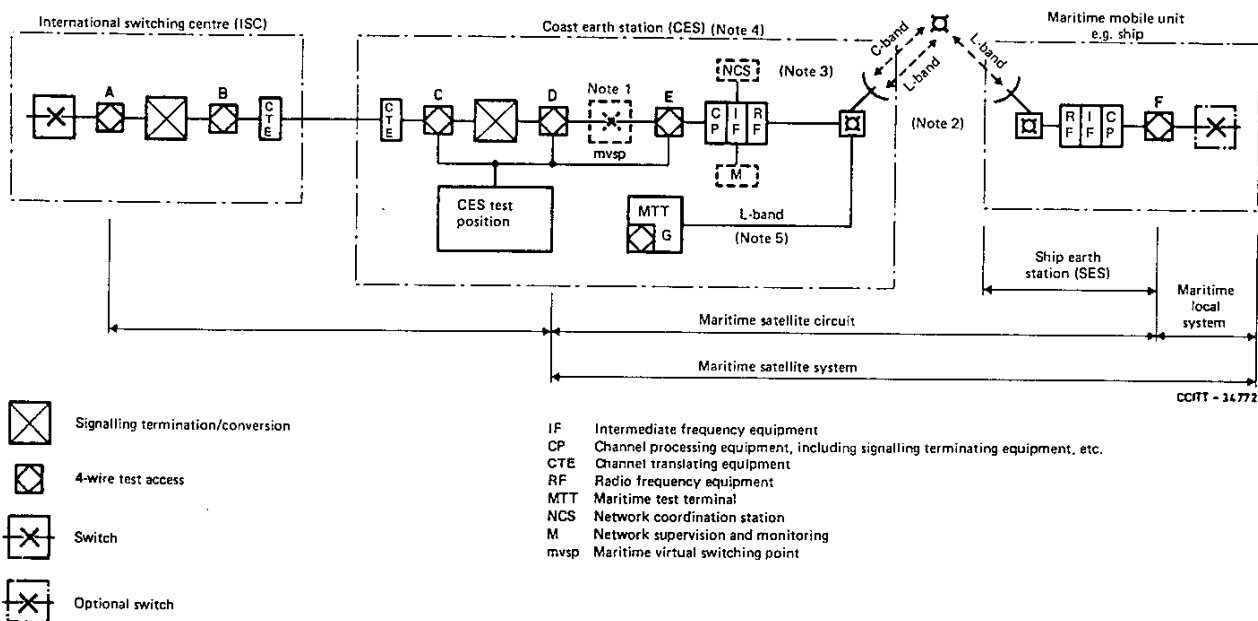
In the Maritime Mobile-Satellite Service, a mobile earth station which provides a 4-wire analogue interface for connection of a *maritime satellite circuit* to a *maritime local system* and a 4-wire circuit test access point.

2.5 coast earth station (CES)

In the Maritime Mobile-Satellite Service, an earth station, which provides a 4-wire analogue interface for connection of a *maritime satellite circuit* to the international public switched telephone network. It also provides circuit test access points and test facilities. (See Recommendation M.1120 for the functions of a coast earth station.)

2.6 maritime test terminal (MTT)

A *ship earth station* and a *maritime local system* installed at a coast earth station and used for test purposes.



Note 1 — A maritime virtual switching point should always be established for transmission planning purposes. However, a switch at the coast earth station is optional.

Note 2 — The actual frequencies used are 4/6 GHz (C-band) and 1.5/1.6 GHz (L-band).

Note 3 — Certain coast earth stations are also network coordination stations; their functions are described in Recommendation M.1110.

Note 4 — Coast earth station functions are described in Recommendation M.1120.

Note 5 — 4-wire test access point G is equivalent to 4-wire test access point F.

FIGURE 1/M.1100

Constitution of a maritime satellite system

2.7 network coordination station (NCS)

A station in the Maritime Mobile-Satellite Service that maintains a pool of frequencies, assigns frequencies on demand from a coast earth station for use in a maritime satellite circuit, and supervises and monitors the use of the frequencies. The network coordination station is normally located at a coast earth station which is designated by the satellite system operator to fulfill these functions. (See Recommendation M.1110 for the functions of a network coordination station.)

2.8 coast earth station test position

A position in a coast earth station that can be used to originate test calls over the maritime satellite system to the maritime test terminal and to receive test calls from the maritime test terminal.

3 General maintenance principles

3.1 Responsibilities

In an international connection which includes a ship earth station, the maritime satellite system may be regarded from a transmission point of view as analogous to a national network and the maritime local system as somewhat analogous to a subscriber terminal within that network. Nevertheless, it should be noted that the maritime satellite circuit is set up between the coast earth station and the ship earth station on a demand assignment basis. Therefore, a coast earth station in the maritime satellite system may not have the direct responsibility for the maintenance of a particular maritime satellite circuit and a particular ship earth station all of the time. The operation and maintenance of the overall maritime satellite system is the responsibility of the maritime satellite system operator, e.g. INMARSAT.

The maintenance organization in each participating country is in general responsible for the maintenance of the maritime satellite circuits.

3.2 Available services

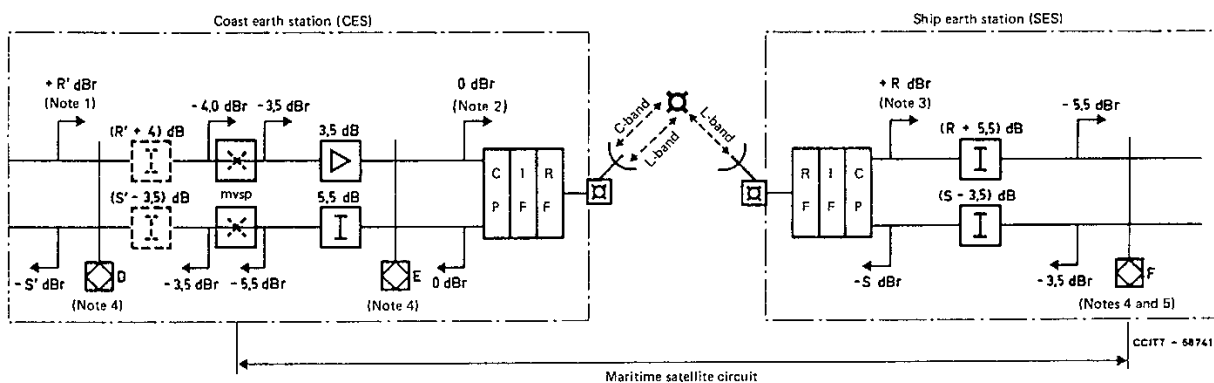
The maritime satellite systems in service provide telex services to maritime mobile units in addition to telephone and data services. When instituting maintenance procedures, Administrations should consider the utilization of these services for communication, diagnostic and maintenance purposes, and should also consider that trained technical staff are generally available at the ship earth station only at the time the ship earth station is commissioned; however, the ship earth station is usually operated by a qualified radio officer who may be able to assist in carrying out simple test procedures.

Special services, e.g. facsimile and high speed data services, are being provided over the maritime satellite systems. The development of new maintenance procedures to support these services will be the subject of future study.

4 Interconnection with the international public switched telephone network

Interconnection arrangements are considered with reference to Figure 1/M.1100.

The maritime virtual switching point at the coast earth station is considered to be the interface between test access points D and E (see Figure 2/M.1100). The circuit between the international switching centre (ISC) and coast earth station is considered as equivalent to an international public switched telephone circuit.



Note 1 — $+R'$ dBr and $-S'$ dBr in the coast earth station correspond to the levels $+R'$ dBm and $-S'$ dBm using a modulation signal with a level of 0 dBm0.

Note 2 — The levels of 0 dBr are given as an example.

Note 3 — $+R$ dBr and $-S$ dBr in the ship earth station correspond to the levels of $+R$ dBm and $-S$ dBm using a modulation signal with a level of 0 dBm0.

Note 4 — See Figure 1/M.1100 for 4-wire test access points.

Note 5 — The levels at test access point F are those given in Recommendation G.473 [3].

Note 6 — For the abbreviations used in this figure see Figure 1/M.1100.

FIGURE 2/M.1100

Levels at the coast earth station and ship earth station

5 Lining-up and maintaining international public switched telephone circuits

The circuit between the international switching centre and the coast earth station in Figure 1/M.1100 should be lined up and maintained in accordance with those Series M Recommendations appropriate to international public switched telephone circuits, e.g. Recommendations M.580 [1] and M.610 [2].

6 Lining-up and maintaining maritime satellite circuits

6.1 *Control, sub-control and respective responsibilities*

6.1.1 *General*

The assignment of control and sub-control stations and respective responsibilities must address the configuration of the maritime satellite system. In every case a control station must be assigned as regards circuits, and, in addition, sub-control stations are required for efficient maintenance.

6.1.2 *Assignment of control stations*

The coast earth station will be the control station for the maritime satellite circuit.

6.1.3 *Assignment of sub-control stations*

6.1.3.1 In principle, the ship earth station should act as the maritime satellite circuit sub-control station. However, the required staff and facilities may not be available to meet the circuit sub-control responsibilities, and special measures may need to be developed.

6.1.3.2 A maritime test terminal may be used to enhance fault location and maintenance in the maritime satellite system. In this regard the maritime test terminal may carry out some tests normally considered to be within the province of a sub-control station on behalf of a ship earth station. Whether or not a maritime test terminal should be assigned as a sub-control station is left for further study when the operation of a maritime test terminal is further defined.

6.1.4 *Responsibilities of control and sub-control stations*

Control stations dealing with maritime satellite circuits should fulfill the responsibilities of control stations as defined in the Series M Recommendations in general. The same will apply to sub-control stations. However, the maritime satellite systems present new concepts which require guidelines inasmuch as a maritime mobile unit is essentially a subscriber location. See Recommendation M.1120.

6.2 *Transmission characteristics*

The transmission design characteristics for maritime satellite circuits are given in Recommendation G.473 [3].

The setting-up, lining-up and maintenance limits of the maritime satellite circuit between test access points E and F of Figure 2/M.1100 should be as defined in Table 1/M.1100 both for the case where no switch is located at the coast earth station and where a switch is located at the coast earth station.

The loss/frequency limits in Table 1/M.1100 are those which should be met with the compandors disabled. The measurements to be carried out with the compandors in circuit are a subject for further study.

The relative levels at the coast earth station and the ship earth station are shown in Figure 2/M.1100.

TABLE 1/M.1100

Provisional setting-up, lining-up and maintenance limits

Transmission parameters	Maintenance limits (dB)
Loss/frequency relative to the loss at reference frequency	(See Note)
Below 300 Hz	Not specified
300-400 Hz	-1.2 to +4.4
400-600 Hz	-1.2 to +2.6
600-2400 Hz	-1.2 to +1.2
2400-2700 Hz	-1.2 to +2.6
2700-3000 Hz	-1.2 to +4.4
3000-3400 Hz	-1.2 to not specified
Idle noise	Not yet specified. See Annex A for further information

Note – To avoid distortion introduced by clippers and the gain variations due to companders, the 1020 Hz reference tone used for measuring the loss shall be set at -10 dBm0 and the companders shall be disabled.

6.3 *Lining-up procedures*

6.3.1 *Measurement of the loss at the reference frequency*

The control station (coast earth station) sends a reference frequency from 4-wire test access E in Figure 2/M.1100 at a level of -10 dBm0. The sub-control station (ship earth station) measures the level at 4-wire test access point F in Figure 2/M.1100 (the -5.5 dBr point). The receive level should be -15.5 dBm.

The sub-control station (ship earth station) applies a reference frequency at the 4-wire test access F in Figure 2/M.1100 (the -3.5 dBr point) at a level of -13.5 dBm, i.e. -10 dBm0. The control station (coast earth station) measures the level at the 4-wire test access point. This should be -10 dBm0 at 4-wire test access point E in Figure 2/M.1100.

The tolerance of the loss measurements shall be as specified in Recommendation M.580 [1].

6.3.2 *Measurement of loss/frequency response*

The loss/frequency characteristic should be measured and recorded at the following frequencies to check that the objectives contained in Table 1/M.1100 are met:

420, 1020, 2500, 2800, 3000 Hz.

The loss/frequency measurements are taken with the companders disabled. The measurements to be carried out with the companders in circuit are a subject for further study.

6.3.3 *Measurement of circuit noise*

The method of measurement of noise is not yet specified and is under study.

6.3.4 *Measurement of circuit stability*

This test should be performed on maritime satellite circuits which are 2-wire terminated at the ship earth station.

With the echo suppressor disabled and the 2-wire portion of the circuit unterminated (open circuit), a reference frequency is applied at a level -10 dBm0 to the test access point E in the transmit direction at the coast earth station. The level measured at the test access point E in the receive direction should not be more than -17 dBm0.

6.4 *Fault reporting procedures*

Fault report points (circuit) should be identified in accordance with Recommendation M.715 [4].

Fault report points (network) should be identified in accordance with Recommendation M.716 [5]. One such point is required for the maritime satellite system and in the INMARSAT system is assigned to the INMARSAT operations control centre (see Recommendation M.1110 for the responsibilities of the operations control centre). However, general international networking problems should in the first instance be referred to the fault report points (network) concerned.

Exchange of contact point information should be in accordance with Recommendation M.93 [6].

6.5 *Maintenance procedures*

Routine measurements on the maritime satellite circuits should be performed to confirm that the transmission parameter limits listed in Table 1/M.1100 continue to be maintained. These maintenance procedures are particularly important with respect to the coast earth station transmission performance.

The periodicity of the routine measurements is under study.

7 **Test facilities at ship earth stations**

7.1 *Automatic testing*

Maritime mobile units operating in marine environments would not in general have personnel with adequate expertise for testing and maintaining equipment connected to the international network. Therefore, remote automatic testing of a ship earth station would be possible by including automatic test equipment at the coast earth station and the ship earth station. The required facilities include quiet termination test line and loop around test line as given in Recommendation O.11 [7].

7.2 *Manual testing*

It should be possible to undertake manual testing of the transmission performance of ship earth stations. This type of test is essential when a ship earth station is being lined up after it has been repaired. It should be possible to initiate the test either from the coast earth station or from the ship earth station.

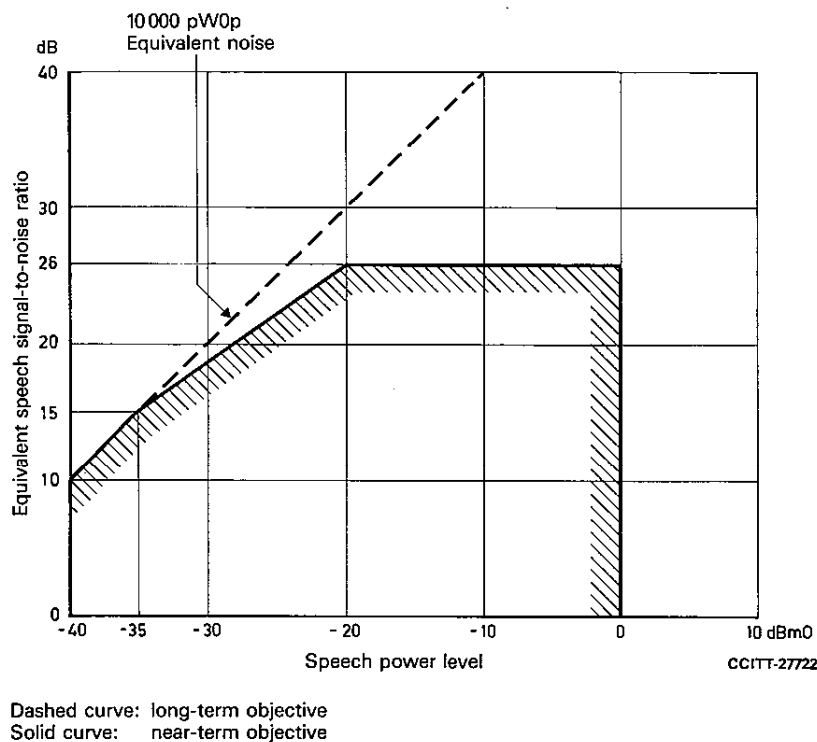
In order to meet these objectives, the ship earth station should, as a minimum, be equipped with a tone generator and level meter.

ANNEX A

(to Recommendation M.1100)

Signal-to-noise ratios of a maritime satellite circuit containing speech dependent devices

As a maritime satellite circuit may contain speech dependent devices (e.g. companders), the customary specification of idle-circuit-noise is inadequate. The near-term and long-term “objectives” of required speech- signal-to-psophometrically-weighted-noise ratio as a function of mean speech power (dBm0, time-average while active), as proposed by Study Group XVI are shown in Figure A-1/M.1100. The maintenance limits and method of measurement are under study.



Note 1 — Below -40 dBm0 and above 0 dBm0 the characteristic is not specified.

Note 2 — The near-term objective is given by the solid lines which relate subjectively equivalent speech signal-to-noise ratio, in dB (see the manual cited in [8]), to mean speech power (dBm0, time average while active).

The long-term objective is given by the dashed lines expressing the performance likewise in terms of equivalent signal-to-noise ratio. It is recognized that it might be difficult with the maritime mobile satellite facilities of today to comply with the long-term objective. When practicable, however, it is expected that the system(s) in the future will comply with this objective.

FIGURE A-1/M.1100

Signal-to-noise ratios of a maritime satellite circuit containing speech dependent devices

References

- [1] CCITT Recommendation *Setting up and lining up an international circuit for public telephony*, Vol. IV, Rec. M.580.
- [2] CCITT Recommendation *Periodicity of maintenance measurements on circuits*, Vol. IV, Rec. M.610.
- [3] CCITT Recommendation *Interconnection of a maritime mobile satellite system with the international automatic switched telephone service; transmission aspects*, Vol. III, Rec. G.473.
- [4] CCITT Recommendation *Fault report point (circuit)*, Vol. IV, Rec. M.715.
- [5] CCITT Recommendation *Fault report point (network)*, Vol. IV, Rec. M.716.
- [6] CCITT Recommendation *Exchange of contact point information for the maintenance of international services and the international network*, Vol. IV, Rec. M.93.
- [7] CCITT Recommendation *Maintenance access lines*, Vol. IV, Rec. O.11.
- [8] CCITT Manual *Transmission planning of switched telephone networks*, Chapter III, Annex 4, ITU, Geneva, 1976.

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