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SERIES M: TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

Mobile telecommunication systems and services

Maintenance aspects of aeronautical mobile telecommunication service via satellite

ITU-T Recommendation M.1160

(Previously CCITT Recommendation)

ITU-T M-SERIES RECOMMENDATIONS

TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

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ITU-T RECOMMENDATION M.1160

MAINTENANCE ASPECTS OF AERONAUTICAL MOBILE TELECOMMUNICATION SERVICE VIA SATELLITE

Summary

This Recommendation describes special maintenance requirements for the Aeronautical Mobile-satellite Service.

Source

ITU-T Recommendation M.1160 was revised by ITU-T Study Group 4 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 19th of April 1997.

Keywords

Inmarsat-Aero System; Maintenance Aspects; Satellite Aeronautical Mobile.

FOREWORD

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The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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MAINTENANCE ASPECTS OF AERONAUTICAL MOBILE TELECOMMUNICATION SERVICE VIA SATELLITE

(1992; revised in 1997)

1 General

1.1 Scope

The purpose of this Recommendation is to describe the special maintenance procedures and facilities that are required for the maintenance of the Inmarsat aeronautical mobile telecommunication system via satellite, and to define interrelationship and interworking issues of such systems with terrestrial voice and data public/private networks. Wherever possible, the standard maintenance procedures and facilities specified in the M- and O-Series Recommendations, and appropriate X-Series Recommendations for data should be followed for the maintenance of these systems.

1.2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] CCITT Recommendation M.715 (1988), *Fault report point (circuit).*

[2] CCITT Recommendation M.716 (1988), *Fault report point (network).*

[3] CCITT Recommendation M.1510 (1992), *Exchange of contact point information for the maintenance of international services and the international network.*

[4] CCITT Recommendation M.1140 (1992), *Maritime mobile telecommunication services via satellite.*

[5] CCITT Recommendation M.710 (1988), *General maintenance organization for the international automatic and semi-automatic telephone service.*

[6] ITU-T Recommendation F.127 (1996), *Operational procedures for interworking between the international telex service and the service offered by the Inmarsat-C system.*

[7] ITU-T Recommendation X.25 (1996), *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.*

2 Available services

The aeronautical mobile telecommunication system is intended for the provision of telephone, fax and data communication services to and from aircraft. The range of possible applications for these services includes airline crew and passenger communications (public correspondence), airline operations communications, air traffic control services and distress urgent/safety calls.

3 System configuration

3.1 Aeronautical satellite system

The major elements of the aeronautical satellite system are as follows (see Figure 1):

a) the space segment including satellites (one for each ocean region);

b) the Network Channel Management System (NCMS) for each satellite region;

c) aeronautical Ground Earth Stations (GESs);

d) Aircraft Earth Stations (AESs).

3.1.1 Space segments

The space segment comprises the satellite communications transponder(s) for each ocean region and associated frequency bands assigned for use by the aeronautical mobile-satellite system. The ocean regions are the Atlantic East, the Atlantic West, the Pacific and the Indian Ocean.

3.1.2 Aircraft Earth Station (AES)

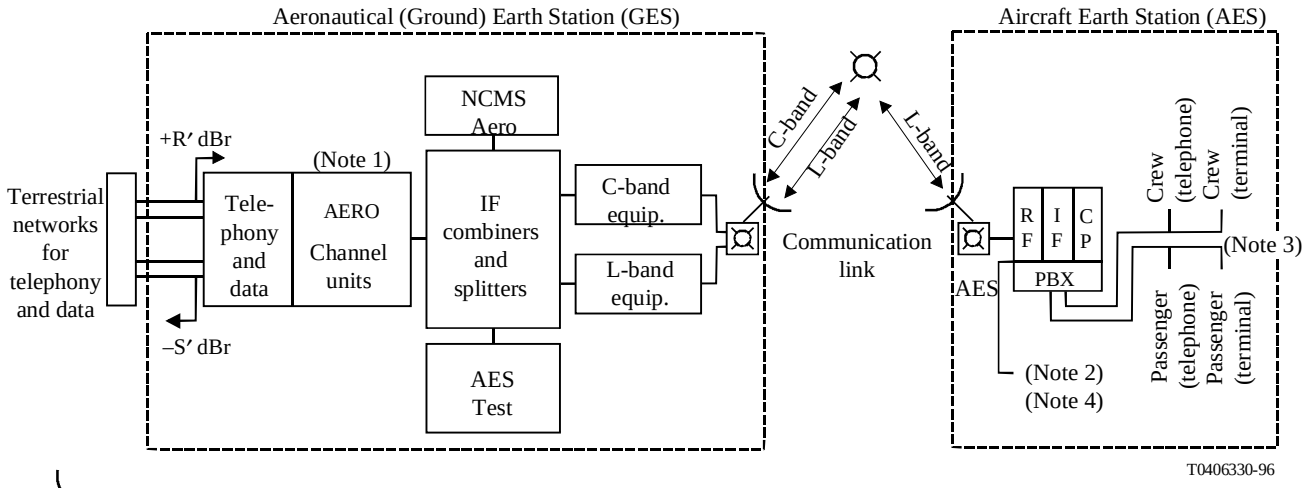
An aircraft earth station interfaces with the space segment (at L-band) for communications with aeronautical ground earth stations, for the purpose of setting up communication with the existing airborne equipment, and with crew and passenger telephone, packet and circuit mode (Recommendation V.22) data, positioning and other avionics equipment, in accordance with the relevant technical and operational requirements.

The AES may have various combinations of voice and/or data channels/circuits in typical configurations that define its class and transmission capabilities. The AES interfacing to voice and data terminations can also vary from a simple telephone to complex PBX-like arrangements for voice/circuit mode data and/or a number of packet-mode (ISO 8208) DTEs individually addressable.

3.1.3 Aeronautical Ground Earth Station (GES)

An aeronautical ground earth station interfaces with the space segment (at C-band and L-band), on the one hand, and with the fixed voice and data networks on the other hand. It operates in accordance with the relevant technical and operational requirements for communications with AESs.

Each GES contains access control and signalling equipment which controls access to the satellite communication system and also acts as a gateway, interfacing with the PSTN and PSPDN or private data network communication links. The GES forms the link between the ground fixed network subscribers and airborne users.



Earth Station

Satellite

AES Aircraft Earth Station
RF Radio Frequency (equipment)
IF Intermediate Frequency (equipment)
CP Channel Processing (equipment)
NCMS Network Channel Management System
PBX Private Branch Exchange

NOTE 1 – +R′ dBr and –S′ dBr in the aeronautical ground earth station correspond to the levels +R′ dBm and –S′ dBm using a modulation signal with the level of 0 dBm0.

NOTE 2 – +R dBr and –S dBr in the aeronautical earth station correspond to the levels of +R dBm and –S dBm using a modulation signal with a level of 0 dBm0.

NOTE 3 – See Figure 1/M.1140 [4] for 4-wire test access points.

NOTE 4 – Interface protocols for data are those given in Recommendations F.127 [6] and X.25 [7].

Figure 1/M.1160 – Configuration of an aeronautical GES and Aircraft Earth Station

3.1.4 Test Terminal (TT)

A test terminal is an aircraft earth station, installed at an aeronautical GES, used for test purposes: it can be either a real AES or special equipment simulating all AES capabilities for testing purposes.

3.1.5 Network Channel Management System (NCMS)

Each ocean region is served by a NCMS which manages circuit mode channel resources and controls access of the AES to the system. It can be independent of the GES or co-located at designated ground earth stations. A network channel management system interfaces via the space segment (at C-band) with the GESs for the purpose of managing a common pool of circuit mode satellite channels for optional frequency reuse between spot beams of the same region or between different regions. Alternatively, NCMS functions may be incorporated into all GESs of a region until a full NCMS becomes operational for that region. This becomes possible since in such cases a fixed pool of channels is permanently allocated to each GES.

3.2 Interconnection with the international public switched telephone/data network

A circuit between the International Switching Centre (ISC) and aeronautical GES is considered as equivalent to an international public switched telephone/data circuit.

X.75 links are used for interfacing with PSDN sub-networks, while X.25 links may be used for directly accessing private service providers or airline networks.

4 General maintenance principles

In an international connection which includes an Inmarsat aeronautical earth station, the aeronautical satellite system may be regarded, from a transmission point of view, as a national network. Nevertheless, it should be noted that the aeronautical satellite circuit is set up between the aeronautical ground earth station and the aircraft earth station on a demand assignment basis. Therefore, an aeronautical ground earth station in the aeronautical satellite system may not have direct or full responsibility for the maintenance of a particular aeronautical satellite circuit and a particular aircraft earth station all of the time. The operation and maintenance of the overall aeronautical satellite system is the responsibility of the aeronautical satellite system operator, e.g. Inmarsat.

The maintenance organization in each participating Administration is, in general, responsible for the maintenance of the aeronautical satellite circuit usually under the guidance and coordination of the Inmarsat Network Operations Center (NOC)[1] and/or Network Channel Management System (NCMS).

5 Lining-up and maintaining public switched telephone/data circuits

The circuit between the International Switching Centre (ISC) and the aeronautical ground earth station should be lined up and maintained in accordance with those M-Series Recommendations appropriate to international public switched telephone/data circuits.

6 Lining-up and maintaining aeronautical satellite circuits

6.1 Control, sub-control and responsibilities

6.1.1 General

The assignment of control and sub-control stations and respective responsibilities must address the configuration of the aeronautical satellite system. A control station must be assigned as regards circuits, and, in addition, sub-control stations as required for efficient maintenance.

6.1.2 Assignment of control stations

The aeronautical ground earth station is the control station for the aeronautical satellite circuit.

6.1.3 Assignment of sub-control stations

In principle, the aircraft earth station should act as the sub-control station for the aeronautical satellite circuit. However, the required staff and facilities may not be available on an aircraft to meet the circuit sub-control responsibilities.

6.1.4 Responsibilities of control and sub-control station

Control stations dealing with aeronautical satellite circuits should fulfil the responsibilities of control stations as defined in the M-Series Recommendations. The same applies to sub-control stations.

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[1] Previously called Network Control Centre (NCC).

6.2 Transmission characteristics

The transmission characteristic and maintenance parameters for GES-AES control and communication (voice and data) channels and the Bit Error Rates shall be as specified by Inmarsat aeronautical system definition and maintenance procedures for such channels.

The overall attenuation/frequency limits are shown in Table 1.

Table 1/M.1160 – Attenuation/frequency limits

Transmission parameters	Maintenance limits (dB)
Attenuation frequency relative to the attenuation at reference frequency	(Note)
300 to 400 Hz	−2.0 to +4.4
400 to 600 Hz	−1.2 to +2.6
600 to 2400 Hz	−1.2 to +1.2
2400 to 2700 Hz	−1.2 to +2.6
2700 to 3400 Hz	−1.2 to +4.4
NOTE – The 1020 Hz reference tone used for measuring the attenuation shall be set at −10 dBm0.	

6.3 Lining-up procedures

Special Line-up Procedures defined by Inmarsat for starting or restoring service need to be followed to assure:

– proper broadcast of satellite network configuration parameters to AESs in region;

– final adjustments of GES e.i.r.p. and frequency parameters under the supervision of the Inmarsat network operations centre;

– proper interworking with other GESs in region;

– that AFC pilot receivers have locked and AFC loops are established;

– proper operation of all channel types and proper functioning of basic data and voice services in both directions (Air-to-Ground and Ground-to-Air), etc.

6.4 Fault reporting procedures

Fault report points (circuit) should be identified in accordance with Recommendation M.715 [1].

Fault report points (network) should be identified in accordance with Recommendation M.716 [2]. One such point is required for the aeronautical satellite system and is assigned to the network operations centre. However, general international networking problems should in the first instance be referred to the fault report points (network) concerned. Inmarsat network or system operating procedures are applicable giving a detailed explanation of fault reporting procedures.

Exchange of contact point information should be in accordance with Recommendation M.1510 [3].

6.5 Maintenance procedures

It is desirable that routine measurements on the aeronautical satellite circuits be performed to confirm that the transmission parameter limits continue to be maintained. These maintenance procedures are important with respect to the aeronautical ground earth station transmission performance.

7 Maintenance organization for aeronautical satellite system

7.1 Maintenance organization as applicable to Inmarsat

The maintenance responsibility within the aeronautical satellite network is divided among the aircraft earth station, the ground earth station, the network channel management system, and the network operations centre.

7.1.1 Aircraft earth station maintenance responsibility

The aircraft earth station must be capable of communicating reliably with the ground earth station and may act as a sub-control station with responsibilities to the GES. As a sub-control station, it is responsible for reporting noticeable degradations in the aeronautical satellite circuits to the GES and for reporting AES-related problems to manufacturers or system integrators.

7.1.2 Ground earth station maintenance responsibility

The ground earth station provides interworking communication functions and has the overall coordination responsibility between the GES and the international public voice/data network, including the responsibility of reporting problems to the network coordination station and the network operations centre as required. It serves as a gateway between the terrestrial networks and the AESs within the coverage area of the particular satellite region. In order to perform its functions, database log-on updates are exchanged between it and the NCMS of its ocean region. As such it has significant capability of detecting and reporting failures of its own equipment.

7.1.3 Network channel management system maintenance responsibility

The network channel management system provides communication, limited monitoring, maintenance and support functions within the aeronautical satellite system.

a) Communication NCMS functions include:
   - assigning circuit mode channels to a GES as needed according to traffic load by optimizing space segment (channel) resources within spot beams of its region and between adjacent regions;
   - maintaining a list of active AESs and updating GESs of its ocean region with this information, communicating also with NCMSs of other regions for their proper global update.

b) Maintenance and monitoring functions may include:
   - assisting in performing routine system tests;
   - providing minimum capability of the GES performance monitoring in its region and corresponding alarms.

c) Other supporting functions include:
   - coordinating network actions in its ocean region in case of serious failure or GES outage;
   - providing performance reports for its region.

7.1.4 Network operations centre maintenance responsibility

The network operations centre provides administrative, operational and maintenance functions within the aeronautical satellite network.

a) Administrative functions include:
   - acting as the fault report point (network);

– preparing controlling and disseminating system information;
– providing a focal point for aircraft (or their agents, etc.), Administrations or service providers.

b) Routine and normal operational functions include:
– liaising with the various space segment suppliers;
– monitoring, identifying and clearing of unauthorized transmissions;
– scheduling and coordinating the bringing-into-service of GESs and network channel management system;
– carrying out monitoring of transmission parameters and collecting call-record data for statistic, charging and fault analysis;
– analysing traffic and performance data provided by network coordination stations and GESs.

c) Emergency and/or corrective (maintenance) actions, in case of:
– space segment failures;
– extended channel management system failures;
– failures or outages of individual GESs;
– incorrect operation of AESs;
– interference in the network of any kind.

7.2 Cooperation between the general maintenance organization (Recommendation M.710 [5]) and the aeronautical satellite maintenance organization

Figure 2 illustrates the interrelationship between the general maintenance organization and the aeronautical satellite maintenance organization (Inmarsat).

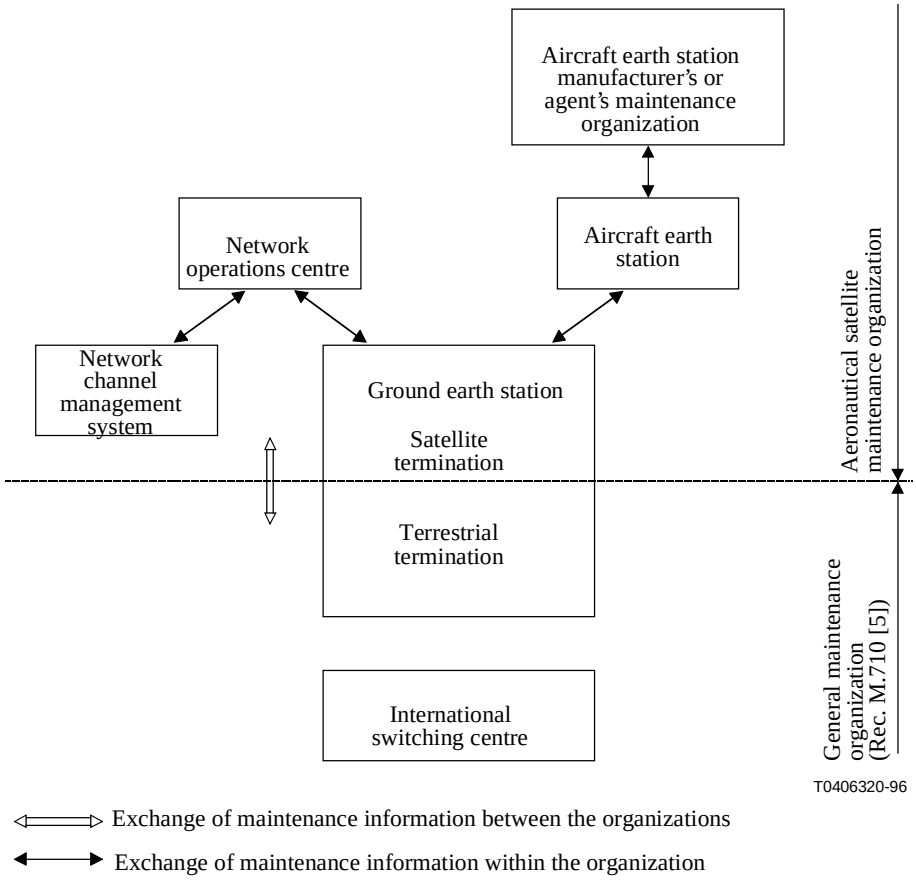

Figure 2/M.1160 – Interrelationship between the general maintenance organization (Recommendation M.710 [5] and the aeronautical satellite maintenance organization (Inmarsat)

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