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SERIES E: TELEPHONE NETWORK AND ISDN

Quality of service, network management and traffic
engineering – Traffic engineering – Mobile network traffic
engineering

**Reference connections for traffic engineering of
maritime and aeronautical systems**

ITU-T Recommendation E.752

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION E.752

REFERENCE CONNECTIONS FOR TRAFFIC ENGINEERING OF MARITIME AND AERONAUTICAL SYSTEMS

Summary

This Recommendation provides a reference architecture for existing maritime and aeronautical systems and also provides high-level reference connections for maritime and aeronautical call/connection set-up. The primary purpose of the reference connections for maritime and aeronautical systems is to provide a basis for developing related-traffic Grade of Service (GOS) Recommendations. The underlying call flow model in the reference connections should be used as a basis for more implementation-specific configurations for detailed performance analysis and GOS target setting.

This Recommendation is initially focused on satellite based systems and circuit-switched user plane traffic.

Source

ITU-T Recommendation E.752 was prepared by ITU-T Study Group 2 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 8th of October 1996.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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 (Helsinki, March 1-12, 1993).

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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Recommendation E.752

REFERENCE CONNECTIONS FOR TRAFFIC ENGINEERING OF MARITIME AND AERONAUTICAL SYSTEMS

(Geneva, 1996)

1 Objective and scope

Users of mobile systems may be classified as: land, maritime and aeronautical depending on whether they move in land, sea or free space. Mobile users are connected to the fixed network through terrestrial or satellite based transport infrastructure.

This Recommendation provides a reference architecture for existing maritime and aeronautical systems and also provides high-level reference connections for maritime and aeronautical call/connection set-up. Reference connections for land mobile networks are covered in Recommendation E.751. The primary purpose of the reference connections for maritime and aeronautical systems is to provide a basis for developing related-traffic Grade of Service (GOS) Recommendations. The underlying call flow model in the reference connections should be used as a basis for more implementation-specific configurations for detailed performance analysis and GOS target setting (Recommendation E.774).

Service to users of maritime and aeronautical systems is provided by:

- signalling and interfacing function;
- switching; and
- terrestrial or satellite transmission, linking the maritime and aeronautical mobile users with the PSTN and PSDN network in the fixed domain.

The elements which constitute the terrestrial part of the maritime/aeronautical domain, before interfacing with the fixed domain, may be owned and operated by one or more system operators. Similarly, mobile services may be provided by one or more service providers.

This Recommendation is initially focused on satellite-based maritime and aeronautical systems. Terrestrial based systems are for further study.

Mobile services in terrestrial and satellite-based systems can be circuit- or packet-switched. This Recommendation is initially concerned with circuit-switched, normal (as opposed to distress and safety) traffic in the user plane. Packet-switched traffic is for further study.

Table 1 shows the current scope of this Recommendation.

TABLE 1/E.752
Scope of Recommendation E.752

Maritime systems				Aeronautical systems			
Terrestrial based		Satellite based		Terrestrial based		Satellite based	
Circuit switching	Packet switching	Circuit switching	Packet switching	Circuit switching	Packet switching	Circuit switching	Packet switching
Speech, fax, dial-up data	Data	Speech, fax, dial-up data	Data, telex	Speech, fax, dial-up data	Data	Speech, fax, dial-up data	Data
ffs	ffs	Rec. E.752	ffs	ffs	ffs	Rec. E.752	ffs
ffs: for further study							

2 Related Recommendations

The following Recommendations contain material that is either relevant to or provides background for this Recommendation:

- ITU-T Recommendation E.751 (1996), *Reference connections for traffic engineering of land mobile networks*.
- ITU-T Recommendation E.770 (1993), *Land mobile and fixed network interconnection traffic grade of service concept*.
- ITU-T Recommendation E.773 (1996), *Maritime and aeronautical mobile grade of service concept*.
- ITU-T Recommendation E.774 (1996), *Network grade of service parameters and target values for maritime and aeronautical mobile services*.
- ITU-T Recommendation F.110 (1996), *Operational provision for the maritime mobile service*.

3 Definitions

For the purposes of this Recommendation, the following definitions are used.

3.1 terrestrial-based mobile network: Provides connection between maritime/aeronautical mobile users and the Land Earth Station through HF or VHF links.

3.2 satellite-based mobile network: Provides connection between maritime/aeronautical mobile users and the Land Earth Station through satellite links.

3.3 mobile user subsystem: Provides for connection and interworking as may be necessary between mobile user terminal equipment and the Terrestrial/Satellite subsystem.

3.4 terrestrial/satellite subsystem (TSS): Provides the link between Ship Earth Station (SES) or Aircraft Earth Station (AES) for Maritime/Aeronautical User Subsystem and the Ground Subsystem (GSS). It consists of a common pool of channels for Terrestrial/Satellite links.

3.5 ground subsystem (GSS): Provides the connection between the Terrestrial/Satellite Subsystem (TSS) and the fixed network. The Ground Subsystem consists of:

- i) the channel units at the Land Earth Station (LES) or Ground Earth Station (GES) in the case of maritime or aeronautical system, respectively;
- ii) the Access Control Switching Equipment (ACSE) and database functions relating to traffic measurements and user service access arrangement;
- iii) the links between LES/GES and the fixed network with at least one-to-one connectivity.

3.6 land earth station (LES): An earth station located within a specified area on land to provide a feeder link for maritime service.

3.7 ground earth station (GES): A station located within a specified area on land to provide a feeder link for aeronautical service (for satellite-based systems).

3.8 ground station (GS): A station located within a specified area on land to provide a feeder link for aeronautical service (for terrestrial-based systems).

3.9 access control switching equipment (ACSE): All the switching and database functions to the Ground subsystem.

3.10 network coordination station (NCS): In the case of maritime systems, performs the following functions:

- i) maintains the common frequency pool;
- ii) allocates voice circuits on demand between LES and SES;
- iii) announces calls to SESs for shore to ship calls;
- iv) maintains the ship busy list in each ocean region.

3.11 ocean region: The area in the footprint of a satellite. In the case of maritime services, an ocean region is served by one NCS.

4 Abbreviations

For the purposes of this Recommendation, the following abbreviations are used.

ACSE	Access Control Switching Equipment
AES	Aircraft Earth Station (aeronautical user)
DIU	Data Interface Unit
GES	Ground Earth Station
GOS	Grade of Service
GS	Ground Station
GSS	Ground Subsystem
HF	High Frequency
ISDN	Integrated Services Digital Network
ISL	Interstation Link
LES	Land Earth Station
NCMS	Network Channel Management System
NCS	Network Coordination Station
PSDN	Public Switched Data Network
PSTN	Public Switched Telephone Network
SES	Ship Earth Station (maritime user)
TE	Terminal Equipment
TSS	Terrestrial/Satellite Subsystem
VHF	Very High Frequency

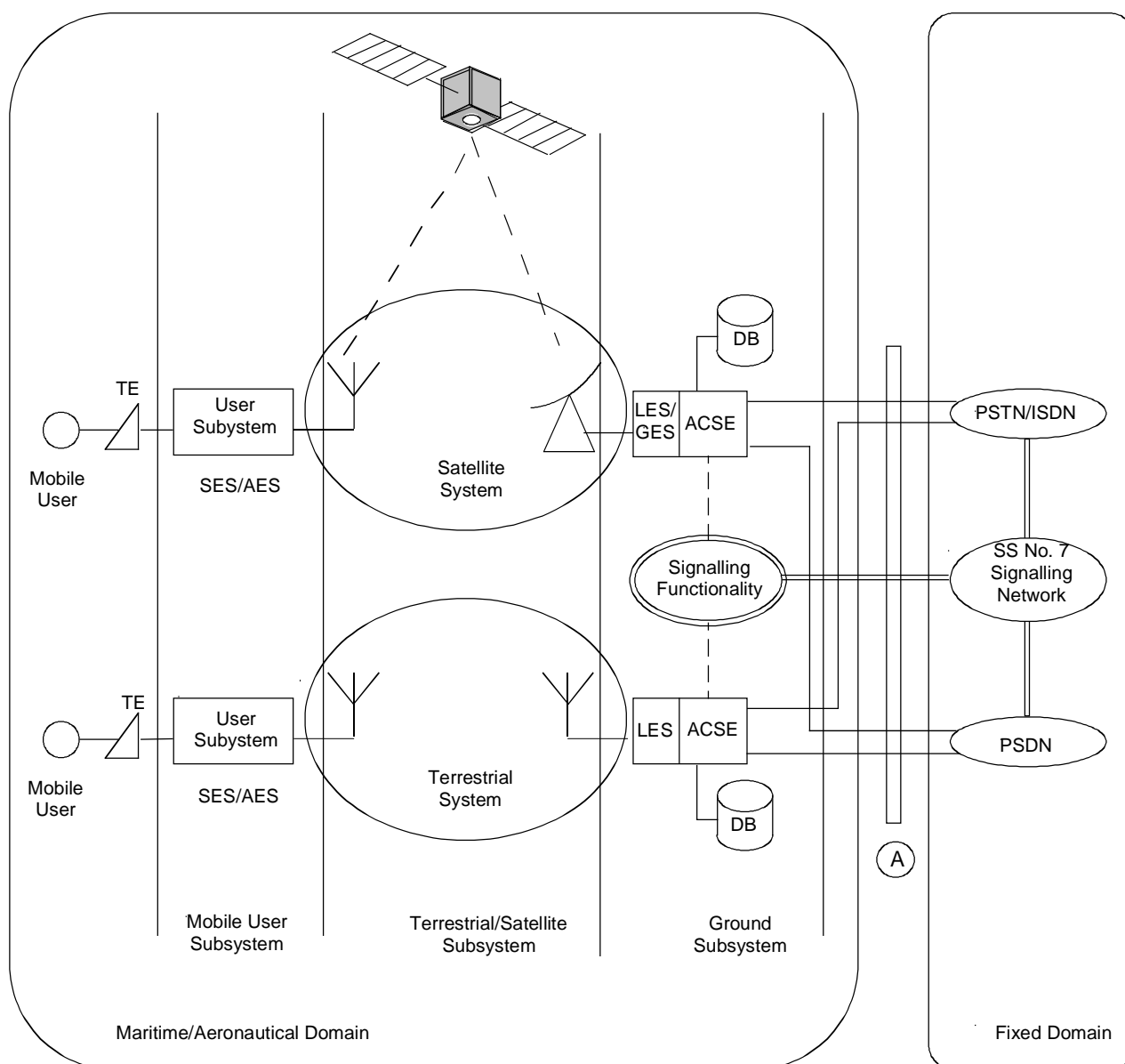
5 Satellite-based systems

5.1 Reference architecture

5.1.1 Reference architecture for interconnection of Maritime/Aeronautical Domain and the Fixed Domain

This subclause provides some examples of the reference architectures for interconnecting the maritime/aeronautical networks with the fixed network.

A reference architecture for maritime/aeronautical circuit-switched service is given in Figure 1. This reference architecture considers interaction between functions in the Maritime/Aeronautical Domain and the Fixed Domain. The Maritime/Aeronautical Domain may be terrestrial or satellite-based. This architecture covers existing systems such as Inmarsat-A, -M, and -B (in the case of maritime service) and Inmarsat-Aero. With this architecture traffic engineering is concerned, i.e., with the traffic flows (in the user as well as the control plane) across the teletraffic interface between maritime/aeronautical and fixed network domain.



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- - - - Logical relationship

———— User plane traffic

===== Control plane traffic

LES	Land Earth Station	ACSE	Access Control Switching Equipment
SES	Ship Earth Station (maritime user)	AES	Aircraft Earth Station (aeronautical user)
GES	Ground Earth Station	GS	Ground Station
DB	DataBase		
A	Teletraffic interface between maritime/aeronautical and fixed network domain		

NOTES

- 1 Fixed domain shows networks examples.
- 2 Users could be a SES/AES.
- 3 User subsystem contains voice codec/data interface circuit/fax interface circuit.
- 4 ACSE may be complemented with database functionality for location registration, authentication and call data record.
- 5 In the case of maritime systems, the network coordination station is not shown.
- 6 All LESs maintain in the databases the service profile of all the maritime users.

FIGURE 1/E.752

Reference architecture for maritime/aeronautical circuit-switched services (voice, fax and data)

5.2 Types of connections

The possible types of connections between land, maritime and aeronautical users are indicated in Table 2.

TABLE 2/E.752

Possible connection types between land, maritime and aeronautical users

	Terminating User		
	Land	Maritime	Aeronautical
Originating User			
Land	Rec. E.751, (Note)	Rec. E.752	Rec. E.752
Maritime	Rec. E.752	Rec. E.752	NA
Aeronautical	Rec. E.752	NA	NA
NA Not Applicable			
NOTE – Land users may be fixed or mobile. The reference connections for the case in which the originating and the terminating users are land users and at least one user is mobile are defined in Recommendation E.751.			

Different network segments are involved in the connection path for the connection types of Table 2. Since land, maritime and aeronautical users may be associated with terrestrial or satellite-based networks, the possible combinations of originating and terminating networks results directly from Table 2.

5.3 Reference connections

Reference connections are aimed at identifying representative cases without involving the specifics of actual realizations. (For example, databases associated with location registers or calling card validation systems should be considered – as far as practicable – at the functional level, without considering the specifics of actual partitioning and distribution.)

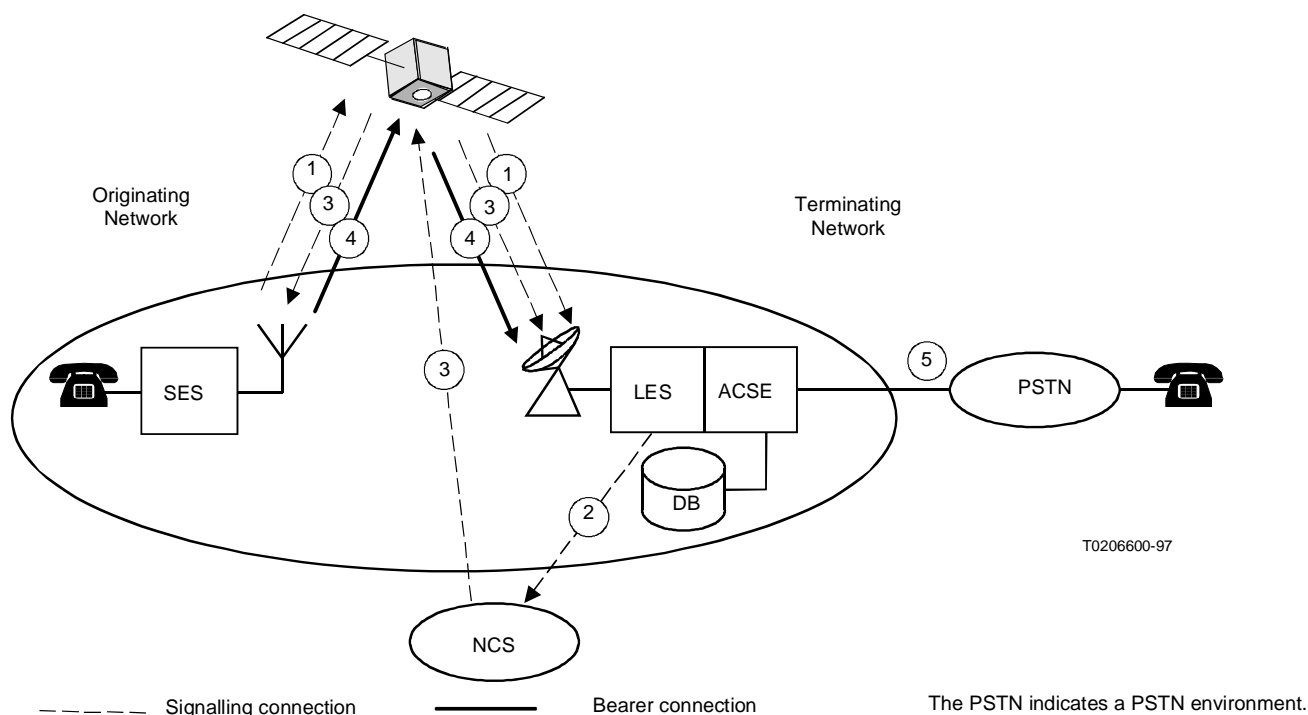
5.3.1 Reference connection for maritime user to land user

5.3.1.1 Reference connection for maritime user originated call to fixed user

The reference connection of Figure 2 is included to represent a nearly worst case configuration with respect to the performance of database access and call set-up for a voice call originated by a maritime user (SES) to a fixed user in the PSTN.

The following assumptions are implicit:

- LES maintain in the database the service profiles of all the maritime users;
- Full SS No. 7 compatibility in the landline network is assumed;
- Signalling from/to SES is via the satellite, whereas signalling between LES and NCS can be via the satellite or the terrestrial network;
- Connection between the LES and the PSTNs is via the terrestrial network.



NOTES

- 1) Access requested for channel from MES.
- 2) Request for channel assignment from LES.
- 3) Voice channel assigned by NCS.
- 4) Satellite link established between SES and LES and called number dialled.
- 5) Connection switched through to the PSTN.

FIGURE 2/E.752

Reference connection for maritime user originated call to fixed user

5.3.1.2 Reference connection for maritime user originated call to land mobile user

For further study.

5.3.2 Reference connection for maritime user to maritime user

The reference connection of Figure 3 is included to represent a nearly worst case configuration with respect to the performance of database access and call set-up for a voice call originated by a maritime user (SES-A) via an LES located in country A to a maritime user (SES-B) via an LES located in country B. The two LESs are in different ocean region.

The following assumptions are implicit:

- i) LESs maintain in the databases the service profiles of all the maritime users (the physical architecture of the database is not considered);
- ii) Full SS No. 7 compatibility in the landline network is assumed;
- iii) Signalling from/to SES is via the satellite, whereas signalling between LES and NCS can be via the satellite or the terrestrial network;
- iv) Connection between PSTNs is via the terrestrial network.

5.3.3 Reference connection for aeronautical user to land user

5.3.3.1 Reference connection for aeronautical user originated call to fixed user

The reference connection of Figure 4 is included to represent a nearly worst case configuration with respect to the performance of database access and call set-up for a voice call originated by an aeronautical user (AES) to a PSTN user.

The following assumptions are implicit:

- i) AES is logged-on to GES-X;
- ii) The aeronautical user selects the routing of his call via GES-Y, a separate GES in the same ocean region as GES-X;
- iii) Both GESs maintain the service profiles of the AES in their databases;
- iv) Full SS No. 7 compatibility in the landline network is assumed;
- v) The voice channel requested by the AES is allocated by GES-Y from its own carrier pool;
- vi) GES-Y forwards the assignment details to GES-X via the inter-GES link which in turn signals the AES via the satellite;
- vii) Signalling from/to AES is via satellite, whereas signalling between GESs can be via the satellite or terrestrial network.

5.3.3.2 Reference connection for aeronautical user originated call to land mobile user

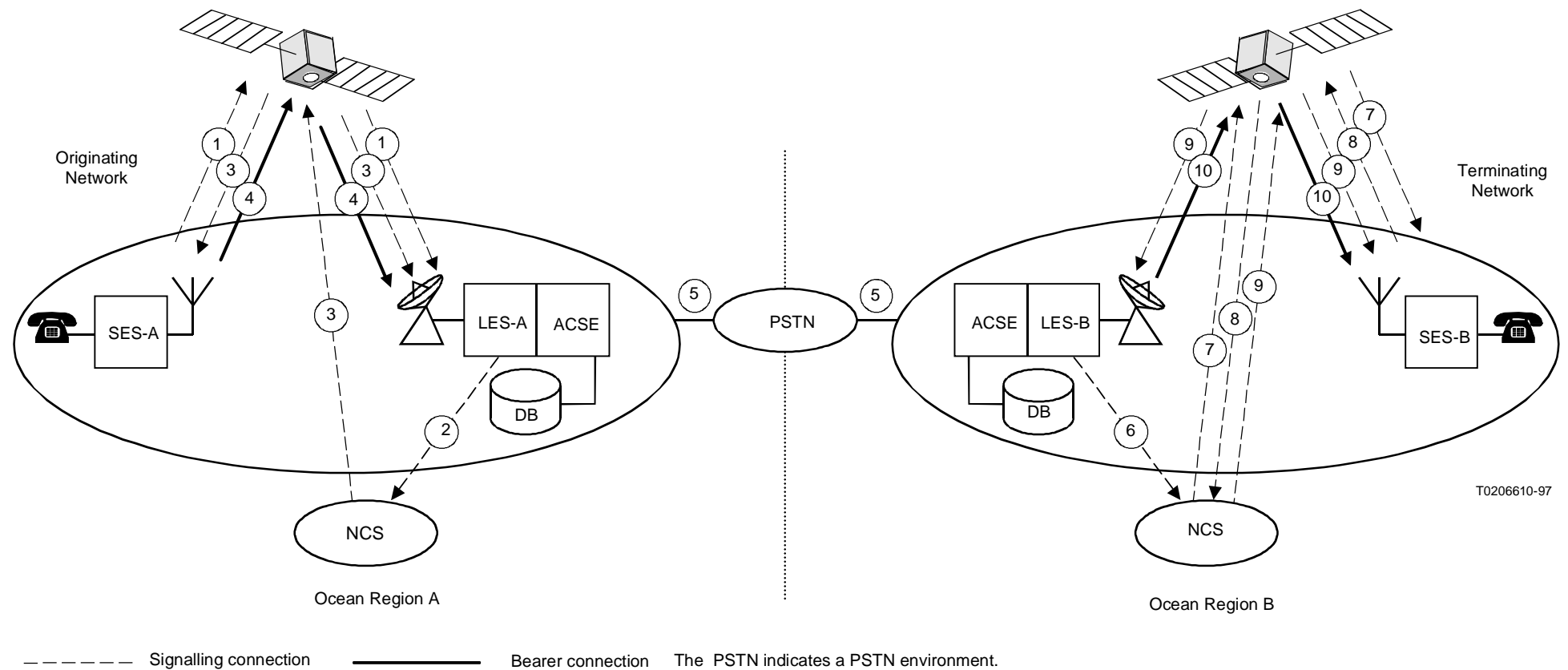
For further study.

6 Terrestrial based systems

For further study.

7 History

This is the first issue of Recommendation E.752

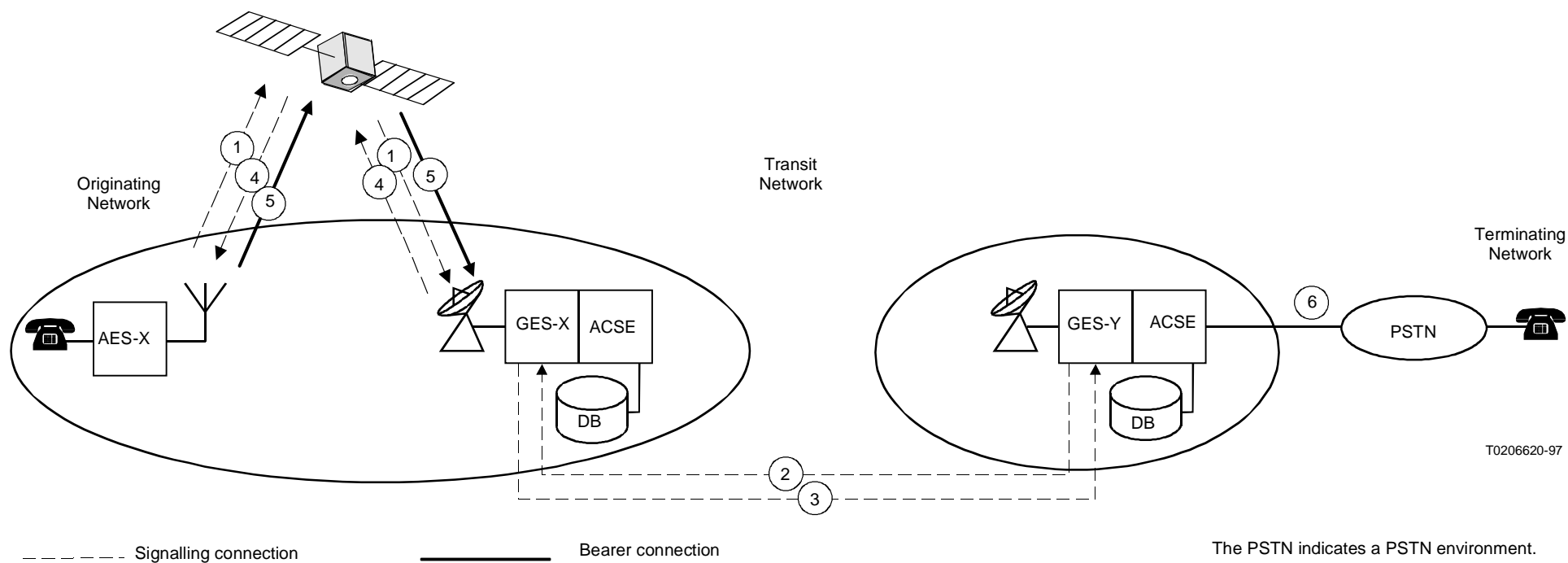


NOTES

- 1) Access request for channel from SES-A to LES-A in ocean region A.
- 2) Request for channel assignment from LES-A.
- 3) Voice channel assigned by NCS-A.
- 4) Satellite link established between SES-A and LES-A.
- 5) Connection switched through to LES-B in ocean region B via the PSTN and the call number dialed.
- 6) LES-B requests NCS-B for call announcement and channel assignment.
- 7) NCS-B announces call to SES-B.
- 8) SES-B responds.
- 9) NCS-B assigns a voice channel.
- 10) Satellite link established between LES-B and SES-B.

FIGURE 3/E.752

Reference connection for maritime user to maritime user in different ocean regions



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NOTES

- 1) AES requests a voice demand from GES-Y via GES-X.
- 2) GES-X relays the request to GES-Y via the inter-GES signalling links.
- 3) GES-Y notifies GES-X of channel allocation.
- 4) GES-X notifies AES of channel assignment.
- 5) Satellite link established between AES and other GES-Y and called number dialed.
- 6) Connection switched through to the PSTN.

FIGURE 4/E.752

Reference connection for aeronautical user originated call to fixed user

Appendix I

Example implementations (Inmarsat systems)

I.1 General

The purpose of this Appendix is to provide architecture implementations of the following satellite based Inmarsat systems for circuit-switched services related to voice, fax and data traffic:

- Inmarsat-A.
- Inmarsat-Aero.
- Inmarsat-M.
- Inmarsat-B.

Separate reference architecture for each Inmarsat system are provided in I.3.1 to I.3.4.

I.2 Abbreviations

ACSE	Access Control Signalling Equipment
AES	Aircraft Earth Station
BDE	Below Deck Equipment
CCS	Cabin Communication Subsystem
DCE	Data Circuit-terminating Equipment
DIU	Data Interface Unit
DT	Data Terminal
DTE	Data Terminal Equipment
FIU	FAX Interface Unit
GES	Ground Earth Station
ISC	International Switching Centre
ITSC	International Telephone Switching Centre
LES	Land Earth Station
MES	Mobile Earth Station
MSSC	Mobile Satellite Switching Centre
NCMS	Network Channel Management System
NCS	Network Coordination Station
PSDN	Public Switched Data Network
PSTN	Public Switched Telephone Network
RFU	Radio Frequency Unit
SES	Ship Earth Station
TIFU	Terminal Interface Function Unit

I.3 Architecture

I.3.1 Architecture for intercommunication between Maritime Inmarsat-A system and fixed domain

The reference architecture for Inmarsat-A system is given in Figure I.1. One Network Coordination Station (NCS) is provided per ocean region. NCSs are in all cases co-located with the Land Earth Station (LES). NCSs are not included in the reference architecture. The system also has access to the Public Switched Telex network.

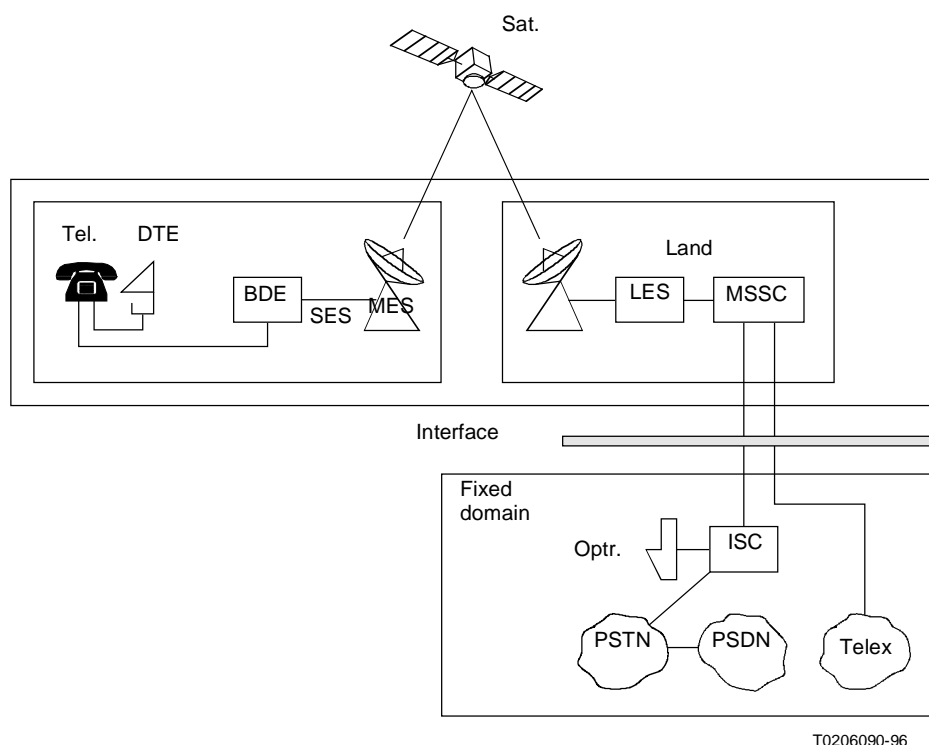


FIGURE I.1/E.752

Architecture for intercommunication between maritime Inmarsat-A system and fixed domain

I.3.2 Architecture for intercommunication between Inmarsat Aeronautical System Aircraft Earth Stations (Inmarsat-Aero) and fixed domain

The reference architecture for Inmarsat Aeronautical system is given in Figure I.2. At present the system is functioning without Network Coordination Stations. Network Channel Management System (NCMS) which would assign voice channels to the GES carrier pools on *a priori* basis is scheduled for introduction in 1998. The system also provides packet mode data services which provide connection to the Aeronautical Packet Network.

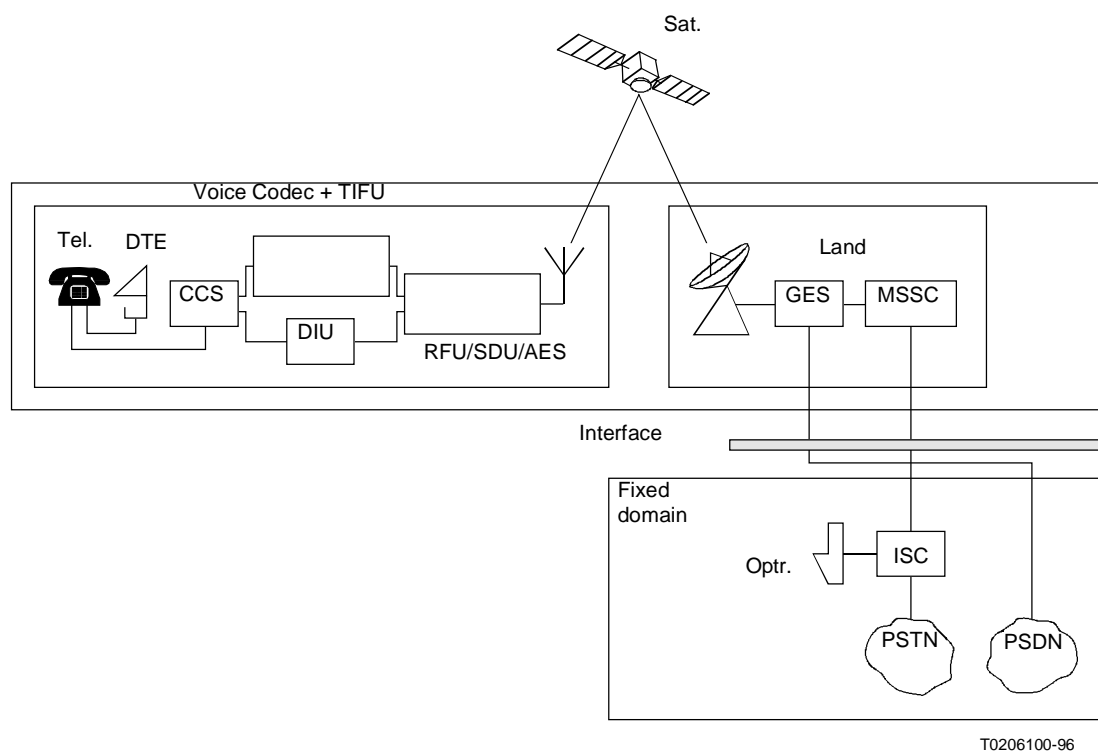


FIGURE I.2/E.752

**Architecture for intercommunication between Inmarsat aeronautical system
aircraft earth stations (Inmarsat-Aero) and fixed domain**

I.3.3 Architecture for intercommunication between Maritime Inmarsat-M system and fixed domain

The reference architecture for Inmarsat-M system is given in Figure I.3. One Network Coordination Station (NCS) is provided per ocean region. NCSs are in all cases co-located with the Land Earth Stations (LESs). NCSs are not included in the reference architecture. NCSs are interconnected via terrestrial links. The system has no access to the Public Switched Telex network.

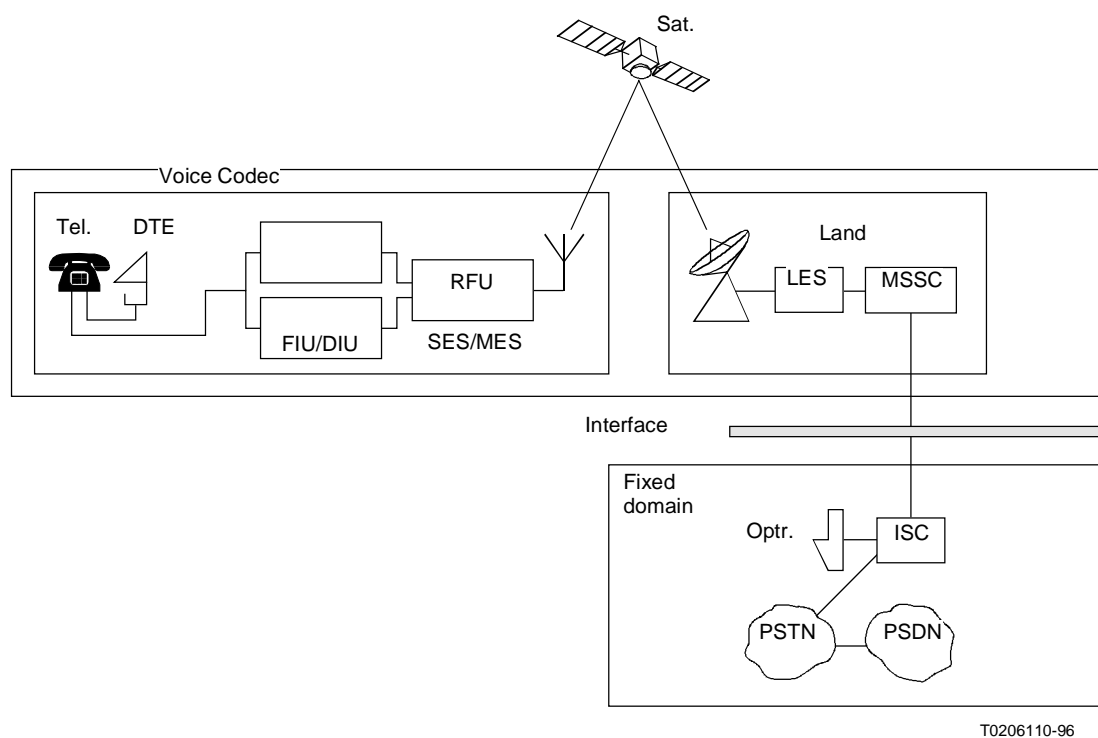


FIGURE I.3/E.752

Architecture for intercommunication between maritime Inmarsat-M system and fixed domain

I.3.4 Architecture for intercommunication between maritime Inmarsat-B system and fixed domain

The reference architecture for Inmarsat-B system is given in Figure I.4. One Network Coordination Station (NCS) is provided per ocean region. The NCSs are in all cases co-located with the land Earth Stations (LESs). NCSs are not shown in the reference architecture. The system also has access to the Public Switched Telex network.

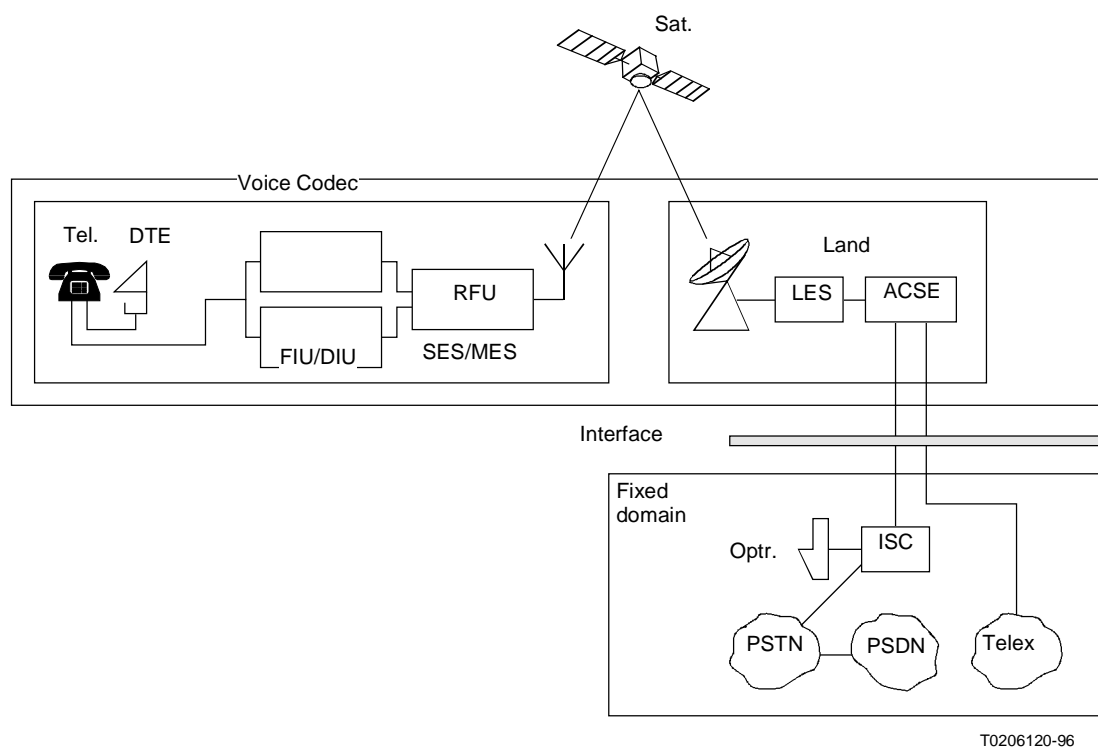


FIGURE I.4/E.752

Architecture for intercommunication between maritime Inmarsat-B system and fixed domain

I.4 Remarks

Reference architecture diagrams for the satellite based Inmarsat systems for circuit-switched services are based on the current elements which constitute the network. Any subsequent changes in the network may result in amendments to these architectures. The systems serve aeronautical, maritime and land mobile earth stations and this needs to be reflected in the text of the Recommendations and suitable terminology should be used in this Recommendation to cover the maritime, aeronautical and land mobile users of the systems.

It should be noted that packet switched store-and-forward Inmarsat-C system and the packet mode data services in the Inmarsat-Aero system are not included in the examples of Inmarsat systems.

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