



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

M.1300

(10/97)

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

International data transmission systems

**Maintenance of international data transmission
systems operating in the range 2.4 kbit/s to
140 Mbit/s**

ITU-T Recommendation M.1300

(Previously CCITT Recommendation)

ITU-T M-SERIES RECOMMENDATIONS

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

Introduction and general principles of maintenance and maintenance organization	M.10–M.299
International transmission systems	M.300–M.559
International telephone circuits	M.560–M.759
Common channel signalling systems	M.760–M.799
International telegraph systems and phototelegraph transmission	M.800–M.899
International leased group and supergroup links	M.900–M.999
International leased circuits	M.1000–M.1099
Mobile telecommunication systems and services	M.1100–M.1199
International public telephone network	M.1200–M.1299
International data transmission systems	M.1300–M.1399
Designations and information exchange	M.1400–M.1999
International transport network	M.2000–M.2999
Telecommunications management network	M.3000–M.3599
Integrated services digital networks	M.3600–M.3999
Common channel signalling systems	M.4000–M.4999

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION M.1300

MAINTENANCE OF INTERNATIONAL DATA TRANSMISSION SYSTEMS OPERATING IN THE RANGE 2.4 kbit/s TO 140 Mbit/s

Summary

This Recommendation provides a general description of international data transmission systems with a PDH presentation to the renter and of the basic requirements for their effective operation.

Source

ITU-T Recommendation M.1300 was revised by ITU-T Study Group 4 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 24th of October 1997.

Keywords

International data transmission links, international data transmission systems, international leased circuits.

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.

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.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 1998

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

	Page
1 Scope	1
2 References	1
3 Terminology and definitions	2
4 Abbreviations	2
5 Operational procedures.....	3
6 Performance limits	3
7 General description of international data transmission systems.....	3
8 General description of international data transmission links	9
9 Timing sources	11
10 Control and sub-control stations	11
11 Reserve arrangements.....	11
12 Designations	11

Recommendation M.1300

MAINTENANCE OF INTERNATIONAL DATA TRANSMISSION SYSTEMS OPERATING IN THE RANGE 2.4 kbit/s TO 140 Mbit/s

(Published 1984; revised 1988, 1992 and 1997)

1 Scope

This Recommendation defines international data transmission systems with a PDH presentation to the renter. The international data transmission system is transported via an international data transmission link, which may typically be provided on a variety of transmission media using a number of network technologies.

2 References

The following ITU-T Recommendations 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 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 listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- [1] CCITT Recommendation G.703 (1991), *Physical/electrical characteristics of hierarchical digital interfaces.*
- [2] ITU-T Recommendation G.704 (1995), *Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels.*
- [3] CCITT Recommendation G.732 (1988), *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s.*
- [4] ITU-T Recommendation G.736 (1993), *Characteristics of a synchronous digital multiplex equipment operating at 2048 kbit/s.*
- [5] CCITT Recommendation G.751 (1988), *Digital Multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 624 kbit/s and using positive justification.*
- [6] CCITT Recommendation G.752 (1980), *Characteristics of digital multiplex equipments based on a second order bit rate of 6312 kbit/s and using positive justification.*
- [7] ITU-T Recommendation G.803 (1997), *Architectures of transport networks based on the Synchronous Digital Hierarchy (SDH).*
- [8] ITU-T Recommendation G.811 (1997), *Timing characteristics of primary reference clocks.*
- [9] ITU-T Recommendation M.60 (1993), *Maintenance terminology and definitions.*
- [10] CCITT Recommendation M.1012 (1988), *Circuit control station for leased and special circuits.*
- [11] CCITT Recommendation M.1013 (1988), *Sub-control station for leased and special circuits.*

- [12] ITU-T Recommendation M.1340 (1996), *Performance allocations and limits for international data transmission links and systems.*
- [13] ITU-T Recommendation M.1370 (1993), *Bringing-into-service of international data transmission systems.*
- [14] ITU-T Recommendation M.1375 (1996), *Maintenance of international data transmission system.*
- [15] ITU-T Recommendation M.1380 (1997), *Bringing-into-service of international leased circuits that are supported by international data transmission systems.*
- [16] ITU-T Recommendation M.1385 (1993), *Maintenance of international leased circuits that are supported by international data transmission systems.*
- [17] ITU-T Recommendation M.1400 (1997), *Designations for international networks.*
- [18] ITU-T Recommendation V.11 (1996), *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s.*
- [19] ITU-T Recommendation V.24 (1996), *List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE).*
- [20] ITU-T Recommendation V.28 (1993), *Electrical characteristics for unbalanced double-current interchange circuits.*
- [21] CCITT Recommendation X.21 (1992), *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks.*
- [22] CCITT Recommendation X.50 (1988), *Fundamental parameters of a multiplexing scheme for the international interface between synchronous data networks.*

3 Terminology and definitions

Terminologies and definitions relating to this Recommendation are provided in Recommendation M.60 [9].

A data transmission system is a component of a digital transmission network, and is primarily used to support international leased circuits. These circuits can be used for a variety of services, including voice, data, video, etc.

4 Abbreviations

This Recommendation uses the following abbreviations.

DNI	Digital Network Interface
FDM	Frequency Division Multiplexing
LTP	Link Terminating Point
MUX	Multiplexing Equipment
PDH	Plesiochronous Digital Hierarchy
RP	Renter's Premises
TDM	Time Division Multiplexing
TIC	Terminal International Centre

5 Operational procedures

Recommendation M.1370 [13] covers the setting up and bringing-into-service of international data transmission systems. Maintenance issues are covered by Recommendation M.1375 [14].

The bringing-into-service and maintenance issues relating to international leased circuits with a digital presentation at renters' premises that are supported by international data transmission systems are covered by Recommendations M.1380 [15] and M.1385 [16], respectively.

6 Performance limits

Performance limits applicable to international data transmission systems and links are provided in Recommendation M.1340 [12].

7 General description of international data transmission systems

An international data transmission system is comprised of an international data transmission link combined with multiplexing equipment¹ at each end and is primarily used for the point-to-point transmission of international leased circuits (see Figure 1). Typical data rates of interest are: 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 48, 56, 64, $N \times 64$ ($N = 2$ to 31), 1544, and 2048 kbit/s, 6, 8, 34, 45 and 140 Mbit/s. A system may be carried as a channel on a higher order system (see Figure 2a).

The international data transmission link that supports the aggregate transmission from the terminal multiplexing equipment of the international data transmission system will be presented via a digital interface that is referred to as the Link Terminating Point (LTP). Where an international data transmission link incorporates an analogue transmission path, the associated modems required to derive the digital interface are considered to be part of the link².

In general, an international data transmission link can be divided into sectional components. The international link section is considered to exist between Terminal International Centres (TICs) and the national link section is considered to exist between a TIC and LTP, where the LTP could be located at numerous points, including Terminal National Centres (TNCs) or renters' premises³. Several typical configurations of an international data transmission system are shown in Figure 3. It should be noted that where an LTP exists at a TIC, no national link section will exist.

Exceptionally, an international data transmission system may not be routed via any Network Operator's/Service Provider's premises. Figure 3 d) shows an international data transmission system routed directly between renters' premises, e.g. via satellite.

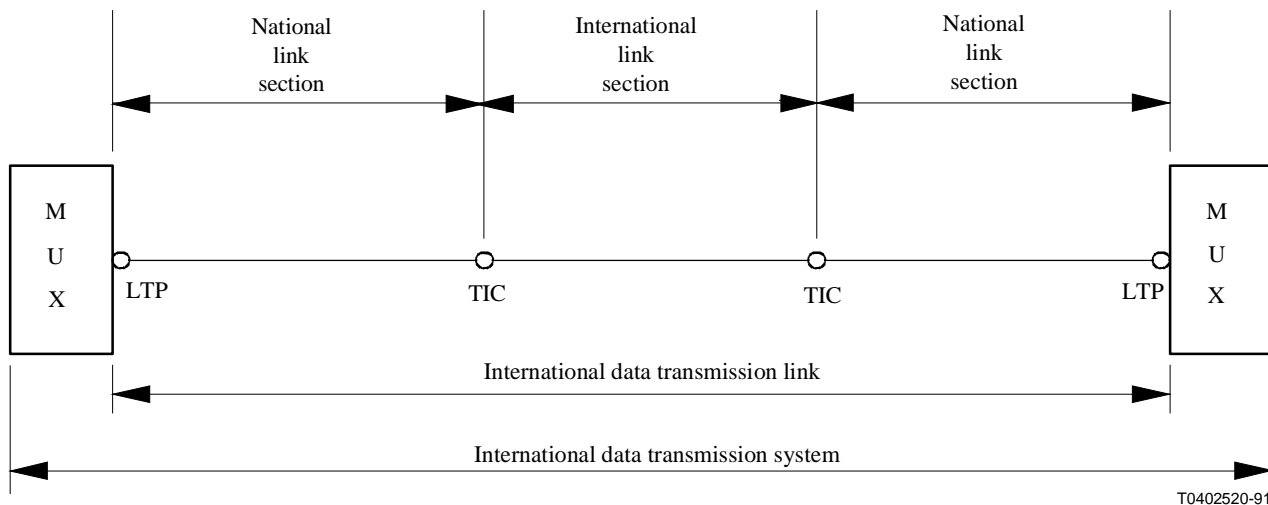
An international data transmission system can support circuits with either analogue or digital presentations at the renter's premises. Typical uses include data, facsimile, voice, etc. (see Figure 4).

¹ The term multiplexing equipment, as defined in Recommendation M.60 [9], includes digital cross-connect equipment.

² Certain terminal equipment incorporates modem and multiplex functions and there may consequently be no physical LTP at which testing is possible. A similar situation can exist where a channel card in a primary multiplex equipment operates as a lower order multiplexing equipment in its own right (e.g. in accordance with Recommendation X.50 [22]). Where a physical LTP does not exist, Network Operators/Service Providers should bilaterally develop alternative testing arrangements.

³ The renter's premises is a geographical location which is outside the Administration's domain.

For data transmission systems operating within an aggregate data rate, it is recommended that the multiplexing equipment used should conform to Table 1. Alternative frame structures may be used by bilateral agreement.



NOTE – Where an LTP is located at a TIC, there will be no national link section at that end of the international data transmission link.

Figure 1/M.1300 – An international data transmission system

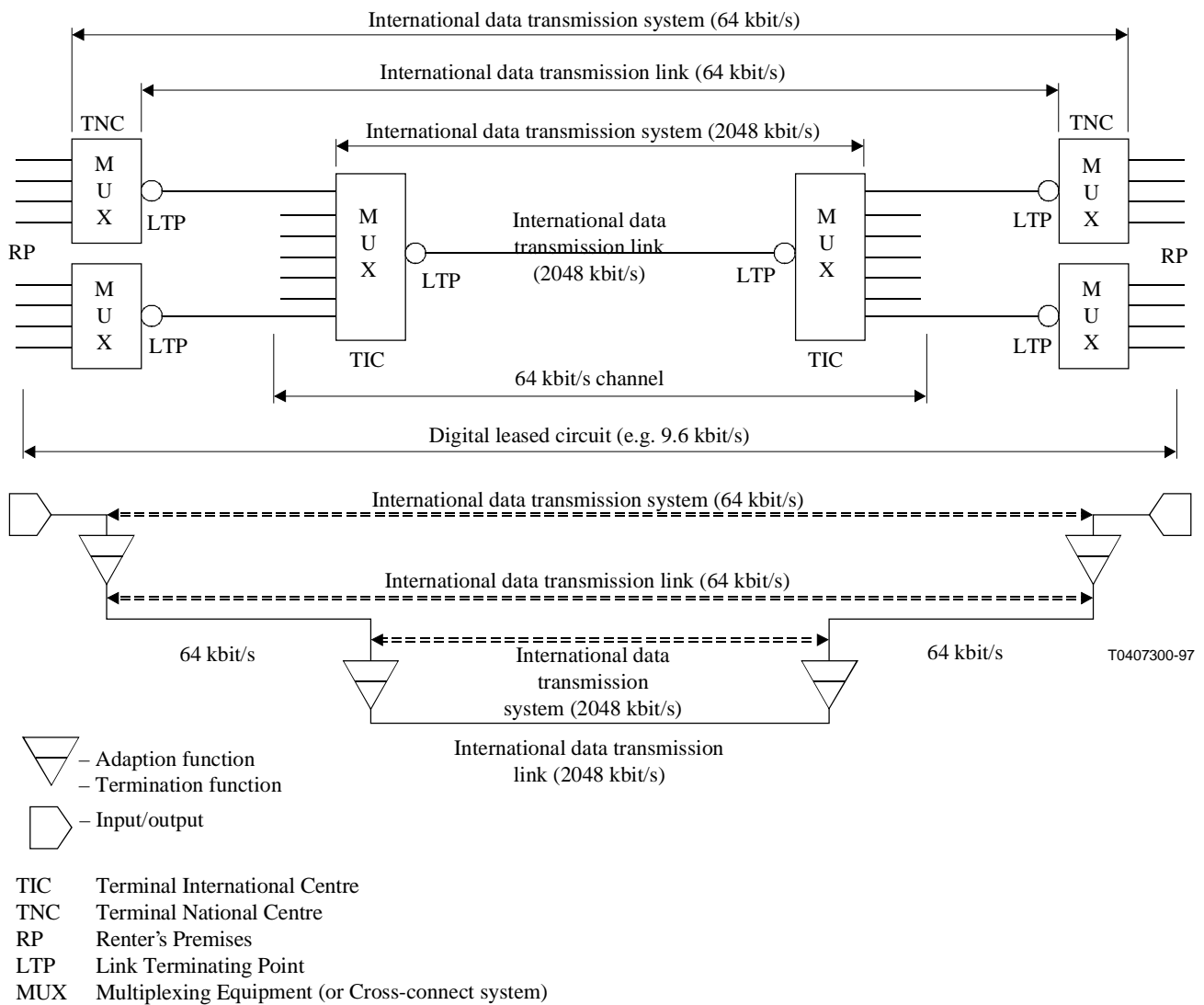


Figure 2a/M.1300 – A typical international data transmission system carried on a higher order system, comprising Multiplex equipment

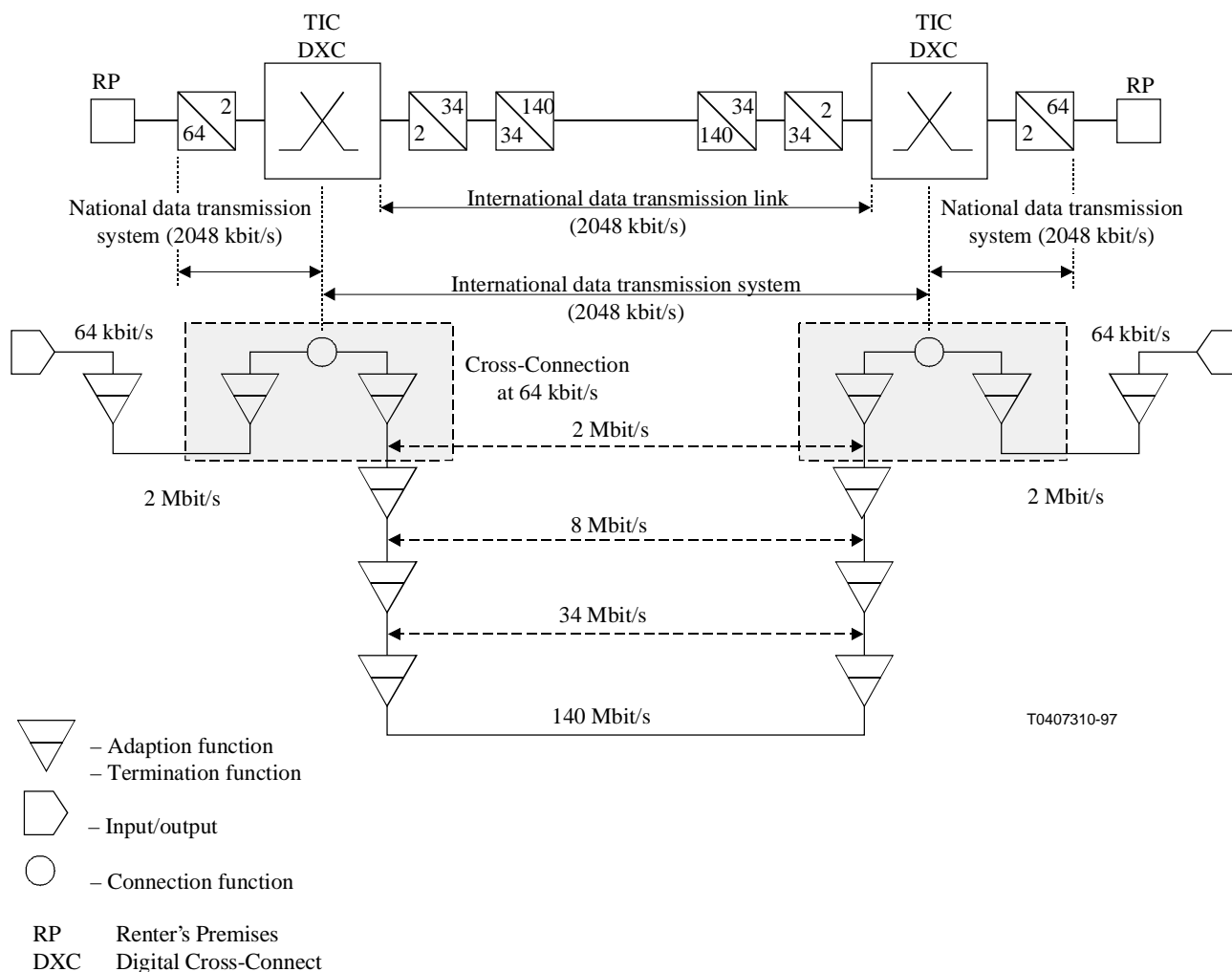
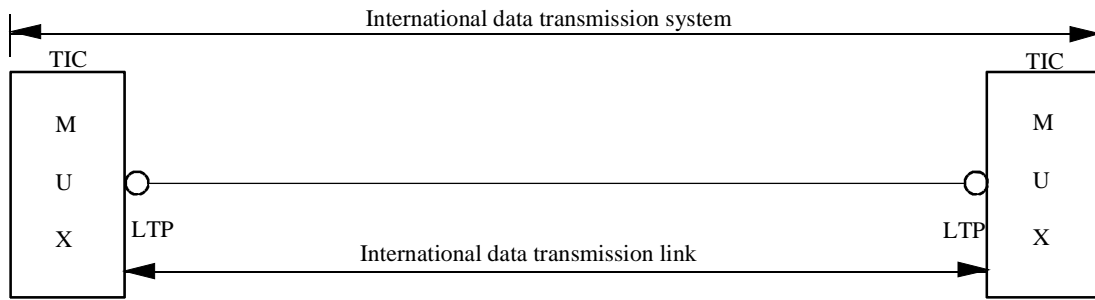


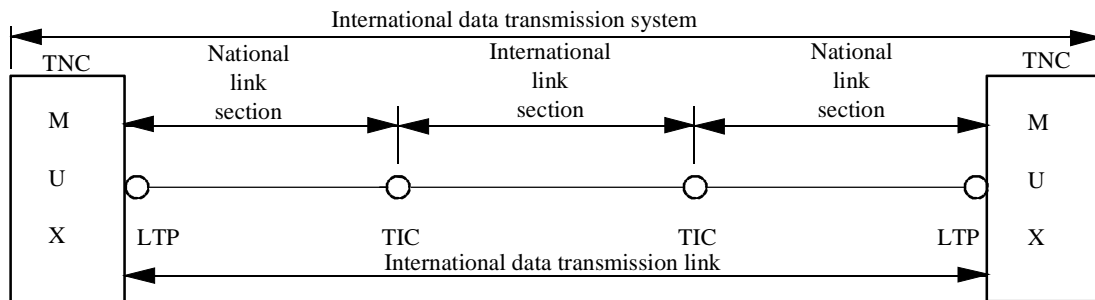
Figure 2b/M.1300 – A typical international data transmission system carried on a higher order system, comprising cross-connect equipment

Figure 2b above shows the case where the terminal multiplexing equipment is replaced with digital cross-connect equipment. In this case the international data transmission system exists between the mid-points of the two cross-connects. It is therefore possible to define a "virtual point" at the centre of the cross-connect equipment, from where the testing of the international data transmission system is carried out.

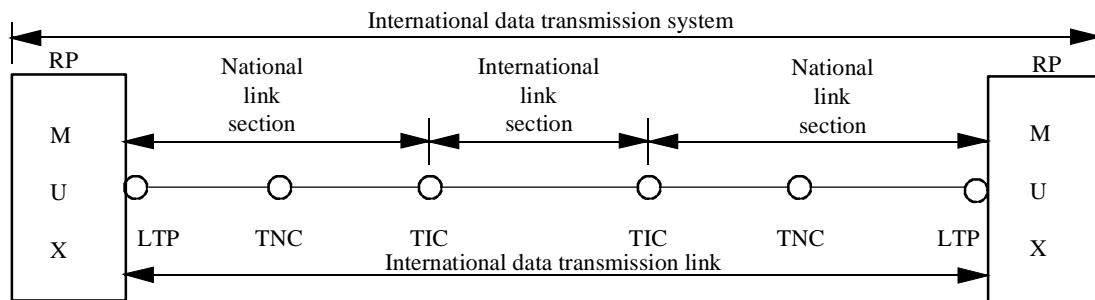
In a similar way, a national data transmission system can be defined which exists, in the case illustrated above, between the TIC and the renter's premises.



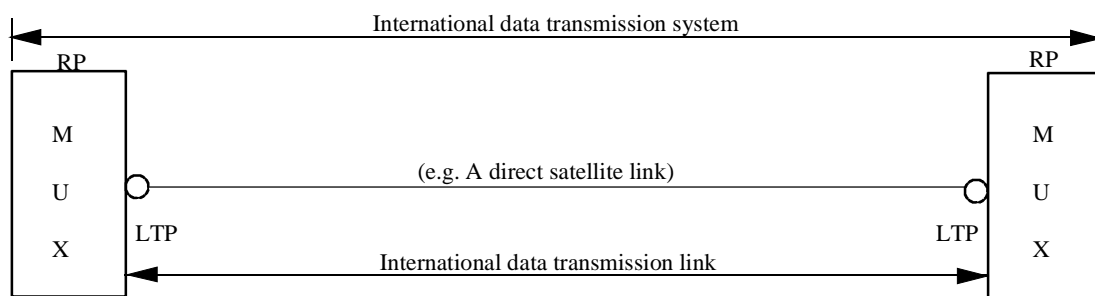
a) Multiplex/Demultiplex equipment located at the TIC



b) Multiplex/Demultiplex equipment located at the TNC



c) Multiplex/Demultiplex equipment located at the RP



d) A data transmission system routed directly between RPs

T0401740-90

- LTP Link Terminating Point
- RP Renters' premises
- TIC Terminal International Centre
- TNC Terminal National Centre

Figure 3/M.1300 – Typical configurations of an international data transmission system

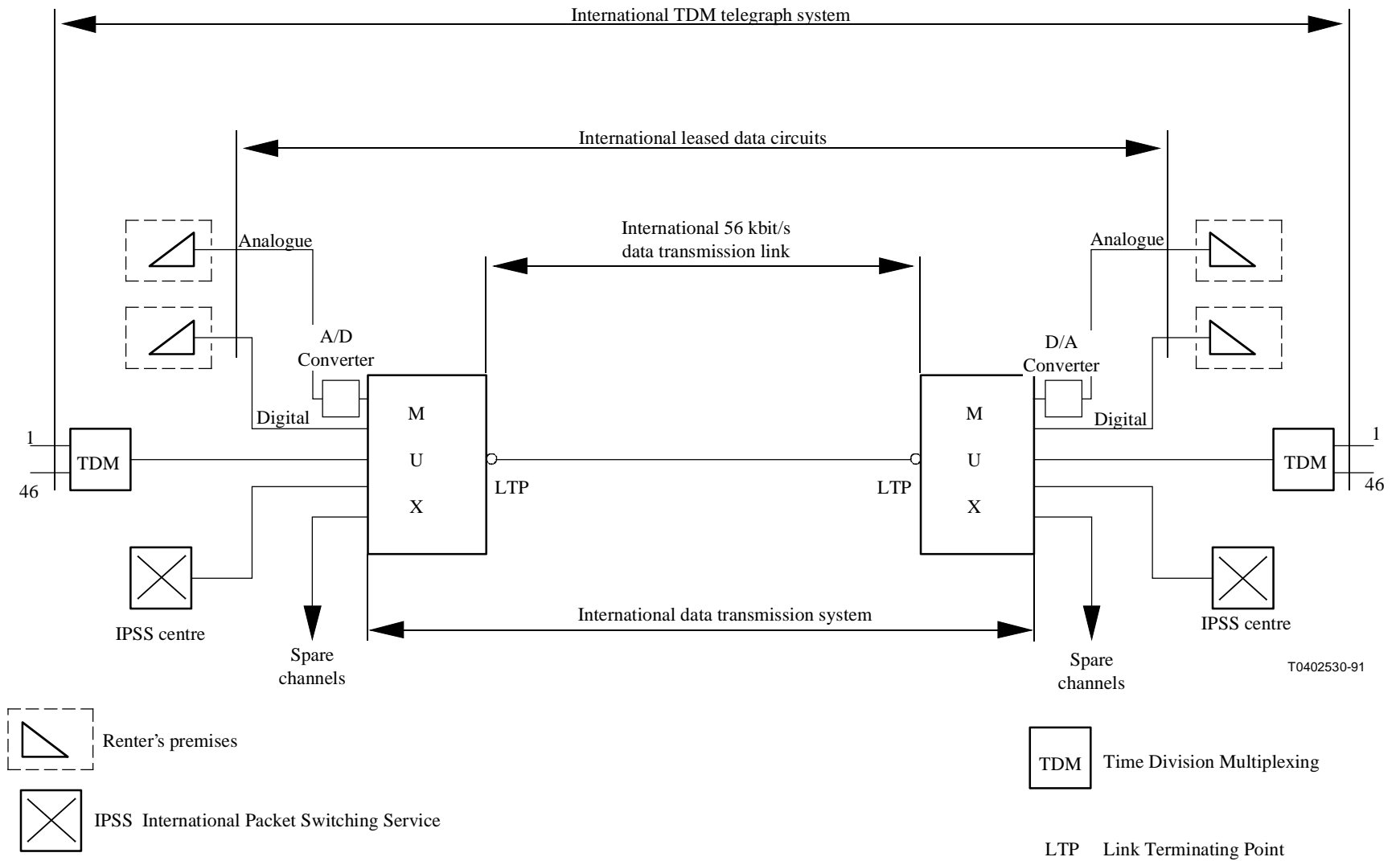


Figure 4/M.1300 – An example of an international data transmission system with different presentations at renter's premises

Table 1/M.1300 – Recommended interfaces and frame structures for multiplexing equipment operating between 1544 kbit/s and 140 Mbit/s

	ITU-T Recommendation	
	Electrical/physical interface characteristics	Framing structure
1 544 kbit/s	Clause 2/G.703 [1]	2.1/G.704 [2]
2 048 kbit/s	Clause 6/G.703 [1]	2.3/G.704 [2]
6 312 kbit/s	Clause 3/G.703 [1]	4.1/G.704 [2]
8 448 kbit/s	Clause 7/G.703 [1]	6.1/G.704 [2]
34 368 kbit/s	Clause 8/G.703 [1]	1.4/G.751 [5]
44 736 kbit/s	Clause 5/G.703 [1]	1.3/G.752 [6]
139 264 kbit/s	Clause 9/G.703 [1]	1.5/G.751 [5]
NOTE 1 – Channel associated signalling for 2048 kbit/s frame structures, where required, should conform to 5.1.3.2/G.704 [2], and 5.1/G.732 [3].		
NOTE 2 – 2048 kbit/s frame structures that provide common channel signalling should conform to clause 2/G.736 [4].		
NOTE 3 – Signalling arrangements for 1544 kbit/s frame structures, where required, are described in 3.1.3/G.704 [2].		

8 General description of international data transmission links

International data transmission links may typically be provided on a variety of transmission media in various combinations:

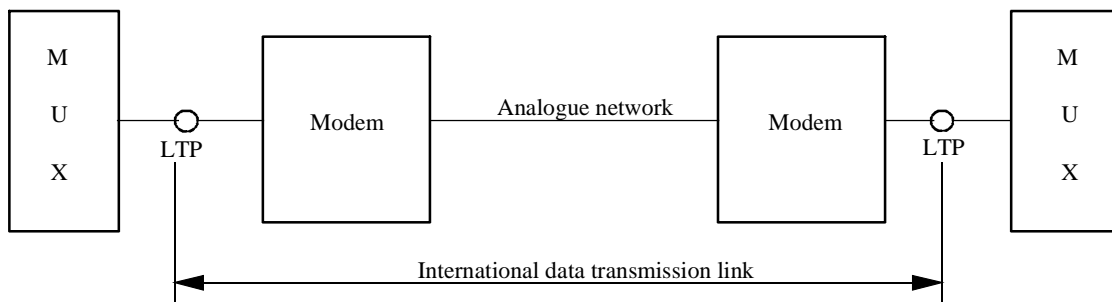
- paired copper cable;
- FDM carrier systems (group or supergroup) via symmetric pair or coaxial cable systems, microwave radio links, satellites;
- voice grade analogue or digital channels;
- digital links via coaxial or optical fibre cable systems, microwave radio links or satellite systems.

Modems or interface adaptors can be used to derive appropriate signals for the transmission medium being used. The LTPs of an international data transmission link provide digital interface test points and should preferably operate as standard G.703 [1] interfaces, although other interfaces (such as Recommendations V.24 [19], V.28 [20], X.21 [21], V.11 [18], etc.) may be used.

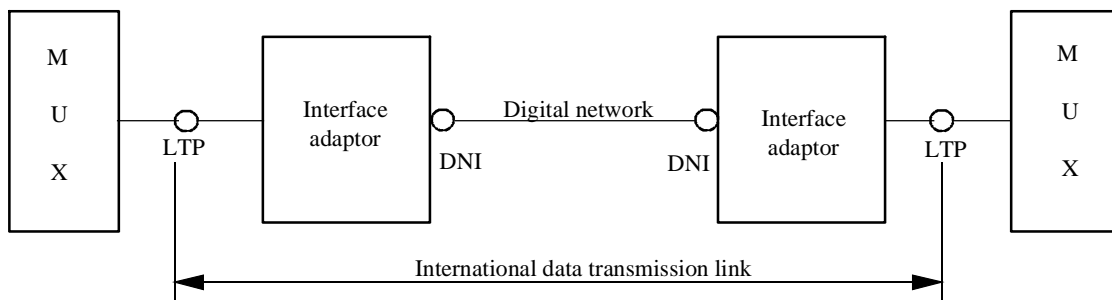
Figure 5 gives an overview of possible configurations for an international data transmission link. While hybrid combinations of link configurations are possible, it is preferable that the same interface type be presented at each end. It should be noted that certain multiplexing equipment will not interwork correctly if differing interface presentations are provided at each LTP.

The international data transmission link should maintain the transparency of the data flow, which means that the transmission rate at all points of the link will be at or above the data rate of the LTP.

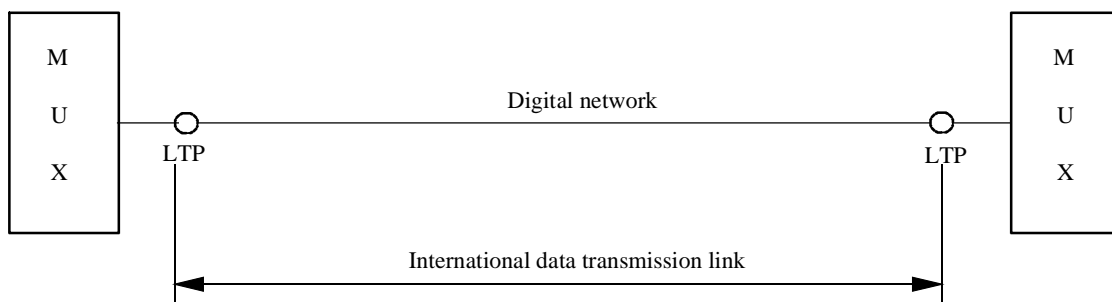
For data transmission links routed via a mixture of transmission media (e.g. microwave, optical fibre or satellite, etc.) the term "section" is used to refer to a section of the overall link, or international or national link section, routed wholly on one type of transmission medium.



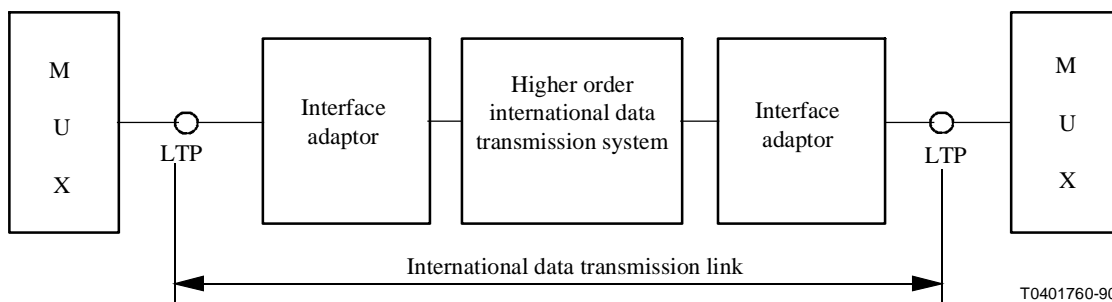
a) Direct connection via an analogue network



b) Connection to a digital network via interface adaptors



c) Direct connection to a digital network



d) Routed via higher order international data transmission system

T0401760-90

- DNI Digital Network Interface
- LTP Link Terminating Point (digital interface)
- MUX Multiplexing/demultiplexing (or similar) equipment

Figure 5/M.1300 – Configuration of an international data transmission link

The "Digital Network" shown in Figures 5 b) and 5 c) signifies that the international data transmission system cannot be broken down to data rates of less than the aggregate transmission rate, but it does include the possibility of the international data transmission system being carried as a channel in a higher rate system.

9 Timing sources

The timing feed at each end of an international data transmission system should be derived from a primary reference clock operating in accordance with clause 2/G.811 [8].

This will allow for correct plesiochronous operation between Network Operators/Service Providers.

10 Control and sub-control stations

Network Operators/Service Providers may elect to assign control and sub-control status to the terminal stations of an international data transmission system in accordance with Recommendations M.1012 [10] and M.1013 [11]. However, in order to achieve the fastest possible response times for maintenance activities on behalf of users, it is acceptable for both terminal stations of an international data transmission system to assume control station status. It is however essential for the control stations involved to develop an effective mechanism for coordinating maintenance activity and that they inform each other of specific maintenance actions as rapidly as possible.

11 Reserve arrangements

Since international data transmission links often carry international leased circuits, data systems, and/or TDM telegraph systems, some Network Operators/Service Providers find it useful to nominate a reserve link for restoration purposes in the event of failure of the normal link. This should be decided by bilateral agreement between the Network Operators/Service Providers at the time of planning the link. Such reserve links must be set up or lined up to meet the requirements of the normal data transmission link and, wherever possible, should follow a different route from the route of the normal link.

12 Designations

The form of designations for international data transmission systems and international data transmission links is described in Recommendation M.1400 [17].

ITU-T RECOMMENDATIONS SERIES

- Series A Organization of the work of the ITU-T
- Series B Means of expression: definitions, symbols, classification
- Series C General telecommunication statistics
- Series D General tariff principles
- Series E Overall network operation, telephone service, service operation and human factors
- Series F Non-telephone telecommunication services
- Series G Transmission systems and media, digital systems and networks
- Series H Audiovisual and multimedia systems
- Series I Integrated services digital network
- Series J Transmission of television, sound programme and other multimedia signals
- Series K Protection against interference
- Series L Construction, installation and protection of cables and other elements of outside plant
- Series M TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits**
- Series N Maintenance: international sound programme and television transmission circuits
- Series O Specifications of measuring equipment
- Series P Telephone transmission quality, telephone installations, local line networks
- Series Q Switching and signalling
- Series R Telegraph transmission
- Series S Telegraph services terminal equipment
- Series T Terminals for telematic services
- Series U Telegraph switching
- Series V Data communication over the telephone network
- Series X Data networks and open system communication
- Series Z Programming languages