INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

R.106

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(08/95)

TELEGRAPHY

MULDEX UNIT FOR TELEGRAPH AND LOW SPEED DATA TRANSMISSION USING TDM BIT INTERLEAVING WITH AN AGGREGATE BIT RATE HIGHER THAN 4800 bit/s

ITU-T Recommendation R.106

(Previously “CCITT Recommendation”)

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (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).

ITU-T Recommendation R.106 was prepared by ITU-T Study Group 14 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 29th of August 1995.

NOTES

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

2. The status of annexes and appendices attached to the Series R Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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CONTENTS

SUMMARY

This Recommendation defines the general principles and parameters of the muldex that is used to send telegraph signals and low-speed data using TDM bit-interleaving with an aggregate bit rate higher than 4800 bit/s on an analogue telephone-type circuit or a higher order TDM system. In this Recommendation telegraph TDM systems are used for framing, and therefore there is no need to standardize a special frame structure for the aggregate bit rates higher than 4800 bit/s.

Recommendation R.106

MULDEX UNIT FOR TELEGRAPH AND LOW SPEED DATA TRANSMISSION USING TDM BIT INTERLEAVING WITH AN AGGREGATE BIT RATE HIGHER THAN 4800 bit/s

(Geneva, 1995)

1 Introduction

Telegraph Time Division Multiplex (TDM) systems with an aggregate bit rate of 600 (Recommendation R.103), 2400 (Recommendations R.101, R.105, R.112) and 4800 bit/s (Recommendation R.102) are widely used on telegraph networks.

The TDM systems listed above provide the setting up of both code- and speed-dependent and code- and speed-independent telegraph channels for signal transmission using modulation rates of 50 to 300 bauds.

In certain cases, for instance, on international paths of satellite circuits it becomes necessary to be able to use the bearer circuit capacity more effectively, i.e. to use an aggregate bit rate higher than 4800 bit/s.

It is more preferable to design telegraph TDM systems operating at aggregate bit rates higher than 4800 bit/s on the basis of existing TDM systems complying with Recommendations R.101, R.102, R.105 and R.112.

The modem to be used in telegraph TDM systems with an aggregate bit rate higher than 4800 bit/s over leased telephone-type circuits is also subjected to standardization in the R-Series Recommendations. It should be noted that the systems, mentioned above, with modems providing the mode of aggregate bit streams 2400 and 4800 bit/s multiplexing (for instance, V.29 modem), cannot be used on a combined bearer circuit consisting of a telephone channel and a 9600 bit/s digital circuit, because in this case an aggregate 9 600 bit/s signal cannot be properly split into streams of 2400 or 4800 bit/s for each muldex.

When designing a telegraph TDM system with an aggregate bit rate higher than 4800 bit/s it is not desirable to allow additional losses of link capacity due to frame alignment between 2400 or 4800 bit/s streams belonging to different muldexes.

2 Scope

This Recommendation defines the general principles and parameters of the muldex that is used to send telegraph signals and low-speed data using TDM bit-interleaving with an aggregate bit rate higher than 4800 bit/s on an analogue telephone-type circuit or a higher order TDM system.

In this Recommendation, telegraph TDM systems complying with the existing R.100-Series Recommendations are used for framing, and therefore there is no need to standardize a special frame structure for the aggregate bit rates higher than 4800 bit/s.

3 References

The following 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.

– ITU-T Recommendation R.101 (1993), *Code and speed dependent TDM system for anisochronous telegraph and data transmission using bit interleaving*.

– ITU-T Recommendation R.102 (1993), *4800 bit/s code and speed dependent and hybrid TDM systems for anisochronous telegraph and data transmission using bit interleaving*.

– ITU-T Recommendation R.103 (1988), *Code and speed – dependent TDM 600 bit/s system for use in point-to-point or branch-line muldex configurations*.

– ITU-T Recommendation R.105 (1993), *Duplex muldex concentrator, connecting a group of gentex and telex subscribers to a telegraph exchange by assigning virtual channels to time slots of a bit-interleaved TDM system*.

– ITU-T Recommendation R.112 (1993), *TDM hybrid system for anisochronous telegraph and data transmission using bit interleaving*.

4 Definitions

This Recommendation makes use of the terms defined in Recommendation R.140.

5 Abbreviations

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

ES	Erasing Sequence
FSR	Frame Synchronization word Receiver
G	Generator
Mx add	Additional Muldex
Mx main	Main Muldex
TDM	Time Division Multiplex
UM	Unit Muldex

6 Basic parameters

6.1 The muldex unit shall be capable of multiplexing aggregate signals of telegraph TDM systems into the common aggregate signal at the transmitting side and demultiplexing them at the receiving side as shown in Table 1.

TABLE 1/R.106

Aggregate signalling rate (bit/s)	TDM systems
9600	Four R.101, R.105 or R.112 systems
9600	Two R.102 systems
4800	Two R.101, R.105 or R.112 systems

NOTES

1 The possibility of simultaneous application of TDM systems using different aggregate rates is for further study.

2 The possibility of constructing a telegraph TDM system using an aggregate bit rate of 7200 bit/s is for further study.

6.2 The muldex unit shall provide for maintaining the frame alignment signal on one TDM system that is called main and make "erasing" of the frame alignment signal in an aggregate signal of other TDM systems that are called subordinate.

6.3 The muldex unit shall "erase" an aggregate signal of a subordinate TDM system by means of a signal addition "modulo 2" with an "erasing" sequence at the sending end and make reverse conversion at the receiving end.

6.4 The "erasing" sequence is defined as a signal of type ...000111000111..., where the length of each "zero" or "one" is 19.5802 ms (the length of the TDM R.101 system aggregate signal subframe) in the case of the basic 2400 bit/s aggregate signal and 9.7901 ms (the length of the TDM R.102 system aggregate signal subframe length) in the case of the basic 4800 bit/s aggregate signal.

7 Synchronization

7.1 The "erasing" sequence shall be synchronized with the beginning of the main TDM system frame.

7.2 The conditions and time of log in/log out muldex unit frame alignment shall comply with 6.4/R.101 in the case of the main 2400 bit/s aggregate signal and clause 6/R.102 for the case of the main 4800 bit/s aggregate signal.

8 Clock synchronization

8.1 The muldex unit shall operate with a built-in generator that is synchronized by means of the modem.

8.2 The muldex unit shall have outputs on 2400 or 4800 Hz for the main and subordinate TDM systems synchronization.

8.3 The connection capability and methods for synchronization of the remote TDM systems are for further study.

9 Interfaces

9.1 The electrical characteristics of the interface between the muldex unit and the modem shall conform to the V-Series Recommendations. The nomenclature of the required interchange circuits is left for further study.

9.2 The interface between the muldex unit and the local telegraph TDM systems shall be provided by the digital signal without the use of modems. The electrical characteristics of the interface shall comply with the V-Series Recommendations.

10 Loops

Maintenance loops, their location and names are left for further study.

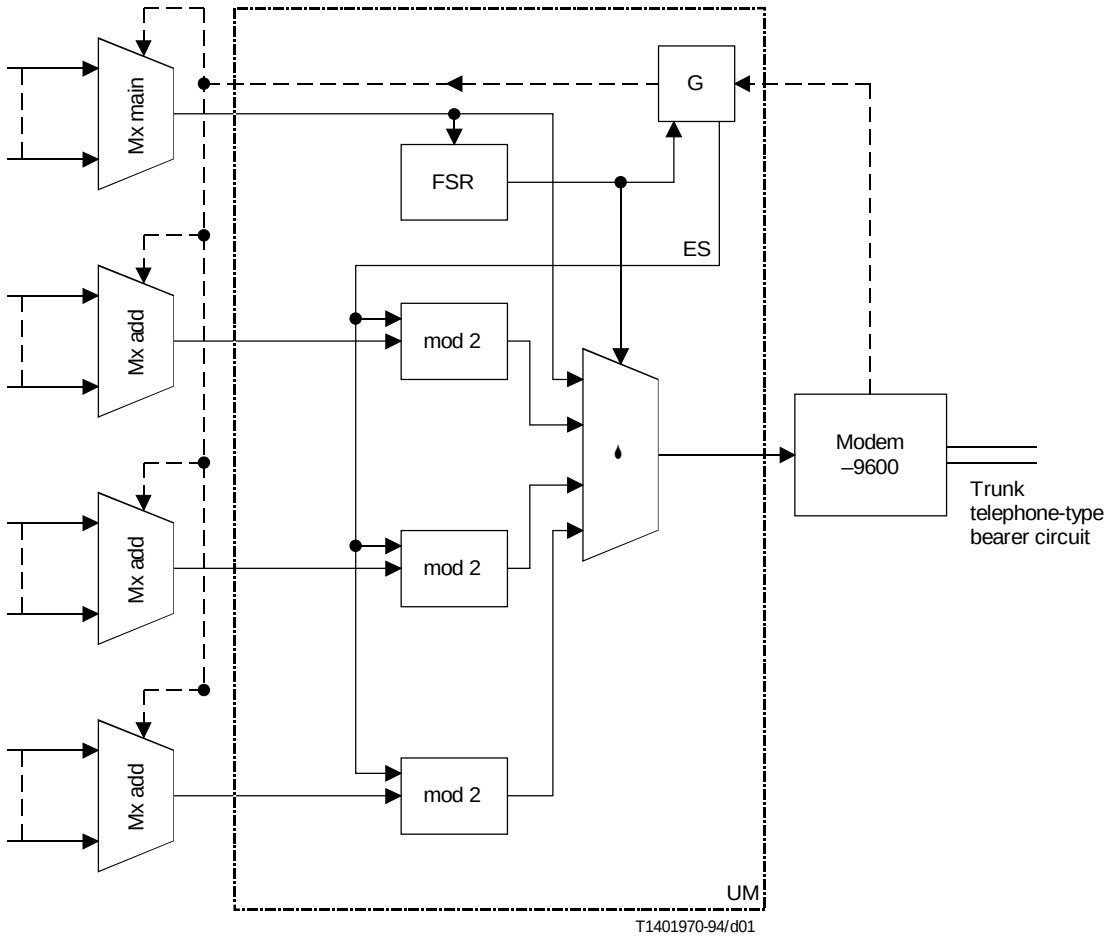
11 Implementation

The block diagram of the muldex unit is shown in Figure A.1.

12 Application

An application scheme in the network for the equipment in question is shown in Figure A.2.

Annex A



Mx main	Main muldex
Mx add	Additional muldex
FSR	Frame Synchronization word Receiver
⧫	Time summator
G	Generator of the erasing sequence and synchronizing pulse
ES	Erasing Sequence
– – –	Clock synchronization
mod 2	"modulo two"summator
UM	Muldex Unit

FIGURE A.1/R.106

Block diagram of the muldex unit

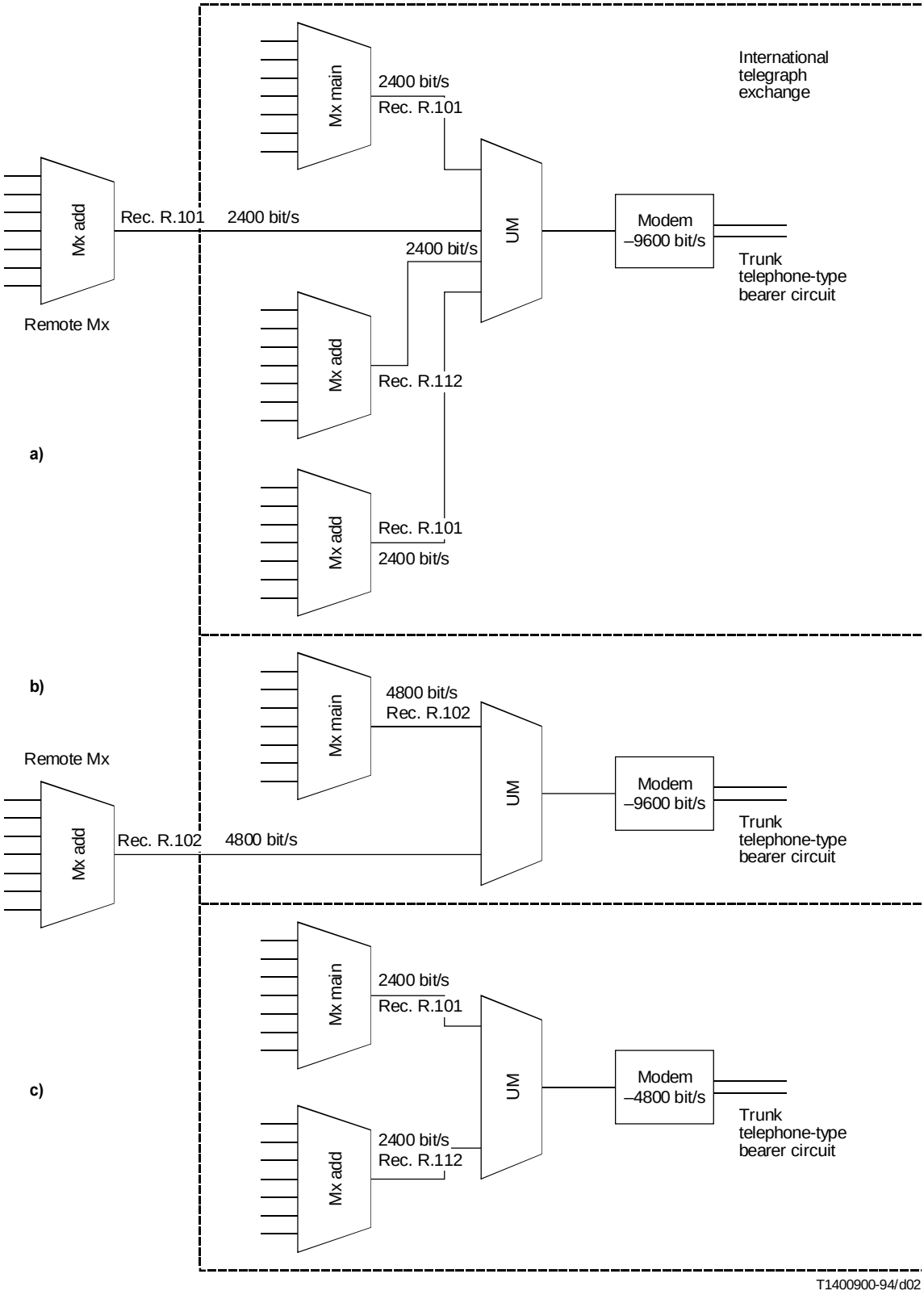


FIGURE A.2/R.106

Application scheme on the network