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Foreword

This draft European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Unified Approval Procedure phase of the ETSI standards approval procedure.

This third edition of ETS 300 147 supersedes the second edition of ETS 300 147 (1995).

This ETS provides inter-vendor and inter-operator compatibility and is based on ITU-T Recommendation G.707 [1].

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This European Telecommunication Standard (ETS) specifies the hierarchical bit rates, the multiplexing structure and the mapping schemes to be used in the transmission networks based on the Synchronous Digital Hierarchy (SDH).

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation G.707 (1996): "Network node interface for the synchronous digital hierarchy".

3 Definitions, abbreviations and conventions

3.1 Definitions

For the purposes of this ETS, the definitions given in section 3 of the ITU-T Recommendation G.707 [1] apply.

3.2 Abbreviations

For the purposes of this ETS the following abbreviations apply:

AIS	Alarm Indication Signal
APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
AU-n	Administrative Unit-n
AUG	Administrative Unit Group
BIP-X	Bit Interleaved Parity-X
DCC	Data Communication Channel
MS-RDI	Multiplex Section Remote Defect Indication
MS-REI	Multiplex Section Remote Error Indication
NNI	Network Node Interface
POH	Path OverHead
SDH	Synchronous Digital Hierarchy
SOH	Section OverHead
STM(-N)	Synchronous Transport Module (-N)
TU-n	Tributary Unit-n
TUG(-n)	Tributary Unit Group (-n)
VC-n	Virtual Container-n

3.3 Conventions

The order of transmission of information in all diagrams in the ITU-T Recommendation G.707 [1] is first from left to right and then from top to bottom. Within each byte, the most significant bit is transmitted first. The most significant bit (bit 1) is illustrated at the left in all diagrams.

In clauses 4 to 8, the status of each requirement is given with reference to the ITU-T Recommendation G.707 [1] with the following conventions:

Normative (N): requirements with which it is necessary to comply in order to be able to claim compliance with this ETS.

Not Relevant (N/R): section/subsection (of G.707) is not relevant to this ETS.

This ETS is not an equipment specification. The fact that a requirement is defined as normative does not imply that the associated function has to be implemented but means that, if implemented, the function shall be implemented in accordance with this requirement.

4 Basic multiplexing principles

The basic multiplexing principles are as given in section 6 of ITU-T Recommendation G.707 [1] together with the following statements and modifications.

Table 1: Modifications and statements to section 6 of ITU-T Recommendation G.707 [1]

Section	Title	Requirement
6	Basic Multiplexing Principle	
6.1	Multiplexing Structure The basic SDH multiplexing structure shall be as described in figure 1. This SDH multiplexing structure is a subset of the SDH multiplexing structure defined in the section 6.1 of ITU-T Recommendation G.707 [1].	N/R
6.2	Basic Frame Structure	
6.2.1	Section overhead	N
6.2.2	Administrative Unit Pointers	N
6.2.3	Administrative Units in the STM-N In this subsection, reference to AU-3 is N/R	N
6.2.4	Maintenance Signals	N
6.2.4.1	Alarm indication signals	
6.2.4.1.1	MS-AIS	N
6.2.4.1.2	AU-TU-AIS	N
6.2.4.1.3	VC-AIS	N
6.2.4.2	Unequipped VC-n signal	
6.2.4.2.1	Case of network supporting the transport of Tandem Connection Signals	N
6.2.4.2.2	Case of network not supporting the transport of Tandem Connection Signals	N/R
6.2.4.3	Supervisory-unequipped VC-n signal	
6.2.4.3.1	Case of network supporting the transport of Tandem Connection Signals	N
6.2.4.3.2	Case of network not supporting the transport of Tandem Connection Signals	N/R
6.3	Hierarchical bit rates	N
6.4	Interconnection of STM-Ns	N
6.5	Scrambling	N
6.6	Physical Specification of the NNI	N
6.7	Frame Structure for 51 840 kbit/s interface	N

5 Multiplexing method

The multiplexing method is as given in section 7 of ITU-T Recommendation G.707 [1] together with the following statements and modifications.

Table 2: Modifications and statements to section 7 of ITU-T Recommendation G.707 [1]

Section	Title	Requirement
7	Multiplexing Method	
7.1	Multiplexing of Administrative Units into STM-N	
7.1.1	Multiplexing of Administrative Unit Groups (AUGs) into STM-N	N
7.1.2	Multiplexing of an AU-4 via AUG	N
7.1.3	Multiplexing of AU-3s via AUG	N/R
7.2	Multiplexing of Tributary Units into VC-4 and VC-3	
7.2.1	Multiplexing of Tributary Unit Group-3s (TUG-3s) into a VC-4	N
7.2.2	Multiplexing of a TU-3 via TUG-3	N
7.2.3	Multiplexing of TUG-2s via a TUG-3	N
7.2.4	Multiplexing of TUG-2s into a VC-3	N/R
7.2.5	Multiplexing of a TU-2 via TUG-2s	N
7.2.6	Multiplexing of TU-1s via TUG-2s In this subsection, reference to TU-11 is N/R	N
7.3	AU-n/TU-n numbering	
7.3.1	Numbering of AU-4s in a STM-N signal	N
7.3.2	Numbering of TU-3s in a VC-4	N
7.3.3	Numbering of TU-2s in a VC-4	N
7.3.4	Numbering of TU-12s in a VC-4	N
7.3.5	Numbering of TU-11s in a VC-4	N/R
7.3.6	Numbering of AU-3s in a STM-N signal	N/R
7.3.7	Numbering of TU-2s in a VC-3	N/R
7.3.8	Numbering of TU-12s in a VC-3	N/R
7.3.9	Numbering of TU-11s in a VC-3	N/R

6 Pointers

The pointers description is as given in section 8 of ITU-T Recommendation G.707 [1] together with the following statements and modifications.

Table 3: Modifications and statements to section 8 of ITU-T Recommendation G.707 [1]

Section	Title	Requirement
8	Pointers	
8.1	AU-n pointer In this subsection, references to AU-3 pointers are not relevant	
8.1.1	AU-n pointer location	N
8.1.2	AU-n pointer value	N
8.1.3	Frequency justification	N
8.1.4	New Data Flag	N
8.1.5	Pointer generation	N
8.1.6	Pointer interpretation	N
8.1.7	AU-4 concatenation	
8.1.7.1	Concatenation of contiguous AU-4s	(1)
8.1.7.2	Virtual concatenation of AU-4s (1) The virtual concatenation of AU-4s is under study and the type of concatenation to be chosen will depend of the result of this study.	(1)
8.2	TU-3 pointer	
8.2.1	TU-3 pointer location	N
8.2.2	TU-3 pointer value	N
8.2.3	Frequency justification	N
8.2.4	New Data Flag	N
8.2.5	Pointer generation	N
8.2.6	Pointer interpretation	N
8.3	TU-2/TU-1 pointer In this subsection, references to TU-11 pointer are not relevant	
8.3.1	TU-2/TU-1 pointer location	N
8.3.2	TU-2/TU-1 pointer value	N
8.3.3	TU-2/TU-1 frequency justification	N
8.3.4	New Data Flag	N
8.3.5	TU-2/TU-1 pointer generation and interpretation	N
8.3.6	TU-2 concatenation	
8.3.6.1	Concatenation of contiguous TU-2s in the higher order VC-3	N/R
8.3.6.2	Virtual concatenation of TU-2s in the higher order VC-4	N
8.3.7	TU-2/TU-1 sizes	N
8.3.8	TU-2/TU-1 multiframe indication byte In this subsection, reference to VC-3 is not relevant	N

7 Overhead bytes description

The Overhead bytes description is as given in section 9 of ITU-T Recommendation G.707 [1] together with the following statements and modifications.

Table 4: Modifications and statements to section 9 of ITU-T Recommendation G.707 [1]

Section	Title	Requirement
9	Overhead bytes description	
9.1	Types of overhead	
9.1.1	SOH	N
9.1.2	Virtual Container POH	N
9.2	SOH description	
9.2.1	SOH bytes location	N
9.2.2	SOH bytes description	
9.2.2.1	Framing A1, A2	N
9.2.2.2	Regenerator Section Trace: J0 In this section, the 16-byte frame applies.	N
9.2.2.3	Spare: Z0	N
9.2.2.4	BIP-8: B1	N
9.2.2.5	Orderwire: E1, E2	N
9.2.2.6	User channel: F1	N
9.2.2.7	Data Communication Channel (DCC): D1 - D12	N
9.2.2.8	BIP-Nx24: B2	N
9.2.2.9	Automatic Protection Switching (APS): K1, K2 (b1-b5)	N
9.2.2.10	MS-RDI: K2 (b6-b8)	N
9.2.2.11	synchronization status: S1 (b5-b8)	N
9.2.2.12	MS-REI: M1 Under study	
9.2.3	Reduced SOH functionalities interface	N
9.3	POH descriptions	
9.3.1	VC-4-Xc/VC-4/VC-3 POH	
9.3.1.1	Path trace: J1 In this section, the 16-byte frame applies.	N
9.3.1.2	Path BIP-8: B3	N
9.3.1.3	Signal label: C2	N
9.3.1.4	Path status: G1: Enhanced RDI is not supported. Consequently Bits 6 and 7 shall be set to "00" or "11" in the source direction and ignored in the sink direct.	N
9.3.1.5	Path user channels: F2, F3	N
9.3.1.6	Position indicator: H4	N
9.3.1.7	Automatic Protection Switching (APS) channel: K3 (b1-b4)	N
9.3.1.8	Network operator byte: N1 Option 2 described in annex D of ITU-T Recommendation G.707 [1] applies	N
9.3.1.9	Spare: K3 (b5-b8)	N
9.3.2	VC-2/VC-1 POH	
9.3.2.1	V5 byte	N
9.3.2.2	Path trace: J2	N
9.3.2.3	Network operator byte: N2	N
9.3.2.4	Automatic protection switching (APS) channel: K4 (b1-b4)	N
9.3.2.5	Reserved: K4 (b5-b7): Enhanced RDI is not supported. These bits shall be set to "000" or "111" in the source direction and ignored in the sink direction	
9.3.2.6	Spare: K4 (b8)	N

8 Mapping of tributaries into VC-n

The mapping of tributaries into VC-n is as described in section 10 of ITU-T Recommendation G.707 [1] together with the following statements and modifications.

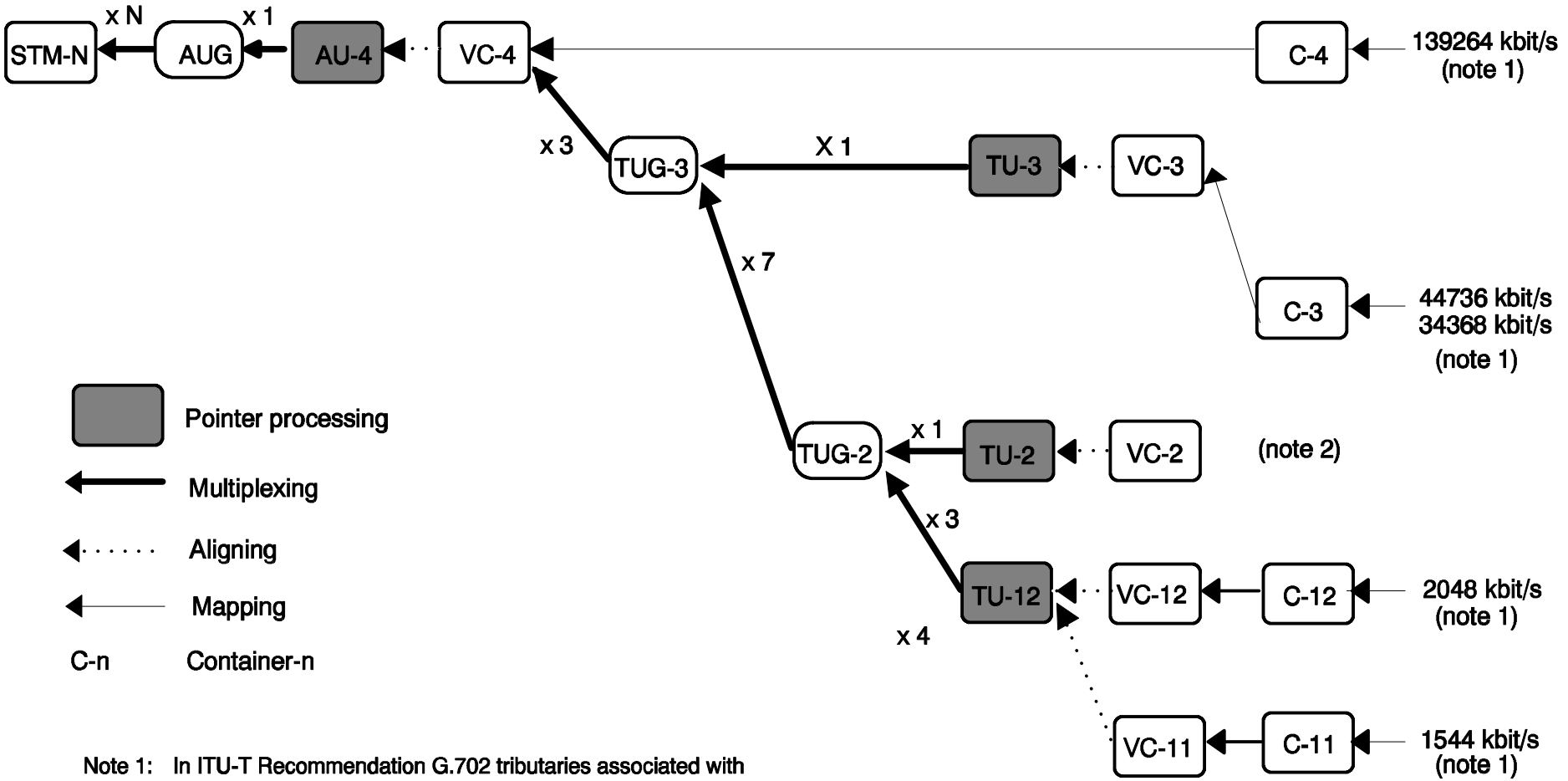
Table 5: Modifications and statements to section 10 of ITU-T Recommendation G.707 [1]

Section	Title	Requirement
10	Mapping of tributaries into VC-n	
10.1	Mapping of G.702 type signals	
10.1.1	Mapping into VC-4	
10.1.1.1	Asynchronous mapping of 139 264 kbit/s	N
10.1.2	Mapping into VC-3	
10.1.2.1	Asynchronous mapping of 44 736 kbit/s	N
10.1.2.2	Asynchronous mapping of 34 368 kbit/s	N
10.1.3	Mapping into VC-2	
10.1.3.1	Asynchronous mapping of 6 312 kbit/s	N/R
10.1.3.2	Bit synchronous mapping of 6 312 kbit/s	N/R
10.1.3.3	Byte synchronous mapping of 6 312 kbit/s	N/R
10.1.4	Mapping into VC-12	
10.1.4.1	Asynchronous mapping of 2 048 kbit/s	N
10.1.4.2	Byte synchronous mapping of 2 048 kbit/s	N
10.1.4.3	Byte synchronous mapping of 31 x 64 kbit/s	N
10.1.5	Mapping into VC-11	
10.1.5.1	Asynchronous mapping of 1 544 kbit/s	N
10.1.5.2	Bit synchronous mapping of 1 544 kbit/s	N
10.1.5.3	Byte synchronous mapping of 1 544 kbit/s	N
10.1.6	VC-11 to VC-12 conversion for transport by a TU-12	N
10.2	Mapping of ATM cells	
10.2.1	Mapping into VC-4-Xc	N
10.2.2	Mapping into VC-4/VC-3	N
10.2.3	Mapping into VC-2-mc	N
10.2.4	Mapping into VC-2	N
10.2.5	Mapping into VC-12/VC-11	N

9 Conformance testing

An SDH based interface can contain any one of a very large number of multiplexing possibilities depending upon the signals being transported over the interface. Recognizing this variety and the fact that the interface terminates on network elements, SDH equipment function standards are based on the identification of atomic functions which are then rigorously specified in terms of information flows into and out of the atomic functions.

Conformance testing is concerned with testing the functional blocks contained within a network element. Conformance testing is performed using a SDH interface(s) to exercise the functional block. Conformance testing principles will, therefore, be associated with the relevant equipment function standards.



Note 1: In ITU-T Recommendation G.702 tributaries associated with containers C-x are shown. Other signals, e.g. ATM, can also accomodated.

Note 2: Virtual concatenation of VC-2 could be used for the transport of new services of non - hierarchical bit rates.

Figure 1: Multiplexing structure

Annex A (informative): Bibliography

The following references are given for information:

1) ITU-T Recommendation G.702: "Digital hierarchy bit rates";

2) ITU-T Recommendation G.704: "Synchronous frame structures used at 1 544, 6 312, 2 048, 8 488 and 44 736 kbit/s hierarchical levels";

3) ITU-T Recommendation G.811: "Timing requirements at the outputs of primary reference clocks suitable for plesiochronous operation of international digital links";

4) ITU-T Recommendation G.831: "Management capabilities of transport networks based on the synchronous digital hierarchy (SDH)".

History

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