International Telecommunication Union

ITU-T G.709/Y.1331

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Amendment 2

(10/2013)

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Recommendation ITU-T G.709/Y.1331

Interfaces for the optical transport network

Amendment 2

Summary

Amendment 2 to Recommendation ITU-T G.709/Y.1331 (2012) contains extensions related to the:

– addition of a low latency 1.25G OTU0 for deployment at the edge of an optical transport network (clauses 2, 3.2, 4, 11.1 and Annex G),

– addition of overhead (OH) type, trail trace identifier (TTI) and nominal central frequency overhead and transport of this overhead plus OCh FDI-P, FDI-O and OCI overhead over a multi-vendor IaDI (clauses 15.5.4, 15.5.4.1 and 15.5.4.2).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.709/Y.1331	2001-02-09	15
1.1	ITU-T G.709/Y.1331 (2001) Amd. 1	2001-11-29	15
2.0	ITU-T G.709/Y.1331	2003-03-16	15
2.1	ITU-T G.709/Y.1331 (2003) Amd. 1	2003-12-14	15
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2.3	ITU-T G.709/Y.1331 (2003) Amd. 2	2007-11-22	15
2.4	ITU-T G.709/Y.1331 (2003) Cor.2	2009-01-13	15
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3.2	ITU-T G.709/Y.1331 (2009) Amd. 1	2010-07-29	15
3.3	ITU-T G.709/Y.1331 (2009) Amd. 2	2011-04-13	15
4.0	ITU-T G.709/Y.1331	2012-02-13	15
4.1	ITU-T G.709/Y.1331 (2012) Cor. 1	2012-10-29	15
4.2	ITU-T G.709/Y.1331 (2012) Amd. 1	2012-10-29	15
4.3	ITU-T G.709/Y.1331 (2012) Amd. 2	2013-10-22	15

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Amendment 2

1) Introduction

This amendment contains extensions to the fourth version (2012) of Recommendation ITU-T G.709/Y.1331, related to the:

– addition of a low latency 1.25G OTU0 for deployment at the edge of an optical transport network (clauses 2, 3.2, 4, 11.1 and Annex G);

– addition of overhead (OH) type, trail trace identifier and nominal central frequency overhead and transport of this overhead plus OCh FDI-P, FDI-O and OCI overhead over a multi-vendor IaDI (clauses 15.5.4, 15.5.4.1 and 15.5.4.2).

2) Additions

2.1) Clause 2

Add the following references to clause 2:

[ITU-T G.698.3] Recommendation ITU-T G.698.3 (2012), *Multichannel seeded DWDM applications with single-channel optical interfaces*.

[ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2010), *Architecture and specification of data communication network*.

2.2) Clause 3.2

Add the following term to clause 3.2:

3.2.2 OTU0 low latency: The OTU0 low latency (OTU0LL) is the information structure used for transport of an ODU0 over a multi-vendor optical network IaDI at the edge of the optical transport network.

NOTE – The OTU0LL is not transported over an OTM-0 IrDI, OTM-n IaDI, OTM-nr IaDI.

2.3) Clause 4

Add the following abbreviations to clause 4:

OTU0LL Completely standardized Optical channel Transport Unit-0 Low Latency

TTI Trail Trace Identifier

2.4) Clause 11.1

Replace the NOTE in clause 11.1 with the following text:

NOTE – This Recommendation does not specify an OTUk frame structure for k=0, k=2e or k=flex. See Annex G for the specification of OTU0LL.

2.5) Clause 15.5

Add the following subclauses to clause 15.5:

15.5.4 Optical channel non-associated overhead (OCh OH) transport over OTM-1 multi-vendor IaDI

Figure 15-5bis illustrates the information and representation to be used when the OCh overhead is to be transferred across a multi-vendor IaDI. This information consists of OCh overhead primitives and of additional information including an OH type field, a trail trace identifier field to check for misconnections over the OCN and a field indicating the nominal central frequency of the associated OCh payload. In the case of single-vendor IaDI, the coding and method of information transfer is vendor specific. For multi-vendor IaDI, the overhead is transferred over the overhead communication network (OCN) as described in [ITU-T G.7712].

NOTE – A multi-vendor IaDI which transfers OCh overhead over an OCN cannot provide fate-sharing of the OCh overhead with the OCh payload across this interface.

Each OCh overhead primitive is represented by a bit that is set to one if the respective condition is present, and will be set to zero when it is not.

The specification of the encapsulation and transmission of this information is outside the scope of this Recommendation. This information must be communicated with the peers such that the OCh overhead primitives come into sync within one second in the absence of changes to OCh FDI-P, FDI-O or OCI. In the event of changes to any OCh overhead primitive, the update must be sent within 10 ms of the change and with a mechanism to guarantee receipt in the event of packet loss.

Size	Contents
2 octets	OH type, 0x0001=OCh overhead
64 octets	Trail trace identifier (TTI): 16 octets SAPI 16 octets DAPI 32 octets operator specific
4 octets	Nominal central frequency (NCF) Encoded as a "DWDM Wavelength Label" per Section 3.2 of [b-IETF RFC 6205]
1 octet	OAM bits

The OAM bits are represented as follows:

1	2	3	4	5	6	7	8
FDI-P	FDI-O	OCI	Reserved				

Figure 15-5bis – OCh overhead information elements to be used for multi-vendor

15.5.4.1 Trail trace identifier (TTI)

The TTI is defined to transport a 64-byte TTI as specified in clause 15.2 over a multi-vendor IaDI to ensure there are no misconnections across the OCN.

15.5.4.2 Nominal central frequency (NCF)

The NCF encodes the nominal central frequency of the intended OCh payload. This is sent explicitly across a multi-vendor IaDI to ensure there are no misconnections across the OCN. The coding for this information for a multi-vendor IaDI is specified in clause 15.5.4.

2.6) New Annex G

Add new Annex G as follows:

Annex G

Mapping ODU0 into a low latency OTU0 (OTU0LL)

(This annex forms an integral part of this Recommendation.)

G.1 Introduction

Optical networks at the edge of the optical transport network have 1.25 Gbit/s applications that benefit from a low latency FEC, see e.g., [ITU-T G.698.3]. Within the optical transport network client signals with a bit rate up to 1.25 Gbit/s are transported within an ODU0 and the ODU0 is transported within a HO ODUk and OTUk (k = 1,2,3,4). This annex specifies a low latency 1.25G OTU0 (OTU0LL) frame format in which one ODU0 is transported which carries a client (e.g., 1G Ethernet) signal as specified in this Recommendation.

G.2 Optical channel transport unit 0 low latency (OTU0LL)

The OTU0LL conditions the ODU0 for transport over a multi-vendor optical network IaDI at the edge of the optical transport network. The OTU0LL frame structure, including the OTU0LL FEC is completely standardized. The optical aspects of the multi-vendor optical network IaDI at the edge of the optical transport network are outside the scope of this Recommendation.

NOTE 1 – Transport of the OTU0LL over the OTM-0 IrDI, OTM-nr IrDI and OTM-n IaDI specified in this Recommendation is not supported.

NOTE 2 – An ODU0 which is transported within an OTU0LL may be passed through the OTN and terminated at the far end edge of the OTN.

G.2.1 OTUk frame structure

The OTU0LL frame structure is based on the ODU0 frame structure and extends it with a distributed forward error correction (FEC) as shown in Figure G.1. Sixteen times 16 columns are added to the ODU0 frame for the FEC and the reserved overhead bytes in row 1, columns 8 to 14 of the ODU0 overhead are used for an OTU0LL specific overhead, resulting in an octet-based block frame structure with four rows and 4080 columns. The MSB in each octet is bit 1, the LSB is bit 8.

The OTU0LL overhead is the same as the OTUk overhead.

The bit rate of the OTU0LL signal is 255/239 × 1 244 160 kbit/s (~1 327 451.046 kbit/s). The frame period of the OTU0LL signal is approximately 98.354 μs.

The sixty-four 16-byte RS(255,239) FEC fields in the OTL0LL frame contain the Reed-Solomon RS(255,239) FEC code. Each RS(255,339) FEC is computed over the previous 239 OTU0LL bytes. Transmission of the OTU0LL FEC is mandatory.

NOTE – The distribution of the RS(255,239) FEC fields over the OTU0LL frame minimizes the transfer delay introduced by the processing of this FEC and the number of codecs to compute this FEC.

The RS(255,239) FEC code shall be computed as specified in Annex A with the notion that each FEC is computed over the previous 239 OTU0LL bytes instead of over a sub-row as described in this annex for the case of an OTUk (k=1,2,3,4).

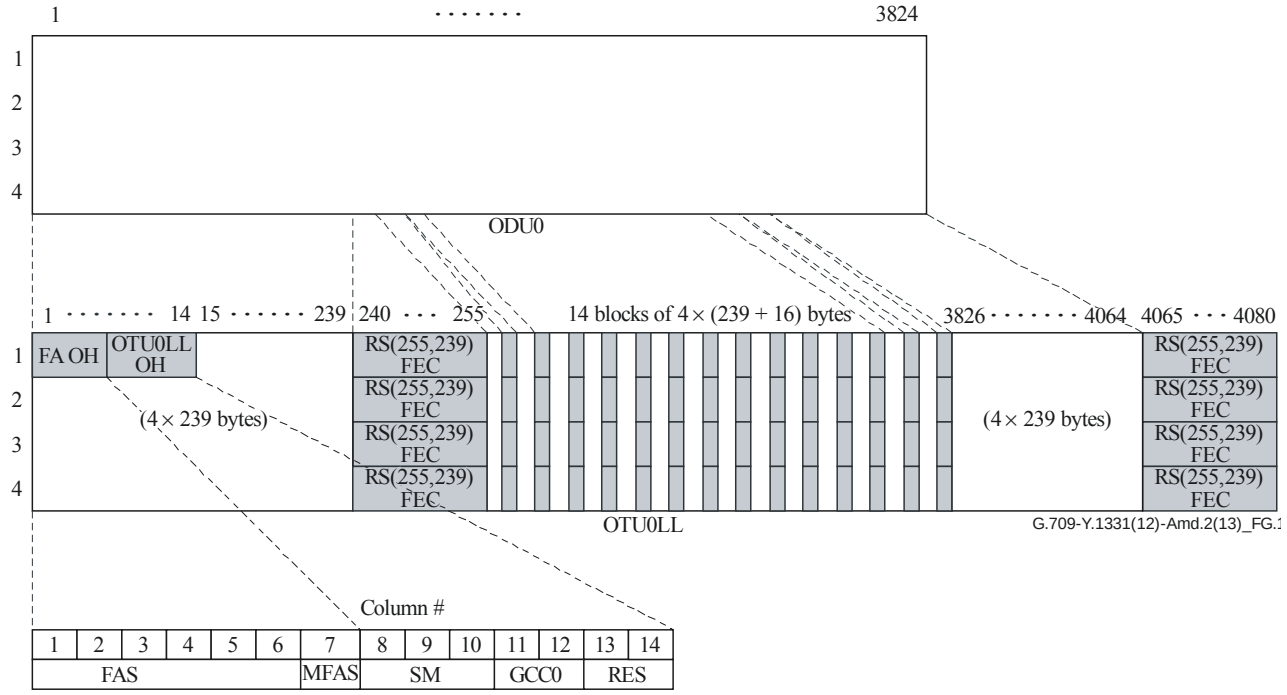

Figure G.1 – OTU0LL frame structure, overhead and ODU0 mapping

The transmission order of the bits in the OTU0LL frame is left to right, top to bottom, and MSB to LSB (see Figure G.2).

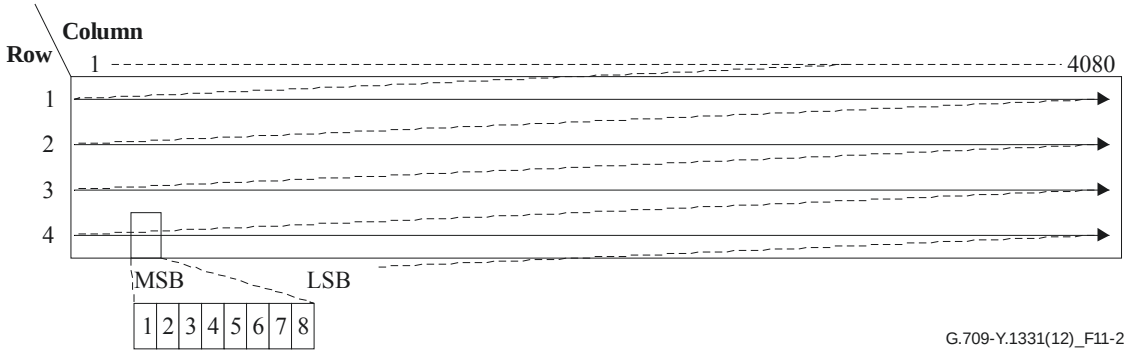

Figure G.2 – Transmission order of the OTU0LL frame bits

G.2.2 Scrambling

The OTU0LL signal must have sufficient bit timing content at the NNI. A suitable bit pattern, which prevents a long sequence of "1"s or "0"s, is provided by using a scrambler.

The operation of the scrambler shall be functionally identical to that of a frame synchronous scrambler of sequence length 65535 operating at the OTU0LL rate.

The generating polynomial shall be $1 + x + x^3 + x^{12} + x^{16}$. Figure G.3 shows a functional diagram of the frame synchronous scrambler.

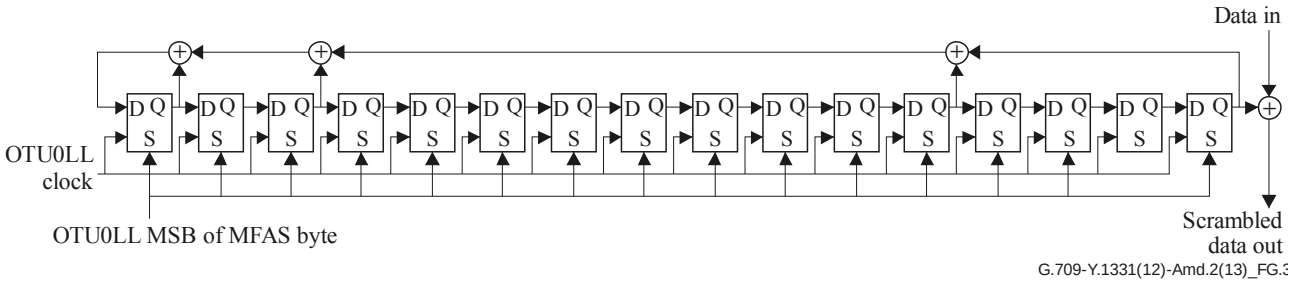

Figure G.3 – Frame synchronous scrambler

The scrambler shall be reset to "FFFF" (HEX) on the most significant bit of the byte following the last framing byte in the OTU0LL frame, i.e., the MSB of the MFAS byte. This bit, and all subsequent bits to be scrambled shall be added modulo 2 to the output from the x^{16} position of the scrambler. The scrambler shall run continuously throughout the complete OTU0LL frame. The framing bytes (FAS) of the OTU0LL overhead shall not be scrambled.

Scrambling is performed after FEC computation and insertion into the OTU0LL signal.

2.7) Bibliography

Add the following entry to the bibliography:

[b-IETF RFC 6205] IETF RFC 6205 (2011), *Generalized Labels for Lambda-Switch-Capable (LSC) Label Switching Routers*.

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