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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Transmission media and optical systems characteristics –
Characteristics of optical systems

Optical interfaces for intra-office systems

Recommendation ITU-T G.693

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Recommendation ITU-T G.693

Optical interfaces for intra-office systems

Summary

Recommendation ITU-T G.693 provides parameters and values for optical interfaces of single channel intra-office systems of nominal 10 Gbit/s and 40 Gbit/s aggregate bit rate. Applications are specified with target distances of 0.6 and 2 km and various loss budgets for ITU-T G.652, ITU-T G.653 and ITU-T G.655 fibres. The latest version makes use of improved specifications for chromatic dispersion of these fibre types.

Source

Recommendation ITU-T G.693 was approved on 13 November 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedures.

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.

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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 ITU-T G.693

Optical interfaces for intra-office systems

1 Scope

The purpose of this Recommendation is to provide optical interface specifications to enable transverse (multivendor) compatibility of nominal 10 Gbit/s and 40 Gbit/s aggregate bit rate intra-office systems for link distances up to 2 km. This Recommendation defines links using optical fibres according to [ITU-T G.652], [ITU-T G.653] and [ITU-T G.655].

Parallel interface specifications may be included in future revisions.

2 References

The following ITU-T 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; 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. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.652] Recommendation ITU-T G.652 (2005), *Characteristics of a single-mode optical fibre and cable*.
- [ITU-T G.653] Recommendation ITU-T G.653 (2006), *Characteristics of a dispersion-shifted single-mode optical fibre and cable*.
- [ITU-T G.655] Recommendation ITU-T G.655 (2006), *Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable*.
- [ITU-T G.691] Recommendation ITU-T G.691 (2006), *Optical interfaces for single channel STM-64 and other SDH systems with optical amplifiers*.
- [ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2003), *Interfaces for the Optical Transport Network (OTN)*.
- [ITU-T G.957] Recommendation ITU-T G.957 (2006), *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*.
- [ITU-T G.959.1] Recommendation ITU-T G.959.1 (2008), *Optical transport network physical layer interfaces*.
- [ITU-T G.8251] Recommendation ITU-T G.8251 (2001), *The control of jitter and wander within the optical transport network (OTN)*.

3 Terms and definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 completely standardized OTUk (OTUk):** [ITU-T G.709].
- 3.1.2 optical tributary signal class NRZ 10G (NRZ 10G):** [ITU-T G.959.1].
- 3.1.3 optical tributary signal class NRZ 40G (NRZ 40G):** [ITU-T G.959.1].

4 Abbreviations and acronyms

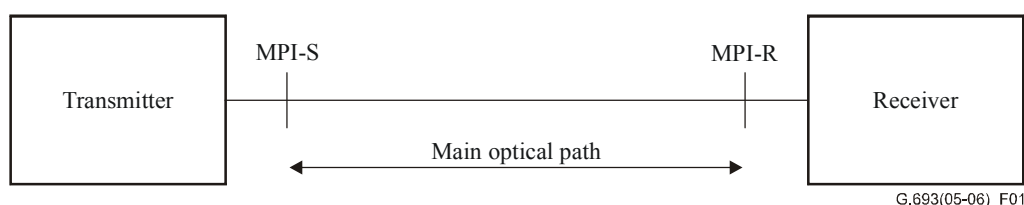
This Recommendation uses the following abbreviations and acronyms:

ASE	Amplified Spontaneous Emission
BER	Bit Error Ratio
DGD	Differential Group Delay
EX	Extinction ratio
FEC	Forward Error Correction
ffs	for further study
MLM	Multi-Longitudinal Mode
MPI	Main Path Interface
MPN	Mode Partition Noise
NA	Not Applicable
NRZ	Non-Return to Zero
ORL	Optical Return Loss
PMD	Polarization Mode Dispersion
PRBS	Pseudo-Random Binary Sequence
RMS	Root Mean Square
SDH	Synchronous Digital Hierarchy
SLM	Single-Longitudinal Mode
SMSR	Side Mode Suppression Ratio
VSR	Very Short Reach
WDM	Wavelength Division Multiplex

5 Classification of optical interfaces

5.1 Applications

This Recommendation defines optical interfaces for single-channel intra-office systems for link distances up to 2 km. These interface descriptions are intended to enable transverse (multivendor) compatibility. Figure 1 illustrates a system of the type considered in this Recommendation, and shows the reference points used to specify optical interface parameters.



NOTE – The main optical path includes fibre and connectors, and may include other passive optical devices such as photonic cross-connects.

Figure 1 – Optical link example showing reference points defined in this Recommendation

Parameters are specified for the transmitter at point MPI-S, for the receiver at point MPI-R, and for the main optical path between points MPI-S and MPI-R.

The main optical path for systems described in this Recommendation may include passive optical devices, e.g., photonic cross-connects, which introduce significant attenuation. Thus, values of maximum attenuation may not be inferred from the target distances of applications. In this Recommendation, attenuation categories are used to distinguish among applications which have the same source and fibre type and target distance, and are intended for the same signal class, but have different values of maximum attenuation. Four attenuation categories are defined with maximum attenuation values of 4 dB, 6 dB, 12 dB and 16 dB, respectively. A fifth category is defined (with a maximum attenuation value for further study) in case the maximum attenuation value provided by the H category is too low to cover all applications.

Appendix II shows examples of system configurations using applications defined in this Recommendation.

5.2 Nomenclature

Applications in this Recommendation are distinguished by application codes. Each code indicates the target distance, highest class of optical tributary signal supported, attenuation category and source and fibre type of the associated application.

Application codes have the following structure:

– W-yAz

where:

W indicates target distance:

– VSR600, VSR1000 and VSR2000, indicating target distances of 0.6 km, 1 km and 2 km, respectively.

y indicates highest class of optical tributary signal supported:

– 2 indicating NRZ 10G.
– 3 indicating NRZ 40G.

A indicates attenuation category:

– R indicating maximum attenuation of 4 dB.
– L indicating maximum attenuation of 6 dB.
– M indicating maximum attenuation of 12 dB.
– H indicating maximum attenuation of 16 dB.
– V indicating maximum attenuation of ffs dB.

The V category has been introduced in case the maximum attenuation value provided by the H category is too low to cover all applications.

z indicates the source and fibre type:

– 1 indicating nominally 1310 nm sources on ITU-T G.652 fibre;
– 2 indicating nominally 1550 nm sources on ITU-T G.652 fibre;
– 3 indicating nominally 1550 nm sources on ITU-T G.653 fibre;
– 5 indicating nominally 1550 nm sources on ITU-T G.655 fibre.

For some application codes, the suffix F is added at the end of the code, to indicate that this application requires FEC bytes as specified in [ITU-T G.709] to be transmitted.

Tables 1 and 2 summarize the application codes described in this Recommendation.

Table 1 – Classification of optical interfaces with 0.6 km target distance

Target distance ^{a)}	0.6 km		
Attenuation category ^{a)}	R	M	
Source nominal wavelength (nm)	1310	1310	1550
Type of fibre	ITU-T G.652	ITU-T G.652	ITU-T G.652 ITU-T G.653 ITU-T G.655
Application codes for optical tributary signal class NRZ 10G	VSR600-2R1	VSR600-2M1	VSR600-2M2 VSR600-2M3 VSR600-2M5
Application codes for optical tributary signal class NRZ 40G	—	—	—
^{a)} Target distances and attenuation categories are for classification and not for specification.			

Source: ITU-T G.693 (11/2009)