अनंतिम टेस्ट गाइड

टीईसी ४८०८१: २०२५

(**सं:** टीएसटीपी/टीईसी/जी आर/आई टी/ईओसी-००१/०४ सितम्बर २०१४ को अधिक्रमित करता है)

TEST GUIDE
TEC 48081:2025

(Supersedes No. : TSTP/TEC/GR/IT/EOC-001/04/SEP 2014)

for

ईथरनेट इलेक्ट्रिकल टू ऑप्टिकल मीडिया कनवर्टर
Ethernet Electrical to Optical Media Converter

(जीआर सं: टीईसी ४८०८०: २०२५)

(Standard No.: TEC 48080:2025)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलालभवन, जनपथ, नई दिल्ली–११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHID LAL BHAWAN, JANPATH, NEW DELHI-110001, INDIA

www.tec.gov.in

Release 02: XXX, 2025

FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This Test Guide of testing pertains to Test Schedule and Test procedures for **Ethernet Electrical to Optical Media Converter.**

CONTENTS

A. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance/functionality/ requirements/ performance of the **Ethernet Electrical to Optical Media Converter** to be deployed-in or implemented through Indian Telecom Network.

B. HISTORY SHEET

Sl. No.	Standard No.	Title	Remarks
1.	TSTP/TEC/GR/IT/EOC001/04/ SEP 2014	TSTP for Ethernet Electrical to Optical Media Converter	Issue No. 1
2.	TEC 48081:2025	Test Guide for Ethernet Electrical to Optical Media Converter	Issue No. 2, Conversion of TSTP to Test Guide

C. General information:

Sl. No.	General Information	Details (to be filled by testing team)	
1	Name and Address of the Applicant		
2	Date of Registration		
3	Name and No. of GR/IR/Applicant's Spec. against which the approval sought		
4	Details of Equipment		
	Type of Equipment	Model No.	Serial No.
(i)			
(ii)			
5	Any other relevant Information:-		

D. Testing team: *(to be filled by testing team)*

S No.	Name	Designation	Organization	Signature

1.				
2.				

E. List of the Test Instruments:

S No.	Name of the test instrument	Make /Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team)*
1.	PC / Laptop		*dd/mm/yyy*
2	Oscilloscope or network Analyser		
3	Ethernet parameters measurement test Jig / Fixture		
4	Optical Power Meter		
5	Optical spectrum Analyser or Digital Communication Analyser		
6	Optical Attenuator		
7	SDH Network Analyser, Optical Splitter OR SDH Analyser with POS capability		
8	PDH / SDH Performance Analyser		

F. Equipment Configuration Offered: (*to be filled by testing team)*

(a)<Equipment/product name> Configuration:

S No.	Item	Details	Remarks

Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

(b) <Other equipment name> Configuration:

S No.	Item	Details	Remarks

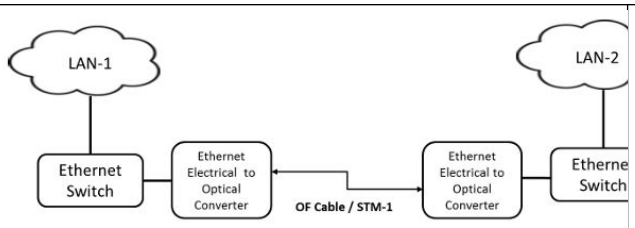
Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

G. Equipment/System Manuals: *(to be filled by testing team)*

Availability of Maintenance manuals, Installation manual, Repair manual & User Manual etc.(Y/N)

H. Clause-wise Test Type and Test No.: -

Cl. No	Sub Cl.	Clause	Type of Test	Compliance
			Physical Check / Declaration / Documentation/ Report from Accredited Test Lab / Functional Verification / Information / Lab Test (Test Reference)	**Complied / Not Complied / Submitted / Not Submitted / Not Applicable (Indicate Annexure No for Test Results)**
1.0		**Introduction**	Information	
	1.1	This document lays down the Generic requirements for all types of Ethernet Electrical to Optical Media Converters to be used to interface with service provider's network. The Interface converter shall be deployed at the customer premises only.	Information	
	1.2	Wherever, the standardized documents like ITU-T, IEEE, QA and TEC documents are referred, the latest issue and number with the amendments shall be applicable.	Information	
2.0		**Description**	Information	
	2.1	Ethernet Electrical to Optical Media Converter is a device that converts an Ethernet UTP electrical signal into light signals for transmission over fiber optic cable. It is used to link Ethernet switches or workstations and extends LAN segments or connecting two Ethernet segments via single mode or multimode fiber cable.	Information	
	2.2	This Media converter is a device that provides cabling flexibility and network distance flexibility. LANs can easily be extended to remote locations.	Information	
	2.3	The functional reference model of Interface converter is as shown in Fig. 1	Declaration	

		 Figure 1: Deployment of Ethernet Electrical to Optical Media Converter the Service Provider's Network.		
3.0		**Functional / Operational Requirements:-**	Information	
	3.1	**General features:** Ethernet Electrical to Optical Media Converter shall support the following General features	Information	
	3.1.1	It shall provide Ethernet Electrical to Fiber conversion.	Lab test - Refer test No. 2 of Compendium	
	3.1.2	It shall support single mode or multimode fiber.	Lab test. Refer test No. 12 (spectrum) of Compendium	
	3.1.3	It shall support full / half / auto duplex mode of communication.	Functional verification	
	3.1.4	It shall support slide switch for UTP Uplink or Down link.	Functional verification	
	3.1.5	It shall support Automatic UTP polarity correction.	Functional verification	
	3.1.6	It shall support data rate 100 Mbps or more for interfaces of 100 Mbps or more speeds.	Functional verification using FTP. Refer test No. 2 for setup of Compendium. FTP throughput shall be minimum 80% of the rated throughput taking into accountthe ethernet frame/IP overheads.	
	3.1.7	Delay time of Ethernet Electrical to Optical	Functional	

		Media Converter shall be not more than 130 n sec.	verification	
	3.1.8	It shall support one of the following wave length and distance.	Information	
	3.1.8.a	850 nm (Multimode)with minimum distance of 300 m.	Lab test - Refer test No. 11, 12 & 13 of Compendium	
	3.1.8.b	1310 nm (Single Mode) with minimum distance of 20 km	Lab test - Refer test No. 11, 12 & 13 of Compendium	
	3.1.8.c	1550 nm (Single Mode) with minimum distance of 40 km	Lab test - Refer test No. 11, 12 & 13 of Compendium	
		Tendering authority shall indicate the exact requirement.	Information	
	3.1.9	It shall support a Bit Error Rate 1 in 10^9 or better.	Test for Bit Error Rate - Refer Test No. 15 of Compendium	
	3.1.10	It shall support in-band management via SNMP version 2, version 3 and ~~Telnet~~ SSH using Command Line Interface or Graphical User Interface.	Test for Management Interface - Refer Test No. 19 of Compendium	
3.2		**Other features:-**	Declaration	
	3.2.1	Ethernet Electrical to Optical Media Converter shall support at least following indications for monitoring as network status indicator:-	Information	
	a)	**DC Power Supply Indicator:** This shall be steady when DC power available to converter	Physical verification	
	b)	**Auto Polarity Indicator:** Lit when the receive polarity is reversed	Physical verification	
	c)	**Link Test Fine Indicator:** This shall be steady when twisted pair or fiber optic link is properly connected	Physical verification	
	d)	**Collision Indicator:** Blinks when a collision is detected	Physical verification	
	e)	**Optic Reception Indicator:** Lit when the optical signal is received	Physical verification	
	f)	UTP Reception Indicator	Physical verification	

	g)	**Activity Indicator:** Blinks when there is activity on the connected port.	Physical verification	
	h)	UTP (Ethernet) Activity Indicator.	Physical verification	
	3.2.2	**Power Supply:** The Ethernet Electrical to Optical Media Converter shall support any of the following powering arrangements be as follows:	Information	
	a)	**AC power Supply:** Directly AC power (Voltage Range: 230V +10% or –15%, frequency range: 50 Hz +/- 2 Hz)	Functional verification for voltage variation and Declaration for frequency variation	
	b)	**DC supply:** The equipment shall be able to powered on from a voltage source having nominal voltage of –48 volt. D.C. with a voltage variation of –40 to –57 volt.	Functional verification	
		Tendering authority shall indicate the exact requirement**.**	Information	
	3.2.3	**Mounting Arrangements:** The Ethernet Electrical to Optical Media Converter shall be rack-mounted type that will fit into a 19" rack or can be standalone/table-top or wall mounted.	Physical Verification	
3.3		**Engineering Requirements:** The Ethernet Electrical to Optical Media Converter shall meet the following engineering requirements:	Information	
	3.3.1	**The equipment shall have:**	Information	
	a)	Proper earthing arrangement	Declaration	
	b)	Protection against short circuit / open circuit	Declaration	
	c)	Protection against accidental operations for all switches / controls provided in the front panel	Declaration	
	d)	Protection against entry of dust, insects and lizards	Declaration	
4.0		**Interface Requirements:** Ethernet Electrical to Optical Media Converter shall support following interfaces:	Information	
4.1		**Electrical Interface:-** It shall support one or more of the following interface	Information	
	~~a)~~	~~10/100 Ethernet Electrical as per IEEE 802.3~~	~~Test for Ethernet Interface –~~	

			~~Refer Test No. 10 of Compendium~~	
	a~~b~~)	10/100/1000 Ethernet Electrical Interface as per IEEE 802.3 (mandatory)	Test for Ethernet Interface - Refer Test No. 10 of Compendium	
	~~c)~~	~~10Mbps Ethernet Electrical Interface as per IEEE 802.3~~	~~Test for Ethernet Interface – Refer Test No. 10 of Compendium~~	
	~~d)~~	~~100Mbps Ethernet Electrical Interface as per IEEE 802.3~~	~~Test for Ethernet Interface – Refer Test No. 10 of Compendium~~	
	~~e)~~	~~1000Mbps Ethernet Electrical Interface as per IEEE 802.3~~	~~Test for Ethernet Interface – Refer Test No. 10 of Compendium~~	
		Note: The Ethernet electrical interfaces shall meet the Differential output voltage, AC Differential input impedance and Output Jitter tests as per IEEE 802.3.	Declaration	
	4.1.1	Connector: RJ-45, 8-pin connector.	Physical Verification	
	4.1.2	Link Length: 100 meters or more.	Physical Verification	
		Tendering authority shall indicate the exact requirement.	Information	
4.2		**Fiber Optic Interface:-** It shall support one or more of the following interfaces:-	Information	
	a)	STM-1 optical interface for Short Haul operation using Monomode or Multimode laser diode as per Table 2/G.957.	Test for output Power - Refer test No. 11 of Compendium	

			Test for Wavelength Ration - Refer Test No. 12 of Compendium	
			Test for Receiver Senstivity - Refer Test No. 13 of Compendium	
			SDH interface test - Refer test No. 14 of the Compendium	
	e)	STM-1 optical interface for Long Haul operation using Monomode or Multimode laser diode as per Table 2/G.957.	Test for output Power - Refer test No. 11 of Compendium	
			Test for Wavelength Ration - Refer Test No. 12 of Compendium	
			Test for Receiver Senstivity - Refer Test No. 13 of Compendium	
			SDH interface test - Refer test No. 14 of the Compendium	

	f)	100Base_FX as per IEEE 802.3 Section 2.	Test for output Power - Refer test No. 11 of Compendium	
			Test for Wavelength Ration - Refer Test No. 12 of Compendium	
			Test for Receiver Senstivity - Refer Test No. 13 of Compendium	
	d)	1000Base_X i.e. 1000Base_LX (Long wave length lesser) as per IEEE 802.3 section 3	Test for output Power Refer test No. 11 of Compendium	
			Test for Wavelength Ration - Refer Test No. 12 of Compendium	
			Test for Receiver Senstivity - Refer Test No. 13 of Compendium	
	e)	1000Base_SX (Short wave length lesser) as per IEEE 802.3 section 3.	Lab. Test - Refer Test No. 11, 12 & 13 of Compendium	
		Note: The optical output power, extinction ratio, spectrum and receiver sensitivity of the STM-1 optical interfaces shall be as per G.957 and the Ethernet optical interfaces shall be as per IEEE 802.3.	Declaration	

	4.2.1	Connector: ST and or SC or FC / LC Type	Physical Verification	
		Tendering authority shall indicate the exact requirement.	Information	
	4.2.2	It shall support a local USB port/ Ethernet port for debugging the Electrical to optical conversion devices.	Physical Verification	
5.0		**Quality Requirements (QR):** The Ethernet Electrical to Optical Media Converter shall meet the following qualitative requirements:	Information	
5.1		The manufacturer shall furnish the MTBF value. Minimum value of MTBF shall be specified by the purchaser. The calculations shall be based on the guidelines given in either QA document No. QM-115 {January 1997} "Reliability Methods and Predictions" or any other international standards ~~The supplier / manufacturer shall manufacture with international quality standards ISO 9002 or later, for which the manufacturer shall be duly accredited. The quality plan describing the quality assurance system followed by the manufacturer shall conform to the guidelines given by CGM QA from time to time and shall be submitted.~~	Declaration	
5.2		The equipment shall be manufactured in accordance with international quality management system ISO 9001:2015 or any other equivalent ISO certificate for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer would be required to be submitted ~~The equipments locally manufactured in India shall be as per guidelines issued by Chief General Manager, Quality Assurance Wing of the BSNL vide Documents No. QM 118, QM 205, QM 206, QM 210, QM 301 and SD (QM) – 333 March 2010.~~	Declaration	
5.3		The equipment shall conform to the requirements for Environment specified in TEC QA standards QM-333 {Issue- March, 2010}(TEC 14016:2010) "Standard for Environmental testing of Telecommunication Equipments" or any other equivalent international standard, for operation, transportation and storage. The applicable environmental category A or B to be decided by the purchaser based	Declaration	

		on the use case. ~~The equipment shall meet the environmental requirements as per category A of SD (QM) – 333 March 2010.~~		
5.4		All components used should be as per QM – 324. It may be ensured that use of non-chinese components is a part of QM-324. ~~All components used shall be as per approval procedures prescribed by BSNL in document QA QM – 324~~	Declaration	
~~5.5~~		~~Marking and identification of the equipment, sub assemblies, PCBs etc. shall be as per guidelines given in para 51.17 Quality Assurance Telecom Document QM 351 / issue 2 / Jan.'95.~~	~~Declaration~~	
~~5.6~~		~~The MTBF (Mean Time Between Failure) and MTTR (Mean Time To Restore) predicted and the manufacturer shall furnish observed values along with calculations.~~	~~Declaration~~	
6.0		**EMI/EMC Requirements**	Certificate from accredited test lab.	
7.0		**Safety Requirements**	Information	
		The equipment shall conform to relevant safety requirements as per IS/IEC 62368-1:2018 or Latest as prescribed under Table no. 1 of the TEC document 'SAFETY REQUIREMENTS OF TELECOMMUNICATION EQUIPMENT": TEC10009: 2024. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements.	1. A test certificate and tests report shall be furnished from a accredited test lab. 2. Test agency shall be an ISO 17025 accredited and details of accreditation shall be furnished.	
8.0		**Security Requirements:-**	Information	
		No Requirements specified		
9.0		**Various requirements of the category/configuration of the product for testing**	Information	

9.1		Minimum Equipment's to be offered for Type-Approval	Information	
	9.1.1	Two number of UTP to optical converters shall be offered for Type approval	Information	
		CHAPTER 2		
10.0		**Information for the procurer of product**	Information	
10.1		Installation Requirements:	Information	
	10.1.1	All necessary interfaces, connectors, connecting cables and accessories required for satisfactory installation and convenient operations shall be supplied. Type of connectors, adopters to be used shall be in conformity with the interfaces defined in this GR.	Information	
	10.1.2	It shall be ensured that all testers, tools and support required for carrying out the stage by stage testing of the equipment before final commissioning of the network shall be supplied along with the equipment.	Information	
	10.1.3	All installation materials, consumables and spare parts to be supplied.	Information	
	10.1.4	All literature and instructions required for installation of the equipment, testing and bringing it to service shall be made available in English language.	Information	
	10.1.5	For the installations to be carried out by the supplier, the time frames shall be furnished by the supplier including the important milestones of the installation process well before commencing the installations.	Information	
10.2		**Documentation:**	Information	
		This clause describes the general requirements for documentation to be provided. All technical documents shall be in English language both in CDROM and in hard copy.	Information	
	10.2.1	The documents shall comprise of:	Information	
	10.2.1.1	System description documents	Information	
	10.2.1.2	**Installation, Operation and Maintenance documents**	**Information**	
	10.2.1.3	Training documents	Information	
	10.2.1.4	Repair manual	Information	

	10.2.2	System description documents: The following system description documents shall be supplied along with the system.	Information	
	10.2.2.1	Over-all system specification and description of hardware and software	Information	
	10.2.2.2	Cabling and wiring diagrams.	Information	
	10.2.2.3	Detailed specification and description of all Input / Output devices	Information	
	10.2.2.4	Adjustment procedures, if there are any field adjustable units.	Information	
	10.2.2.5	Spare parts catalogue - including information on individual component values, tolerances, etc. Enabling procurement from alternative sources.	Information	
	10.2.2.6	Detailed description of software describing the principles, functions, and interactions with hardware, structure of the program and data.	Information	
	10.2.2.7	Detailed description of each individual software package indicating its functions and its linkage with the other packages, hardware, and data	Information	
	10.2.2.8	Graphical description of the system. In addition to the narrative description a functional description of the system using the functional Specification	Information	
	10.2.3	System operation documents: The following system operation documents shall be available.	Information	
	10.2.3.1	Installation manuals and testing procedures	Information	
	10.2.3.2	Precautions for installation, operations and maintenance	Information	
	10.2.3.3	Operating and Maintenance manual of the system	Information	
	10.2.3.4	Safety measures to be observed in handling the equipment	Information	
	10.2.3.5	Man-machine language manual	Information	
	10.2.3.6	Fault location and troubleshooting instructions including fault dictionary.	Information	
	10.2.3.7	Test jigs and fixtures required and procedures for routine maintenance, preventive maintenance and unit / card / sub-assembly replacement.	Information	
	10.2.3.8	Emergency action procedures and alarm dictionary.	Information	

	10.2.4	Training Documents	Information	
	10.2.4.1	Training manuals and documents necessary for organizing training in installation, operation and maintenance and repair of the system shall be made available	Information	
	10.2.4.2	Any provisional document, if supplied, shall be clearly indicated. The updates of all provisional documents shall be provided immediately following the issue of such updates	Information	
	10.2.4.3	The structure and scope of each document shall be clearly described	Information	
	10.2.4.4	The documents shall be well structured with detailed cross-referencing and indexing enabling easy identification of necessary information	Information	
	10.2.4.5	All diagrams, illustrations and tables shall be consistent with the relevant text	Information	
	10.2.5	Repair Manual	Information	
	10.2.5.1	List of replaceable parts used	Information	
	10.2.5.2	Detailed ordering information for all the replaceable parts	Information	
	10.2.5.3	Procedure for trouble shooting and sub-assembly replacement	Information	
	10.2.5.4	Test fixtures and accessories for repair	Information	
	10.2.5.5	Systematic trouble shooting charts (fault tree) for all the probable faults with their remedial actions	Information	
10.3		**Tendering Authority Information:** The following information shall be specified by the purchaser while tendering the items	Information	
	10.3.1	Optical wavelength and distance requirement as per clause 3.1.8 ~~10~~	Information	
	10.3.2	Power supply requirements as per clause 3.2.2	Information	
	10.3.3	Mounting arrangement as per clause 3.2.3	Information	
	10.3.4	Electrical interfaces as per clause 4.1	Information	
	10.3.5	Optical interfaces as per clause 4.2	Information	
	10.3.6	Optical connector requirement as per clause 4.2.1	Information	
	10.3.7	Installation requirements as per clause 10.1	Information	
	10.3.8	Documentation requirements as per clause 10.2	Information	
	11.0	Specific items to be mentioned in the	Information	

		certificate		
		The following information shall be specified in the certificate:	Information	
	11.1	Make and Model Number	Information	
	11.2	Wave length supported as per clause 3.1.8 ~~10~~	Information	
	11.3	Type of power supply supported as per clause 3.2.2	Information	
	11.4	Mounting arrangement as per clause 3.2.3	Information	
	11.5	Electrical Interface supported as per clause 4.1	Information	
	11.6	Optical Interfaces supported as per clause 4.2	Information	
	11.7	Optical interface connector as per clause 4.2.1	Information	

***** *Physical Check/Declaration/Documentation/ Report from Accredited test lab/ Functional verification / Information / Test No.*

I. TEST SETUP & PROCEDURES:

1. Test No.	
2. Test Details	*Name and Other relevant details*
3. Test Instruments Required	1. <Name> 2.
4. Test Setup	
5. Test Procedure	*Testing Steps may be written here.....* 1. …….. 2. …….. 3. ……..
6. Test Limits	(*if any*)
7. Expected Results	1. ……..<values>…….. 2. ……..<values>…….. 3.

Further Test Setup & Procedures may be added as per requirement

J. SUMMARY OF TEST RESULTS

TEC Standard No.

TEC Test Guide No.

Equipment name & Model No.

Clause No.	***Compliance*** *(Compiled /Not Compiled /Submitted/Not Submitted /Not Applicable)*	***Remarks / Test Report Annexure No***.

[Add as per requirement]

Date:

Place: ***Signature & Name of TEC testing Officer /***

**** Signature of Applicant / Authorized Signatory***

- ***Section J as given above is also to be submitted by the Applicant/ Authorised signatory as part of in-house test results along with Form-A. The Authorised signatory shall be the same as the one for Form 'A'.***

टेस्ट गाइड संग्रह
टीईसी ४८१६९:२०२४

Compendium of TEST GUIDE
TEC 48169:2024

Compendium of Test Guides of IT

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र
खुर्शीदलाल भवन, जनपथ, नई दिल्ली–११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE
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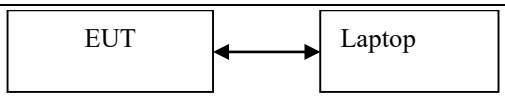
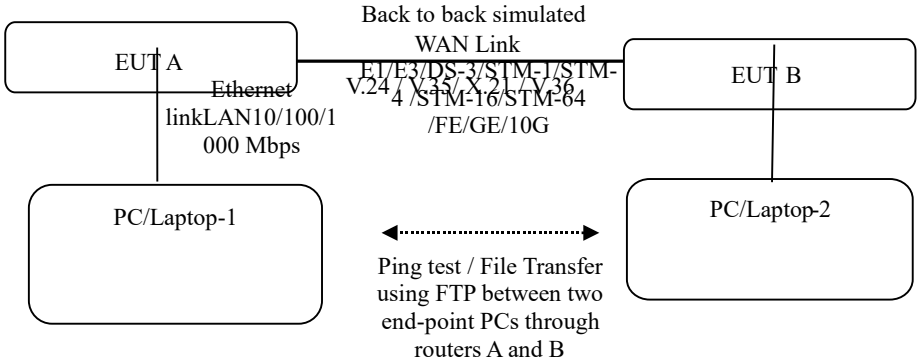
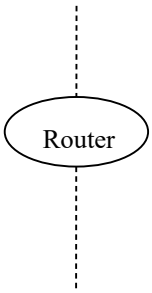
History Sheet

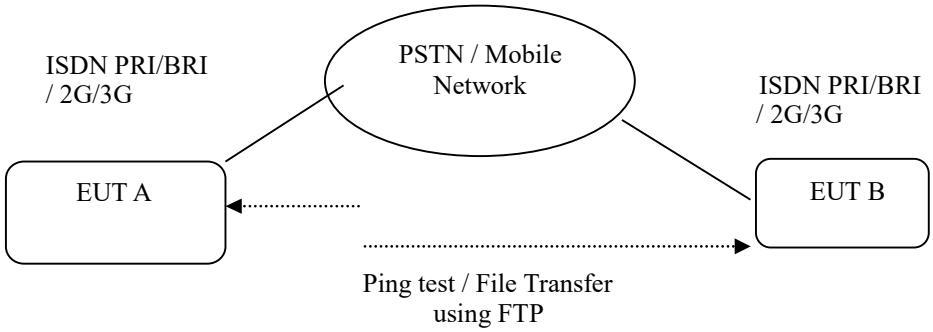
S.No.	Name & Number	Remarks
1	Compendium of Tests	1st issue March 2014
2.	Compendium of Tests	2nd issue September 2014
3.	Compendium of Tests	3rd issue November 2014
4.	Compendium of Tests	4th issue December 2014
5.	Compendium of Tests	5th issue April 2015
6.	Compendium of Tests	6th issue April 2016 after incorporation of detailed protocol tests as per RFC's
7.	Compendium of Tests TEC 48169:2024	7th issue July 2024 after incorporating additional interfaces

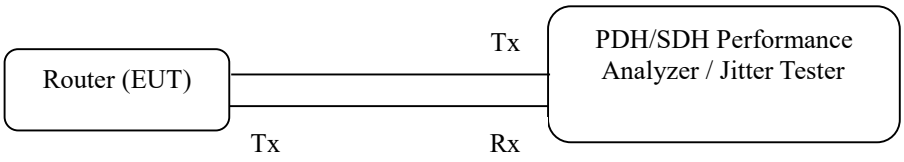
Table of Contents

Test No.	1
Test Details	Test for 10/100/1000 Auto-negotiation Ethernet Interface
Test Instruments Required	1. Laptop
Test Setup	
Test Procedure	1. Set the Laptop Ethernet interface speed to 10Mbps and see whether the EUT is syncing with the Laptop. I.e. the Ethernet interface lamp of the Laptop shall glow. 2. Repeat the above for 100Mbps 3. Repeat the same for 1000Mbps [In case required]
Expected Results	Enclose the Screen Capture Results

Test No.	2
Test Details	Test for the Availability of Service
Test Instruments Required	1. PC / Laptop – 2 Nos
	
Test Procedure	1. Connect the V.24 / V.35 /V.36/X.21/ E1 / E3 / DS-3 / STM-1 / STM-4/STM16/STM-64/FE/GE/10G interface as the case may be as shown in the setup. 2. Connect the PC/Laptop to the 10/100/1000Mbps LAN link as shown 3. Configure the Interface IP of the EUT as well as the PC/Laptop 4. Carry out the Ping test from PC/Laptop-1 to PC/Laptop-2 and see whether it is reachable as well as there are no packet drop 5. Carry out file transfer from PC/Laptop-1 to PC/Laptop-2 6. In case of Nx64, repeat the test at different speeds
Expected Results	Enclose the Ping Results

Test No.	3
Test Details	Test for the Availability of Service (Devices without Ethernet Interface)
Test Instruments Required	1. PC / Laptop – 2 Nos 2. Router or Interface converter in case the EUT do not have the 10/100/1000 Ethernet interface
Test Setup	
Test Procedure	1. Connect the EUT as shown in the setup. 2. Connect the PC/Laptop to the 10/100/1000 Mbps LAN link as shown 3. In case of V.24/V.36/V.37/ V.11/X.21 Interface, same may be connected to the PC/Laptop through a Router acting as interface converter. 4. Configure the Interface IP of the HSL Driver if required, Routers as well as the PC/Laptop 5. Carry out the Ping test from PC/Laptop-1 to PC/Laptop-2 and see whether it is reachable as well as there are no packet drop 6. Carry out file transfer from PC/Laptop-1 to PC/Laptop-2 7. In case of Nx64, repeat the test at different speeds. 8. Carry out Telnet check also.
Expected Results	Enclose the Results/screenshots

Test No.	4
Test Details	PRI/BRI / 2G/3G wave functional test
Test Instruments Required	1. PSTN / 2G/3G conne :tivity
Test Setup	
Test Procedure	1. Connect EUT A and EUT B through PSTN in case of PRI/BRI. 2. Connect EUT A and EUT B through Mobile Network in case of 2G/3G. In such case EUT shall be equipped with 2G/3G interface cards along with SIM 3. Test for Ping and File Transfer from EUT A to EUT B
Expected Results	Enclose the Ping Results

Test No.	5	
Test Details	Test for Output Jitter	
Test Instruments Required	1. PDH/SDH Performance Analyser or Jitter Tester	
Test Setup	PDH/SDH Interface in loopback mode Rx 	
Test Limits	Limits for Output Jitter [Maximum Permissible Jitter at Output Interfaces] for PDH interfaces (64Kbps, 2, 34, 45, 140Mbps)	Refer Table 1/G.823
	Limits for Output Jitter [Maximum Permissible Jitter at Output Interfaces] for SDH interfaces (STM-1, STM-4, STM-16, STM-64)	Refer Table 1/G.825

Standards Reference	**Table 1/G.823**

Table 1/G.823 – Maximum permissible jitter at traffic interfaces

Interface	Measurement bandwidth, –3 dB frequencies (Hz)	Peak-to-peak amplitude (UIpp) (Note 3)
64 kbit/s	20 to 20 k	0.25
(Note 1)	3 k to 20 k	0.05
2048 kbit/s	20 to 100 k	1.5
	18 k to 100 k (Note 2)	0.2
8448 kbit/s	20 to 400 k	1.5
	3 k to 400 k (Note 2)	0.2
34 368 kbit/s	100 to 800 k	1.5
	10 k to 800 k	0.15
139 264 kbit/s	200 to 3.5 M	1.5
	10 k to 3.5 M	0.075

NOTE 1 – For the codirectional interface only.

NOTE 2 – For 2048 kbit/s and 8448 kbit/s interfaces within the network of an operator, the high-pass cut-off frequency may be specified to be 700 Hz (instead of 18 kHz) and 80 kHz (instead of 3 kHz) respectively. However, at interfaces between different operator networks, the values in the table apply, unless involved parties agree otherwise.

NOTE 3 –

64 kbit/s 1 UI = 15.6 µs
2048 kbit/s 1 UI = 488 ns
8448 kbit/s 1 UI = 118 ns
34 368 kbit/s 1 UI = 29.1 ns
139 264 kbit/s 1 UI = 7.18 ns

	Table 1/G.825

Table 1/G.825 – Maximum permissible jitter at network interfaces

Interface	Measurement bandwidth, –3 dB frequencies (Hz)	Peak-to-peak amplitude (UIpp)
STM-1e (Notes 1, 2)	500 to 1.3 M	1.5
	65 k to 1.3 M	0.075
STM-1 (Note 4)	500 to 1.3 M	1.5
	65 k to 1.3 M	0.15
STM-4 (Note 4)	1 k to 5 M	1.5
	250 k to 5 M	0.15
STM-16 (Note 4)	5 k to 20 M	1.5
	1 M to 20 M	0.15

Table 1/G.825 – Maximum permissible jitter at network interfaces (*concluded*)

Interface	Measurement bandwidth, –3 dB frequencies (Hz)	Peak-to-peak amplitude (UIpp)
STM-64 (Note 4)	20 k to 80 M	1.5
	4 M to 80 M	0.15 (Note 3)

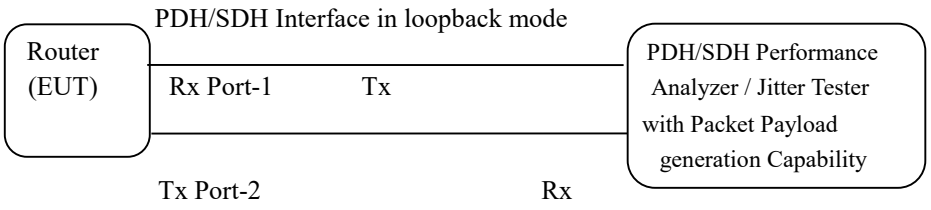
NOTE 1 – Electrical format CMI-encoded, according to G.703.

NOTE 2 – For networks deployed with G.813 Option II clocks or G.812 Type II, III or IV clocks, STM-1 requirements apply to STM-1e.

NOTE 3 – The effect of dispersion and non-linearities on the eye opening and on the choice of this value is for further study.

NOTE 4 – STM-1 1 UI = 6.43 ns
STM-4 1 UI = 1.61 ns
STM-16 1 UI = 0.402 ns
STM-64 1 UI = 0.100 ns

Test Procedure	1. Connect the setup as shown in the figure. 2. Measure the output jitter on the connected PDH/SDH interface 3. Verify whether the output jitter is within the tolerance limits as specified in the relevant ITU specifications as indicated above. 4. Enclose the test results
Expected Results	Enclose the Test Results

Test No.	6
Test Details	Test for Input Jitter Tolerance
Test Instruments Required	1. PDH/SDH Performance analyser with POS capability for SDH and Packet Payload Capability for PDH
Test Setup	
Test Limits	

64 Kbps co-directional interface input jitter and wander tolerance limit	Refer Figure 12/G.823
2048 Kbps input jitter and wander tolerance limit	Refer Figure 13/G.823
34.368 Mbps input jitter and wander tolerance limit	Refer Figure 15/G.823
44.736 Mbps input jitter and wander tolerance limit	Refer Figure 9/G.824
STM-1e Jitter Tolerance Requirement for 2048Kbps Networks	Refer Figure 2/G.825
STM-4 Jitter Tolerance Requirement	Refer Figure 3/G.825
STM-16 Jitter Tolerance Requirement	Refer Figure 4/G.825
STM-64 Jitter Tolerance Requirement	Refer Figure 5/G.825

Standards reference

Figure 12/G.823

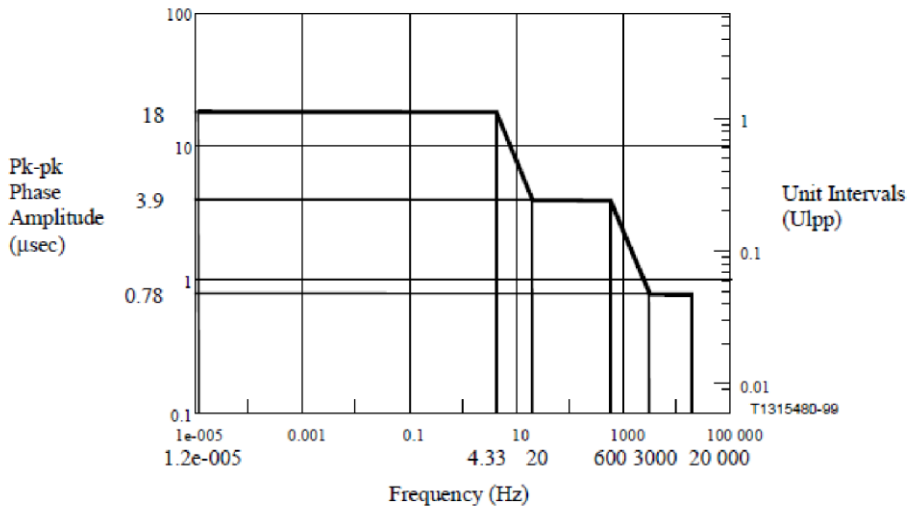


Figure 12/G.823 – 64 kbit/s input jitter and wander tolerance limit

Figure 13/G.823

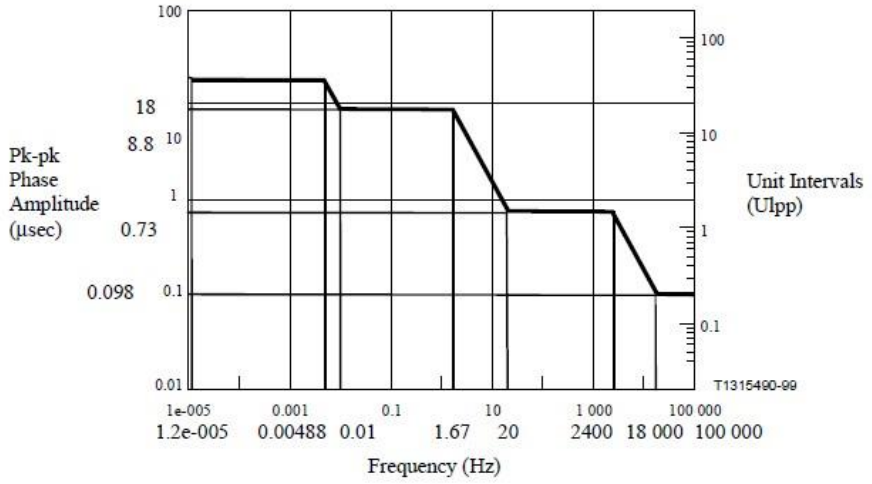


Figure 13/G.823 – 2048 kbit/s input jitter and wander tolerance limit

Figure 15/G.823

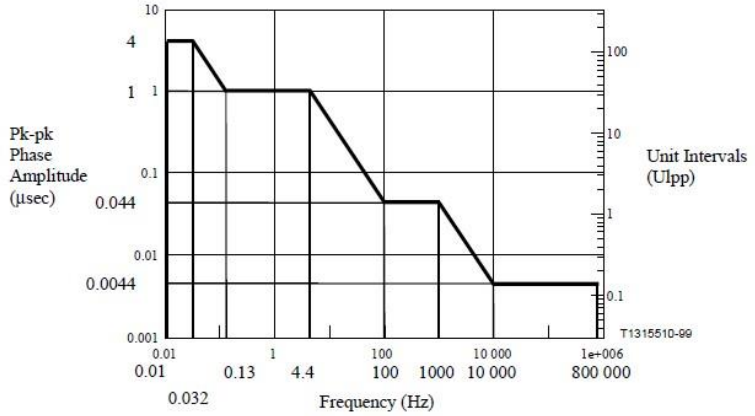


Figure 15/G.823 – 34 368 kbit/s input jitter and wander tolerance limit

Figure 9/G.824

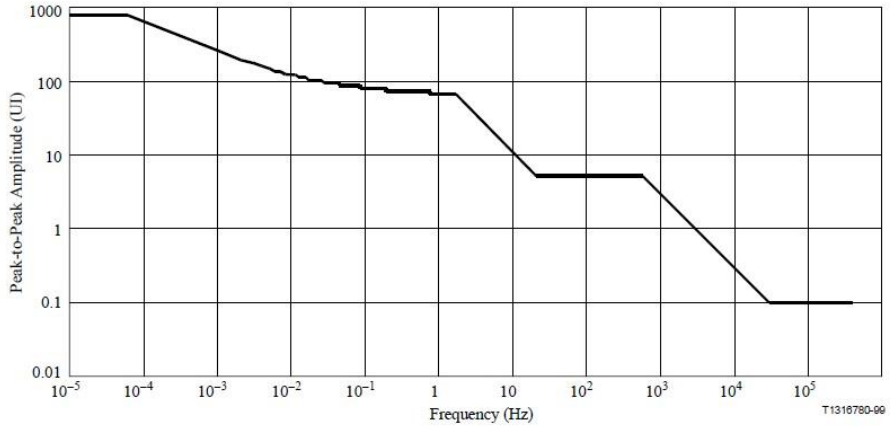


Figure 9/G.824 – Jitter and wander tolerance of 44 736 kbit/s input ports

Figure 2/G.825

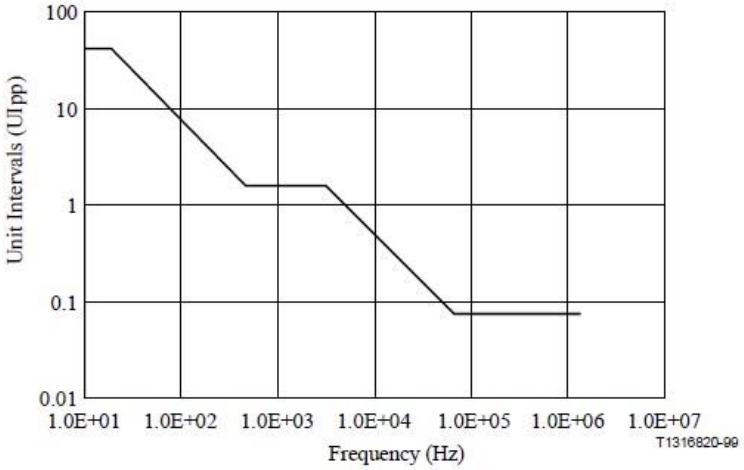
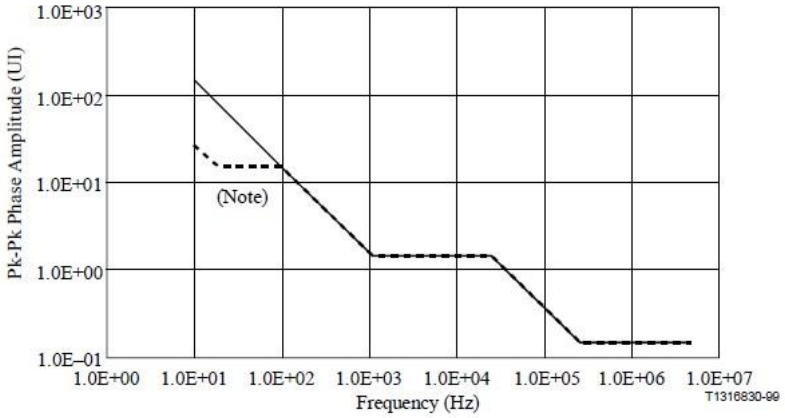


Figure 2/G.825 – STM-1e jitter tolerance requirement (applies to 2048 kbit/s networks only)

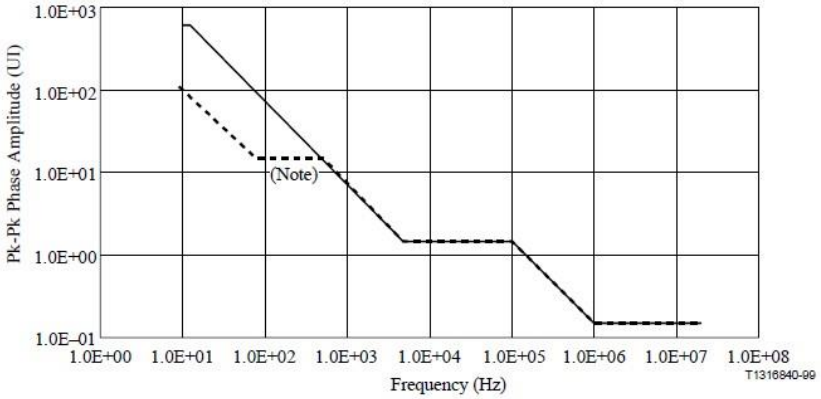
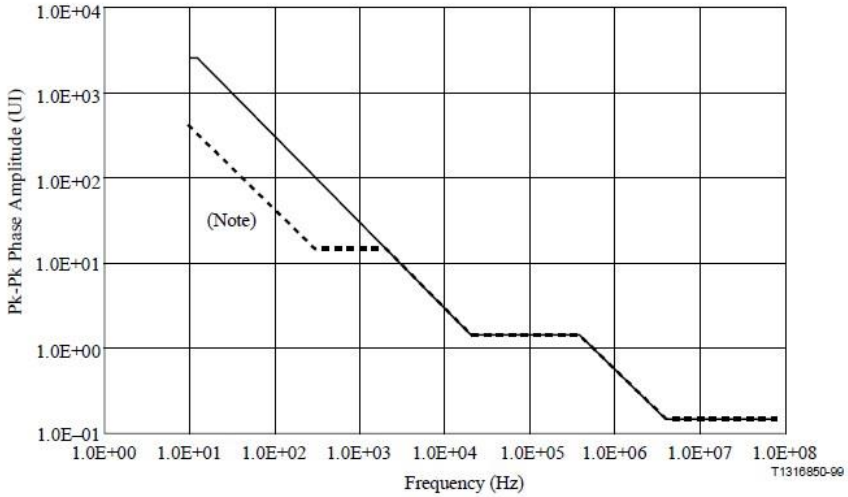
Figure 3/G.825

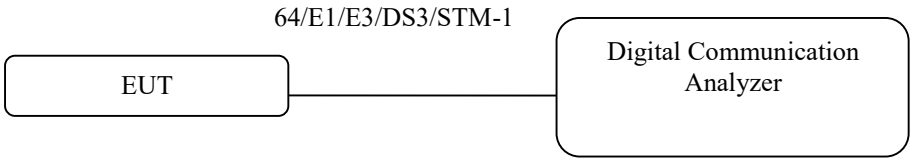


NOTE – The dashed curve is the requirement for 1544 kbit/s networks for frequencies less than 100 Hz.

Figure 3/G.825 – STM-4 jitter tolerance

Figure 4/G.825

	 NOTE – The dashed curve is the requirement for 1544 kbit/s networks for frequencies less than 500 Hz. **Figure 4/G.825 – STM-16 jitter tolerance**
	Figure 5/G.825
	 NOTE – The dashed curve is the requirement for 1544 kbit/s networks for frequencies less than 2 kHz. **Figure 5/G.825 – STM-64 jitter tolerance**
Test Procedure	1. Connect the setup as shown in the figure. 2. Configure the Router with Port-1 as IP-1 and Port-2 as IP-2 3. Configure the POS in the SDH analyser with Source Address as IP-1 and destination address as IP-2 4. Configure Router-A for Static routing the packets 5. SDH Analyser shall introduce Jitter over the generated packets with PRBS pattern as per G.825 6. Measure the Jitter tolerance as per the Mask and Range of frequencies 7. Take a plot of the Jitter tolerance along with the Mask
Expected Results	Enclose the Test Results

Test No.	7
Test Details	Test for Output Pulse Mask for PDH/SDH interfaces
Test Instruments Required	1. Digital Communication Analyser OR Digital Storage Oscilloscope
Test Setup	

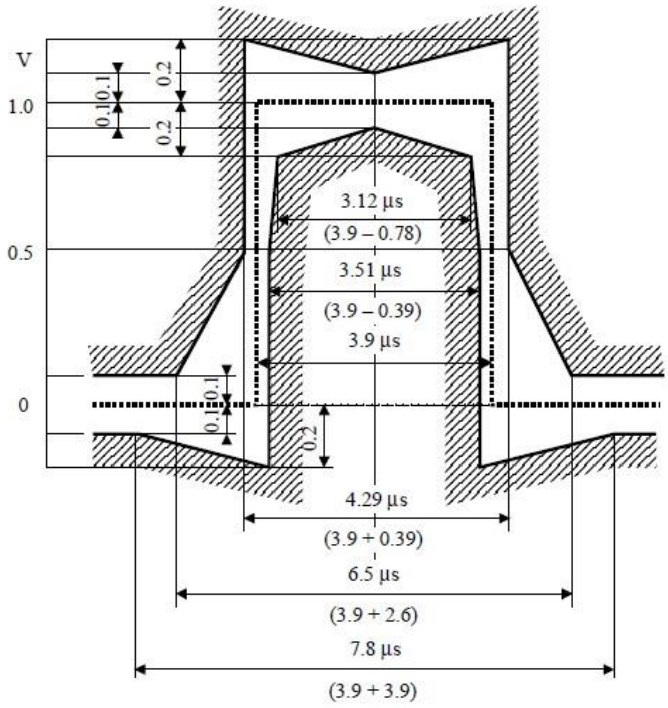
Test Limits		
	Limits for Pulse shape & characteristics for 64Kbps co-directional interface	Refer Table-1 and Figure-5 G.703
	Limits for Pulse shape & characteristics for 2048kbps (E1) interface	Refer Table-7 and Figure-15 G.703
	Limits for Pulse shape & characteristics for 34Mbps interface	Refer Table-9 and Figure-17 G.703
	Limits for Pulse shape & characteristics for 44.736Mbps (DS3) Interface	Refer Table-6 and Figure-14 G.703
	STM-1	Refer Table-12 and Figure-22,23 G.703

Standards reference

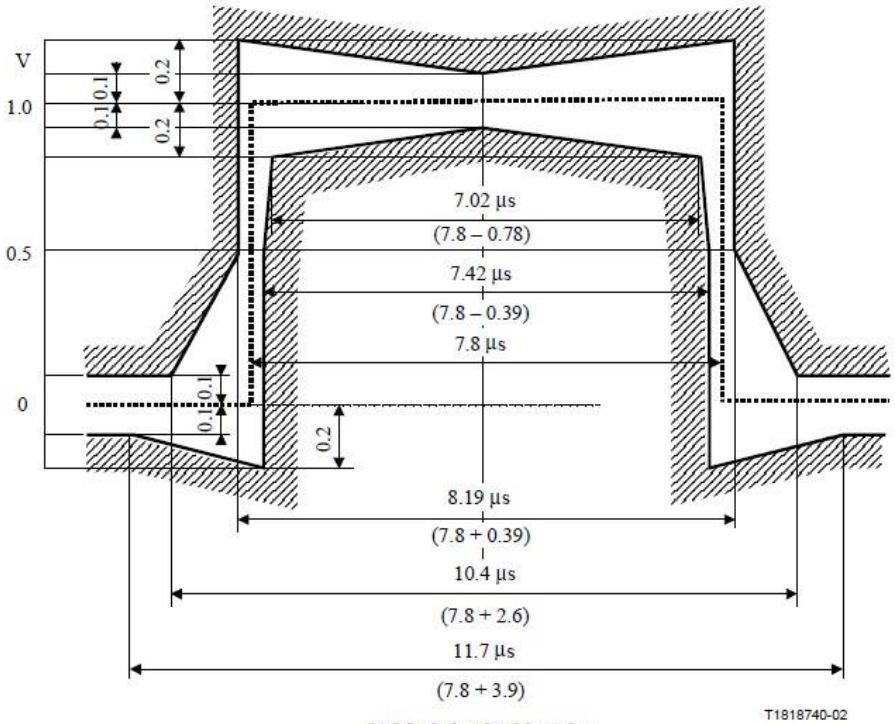
Table-1 and Figure-5 G.703

Table 1/G.703 – Digital 64 kbit/s codirectional interface

Symbol rate	256 kBauds
Pulse shape (nominally rectangular)	All pulses of a valid signal must conform to the masks in Figure 5, irrespective of the polarity
Pair for each direction	One symmetric pair
Test load impedance	120 ohms resistive
Nominal peak voltage of a "mark" (pulse)	1.0 V
Peak voltage of a "space" (no pulse)	0 V ± 0.10 V
Nominal pulse width	3.9 µs
Ratio of the amplitudes of positive and negative pulses at the centre of the pulses interval	0.95 to 1.05
Ratio of the widths of positive and negative pulses at the nominal half amplitude	0.95 to 1.05
Maximum peak-to-peak jitter at the output port (Note)	Refer to 5.1/G.823
NOTE – For the time being these values are valid only for equipments of the 2 Mbit/s hierarchy.	



a) Mask for single pulse



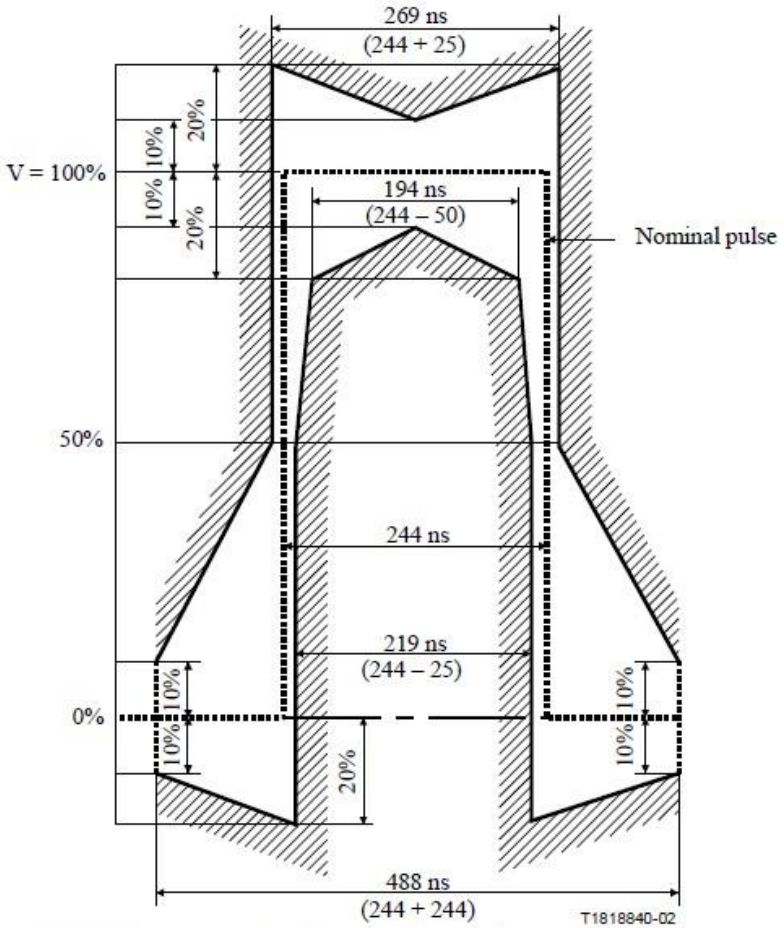
b) Mask for double pulse

NOTE – The limits apply to pulses of either polarity.

Table-7 and Figure-15 G.703

Table 7/G.703 – Digital interface at 2048 kbit/s

Pulse shape (nominally rectangular)	All marks of a valid signal must conform with the mask (see Figure 15) irrespective of the sign. The value V corresponds to the nominal peak value.	
Pair(s) in each direction	One coaxial pair (see 9.4)	One symmetrical pair (see 9.4)
Test load impedance	75 ohms resistive	120 ohms resistive
Nominal peak voltage of a mark (pulse)	2.37 V	3 V
Peak voltage of a space (no pulse)	0 ± 0.237 V	0 ± 0.3 V
Nominal pulse width	244 ns	
Ratio of the amplitudes of positive and negative pulses at the centre of the pulse interval	0.95 to 1.05	
Ratio of the widths of positive and negative pulses at the nominal half amplitude	0.95 to 1.05	
Maximum peak-to-peak jitter at an output port	Refer to 5.1/G.823	



NOTE – V corresponds to the nominal peak value.

Figure 15/G.703 – Mask of the pulse at the 2048 kbit/s interface

Table-9 and Figure-17 G.703

Table 9/G.703 – Digital interface at 34 368 kbit/s

Pulse shape (nominally rectangular)	All marks of a valid signal must conform with the mask (see Figure 17), irrespective of the sign.
Pair(s) in each direction	One coaxial pair (see 11.4)
Test load impedance	75 ohms resistive
Nominal peak voltage of a mark (pulse)	1.0 V
Peak voltage of a space (no pulse)	0 V ± 0.1 V
Nominal pulse width	14.55 ns
Ratio of the amplitudes of positive and negative pulses at the center of a pulse interval	0.95 to 1.05
Ratio of the widths of positive and negative pulses at the nominal half amplitude	0.95 to 1.05
Maximum peak-to-peak jitter at an output port	Refer to 5.1/G.823

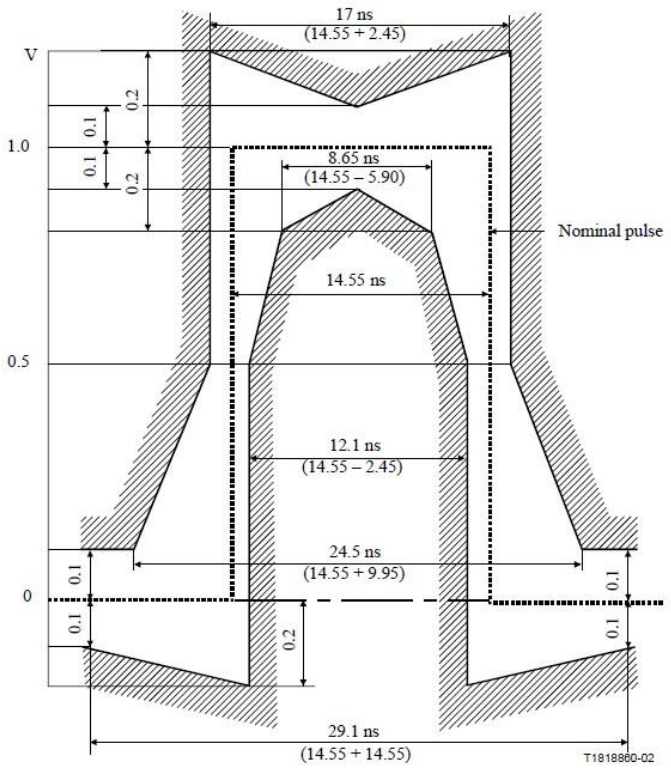


Figure 17/G.703 – Pulse mask at the 34 368 kbit/s interface

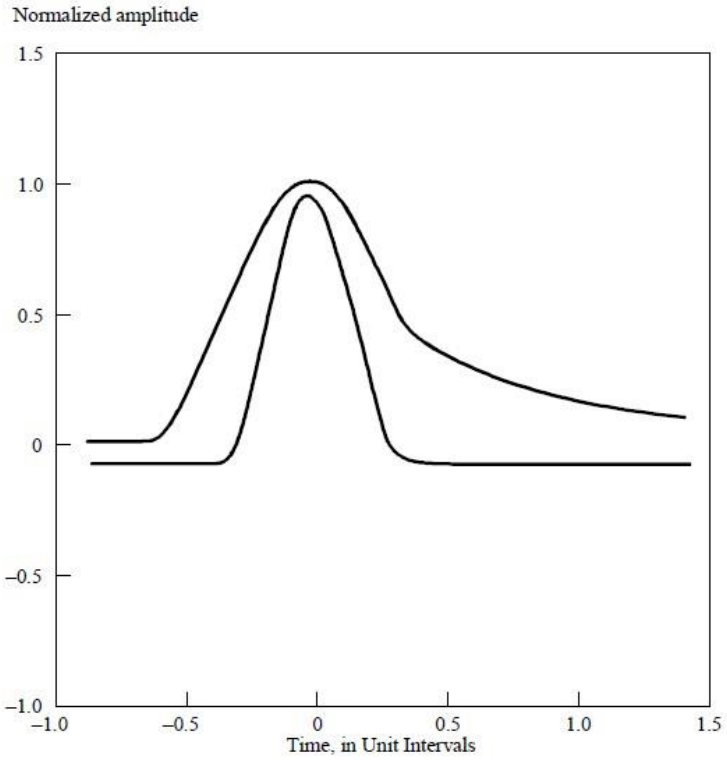
S

Table-6 and Figure-14 G.703

Table 6/G.703 – Digital interface at 44 736 kbit/s

Parameter	Specification
Nominal bit rate	44 736 kbit/s
Bit rate accuracy	In a self-timed, free-running mode, the bit rate accuracy shall be ±895 bits/s (±20 ppm) or better.
Line code	B3ZS (bipolar with three-zero substitutions)
Frame structure	The signal shall have the frame structure defined in ITU-T Rec. G.752 to ensure transmission through all types of 44 736 kbit/s transport equipment. The frame structure is not required for multiplexing to higher level DSN signals.
Medium	One unbalanced coaxial line shall be used for each direction of transmission.
Test load impedance	A resistive test load of 75 ohms ± 5% shall be used at the interface for the evaluation of pulse shape and the electrical parameters specified below.
Pulse amplitude	The amplitude (Note 1) of an isolated pulse shall be between 0.36 V and 0.85 V peak.
Pulse shape	The shape of every pulse that approximates an isolated pulse (is preceded by two zeros and followed by one or more zeros) shall conform to the mask in Figure 14. See 5.2 for allowable procedures to be followed in checking conformance. This mask includes an allowance of ±3% of the peak pulse amplitude at any point on the mask relative to the pulse mask in the earlier version. Equations defining the various line segments making up the mask are listed below the figure.
Power level	A wideband power measurement of an AIS signal (as defined in ITU-T Rec. G.704) using a power level sensor with a working frequency range of 200 MHz shall be between –4.7 dBm and +3.6 dBm, including the effects of a range of connecting cable lengths between 68.6 meters (225 feet) and 137.2 meters (450 feet). A low-pass filter having a flat passband and cutoff frequency of 200 MHz shall be used. The rolloff characteristics of this filter are not important; or an alternate power level specification of the power of an all-ones signal (Note 2) is useful for some equipment qualifications. It requires that the power in a 3 kHz ± 1 kHz band centered at 22 368 kHz be between –1.8 dBm and +5.7 dBm. It further requires that the power in a 3 kHz ± 1 kHz band centered at 44 736 kHz be at least 20 dB below that at 22 368 kHz.
Pulse imbalance	1) The ratio of amplitudes of positive and negative isolated pulses shall be between 0.90 and 1.10. 2) Positive and negative isolated pulses shall both conform to the mask of Figure 14.
DC power	There shall be no DC power applied at the interface.
Verification access	Access to the signal at the interface shall be provided for verification of these signal specifications.

Parameter	Specification
NOTE 1 – While both voltage and power requirements are given to assist in qualification of signals at the interface, the values are not equivalent. Voltage specifications are given for isolated pulses, while power levels are specified for an AIS signal, or alternatively an all-ones signal. NOTE 2 – The all-ones signal is not realizable within the frame structure specified in Recommendation G.752, and is not encountered in North American telecommunication networks.	



Time axis range (Unit Intervals)	Normalized amplitude equation
Upper curve	
$-0.85 \le T \le -0.68$	0.03
$-0.68 \le T \le 0.36$	$0.5\left\{1+\sin\left[\frac{\pi}{2}\left(1+\frac{T}{0.34}\right)\right]\right\}+0.03$
$0.36 \le T \le 1.4$	$0.08+0.407e^{-1.84(T-0.36)}$
Lower curve	
$-0.85 \le T \le -0.36$	–0.03
$-0.36 \le T \le 0.36$	$0.5\left\{1+\sin\left[\frac{\pi}{2}\left(1+\frac{T}{0.18}\right)\right]\right\}-0.03$
$0.36 \le T \le 1.4$	–0.03

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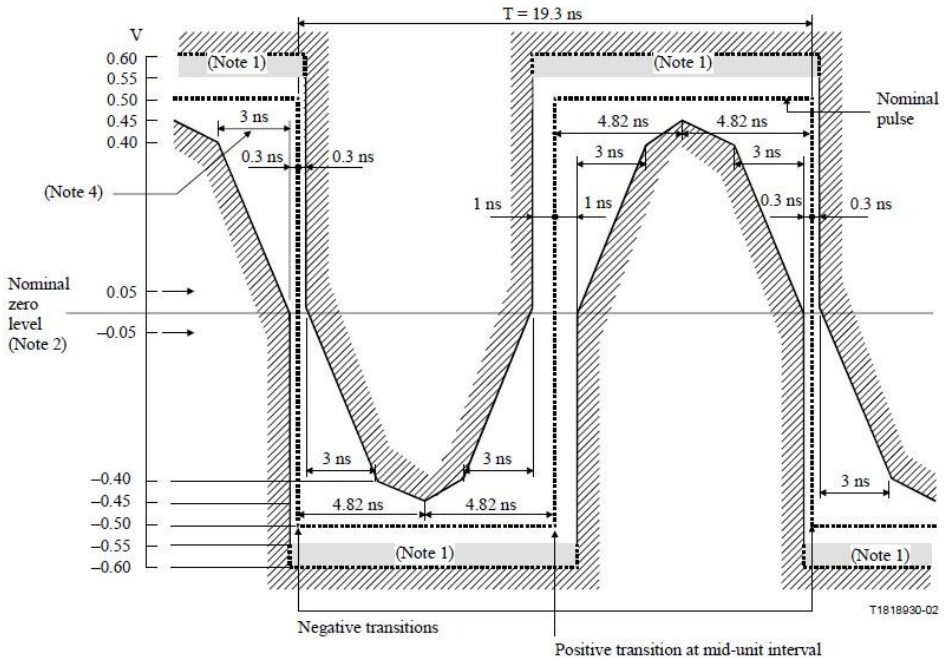
Figure 14/G.703 – 44 736 kbit/s interface isolated pulse mask and equations

Table-12 and Figure-22,23 G.703

Table 12/G.703 – Digital interface at 155 520 kbit/s

Pulse shape	Nominally rectangular and conforming to the masks shown in Figures 22 and 23
Pair(s) in each direction	One coaxial pair
Test load impedance	75 ohms resistive
Peak-to-peak voltage	1 ± 0.1 V
Rise time between 10% and 90% amplitudes of the measured steady state amplitude	≤2 ns
Transition timing tolerance referred to the mean value of the 50% amplitude points of negative transitions	Negative transitions: ±0.1 ns Positive transitions at unit interval boundaries: ±0.5 ns Positive transitions at mid-unit intervals: ±0.35 ns
Return loss	≥15 dB over frequency range 8 MHz to 240 MHz
Maximum peak-to-peak jitter at an output port	Refer to 5.1/G.825



NOTE 1 – The maximum "steady state" amplitude should not exceed the 0.55 Vlimit. Overshoots and other transients are permitted to fall into the dotted area, bounded by the amplitude levels 0.55 V and 0.6 V, provided that they do not exceed the steady state level by more than 0.05 V. The possibility of relaxing the amount by which the overshoot may exceed the steady state level is under study.

NOTE 2 – For all measurements using these masks, the signal should be AC coupled, using a capacitor of not less than 0.01 µF, to the input of the oscilloscope used for measurements.

The nominal zero level for both masks should be aligned with the oscilloscope trace with no input signal. With the signal then applied, the vertical position of the trace can be adjusted with the objective of meeting the limits of the masks. Any such adjustment should be the same for both masks and should not exceed ±0.05 V. This may be checked by removing the input signal again and verifying that the trace lies within ±0.05 V of the nominal zero level of the masks.

NOTE 3 – Each pulse in a coded pulse sequence should meet the limits of the relevant mask, irrespective of the state of the preceding or succeeding pulses, with both pulse masks fixed in the same relation to a common timing reference, i.e. with their nominal start and finish edges coincident.

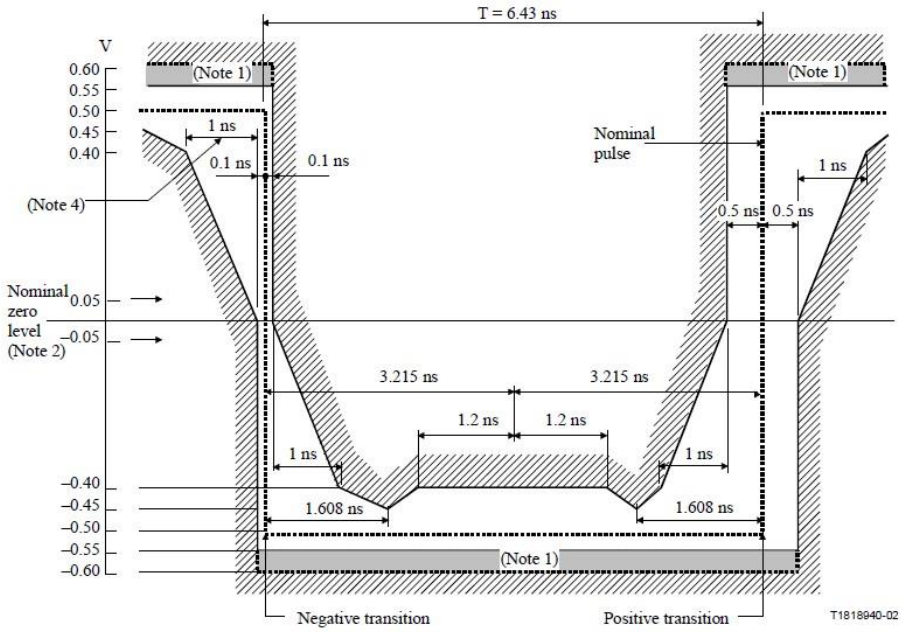
The masks allow for HF jitter caused by intersymbol interference in the output stage, but not for jitter present in the timing signal associated with the source of the interface signal.

When using an oscilloscope technique to determine pulse compliance with the mask, it is important that successive traces of the pulses overlay in order to suppress the effects of low frequency jitter. This can be accomplished by several techniques [e.g. a) triggering the oscilloscope on the measured waveform or b) providing both the oscilloscope and the pulse output circuits with the same clock signal].

These techniques require further study.

NOTE 4 – For the purpose of these masks, the rise time and decay time should be measured between –0.4 V and 0.4 V, and should not exceed 2 ns.

Figure 22/G.703 – Mask of a pulse corresponding to a binary 0 (at the 155 520 kbit/s interface)

<table>
<tr>
<td></td>
<td>


NOTE 1 – The maximum "steady state" amplitude should not exceed the 0.55 V limit. Overshoots and other transients are permitted to fall into the dotted area, bounded by the amplitude levels 0.55 V and 0.6 V, provided that they do not exceed the steady state level by more than 0.05 V. The possibility of relaxing the amount by which the overshoot may exceed the steady state level is under study.

NOTE 2 – For all measurements using these masks, the signal should be AC coupled, using a capacitor of not less than 0.01 µF, to the input of the oscilloscope used for measurements.

The nominal zero level for both masks should be aligned with the oscilloscope trace with no input signal. With the signal then applied, the vertical position of the trace can be adjusted with the objective of meeting the limits of the masks. Any such adjustment should be the same for both masks and should not exceed ±0.05 V. This may be checked by removing the input signal again and verifying that the trace lies within ±0.05 V of the nominal zero level of the masks.

NOTE 3 – Each pulse in a coded sequence should meet the limits of the relevant mask, irrespective of the state of the preceding or succeeding pulses, with both pulse masks fixed in the same relation to a common timing reference, i.e. with their nominal start and finish edges coincident.

The masks allow for HF jitter caused by intersymbol interference in the output stage, but not for jitter present in the timing signal associated with the source of the interface signal.

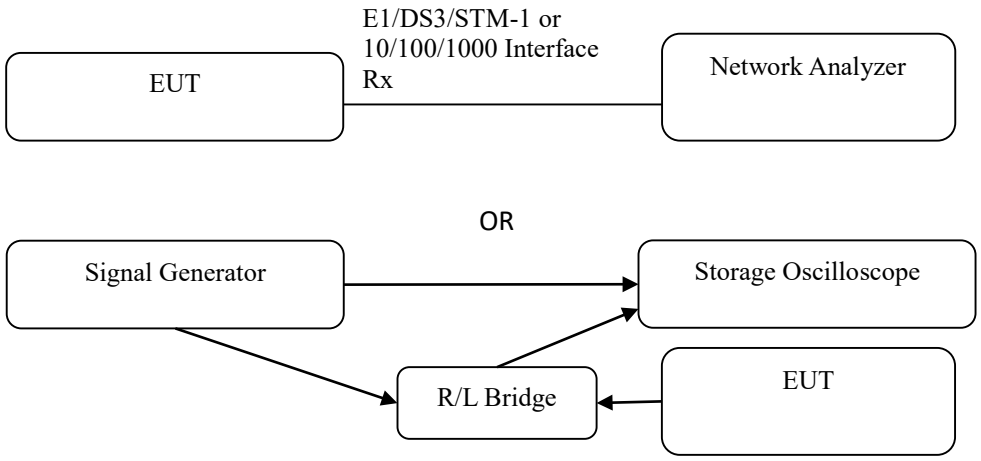
When using an oscilloscope technique to determine pulse compliance with the mask, it is important that successive traces of thepulses overlay in order to suppress the effects of low frequency jitter. This can be accomplished by several techniques [e.g. a) triggering the oscilloscope on the measured waveform or b) providing both the oscilloscope and the pulse output circuits with the same clock signal].

These techniques require further study.

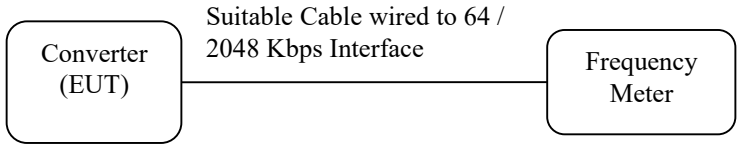
NOTE 4 – For the purpose of these masks, the rise time and decay time should be measured between –0.4 V and 0.4 V, and should not exceed 2 ns.

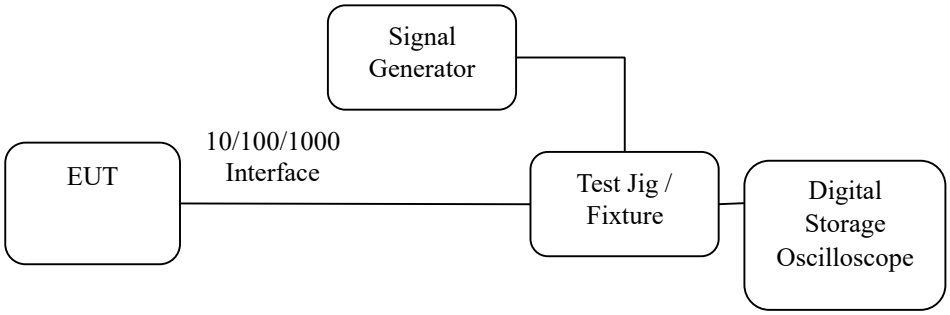
NOTE 5 – The inverse pulse will have the same characteristics, noting that the timing tolerance at the level of the negative and positive transitions are ±0.1 ns and ±0.5 ns respectively.

Figure 23/G.703 – Mask of a pulse corresponding to a binary 1 (at the 155 520 kbit/s interface)
</td>
</tr>
<tr>
<td>Test Procedure</td>
<td>
1. Connect the EUT as shown in the figure.
2. Enable the Port if required.
3. See whether the output pulse is within the mask/limits as indicated above.
</td>
</tr>
<tr>
<td>Expected Results</td>
<td>Enclose the Test Results with the Pulse shape & the Pulse Mask</td>
</tr>
</table>

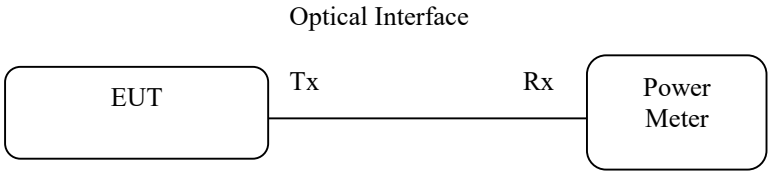
<table>
<tr><td>Test No.</td><td>8</td></tr>
<tr><td>Test Details</td><td>Test for Return Loss (This test is applicable to 64Kbps / 2048Kbps / 34Mbps/45Mbps/STM-1 interfaces)</td></tr>
<tr><td>Test Instruments Required</td><td>1. Network Analyser for PDH/SDH Interfaces
2. Vector Network Analyser with Balun to convert to differential voltage OR Signal Generator, Storage Oscilloscope & Return Loss Bridge</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><td>Minimum Return loss limits at input port for 64Kbps co-directional interface</td><td>Refer clause 4.2.1.3 of G.703</td></tr>
<tr><td>Minimum Return loss limits at output port for 64Kbps co-directional interface</td><td>Refer clause 4.2.1.2 of G.703</td></tr>
<tr><td>Minimum Return loss limits at input port for 2048 kbps (E1) interface</td><td>Refer clause 9.3 of G.703</td></tr>
<tr><td>Minimum Return loss limits at output port for 2048 kbps (E1) interface</td><td>Refer clause 9.2 of G.703</td></tr>
<tr><td>Minimum Return loss limits at input port for 34Mbps interface</td><td>Refer clause 11.3 of G.703</td></tr>
<tr><td>Minimum Return loss limits at output port for 34Mbps interface</td><td>Refer clause 11.2 of G.703</td></tr>
<tr><td>Minimum Return loss limits at input port for STM-1 interface</td><td>≥15 dB over frequency range 8 MHz to 240 MHz</td></tr>
<tr><td>Minimum Return loss limits at output port for STM-1 interface</td><td>≥15 dB over frequency range 8 MHz to 240 MHz</td></tr>
</table>
</td></tr>
<tr><td>Standards Reference</td><td>clause 4.2.1.3 of G.703
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>4 to 13
13 to 256
256 to 384</td><td>12
18
14</td></tr>
</table>
clause 4.2.1.2 of G.703</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>6.4 to 13
13 to 384</td><td>6
8</td></tr>
</table>
clause 9.3 of G.703
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>51 to 102
102 to 2048
2048 to 3072</td><td>12
18
14</td></tr>
</table>
clause 9.2 of G.703
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>51 to 102
102 to 3072</td><td>6
8</td></tr>
</table>
clause 11.3 of G.703
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>860 to 1720
1720 to 34 368
34 368 to 51 550</td><td>12
18
14</td></tr>
</table>
clause 11.2 of G.703
<table>
<tr><th>Frequency range (kHz)</th><th>Return loss (dB)</th></tr>
<tr><td>860 to 1720
1720 to 51 550</td><td>6
8</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure</td><td>1. Connect the Setup as shown in the figure.
2. Measure the input port return loss using the Network Analyser
3. Check whether the Return Loss is within the specified limits</td></tr>
<tr><td>Expected Results</td><td>Enclose the Test Results</td></tr>
</table>

<table>
<tr><td>Test No.</td><td>9</td></tr>
<tr><td>Test Details</td><td>Test for Output Frequency</td></tr>
<tr><td>Test Instruments Required</td><td>1. Frequency Meter</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td><table>
<tr><td>64Kbps</td><td>±100 ppm</td></tr>
<tr><td>2048Kbps</td><td>±50 ppm</td></tr>
</table></td></tr>
<tr><td>Test Procedure</td><td>1. Connect the test setup as shown in figure using a suitable cable wired to the 64/2048Kbps interface
2. Measure the Output Frequency using the Frequency Meter</td></tr>
<tr><td>Expected Results</td><td>Enclose the Test Results</td></tr>
</table>

<table>
<tr><td>Test No.</td><td>10</td></tr>
<tr><td>Test Details</td><td>Test for Ethernet Interface
1. Differential output voltage
2. AC Differential input impedance
3. Output Jitter</td></tr>
<tr><td>Test Instruments Required</td><td>1. 2. Digital Storage Oscilloscope
3. Ethernet parameters measurement test Jig/Fixture
Signal generator</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><td>Differential output voltage, loaded 10Base-T</td><td>Refer 14.3.1.2.1of IEEE802.3 Section1 Differential output voltage</td></tr>
<tr><td>Differential output voltage, 100Base-T</td><td>Refer 23.5.1.2.1 of IEEE802.3 Section2 Peak differential output voltage</td></tr>
<tr><td>Differential output voltage, loaded 1000Base-T</td><td>Refer 40.6.1.2.1 of IEEE802.3 Section3 Peak differential output voltage</td></tr>
<tr><td>Differential input impedance - 10BaseT</td><td>Refer 14.3.1.3.4 of IEEE802.3 Section-1AC differential input impedance</td></tr>
<tr><td>Receiver differential input impedance - 100Base-T</td><td>Refer 23.5.1.3.3 of IEEE802.3 Section-2 Receiver differential input impedance</td></tr>
<tr><td>10Base-T Output timing Jitter</td><td>Refer 14.3.1.2.3of IEEE802.3 Section 3 Output timing jitter</td></tr>
<tr><td>100base-T Output timing Jitter</td><td>Refer 23.5.1.2.5 of IEEE802.3 Section 3 Output timing jitter</td></tr>
<tr><td>1000Base-T Transmitter output Jitter</td><td>Refer 40.6.1.2.6 of IEEE802.3 Section 3 Transmitter Timing Jitter</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure</td><td>1. Connect the test setup as shown in figure to the 10/100/1000Base-T interface
2. The test Jig / Fixture is an electronics hardware attached to the oscilloscope / Network analyser for the measurement of Ethernet parameters
3. Measure the Ethernet parameters</td></tr>
<tr><td>Expected Results</td><td>Enclose the Test Results</td></tr>
</table>

Note:	1. Tests can be conducted under one of the following options a. Test facility in TEC if available. b. Any Test Location in India including the premises of the trader/manufacturer of the product approved by RTEC where the Test facility is available for testing by RTEC.
	2. In case it is not possible to carry out the tests as above, the test results from any one of the following options can be accepted. RTEC shall verify whether the test results are within the prescribed limits. a. Results from any Indian/Foreign lab accredited as per ISO 17025 and having Ethernet Physical interface testing included in the scope of accreditation b. In house test results of the Equipment Under Test (EUT) in case of Foreign OEM c. In house test results of the Ethernet chipsets used in the EUT, from the OEM of the Ethernet chipset. The physical availability of the Ethernet Chipset in the EUT shall be verified by the RTEC. The following remark shall be indicated in the TAC. "The chipset number/code of the Ethernet chipset used in the equipment offered for testing: ……..."

<table>
<tr><td>Test No.</td><td>11</td></tr>
<tr><td>Test Details</td><td>Test for output Power [Mean Launch Power]</td></tr>
<tr><td>Test Instruments Required</td><td>1. Optical Power Meter</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><td>STM-1 Short Haul / Long Haul</td><td>Refer Table-2/G.957</td></tr>
<tr><td>STM-4 Short Haul / Long Haul</td><td>Refer Table-3/G.957</td></tr>
<tr><td>STM-16 Short Haul / Long Haul</td><td>Refer Table-4/G.957</td></tr>
<tr><td>FE Short Haul/Long Haul (100BASE-FX/SX/LX)</td><td>Refer IEEE 802.3u</td></tr>
<tr><td>GE Short Haul (1000BASE-SX)</td><td>Refer clause 38.3.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3</td></tr>
<tr><td>GE Long Haul (1000BASE-LX)</td><td>Refer clause 38.4.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3</td></tr>
<tr><td>10 GE Short Haul/Long Haul (10G-SR/LR/ER)</td><td>Refer table 52-7 for SR, 52-12 for LR and 52-16 for ER of IEEE 802.3ae specifications</td></tr>
<tr><td>40 GE (SR4/LR4)</td><td>Refer Table 86-6 for SR4 and 87-7 for LR4 of IEEE 802.3ba specifications</td></tr>
<tr><td>100 GE (SR10/LR4/ER4)</td><td>Refer Table 86-6 for SR10, 88-7 for LR4/ER4 of IEEE 802.3ba specifications</td></tr>
<tr><td>25 GE (SR/LR/ER)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>50 GE (SR/LR/ER/FR)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>200 GE (SR4/LR4/DR4/FR4)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>400 GE (SR8/LR8/DR4/FR8)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
</table>
</td></tr>
</table>

Standards Reference

Table-2/G.957

Table 2/G.957 – Parameters specified for STM-1 optical interfaces

	Unit	Values								
Digital signal Nominal bit rate	kbit/s	STM-1 according to ITU-T Rec. G.707/Y.1322 155 520								
Application code (Table 1)		I-1		S-1.1	S-1.2		L-1.1		L-1.2	L-1.3	
Operating wavelength range	nm	1260[a]-1360		1261[a]-1360	1430-1576	1430-1580	1263[a]-1360		1480-1580	1534-1566/ 1523-1577	1480-1580
Transmitter at reference point S											
Source type		MLM	LED	MLM	MLM	SLM	MLM	SLM	SLM	MLM	SLM
Spectral characteristics:											
– maximum RMS width (σ)	nm	40	80	7.7	2.5	–	3	–	–	3/2.5	–
– maximum –20 dB width	nm	–	–	–	–	1	–	1	1	–	1
– minimum side mode suppression ratio	dB	–	–	–	–	30	–	30	30	–	30
Mean launched power:											
– maximum	dBm	–8		–8	–8		0		0	0	
– minimum	dBm	–15		–15	–15		–5		–5	–5	
Minimum extinction ratio	dB	8.2		8.2	8.2		10		10	10	
Optical path between S and R											
Attenuation range[b]	dB	0-7		0-12	0-12		10-28		10-28	10-28	
Maximum dispersion	ps/nm	18	25	96	296	NA	246	NA	NA	246/296	NA
Minimum optical return loss of cable plant at S, including any connectors	dB	NA		NA	NA		NA		20	NA	
Maximum discrete reflectance between S and R	dB	NA		NA	NA		NA		–25	NA	
Receiver at reference point R											
Minimum sensitivity[b]	dBm	–23		–28	–28		–34		–34	–34	
Minimum overload	dBm	–8		–8	–8		–10		–10	–10	
Maximum optical path penalty	dB	1		1	1		1		1	1	
Maximum reflectance of receiver, measured at R	dB	NA		NA	NA		NA		–25	NA	

[a] Some Administrations may require a limit of 1270 nm.
[b] See clause 6.

Table-3/G.957

Table 3/G.957 – Parameters specified for STM-4 optical interfaces

	Unit	Values							
Digital signal Nominal bit rate	kbit/s	STM-4 according to ITU-T Rec. G.707/Y.1322 622 080							
Application code (Table 1)		I-4		S-4.1	S-4.2	L-4.1		L-4.2	L-4.3
Operating wavelength range	nm	1261[a]-1360		1293-1334/ 1274-1356	1430-1580	1300-1325/ 1296-1330	1280-1335	1480-1580	1480-1580
Transmitter at reference point S									
Source type		MLM	LED	MLM	SLM	MLM	SLM	SLM	SLM
Spectral characteristics:									
– maximum RMS width (σ)	nm	14.5	35	4/2.5	–	2.0/1.7	–	–	–
– maximum –20 dB width	nm	–	–	–	1	–	1	< 1[b]	1
– minimum side mode suppression ratio	dB	–	–	–	30	–	30	30	30
Mean launched power:									
– maximum	dBm	–8		–8	–8	+2		+2	+2
– minimum	dBm	–15		–15	–15	–3		–3	–3
Minimum extinction ratio	dB	8.2		8.2	8.2	10		10	10
Optical path between S and R									
Attenuation range[b]	dB	0-7		0-12	0-12	10-24		10-24	10-24
Maximum dispersion	ps/nm	13	14	46/74	NA	92/109	NA	1600	NA
Minimum optical return loss of cable plant at S, including any connectors	dB	NA		NA	24	20		24	20
Maximum discrete reflectance between S and R	dB	NA		NA	–27	–25		–27	–25
Receiver at reference point R									
Minimum sensitivity[b]	dBm	–23		–28	–28	–28		–28	–28
Minimum overload	dBm	–8		–8	–8	–8		–8	–8
Maximum optical path penalty	dB	1		1	1	1		1	1
Maximum reflectance of receiver, measured at R	dB	NA		NA	–27	–14		–27	–14

[a] Some Administrations may require a limit of 1270 nm.
[b] See clause 6.

Table-4/G.957

Table 4/G.957 – Parameters specified for STM-16 optical interfaces

	Unit	Values					
Digital signal Nominal bit rate	kbit/s	STM-16 according to ITU-T Rec. G.707/Y.1322 2 488 320					
Application code (Table 1)		I-16	S-16.1	S-16.2	L-16.1	L-16.2	L-16.3
Operating wavelength range	nm	1266[a]-1360	1260[a]-1360	1430-1580	1280-1335	1500-1580	1500-1580
Transmitter at reference point S							
Source type		MLM	SLM	SLM	SLM	SLM	SLM
Spectral characteristics:							
– maximum RMS width (σ)	nm	4	–	–	–	–	–
– maximum –20 dB width	nm	–	1	< 1[b]	1	< 1[b]	< 1[b]
– minimum side mode – suppression ratio	dB	–	30	30	30	30	30
Mean launched power:							
– maximum	dBm	–3	0	0	+3	+3	+3
– minimum	dBm	–10	–5	–5	–2	–2	–2
Minimum extinction ratio	dB	8.2	8.2	8.2	8.2	8.2	8.2
Optical path between S and R							
Attenuation range[b]	dB	0-7	0-12	0-12	12-24[d]	12-24[d]	12-24[d]
Maximum dispersion at upper wavelength limit	ps/nm	12[c]	NA	800[c]	NA	1600[c]	450[c]
Maximum dispersion at lower wavelength limit	ps/nm	12[c]	NA	420[c]	NA	1200[c]	450[c]
Minimum optical return loss of cable plant at S, including any connectors	dB	24	24	24	24	24	24
Maximum discrete reflectance between S and R	dB	–27	–27	–27	–27	–27	–27
Receiver at reference point R							
Minimum sensitivity[b]	dBm	–18	–18	–18	–27	–28	–27
Minimum overload	dBm	–3	0	0	–9	–9	–9
Maximum optical path penalty	dB	1	1	1	1	2	1
Maximum reflectance of receiver, measured at R	dB	–27	–27	–27	–27	–27	–27

[a] Some Administrations may require a limit of 1270 nm.

[b] See clause 6.

[c] For wavelengths between the upper and lower wavelength limits, the maximum dispersion is linearly interpolated between the values given for the wavelength extremes. Where the maximum dispersion values are the same, this value is required to be met across the entire wavelength range.

[d] Some Administrations may require 10 dB minimum attenuation instead of 12 dB, to do this, it is required to decrease the maximum output power of the transmitter or to increase the minimum overload of the receiver (or a combination of both).

Clause 38.3.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3

Table 38–3—1000BASE-SX transmit characteristics

Description	62.5 μm MMF	50 μm MMF	Unit
Transmitter type	Shortwave Laser		
Signaling speed (range)	1.25 ± 100 ppm		GBd
Wavelength (λ, range)	770 to 860		nm
T_{rise}/T_{fall} (max; 20%-80%; λ > 830 nm)	0.26		ns
T_{rise}/T_{fall} (max; 20%-80%; λ ≤ 830 nm)	0.21		ns
RMS spectral width (max)	0.85		nm
Average launch power (max)	See footnote [a]		dBm
Average launch power (min)	–9.5		dBm
Average launch power of OFF transmitter (max)[b]	–30		dBm
Extinction ratio (min)	9		dB
RIN (max)	–117		dB/Hz
Coupled Power Ratio (CPR) (min)[c]	9 < CPR		dB

[a]The 1000BASE-SX launch power shall be the lesser of the class 1 safety limit as defined by 38.7.2 or the average receive power (max) defined by Table 38–4.

[b]Examples of an OFF transmitter are: no power supplied to the PMD, laser shutdown for safety conditions, activation of a "transmit disable" or other optional module laser shut down conditions. During all conditions when the PMA is powered, the ac signal (data) into the transmit port will be valid encoded 8B/10B patterns (this is a requirement of the PCS layers) except for short durations during system power-on-reset or diagnostics when the PMA is placed in a loopback mode.

[c]Radial overfilled launches as described in 38A.2, while they may meet CPR ranges, should be avoided.

Clause 38.4.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3

Table 38–7—1000BASE-LX transmit characteristics

Description	62.5 μm MMF	50 μm MMF	10 μm SMF	Unit
Transmitter type	Longwave Laser			
Signaling speed (range)	1.25 ± 100 ppm			GBd
Wavelength (range)	1270 to 1355			nm
T_{rise}/T_{fall} (max, 20-80% response time)	0.26			ns
RMS spectral width (max)	4			nm
Average launch power (max)	–3			dBm
Average launch power (min)	–11.5	–11.5	–11.0	dBm
Average launch power of OFF transmitter (max)	–30			dBm
Extinction ratio (min)	9			dB
RIN (max)	–120			dB/Hz
Coupled Power Ratio (CPR)[a]	28 < CPR< 40	12 < CPR < 20	N/A	dB

[a]Due to the dual media (single-mode and multimode) support of the LX transmitter, fulfillment of this specification requires a single-mode fiber offset-launch mode-conditioning patch cord described in 38.11.4 for MMF operation. This patch cord is not used for single-mode operation.

Table 52-7 for SRof IEEE 802.3ae specifications

Table 52–7—10GBASE-S transmit characteristics

Description	10GBASE-SW	10GBASE-SR	Unit
Signaling speed (nominal)	9.95328	10.3125	GBd
Signaling speed variation from nominal (max)	± 20	± 100	ppm
Center wavelength (range)	840 to 860		nm
RMS spectral width[a] (max)	See footnote[b]		
Average launch power (max)	See footnote[c]		
Average launch power[d] (min)	–7.3		dBm
Launch power (min) in OMA	See footnote[b]		
Average launch power of OFF transmitter[e] (max)	–30		dBm
Extinction ratio (min)	3		dB
$RIN_{12}OMA$ (max)	–128		dB/Hz
Optical Return Loss Tolerance (max)	12		dB
Encircled flux	See footnote[f]		
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}		
Transmitter and dispersion penalty[g] (max)	3.9 dB		dB

[a]RMS spectral width is the standard deviation of the spectrum.
[b]Trade-offs are available between spectral width, center wavelength and minimum optical modulation amplitude. See Figure 52–3 and Table 52–8.
[c]The 10GBASE-S launch power shall be the lesser of the class 1 safety limit as defined by 52.10.2 or the average receive power (max) defined by Table 52–9.
[d]Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
[e]Examples of an OFF transmitter are: no power supplied to the PMD, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shut down conditions.
[f]The encircled flux at 19 μm shall be greater than or equal to 86% and the encircled flux at 4.5 μm shall be less than or equal to 30% when measured into Type A1a (50/125 μm multimode) fiber per ANSI/TIA/EIA-455-203-2001.
[g]TDP(max) and OMA(min) are at the respective wavelength and spectral width as specified in Table 52–8.

Table 52-12 for LR of IEEE 802.3ae specifications

Table 52–12—10GBASE-L transmit characteristics

Description	10GBASE-LW	10GBASE-LR	Unit
Signaling speed (nominal)	9.95328	10.3125	GBd
Signaling speed variation from nominal (max)	± 20	± 100	ppm
Center wavelength (range)	1260 to 1355		nm
Side Mode Suppression Ratio (min)	30		dB
Average launch power (max)	0.5		dBm
Average launch power[a] (min)	–8.2		dBm
Launch power (min) in OMA minus TDP[b]	–6.2		dBm
Optical Modulation Amplitude[c] (min)	–5.2		dBm
Transmitter and dispersion penalty (max)	3.2		dB
Average launch power of OFF transmitter[d] (max)	–30		dBm
Extinction ratio (min)	3.5		dB
$RIN_{12}OMA$ (max)	–128		dB/Hz
Optical Return Loss Tolerance (max)	12		dB
Transmitter Reflectance[e] (max)	–12		dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}		

[a]Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
[b]TDP is transmitter and dispersion penalty.
[c]Even if the TDP < 1 dB, the OMA(min) must exceed this value.
[d]Examples of an OFF transmitter are: no power supplied to the PMD, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shut down conditions.
[e]Transmitter reflectance is defined looking into the transmitter.

Table 52-16 for ER of IEEE 802.3ae specifications

Table 52–16—10GBASE-E transmit characteristics

Description	10GBASE-EW	10GBASE-ER	Unit
Signaling speed (nominal)	9.95328	10.3125	GBd
Signaling speed variation from nominal (max)	± 20	± 100	ppm
Center wavelength (range)	1530 to 1565		nm
Side Mode Suppression Ratio (min)	30		dB
Average launch power (max)	4.0		dBm
Average launch power[a] (min)	–4.7		dBm
Launch power (min) in OMA minus TDP[b]	–2.1		dBm
Average launch power of OFF transmitter[c] (max)	–30		dBm
Optical Modulation Amplitude[d] (min)	–1.7		dBm
Transmitter and dispersion penalty (max)	3.0		dB
Extinction ratio (min)	3		dB
$RIN_{21}OMA$[e] (max)	–128		dB/Hz
Optical Return Loss Tolerance (max)	21		dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}		

[a]Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
[b]TDP is transmitter and dispersion penalty.
[c]Examples of an OFF transmitter are: no power supplied to the PMD, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shut-down conditions.
[d]Even if the TDP < 0.4 dB, the OMA(min) must exceed this value.
[e]RIN measurement is made with a return loss at 21 dB.

Table 86-6 for SR4/SR10 of IEEE 802.3ba specifications

Table 86–6—40GBASE–SR4 or 100GBASE–SR10 optical transmit characteristics

Description	Type	Value	Unit
Center wavelength	Range	840 to 860	nm
RMS spectral width[a]	Max	0.65	nm
Average launch power, each lane	Max	2.4	dBm
Average launch power, each lane	Min	–7.6	dBm
Optical Modulation Amplitude (OMA), each lane	Max	3	dBm
Optical Modulation Amplitude (OMA), each lane	Min	–5.6[b]	dBm
Difference in launch power between any two lanes (OMA)	Max	4	dB
Peak power, each lane	Max	4	dBm
Launch power in OMA minus TDP, each lane	Min	–6.5	dBm
Transmitter and dispersion penalty (TDP), each lane	Max	3.5	dB
Extinction ratio	Min	3	dB
Optical return loss tolerance	Max	12	dB
Encircled flux[c]		≥ 86% at 19 μm, ≤ 30% at 4.5 μm	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} Hit ratio 5×10^{-5} hits per sample	Spec values	0.23, 0.34, 0.43, 0.27, 0.35, 0.4	
Average launch power of OFF transmitter, each lane	Max	–30	dBm

[a] RMS spectral width is the standard deviation of the spectrum.
[b] Even if the TDP < 0.9 dB, the OMA (min) must exceed this value.
[c] If measured into type A1a.2 50 μm fiber in accordance with IEC 61280-1-4.

Table 87-7 for LR4 of IEEE 802.3ba specifications

Table 87–7—40GBASE-LR4 transmit characteristics

Description	Value	Unit
Signaling rate, each lane (range)	10.3125 ± 100 ppm	GBd
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Total average launch power (max)	8.3	dBm
Average launch power, each lane (max)	2.3	dBm
Average launch power, each lane[a] (min)	–7	dBm
Optical Modulation Amplitude (OMA), each lane (max)	3.5	dBm
Optical Modulation Amplitude (OMA), each lane (min)[b]	–4	dBm
Difference in launch power between any two lanes (OMA) (max)	6.5	dB
Launch power in OMA minus TDP, each lane (min)	–4.8	dBm
Transmitter and dispersion penalty (TDP), each lane (max)	2.6	dB
Average launch power of OFF transmitter, each lane (max)	–30	dBm
Extinction ratio (min)	3.5	dB
$RIN_{20}OMA$ (max)	–128	dB/Hz
Optical return loss tolerance (max)	20	dB
Transmitter reflectance[c] (max)	–12	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}	

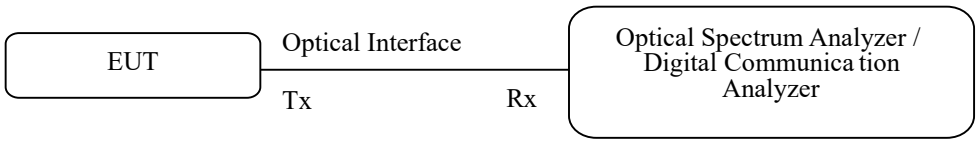
[a]Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
[b]Even if the TDP < 0.8dB, the OMA (min) must exceed this value.
[c]Transmitter reflectance is defined looking into the transmitter.

	Table 88-7 for LR4/ER4 of IEEE 802.3ba specifications
	Table 88–7—100GBASE-LR4 and 100GBASE-ER4 transmit characteristics

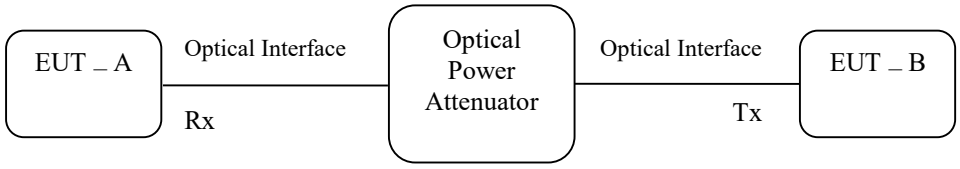
Description	100GBASE–LR4	100GBASE–ER4	Unit
Signaling rate, each lane (range)	25.78125 ± 100 ppm		GBd
Lane wavelengths (range)	1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19		nm
Side-mode suppression ratio (SMSR), (min)	30		dB
Total average launch power (max)	10.5	8.9	dBm
Average launch power, each lane (max)	4.5	2.9	dBm
Average launch power, each lane[a] (min)	–4.3	–2.9	dBm
Optical Modulation Amplitude (OMA), each lane (max)	4.5		dBm
Optical Modulation Amplitude (OMA), each lane (min)	–1.3[b]	0.1	dBm
Difference in launch power between any two lanes (OMA) (max)	5	—	dB
Difference in launch power between any two lanes (Average and OMA) (max)	—	3.6	
Launch power in OMA minus TDP, each lane (min)	–2.3	—	dBm
Transmitter and dispersion penalty (TDP), each lane (max)	2.2	2.5	dB
Average launch power of OFF transmitter, each lane (max)	–30		dBm
Extinction ratio (min)	4	8	dB
$RIN_{20}OMA$ (max)	–130		dB/Hz
Optical return loss tolerance (max)	20		dB
Transmitter reflectance[c] (max)	–12		dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}		

[a]Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
[b]Even if the TDP < 1 dB, the OMA (min) must exceed this value.
[c]Transmitter reflectance is defined looking into the transmitter.

Test Procedure	1. Connect the Setup as shown in the figure. 2. Enable the output Optical Port 3. Measure the optical output power 4. Check whether the output power is within the specification limits
Expected Results	Enclose the Test Results

<table>
<tr><td>Test No.</td><td>12</td></tr>
<tr><td>Test Details</td><td>Wavelength/Spectrum / Extinction Ratio</td></tr>
<tr><td>Test Instruments Required</td><td>1. Optical Spectrum Analyser or Digital Communication Analyser</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><td>STM-1 Short Haul / Long Haul</td><td>Refer Table-2/G.957</td></tr>
<tr><td>STM-4 Short Haul / Long Haul</td><td>Refer Table-3/G.957</td></tr>
<tr><td>STM-16 Short Haul / Long Haul</td><td>Refer Table-4/G.957</td></tr>
<tr><td>FE Short Haul/Long Haul (100BASE-FX/SX/LX)</td><td>Refer IEEE 802.3u</td></tr>
<tr><td>GE Short Haul (1000BASE-SX)</td><td>Refer clause 38.3.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3</td></tr>
<tr><td>GE Long Haul (1000BASE-LX)</td><td>Refer clause 38.4.1 Transmitter optical specifications of IEEE 802.3 2008 Section-3</td></tr>
<tr><td>10 GE Short Haul/Long Haul (10G-SR/LR/ER)</td><td>Refer table 52-7 for SR, 52-12 for LR and 52-16 for ER of IEEE 802.3ae specifications</td></tr>
<tr><td>40 GE (SR4/LR4)</td><td>Refer Table 86-6 for SR4 and 87-7 for LR of IEEE 802.3ba specifications</td></tr>
<tr><td>100 GE (SR10/LR4/ER4)</td><td>Refer Table 86-6 for SR10, 88-7 for LR4/ER4 of IEEE 802.3ba specifications</td></tr>
<tr><td>25 GE (SR/LR/ER)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>50 GE (SR/LR/ER/FR)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>200 GE (SR4/LR4/DR4/FR4)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
<tr><td>400 GE (SR8/LR8/DR4/FR8)</td><td>Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures</td></tr>
</table>
</td></tr>
<tr><td>Standards Reference</td><td>Refer the Standards Reference in Test 11</td></tr>
<tr><td>Test Procedure</td><td>1. Connect the Setup as shown in the figure.
2. Enable the output Optical Port
3. Measure the Wavelength/Spectrum / Extinction Ratio
4. Check whether the Wavelength/Spectrum / Extinction Ratio is within the specification limits</td></tr>
</table>

Expected Results	Enclose the Test Results

Test No.	13
Test Details	Test for Receiver Sensitivity
Test Instruments Required	1. Optical Attenuator
Test Setup	

Test Limits		
	STM-1 Short Haul / Long Haul	Refer Table-2/G.957 (Given under Test-11)
	STM-4 Short Haul / Long Haul	Refer Table-3/G.957 (Given under Test-11)
	STM-16 Short Haul / Long Haul	Refer Table-4/G.957 (Given under Test-11)
	FE Short Haul/Long Haul (100BASE-FX/SX/LX)	Refer IEEE 802.3u
	GE Short Haul (1000BASE-SX)	Refer clause 38.3.2 Receiver optical specifications of IEEE 802.3 2008 Section-3
	GE Long Haul (1000BASE-LX)	Refer clause 38.4.2 Receiver optical specifications of IEEE 802.3 2008 Section-3
	10 GE Short Haul/Long Haul (10G-SR/LR/ER)	Refer table 52-9 for SR, 52-13 for LR and 52-17 for ER of IEEE 802.3ae specifications
	40 GE (SR4/LR4)	Refer Table 86-8 for SR4 and 87-8 for LR4 of IEEE 802.3ba specifications
	100 GE (SR100/LR4/ER4)	Refer Table 86-8 for SR100, 88-8 for LR4/ER4 of IEEE 802.3ba specifications
	25 GE (SR/LR/ER)	Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures
	50 GE (SR/LR/ER/FR)	Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures
	200 GE (SR4/LR4/DR4/FR4)	Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures
	400 GE (SR8/LR8/DR4/FR8)	Refer Annexure H in Annexure to ER document available in https://www.mtcte.tec.gov.in/annexures

Standards Reference	**Clause 38.3.2 Receiver optical specifications of IEEE 802.3 2008 Section-3**

Table 38–4—1000BASE-SX receive characteristics

Description	62.5 μm MMF	50 μm MMF	Unit
Signaling Speed (range)	1.25 ± 100 ppm		GBd
Wavelength (range)	770 to 860		nm
Average receive power (max)	0		dBm
Receive sensitivity	–17		dBm
Return loss (min)	12		dB
Stressed receive sensitivity[a, b]	–12.5	–13.5	dBm
Vertical eye-closure penalty[c]	2.60	2.20	dB
Receive electrical 3 dB upper cutoff frequency (max)	1500		MHz

[a]Measured with conformance test signal at TP3 (see 38.6.11) for BER = 10^{-12} at the eye center.
[b]Measured with a transmit signal having a 9 dB extinction ratio. If another extinction ratio is used, the stressed receive sensitivity should be corrected for the extinction ratio penalty.
[c]Vertical eye-closure penalty is a test condition for measuring stressed receive sensitivity. It is not a required characteristic of the receiver.

Clause 38.4.2 Receiver optical specifications of IEEE 802.3 2008 Section-3

Table 38–8—1000BASE-LX receive characteristics

Description	Value	Unit
Signaling speed (range)	1.25 ± 100 ppm	GBd
Wavelength (range)	1270 to 1355	nm
Average receive power (max)	–3	dBm
Receive sensitivity	–19	dBm
Return loss (min)	12	dB
Stressed receive sensitivity[a, b]	–14.4	dBm
Vertical eye-closure penalty[c]	2.60	dB
Receive electrical 3 dB upper cutoff frequency (max)	1500	MHz

[a]Measured with conformance test signal at TP3 (see 38.6.11) for BER = 10^{-12} at the eye center.
[b]Measured with a transmit signal having a 9 dB extinction ratio. If another extinction ratio is used, the stressed receive sensitivity should be corrected for the extinction ratio penalty.
[c]Vertical eye-closure penalty is a test condition for measuring stressed receive sensitivity. It is not a required characteristic of the receiver.

Table 52-9 for SR of IEEE 802.3ae specifications

Table 52–9—10GBASE-S receive characteristics

Description	10GBASE-S	Unit
Signaling speed (nominal) 10GBASE-SR 10GBASE-SW	 10.3125 9.95328	GBd
Signaling speed variation from nominal (max)	± 100	ppm
Center wavelength (range)	840 to 860	nm
Average receive power[a] (max)	–1.0	dBm
Average receive power[b] (min)	–9.9	dBm
Receiver sensitivity (max) in OMA[c]	0.077 (–11.1)	mW (dBm)
Receiver Reflectance (max)	–12	dB
Stressed receiver sensitivity in OMA[d] [e](max)	0.18 (–7.5)	mW (dBm)
Vertical eye closure penalty[f] (min)	3.5	dB
Stressed eye jitter[g] (min)	0.3	UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3	GHz

[a]The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having a power level equal to the Average Receive Power (max) plus at least 1 dB.
[b]Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
[c]Receiver sensitivity is informative.
[d]Measured with conformance test signal at TP3 (see 52.9.9.2) for BER = 10^{-12}.
[e]The stressed sensitivity values in the table are for system level BER measurements which include the effects of CDR circuits. It is recommended that at least 0.4 dB additional margin be allocated if component level measurements are made without the effect of CDR circuits
[f]Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
[g]Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

Table 52-13 for LR of IEEE 802.3ae specifications

Table 52–13—10GBASE-L receive characteristics

Description	10GBASE-L	Unit
Signaling speed (nominal) 10GBASE-LR 10GBASE-LW	 10.3125 9.95328	GBd
Signaling speed variation from nominal (max)	± 100	ppm
Center wavelength (range)	1260 to 1355	nm
Average receive power[a] (max)	0.5	dBm
Average receive power[b] (min)	–14.4	dBm
Receiver sensitivity (max) in OMA[c]	0.055 (-12.6)	mW (dBm)
Receiver Reflectance (max)	–12	dB
Stressed receiver sensitivity (max) in OMA[d, e]	0.093 (–10.3)	mW (dBm)
Vertical eye closure penalty[f] (min)	2.2	dB
Stressed eye jitter[g] (min)	0.3	UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3	GHz

[a]The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having a power level equal to the Average Receive Power (max) plus at least 1 dB.
[b]Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
[c]Receiver sensitivity is informative.
[d]Measured with conformance test signal at TP3 (see 52.9.9.2) for BER = 10^{-12}.
[e]The stressed sensitivity values in the table are for system level BER measurements which include the effects of CDR circuits. It is recommended that at least 0.4 dB additional margin be allocated if component level measurements are made without the effect of CDR circuits.
[f]Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
[g]Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

Table 52-17 for ER of IEEE 802.3ae specifications

Table 52–17—10GBASE-E receive characteristics

Description	10GBASE-E	Unit
Signaling speed (nominal) 10GBASE-ER 10GBASE-EW	 10.3125 9.95328	GBd
Signaling speed variation from nominal (max)	± 100	ppm
Center wavelength (range)	1530 to 1565	nm
Average receive power (max)	–1.0	dBm
Average receive power[a] (min)	–15.8	dBm
Maximum receive power (for damage)	4.0	dBm
Receiver sensitivity (max) in OMA[b]	0.039 (–14.1)	mW (dBm)
Receiver Reflectance (max)	–26	dB
Stressed receiver sensitivity (max) in OMA[c,d]	0.074 (-11.3)	mW (dBm)
Vertical eye closure penalty[e] (min)	2.7	dB
Stressed eye jitter (min)[f]	0.3	UI pk-pk
Receive electrical 3 dB upper cutoff frequency (max)	12.3	GHz

[a]Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
[b]Receiver sensitivity is informative.
[c]Measured with conformance test signal at TP3 (see 52.9.9.2) for BER = 10^{-12}.
[d]The stressed sensitivity values in the table are for system level BER measurements which include the effects of CDR circuits. It is recommended that at least 0.4 dB additional margin be allocated if component level measurements are made without the effects of CDR circuits.
[e]Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.
[f]Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

Table 86-8 for SR4/SR100 of IEEE 802.3ba specifications

Table 86–8—40GBASE–SR4 or 100GBASE–SR10 optical receiver characteristics

Description	Type	Value	Unit
Center wavelength, each lane	Range	840 to 860	nm
Damage threshold[a]	Min	+3.4	dBm
Average power at receiver input, each lane	Max	+2.4	dBm
	Min	–9.5	dBm
Receiver reflectance	Max	–12	dB
Optical Modulation Amplitude (OMA), each lane	Max	3	dBm
Stressed receiver sensitivity in OMA, each lane[b]	Max	–5.4	dBm
Peak power, each lane	Max	4	dBm
Conditions of stressed receiver sensitivity test:			
Vertical eye closure penalty (VECP)[c], each lane	—	1.9	dB
Stressed eye J2 Jitter[c], each lane	—	0.3	UI
Stressed eye J9 Jitter[c], each lane	—	0.47	UI
OMA of each aggressor lane	—	–0.4	dBm
Receiver jitter tolerance in OMA, each lane[d]	Max	–5.4	dBm
Conditions of receiver jitter tolerance test:			
Jitter frequency and peak-to-peak amplitude	—	(75, 5)	(kHz, UI)
Jitter frequency and peak-to-peak amplitude	—	(375, 1)	(kHz, UI)
OMA of each aggressor lane	—	–0.4	dBm

[a] The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
[b] Measured with conformance test signal at TP3 (see 86.8.4.7).
[c] Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver. The apparent discrepancy between VECP and TDP is because VECP is defined at eye center while TDP is defined with ±0.15 UI offsets of the sampling instant.
[d] This is a test of the optical receiver's ability to track low-frequency jitter and is inappropriate for any subsystem that does not include a CRU.

Table 87-8 for LR4 of IEEE 802.3ba specifications

Table 87–8—40GBASE–LR4 receive characteristics

Description	Value	Unit
Signaling rate, each lane (range)	10.3125 ± 100 ppm	GBd
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Damage threshold[a] (min)	3.3	dBm
Average receive power, each lane (max)	2.3	dBm
Average receive power, each lane[b] (min)	–13.7	dBm
Receive power, each lane (OMA) (max)	3.5	dBm
Difference in receive power between any two lanes (OMA) (max)	7.5	dB
Receiver reflectance (max)	–26	dB
Receiver sensitivity (OMA), each lane[c] (max)	–11.5	dBm
Receiver 3 dB electrical upper cutoff frequency, each lane (max)	12.3	GHz
Stressed receiver sensitivity (OMA), each lane[d] (max)	–9.6	dBm
Conditions of stressed receiver sensitivity test:		
Vertical eye closure penalty,[e] each lane	1.9	dB
Stressed eye J2 Jitter,[e] each lane	0.3	UI
Stressed eye J9 Jitter,[e] each lane	0.47	UI

[a]The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level

[b]Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

[c]Receiver sensitivity (OMA), each lane (max) is informative.

[d]Measured with conformance test signal at TP3 (see 87.8.11) for BER = 10^{-12}.

[e]Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

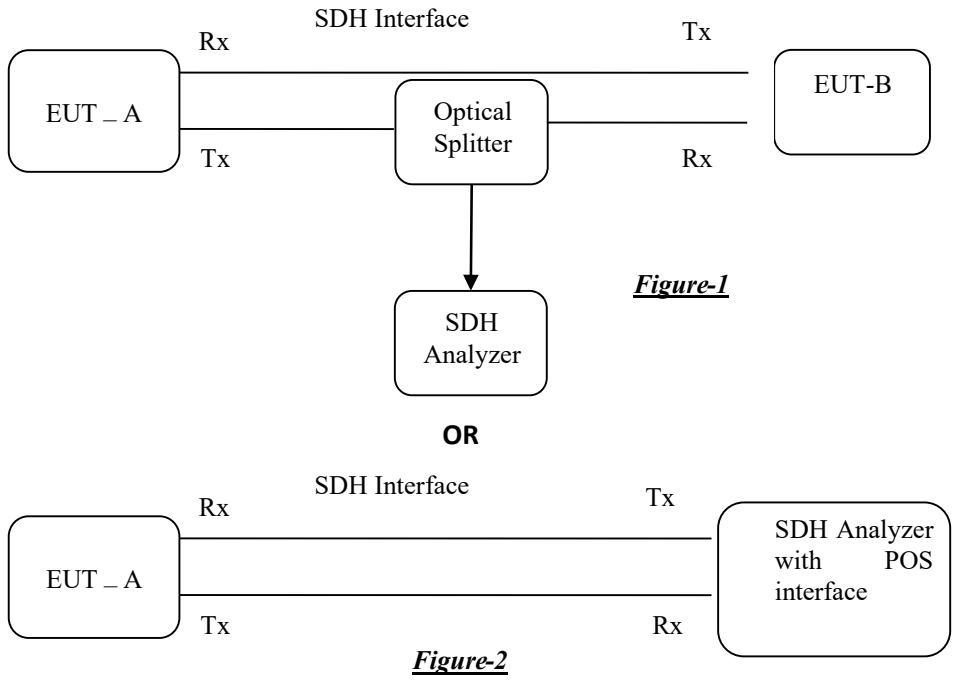
Table 88-8 for LR4/ER4 of IEEE 802.3ba specifications

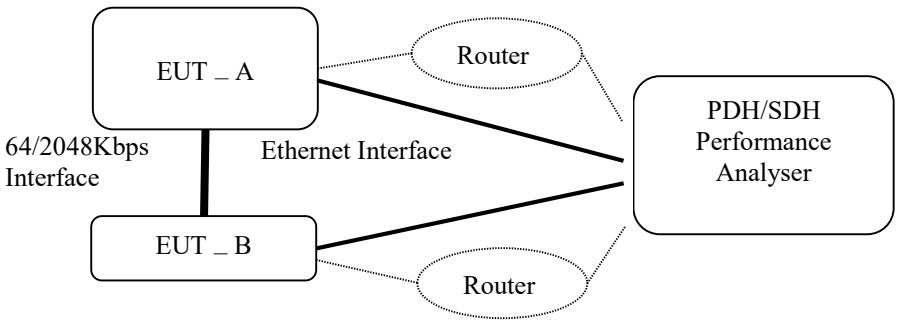
Table 88–8—100GBASE–LR4 and 100GBASE–ER4 receive characteristics

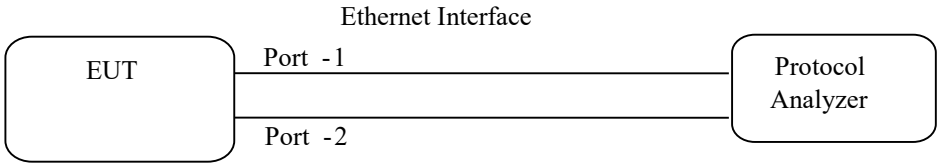
Description	100GBASE–LR4	100GBASE–ER4	Unit
Signaling rate, each lane (range)	25.78125 ± 100 ppm		GBd
Lane wavelengths (range)	1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19		nm
Damage threshold[a]	5.5		dBm
Average receive power, each lane (max)	4.5[b]		dBm
Average receive power, each lane[c] (min)	–10.6	–20.9	dBm
Receive power, each lane (OMA) (max)	4.5		dBm
Difference in receive power between any two lanes (OMA) (max)	5.5	—	dB
Difference in receive power between any two lanes (Average and OMA) (max)	—	4.5	
Receiver reflectance (max)	–26		dB
Receiver sensitivity (OMA), each lane[d] (max)	–8.6	–21.4	dBm
Receiver 3 dB electrical upper cutoff frequency, each lane (max)	31		GHz
Stressed receiver sensitivity (OMA), each lane[e] (max)	–6.8	–17.9	dBm
Conditions of stressed receiver sensitivity test			
Vertical eye closure penalty,[f] each lane	1.8	3.5	dB
Stressed eye J2 Jitter,[f] each lane	0.3		UI
Stressed eye J9 Jitter,[f] each lane	0.47		UI

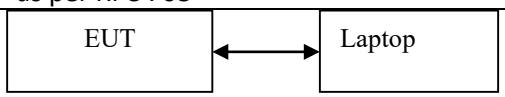
[a]The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
[b]The average receive power, each lane (max) for 100GBASE-ER4 is larger than the 100GBASE-ER4 transmitter value to allow compatibility with 100GBASE-LR4 units at short distances.
[c]Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
[d]Receiver sensitivity (OMA), each lane (max) is informative.
[e]Measured with conformance test signal at TP3 (see 88.8.10) for BER = 10^{-12}.
[f]Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

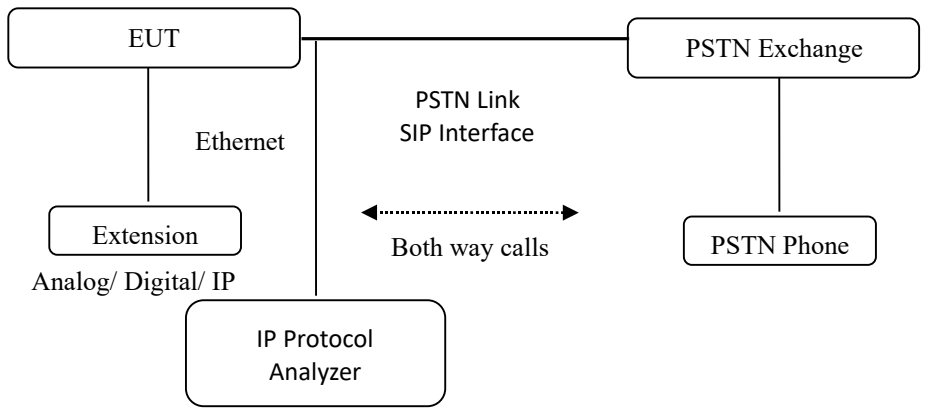
Test Procedure	1. Connect the setup as shown in the figure above. 2. Configure EUT B for sending packets to EUT A 3. Enable the output Optical Port of EUT B 4. Adjust the Optical Power Attenuator 5. Measure the Receiver Sensitivity 6. Verify whether the Receiver Sensitivity is within limits. 7. In case of Ethernet Optical Ports verify whether the Output Power / Receiver Sensitivity combination is able to meet the distance criteria requirements
Expected Results	Enclose the Test Results

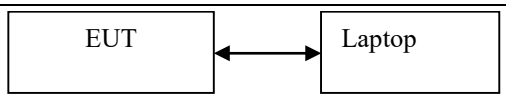
Test No.	14
Test Details	Test for SDH Payload Measurements
Test Instruments Required	1. SDH Network Analyser, Optical Splitter OR 2. SDH Analyser with POS capability
Test Setup	 ***Figure-1*** ***Figure-2***
Test Procedure	1. Connect the test setup as shown in figure. 2. The test setup in Figure-2 shall be used in case the SDH analyser has the POS interface. [Packet Over SDH] 3. The EUT-A shall be configured in the loopback mode such that the Packets sent from EUT-B / SDH Analyser is sent back. 4. Verify whether the SDH frame structure sent by the EUT is as per G.707 standards.
Expected Results	Enclose the Test Results

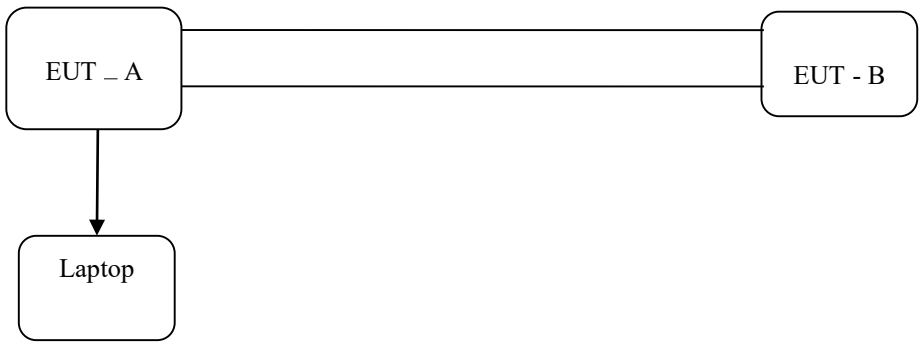
Test No.	15
Test Details	Test for Bit Error Rate [BER]
Test Instruments Required	1. PDH/SDH Performance Analyser
Test Setup	
Test Limits	The EUT shall be able to work with a BER better than $1x10^{-10}$ measured in any 15 minutes interval for all the speed/s of digital interface.
Test Procedure	1. Connect the test setup as shown in figure using a suitable cable wired to the Ethernet interface 2. A Router may be used for interface conversion in case the PDH/SDH Analyser does not have the compatible interface. 3. Perform the BER performance for 15 minutes interval
Expected Results	Enclose the Test Results

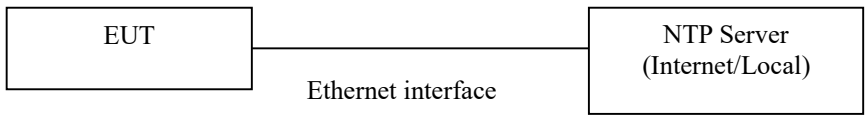
Test No.	16
Test Details	Test for Various Protocols
Test Instruments Required	1. IP Protocol Analyser
Test Parameters	As per various protocols being referred in the respective clause of the Test Schedule (TSTP)
Test Setup	
Test Procedure	1. Connect the test setup as shown in figure 2. The EUT shall be configured through the CLI [Command Line Interface] or SNMP interface for the various tests like IPv4, IPv6, TCP, Static Routing, Dynamic Routing, BGP, PPP etc 3. Various test parameters shall be measured using this setup 4. The test results may be recorded.
Expected Results	Enclose the Test Results
	Note: 1. The test procedure for those RFC's which are forming part of the "compendium of test setup and test procedures for testing of RFC's of IETF" shall be performed as per the same. This test setup (at test no 16) is generic in nature and shall apply in case of RFC's which are not covered in the above referred compendium. 2. TEC New Delhi NGN Lab has this test facility 3. Where ever conformance tests are not available, functional tests shall be carried out. Moreover, wherever the specification requirement is to meet a specific functionality of the RFC, the clause of the RFC refereeing to the function shall be tested as per the functional test procedure. The functional test model available in the "compendium of test setup and test procedures for testing of RFC's of IETF" can be followed for those RFC's which are not covered in the compendium and where functional tests are carried out. 4. The protocol analyser shall be able to send various test packets to the EUT, check the response packet and check the conformance/functionality. Software tools like wireshark has got only the capability to analyse the received packets and do not have the capability to send test packets and measure the response. Hence the tools like wireshark cannot be used for this test. 5. In case the product is offered (with the same product version) is 'IPv6 Readylogo Certified', then the tests against RFC 4862, RFC 4443, RFC 4291, RFC 2460, RFC 4861, RFC 1981 and RFC 5095 (where ever referred in the Test Schedule) which are covered as part of the 'IPv6 Readylogo certification' shall not be carried out. I.e. in this case, the product version of the 'IPv6 Readylogo certificate' and the offered product shall be the same. Later versions than the certified versions will not come under the purview of this condition.

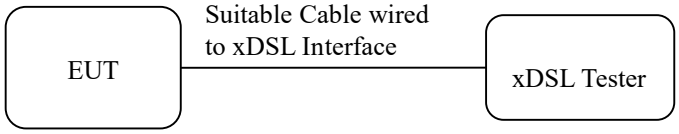
Test No.	17
Test Details	Test for Various Protocols using Wireshark
Test Instruments Required	1. Laptop/PC
Test Parameters	1. TCP as per RFC 793 2. UDP as per RFC 768
Test Setup	
Test Procedure	1. Connect the test setup as shown in figure 2. Load a suitable protocol analysis software such as Wireshark in the Laptop 3. The EUT shall be configured through the CLI [Command Line Interface] or SNMP interface for the TCP & UDP test. 4. The IP Packets may be observed in the Wireshark for TCP/UDP Compliance 5. The test results may be recorded.
Expected Results	Enclose the Test Results

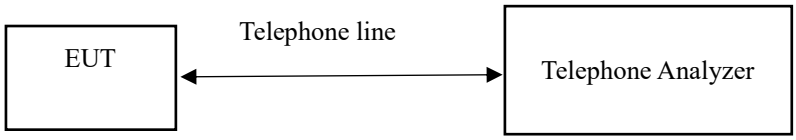
Test No.	18
Test Details	Test for the IP Protocol support for PSTN interface over IP - 1. SIP Protocol 2. IP version 4 3. Audio codecs 4. TCP protocol 5. RTP protocol 6. RTCP protocol
Test Instruments Required	1. IP Protocol Analyzer
Test Setup	
Test Procedure	1. Connect the system, as shown in the above setup and configure the EUT to enable it to send and receive calls to/from PSTN using SIP interface with different audio codecs. 2. Make outgoing and incoming calls from SIP extension to PSTN phone and vice versa. 3. Take message traces from IP Protocol Analyzer for verifying support for a. SIP Protocol b. IP version 4 c. All the Audio codecs (G.711, G.723, G.726, G.729, G.729A, G.729B, G.728AB, G.725A, AMR and T.38) d. TCP protocol e. RTP protocol f. RTCP protocol
Expected Results	Enclose the message traces from IP Protocol Analyzer

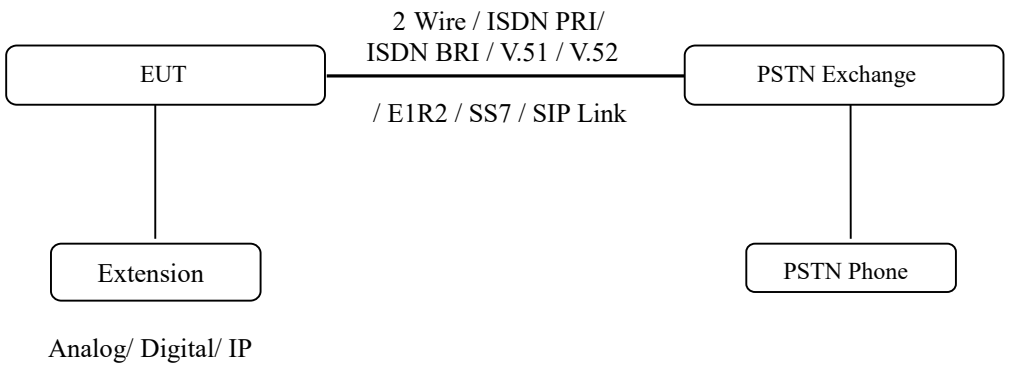
Test No.	19
Test Details	Test for Management Interface
Test Instruments Required	1. Laptop
Test Setup	
Test Procedure	1. Connect the EUT to the Laptop over Ethernet Interface as shown in the setup. 2. Load SNMP management software supplied by the Equipment Manufacturer or any other software [Freely downloadable from the Internet] 3. Configure EUT from the Laptop to act as the SNMP master. 4. Configure the SNMP software for SNMPv2 5. Check for the alarms [Traps] coming from the EUT to the Laptop. 6. Configure some parameters of the EUT from the Laptop through get and set commands.
Expected Results	Enclose the Test Results / Screen Shots

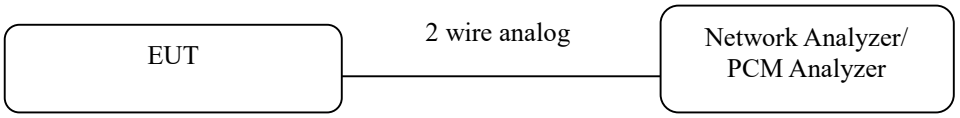
Test No.	20
Test Details	Test for Clock Extraction
Test Instruments Required	1. Laptop
Test Setup	
Test Procedure	1. Connect the test setup as shown in figure 2. Configure EUT-A for using the clock extracted from the interface connected to EUT-B [Slave Mode] 3. Verify the configuration about the usage of the clock 4. Verify whether the EUT-A is able to configure in Master Mode
Expected Results	Enclose the Command Line Interface [CLI] Results / Screenshots

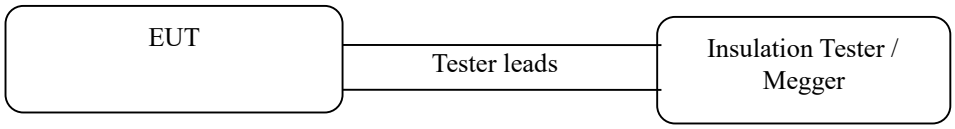
Test No.	21
Test Details	Test for NTP Server Synchronization support
Test Instruments Required	Nil
Test Setup	
Test Procedure	1. Setup the system as shown in the diagram above. 2. Configure the system to synchronize with NTP server, either located locally or on the internet. 3. The system should be able to synchronize with NTP server.
Expected Results	Enclose the Screen Capture Results

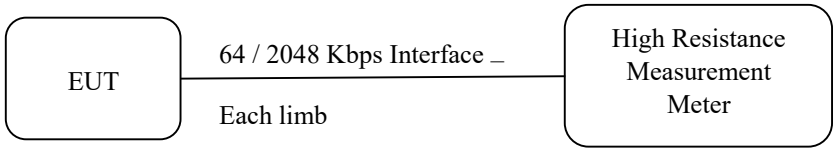
<table>
<tr><td>Test No.</td><td>22</td></tr>
<tr><td>Test Details</td><td>xDSL Line Tests
[The tests shall be limited to the tests specified under the Test Limits below]
<table>
<tr><td>ADSL Tests</td><td>Conformity Tests as per G.992.1, G.992.3, G.992.5</td></tr>
<tr><td>VDSL Tests</td><td>Conformity Tests as per G.993.1, G.993.2</td></tr>
<tr><td>SHDSL Tests</td><td>Conformity Tests as per G.991.2 Annex G</td></tr>
<tr><td>Other Tests for all xDSL interfaces</td><td>Support of Protocols - PPPoE as per RFC2516, PVC, VPI/VCI support FTP Speed Test
Metallic Loop Tests (Loop Resistance, Insulation Resistance, Capacitance)
Impulse Noise Protection</td></tr>
</table></td></tr>
<tr><td>Test Instruments Required</td><td>1. xDSL Tester [Capable of testing xDSL CPE’s].
2. In case the tester do not have the capability to measure some of the above tests, separate tester can be used
3. For Impulse Noise Tests test results from the OEM can be obtained.</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><td>G.992.1</td><td>PSD [Power Spectral Density] as per Annexure-A</td></tr>
<tr><td>G.992.3</td><td>PSD</td></tr>
<tr><td>G.992.5</td><td>PSD</td></tr>
<tr><td>G.993.1</td><td>PSD and Return Loss as per clause 6.2 and 6.5</td></tr>
<tr><td>G.993.2</td><td>Profiles as per Clause 6.3, PSD as per clause 7.2</td></tr>
<tr><td>G.991.2</td><td>Return Loss as per Clause 11.3 and PSD as per Clause 11.5</td></tr>
<tr><td>PPPoE</td><td>Shall support PPPoE configuration as per RFC2516</td></tr>
<tr><td>PVC</td><td>Shall support PVC configuration</td></tr>
<tr><td>VPI/VCI</td><td>Shall support VPI/VCI configuration</td></tr>
<tr><td>FTP Speed Tests</td><td>1. ADSL2+ interface supporting 16Mbps speeds using 0.5mm copper loop distance of 2Km
2. VDSL2 interface supporting 30Mbps speeds using 0.5mm copper loop distance of 500m
3. SHDSL interface supporting 1.5Mbps speeds using 0.5mm copper loop distance of 2Km</td></tr>
<tr><td>Loop Resistance</td><td>As per Telephone line requirements</td></tr>
<tr><td>Insulation Resistance</td><td>As per Telephone line requirements</td></tr>
<tr><td>Capacitance</td><td>As per Telephone line requirements</td></tr>
<tr><td>Impulse Noise Protection[INP]</td><td>INP shall be better than 2</td></tr>
</table></td></tr>
<tr><td>Test Procedure</td><td>1. Connect the test setup as shown in figure
2. Measure the various parameters as per the test details and verify whether they are within the Test Limits.</td></tr>
<tr><td>Expected Results</td><td>Enclose the Test Results / Screen Shots</td></tr>
</table>

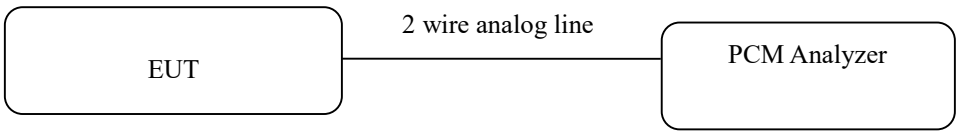
Test No.	23
Test Details	Test for Loop Current (for 2 wire analog interface only
Test Instruments	1. Telephone Analyzer Required
Test Setup	
Test Procedure	1. Setup the CTI equipment and Telephone analyser as shown in the test setup above while enabling the 2 wire analog interface on the EUT. 2. Measure the loop current on the telephone analyser .
Expected Results	1. The loop current in idle condition (on-hook) should not be more than 0.5 mA. 2. The loop current in the off-hook condition should not be more than 60 mA. 3. When CTI is connected to PSTN line (i.e. when customer calls IVRS facility) the current drawn from the line shall be less than 40 micro Amps. Enclose the test results

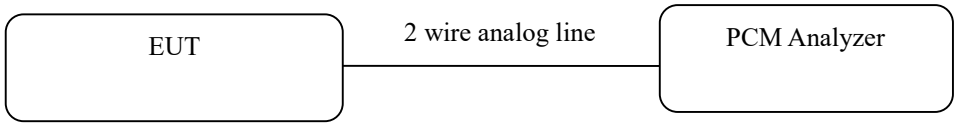
Test No.	24
Test Details	Test for the DTMF support
Test Instruments Required	Nil
Test Setup	
Test Procedure	1. Setup the system as per above diagram and configure the EUT to enable it to send and receive calls to/from PSTN 2. Make an incoming call from PSTN phone to EUT and the Interactive Voice Response System should get activated and should prompt the user to dial a digit soon. 3. Program the IVRS to detect all DTMF tones and respond accordingly. 4. Check that the IVRS system responds properly to all dialled digits. 5. Make an outgoing call from EUT system to PSTN phone and activate the IVRS facility. Prompt the user to dial different digits. The EUTshall respond according to the dialled digits. 6. Make an incoming call from a mobile phone to EUT and check that the call matures.
Expected Results	Enclose the logs from EUT.

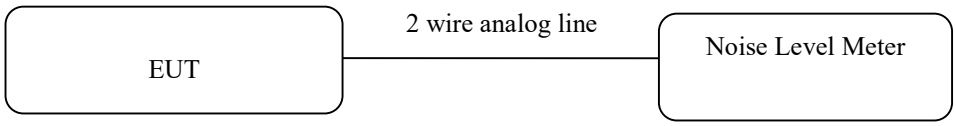
Test No.	25
Test Details	Test for Return Loss (2 wire interface only)
Test Instruments Required	1. Network Analyser or PCM Analyzer
Test Setup	
Test Limits	1. Balance Return Loss > 12 dB in the range 300Hz to 3400Hz 2. Echo Return Loss > 16 dB
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the Balance and Echo Return loss using the Test instrument. 3. Check whether the Return Loss is within the specified limits.
Expected Results	Enclose the Test Results

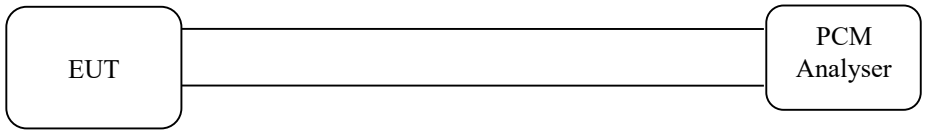
Test No.	26
Test Details	Test for Insulation Resistance (2 wire interface only)
Test Instruments Required	1. Insulation Tester / Megger
Test Setup	
Test Limits	1. Insulation resistance >= 5 Mega ohms
Test Procedure	2. Connect the Setup as shown in the figure. 3. Measure the Insulation resistance (between any two points not electrically connected) using the Test instrument leads. 4. Check whether the Insulation resistance is within the specified limits.
Expected Results	Enclose the Test Results

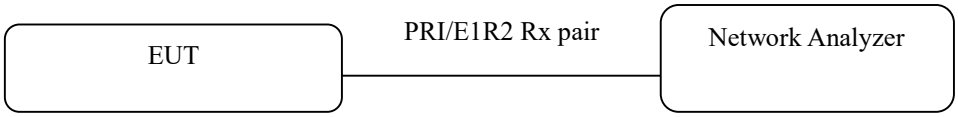
Test No.	27
Test Details	Test for Input Resistance
Test Instruments Required	1. High Resistance measurement Meter
Test Setup	
Test Limits	> 5 Mohm
Test Procedure	1. Connect the test setup as shown in figure for Limb-A 2. Measure the Input resistance 3. Repeat the test for Limb-B
Expected Results	Enclose the Test Results

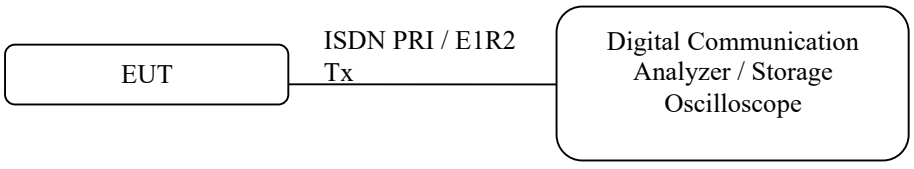
Test No.	28
Test Details	Test for Loudness Rating (SLR and RLR) (2 wire interface only)
Test Instruments Required	1. PCM Analyzer
Test Setup	
Test Limits	1. SLR at zero line +7dB 2. SLR at limiting line +12dB 3. RLR not louder than -6dB 4. RLR not quieter than -1dB
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the SLR and RLR values using test equipment. 3. Check whether the values are within the specified limits.
Expected Results	Enclose the Test Results

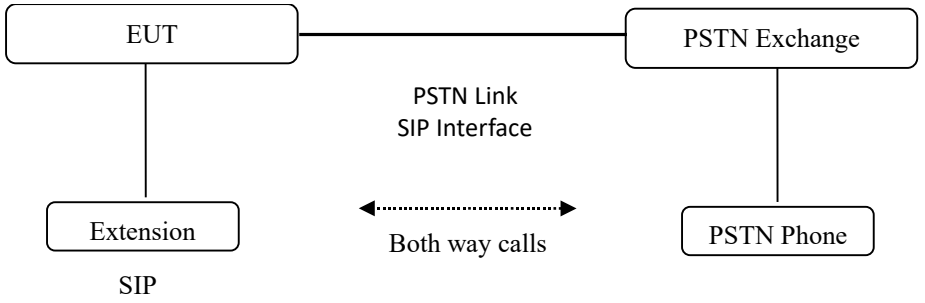
Test No.	29
Test Details	Test for Side Tone Masking Rate (STMR) (2 wire interface only)
Test Instruments Required	1. PCM Analyzer
Test Setup	
Test Limits	1. STMR > +8 dB
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the STMR value using test equipment for different line lengths. 3. Check whether the values are within the specified limits.
Expected Results	Enclose the Test Results

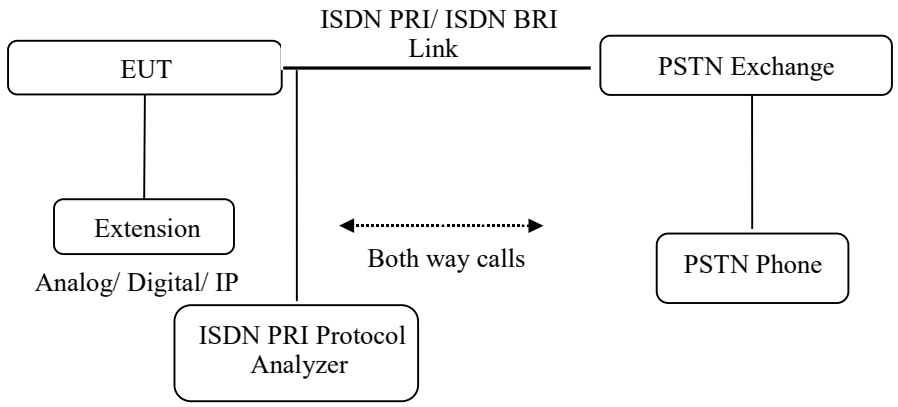
Test No.	30
Test Details	Test for Noise level (2 wire interface only)
Test Instruments Required	1. Noise Level Meter
Test Setup	
Test Limits	1. Noise level less than -65dBm
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the Noise level value across 600 ohms termination of EUT using test equipment. 3. Check whether the values are within the specified limits.
Expected Results	Enclose the Test Results

Test No.	31
Test Details	Test for Minimum Longitudinal Loss
Test Instruments Required	1. PCM Analyser
Test Setup	
Test Procedure	1. Connect the test setup as shown in figure 2. Measure the Minimum Longitudinal Loss using the PCM Analyser
Expected Results	Enclose the Results / Screenshots

Test No.	32
Test Details	Test for Return Loss (ISDN PRI/E1R2 interface)
Test Instruments Required	1. Network Analyser
Test Setup	
Test Limits	1. Refer clause 9.3 of ITU-T G.703 [Refer Test-8 for details]
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the input port return loss using the Network Analyser 3. Check whether the Return Loss is within the specified limits
Expected Results	Enclose the Test Results

Test No.	33
Test Details	Test for Output Pulse Mask (ISDN PRI/E1R2 interface)
Test Instruments Required	1. Digital Communication Analyser / Storage Oscilloscope
Test Setup	
Test Limits	Refer Figure-15 G.703 [Refer Test-7 for details]
Test Procedure	1. Connect the EUT as shown in the figure. 2. Enable the Port if required. 3. See whether the output pulse is within the mask/limits as indicated above.
Expected Results	Enclose the Test Results with the Pulse shape & the Pulse Mask

Test No.	34
Test Details	Test for support of Traffic report generation
Test Instruments Required	Nil
Test Setup	
Test Procedure	1. Connect the system, as shown in the above setup and configure the EUT to enable it to send and receive calls to/from PSTN using SIP interface. 2. Configure the system to generate traffic reports for IC and OG calls. 3. Make outgoing and incoming calls from SIP extension to PSTN phone and vice versa. 4. Check if the system is able to generate traffic report.
Expected Results	Enclose the traffic report.

Test No.	35
Test Details	Test for the ISDN PRI/BRI Protocols
Test Instruments Required	ISDN Protocol Analyzer
Test Setup	
Test Procedure	1. Connect the system, as shown in the above setup and configure the EUT to enable it to send and receive calls to/from PSTN 2. Make outgoing and incoming calls from EUT extension to PSTN phone and vice versa. 3. Use ISDN PRI protocol Analyzer for verifying support of the following parameters in ISDN PRI / BRI messages - a. Call reference b. Bearer capability c. Called party number d. Calling party number e. Channel identification f. Numbering plan identification
Expected Results	Enclose the results from ISDN PRI / BRI Protocol Analyzer

Test No.	36
Test	Tests with connectivity over E1R2 Signaling
Tests involved	1. Line Signaling 2. Register Signaling 3. Fax Transmission
Test Setup	Typical connectivity of EUT with E1R2 Signaling Interface
	Note: E1R2 signaling to be tested between EUT and two Switches of different switching technologies.

Line Signaling and Register Signaling as per Chapter 2, Section B of GR G/LLT-01/04.DEC98 (Relevant clauses are given.)

2.5.2.1.1 Line signalling - Digital Type 1

Operating condition	Signaling				
	Forward			Backward	
	af	bf	cf	ab	bb
Idle	1	0	0	1	0
Seizure	0	0	0	1	0
Acknowledgement	0	0	0	1	1
Answer	0	0	0	0	1
Metering Pulse (180 - 270 ms)	0	0	0	1	1
Clear back	0	0	0	1	1
Clear forward	1	0	0	0 or 1	1
Release guard	1	0	0	1	0
Trunk Offering and Re-ringing					
a) TKO press key	0	0	1	1	1
b) False answer	0	0	1	0	1
c) Release key	0	0	0	0	1
d) "B" party on hook	0	0	0	1	1
e) Re-verify	0	0	1	1	1
Blocking	1	0	0	1	1

Notes:

1. For all supervisory signals bf = 0; a change to bf = 1 indicates a fault.
2. The trunk offering signal can be used as a control signal for echo suppresser in case of satellite application.
3 df, cb, db are spare bits, df =db = 1, and cb = 0, are assigned according to ITU-T Recommendation G732.

2.5.2.2.1 Line signalling - Digital Type 2

Operating condition	Signaling			
	Forward		Backward	
	af	bf	ab	bb
Idle	1	1	1	0
Seizure	0	1	1	0
Acknowledgement	0	1	1	1
Answer	0	1	0	1
Metering Pulse	0	1	1	1
Clear back	0	1	1	1
Clear forward	1	1	0 or 1	1
Release guard	1	1	1	0
Trunk Offering and Re-ringing				
a) TKO press key	0	0	1	1
b) False answer	0	0	0	1
c) Release key	0	1	0	1
d) "B" party on hook	0	1	1	1
e) Re-verify	0	0	1	1
Blocking	1	1	1	1

Forward	cf = 0
	df = 1
Backward	cb = 0
	db = 1

2.5.2.3.1 Line signalling - Digital Type 3

Operating condition	Signaling			
	Forward		Backward	
	af	bf	ab	bb
Idle	1	1	1	1
Seizure	0	1	1	1
Answer	0	1	0	1
Metering Pulse	0	1	1	1
Clear back	0	1	1	1
Clear forward	1	1	0 or 1	1
Release guard	1	1	1	0
Trunk Offering and Re-ringing				
a) TKO press key	0	0	1	1
b) False answer	0	0	0	1
c) Release key	0	1	0	1
d) "B" party on hook	0	1	1	1
e) Re-verify	0	0	1	1
Blocking	1	1	0	1

2.5.2.4.1 Line Signalling - Digital Type 4 (E&M signalling)

This signalling scheme is used over carrier circuits and is basically the same as that specified for ITU-T signalling system R2, analogue version as per recommendations Q.411, Q.412, Q.414, Q.415 and Q.416. It is of the out of band and low level continuous type (3825 Hz + 4 Hz) with tone-OFF in the answered condition (tone-ON-idle signalling). The system provides for link-by-link transmission of the line signals. The tone OFF condition in the forward (backward), direction is signalled by connecting earth to the send (receive) leg of the signalling channel. The signalling scheme available on the analogue media and corresponding sequence on TS16 of the 2048 kbit/s PCM stream is outlined in the table below :

Signal	Forward	Backward	af	bf	ab	bb
Idle	Tone ON	Tone ON	0	0	0	0
Seizure	Tone OFF	Tone ON	1	0	0	0
Answer	Tone OFF	Tone OFF	1	0	1	0
Metering Over channel	Tone OFF	Tone ON during the meter pulse followed by Tone OFF	1	0	1/0/1	0
Clear forward	Tone ON	Tone ON or OFF	0	0	0 or 1	0
Clear back	Tone OFF	Tone ON	1	0	0	0

Release guard	Tone ON	On recognition of clear forward Tone OFF followed by Tone ON	0	0	1/0	0
Blocking	Tone ON	Tone OFF	0	0	1	0
Echo canceller control						
(On O/G side)	Tone OFF	Tone ON	1	1	0	0
(On I/C side)	Tone OFF	Tone ON	1	0	0	1

Notes:

1. The period of backward tone off for release guard is 450 □ 90 ms, as per ITU-T R2 Recommendation Q.412. However, in existing electromechanical exchanges in the Indian network this may be of the order of 70-100 ms only. E-10B TAXs may provide the timing as per ITU-T R2 Recommendation Q.412.
2. The recognition time for a changed condition is 20 ms.
3. In transit exchanges, the answer signal is immediately repeated to the preceding exchange.
4. The metering signal has a duration of 180 to 270 ms.
5. A signal to switch "in" or "out" echo-suppresser is to be sent, while working over satellite circuits. The echo-suppresser is assumed to be provided along with the transmission equipment outside the exchange. The signal to switch echo-suppresser is carried out on M 2 wire.

2.0 : Register Signalling - Indian R2 Modified MFC Signalling

2.5.1.2.2.1 Indian R2 Modified MFC Signalling

2.5.1.2.2.1(a) The register signalling uses multi-frequency compelled sequence self-checking code. Generally end to end signalling is used except on national and international calls established through a TAX, in which case, the signalling is end-to-end between the originating exchange and the originating TAX and between originating TAX and the last exchange (TAX or local) using MFC.

2.5.1.2.2.1(b) In the existing TAXs, only 5 forward and 5 backward frequencies have been equipped (allowing 10 MF signals in each direction in 2/5 code), though provision exists for introduction of sixth frequency as per R2 scheme. In local MFC type exchanges, only 5 forward and 4 backward frequencies have been equipped.

2.5.1.2.2.1(c) The frequencies used in the backward direction are 660, 780, 900, 1020 and 1140 Hz. Those used in forward direction are 1380, 1500, 1620, 1740, and 1860 Hz. (Provision exists for addition of 1980 Hz in forward and 540 Hz in backward direction).

2.5.1.2.2.1(d) Forward signals

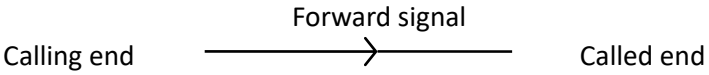
The forward frequencies can be used to send digits (when used as Group-I forward signals) or to send the category of calling subscriber (when used as group-II forward signals).

2.5.1.2.2.1(e) Backward signals

The backward frequencies can be used to make further demands (when used as Group-A backward signals), or to report back the called line condition to the calling side (when used as Group-B backward signals). In electronic exchanges all 5 backward frequencies shall be equipped.

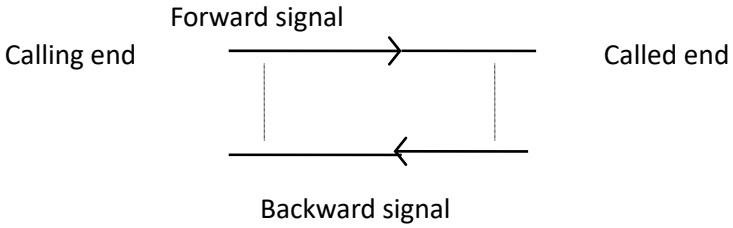
2.5.1.2.2.1(f) Signalling sequence

i)



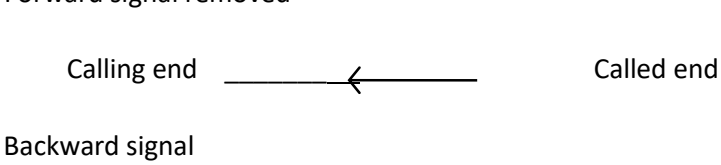
Calling end applies the forward signal as per the demand previously made by the called end (or the first digit start with). At the called end, this signal is examined for relevance and 2/5 validity.

ii)



Called end applies backward signal as per next requirement. The application of backward signal is recognised at calling end as the acknowledgement for reception of forward signal. The 2/5 validity is checked and the demand is decoded.

iii)



Forward signal is removed as an acknowledgement to the receipt of a backward signal.

iv) When the removal of a forward signal is recognised, the backward signal is also removed and this removal is recognised by the calling end, to end the sequence.

2.5.1.2.2.1(g) Significance of the Multi-frequency signals:

The significance of the forward signals and backward signals, as interpreted in the Indian network, are given in tables below :

Group I - Forward Signals

Signals	Indian National MFC scheme
I.1 I.2	Digit 1
I.3 I.4	Digit 2
I.5 I.6	Digit 3
I.7 I.8	Digit 4
I.9	Digit 5
I.10	Digit 6
	Digit 7
	Digit 8
	Digit 9
	Digit 0

Group II - Forward Signals

Signals	Indian National MFC scheme
II.1	Ordinary Subscriber
II.2	Priority Subscriber
II.3	Spare at present (proposed for use in future for 'maintenance equipment call')
II.4	Spare at present
II.5	Operator STD
II.6	coin box.
II.7	Spare
II.8	Spare
II.9	Spare
II.10	Spare

Group A - Backward Signals

Signals	Indian National MFC scheme
A.1	Send next digit (n+1)
A.2	Restart
A.3	Change over to reception of B-signals
A.4	Calling line identification-see note
A.5	Send category of the calling subscriber
A.6	Switch-through the speech path
A.7	Send last but two digit (n-2) } Not
A.8	Send last but three digit (n-3) } available in
A.9	Send last but one digit (n-1) } local exchange
A.10	Spare at present (may be used for } at present trunk congestion if network permits) }

Group B - Backward Signals

Signals	Indian National MFC scheme
B.1 B.2	Spare
B.3 B.4	Changed number
B.5 B.6	Called line busy
B.7	Congestion
B.8	Unallotted number
B.9	Normal subscriber, free, with metering
B.10	Spare
	Spare; not available in local exchange
	Spare; not available in local exchange
	Spare; not available in local exchange

Test No.	37
	SIGNALLING TEST FOR CONNECTIVITY BY CCS7
Test Setup	
Tests	1. Protocol Data Check 2. MTP Level 2 Tests 3. MTP Level 3 Tests 4. ISUP Tests 5. Interface Tests
Test arrangement:	At least 2 signaling link sets should be available to check various capabilities of CCS7 signaling. A suitable CCS7 protocol Simulator and Analyser is required to be connected to IP based Integrated Media Gateway for simulating and monitoring the messages. The testing shall be carried out as per the test description given in each Test sheet of the ITU-T document given in the following Test Schedule.

1. Protocol Data check: Check the document or obtain certificate from the vendor in support of the following sub paras:

1.1. Signalling network Management messages:

Check messages implemented in the system with Table 1 of ITU-T recommendation Q.704 (1988). Following signalling network management messages are optional for interface approval.

CNP, CNS, CSS, DLC, RSR, TFR and UPU.

1.2. ISUP messages: Check Heading Code implemented in the system with Table 3 of ITU-T recommendation Q.763 (1988). Following ISUP messages are optional for interface approval:

CMC, CMRJ, CMR, CQM, CQR, COT, DRS, FAA, FAR, FRJ, FOT, LPA, OLM, PAM, USR and UCIC.

1.3. Timer values: Check the values of Level 2 Timers, Level 3 Timers and Application call processing timers implemented in the system with the following documents:

Timer **Document Reference**

Level 2 Timers Page 3 MTP para 12.3 of National CCS7 specification for Local/Tandem exchanges No. G/CCS-01/01.JUN93.

Level 3 Timers Para 16.8 of ITU-T recommendation Q.704 (1988). Timers T11, T15, T16 are not applicable. Timers T7, T18, T19, T20, T21 & T24 are optional.

Application call Annex A to ITU-T recommendation Q.764 of call 1988. Timers T3 and T4 timers processing are not used. Timers T28, T31 and T32 are optional.

2. MTP Level 2 tests: The compatibility tests given in ITU-T Q.781 (1988) will be done on the CCS7 links of Integrated Media Gateway with a suitable CCS 7 protocol Simulator and Analyser. The protocol shall conform to the ITU-T test sheets mentioned below.

Tests for MTP2

Clause No.	**Description**		**Test results**
2.3 Clause from S/CCS 02/03	The functions and procedures relating to transfer of signaling messages over a data link shall be as per ITUT Rec. Q.703 (1993). This provides the layer 2 functions for the CCS7 protocol Stack.		ITU-T Rec. Q.781 validates the protocol specification in ITU-T Rec Q.703
	ITU-T Rec Q781 Test Cases		
SI No	Test case Description	Limits	Compliance Test Results
MTP2-1	Timer T2 - Q781:1.2	5-150sec	
MTP2-2	Timer T3- Q781:1.3	1-2sec	
MTP2-3	Timer T1 and T4 (Normal) – Q781:1.4	7.5-9.5sec	
MTP2-4	Normal Alignment - correct procedure (FISU) - Q781:1.5		
MTP2-5	Emergeny Alignment – Timer T4 - Q781:1.19	400-600msec	
MTP2-6	AERM: Error rate above normal threshold - Q781:7.3		
MTP2-7	Negative Acknowledgement - Q781:8.2		
MTP2-8	Retransmission Buffer Full - Q781:8.3		
MTP2-9	Excessive delay of acknowledgement - Q781:8.12		
MTP2-10	Restart of Timer T7 - DelayQ781:10.2		
MTP2-11	Timer T6 -Congestion Control Timer Q781:10.3	3-6sec	

3. MTP Level 3 tests: The compatibility tests given in ITU-T Q.782 (1988) will be done on the CCS7 links of Integrated Media Gateway with Suitable CCS7 Simulator and Analyser. The protocol shall conform to the ITU-T test sheets mentioned below.

Tests for MTP3

Clause No.	Description	Test Results
2.4 Clause from S/CCS-02/03	The functions and procedures relating to transfer of signaling messages between the signaling points shall be as per ITU-T Rec. Q.704 (1993). This provides the layer 3 functions for the CCS7 protocol stack	ITU-T Rec. Q.782 validates the protocol specification in ITUT Rec Q.704

	ITU-T Rec Q782 Test Cases	
Sl.No	**Test Cases Description**	
MTP3-1	Signalling linkset deactivation - Q782:1.2	
MTP3-2	Signalling linkset activation- Q782:1.3	
MTP3-3	Message with invalid DPC - Q782.2.2 – use a SLTM message.	
MTP3-4	Message with errorneous SI-Q782.2.3	
MTP3-5	Reception of an additional Changeover Order – Q782.3.6	
MTP3-6	Changeover to several links within a linkset - Q782:3.15	
MTP3-7	Additional CBD – Q782.4.3	
MTP3-8	No Acknowledgement to first CBD – Q782.4.4	
MTP3-9	Inhibition of an available link - Q782:7.1.1	
MTP3-10	Inhibition of an unavailable link – Q782:7.1.2	
MTP3-11	Local reject on available link – Q782:7.2.1	
MTP3-12	Forced unhibition of a link - sending LFU - Q782:7.10.1	
MTP3-13	Forced unhibition of a link - reception of LFU - Q782:7.10.2	
MTP3-14	Management Inhibiting Test: Periodic sending and receiving of LLI and LRI-Q 782: 7.17.1	
MTP3-15	Signalling link test: After activation of a Link-Q782:12.1	
	Miscellaneous MTP Test Cases	
MTPMisc-1	It shall be possible to assign the signaling data link to any timeslot of the PCM except timeslot 0.	

4. ISUP tests:

The compatibility tests given in ITU-T Q.784 (1991) will be done on the CCS7 links of Integrated Media Gateway with A Suitable CCS7 Simulator and Analyser. The protocol shall conform to the ITU-T test sheets mentioned below.

Test Cases for ISUP

Clause No.	Description	**Test Results**
	Clause from S/CCS-02/03	
5.1	ISUP shall be as per the functional description given in ITU-T Rec. Q.761 (09/97).	ITU-T Rec. Q.784 validates the protocol specification in ITU-T Rec Q.761Q.764
5.2	The messages, parameters and the parameter information used by ISUP shall be as per ITU-T Rec.Q.762(09/97)	
5.3	The formats and codes of ISUP messages and the parameters required to support basic bearer services and the supplementary services shall be as per ITU-T Rec. Q763(09/97)	

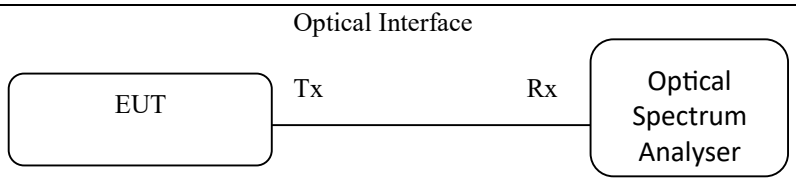
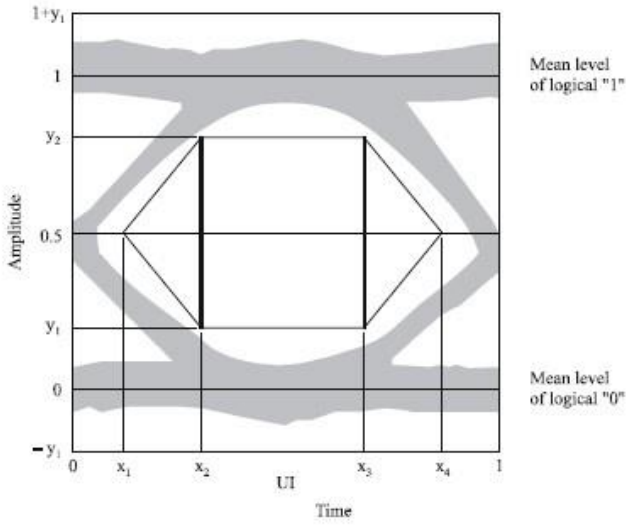
5.4	The ISUP signaling procedures for setting up and clearing down of national and international ISDN connections shall be as per ITU-T Rec. Q764(09/97)	
	ITU-T Rec.Q784 Test Cases	
SL.No.	Test Cases Description	
ISUP-1	Reset received on an idle circuit – Q784.1.2.1	
ISUP-2	Reset sent on an idle circuit – Q784.1.2.2	
ISUP-3	Circuit group reset received-Q784:1.2.5	
ISUP-4	Circuit group reset sent-Q784.1.2.6	
ISUP-5	CGB and CGU received - Q784:1.3.1.1	
ISUP-6	CGB and CGU sent - Q784:1.3.1.2	
ISUP-7	Circuit Blocking received– Q784.1.3.2.1	
ISUP-8	Circuit blocking sent – Q784.1.3.2.2	
ISUP-9	Continuity Check Test: CCR received: Q784:1.4.1	
ISUP-10	Continuity Check Test: CCR sent: Q784:1.4.2	
ISUP-11	Normal Call setup:Overlap operation(with SAM)-Q784:2.2.2	
ISUP-12	T7: Waiting for ACM - Q784:5.2.1	
ISUP-13	T9:Waiting for an answer message-Q784:5.2.2	
ISUP-14	T16 and T17: failure to receive a RLC – Q784.5.2.8	
ISUP-15	Reset of circuits during a call – outgoing circuit- Q784:5.3.1	
ISUP-16	Reset of circuits during a call – incoming circuit- Q784:5.3.2	
ISUP-17	Automatic repeat attempt - blocking of a circuit - Q784:6.2.2	
ISUP-18	Dual Seizure for controlling SP-Q784:6.3.1	

Test For ISUP Supplementary Services

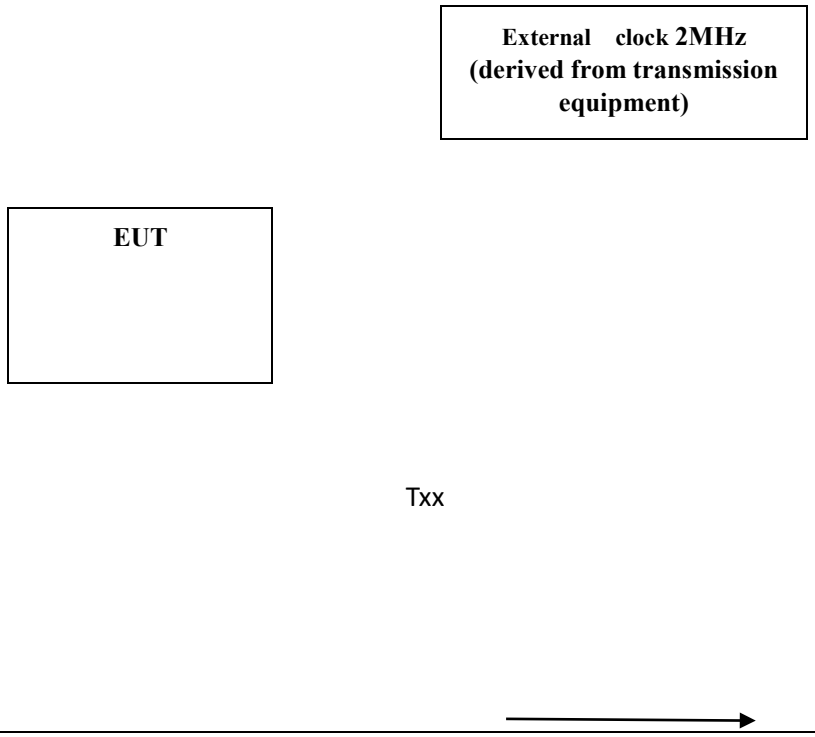
Clause No.	Description	Test Results
	Clause No. S/CCS-02/03	
Chapter4	The general format for ISDN user part (ISUP) supplementary services shall be as per ITU-T Rec.Q.730(9/97)The implementation of the supplementary services shall be as per IT-T Rec. Q.731 to Q.737.	
Sl.No.	Test Case Description	
SUPP-1	Calling Line Identification Presentation (CLIP)-Q731.3(3/97)	
SUPP-2	Calling Line Identification Restriction(CLIR)-Q.731.4(3/97)	
SUPP-3	Connected Line Identification Presentation(COLP)-Q.731.5(3/97)	
SUPP-4	Connected Line Identification Restriction (COLR)-Q.731.6(3/97)	
SUPP-5	Malicious Call Identification (MCID)-Q.731.7(2/97)	
SUPP-6	Sub addressing (SUB)-Q.731.8(6/97)	

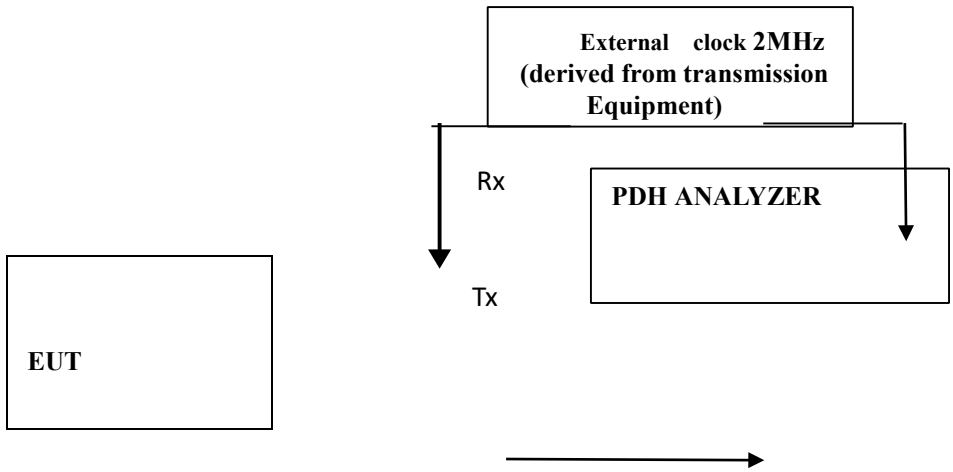
5 : Interface Tests for CCS7 Signaling

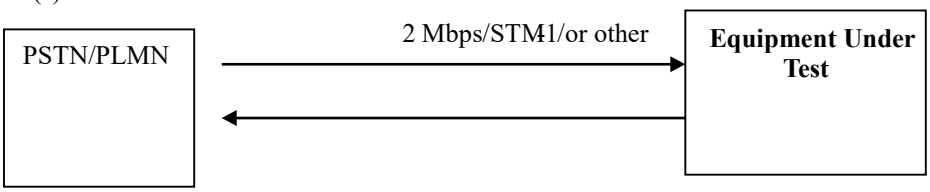
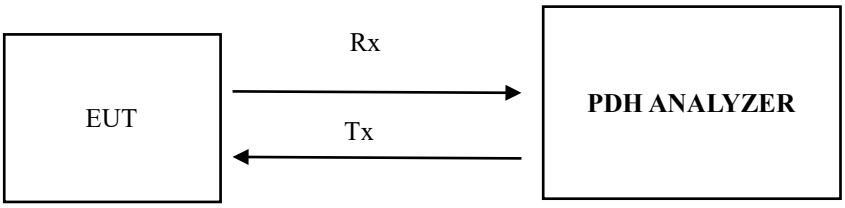
Clause No.	*Description*		Test Results
1	**Completed Call**	Check for ISUP Messages	
2	A-Party Release	Check for ISUP Messages	
3	B-Party Release	Check for ISUP Messages	
4	B-Party Engaged	Check for ISUP Messages	
5	Incomplete Dialling	-	
6	Call with 10 digit CLI	Check for ISUP Messages	
7	B Party No answer	Check for ISUP Messages	
8	Fax	Fax Transmission	
9	Modem connection	Set the codec to G711 & initiate call from Modem A to Modem B through VOIP network. The data transfer should be tested between the two modems.	
10	Modem Connection	Set the codec to G729 & initiate call from Modem A to modem B through VOIP network. The data transfer should be tested between the two modems.	

<table>
<tr><td>Test No.</td><td>38</td></tr>
<tr><td>Test Details</td><td>Eye Pattern for Optical Interfaces</td></tr>
<tr><td>Test Instruments Required</td><td>1. Optical Spectrum Analyser</td></tr>
<tr><td>Test Setup</td><td> 
</td></tr>
<tr><td>Test Limits</td><td><table>
<tr><td>STM-1 Short Haul / Long Haul</td><td>Refer Figure-2/G.957</td></tr>
<tr><td>STM-4 Short Haul / Long Haul</td><td>Refer Figure-2/G.957</td></tr>
<tr><td>STM-16 Short Haul / Long Haul</td><td>Refer Figure-2/G.957</td></tr>
</table></td></tr>
<tr><td>Standards Reference</td><td> 

<table>
<tr><td></td><td>STM-1</td><td>STM-4</td></tr>
<tr><td>x1/x4</td><td>0.15/0.85</td><td>0.25/0.75</td></tr>
<tr><td>x2/x3</td><td>0.35/0.65</td><td>0.40/0.60</td></tr>
<tr><td>y1/y2</td><td>0.20/0.80</td><td>0.20/0.80</td></tr>
</table>
<table>
<tr><td></td><td>STM-16</td></tr>
<tr><td>x3−x2</td><td>0.2</td></tr>
<tr><td>y1/y2</td><td>0.25/0.75</td></tr>
</table>
G.957_F02
NOTE – In the case of STM-16, x2 and x3 of the rectangular eye mask need not be equidistant with respect to the vertical axes at 0 UI and 1 UI. The extent of this deviation is for further study. In view of the frequencies involved in STM-16 systems and the consequent difficulty of realizing this filter, the parameter values for STM-16 may need slight revision in light of experience.
Figure 2/G.957 – Mask of the eye diagram for the optical transmit signal</td></tr>
<tr><td>Test Procedure</td><td>1. Connect the Setup as shown in the figure.
2. Enable the output Optical Port
3. Measure the optical spectrum / eye pattern
4. Check whether the spectrum / eye patternis within the specification limits</td></tr>
<tr><td>Expected Results</td><td>Enclose the Test Results</td></tr>
</table>

Test No.	39
Test Details	Test for Frequency Stability in Holdover Mode
Test Instruments Required	PDH Analyzer
Test Setup	
Test Procedure	1. Connect the Setup as shown in the figure. Synchronies both the EUT & PDH Analyser (Testing equipment) as per test setup from external timing reference which may be extracted from transmission equipment.) 2. After the EUT is synchronised and stabilised, remove the reference input. 3. It will go to holdover mode. 4. Now run the TIE measurement in holdover mode, which should be started at this point for 24 Hrs. 5. Measure Time Interval Error (TIE) on PDH analyzer 6. Clock stability should be calculated as follows: Clock stability= Time Interval Error (TIE)/Measurement Duration
Test Limits	Frequency Stability in Holdover Mode. Minimum stability of clock in holdover mode shall be 1*10-9 per day. The term 'minimum stability' implies that the stability should be equal to or better than the value specified.

Test No.	40
Test Details	Test for Bit Slip Measurement
Test Instruments Required	PDH Analyzer
Test Setup	
Test Procedure	1. Connect the Setup as shown in the figure. Synchronize both the EUT & PDH Analyser (Testing equipment) as per test setup from external timing reference which may be extracted from transmission equipment.) 2. After the EUT is synchronised and stabilized, run the measurement (PRBS bit pattern) which should be started at this point for 96 Hrs. 3. Measure Slipon PDH analyzer for a period of atleast 96 hours of operation. In synchronised mode of operation, not more than 2 slips per day are permitted.
Test Limits	Under synchronized condition, slips observed at the 2048 Kbits interface of digital exchange/ EUT shall be less than or equal to 2 slips in 24 hours.

Test No.	*41*
Test Details	*Test for junction test*
Test Instruments Required	PDH Analyzer
Test Setup	(a)   (b)
Test Procedure	1. *First connect the Setup as shown in the figure (a) as per interface applicable 2Mbps/STM-1/or other. Break the interface continuity either by soft command or physically removing the wire. Verify the status of link in break condition; alarm should appear, when reconnect the alarm should disappear.* 2. *Now connect the Setup as shown in the figure (b) as per interface applicable 2Mbps/STM-1/or other through PDH analyzer. Verify the status of link in healthy condition of interface from PDH analyzer. Now increase the BER gradually through PDH analyzer and observe the alarm condition. Note down the BER threshold level when alarm appear. This value of BER should be within accepting limits.*
Test Limits	Check all alarms and note down the values of thresholds regarding junction testing.

Comments on Revision of Test Guide of Standard for GR Titled "Ethernet Electrical to Optical Media Converter"

(Draft Test Guide No. TEC 48081:2025)

Name of

Manufacturer/Stakeholder:

Organization:

Contact details:

Clause No.	Clause	Comments	Other Remarks, if any

Note: The comments on the revision of Test Guide of Standard for GR titled "Ethernet Electrical to Optical Media Converter" may be provided in the above format vide Email to adic1.tec@gov.in , adit2.tec-dot@gov.in, dirit2.tec-dot@gov.in