Template for submitting comments/inputs on draft Test Guide titled "
SIGNALLING GATEWAY**"**
(Draft Test Guide No. TEC 59051:2020)

Name of Manufacturer/Stakeholder:

Organisation:

Contact Details:

S. No	Clause No.	Clause	Comments	Other Remarks, if any

Note: The comments/inputs on the draft Test Guide (Draft Test Guide No. **TEC 59051:2020**) may be provided in the above format vide email to **director-al.tec-dot@gov.in, ddglte.tec@gov.in**

अनंतिम टेस्ट गाइड

टीईसी 59051:2020

PROVISIONAL TEST GUIDE

TEC 59051:2020

for

सिगनलिंग गेटवे

SIGNALLING GATEWAY

(STANDARD No.: TEC 59050: 2019)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-110001, भारत

TELECOMMUNICATION ENGINEERING CENTRE

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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 detailed provisional test schedule and test procedure for evaluating conformance/functionality/requirements/ performance of standard on Signalling Gateway per standard no. TEC 59050:2019 [earlier known as GR No. TEC/GR/SW/SGW-001/04/DEC-19].

CONTENTS

A.   HISTORY SHEET

Sl. No.	Standard / documents No.	Title	Remarks
1.	TEC/TSTP/GR/SG/SGW-001/03.JAN-12	Signalling Gateway	TSTP against GR no. TEC/GR/SG/SGW-001/03.JAN-12
2.	TEC 59051: 2020	Signalling Gateway	Test Guide against TEC standard No. TEC 59050:2019 [earlier known as GR No. TEC/GR/SW/SGW-001/04/DEC-19].
Document number changed as per Revised Numbering scheme of TEC for conversion of existing TEC document to Standard vide document no.4-47/2019-RC/TEC dated 07-09-2020			

Note:

1. Since the documents have been renumbered as per revised numbering scheme, kindly refer the Mapping- Listing Table pertaining to old and revised document number available on TEC website www.tec.gov.in/. In case of further clarification, please contact at e mail id adgdoc.tec@gov.in

2. Inside the document, General Requirements may be read as Standard for General Requirements, Interface Requirements as Standard for Interface Requirements, Service Requirements as Standard for Service Requirements and Test Schedule & Test Procedure(TSTP) as TEC Test Guide."

B.   INTRODUCTION

This standard enumerates detailed provisional test schedule and test procedure for evaluating conformance / functionality / requirements / performance of Signalling Gateway per standard no. TEC 59050:2019 [earlier known as GR No. TEC/GR/SW/SGW-001/04/DEC-19].

C.   General information:

Sn.	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)			
5	Any other relevant Information:-		

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

Sl. No.	Name	Designation	Organization	Signature
1.				
2.				

E. List of the Test Instruments:

Sno.	Name of the test instrument	Make /Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team)*
1.	External Clock Source		dd/mm/yyy
2.	ANT-20		
3.	PFA 30 or Slip Comparator		
6.	PDH/SDH Analyzer		
7.	IP Protocol Analyzer		
8.	BER Meter		
9.	SS7 Signaling Monitor/ Simulator/Analyser		
10.	Pulse Mask measuring instrument (Digital Communication Analyzer)		
11.	Return Loss Measuring Set (Network Analyzer		

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.: -

Clause No.	Clause	Type of Test / Test No. etc. *
General	The hardware equipped should conforms to the document supplied.	Physical Check A list of hardware details up to PCB level with identification shall be provided by the supplier. Verify that the hardware equipped conforms to the hardware list provided.
General	Software version taken from the system should match with document provided by the supplier.	software version to be checked
1.0	**Introduction**	Heading
1.1	This document specifies the Generic Requirements (GR) of a Signaling Gateway (SG), to be used in Indian telecom networks.	Information
1.2	The SG is intended to facilitate seamless interworking between Signaling System Number 7 (SS7) network and IP based network.	Information
1.3	Operational, Qualitative and other requirements of the system shall be as per of TEC GR on STP No. TEC/GR/SW/STP-001/04.OCT-2015.	Undertaking required from the applicant
1.4	Traffic measurement and recording shall be as per TEC GR on STP No. TEC/GR/SW/STP-001/04.OCT-2015.	Functional Verification Start traffic and measure the following parameters: • Number of SIF (Signalling Information Field) and SIO (Service indicator octet) • Received/ transmitted with a given OPC (Originating Point Code) and set of OPCs • handled with a given SI (Service Indicator) or SI set • received/handled with a given OPC or OPCs set and SI or SI set • transmitted with a given DPC (Destination point code) or DPCs set and SI or SI set • Number of MSU (Message Signal Unit) handled with a given OPC set, DPC set and SI set Repeat the above observation

			for 15 min. and 30 minutes' duration. All measurements should be possible. Measure number of unauthorized messages on any link set or from a particular SP code. It should be possible to measure and count such unauthorized messages and the same should be notified by generating. For generating alarms/ unauthorized messages simulator can be used. Figure-1 of Test no. 1 may be referred for Setup.
1.5	Wherever, the standardized documents like ITU-T, IEEE, QA and TEC documents are referred; the latest issue and number with amendments shall be applicable.		Information
1.6	The RFC documents of the IETF are subject to periodic revision. Hence where ever RFC's are mentioned in this document, the offered product shall meet either the referred RFC or its version. Wherever a feature of the RFC is mentioned, product shall comply with the part of the RFC specifying the feature.		Information
1.7	The interpretation of the clauses of the RFC's shall be as per RFC 2119.		Information
2.0	**Description**		Heading
2.1	The Signaling Gateway (SG) shall provide transparent interworking of CCS-7 signaling between Switched Circuit Network (SCN) and IP networks		Test No. 1
2.1.1	The signaling gateway shall provide standalone Signal Transfer Point (STP) equipment functionality as per TEC GR. No. TEC/GR/SW/STP-001/04.OCT-2015.		Undertaking required from the applicant.
2.1.2	The Signaling Gateway shall be capable of terminating SS7 signaling as well as translate and relay messages over an IP network to a Soft switch complying to TEC GR No. TEC/GR/SW/NGN-LTS/02.FEB-13 for soft switch or another signaling gateway.		Test No. 2
2.1.3	The signaling gateway shall provide the transformation of Message Transfer Part (MTP) and application part of CCS7 signaling for transport over SCTP over IP over MPLS network.		Test No. 2
3.0	**Functional/Operational Requirements**		Heading
3.1	**General**		Heading

| 3.1.1 | Signaling gateway shall support Stream Control Transport Protocol (SCTP) for reliable transportation of CCS7 messages in the IP network. It shall be used to transfer ISUP, SCCP, TCAP, INAP, MAP and CAP. | Refer Figure-2 in Test No.2

Test for reliable transportation of CCS7 messages (ISUP, SCCP, TCAP, INAP, CAP and MAP) using SCTP (Stream Control Transport Protocol). Functional tests have to be done. |
|---|---|---|
| 3.1.2 | For telephony over IP/MPLS solution, the signaling Gateway shall convert the narrowband signaling information into IP packets and send them through the MPLS network. | Refer Test No. 2

Do Testing for conversion of the narrow band signalling information into IP packets and sending them through the MPLS/IP network. |
| 3.1.3 | The signaling Gateway shall support high speed signaling links as per ITU-T Q.703. | Functional Verification

Test for supporting signalling links as per ITU-T Q.703. |
| 3.1.4 | The signaling Gateway shall support at least 128 point codes. | Undertaking required from the applicant. |
| 3.1.5 | It shall be able to connect at least 500 signaling links of 64 kbps / 32 signaling links of 2 Mbps or any combination as per service provider requirements, as a standalone signaling gateway (SSGW). | Undertaking required from the applicant regarding the number of signalling links.

In addition, Test no. 3, 4, 5, 6 & 7 will be applicable for EUT/SG (having a 2 Mbps interface link which shall meet the Output Pulse Mask, Output Jitter, Input Jitter Tolerance and Input Return Loss and Bit rate accuracy/Bit rate tolerance tests as per G.703). |
3.2	**Addressing**	Heading
3.2.1	The signaling Gateway shall support SS7 point codes as per the National CCS7 signaling Plan.	Check that Numbering and addressing as per the 'National Numbering Plan' of DoT. Undertaking required from the applicant.
3.2.2	The signaling Gateway shall support any one of the following addressing and same should be mentioned on the certificate issued to the applicant	Test no. 8

	1. IPv4 as per IETF RFC 791 2. Dual stack as per IETF RFC 4213 3. IPv6 as per IETF RFC 8200	
3.3	**Operation and Maintenance**	Heading
3.3.1	The signaling Gateway shall provide capability for operation, maintenance and administration from a remotely located Network Management System (NMS) as per TEC GR No. GR/NMC-01/01APR 2004.	Undertaking required from the applicant.
3.3.2	In addition, operation, maintenance and administration shall be provided locally also, using local terminals.	Functional Verification: From system OMAP, measure the following (by command) ■ MTP signalling link faults and performance (Table-1/Q.752 ■ MTP signalling link availability (Table-2/ Q.752) ■ MTP signalling link utilization (Table 3 /Q.752) ■ MTP signalling link set and route set availability (Table 4/ Q.752) ■ MTP signalling point status (Table 5/ Q.752) ■ MTP signalling traffic distribution (signalling route utilization) (Table 6/ Q.752) ■ SCCP error performance (Table 7/ Q.752) ■ SCCP subsystem availability (Table 8/ Q.752) ■ SCCP – Utilization (Table 9/ Q.752) ■ SCCP – Quality of Service (Table 9 bis) / Q.752 All measurements should be possible.
3.3.3	The signaling gateway shall support signaling tracers with parameter decoding for MTP2, MTP3, SCCP, ISUP, M2UA, M2PA, M3UA and SCTP internally or through external protocol analyzer.	Do Functional Verification for following; (a) number of count of message sent and received (b) the number of bytes in

		both type of message
		(c) message tracing task
		(d) SCCP status can be queried
		(e) SCCP data can be configured.
		(f) Status of link sets
3.4	**Interface to Billing System**	Heading
3.4.1	The signaling Gateway shall provide on-line transfer of billing information (signaling Data Records) over TCP/IP to the billing Centre using FTP for file transfer. In addition, it shall be possible to take back-up of the billing information on Optical/Magnetic media locally.	Functional Verification
3.5.	**Networking with SCP**	Heading
3.5.1	The signaling Gateway shall be capable of interworking with the Service Control Points (SCP) in the network as per TEC SD No. SD/INP-01/02. MAY2007 and shall not necessitate any changes to interfaces or protocols in SCPs.	Undertaking required from the applicant.
3.6	**Synchronization**	Heading
3.6.1	The system shall preferably provide integrated synchronization equipment conforming to TEC Generic Requirement No. TEC/GR/IT/SYN-003/04/MAR-19.Holdover stability for layer -2 i.e.$1*10^{-10}$ per day or better shall be applicable.	(A) Undertaking required from the applicant regarding the capability of integrated synchronization equipment in the EUT.
3.6.2	The synchronization method shall be master/slave.	(B) In addition, following test are to be carried out; • Holdover stability Test- Refer Test No. 9 • Jitter Test Refer Test no. 10 • Bit error rate Test Refer Test no. 11 • Slip Rate Test Refer Test no. 12
3.6.3	The acceptable slip rate shall be in accordance with ITU-T Recommendation G.822.	(C) Following functional test are also to be carried out; • Redundancy Checks • Reference timing selection • Testing of alarms • Check of priority of clock inputs (Master/slave)

3.6.4	The signaling Gateway shall be capable of synchronization with NTP server.	Functional Verification Verify that the Network Time Protocol (NTP) server time synchronization function is normal. Check the time stamp on message.
3.7	**Requirements Specific Millennium Problem** The equipment hardware and software shall not pose any problem, due to changes in data time caused by events such as changeover of century, leap year etc., in the normal functioning.	Undertaking required from the applicant. or Do Functional Testing: Check that hardware and software shall not pose any problem in changeover of century/ leap year etc.
3.8	Alarm messages shall contain but not limited to, the following: a. date b. time c. severity d. unique identifying number e. user defined component identifier f. user defined category g. alarm text h. Component/ node/ interface i. Detailed alarm description including probable cause and impact. j. Possible ways to rectify the alarm.	Functional Verification • alarm can be reported when a fault occurs and the alarm can be cleared when the fault is rectified. • alarms can be queried • historical alarm logs that meet query conditions are displayed. • Alarm Indications: Check for necessary Audio/visual alarms for indication of faults at various levels of hardware on the individual modules. • Attach a list of the alarms available and tested.
3.8.1	The system shall provide tools to enable tracing, fault isolation and fault diagnosis in the signaling plane as well as on system, application and service level in order to perform "Root Cause Analysis".	Functional Verification
3.8.2	The Fault Management System shall comprise an interface to the Performance Management System in order to allow for alarming and clearing of performance degradation.	Functional Verification
3.8.3	The Fault Management System shall comprise a 'Maintenance Function' that allows for suppressing alarms for IMS components that are temporarily out of order e. g. due to upgrade installations, maintenance task etc.	Undertaking required from the applicant.
3.9	**Routine/ Diagnostic Tests**	Heading

3.9.1	Provision shall exist for routine tests of the supplied system either automatically or manually through man-machine command.	Functional Verification
3.9.2	There shall be provision for diagnostic testing to know the health of each module in the system like running normal or not, communication link available or not etc.	Functional Verification
3.10	**Command Log**	Heading
3.10.1	Commands which are used for modification of system program or data shall be logged in a file and it shall be possible to retrieve the same on demand whenever required, using MML command. It should not be possible to modify or delete log file by any MML command.	Functional Verification
3.10.2	It shall be possible to store at least the last 20 commands on the screen and by scrolling and editing any command can be re-executable (optional).	Functional Verification Or Undertaking required from the applicant.
3.11	**System back-up**	Heading
3.11.1	It shall be possible to take complete system backup on the same device. It shall also be possible to load the system from the backup. It shall be possible to store multiple files of charging information, detailed billing information, traffic statistics, command log, system software, office data etc. on the same device.	Functional Verification
3.11.2	It should be possible to save system back-up automatically at a specified time in the system hard disk. In addition, it should also be possible to save system backup automatically in CD-ROM/DVD/ Optical disk /Cartridge etc. It shall be possible to define the above time by MMC.	Functional Verification
3.12	**System Redundancy**	Heading
3.12.1	The system shall have adequate redundancy so as to comply with the requirements of system reliability and stability.	Functional Verification Redundancy of interface may be checked by removing one interface, there should not be any adverse effect on completed calls or calls in establishment phase.
3.12.2	Sufficient redundancy shall be built into the design of the system so that the failure of any component/sub-system STP shall not result in the total system failure.	Functional Verification
3.12.3	System shall be equipped with redundancy for power supply.	Functional Verification
4.0	**Interface Requirements**	**Heading**
4.1	**Interface**	**Heading**

4.1.1	The signaling gateway shall support IP over MPLS interfaces towards MPLS network and shall consist of Gigabit Ethernet interface and 10/100 Base T. The signaling gateway shall interface with router as per TEC GR No. TEC/IR/IT/TCP-001/05 Mar-2014.	Test No. 13
4.1.2	It shall be possible to extract and process the signaling information from 64 kbit/s signalling links multiplexed on a 2048 kbit (ITU-T G.703) links. The signaling gateway shall be able to extract signaling information which can be on any time slots (except time slot 0).	Functional Verification • Ability to extract the signalling information from 64 kbit/s signalling links multiplexed on a 2048 kbps link. • Ability to extract signalling information which can be on more than one-time slot (except time slot 0). • Check that it is possible to extract signalling from 16 time slots on one E1.
4.2	**Signaling Protocols**	Heading
4.2.1	Depending upon the requirement signaling Gateway shall support the following signaling Protocols as defined by SIGTRAN working group of IETF.	Information A declaration is also required from the applicant in which it is mentioned about the use cases of EUT & accordingly respective application protocol should be tested by TEC/RTEC. Accordingly, it will be mentioned in the type approval certificate. **In case of no declaration about use cases, all protocol will be tested.**
4.2.1.1	Frame work Architecture for signaling transport as per RFC 2719.	Test No. 14
4.2.1.2	Stream Control Transport Protocol (SCTP) as per IETF RFC 3286, 3257, (3309 & 2960) / (4960 & 3873).	
4.2.1.3	M3UA (MTP3 User Adaptation Layer protocol) as per IETF RFC No 3332/4666.	
4.2.1.4	M2UA (MTP2 User Adaptation Layer protocol) as per IETF RFC No 3331.	
4.2.1.5	M2PA (MTP2 Peer to Peer Adaptation protocol) as per IETF RFC No.4165.	
4.2.1.6	UA (SCCP user Adaptation protocol) as per IETF RFC 3868.	

4.2.2	The system shall provide CCS7 as per the following National Standard; a. Message Transfer Part (MTP) and ISDN User Part (ISUP) as per 'National CCS7 standards for MTP and ISUP (No.SD/CCS-02/03. JAN2000). b. Signaling Connection and Control Part (SCCP) as per National SCCP standards (No.SD/CCS-03/03. MAR06).	Test of supporting CCS7 by EUT as per National Standards is covered in Test no. 2.
4.3	**Other Mandatory Requirements**	Heading
4.3.1	**SS7 MTP Level 3 Requirements** The signaling gateway shall support the following MTP Level3 requirements.	
4.3.1.1	Message Loss: Not more than 1 in 10^7 messages shall be lost due to transport failure	
4.3.1.2	Sequence Error: Not more than 1 in 10^{10} messages shall be delivered out-of-sequence (including duplicated messages) due to transport failure.	Undertaking required from the applicant regarding the capability of SS7 MTP level3 requirements.
4.3.1.3	Message Errors: Not more than 1 in 10^{10} messages shall contain an error that is undetected by the transport protocol.	
4.3.1.4	Availability: Availability of any signaling route set shall be 99.9998% or better, i.e., downtime 10 min/year or less.	
4.3.1.5	Message length (payload accepted from SS7 user parts): 272 bytes for narrowband SS7.	
4.3.2	It shall be possible to set all timers related to SS7 and SIGTRAN protocols using MML. The end to end performance requirement for CCS7 signalling for all signalling path including the IP network path shall conform to National CCS7 Plan (SD/NSP-01/01.SEP92) and National CCS7 standards SD/CCS-02/03.JAN2000.	Undertaking required from the applicant
4.3.3	The equipment shall support both the network indicators i.e. NI = 01, 11 simultaneously.	Functional Verification
5.0	**Quality Requirements**	Heading
5.1	The signalling handling capacity of Signalling gateway shall be as follows for the rated call load: a. 15 MSU per call. b. 0.2 Erlang traffic per signalling link	
5.2	The signaling gateway shall be able to handle 50% overload of the rated BHCA capacity.	Undertaking required from the applicant
5.3	The signaling gateway shall be able to handle signaling traffic load of up to 0.4 Erlang per signaling link, including signaling traffic due to failure of other stand by signaling links.	
5.4	**Environmental conditions**	Heading
5.4(i) & (ii)	(i) Extreme environmental conditions under which the equipment is capable of short-term emergency operation without permanent damage may be indicated. (ii) Other parameter should be as per TEC standard SD: QM 333.	A test certificate and test report shall be furnished from an an ISO 17025 accredited test

			agency for the parameters as per TEC standard SD: QM 333. Extreme environmental conditions under which the equipment is capable of short-term emergency operation without permanent damage may be indicated by applicant.
6.0	**EMI/EMC Requirements** The equipment shall conform to the following EMC requirements for Class A:		A test certificate and test report shall be furnished from an ISO 17025 accredited test agency.
7.0	**Safety Requirements**		Heading
7.1	The equipment shall conform to IS 13252 part 1:2010- "Information Technology Equipment – Safety- Part 1: General Requirements" [equivalent to IEC 60950-1 {2005} "Information Technology Equipment – Safety- Part 1: General Requirements" or IEC 62368-1 and.		A test certificate and test report shall be furnished from an ISO 17025 accredited test agency.
7.2	A test certificate and test report shall be furnished from an accredited test agency		
7.3	The test agency for safety requirements tests shall be an ISO 17025 accredited agency and details of accreditation shall be submitted.		
8.0	**Security Requirements**		Heading
8.1	Security Requirements for SS7 over IP The signaling gateway shall support following security requirement		Information
8.1.1	Security for the signaling transport shall be ensured using secured transport mechanisms.		
8.1.2	Appropriate security mechanisms for authentication, integrity and confidentiality, shall be used for secured transportation through IP network as per the IETF RFC 2401.		Test No. 15
8.1.3	signaling gateway shall not impose any restriction for Lawful interception in complying to TEC GR No. TEC/GR/SW/LIS-001/04/JUN-17 regarding lawful interception.		Undertaking required from the applicant
8.2	**Unauthorized Access**		Heading
8.2.1	Suitable safeguards shall be provided in the man-machine communication programs to debar unauthorized persons from making any changes in the memory contents or office data. Access to system operations shall be controlled through multi-level password and authentication checks.		Functional Verification (i) Check password management. Give different command from different user account. It should not be possible to access system without password.
8.2.2	The man-machine communication programs shall have the facility of restricting the use of certain commands or procedures to certain passwords and terminals.		
8.2.3	Access to system operations should be controlled through multi-level password and authentication checks.		(ii) Log in the system and leave the terminal ideal (i.e. do not give any command).
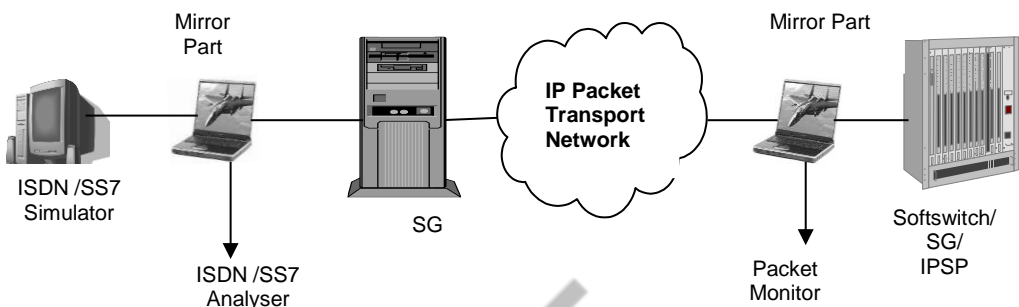
		After Session logout timing, terminal shall automatically log-out.	
		(iii) Password should not be visible on the monitor.	
		(iv) Check that System access should not interrupt the working of EUT.	
		(v) During working condition, give some command on the system. Both command & working should be processed successfully.	
8.3	**Monitoring**	Heading
8.3.1	The system shall pose no limitation in interception and monitoring any signalling link from monitoring positions.	Undertaking required from the applicant
8.3.2	Adequate security mechanisms at different levels shall be provided in the system so as to prevent unauthorized access or interference to services, protocols and data.	Functional Verification covered in clause no. 8.2
8.3.3	The system shall have facility to prevent Denial of Service (DOS) attacks. It shall be able to interact with various elements based on known IP address (source and destination), port number (source and destination) and Interface Identity.	Undertaking required from the applicant
8.4	The system shall comply with relevant contemporary Indian or International Security Standards e.g. IT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, Telecom and Telecom related elements against 3GPP security standards, 3GPP2 security standards etc. The equipment shall conform to prevailing law/requirement/conditions of DoT/Govt. of India.	The applicant/manufacturer shall submit a certificate from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards or as per requirements stated by DoT/ licensor/Regulatory body from time to time. Certificate from authorized and certified agencies/labs in India shall be submitted.
8.4.1	The applicant/manufacturer shall submit a certificate from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards or as per requirements stated by DoT/ licensor/Regulatory body from time to time. Certificate from authorized and certified agencies/labs in India shall be submitted.	
9.0	**Information for the procurer of product (Desirable Requirements)**	No testing is required for clause 9.0 as this is desirable/ suggestive requirements for purchaser.
10.0	Specific items to be mentioned in the certificate	Information
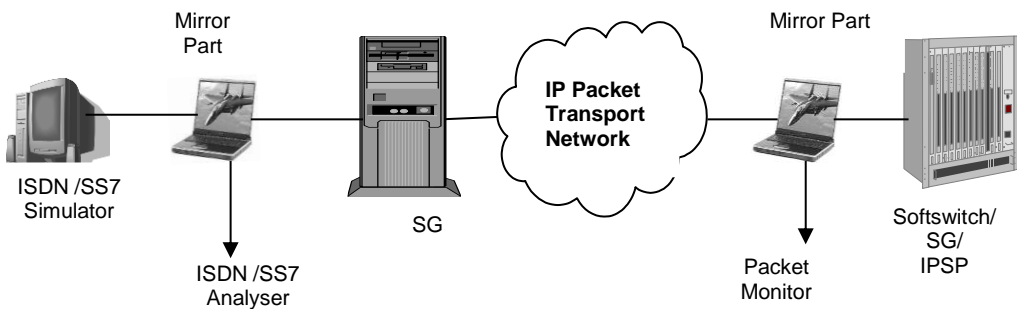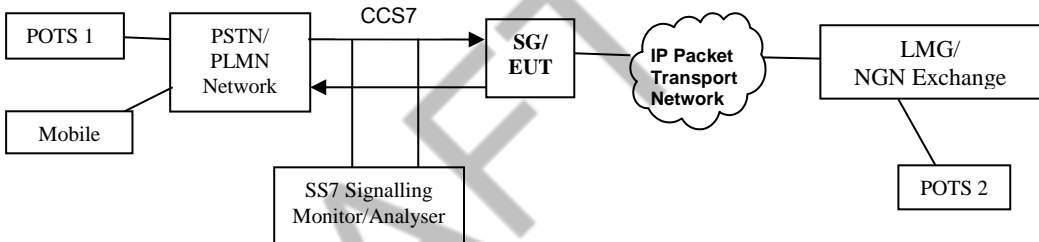
Physical Check/Declaration/Documentation/ Report from Accredited test lab/ Functional verification / Information / Test No.
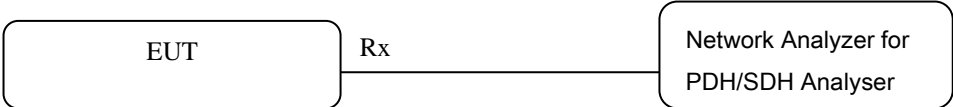
Note:
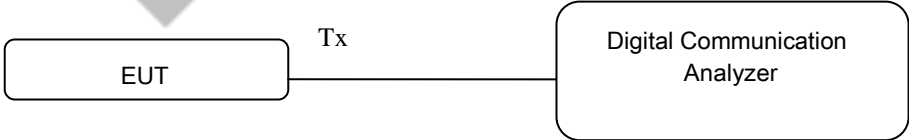
1. The test set-up given in this document are tentative and may be changed by testing officer/testing team, taking into account network/ testers/ analyzer/ simulator availability. In case of any discrepancy between this Test Guide and standard (earlier known as GR), standard clause prevail.

2. Where, it is not possible to conduct the test with public network exchange/ system or main exchange connectivity is not available, simulator may be used for testing purpose.

3. Wherever any extension is required from main exchange, same should be available in premises where testing is being carried out.

4. Message sequence given in expected results contain messages which testing officers should look-for but it may also include some additional messages.

5. Since this is provisional Test Guide. On the basis of input received setup was prepared. Whenever the first testing was offered this provisional Test Guide would be revised.

6. For all RFC mentioned in the document conformance test to be done for relevant clauses

7. 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 test.

8. CCS7 Analyser/Simulator should have at least the following capabilities:

   i. Should record and analyse CCS7 messages calls including general messaging and call flow scenarios. Logging and pass/fail results should be reported.

   ii. Should verify conformance of actions

   iii. Should monitor progress of simultaneous calls with bidirectional data traffic.

   iv. Supports Call Capturing based on Link or called / calling numbers or link-set

   v. Should provide detailed protocol analysis, traffic analysis, and packet data analysis

   vi. It should have inbuilt test scenarios for testing CCS7 based component for feature conformance and functionality. The various scenarios for MTP testing tool to simulate messaging.

   vii. It should have filter capability to filter message based on

   - The Frame number.
   - Date/Time
   - Call Number.
   - String matching e.g. any call, where some CCS7 message in that call has a header that contains the specified.

I. TEST SETUP & PROCEDURES:

Test No.	1
Test Details	For Clause no. 2.1 [Transparent interworking of SG]
Test Instruments Required	SS7/ISDN Protocol Analyzer/simulator, IP Packet network, Packet Monitor/IP Analyser
Test Setup	**Figure-1**
Test Procedure	1. Connect the setup as shown in the figure. 2. ISDN/SS7 Simulator or equivalent setup send the ccs7 signalling to SG/EUT. 3. SG will convert and transport the CCS7 signalling to IP network. 4. Check the working of SG by capturing the data or observe the console/O&M of SG.
Expected Result	Verify that that the Signaling Gateway (SG) shall provide transparent interworking of CCS-7 signaling between Switched Circuit Network (SCN) and IP networks.

Test No.	2
Test Details	For Clause no. 2.1.2 [Testing of Support of CCS7 Signalling], Clause no. 2.1.3
Test Instruments Required	SS7/ISDN Protocol Analyzer/simulator, IP Packet network, Packet Monitor/IP Analyser
Test Setup	 **Figure-2** **Figure-3**

Test Procedure	1. Connect the setup as shown in the figure 1 or figure 2.
	2. Call from POTS 1/Mobile to POTS 2 and capture the CSS7 Signalling flow.
	3. Call from POTS 2 to POTS 1 and capture the CSS7 Signalling flow.
	4. Do thorough testing of support of CCS7 Signalling as per Annexure-1.
	  (a) Protocol Data Check
	  (b) MTP Level 2 Tests
	  (c) MTP Level 3 Tests
	  (d) ISUP Tests
	  (e) Interface Tests
	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 for simulating and monitoring the messages.
	5. Capture the IP Packets after SG.

Expected Result	1. Verify that the signaling gateway (SG) shall be capable of terminating SS7 signaling as well as translate and relay messages over an IP network. 2. Verify that the signaling gateway shall provide the transformation of CCS7 signaling message [Message Transfer Part (MTP) and application part] for transport over SCTP over IP network.
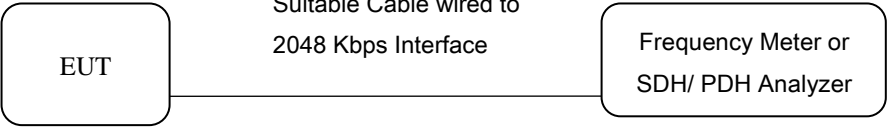
Test No.	3
Test Details	Clause no. 3.1.5 (Test for Input Port Return Loss)
Test Instruments Required	Network Analyzer for PDH/SDH Interfaces
Test Setup	**Figure-4**
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the input port return loss using the Network Analyzer 3. Check whether the Return Loss is within limit given below
Test Limits	Minimum Return loss limits at input port for 2048 kbps (E1) interface — Refer clause 9.3 of G.703
Expected Results	

Frequency range	Return loss
51 KHz to 102 KHz	≥ 12 dB
102 KHz to 2048 KHz	≥ 18 dB
2048 KHz to 3072 KHz	≥ 14 dB
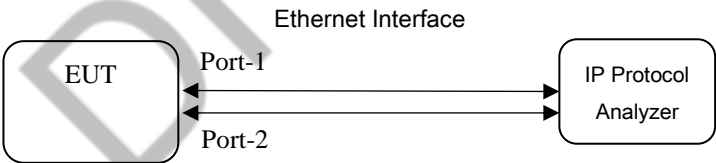
Test No.	4
Test Details	Clause no. 3.1.5 (Test for Output Pulse Mask)
Test Instruments Required	Digital Communication Analyser or Digital Storage Oscilloscope
Test Setup	**Figure-5**
Test Procedure	1. Connect the EUT as shown in the figure above. 2. Enable the Port if required. 3. See whether the output pulse is within the mask/limits as given in table given below.
Test Limits	Limits for Pulse shape & characteristics for 2048kbps (E1) interface — Refer Table-7 and Figure-15 of G.703
Expected Results	Enclose the Test Results with the Pulse shape & the Pulse Mask. [Refer Annexure-2]
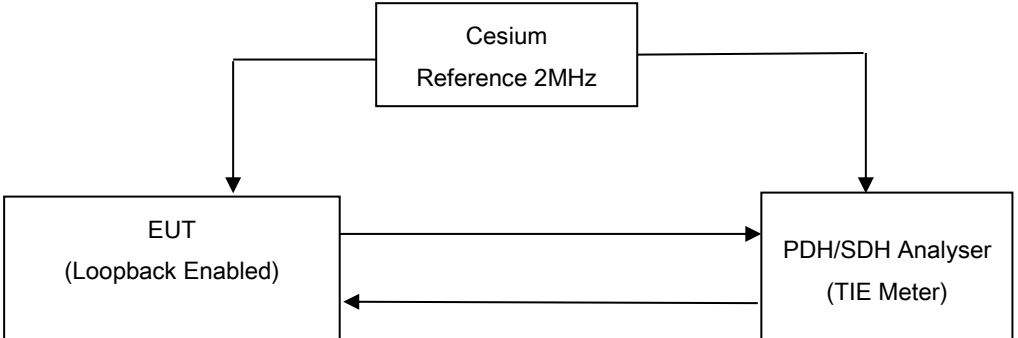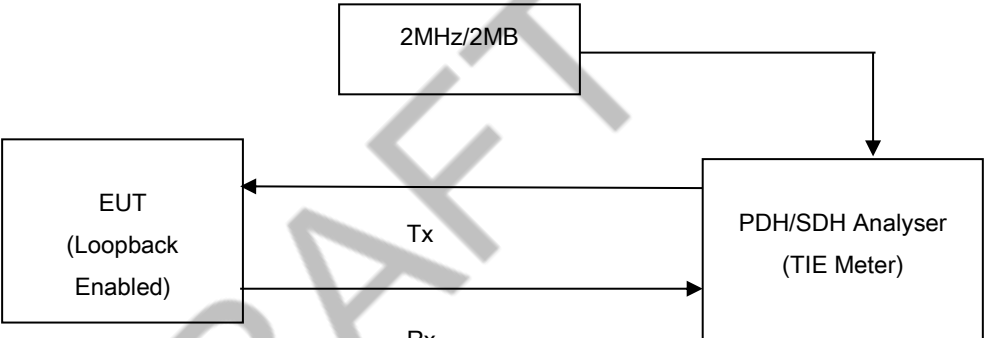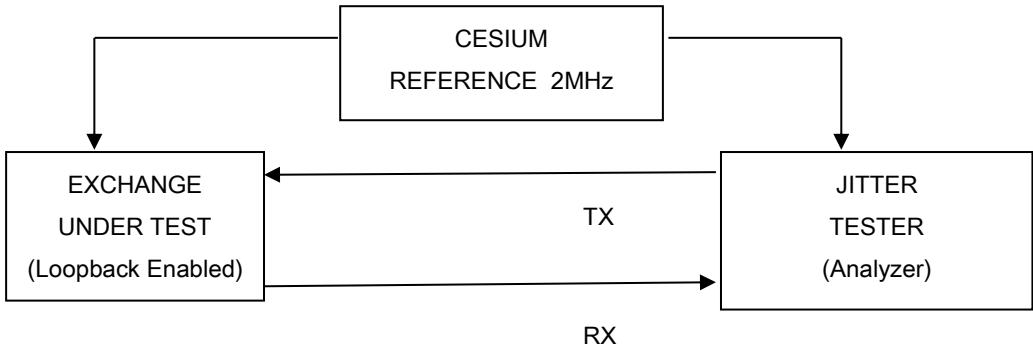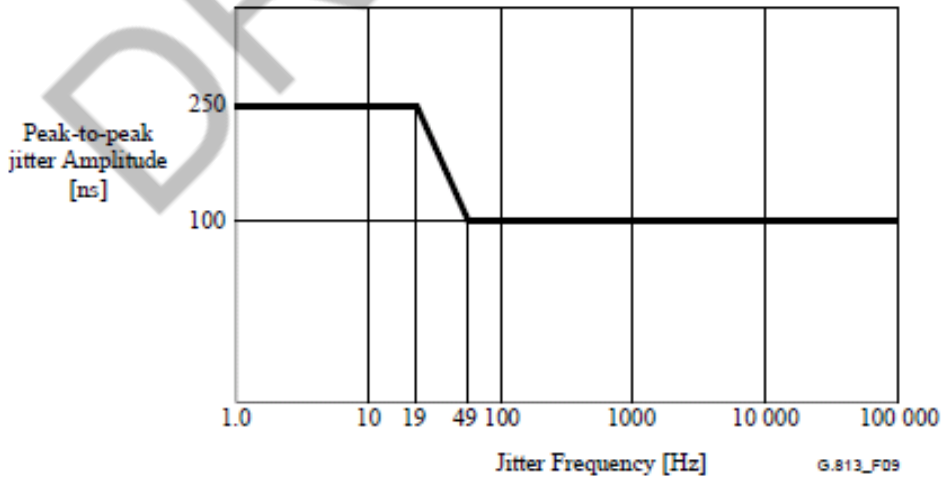
Test No.	5
Test Details	Clause no. 3.1.5 (Test for Jitter Tolerance at input port)
Test Instruments Required	PDH/SDH Performance Analyser or Jitter Tester
Test Setup

Figure-6 |
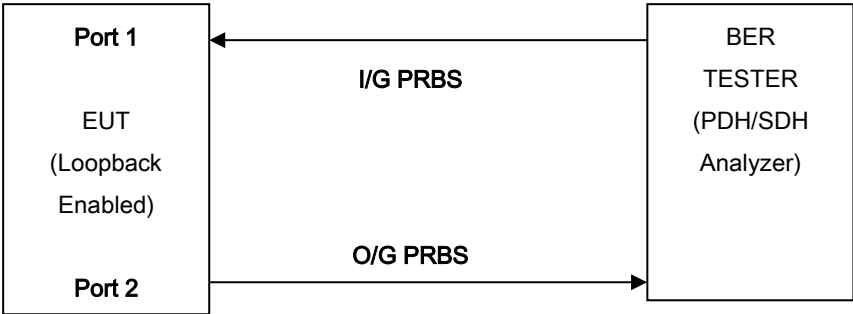| Test Procedure | 1.   Connect the setup as shown in the figure.
 2.   Measure the jitter on the connected PDH/SDH interface
 3.   Verify whether the jitter is within the tolerance limits as given below. |
| Test Limits | <table><tr><td>2048 Kbps input jitter and wander tolerance limit</td><td>Refer Figure 13/G.823</td></tr></table> Figure 13/G.823 − 2048 kbit/s input jitter and wander tolerance limit |
| Expected Results | Verify that Jitter tolerance at input port of 2048 kbps card as per ITU-T Table 16/G.823, as below

 <table><tr><td>Frequency</td><td>Jitter amplitude to be applied - Peak to peak (UI)</td><td>Status of Exchange clock</td></tr><tr><td>20   Hz
2.40 KHz
18   KHz
100 KHz</td><td>1.5
1.5
0.2
0.2</td><td>Synch mode
"<br>"<br>"</td></tr><tr><td colspan="3">Note 1: For 2048 kbps rate 1 UI = 488 ns.
Note 2: Synchronisation should not fail with the above input Jitter at various frequencies.</td></tr></table> |

Test No.	6
Test Details	Clause no. 3.1.5 (Test for Output Jitter)
Test Instrument Required	PDH/SDH Performance Analyser or Jitter Tester
Test Setup	PDH/SDH Interface in loopback mode Rx EUT ←——————→ PDH/SDH Performance Analyzer / Jitter Tester **Figure-7**
Test Limits	Limits for Output Jitter [Maximum Permissible Jitter at Output Interfaces] for PDH interfaces (2048kbps) — Refer Table 1/G.823
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-T specifications as indicated above. 4. Enclose the test results
Expected Results	Verify the Jitter tolerance at outport as per below table;

Expected Results continued:

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

Interface	Measurement bandwidth, –3 dB frequencies (Hz)	Peak-to-peak amplitude (UIpp)
2048 kbit/s	20 to 100 k	1.5
	18 k to 100 k	0.2

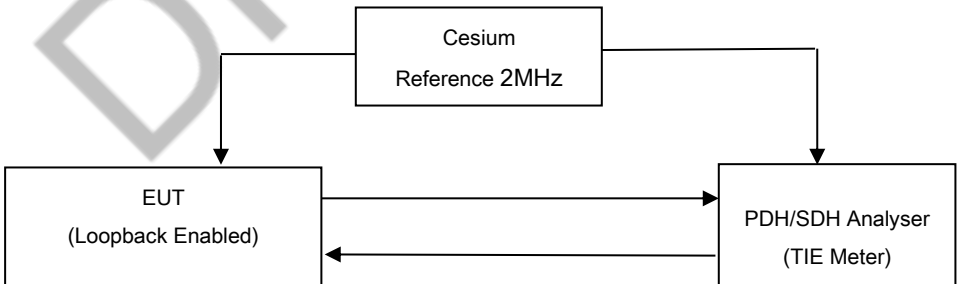1 UI = 488 ns

Test No.	7
Test Details	Clause no. 3.1.5 (Test for Bit Rate Accuracy/Bit Rate Tolerance)
Test Instrument Required	Frequency Meter or SDH/ PDH Analyzer
Test Setup	**Figure-8**
Test Limits	As per ITU-T G.703 Clause no. 11.1 	2048Kbps	±50 ppm	
Test Procedure	1. Connect the test setup as shown in figure using a suitable cable wired to the 2048Kbps interface. 2. Measure the Bit rate accuracy/ Bit rate tolerance.
Expected Results	Enclose the Test Results

Test No.	8
Test Details	Clause no. 3.2.2 (Conformance Testing of Addressing RFCs)
Test Instrument Required	IP Protocol Analyser
Test Setup	**Figure-9**
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 IPv4 as per IETF RFC 791, Dual stack as per IETF RFC 4213 and IPv6 as per IETF RFC 8200. 3. Do Conformance Testing of these RFCs. 4. The test results may be recorded.
Expected Results	Enclose the Test Results
Note	1. The protocol analyser shall be able to send various test packets to the EUT, check the response packet and check the conformance result. Various software tools/packet capture tools like wireshark etc. is having only the capability to check the received packets flow and do not have the capability to send test packets and measure the response. Hence the tools like wireshark etc. cannot be used for this test.
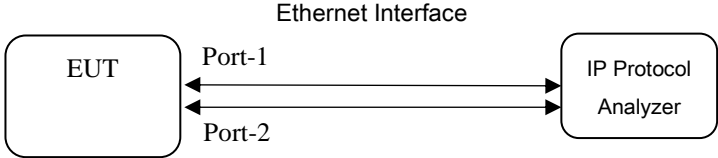
Test No.	9
Test Details	Clause no. 3.6.1 [Test for Frequency Stability in Holdover Mode]
Test Instruments Required	TIE Meter (PDH/SDH Analyzer)
Test Setup	 **Figure-10** **Figure-11**
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the TIE using the TIE Meter for 24 Hrs. 3. calculate stability as below; Synchronise the exchange as per test setup without any jitter by clock. After the exchange is synchronised and stabilised, introduce the jitter in the reference input. Increase jitter amplitude upto 1.5 UI at 20 Hz. If the jitter amplitude is increased further, exchange clock will reject this input and it will go to holdover mode. The input reference should be removed and the TIE measurement in holdover mode should be started at this point for 24 Hrs. Clock stability should be calculated as follows: Clock stability= Time Interval Error (TIE)/Measurement Duration
Expected Result	Minimum Stability of clock in Holdover Mode should be better than $1 * 10^{-9}$.

Test No.	10
Test Details	Clause no. 3.6.1 [Test for Jitter Measurement]
Test Instruments Required	PDH/SDH Performance Analyser or Jitter Tester
Test Setup	 **Figure-12**
Test Procedure	1. Connect the setup as shown in the figure. 2. Measure the jitter on the connected input port of 2048 khz/ synchronisation card. 3. Verify whether the jitter is within the tolerance limits.
Test Limits	As mentioned in the Figure 9 of ITU-T G.813.
Expected Results	Jitter tolerance at input port of 2048 khz/ synchronisation card : The lower limit of maximum tolerable input jitter for 2048 kHz and 2048 kbit/s signals carrying synchronization to a SEC is given in Figure 9 of ITU-T G.813. Figure 9/G.813 – Lower limit of maximum tolerable input jitter
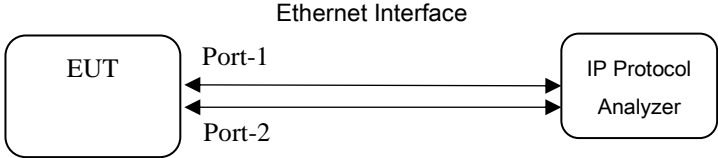
Test No.	11
Test Details	Clause no. 3.6.1 [Test for Bit Error Ratio]
Test Instruments Required	PDH/SDH Analyzer
Test Setup	 **Figure-13**
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the BER using the BER tester for 48 Hrs. 3. Check whether the BER is within limits given below
Expected Result	Measured BER should be better than 1 in 10^{-9} for a 64kbps connection through the switch.

Test No.	12
Test Details	Clause no. 3.6.3 [Test for Bit Slip Measurement]
Test Instruments Required	PDH/SDH Analyzer
Test Setup	 **Figure-14**
Test Procedure	1. Connect the Setup as shown in the figure. 2. Measure the Slip using the PDH/SDH Analyzer for 96 Hrs. 3. Check whether the SLIP is as given below **Slip measurement:** Synchronise the EUT with 2048Kbit/s interface. Slip measurement should be made for a period of atleast 96 hours of operation. In synchronised mode of operation, not more than 2 slips per day are permitted.
Expected Result	Under synchronized condition, slips observed at the 2048 Kbits interface of EUT shall be less than or equal to **2 slips in 24** hours.

Test No.	13
Test Details	Clause no. 4.1.1 [Test for parameters of 10/100 Base-T and Gigabit Ethernet Interface] "Ethernet Link Speed and Auto-negotiation Test"
Test Instruments Required	Ethernet Tester or Similar Analyzer
Test Setup	**Figure-15**
Test Procedure	1. Connect the Ethernet Tester or similar testing instrument to the applicable/ supported Ethernet interface of the EUT as shown above. 2. Configure the EUT to use auto-negotiation on its selected Ethernet port. 3. Configure the Ethernet Tester to run at 100 mbps speed and see if it is able to connect to the EUT. The Ethernet link between the Ethernet Tester and EUT should be active and report 100mbps link speed (if link speed 100 mbps is supported by the EUT). 4. Configure the Ethernet Tester to run at 1000 mbps speed and see if it is able to connect to the EUT. The Ethernet link between the Ethernet Tester and EUT should be active and report 1000mbps link speed. (if link speed 1000 mbps is supported by the EUT).
Expected Result	The Ethernet link between the Ethernet Tester and EUT should be active and report 100 or 1000 mbps link speed as per the link speed supported by the EUT

Test No.	14
Test Details	Clause no. 4.2.1.1 to 4.2.1.6 (Conformance Testing of various protocol RFCs of SIGTRAN)
Test Instrument Required	IP Protocol Analyser
Test Setup	 **Figure-16**

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 following;
	   (a) Frame work Architecture for signaling transport as per RFC 2719.
	   (b) Stream Control Transport Protocol (SCTP) as per IETF RFC 3286, 3257, (3309 & 2960) / (4960 & 3873).
	   (c) M3UA (MTP3 User Adaptation Layer protocol) as per IETF RFC No 3332/4666.
	   (d) M2UA (MTP2 User Adaptation Layer protocol) as per IETF RFC No 3331.
	   (e) M2PA (MTP2 Peer to Peer Adaptation protocol) as per IETF RFC No.4165.
	   (f) UA (SCCP user Adaptation protocol) as per IETF RFC 3868.
	3. Do Conformance Testing of these RFCs.
	4. The test results may be recorded.

Expected Results	Enclose the Test Results
Note	The protocol analyser shall be able to send various test packets to the EUT, check the response packet and check the conformance result. Various software tools/packet capture tools like wireshark etc. is having only the capability to check the received packets flow and do not have the capability to send test packets and measure the response. Hence the tools like wireshark etc. cannot be used for this test.

Test No.	15
Test Details	Clause no. 8.1.2 (Conformance Testing of security RFC 2401)
Test Instrument Required	IP Protocol Analyser
Test Setup

Figure-17 |
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 IETF RFC 2401. 3. Do Conformance Testing of this RFC. 4. The test results may be recorded.
Expected Results	Enclose the Test Results
Note	The protocol analyser shall be able to send various test packets to the EUT, check the response packet and check the conformance result. Various software tools/packet capture tools like wireshark etc. is having only the capability to check the received packets flow and do not have the capability to send test packets and measure the response. Hence the tools like wireshark etc. cannot be used for this test.

CCS 7 Signalling Test:

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 EUT with a suitable CCS 7 protocol Simulator and Analyser. The protocol shall conform to the ITU-T test sheets mentioned below.

<u>Tests for MTP2</u>

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 ITU-T 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 EUT 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 ITU-T Rec Q.704
	ITU-T Rec Q782 Test Cases	
Sl.No	**Test Cases Description**	
MTP3-1	Signallinglinkset deactivation - Q782:1.2	
MTP3-2	Signallinglinkset 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 EUT 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.761-Q.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.	
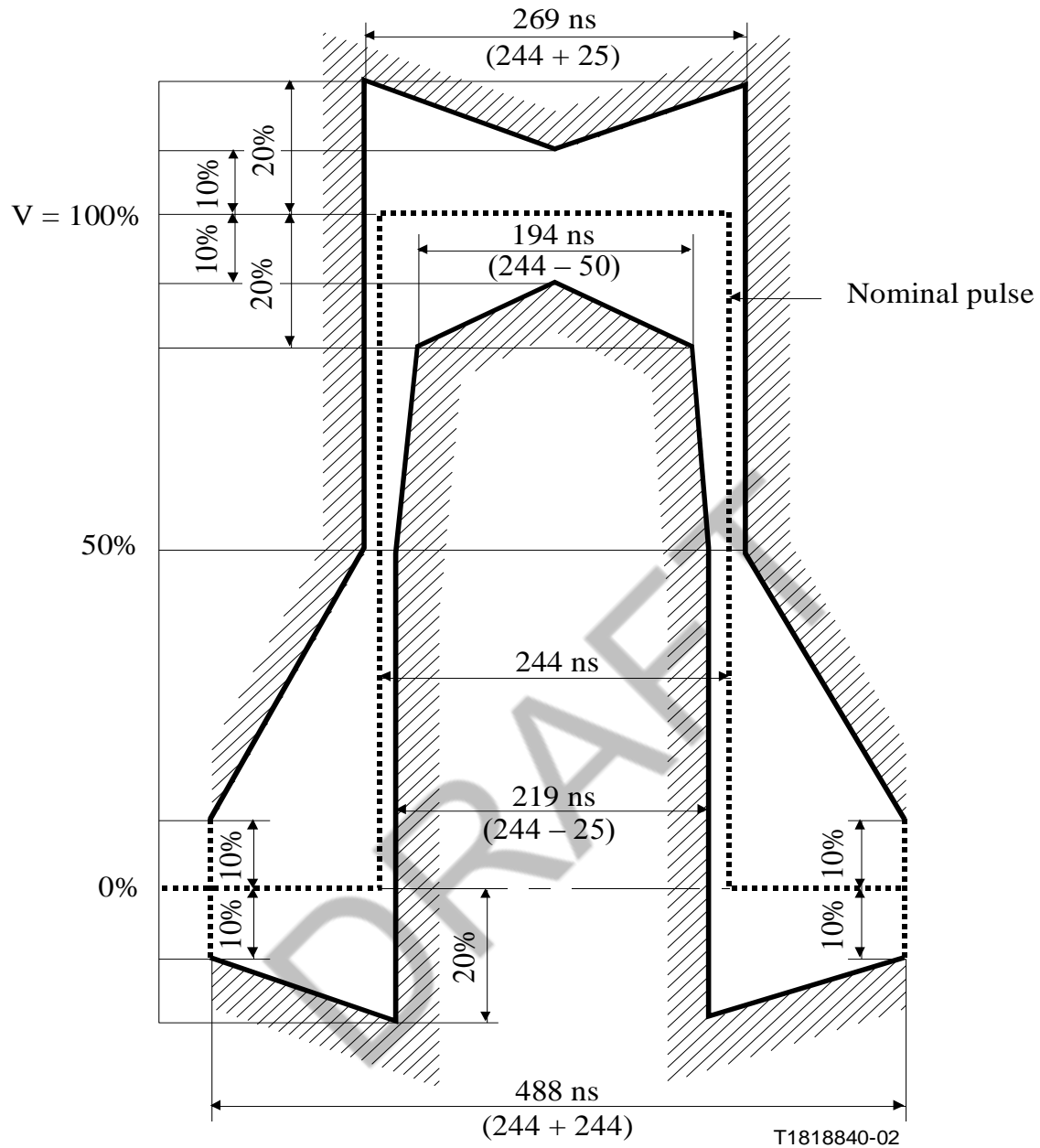
NOTE – V corresponds to the nominal peak value.

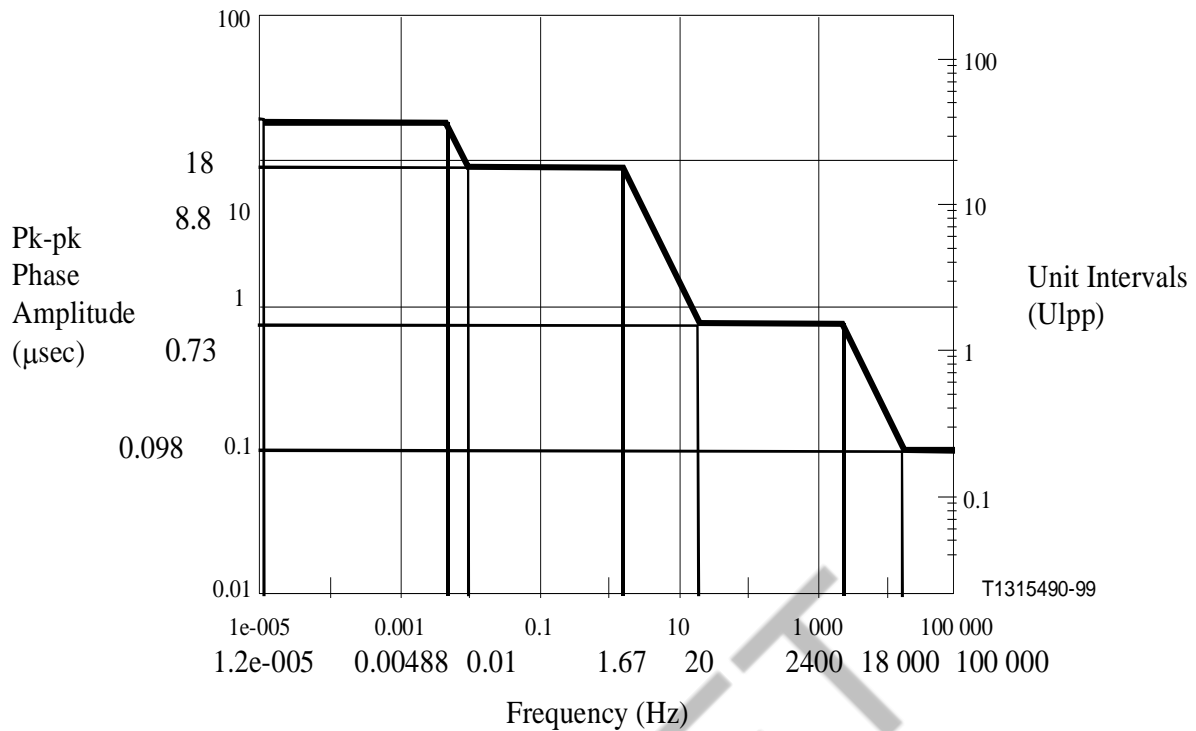**Figure 15/G.703 – Mask of the pulse at the 2048 kbit/s interface**

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

Frequency f (Hz)	Requirement (pk-pk phase amplitude)
20 < f ≤ 2.4 k (Note 1)	1.5 UI
2.4 k < f ≤ 18 k (Note 1)	$3.6 \times 10^3 \, f^{-1}$ UI
18 k < f ≤ 100 k (Note 1)	0.2 UI
NOTE 1 − For 2048 kbit/s interfaces within the network of an operator, the frequencies may be specified as 93 Hz (instead of 2.4 kHz) and 700 Hz (instead of 18 kHz). However, at interfaces between different operator networks, the values in the table apply, unless involved parties agree otherwise. NOTE 2 − 1 UI = 488 ns.	

Table 16/G.823 – Minimum requirement for 2048 kbit/s

input jitter and wander tolerance

J.   SUMMARY OF TEST RESULTS

TEC Standard No._____

TEC Test Guide No._____

Equipment name & Model No._____

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

Date: Signature & Name of TEC testing Officer /

Place: *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'.