वर्गीय आवश्यकताओं के लिए मानक

टीईसी ५९०६०:२०२५

(सं: टीईसी ५९०६०:२०१६ को अधिक्रमित करता है)

STANDARD FOR GENERIC REQUIREMENTS

TEC 59060:2025

(Supersedes No: TEC 59060:2016)

ट्रंक मीडिया गेटवे

TRUNK MEDIA GATEWAY

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीद लाल भवन, जनपथ, नई दिल्ली-110001, भारत

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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 document specifies the Generic Requirements of a Trunk Media Gateway (TMG) to interconnect the IP and TDM networks of Telecom Service Providers. The TMG shall accept the TDM traffic which may consist of voice, FAX and Voice band data and convert it to IP packet format for transmission over the Packet Network.

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HISTORY SHEET

S.No.	*Standard/Document No.*	*Title*	*Remarks*
1.	GR/TMG01/01. JUL 2003	Trunk Media Gateway for IP based TAX network	Issue 1
2.	GR/TMG-01/01 JUL 2003 Amendment 1 dated 15.01.2005.	Trunk Media Gateway for IP based TAX network	Amendment 1
3.	GR/TMG-01/02 MAR.2008	Trunk Media Gateway (TMG)	Issue 02 Following updation have been incorporated i. Requirement of eMS management system ii. H.248 version 2 with control profile ETSI ES 283024 iii. Codecs for mobile and CDMA applications iv. References mentioned in the GR on Soft-switch No. GR/LTS-01 have been included
4.	TEC/GR/SW/TMG-S01/03/FEB-09	Trunk Media Gateway (TMG)	Issue 03 GR in new format with mandatory and desirable requirements
5.	TEC/GR/SW/TMG-S01/04/FEB'13	Trunk Media Gateway (TMG)	Issue 04

6.	TEC 59060:2016 (Earlier No: TEC/GR/SW/TMG-001/05/SEP-16)	Trunk Media Gateway (TMG)	Issue 05 Following updation have been incorporated i. GR has been prepared in new format ii. Diagram showing TMG in the same operator's network and between different operator's networks iii. Command log, system backup has been included iv. On PSTN side, 34 Mbps/45 Mbps/ STM-1 Electrical interfaces and STM4/STM16 optical interfaces have been removed v. On IP side, 64 Kbps/2 Mbps/ 34 Mbps/45 Mbps/STM-1 Electrical interfaces and vi. STM1/STM4/STM16 optical interfaces have been removed MF R2 signalling has been removed vii. IP addressing IPv6 has been made mandatory only in case SBC is inbuilt. Password management has been added
7.	TEC 59060:2016 (Earlier No: TEC/GR/SW/TMG-001/05/SEP-16)	Trunk Media Gateway (TMG)	Issue 05 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
8.	TEC 59060:2025 (Supersedes No: TEC 59060:2016	Trunk Media Gateway (TMG)	Issue 6 [Prepared as per new format of GR, updated Safety,security, EMI and EMC requirements included]

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.

REFERENCES

S.No.	Document No.	Title/Document Name
(I)	TEC GR/IRs	
	TEC/EMI/TEL-001/01/ FEB-09	EMI/EMC Standards
	S/CCS-02	National CCS7 Standards for MTP and ISUP
	S/CCS-03	National SCCP Standards
	TEC/IR/CCS-SIG/01	Interface Requirements for CCS7
(II)	ITU Standard/Recommendations	
	ITU-T G.107	A computational model for use in transmission planning
	ITU-T G.108	A planning guide
	ITU-T G.114	One-way transmission time
	ITU-T G.168	Digital network echo cancellers
	ITU-T G.703	Physical/electrical characteristics of hierarchical digital interfaces
	ITU-T G.711	Pulse code modulation (PCM) of voice frequencies
	ITU-T G.719	Full-band audio coding for high-quality, conversational applications
	ITU-T G.722	7 kHz audio-coding within 64 kbit/s

	ITU-T G.723.1	Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s
	ITU-T G.726	Coding of analogue signals
	ITU-T G.729	Coding of voice and audio signals
	ITU-T G.822	Controlled Slip Rate Objective on International Digital Connection
	ITU-T G.825	The control of jitter and wander within digital networks
	ITU-T G.957	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy
	ITU-T T.38	Procedures for real-time Group 3 facsimile communication over IP networks
	ITU-T H.263	Video coding for low bit rate communication
	ITU-T H.264	Advanced video coding for generic audiovisual services
	ITU-T Q.513	Digital exchange interfaces for operations, administration and maintenance

(III)	IETF Recommendations

	IETF RFC 791	IPv4 addressing
	IETF RFC 1305	Network Time Protocol
	IETF RFC 2119	Key words for use in RFCs
	IETF RFC 1981	Path MTU Discovery for IP version 6
	IETF RFC 2401	Security Architecture for the Internet Protocol
	IETF RFC 2402	IP Authentication Header

	IETF RFC 2460	IPv6 addressing

	IETF RFC 2474	Definition of the Differentiated Services Field (DS Field)in the IPv4 and IPv6 Headers
	IETF RFC 2475	A n Architecture for Differentiated Services

	IETF RFC 3261	SIP: Session Initiation Protocol
	IETF RFC 3264	An Offer/Answer Model with the Session Description Protocol (SDP)
	IETF RFC 3545	Enhanced Compressed RTP (CRTP) for Links with High Delay, Packet Loss and Reordering
	IETF RFC 3550 & 3551	Real Time Transport Protocol (RTP, RTCP)
	IETF RFC 4443	Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
	IETF RFC 4733	RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals
	IETF RFC 4861	Neighbour Discovery for IP version 6 (IPv6)
	IETF RFC 4862	IPv6 Stateless Address Auto configuration

(IV)	IEEE Standard/Recommendations

1.	IEEE 802.3	Carrier sense multiple access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

(v)	Other Standards

1.	CISPR 11	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific & medical (ISM) radiofrequency equipment
2.	CISPR 22	Limits and methods of measurement of radio disturbance characteristics of ITE
3.	EN 55011	Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement
4.	EN 55022	Information Technology Equipment - Radio disturbance characteristics - Limits and methods of measurement
5.	IEC/EN 61000-4-2	Testing and measurement techniques – Electrostatic discharge immunity test
6.	IEC/EN 61000-4-3	Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test

7.	IEC/EN 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
8.	IEC/EN 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
9.	IEC/EN 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
10.	IEC/EN 61000-4-11	Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques Voltage dips, short interruptions and voltage variations immunity tests

11.	IS 10437 / IEC 60215	Safety requirements for radio transmitting equipment
12.	IS 13252 part 1:2010 / IEC 60950-1 {2005}	Information Technology Equipment -- Safety, Part 1: General Requirements

CHAPTER-1

1.0 Introduction

1.1 This document specifies the Generic of Requirements (GR) of Trunk Media Gateway (TMG) to interconnect the IP and TDM networks of Telecom Service Providers. The TMG shall accept the TDM traffic which may consist of voice, FAX and Voice band data and convert it to IP packet format for transmission over the Packet Network. The IP media gateway shall be capable of handling the requirements in terms of the DTMF Relay, support for supplementary services and call handling capabilities.

1.2 (a) For all ITU–T/IEEE recommendations, TEC standards/specification and other standards referred in this document, the latest release/issue with all associated amendments, addendum and corrigendum shall be applicable.

(b) The RFC's documents of 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 previous version or its previous draft or its updated version. Wherever a feature of RFC is mentioned, the product shall comply with the part of RFC specifying the feature.

(c) For all IETF RFC's, the interpretation of clauses of RFC's shall be as per RFC 2119

1.3 Functioning or intended use of the equipment shall conform to the prevailing laws/ regulation/instructions of Govt. of India.

1.4 All the requirements described in chapter 2 of this document are suggestive requirements and shall be decided by the purchaser at the time of procurement/ tender as per his requirements. However, the requirements described in Chapter-2 shall not be tested/ verified by TEC at the time of initial certification.

2.0 Description

2.1 Functional Architecture: Trunk Media Gateway is a translation device that converts media streams between circuit switch and packet switch networks. It enable multimedia communications across packet networks using IP transport protocols. Since TMG connects different types of networks, one of its main functions is to do conversion between different transmission and coding techniques. Media streaming functions such as echo cancellation, DTMF, and tone sender are also located in the media gateway.

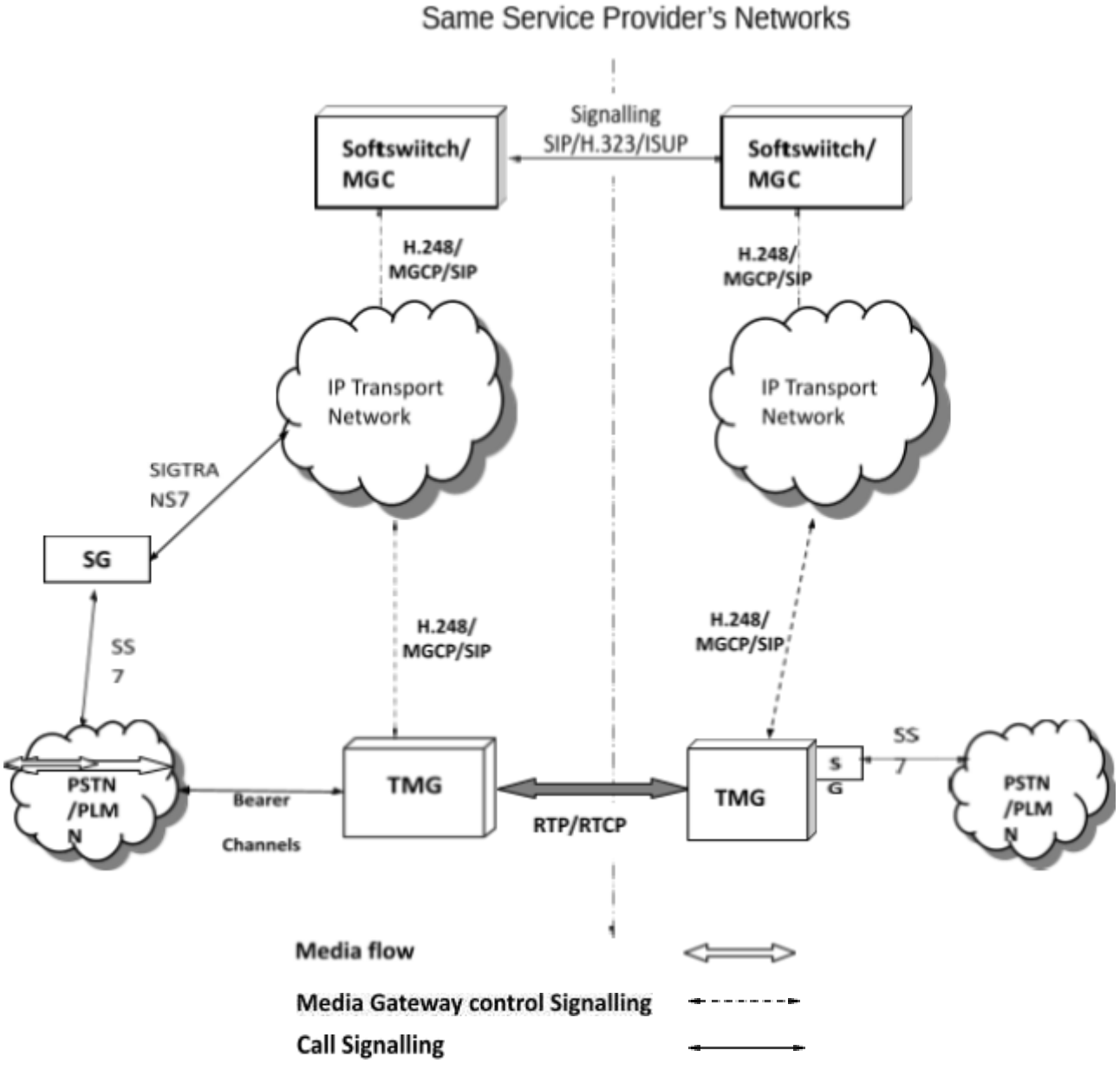

Figure A.1

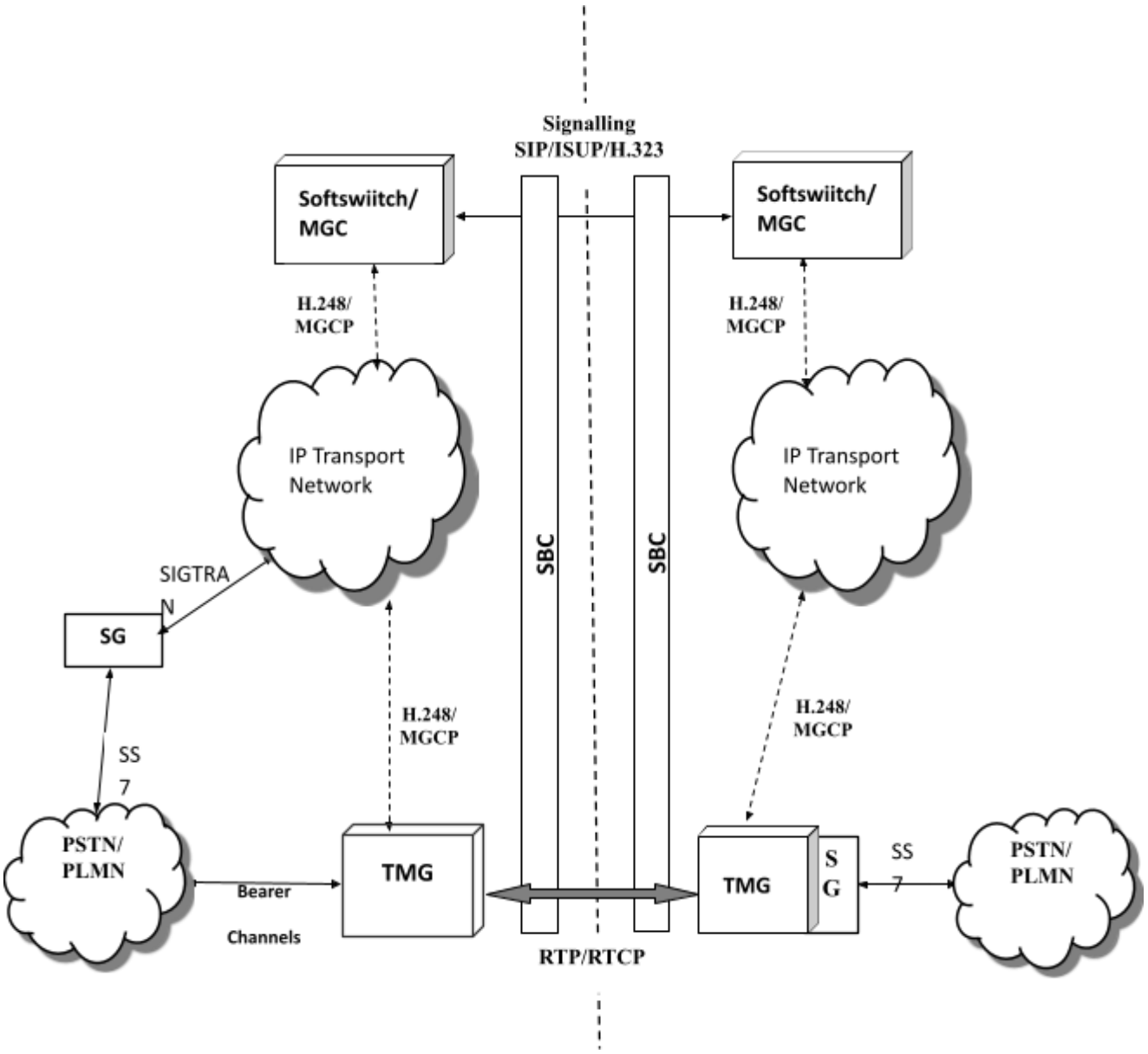

Figure A.2

TMG connected to two different Service Providers

2.2 TMGs are often controlled by a separate Media Gateway Controller (MGC) or Call Agent (Soft-switch) which provides the call control and signaling functionality. Communication between TMG and MGC/Call Agents is achieved by means of protocols such as MGCP or Megaco (H.248) or SIP. However TMG used with SIP may also be stand-alone units with their own call and signaling control functioning integrated and may function as independent, intelligent SIP end-points. (Ref. RFC 2805)

2.3 Signalling gateway function is needed to convey the signalling messages (e.g. call control messages) across different transport domains. These messages are set up between the PSTN node & MGC/Call agent but the call is transmitted through the TMG. Signalling gateway functions is normally co-located in TMG node but can also be separate node.

3.0 **Functional/Operational Requirements**

3.1 TMG shall terminate circuit switched network trunks, packetize the media stream and deliver the packetized traffic to IP/MPLS network. Similarly, it shall also convert the packetized stream received from IP network and shall deliver it over TDM trunks. TMG shall support point-to-point connections and conferences and shall supports resource functions such as media conversion, resource allocation, resource management and O&M notifications.

3.2 In addition to Media resource management functionality, TMG shall include –

i Trunk Media Gateway Control

ii Media Resource

3.3 Resource Management

3.3.1 For the creation of voice paths over IP/MPLS, traffic parameters shall be received from the Soft Switch/MGC. The Trunk Media Gateway shall set up IP paths over IP/MPLS network and send the voice packets.
TMG shall provide media connection between the circuit-switched domain and the IP domain, by means of RTP bearer connections.

3.3.2 It should be possible to pre-configure the bandwidth between TMG and IP interface.

3.3.3 TMG shall provide the media mapping and transcoding functions between PSTN/ISDN/PLMN and IP/MPLS based packet network.

3.3.4 TMG should support reservation and release of resources for smooth migration of incoming TDM traffic to IP network and vice-versa.

3.3.5 TMG should support both Hairpin as well as Non Hairpin connections. For hair pin connections on the TDM side it shall support Echo cancellation also.

3.3.6 TMG shall support back-up IP route i.e. it shall have the capability to set up an IP call path between two IP end-points by routing the voice call away from the usual TDM bus connection.

3.3.7 It should provide a smooth migration of the telephony services when calls/data including all value added services, are transmitted from circuit switched network to packet network and vice-versa.

3.3.8 The Dual Tone Multi Frequency (DTMF) dialled by the subscribers after the call set up shall be transparently passed as per RFC 4733. TMG shall be able to indicate detection of fax tone and should transport it as per ITU-T rec. T.38

3.3.9 It shall support two way communications for Bidirectional Forwarding Detection (BFD) protocol with other Trunk Media Gateways.

3.4 TMG shall generate tones as per H.248 control profile ETSI ES283024. Optionally, it may support connectivity with Media server to provide different types of announcements and Tones.

3.5 It shall support Virtual Media Gateway (VMGW) features and the maximum number of supported virtual media gateway shall be specified by the purchaser. Each virtual Media Gateway can work as induvidual Media Gateway meeting all functional requirements of TMG.

3.6 Hardware and software

3.6.1 The functional modularity of the hardware and software should permit addition or removal of any functionality without disturbing the other functionalities.

3.6.2 Enhancement/upgrades of existing hardware/software should be possible without loss of the services.

3.6.3 The normal operation of the system should not be adversely affected (excluding planned outage) while undertaking

i. Extension to existing equipment (Hardware expansion).

ii. Enhancement of facilities.

iii. Correction to programs or functional blocks.
iv. Software up-gradation and up-dates/Patch loading.

3.6.4 Facilities should be in-built to ensure automatic system recovery on detection of hardware/ software fault.

3.6.5 The software shall provide automatic switchover to the standby sub-system in the event of any hardware/software fault.

3.7 Synchronisation:

3.7.1 The TMG shall be capable of synchronising with an external timing signal derived from any one or more of the following input PSTN interfaces.

i. 2048 Kbps E1 interface
ii. STM-1 input stream
iii. 2048 KHz external timing reference as per clause 13.0 of ITU-T G.703, 75 ohms coaxial.

3.7.2 In case of provision of more than one external clock, TMG shall be capable of selecting the clock from any one of the above provisioned interfaces as per pre-set priority.

3.7.3 The acceptable slip rate shall be in accordance with ITU-T Rec. G.822

3.7.4 Bit Error Rate -

I. A long term bit error rate of the signalling data link should be less than 10^{-6}
II. A medium term bit error rate should be less than 10^{-4}

3.7.5 The TMG shall be capable of synchronising with Network Time Protocol (NTP) server and use this timing information for time stamping of all messages. (Ref. RFC5905)

3.8 O&M terminal (LCT) -

3.8.1 The LCT shall support Graphical User Interface (GUI) for maintenance, configuration, management and supervision. It shall be possible to test trunk circuits/IP link from LCT.

3.8.2 It shall provide facility for cancelling and aborting the execution of commands.

3.8.3 Where same command is given from different terminals, a mechanism shall be available to avoid clashes

3.9 Diagnostic

a. On a faulty condition, the equipment shall identify the faulty sub-system and shall run diagnostic automatically and take it out of service. Normal function of the system shall not be affected due to invocation of any diagnostic program. The resolution of the fault diagnosis in the offered system shall be indicated.
b. Details of the off-line diagnostic programs shall be given. The procedure for invoking such programs shall be described. The procedure for consulting fault dictionary for diagnostic programs should be made available.
c. In case a fault requiring reloading of the program is detected, this shall be carried out automatically. In case of manual re-loading, it should be possible to stop and start at any particular point in the program.

3.10 Command/Command Log

3.10.1 Under normal conditions, the execution of any command shall not result in malfunctioning and/or over loading of the system.

3.10.2 It shall be implemented in such a way that errors in commands or control actions shall not cause the system to stop or unduly alter the system configuration.

3.10.3 Command errors detected by the system shall be indicated by the output of error messages.

3.10.4 The system shall support priority messages to interrupt an input or output message of lower priority

3.10.5 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.

3.11 System back-up

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 on external disk/device.

It shall also be possible to load the system from the system backup

3.12 System Redundancy

a) Sufficient redundancy shall be built into the design of the system so that the failure of any component/sub-system shall not result in the total system failure.
b) System shall be equipped with redundancy for power supply

3.13 Power Supply

Option 1:

The equipment shall be capable of working with –40 V to -60 V. DC input from power supply.

Switching mode Power Supply (SMPS) shall be used. Power supply and battery shall be modular and expendable to support the ultimate equipment configuration.

Option 2:

AC Mains supply of 220 Volts with a tolerance of -15% to + 10% would be available. The frequency may be 50 Hz $\pm$ 2 Hz. UPS and other power requirements are to be specified by the system developer.

Purchaser may decide option 1 or option 2 of power supply as per its requirement.

3.13.1 All TMG units shall have redundant power supply arrangement. The power feeding arrangement to power supply units shall also be provided in redundant configuration.

3.14 NMS/eMS connectivity-

It should be possible for TMG to interface with Network Management system (NMS)) either directly or through Element Management System (eMS). From NMS/eMS, it shall be possible to create different user category for local and remote O&M terminal (including LCTs) with different privilege for configuration & other management functions.

Following FCAPS management functions shall be supported:

3.14.1 Fault management – The system shall provide for visual/audible alarms to assist in efficient administration. The following minimum printouts/alarms are envisaged:

a) The alarm program shall provide an alarm on O&M terminal to indicate the failure of power supply.
b) A suitable message on O&M terminal shall be provided to indicate the operating status of the processors (e.g. When the processor load exceeds a certain pre-set value), signalling links e.g. link/link set failure, inaccessibility of a route i.e. `Route Busy' (RTB) on any group or circuits
c) The Ethernet link down condition shall result in an alarm of highest category
d) A visual display of faults detected with identification of faulty units. The display/message shall contain the date and the time.
e) Emergency action procedures and alarm dictionary shall be provided.

3.14.2 Configuration management-

a. It shall be possible to configure PSTN links/trunks
b. It shall be possible to configure IP links. It shall also be possible to allocate bandwidth to individual voice link.
c. It shall be possible to monitor the traffic over any data link and to decrease/increase bandwidth allocation.
d. It shall be possible to test trunk circuits/IP link testing towards PSTN network and it shall be possible to test 'reach ability' of IP network.

3.14.3 Accounting management

From NMS it shall be possible to collect at the least the following measurements-

a) Number of calls answered/ non-answered
b) Traffic carried over Ethernet interface wise
c) RTP packets handled by TMG
d) RTP packets handled announcement server (Optional)

3.14.4 Performance management –

(i) Performance management module shall support collection, processing and presentation of the performance related data for the purpose of study of route profile, traffic study, planning of capacities, monitoring of network health etc. it shall include

(a) Processor utilisation for the TMG and the announcement server.
(b) Total traffic handled by the Trunk Media Gateway.
(c) The total traffic carried by the Ethernet interface. The total RTP Traffic carried by the Ethernet Interface.
(d) Total Packets carried per Destination wise.
(e) Jitter as per RFC 8860/7160

(ii) The above measurements, when activated and performed, shall not affect the call handling capacity of the TMG and the announcement Server

(iii) All the measurements related to individual circuit groups shall be measurable. Information for estimating the average number of circuits in service during the result accumulation period shall be provided in addition to the traffic data for each circuit.

3.14.5 Security management - Security requirements shall be as described in Clause 8 of this document.

4.0 Intrface Requirements

4.1 The TMG shall support interfaces towards PSTN/PLMN and Packet based IP Networks

4.2 PSTN Interface:

The TMG shall interface to the PSTN/PLMN with anyone or any combination of the following signaling interfaces -

a) 2048 Kbps (E1) 120 ohms balanced as per clause 9 of ITU-T G.703
b) STM-1 optical interface for short haul operation using Monomode or Multimode laser diode as per Table 2 / G.957
c) STM-1 optical interface for long haul operation using monomode or multimode laser diode as per Table 2 / G.957

Applicant can apply for any one or more of the above interface(s) and the same shall be indicated in TAC.

4.2.1 The 2048 Kbps Electrical interface shall meet the Output Pulse Mask, Output Jitter, Output Return Loss, Input Jitter Tolerance and Input Return Loss tests as per G.703.

4.2.2 The optical output power, extinction ratio, spectrum receiver sensitivity and eye pattern of the STM-1 optical interface shall be as per G.957 and Input Jitter tolerance shall be as per G.825

4.2.3 Only Standard bit rate of 64 kbps shall be used for digital signalling data link which shall be derived either from 2 Mbps or nX2 Mbps stream.

4.3 TMG shall support the following:

4.3.1 CCS7 Signalling

(a) TMG shall support ISUP, MTP and SCCP messages as per TEC standard S/CCS-02 and S/CCS-03 and TEC/IR/CCS-SIG/01
(b) The signaling and media information can be carried over common or separate links.
c) TMG shall support the receipt of charge band message on CCS-7 link, including the configurability to ignore the charge-band message without rejecting the call.
(d) *'N*o charge' indication in ACM, CPG, CON and ANM shall not be sent over inter-working trunk group between PSTN/PLMN and TMG.

(e) TMG shall use SIGTRAN signaling for carrying CCS7 signalling over IP network.

4.3.2 TMG shall support junction testing towards PSTN/PLMN.

4.3.3 TMG shall support static or dynamic routing protocol or Layer-2 forwarding for routing or forwarding the IP packet to IP transport network.

4.4 Interface towards IP network.

4.4.1 TMG shall support any one or any combination of the following interfaces in order to carry the packetized voice over the IP network-

i) 10/100 Mbps Ethernet electrical interface as per IEEE 802.3
ii) 10/100/1000 Mbps Ethernet optical interface as per IEEE 802.3
iii) GE optical interface as per as per IEEE 802.3
iv) 10GE optical interface as per as per IEEE 802.3

4.4.2 The optical output power, extinction ratio, spectrum and receiver sensitivity of the Ethernet optical interfaces shall be as per IEEE 802.3.

4.4.3 The Ethernet electrical interfaces shall meet the Differential output voltage, AC Differential input impedance and Output Jitter tests as per IEEE 802.3.

4.5 Addressing

a) IMG shall support any one of the following addressing:

i) IPv4 as per IETF RFC No 791
ii) Dual stack i.e. IPv4 (as per IETF RFC No 791) as well as IPv6 (as per IETF RFC 8200)
iii) IPv6 as per IETF RFC 8200

Applicant may apply any one of the above and the same shall be indicated in TAC.

b) Transport Control Protocol as per IETF RFC 9293

4.6 For multi-media session between two or more participants, TMG shall support RFC 3853 and RFC 6157/9143/8843.

4.7 Interface towards eMS/NMS – Interface from TMG to eMS/NMS should support SNMP/XML/CORBA etc. Protocol supported shall be specified by the applicant and the same shall be specified in TAC (after testing).

TMG Control:

4.7.1 TMG shall be controlled by Soft switches (of different makes) conforming to TEC GR No. GR/SW/NGN-LTS/01 or MGC using any of the following protocol(s) -

i. MGCP
ii. H.248

Applicant can apply for any one or both of the above protocol(s) and the same shall be indicated in TAC.

4.7.2 TMG shall be controllable by at least two different soft switches/ MGCs (of different makes) in hot standby mode.

4.8 Signalling transport protocol

TMG shall support following transport protocol

S.No.	Control function	Protocol
1	Bearer Control	• RTP, RTCP as per RFC 8860/7160 & 8860/7007 • cRTP (Optional) as per RFC 3545
2	Transport Control protocol	TCP (as per IETF RFC 793) or UDP or SCTP

4.9 Transport protocol TCP or UDP or SCTP shall be specified by the purchaser.

5.0 **Quality Requirements:**

5.1 Codec support

It shall automatically recognize the voice, FAX & data traffic coming from PSTN/PLMN and do the required compression, echo cancellation. It shall support different codecs for GSM, WCDMA, CDMA (optional) and video applications as required by the purchaser. It shall support Modem to Modem (voice band data) communication by detecting the Modem tone and switching over to suitable Encoding scheme.

5.2 TMG shall support at least the following codec's as per latest ITU-T recommendations -

	Type of service	Codec to be supported	
a)	Voice Call	G.711(μlaw) G.729 A	
b)	FAX	T.38	
c)	GSM Applications (Ref. G/PCS-01)	a).	AMR-FR
		b).	AMR-HR
		c).	EFR
		d).	FR
		e).	HR
		f).	AMR-WB
d)	Video applications	H.264 H.263 (optional)	
e) CDMA		EVRC (optional)	

Applicant may apply for additional codec supported and the same may be mentioned in the approval certificate after testing.

(Purchaser may specify the additional Codec required as per its requirement)

5.3 Codec Negotiation: The Trunk media Gateway shall support the Codec negotiation in association with Soft-switch which shall provide the ability for one

Trunk Media Gateway to connect to other Trunk Media Gateways without necessarily knowing the type of Codec (used at the time of call set-up). It shall also support mid call detection and codec negotiation e.g. Voice call to fax call, voice call to modem call. Voice call to ISDN data call and vice versa. Any voice processing functions shall not interfere with transparent interchange of FAX signals It shall support FAX over IP as per ITU-T recommendation T.38.

5.4 TMG shall support the Diffserv as per RFC No. 3168/3260/8436, 2475. The Trunk Media Gateway shall be able to set the Type of Service (TOS) bits depending upon the Codec, priority subscribers, incoming PSTN Ports etc.

5.5 TMG shall generate voice quality deterioration alarms in case RTP characteristics go down below a configured threshold. The TMG shall not contribute to Packet Loss. The one way Delay introduced by the Trunk Media Gateway for different encoding schemes shall be as per Table I.3 of ITU-T Rec G.114. The Trunk Media Gateway shall support adaptive and configurable jitter buffer up to 50ms

5.6 Echo Cancellation: It shall support integrated echo cancellations, as per ITU-T recommendations G.168 up to a configurable value of 128 ms. It shall be configurable to activate and deactivate the echo cancellation on each trunk group. Activation of Echo cancellation shall not result in decrease in number of circuits.

5.7 Voice Activity Detection (VAD) and silence suppression functionality shall be integrated with voice codec. It shall be possible to activate and deactivate VAD and Silence Suppression. The Trunk Media Gateway shall support the Comfort Noise Generation and insertion. This shall not result in performance deterioration.

6.0 **EMI/EMC Requirements**

The equipment shall conform to the EMC requirements for Class A:

General Electromagnetic Compatibility (EMC) Requirements: - The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from an accredited test agency.

a) Conducted and radiated emission (applicable to telecom equipment):

Name of EMC Standard: "CISPR 32 (2015) with amendments - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-

i) To comply with Class B of CISPR 32 (2015) with amendments for indoor deployments and Class A of CISPR 32 (2015) with amendments with amendments for outdoor deployments.

b) Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2 {2008) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits:-

i) Contact discharge level 2 {± 4 kV} or higher voltage;

ii) Air discharge level 3 {± 8 kV} or higher voltage;

c) Immunity to radiated RF:

Name of EMC Standard: IEC 61000-4-3 (2010) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test".

Limits:-

For Telecom Equipment and Telecom Terminal Equipment without Voice interface (s)

Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):

Name of EMC Standard: IEC 61000-4-4 {2012) "Testing and measurement techniques

of electrical fast transients/burst immunity test".

Limits:-

Test Level 2 i.e.

a) 1 kV for AC/DC power lines;

b) 0. 5 kV for signal / control / data / telecom lines;

e) Immunity to surges:

Name of EMC Standard: IEC 61000-4-5 (2014) “Testing & Measurement techniques for Surge immunity test".

Limits:-

i) For mains power input ports : (a) 2 kV peak open circuit voltage for line to ground coupling (b) 1 kV peak open circuit voltage for line to line coupling

ii) For telecom ports : (a) 2kV peak open circuit voltage for line to ground (b) 2KV peak open circuit voltage for line to line coupling.

f) Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC Standard: (IEC 61000-4-6 (2013) with amendments) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields”.

Limits:-

Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11 (2004) “Testing & measurement techniques-voltage dips, short interruptions and voltage variations immunity tests”.

Limits:-

i) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70 % supply voltage for 500 ms)

ii) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) and

iii) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

iv) a voltage interruption corresponding to a reduction of supply voltage of >95% for 10s.

h) Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any):

Name of EMC Standard: IEC 61000-4-29:2000: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests.

Limits:-

i. Voltage Interruption with 0% of supply for 10ms. Applicable Performance Criteria shall be B.

ii. Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. Applicable Performance Criteria shall be C.

iii. Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. Applicable Performance Criteria shall be B.

iv. Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000ms. Applicable Performance Criteria shall be C.

v. Voltage variations corresponding to 80% and 120%of supply for 100 ms to10s as per Table 1c of IEC 61000-4-29. Applicable Performance Criteria shall be B.

Note: - For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/SD/DD/EMC-221/05/OCT-16 and the referenced base standards i.e. IEC and CISPR standards and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (h) and TEC Standard TEC/SD/DD/EMC-221/05/OCT-16. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	Euro Norm
CISPR 11	EN 55011
CISPR 32	EN55032
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11
IEC 61000-4-29	EN 61000-4-29

7.0 Safety Requirements

7.1 "The equipment shall conform to relevant safety requirements as per to IS/IEC 62368-1: 2023 Audio / Video, Information and Communication Technology Equipment as prescribed under Table no. 1 of the TEC document 'SAFETY REQUIREMENTS OF TELECOMMUNICATION EQUIPMENT": TEC10009: 2024"

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 Security Requirements

Unauthorised Access Unauthorised Access

8.1.1 Access to system operations shall be controlled through multi-level password and authentication checks

8.1.2 The man-machine communication programs shall have the facility of restricting the use of certain commands or procedures to certain passwords and terminals

8.1.3 It shall be possible to define users and user groups with different access rights

8.1.4 It shall be possible to modify user password number of times.

8.1.5 Session ID shall be logged with information of user ID, password, time of login, commands/parameters given etc.

8.1.6 All passwords shall be stored in encrypted form and no user including 'Network Manager' shall be able to read the password.

8.1.7 The system must support 'session logout timing with configurable time periods

8.1.8 The system should block the access from local as well from remote terminals after receipt of consecutive predefined (say 5) wrong login/passwords and unauthorised commands.

8.2 Appropriate security mechanisms for authentication, integrity and confidentiality shall be used for secured transportation through IP network as per IETF RFC 4301 and RFC 2402.

8.3 Monitoring

8.3.1 TMG shall pose no limitation in Lawful interception and monitoring

8.3.2 TMG shall have the capability of provisioning of target, delivery of Intercept Related Information (IRI) and Call Content (CC) for the purpose of Lawful Interception.

8.3.3 In case of IP connectivity with TMG, the system shall have safe guards to prevent Denial of Service (DOS) attacks. It should be possible to configurable IP port linking it with IP address or port number interface identity (Applicable for IP interface only)

9.0 Various requirements of category/configuration of the product for testing

1. TMG with inbuilt SG
2. TMG without SG

CHAPTER-2

10.0 Desirable Requirements

The various functions/facilities/ features described in this chapter are comprehensive and suggestive which may be useful. These need not be treated as mandatory for the product. However, the purchaser will select the functions/ facilities/features of TMG as per its requiremets at the time of procurement/ tendering.

The functions/ facilities/ features described in this chapter will not be tested/ verified by TEC

10.1 Input-output devices (LCT)

10.1.1 Adequate number of man-machine interfaces may facilitate various types of system administrations listed.

10.1.2 If provision is made for monitoring from a remote terminal, it shall be ensured that the data links conform to the ITU-T Recommendations Q.513. Care shall be taken that the reliability of the data links does not, in any way, affect the reliability of the TMG system. Special provision may also be made for transmission of a failure signal even when the system is unable to transmit an output message.

10.1.3 It may be possible to give all the man-machine commands from remote location. Purchaser may specify the number LCTs required. Purchaser may access the requirement of eMS/NMS as per its network architecture.

10.1.4 Sufficient check and safeguards shall be built in to the implementation of MML so as to ensure reliable operation of TMG.

10.2 Hardware

10.2.1 The system may support following redundancies-

I. All Control processors may have redundancy
II. Redundant Hard disk
III. Redundant Ethernet interface
IV. Redundant STM1 interface
V. Redundant switch fabric
VI. Redundant synchronisation module
VII. E1 interface for CCS7

10.2.2 Adequate backup memory may be provided so as to comply with the requirements of system reliability and stability as specified for the system.

10.2.3 Redundant interface processor/switching fabrics etc. shall be provided using separate hardware.

10.2.4 It shall support hot standby operation in Call handling

10.2.5 It shall support automatic updates of configuration data

10.2.6 Period for which redundant storage device is required for storing traffic statistics, command log, office data etc. Shall be specified by the purchaser.

10.2.7 Provision may be made to prevent the loss/alteration of memory contents due to power failures, improper operation and shall provide the procedure for restoring the system to its normal state, etc.

10.2.8 Fuses may have a suitable marking for the different ratings to enable easy identification and replacement. Marking may ensure easy trace ability

10.3 Software

10.3.1 Right to use: There may be no imposition of any sort of precondition on the -Right to Use' of software.

The supplier may undertake to supply on continuous basis all software updates,

for a period of seven years (to be specified by purchaser) from the date of taking over of system. These updates may include new features and services and other maintenance updates

10.3.2 All the software updates may be provided on continuous basis

10.3.3 The software related licenses for support of all protocols and interfaces required shall be ensured.

10.3.4 TMG may have provision for supporting at least two software versions, one active and other passive. Any update to be made to TMG software shall be carried out on the passive version and not on the active version, which shall subsequently be made active. There shall be a fallback mechanism for reverting back to existing version in case the new version of software fails.

10.3.5 The suppliers may set up facilities for software maintenance.
The following functions are expected to be served by such facilities:

i. Post dump Analysis
ii. System analysis and coding for above
iii. Debugging for above
iv. Patch realization
v. Patch verification
vi. Patch implementation at sites
vii. Version control of software
viii. Document generation
ix. Repository of working versions

New software jobs will be mutually discussed/negotiated for terms and implementation, so long as they are not covered by normal and/or life time warranties)

10.3.6 In the event of a full system failure, a trace area shall be maintained in non-volatile memory for analysis and problem resolution.

10.3.7 The bandwidth control mechanism shall be provided in the TMG in conjunction with router.

10.3.8 Software support of all protocols and interfaces mentioned in this GR shall be ensured in the devices.

10.4 Hardware Quality: Following hardware design requirements to maintain the quality of service shall be provided :

a) The design of the equipment shall not allow plugging of a module in the wrong slot or upside down.
b) A single point failure on the equipment shall not result in network or network management system downtime.
c) In the event of a bug found in the software, the manufacturer shall provide patches and firmware replacement if involved, free of cost. Compatibility of the existing hardware shall be maintained with future software/firmware.
d) A power down condition shall not cause loss of connection configuration data storage.
e) Live Insertion and hot swap of modules shall be possible to ensure maximum network availability and easy maintainability.
f) The Hardware and software components shall not pose any problems in the normal functioning of all network elements wherever interfacing with Service Provider’s network for voice, data and transmission systems, as the case may

be.

g)

h) All mission critical modules shall be identified and shall be provided in full redundant configuration for high reliability.

i) The equipment shall have availability figure of 99.999%. The MTBF (Mean Time Between Failure) and MTTR (Mean Time To Restore) Predicted and observed values shall be furnished along with calculations by the manufacturer

10.4.1 A list of equipment (make, model, hardware and software version) in the network with which the equipment against this GR has to inter work shall be provided by the service provider.

10.4.2 Firewall System as per TEC GR GR/FWS-01 to be procured separately by the purchaser.

10.4.3 Multi-Vendor Compatibility for other manufacturers' products in the network, say Signalling Gateway, Media server, Soft switch and other application servers may be asked.

10.4.4 Details shall be specified by the purchaser for spares of various types of cards/modules (5% spares of the total requirement is suggested)

10.5 It should be possible to use TMG for the following functionalities

a) Media Gateway **(**MGw**)**
b) Boarder Gateway Function **(**BGF**)**
c) Multimedia Resource Function **(**MRF**)**
d) IP Multimedia Media Gateway **(**IM**-**MGw**)**

TMG shall enable combined media handling to allow resource sharing and pooling between logical media functions and therefore reducing the number of network nodes to maintain**.** TMG shall be built with state of the art technology, which means that it can offer superior energy efficiency, capacity, scalability, reliability and foot**-**print

10.6 Capacity

10.6.1 Different categories depending upon the required circuits in TMG shall be classified. The purchaser shall decide the required category with the required call holding time and BHCA.

10.6.2 TMG shall be available in the five categories as given below. Taking the call holding time as 90 seconds, junction traffic as 0.7 Erlang and the number of circuits as shown, the required BHCA shall be as follows :

Category	Number of Circuits	BHCA
A	Up to 4000	1.12 lakh
B	40000 to 8000	2.24 lakh
C	80000 to 12000	3.36 lakh
D	120000 to 16000	4.48 lakh
E	Above 16000	5.6 lakh

10.6.3 Purchaser may specify the value of following parameters as per its network requirements

S. No.	Parameters
1.	Total Trunk circuit capacity
2.	E1 Electrical interfaces capacity
3.	E1 Optical interfaces capacity
4.	STM1 Optical interfaces capacity
5.	10/100/1000 MG Ethernet electrical interfaces capacity
6.	10/100/1000 MB Ethernet optical interfaces capacity
7.	GE/10 GE optical interfaces capacity
8.	Average Traffic per Trunk circuit (Erlang)
9.	Average Call Holding Time (sec.)
10.	Normal BHCA
11.	Overload BHCA
12.	Processed BHCA capacity in case of overload
13.	Backup plane capacity
14.	Number of virtual media gateway supported
15.	Number of Ethernet Interfaces

10.6.4 Suggestive values (purchaser may specify his own values) for different parameters required for each TMG category are as follows:

S. No	Parameter		Number of E1s	Number of STM1
	E1s/STM1s connecting capacity	Minimum	16(suggestive)	1(suggestive)
		Maximum	630(suggestive)	63(suggestive)
	Average Traffic per trunk (Erlang)		0.7	
	Average Call Holding Time		60 Sec.	
	Normal BHCA			
	Overload BHCA		1.5 times rated BHCA	
	Processed BHCA capacity in case of overload		90% of the rated BHCA	
	Packet forwarding rate		At least 70 Mbps	

10.6.5 For calculating the number of links/E1s etc. the Grade of Service (GoS) shall be taken as 0.002 percent. Call holding time may be specified.

10.6.6 The TMG under the control of Soft-switch/MGC may detect overload conditions and apply overload control mechanism as per relevant protocol standard. For overload condition the percentage of different mix (CCS 7, IN) and processing

percentage shall be specified by the purchaser.

10.6.7 Type of power supply required e.g. option 1 or option 2 (Refer clause 3.13 of this document).

10.6.8 Details for spares may be specified by the purchaser.

10.7 Signalling – Purchaser may specify the type(s) of signalling required between various interfaces -

10.7.1 Interface required towards MGS/Soft switch may be specified by the purchaser such as

i. MGCP (media gateway control protocol)
ii. MEGACO (ITU-T Rec. H.248) latest version

10.7.2 Interface required towards NMS may be specified by the purchaser such as SNMP/XML/CORBA

10.8 In addition to codec specified in clause 5.2, following codec may be supported: G.719, G.723, G.726, G.722, iLBC, GSM-FR, GSM-EFR , H.263, EVS Capacity of various codec required may be specified by the purchaser.

10.9 It shall be possible to initiate the trunk testing towards the PSTN network. It shall be possible to test the reach ability of the IP network.

10.10 The quality plan describing the quality assurance system may be specified.

10.11 The purchaser may specify quality standards like ISO 9002 or ISO 9001:2000 certification

10.12 Documentation:

All technical documents shall be submitted in English for hard copies, and in both Hindi and English for soft copies. The documents shall comprise of:

i) System description documents.
ii) Installation, Operation and Maintenance documents.
iii) Training documents.
iv) Repair manual.
v) Emergency action procedure

10.12.1 Number of copies (hard/soft) of above documents may be specified by the purchaser

10.13 Details plan/requirement regarding the following may be specified by the purchaser –

i Installation
ii Validation
iii Acceptance testing
iv Field trial
v AMC

10.14 Environment Conditions: The purchaser may specify environmental Conditions that the system shall satisfy as specified in environmental quality measurement manual for relevant category of equipment.

10.15 Service Circuits:

10.15.1 Service circuits provide functions such as multi frequency signalling, tones, and access to operators. Grouping of auxiliary units may vary with system implementation characteristics.

10.15.2 Scanning interval for traffic data related to service circuit equipment (if available) shall be sufficiently small to ensure accuracy of measurement.

10.15.3 The measurements intended to provide information for the dimensioning of service circuits shall be provided. They shall be provided for each group, which may require dimensioning.

10.15.4 Measurements may be activated for any specified list of auxiliary units. Information for estimating the average number of units in service during the result accumulation period shall be provided in addition to the traffic data for each circuit group:

i. Traffic intensity i.e. Total Number of call attempts
ii. Number of seizures i.e. Number of call attempts resulting in an outgoing seizure
iii. Number of call attempts not served.
iv. Number calls answered

10.15.5 Facility shall be provided for initiating the measurements through a suitable command giving details of the measurement required, the time, period and intervals at which the measurements are to be made. The results of the measurements shall be stored for retrieval, as and when required.

10.15.6 Faulty junctions or equipment taken out of service/ busied by maintenance personal shall be excluded from the measurements.

10.16 In addition to NMS functionalities described in clause 3.14 of this document, following FCAPS management functions may be supported –

10.16.1 Fault Management –

a) Alarm Threshold administration
b) Voice quality deterioration alarm when RTP characteristics go down below a configured threshold.
c) Logging and browsing of performance alarms

10.16.2 Configuration management

It shall be possible to configure RTP characteristics & jitter buffer

10.16.3 Performance management: Following measurements shall be possible-

(a) Collection of traffic dispersion.
(b) Number of operator-handled call attempts, if any
(c) Average holding time of answered & non-answered calls and average holding time of TMG & Announcement Server.
(d) Average and maximum delay in servicing any incoming call.
(e) The RTP/RTCP traffic handled by the Trunk Media Gateway and the Announcement Server.
(f) Total Packet lost per destination wise.
(g) Total errored packet received per destination wise.
(h) Total packets carried per QoS type wise.
(i) R value measurement as per ITU-T Recommendation G.107 and G.108 per destination wise.
(j) Average delay per destination wise.
(k) It shall be possible to activate and record/print the measurement of delay, packet loss per session also.
(l) Congestion counter

(m) Call rejection counter

(n) Real Time Performance Alarms through Threshold Supervision and forwarding to umbrella management system via SNMP.

(o) Comprehensive and flexible reporting features to facilitate quick and easy investigations of network traffic problems. Various reports shall be possible to be generated such as:
- Date & time of fault on circuit or network elements
- Date & time of fault restoration on circuit or network elements
- Circuit/link availability
- Reports for evaluation of AMC performance etc.

If any other parameter is required, it shall be specified by the purchaser

(p) Customization of Reports: It shall be possible to customize the reports. The Purchaser shall be free to ask for customization of reports based on the data available in the database from time to time during warranty period & AMC period. It shall be possible to generate the customized reports as per purchaser requirement.

(q) Correlation with, historical traffic values such as daily, weekly monthly statistics

(r) Monitoring at programmed intervals.

(s) TMG shall support Traffic Policing.

(t) TMG shall support Traffic Shaping

(u) TMG shall support Traffic Queuing

11.0 Following shall be indicated in the Type Approval certificate:

1. Type of TMG – e.g. with/without inbuilt Signalling Gateway
2. Addressing scheme supported
   e.g. IPv4/IPv6/Dual stake
3. Physical IP interface supported
   e.g. Gigabit interface, 10/100/1000 Mb Base T.
4. Physical PSTN interface supported e.g. E1/STM1 etc.
5. Type of signaling towards Soft switch/MGC supported e.g. H.248/MGCP
6. External synchronization interfaces supported
7. Type of power supply required e.g. option 1 or option 2 (Refer clause 3.13 of this document).
8. Type(s) of additional codec supported
9. Transport control protocol supported e.g. TCP/UDP/SCTP
10. The product name and model number of the associated equipment's (Controller/Soft Switch) used for testing. (This Media Gateway is not a stand-alone equipment and is tested in association with)

ABBREVIATIONS

AC	Alternating Current
AMR-FR	Adaptive Multi-Rate (Full Rate)
AMR-HR	Adaptive Multi-Rate (Half Rate)
BFD	Bidirectional Forwarding Detection
BHCA	Busy Hour Call Attempts
CC	Call Content
CCS7	Common Channel Signalling No. 7
CDMA	Code Division Multiple Access
CISPR	Special international committee on radio interference
CRTP	Compressed RTP
DC	Direct Current
DiffServ	Differentiated Services
DOS	Denial of Service
DOT	Department of Telecommunications
DTMF	Dual Tone Multi Frequency
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Induction
EMR	Enhanced Full Rate
EMS	Element Management System
ETSI	European Telecommunications Standards Institute
FAX	Facsimile Trans-receiver
FCAPS	Fault, Configuration, Accounting, Performance, Security
FE	Fast Ethernet
FR	Full Rate, Frame Relay
GE	Gigabit Ethernet
GR	Generic Requirements

GSM	Global System for Mobile communications
GUI	Graphical User Interface
HR	Half Rate
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
IRI	Intercept Related Information
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
ITU-T	International Telecommunication Union Telecommunication Standardisation
KHz	Kilo Hertz
LCT	Local Craft Terminal
Mbps	Mega Bit Per Second
MGCP	Media Gateway Control Protocol
NMS	Network Management System
MTP	Media Transfer Protocol
MML	Man Machine Language
MTBF	Mean Time Between Failure
MTTR	Mean Time To Restore
NTP	Network Time Protocol
O&M	Operation & Maintenance
PCM	Pulse Code Modulation
PLMN	Public Land Mobile Network
PSTN	Public Switch Telephone Network
RF	Radio Frequency

RFC	Request For Comments
RTB	Route Busy
RTCP	RTP Control Protocol
RTP	Real-time Transport Protocol
SBC	Session Border Controller
SG	Signalling Gateway
SIP	Session Initiation Protocol
SCTP	Stream Control Transport Protocol
SNMP	Simple Network Management Protocol
STM	Synchronous Transport Module
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TEC	Telecommunications Engineering Centre
TOS	Type of Service
UDP	User Datagram Protocol
VAD	Voice Activity Detection
VMGW	Virtual Media Gateway
VoIP	Voice Over Internet Protocol
WCDMA	Wideband Code Division Multiple Access,

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