Customer Premises Equipment (CPE)
For
MPLS Network

Interface Requirements

No. TEC/IR/IT/CPE-003/02 MARCH 2014)  
(Supersedes IR No. IR/CPE-03/01 JUL 2003)
Interface requirement for "Customer Premises Equipment (CPE) for MPLS Network. No. TEC/IR/IT/CPE-003/02 MARCH 2014".

History Sheet

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# Interface Requirements for Customer Premises Equipment (CPE) for MPLS Network

(No. TEC/IR/IT/CPE-003/02 MARCH 2014)

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References:

a) TEC GRs/IRs/Standards
1. GR/TX/SDH-04 STM-1 Synchronous Multiplexer
2. IR/IT/RAS-01 Interface Requirements of Remote Access Server
3. TEC/EMI/TEL-001/01/FEB-09 Electromagnetic Compatibility Standard for Telecommunication Equipment

b) ITU-T Recommendations
1. G.703 Physical/electrical characteristics of hierarchical digital interfaces
2. G.704 Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels
3. G.707 Network node interface for the synchronous digital hierarchy (SDH)
4. G.752 Characteristics of digital multiplex equipments based on a second order bit rate of 6312 kbit/s and using positive justification
5. G.783 Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks
6. G.823 The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy
7. G.824 The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy
8. G.957 Optical interfaces for equipments and systems relating to the synchronous digital hierarchy
9. V.24 List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)
10. V.35 Data transmission at 48 kbit/s using 60-108 kHz group band circuits
11. V.36 Modems for synchronous data transmission using 60-108 kHz group band circuits
12. X.21 Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks

c) IETF/IEEE Standards
1. RFC 791 Internet protocol darpa internet program protocol specification
2. RFC 793 Transmission control protocol darpa internet program protocol specification
3. RFC 1583 Security Mechanisms for the Internet
4. RFC 1661 The Point to Point Protocol
5. RFC 1981 Path MTU Discovery for IP version 6
6. RFC 2080 RIPng for IPv6
7. RFC 2328 OSPF Version 2
8. RFC 2375  IPv6 Multicast Address Assignments
9. RFC 2453  RIP v2
11. RFC 2475  Architecture for Differentiated Services
12. RFC 2545  Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
13. RFC 2547  BGP/MPLS VPNs
14. RFC 2598  An Expedited Forwarding PHB
15. RFC 2615  PPP over SONET/SDH
16. RFC 2740  OSPF for IPv6
17. RFC 3260  Diff-Serve
18. RFC 3315  Dynamic Host Configuration Protocol for IPv6 (DHCPv6)
19. RFC 3376  Internet Group Management Protocol, Version 3
20. RFC 3396  Encoding Long Options in the Dynamic Host Configuration Protocol (DHCPv4)
22. RFC 4271  A Border Gateway Protocol 4 (BGP-4)
23. RFC 4443  Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
25. RFC 4760  Multi Protocol Extensions for BGP4
26. RFC 4862  IPv6 Stateless Address Autoconfiguration
27. RFC 5072  IP version 6 over PPP
29. IEEE 802.1q  VLAN Trunking
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d)  IEC/CISPR/ Euro Norms for EMC

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Chapter 1

INTRODUCTION

1.1 This document is for Interface requirements of all types of Customer Premises Equipment (CPE) like Customer Edge Routers etc used by subscriber to connect to Service Provider’s MPLS network Point of Presence (PoP). This document also contains the Interface requirement for interconnecting the MPLS network between Service Provider MPLS networks. The interfacing shall be at MPLS PE Router. This document lays down only the minimum requirements for connectivity between Service Provider networks. Deployment of CPE approved against this IR shall inter-alia enable Service Provider to provide MPLS managed services.

1.2 This document is applicable to Stand-alone or Rack-mounted Customer Premises Equipment. It applies to MPLS CPE’s with interface speeds ranging from N x 64 Kbps, 2Mbps, E3 (34 Mbps), DS3 (45 Mbps), STM-1 (155 Mbps), STM-16, 10/100 Mbps Ethernet, 10/100/1000 Mbps Ethernet, and FE/GE/10GE/40GE/100GE Ethernet Optical

1.3 This document is not applicable to Router ports integrated on the Remote Access Server (Narrow Band RAS) equipment for which the IR No. TEC/IR/IT/RAS-001 shall be applicable.

1.4 Wherever, the standardized documents like ITU-T, QA and TEC documents are referred, the latest issue and number with the amendments shall be applicable.

1.5 The RFC documents of the IETF are subject to periodic revision. Hence wherever 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 the RFC is mentioned, product shall comply with the part of the RFC specifying the feature.

1.6 The interpretation of the clauses of the RFC’s shall be as per RFC 2119.

1.7 The device shall comply with all the protocols listed in Para 2.0.
Chapter 2

FUNCTIONAL REQUIREMENTS

2.1 Protocols support:

2.1.1 Network Protocols:- The device shall support the

i. Internet Protocol (IP) version - 4 as per IETF RFC791
ii. IP ver 6 as per IETF RFC 2460, RFC 4861, RFC 4862, RFC 1981 and RFC 4443
iii. Transmission Control Protocol (TCP) as per IETF RFC 793.

2.1.2 Routing Protocols: The CPE shall support the following routing protocols:

i. Static and Dynamic routing protocols for both IPv4 and IPv6
ii. RIPv2 as per RFC 2453
iii. RIPng for IPv6 as per RFC 2080
iv. OSPF as per RFC 1583 & RFC 2328
v. OSPF for IPv6 as per RFC 2740
vi. BGP-4 as per RFC 4271
vii. BGP for IPv6 as per RFC 2575
viii. IS-IS using adaptive algorithms
ix. Multicast Protocol: IGMP as per RFC 3376
x. Quality of Service (QoS):
   a) Differentiated Service Point Code (DSCP) as per RFC 3260
   b) PHB as per RFC 3140 and RFC 2598
   c) ToS Bit as per RFC 2474 and RFC 2475.
   d) VLAN Tagging as per 802.1q and 802.1p.
   e) QoS marking for IPv6 packets shall be as per RFC2460/RFC3697.
xii. The DHCPv4 as per RFC 3396.
xiii. The DHCPv6 support shall be as per RFC 3315.
xiv. Multi Protocol Label Switching (MPLS)
   a) MPLS Architecture shall be as per RFC 3031
   b) The CPE shall support MPLS Label Edge Router functionality.
   c) The CPE shall support MPLS class of service.
   d) The CPE shall support LDP specification as per RFC5036
   e) The CPE shall support BGP/MPLS IP Virtual Private Networks (VPNs) as per RFC 4364
   f) The CPE shall support Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling as per RFC 4762

2.1.3 WAN Protocols (subscriber access protocol):-

The CPE equipment shall support one or more of the following WAN protocols:

a) Point to Point Protocol (PPP) as per IETF RFC 1661 shall be supported for 64Kbps / n x 64Kbps / E1 / E3 / DS3 interfaces
b) IPv6 over PPP shall be as per RFC 5072 for non-Ethernet interfaces
c) It shall support PPP over SONET/SDH as per RFC 2615 for STM interfaces
2.2 Interface Support:

2.2.1 Physical Interface:

i. The CPE shall support one or more of the LAN interfaces
   a) 10/100 Ethernet Electrical as per IEEE 802.3
   b) 10/100/1000 Ethernet Electrical as per IEEE 802.3
   c) FE Optical as per IEEE 802.3u
   d) GE Optical as per IEEE 802.3
   e) 10GE Optical as per IEEE 802.3ae
   f) 40GE Optical as per IEEE 802.3ba
   g) 100GE Optical as per IEEE 802.3ba

ii. The physical interface on the CPE for leased lines connection to MPLS network shall be supporting one or more of the WAN Interfaces as given below.
   a) V.35
   b) V.36
   c) V.24
   d) V.28
   e) V.11
   f) V.21
   g) 64Kbps co directional as per ITU-T G.703
   h) NX64Kbps interface as per ITU-T G.703
   i) 2048Kbps 120 Ohm balanced as per ITU-T REC.G.703 or 75ohm unbalanced, Framed or Unframed
   j) E3 (34Mbps), ITU-REC.G.703, G.804, G.832.
   k) STM-1 Electrical as per ITU-T Rec.G.703& G.707
   l) STM-1 optical short haul or Intermediate range or long haul interface on mono mode/multimode Fibre as per ITU-T Rec. I.432, G.957 & G.707. The CPE shall be connected to Service Provider STM equipment with FC-PC connector.
   m) DS3 45 Mbps (as per G.703) Interface.
   n) STM-16 Optical short haul or Intermediate range or long haul interface on mono mode/multimode Fibre as per ITU-T Rec. I.432, G.957 & G.707. The CPE shall be connected to Service Provider STM equipment with FC-PC connector.
   o) 10/100 Ethernet Electrical as per IEEE 802.3
   p) 10/100/1000 Ethernet Electrical as per IEEE 802.3
   q) FE Optical as per IEEE 802.3u
   r) GE Optical as per IEEE 802.3
   s) 10GE Optical as per IEEE 802.3ae
   t) 40GE Optical as per IEEE 802.3ba
   u) 100GE Optical as per IEEE 802.3ba

2.2.2 The CPE shall support configuration of the Service Level Monitoring parameters from the Service Provider’s Network.

2.2.3 The CPE shall support the Service Level monitoring by using the Round Trip Time Monitor parameter. This data shall be exportable to Service Provisioning Server.
2.2.4. CPE shall provide NAT (Network Address Translation) functionality.

2.2.5. Synchronisation: The CPE shall be capable of extracting the receive clock from line or external interface and shall be able to use the recovered clock as transmit clock.

2.2.6. Output Jitter:
   a. Output Jitter at 2048 kbps / 34Mbps network interface shall be as per ITU-T G.823.
   b. Output Jitter at DS3 network interface shall be as per ITU-T G.824.
   c. Output jitter at STM-1/STM-16/STM-64 interface shall be as per ITU-T G.825.

2.2.7. Jitter Tolerance:
   a. Jitter Tolerance at 2048 kbps / 34Mbps network interface shall be as per ITU-T G.823.
   b. Jitter Tolerance at DS3 network interface shall be as per ITU-T G.824.
   c. Jitter Tolerance at STM-1/STM-16/STM-64 interface shall be as per ITU-T G.825.

2.2.8. Output Pulse Mask:
   a. Pulse Mask at 2048 kbps / 34Mbps network interface shall be as per ITU-T G.703.
   b. Pulse Mask at DS3 network interface shall be as per ITU-T G.704.
   c. Pulse Mask at STM-1 electrical interface shall be as per ITU-T G.703.

2.2.9. Return Loss: The return loss at the input port shall be as follows:
   a. Return Loss at 2048 kbps / 34Mbps network interface shall be as per ITU-T G.703.
   b. Return Loss at DS3 network interface shall be as per ITU-T G.704.
   c. Return Loss at STM-1 electrical interface shall be as per ITU-T G.703.
   d. AC differential input impedance of the Ethernet interfaces shall be as per IEEE 802.3

2.3 Management and Security: The CPE shall be manageable from the Service Provider Network Management System. The CPE shall support the following management and security features.
   i. SNMP: Support for MIBs for SNMP - versions 2 & v3 shall be provided.
   ii. Access Security: The CPE shall have at least one level of password protection features. Multiple levels of management access privileges for privileged (configuration) and non-privileged (read only) tasks shall be supported.
   iii. Packet Filtering / Firewalling: The CPE shall support extensive packet filtering. Ability to assign traffic filters based on IP address, TCP and UDP port numbers in a data packet shall be supported.
iv. **Console or Out-of-band Management:** The CPE shall have console management access with the provision for remote out-of-band management capability.

v. **Telnet, FTP and BOOTP support:** The CPE shall support Telnet access to the console and FTP / TFTP BOOTP access to its configuration / boot files. Provision shall also exist for remote reboot.

vi. **Configuration Management:** The CPE shall support configuration management through the command line interface. The CPE shall support API such as XML for integration with GUI based/web based configuration manager.

vii. **Debugging / Troubleshooting:** The CPE shall provide extensive debugging and troubleshooting features to assist in hardware and software problem resolution.

viii. **Event and System logging:** Event and system history logging functions shall be available. The CPE shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware where the analysis of log shall be supported.

ix. **Pre-planned Timed Reboot Facility:** The CPE shall support the pre-planned timed reboot to upgrade their hardware to a new software feature and plan the rebooting at an off-peak time.

### 2.4 QoS Support

i. Class-based scheduling / queuing with at least 4 Classes that provides configurable minimum bandwidth allocation to each class.

ii. Committed Access Rate, Traffic Policing, sub-rate service shall be supported.

iii. At least three level dropping precedence levels in each queue shall be supported.

iv. The CPE shall support for traffic policing like packet and byte counts, start time and stop time stamps, input and output interface ports, Type of service, TCP Flag and Protocol, Source and Destination IP and TCP / UDP addresses, Next Hop Address, Source and Destination Autonomous Number & Subnet masks.

### 2.5 Network Management

i. The CPE shall support Telnet client and server functionality.

ii. The CPE shall support BOOTP, FTP and TFTP for easy software upgrades over the network.

iii. The CPE shall provide adequate tools for detailed traffic statistics collection and analysis.

iv. Network management services shall be provided using standards based protocols like SNMP (Ver 2 & Ver 3)

v. Support for standard MIBs such as Static Routing, RIP, RIPing, BGP4, OSPF (v2 & v3), MIB I & II

vi. The CPE shall support Network Time Protocol (NTPv4) as per RFC 5905.
Chapter 3

EMI / EMC REQUIREMENTS

**General Electromagnetic Compatibility (EMC) Requirements:**
The equipment shall conform to the EMC requirements of class “A” as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from a test agency.

a. **Conducted and radiated emission:**
   (applicable to telecom equipment)
   
   
   **Limits:**
   i) To comply with Class A or B (to be mentioned in the GR / IR as per the specific requirement) of CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006).
   
   ii) The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09.

   OR

   Conducted and radiated emission (applicable to instruments such as power meter, frequency counters etc.):
   
   Name of EMC Standard: “CISPR 11 {2004} - Industrial, scientific and medical (ISM) radio-frequency equipment-Electromagnetic disturbance characteristics-Limits and methods of measurement”
   
   **Limits:**
   i) To comply with the category of Group 1 of Class A of CISPR 11 {2004}
   
   ii) The values of limits shall be as per clause No. 8.5.2 of TEC Standard No. TEC/EMI/TEL-001/01/FEB-09.

b. **Immunity to Electrostatic discharge:**
   Name of EMC Standard: IEC 61000-4-2 {2001} "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 (2006) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"
**Limits:-**

For Telecom Equipment and Telecom Terminal Equipment with Voice interface(s)

i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and

ii) Under test level 3 (10 V/m) 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.

For 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 {2004) "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:**


**Limits:-**

i) For mains power input ports: (a)1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling

ii) For telecom ports: (a) 0.5 kV peak open circuit voltage for line to ground (b) 0.5 KV peak open circuit voltage for line to line coupling.

f. **Immunity to conducted disturbance 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):

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.

Note 1: Classification of the equipment:
Class B: Class B is a category of apparatus which satisfies the class B disturbance limits. Class B is intended primarily for use in the domestic environment and may include:
   • Equipment with no fixed place of use; for example, portable equipment powered by built in batteries;
   • Telecommunication terminal equipment powered by the telecommunication networks
   • Personal computers and auxiliary connected equipment.

Please note that the domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus connected.

Class A: Class A is a category of all other equipment, which satisfies the class A limits but not the class B limits.

Note 2: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

Alternatively EMC test report from a non-accredited test lab, which is audited by an accredited lab / accrediting authority for the availability of all the essential facilities (test equipment, test chamber, calibrations in order, test instructions, skilled personnel etc.), required for performing the tests according to the EMC test methods audited, may be acceptable.

However, such accredited lab / accrediting authority should take responsibility of the test results of the “non accredited lab” along with indication of period of such delegation and the submitted test report should be of such valid period of delegation. The audit report, mentioning above facts, should be provided along with EMC test report.

Note 3:- For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/EMI/TEL-001/01/FEB-09 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 (g) and TEC Standard No. TEC/EMI/TEL-001/01/FEB-09. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

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Chapter 4

SAFETY REQUIREMENTS

The CPE shall meet the following safety requirements:

i. The operating personnel shall be protected against shock hazards as per IS8473 (1993) – Guide on the effects of current passing through the human body [equivalent to IEC publications 60479-1 (1984)]. The manufacturer / supplier shall submit a certificate in respect of compliance to these requirements.

ii. The equipment shall conform to IS 13252 (2003) – Safety of Information Technology equipment including electrical business equipment [equivalent to IEC publication 60950 (2001) and IS 10437 (1986). Safety requirements of Radio transmitting equipments (equivalent to IEC publication 60215). The manufacturer / supplier shall submit a certificate in respect of compliance to these requirements.

Chapter 5

OTHER REQUIREMENTS

5.1 Lawful Interception Requirements:
The CPE shall support port mirroring. It shall be possible to mirror the traffic belonging to a particular service from a particular port. The CPE shall support logging and forwarding the egress and ingress traffic on a per-logical channel basis to a central location in the network for Lawful Interception and Monitoring.

5.2 Items to be mentioned on interface approval certificate shall be as follows:

i. Interface as per clause 2.2
ii. Interface wavelength(s) and type in case of optical interface
iii. Backplane full duplex capacity of the CPE
iv. IPv4 Routes supported
v. IPv6 Routes supported
vi. Availability of Power Supply redundancy
vii. Availability of control card redundancy
viii. MAC Address table size
ix. Routing table size
x. LSP Entries supported
**GLOSSARY**

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<td>BGP</td>
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<td>BOOTP</td>
<td>Boot Protocol</td>
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<td>CPE</td>
<td>Customer Premises Equipment</td>
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<td>DoT</td>
<td>Department Of Telecommunication</td>
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<td>E1</td>
<td>2.048 Mbps (ITU-T G.703 format)</td>
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<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>STM</td>
<td>Synchronous Transport Module</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission Control Protocol</td>
</tr>
<tr>
<td>TEC</td>
<td>Telecommunication Engineering Centre</td>
</tr>
<tr>
<td>TFTP</td>
<td>Trivial File Transfer Protocol</td>
</tr>
<tr>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
</tbody>
</table>

- End of the Document -