Interface Requirements for Router

Interface Requirements

No.TEC/IR/IT/TCP-001/05 MARCH 2014
(Supersedes IR No. TEC/IR/I/TCP-001/04.MAR 2012)

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History Sheet

S .No.	Interface Requirements No.	Remarks
1	IR No. I/TCP-01/01.APR 99.	Original IR for Router
2	IR No. IR/TCP-01/02. OCT 2001 Amendment No. 1 dated 11-12-2001 Amendment No. 2 dated 25-11-2002	To categorise the Router in two categories i.e. Low end and High end.
3	IR No. IR/TCP-01/03.DEC 2004 Interface Requirements for Router	Change of name of the IR. To incorporate two amendments and Dial Backup in Router. To incorporate Fast Ethernet in Low end Router and STM-4, STM-16, Fast Ethernet Gigabit Ethernet Interfaces in High end Router.
4	IR No. TEC/IR/I/TCP-001/04 MAR 2012.	Fourth issue after review
5	**IR No. TEC/IR/IT/TCP-001/05 MARCH 2014**	Fifth issue after incorporating IPv6 protocols and other features after review. The Router categorisation is removed

References:

a) **TEC GRs/IRs/Standards**

1.	GR/SDH-04	STM-1 Synchronous Multiplexer
2.	IR/RAS-01	Interface Requirements of Remote Access Server
3.	SD/ISN-01	ISDN User Network Interface (S/T) National Standards
4.	SD/ISN-02	National Standards for ISDN Basic Rate Access U-Interface
5.	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 1661	Point to Point Protocol
4.	RFC 1981	Path MTU Discovery for IP version 6
5.	RFC 2080	RIPng for IPv6
6.	RFC 2328	OSPF Version 2
7.	RFC 2375	IPv6 Multicast Address Assignments
8.	RFC 2453	RIP v2
9.	RFC 2460	Internet Protocol, Version 6 (IPv6) Specification
10.	RFC 2475	Architecture for Differentiated Services
11.	RFC 2545	Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
12.	RFC 2547	BGP/MPLS VPNs
13.	RFC 2598	An Expedited Forwarding PHB
14.	RFC 2615	PPP over SONET/SDH
15.	RFC 2740	OSPF for IPv6
16.	RFC 3260	Diff-Serve
17.	RFC 3315	Dynamic Host Configuration Protocol for IPv6 (DHCPv6)
18.	RFC 3376	Internet Group Management Protocol, Version 3
19.	RFC 3396	Encoding Long Options in the Dynamic Host Configuration Protocol (DHCPv4)
20.	RFC 3697	IPv6 Flow Label Specification
21.	RFC 4271	A Border Gateway Protocol 4 (BGP-4)
22.	RFC 4443	Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
23.	RFC 4601	Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification
24.	RFC 4760	Multi Protocol Extensions for BGP4
25.	RFC 4861	Neighbor Discovery for IP version 6 (IPv6)
26.	RFC 4862	IPv6 Stateless Address Autoconfiguration
27.	RFC 5072	IP version 6 over PPP
28.	IEEE 802.1p	LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization
29.	IEEE 802.1q	VLAN Trunking
30.	IEEE 802.3	Ethernet

d) IEC/CISPR/ Euro Norms for EMC

	IEC/CISPR Norms	Euro Norms
1.	CISPR 11	EN 55011
2.	CISPR 22	EN 55022
3.	IEC 61000-4-2	EN 61000-4-2
4.	IEC 61000-4-3	EN 61000-4-3
5.	IEC 61000-4-4	EN 61000-4-4
6.	IEC 61000-4-5	EN 61000-4-5
7.	IEC 61000-4-6	EN 61000-4-6
8.	IEC 61000-4-11	EN 61000-4-11

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Chapter 1

INTRODUCTION

1.1   This document is for Interface requirements of all types of Routers & equivalent devices used by Customers/ Private ISPs to interconnect to Service Provider Internet Point of Presence (PoP). This document lays down only the minimum requirements for connectivity to Service Provider networks.
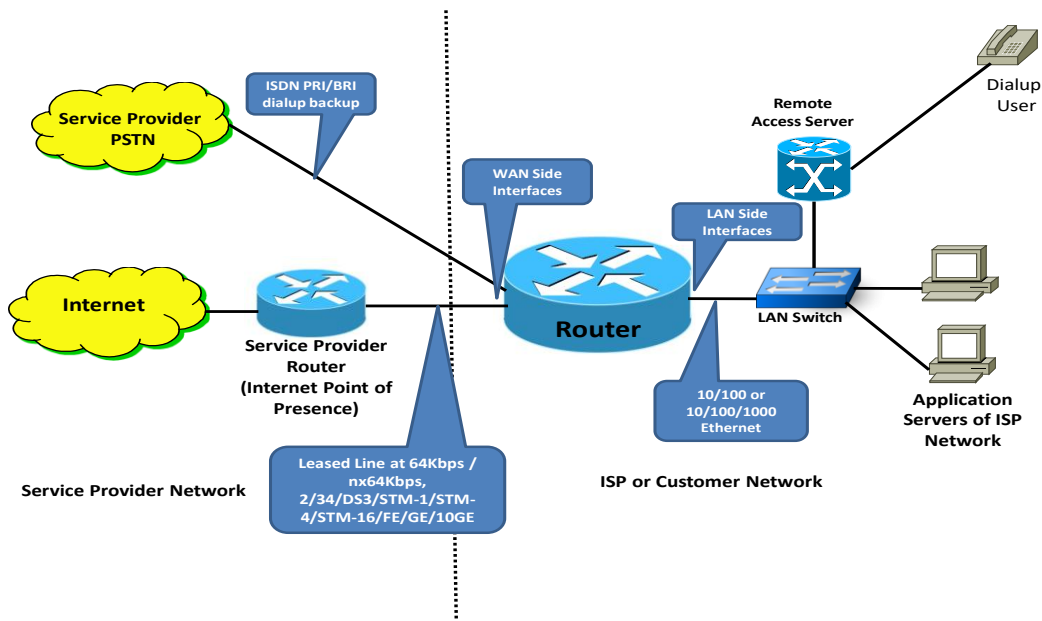
Chapter 2

DESCRIPTION

2.1   This document is applicable to all types of Stand-alone or Rack-mounted Routers equipment. The Routers may be equipped with a variety of interfaces with speeds ranging from 64 Kbps, N x 64 Kbps, 2 Mbps, 10/100 Ethernet, 10/100/1000 Ethernet, E-3, DS-3, STM-1, STM-4, STM-16, STM-64 and FE/GE/10GE Optical etc. The Routers shall be utilised for variety of interconnection requirements including connecting subscriber's networks to internet service provider networks, connecting internet service provider networks to Service Provider Internet Point of presence (PoP) etc.

2.2   This document is not applicable to Router ports integrated on the Remote Access Server equipment for which the IR No. IR/RAS-01 shall be applicable.

2.3   This Interface Requirement (IR) document shall be applicable to all type of TCP / IP access devices like Routers & equivalents.

2.4   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 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.

2.5   The interpretation of the clauses of the RFC's shall be as per RFC 2119.

2.6   Router connectivity
A typical connectivity of the Router deployed in ISP or customer networks and interfacing with Service Provider Internet POP is given below.

Chapter-3

FUNCTIONAL REQUIREMENTS

3.1 **Support for Protocols:** It shall support following protocols:

3.1.1 **Network Protocols:** The device shall support
   i) IP Version 4 as per RFC 791
   ii) IP version 6 as per RFC2460, RFC 4861, RFC 4862, RFC 1981 and RFC 4443.
   iii) Transmission Control Protocol (TCP) as per IETF RFC 793 .

3.1.2 **Routing Protocols**: Routers shall support
   i) Both static and dynamic routing using the adaptive algorithms.
   ii) BGP4 as per RFC 4271 and MBGP as per IETF RFC 4760 (Multiprotocol Extensions for BGP-4).
   iii) BGP for IPv6 as per RFC2545.
   iv) RIP2 as per RFC 2453
   v) RIPng for IPv6 as per RFC2080
   vi) OSPF as per RFC 2328
   vii) OSPF for IPv6 as per RFC2740
   viii) Multicast Protocol: IGMP as per RFC 3376 and PIM-SM as per RFC 4601.
   ix) IPv6 multicast assignments shall be as per RFC2375
   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 2475.
      d) VLAN Tagging as per IEEE 802.1q and IEEE 802.1p.
      e) QoS marking for IPv6 packets shall be as per RFC2460/RFC3697.
   xi) Encoding Long Options in the Dynamic Host configuration Protocol (DHCPv4) as per RFC 3396.
   xii) The DHCPv6 support shall be as per RFC 3315.

3.1.3 **WAN Protocols** (subscriber access protocol**):**
   i) Point to Point (PPP) protocol shall be used for connecting the TCP/IP Devices to Telecom Network Point of Presence. PPP shall be supported as per RFC 1661 for 64Kbps / n x 64Kbps / E1 / E3 / DS3 interfaces.
   ii) IPv6 over PPP shall be as per RFC 5072 for non-Ethernet interfaces
   iii) It shall support PPP over SONET/SDH as per RFC 2615 for STM interfaces.

3.2 **Physical Interfaces:** Physical Interface shall be capable of supporting one or more of the Interfaces as given below. The speed of the leased line may vary from 64 Kbps, n x 64 Kbps to 2 Mbps,E3 (34Mbps), DS3(45Mbps), STM-1(155Mbps), STM-4(622Mbps),STM-16(2488Mps), STM-64(10Gbps), FE/GE/10GE Ethernet.

(a) The Router shall support one or more out of the following LAN interfaces:
  i) 10/100 Base Tx Ethernet Electrical as per IEEE 802.3
  ii) 10/100/1000 Base Tx Ethernet Electrical as per IEEE 802.3

(b) The Router shall support one or more out of the following WAN interfaces
  i) x DSL
  ii) X.21
  iii) V.36
  iv) ISDN PRI Interface as per TEC standard No. SD /ISN-01/03 OCT 2003
  v) ISDN BRI Interface as per TEC standard No. SD /ISN-02/02 SEP2003
  vi) 2G/3G Interface, (Approvals if needed shall be arranged by vendor through WPC)
  vii) 64Kbps co directional as per ITU-T G.703, V.24, V.35.
  viii) NX64Kbps interface as per ITU-T G.703, V.24, V.35
  ix) 2048Kbps 120 Ohm balanced as per ITU-T REC.G.703 or 75ohm unbalanced, Framed or Unframed
  x) 34Mbps as per ITU-T G.703
  xi) 45Mbps as per ITU-T G.703, G.704, G.707, G.752 and G.824.
  xii) STM-1 Electrical as per ITU-T G.703, G.707 & shall work with equipment specified in TEC GR G/SDH-04/03 with BNC connectors.
  xiii) STM-1 optical interface for Short Haul operation using Monomode or Multimode laser diode as per Table 2/G.957. Please see the note.
  xiv) STM-1 optical interface for Long Haul operation using Monomode or Multimode laser diode as per Table 2/G.957. Please see the note.
  xv) STM-4 optical interface for Long Haul/Short Haul operation using Monomode or Multimode laser diode as per Table 3 of ITU-T Rec G.957 . Please see the note.
  xvi) STM-16 optical interface for Long Haul/Short Haul operation using Monomode or Multimode laser diode as per Table 4 of ITU-T Rec G.957. Please see the note.
  xvii) STM-64 optical interface for long haul/short haul operations using Monomode or Multimode laser diode as per Table 2 of ITU-T Rec G.693. Please see the note.
  xviii) 10/100 Ethernet Electrical as per IEEE 802.3
  xix) 10/100/1000 Ethernet Electrical Interface as per IEEE 802.3
  xx) Fast Ethernet short Haul / long Haul Optical as per IEEE 802.3u. Please see the note.
  xxi) Gigabit Ethernet short haul / long haul optical as per IEEE 802.3. Please see the note.
  xxii) 10G Ethernet long haul / short haul optical as per IEEE 802.3ae. Please see the note.

Note: The Router with STM-1, STM-4, STM-16, STM-64 and FE/GE/10GE Optical interface shall support FCPC termination towards Telecom network. (Connection to the DDF of Telecom Network shall support FCPC termination.)

The type & number of physical interfaces will depend upon the network architecture in which the router has to be connected.

3.2.1 The Router shall be capable of extracting the receive clock from line or external interface and shall be able to use recovered clock as transmit clock.

3.3 **Manageability:** The Router shall support manageability over the SNMP ver2 and ver3 protocols and all MIBs (Management Information Base) shall be provided.

3.4 **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-4/STM-16/STM-64 interface shall be as per ITU-T G.825.

3.5 **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-4/STM-16/STM-64 interface shall be as per ITU-T G.825.

3.6 **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.

3.7 **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

Chapter-4

EMI/EMC Requirements

4.1 Electromagnetic Interference

The equipment shall conform to the following 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 a test agency.

a) Conducted and radiated emission*(applicable to telecom equipment)***:**
Name of EMC Standard: "CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006) - Limits and methods of measurement of radio disturbance characteristics of Information Technology 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**.**

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:
Name of EMC Standard: IEC 61000-4-5 (2005) "Testing & Measurement techniques for Surge immunity test"
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:
Name of EMC Standard: IEC 61000-4-6 (2003) with amendment 1 (2004) &amd. 2 (2006) "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.

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:

IEC/CISPR	Euro Norm
CISPR 11	EN 55011
CISPR 22	EN 55022
EC 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

Chapter-5

SAFETY REQUIREMENTS

(i) The operating personnel shall be protected against shock hazards as per IS 8437 (1993)- "Guide on the effects of current passing through the human body" [equivalent to IEC publication 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-6

OTHER REQUIREMENTS

6.1 **Lawful Interception Requirements:**
The Router shall support port mirroring. It shall be possible to mirror the traffic belonging to a particular service from a particular port. The Router 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.

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

i) Interface as per clause 3.2.
ii) Wavelength and Type in case of optical interfaces
iii) Backplane full duplex capacity of the Router
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) Type of Synchronisation as per clause 3.2.1

GLOSSARY

BGP	Border Gateway Protocol
BRI	Basic Rate Interface
CIDR	Classless Internet Domain Routing
CISPR	Special international committee on radio interference
DDF	Digital Distribution Frame
DHCP	Dynamic Host Configuration Protocol
DOT	Department Of Telecommunication
DS3	45 Mbps Link
E1	2.048 Mbps (ITU-T G.703 format)
E3	34.368 Mbps (ITU-T G.703 format)
FE	Fast Ethernet (100Mbps) (Electrical or Optical Interface)
GE	Gigabit Ethernet (1000Mbps) (Electrical or Optical Interface)
GR	Generic Requirements
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITU-T	International Telecommunication Union - Telecommunication Standardisation
LAN	Local Area Network
MIB	Management Information Base
MBGP	Multi Protocol BGP
OSPF	Open Shortest Path First
PIM-SM	Protocol Independent Multicast – Sparse Mode
POP	Point of Presence
PPP	Point To Point Protocol
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
QOS	Quality of Service
RAS	Remote Access Server
RFC	Request For Comments, Standard released by IETF
RIP	Routing Information Protocol
SNMP	Simple Network Management Protocol
STM	Synchronous Transport Module of SDH [Synchronous Digital Hierarchy]
TCP	Transmission Control Protocol
TEC	Telecommunication Engineering Centre
WAN	Wide Area Network
WPC	Wireless Planning Commission