



# Trend's xDSL Guide

Quick Reference

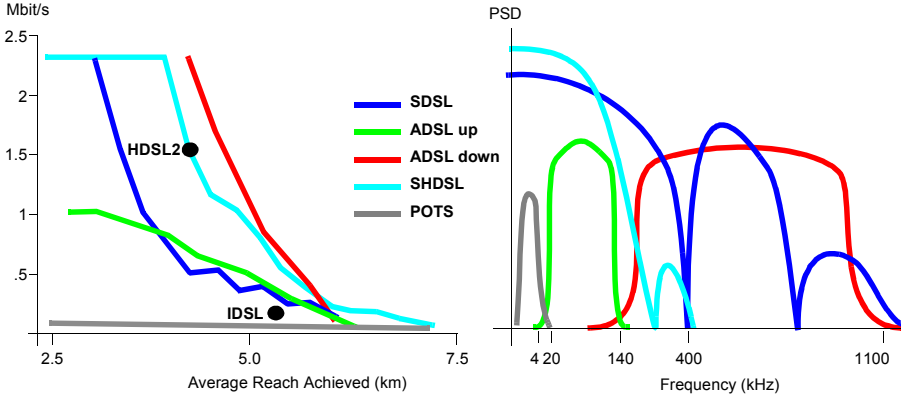


Figure 1 Reach achieved by different xDSL technologies and Spectral efficiency.

Technology	Pairs	Symmetric	POTS	Standard
ADSL	1 or 2	No	Yes	G.992.1, G.992.2, ANSI T1.413.2
HDSL	1 or 2	Yes	No	T1.418
IDSL	1	Yes	No	I.430, I.431
SDSL	1	Yes	No	None
SHDSL	1 or 2	Yes	No	G.991.2

Figure 2 Technologies comparison.



### AuroraPresto

A multi-layer xDSL tester developed to provide all the features necessary for a technician to install, maintain and troubleshoot Asymmetric and Symmetrical Digital Subscriber Lines and services. Its flexible build architecture allows different modem types, as well as data interfaces and analogue test functions including TDR, DMM, ADSL, SHDSL, ATM, IP, PPP, HTTP and internet download test.

### AuroraTango

Multi-technology Personal Test Assistant Platform for simple, fast and effective testing of ADSL, SHDSL, ISDN and GbE. It can operate in both One-button mode and Expert mode by using pre-defined test scripts and parameters. A PDA provides an intuitive graphical menu structure for testing and workflow organization. Bluetooth interface provides Tango wireless access and host independent test.

### AuroraForte

A powerful tool for the Physical, ATM and IP layer operation of ATM circuits. Provides E1, E3, DS1, DS3, ATM25, STM1/OC3 and STM4/OC12 connectivity for unparalleled multi-circuit testing ATM, xDSL and 3G networks. Physical and ATM BER testing is provided. Advanced features: AALS, OAM, QoS, SVC support and IP Ping over ATM, protocol decoding and remote testing.

### LT2000

It is a hand-held tester for analogue qualification of copper pairs. It will determine their suitability for use by xDSL services prior to and during installation and maintenance.

### ALT2000

This is the right tool for any physical qualification, monitoring or maintenance of copper pair subscriber loops. Extensive range of analogue measurements for xDSL make it attractive to engineers needing a high-performance analyzer with precision measurements. It includes ultra low noise floor, spectrum analyzer, zero blindspot TDR, DMM, and a collection of predefined masks.

### FlexaNetxDSL

A cost-effective solution that provides complete loop fault management for Control Centres that support a large number of xDSL installations. Its remote testing capacities include: emulation of equipment at both central offices and customer premises, TDR, DMM, an extensive range of analogue measurements, spectrum analysis, ATM, PPP, IP and higher level protocol test.

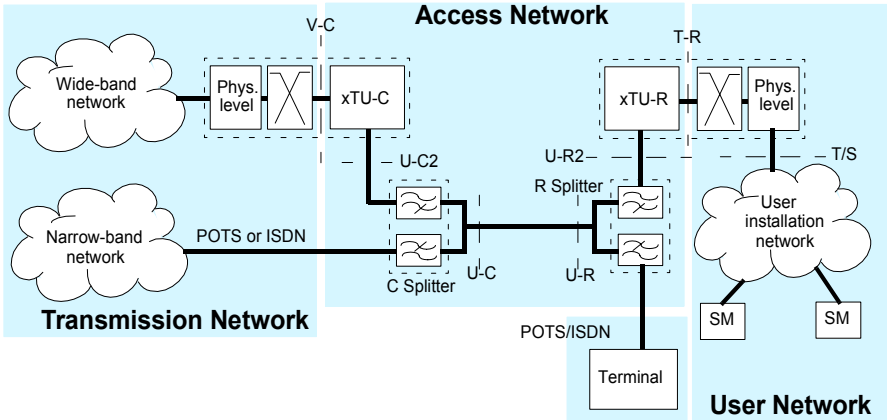


Figure 3 xDSL Reference model.

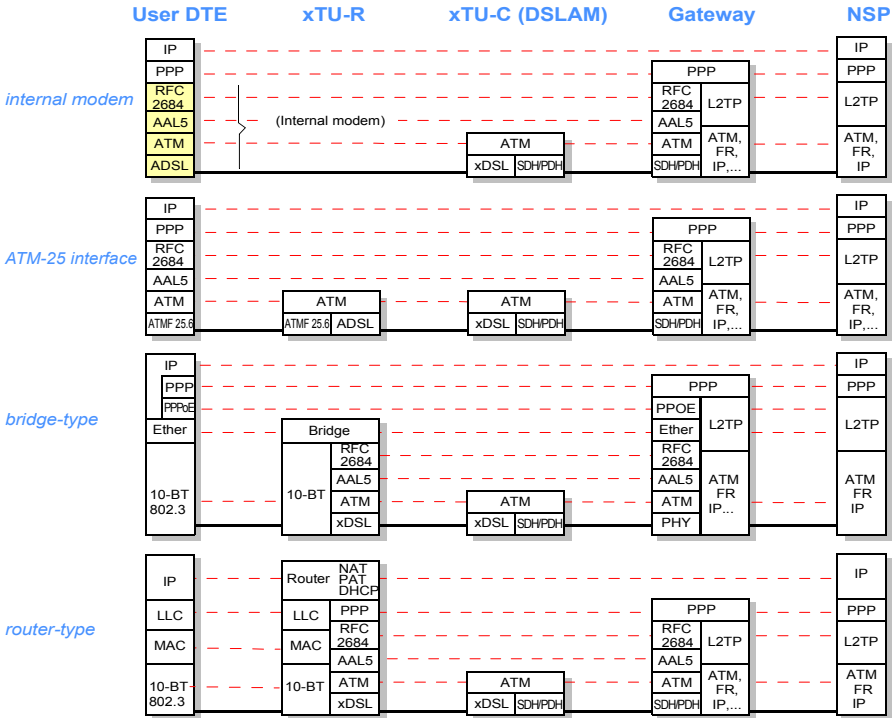
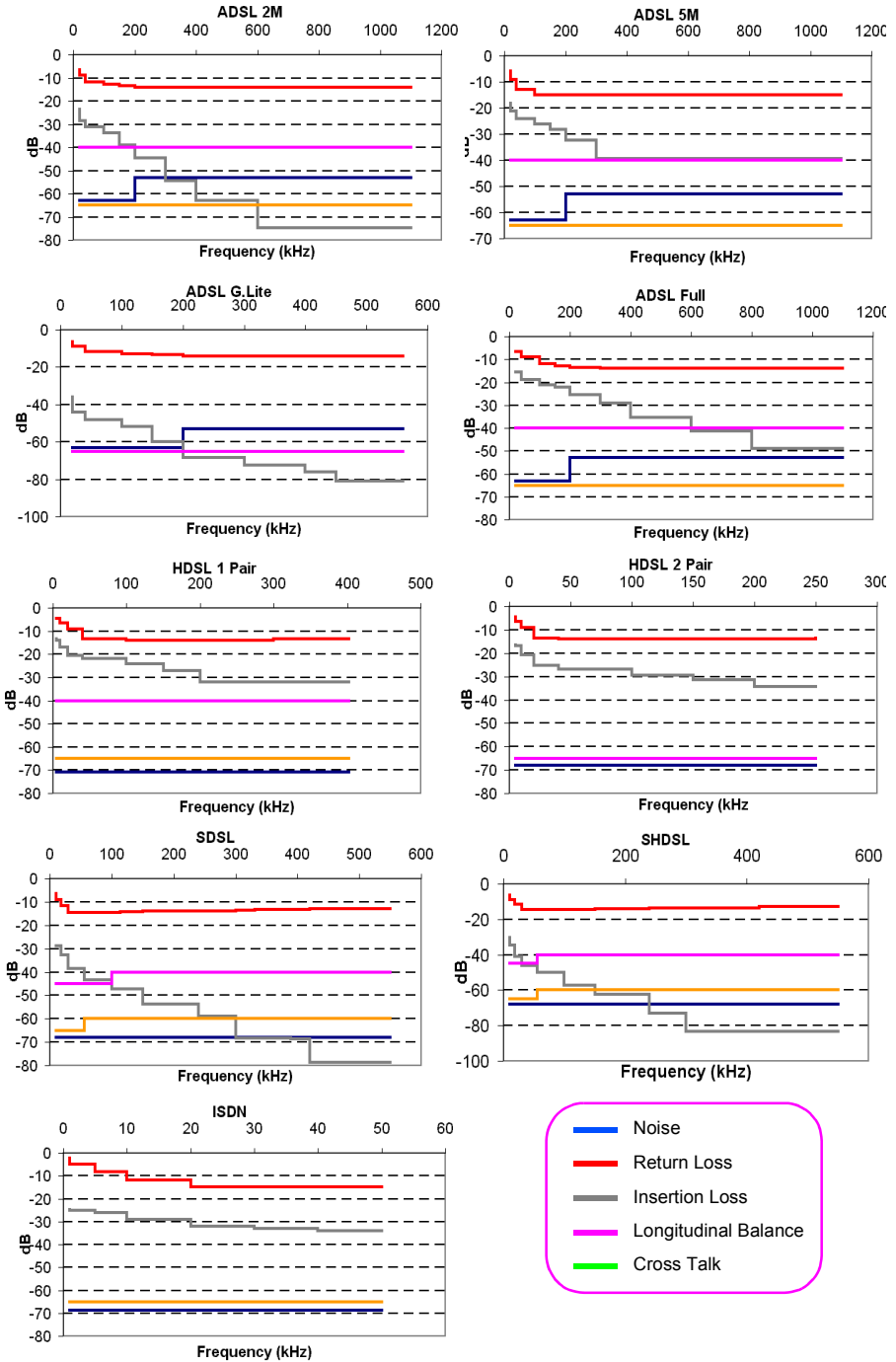
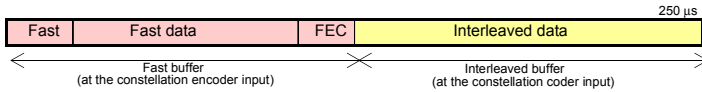


Figure 4 Structure and protocols involved in the xDSL service.

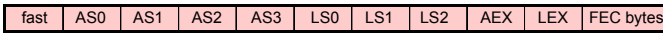


**Figure 5** ANSI masks for copper qualification.

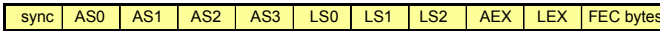
### ADSL Frame



### Fast buffer (ATU-C)



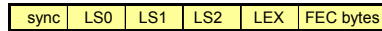
### Interleaved buffer (ATU-C)



### Fast buffer (ATU-R)

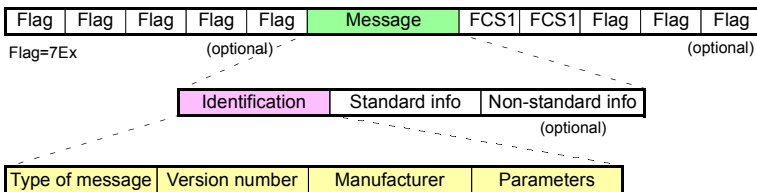


### Interleaved buffer (ATU-R)

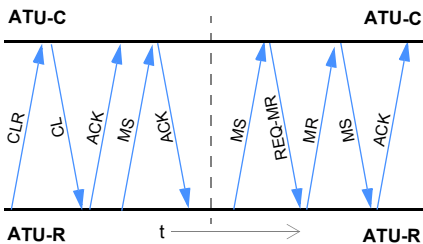


**Figure 6** ADSL frame models.

### Handshake frame

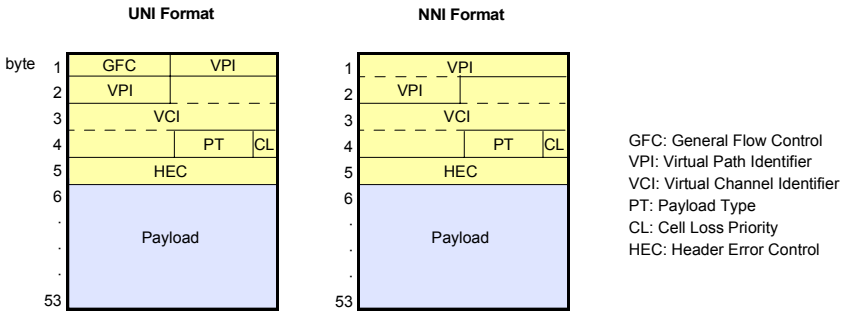


**Figure 7** Handshake frame format. Messages: MS, MR, CL, CLR, ACK(1), ACK(2), NAK-EF, NAK-NR, NAK-NS, NAK-CD, REQ-MS, REQ-MR, REQ-CLR.

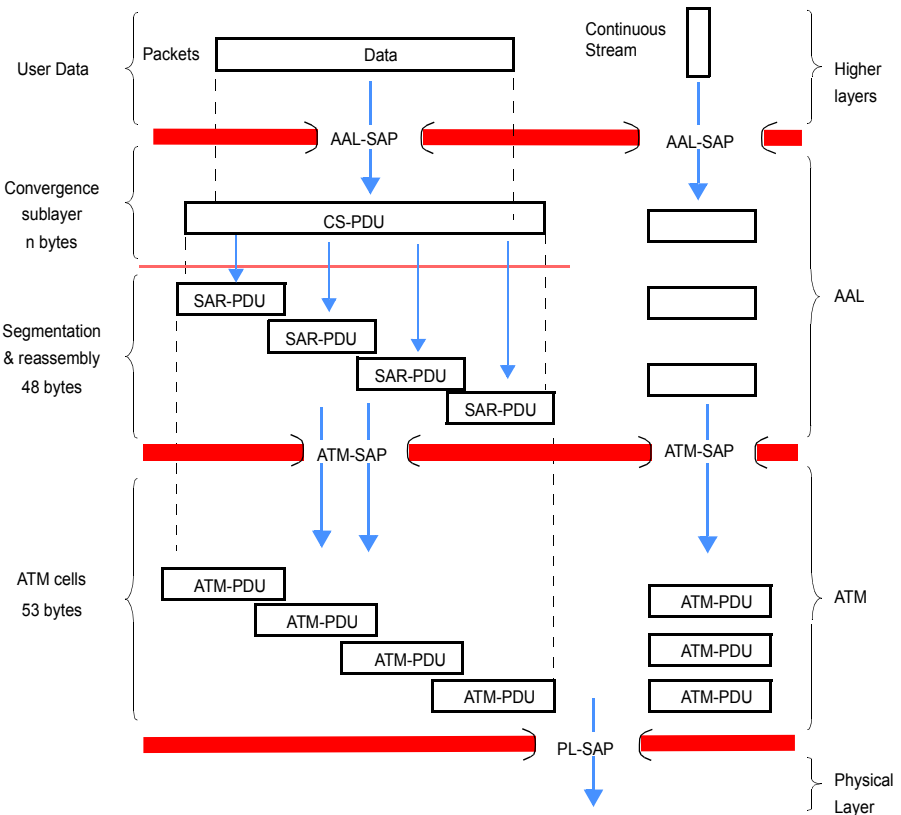


- CLR:** the ATU-R sends a list with all the operation modes it accepts
- CL:** the ATU-C responds with a list of modes it accepts
- ACK:** the ATU-R has received the list of modes correctly
- MS:** the ATU-R demands a operation mode
- ACK:** the ATU-C accepts it
- MS:** the ATU-R requires a certain operation mode
- REQ-MR:** the ATU-C wants to select the mode and makes a request for an MR message
- MR:** the ATU-R requires an MS operation mode
- MS:** the ATU-R demands a certain operation mode
- ACK:** the ATU-R accepts the request

**Figure 8** Handshake sessions.



**Figure 9** ATM Cell format according to the ATM Forum.



**Figure 10** Protocol Data Unit (PDU) exchange between ATM layers.

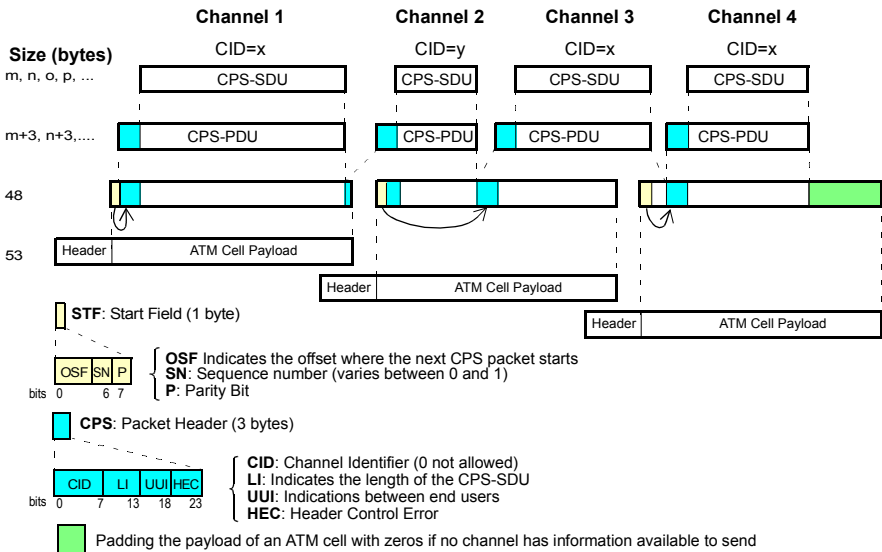
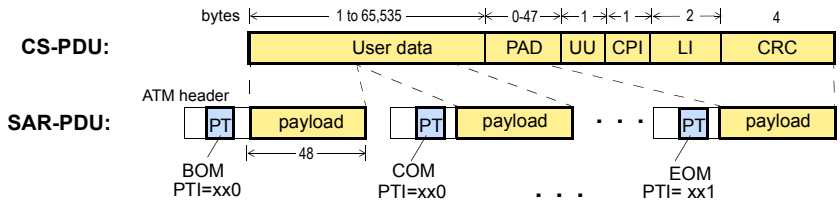


Figure 11 AAL2 format.



PAD: Complements the PDU up to forming a multiple integer of 48 bytes.  
 UU: Allows for transparent data transmission between AAL5 extremes.  
 CPI: Aligns the PDU in 64 bits  
 LI: Data size  
 CRC:  $G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$  (Calculated for the entire PDU)

Figure 12 AAL5 format.

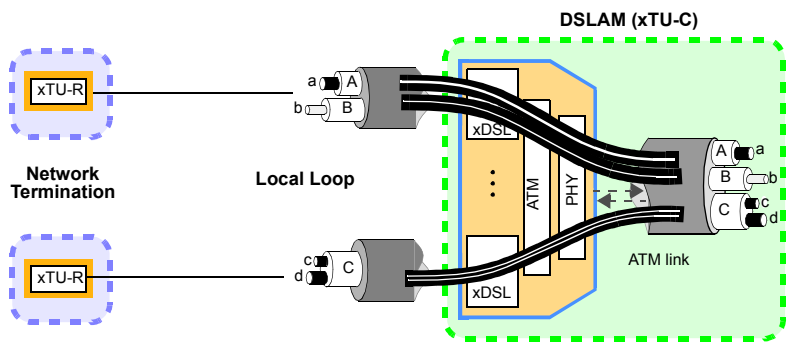
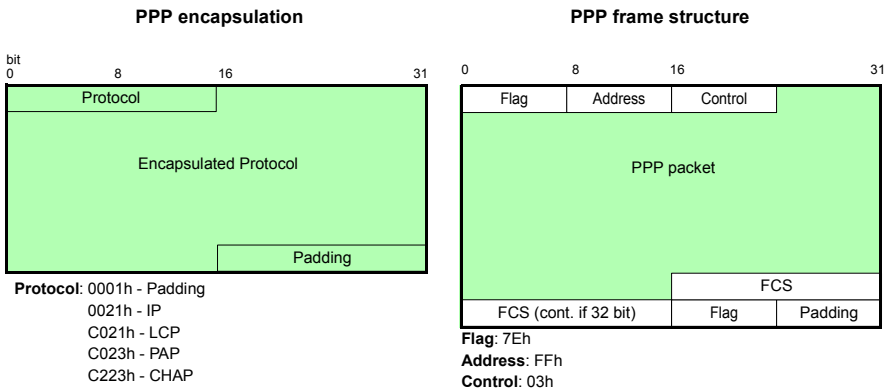
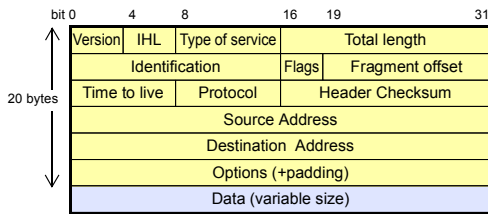


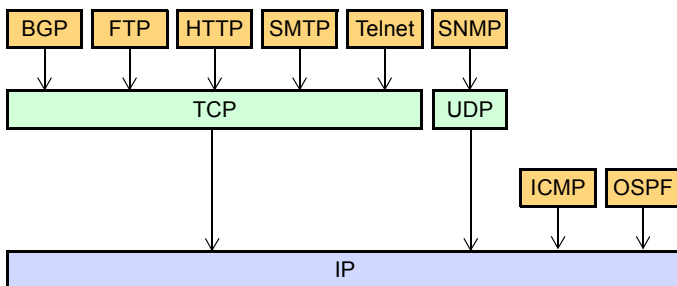
Figure 13 Multiplexing ATM in the DSLAM.



**Figure 14** PPP encapsulation.



**Figure 15** IP Format.



**Figure 16** Higher protocols.

# Acronyms

AAL	ATM Adaption Layer	LI	Length Indicator
ACK	Acknowledge	LLC	Logical Link Control
ADSL	Asymmetric Digital Subscriber Line	MAC	Media Access Control
AEX	A(S) extension byte; byte inserted in the transmitted ADSL frame structure	NAT	Network Address Translation
ASx	Any one of the simplex bearer channels (0 -3)	NSP	Network Service Provider
ATM	Asynchronous Transfer Mode	OSPF	Open Shortest Path First
ATU-C	ADSL Termination Unit Central	PAD	Padding
ATU-R	ADSL Termination Unit - Remote	PAP	Password Authentication Protocol
BGP	Border Gateway Protocol	PAT	Port Address Translation.
BOM	Begin of message	PDH	Plesiochronous Digital Hierarchy
CHAP	Challenge Handshake Authentication Protocol	PDU	Protocol Data Unit
COM	Continuation of Message	POTS	Plain Old Telephone Service
CPI	Common Part Indicator	PPP	Point to Point Protocol
CRC	Cyclic Redundancy Check	PT	Payload Type
DMM	Digital Multi-Meter	PVC	Permanent Virtual Circuit
DSLAM	Digital Subscriber Line Access Multiplexer	RADSL	Rate Adaptive Digital Subscriber Line
EOM	End of Message	SAP	Service Access Point
FCS	Frame Check Sequence	SAR	Segmentation and Reassembly
FEC	Forward Error Correction	SDH	Synchronous Digital Hierarchy
FR	Frame relay	SDSL	Symmetric Digital Subscriber Line
FTP	File Transfer Protocol	SHDSL	Symmetrical High Bit Digital subscriber Line
HDSL	High bit-rate Digital Subscriber Line	SMTP	Simple Mail Transfer Protocol
HEC	Header Error Control	SNMP	Simple Network Management Protocol
HTTP	Hypertext Transfer Protocol	STF	Start Field
ICMP	Internet Control Message Protocol	TCP	Transmission Control Protocol
IP	Internet Protocol	TDR	Time Domain Reflectometer
ISDN	Integrated Services Digital Network	UDP	Universal Datagram Protocol
ISP	Internet Service Provider	UU	User-to-User indication
L2TP	Layer 2 Tunnelling Protocol	VCI	Virtual Channel Identifier
LCP	Link Control Protocol	VPI	Virtual Path Identifier
LEX	L9S) Extension byte; byte inserted in the transmitted frame structure		



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More information in:

*Installation and Maintenance of SDH/SONET, ATM, XDSL, and Synchronization Networks.*

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