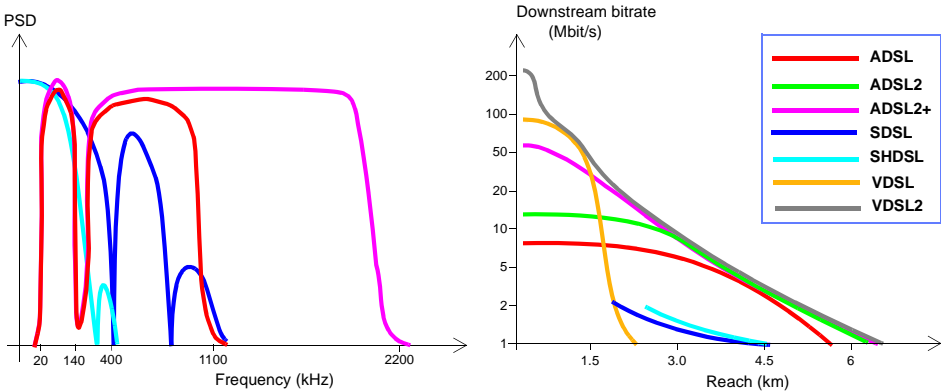


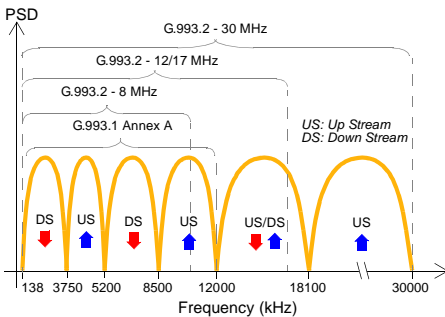


# Trend's xDSL Guide

Pocket Guide



**Figure 1** Reach achieved and power spectrum of different xDSL technologies



**Figure 2** VDSL / VDSL2 frequency plans

	Pairs	Symmetric	POTS	Standard
ADSL	1	No	Yes	G.992.1, G.992.2, ANSI T1.413.2
ADSL2	≥1	No	Yes	G.992.3, G.992.4
ADSL2+	≥1	No	Yes	G.992.5
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
VDSL	1	Yes	Yes	G.993.1
VDSL2	1	Yes	Yes	G.993.2

**Figure 3** Technology comparison



### Trend Multipro

The Trend Multipro is an efficient solution for Triple Play installation and maintenance. This new tool ensures proper end-to-end operation of VoIP, IPTV and Internet access by verifying the service performance as it is experienced by the customer (QoE). Powerful and simple, The Trend Multipro is the ideal partner for the world's most demanding operators that are bundling multimedia applications.

### AuroraPresto

Hand-held tester with multi-layer capabilities for testing Physical, ADSL2, ADSL2+, READSL SHDSL, ADSL over ISDN/POTS, ATM, PPP, IP and application layers, such as Internet download testing. Internal interface cards provide various modem types, data interfaces and TDR/DMM testing capabilities within one unit.

### AuroraJazz

Powerful and flexible tool for testing the Physical, ATM and IP layer operation during the commissioning, maintenance and trouble-shooting of ATM. Aurora Forte can be used with Aurora Presto for multi-layer testing of xDSL. Advanced features, such as AAL support, F4 and F5 OAM, QoS, SVC support, IP Ping, higher protocol analysis and remote control, ideally suit Aurora Forte for xDSL testing.

### ALT2000

The ALT2000 is the tool for physical qualification, monitoring and maintenance of copper pair subscriber loops. Its advanced features and Pass/Fail testing capacity make it easy for anyone to use. Capabilities for voice and DSL make it attractive to the specialist needing a high performance analyser. This tester includes all the functions you need for copper loop testing.

### AuroraTango

Modular multi-technology platform for simple, fast and effective testing. It can operate in both One-button mode, using pre-defined parameters, and PDA mode. Swappable modules offer flexibility in testing various technologies. The ADSL option is designed to assist service providers in the volume deployment of ADSL to residential and business customers. ADSL2 and ADSL2+ ready!

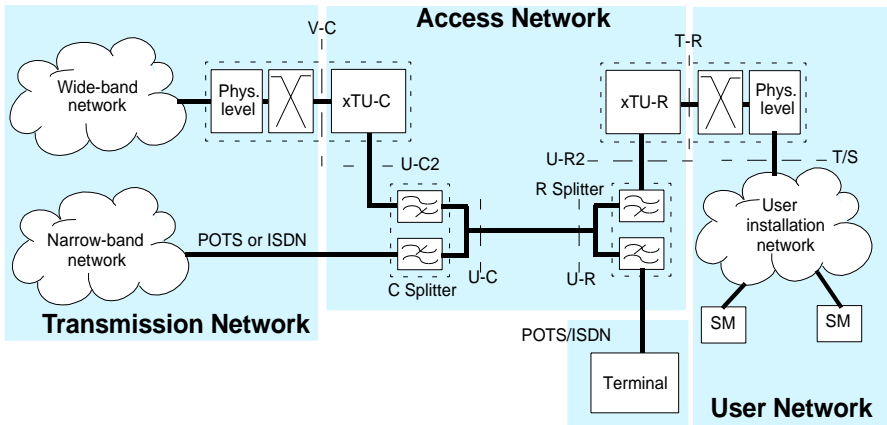


Figure 4 xDSL Reference model

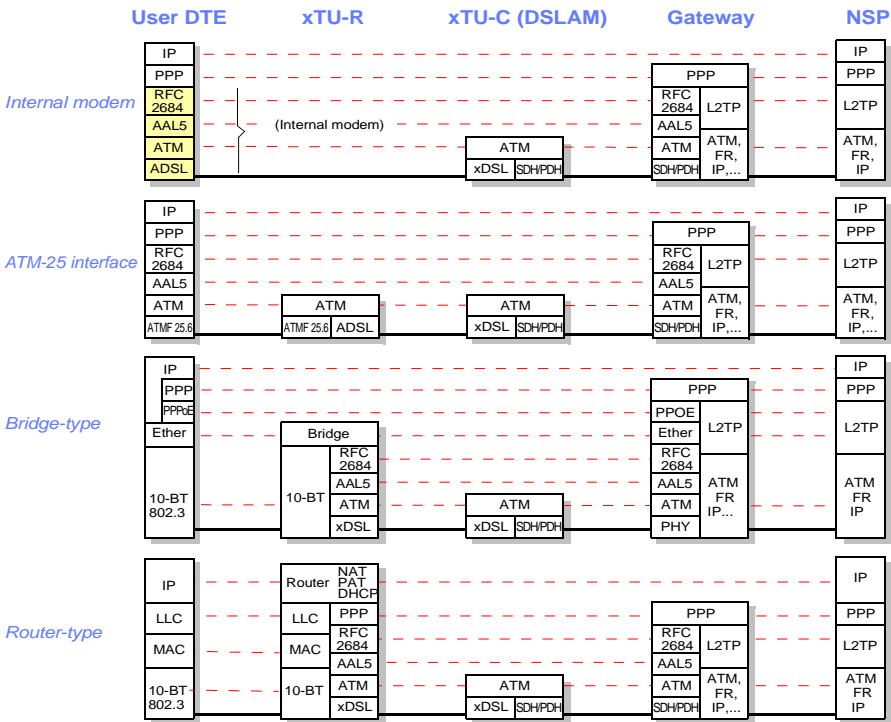


Figure 5 Structure and protocols involved in the xDSL service

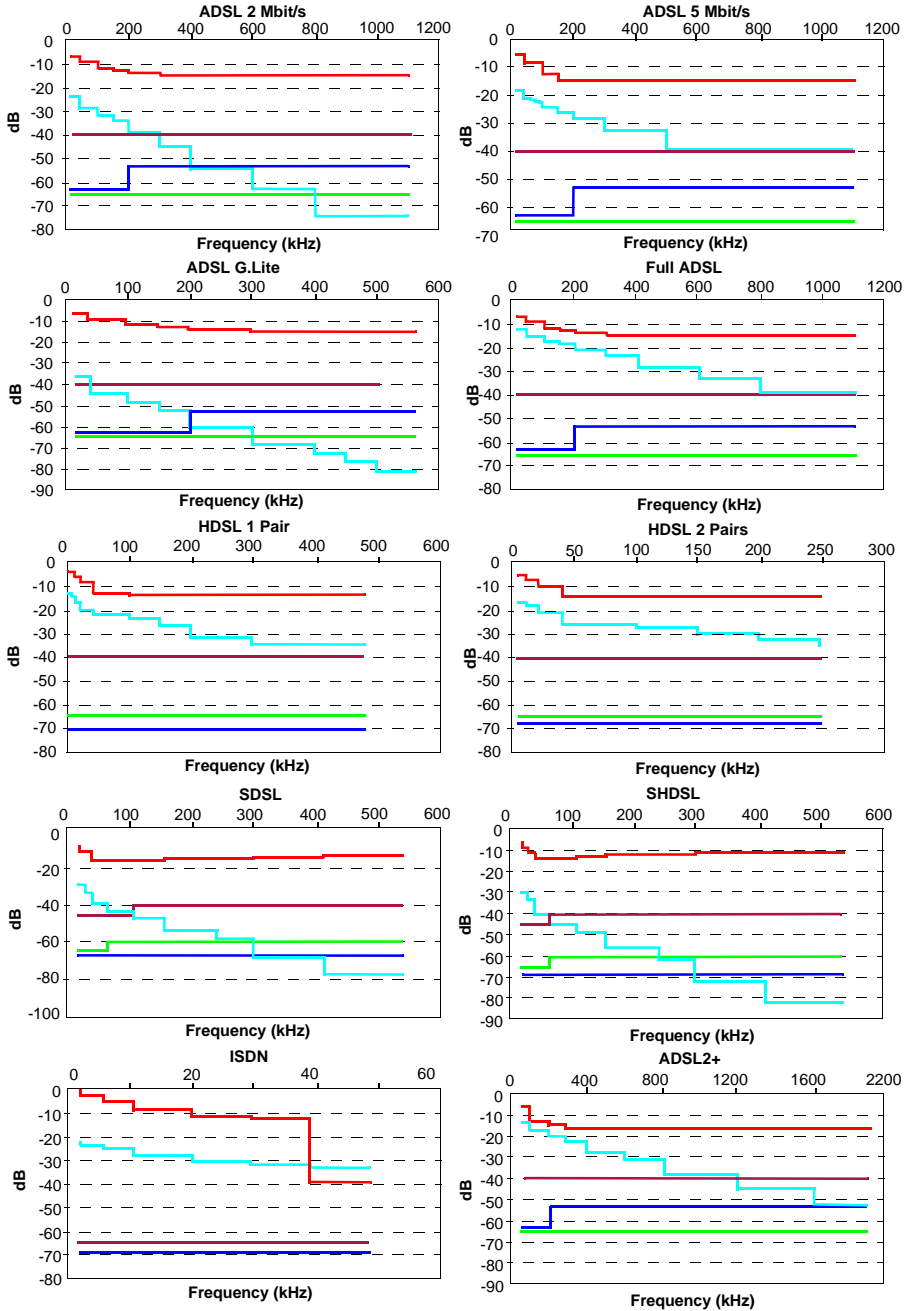
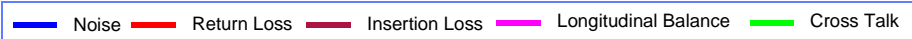


Figure 6 ETSI masks for copper qualification

### ADSL Frame

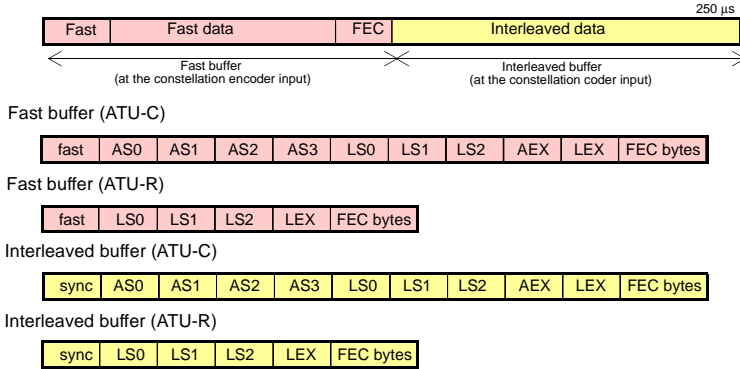


Figure 7 ADSL frame models

### Handshake frame

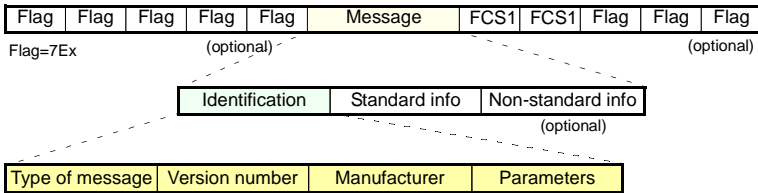
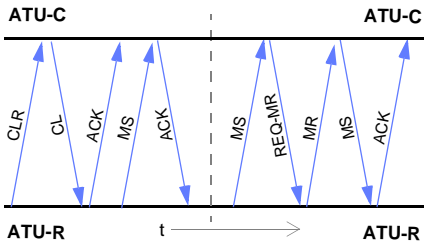


Figure 8 Handshake frame format. Messages: MS, MR, CL, CLR, ACK(1), ACK(2), NAK-EF, NAK-NR, NAK-NS, NAK-CD, REQ-MS, REQ-MR, REQ-CLR.



- 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 asks for an 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 requests a certain operation mode
- ACK:** the ATU-R accepts the request

Figure 9 Handshake sessions

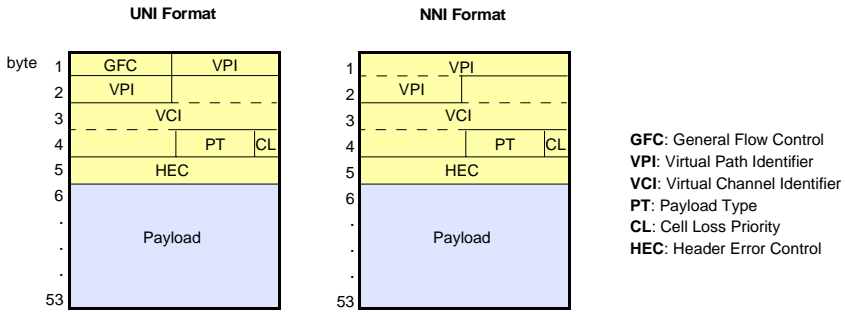


Figure 10 ATM Cell format according to the ATM Forum

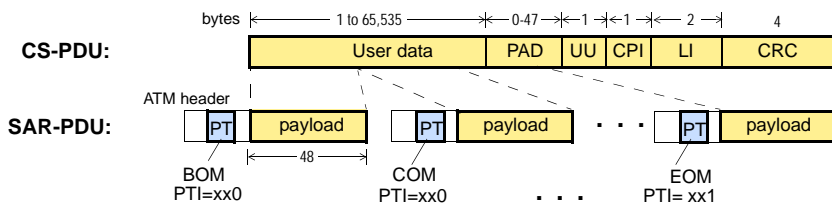
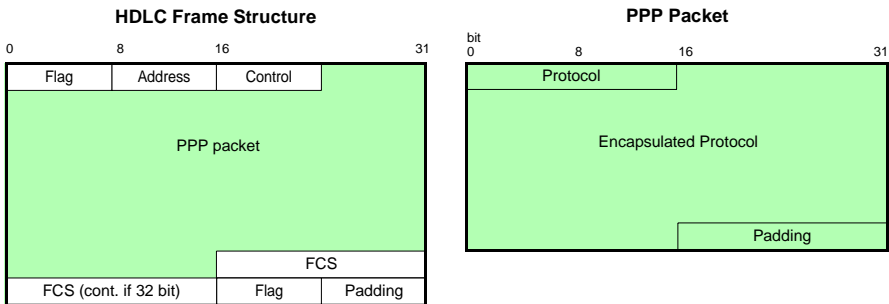


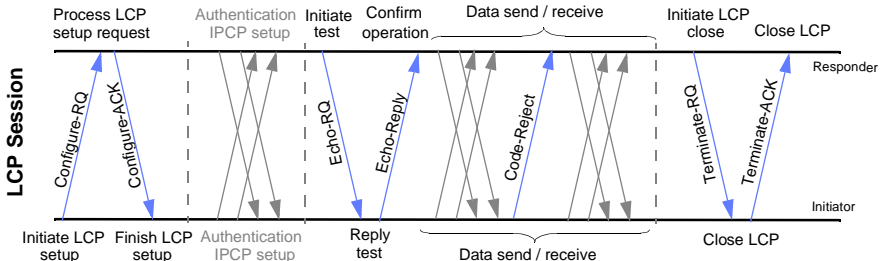
Figure 11 AAL5 format



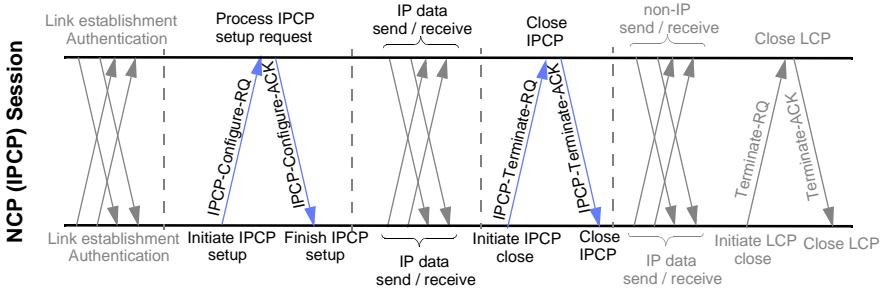
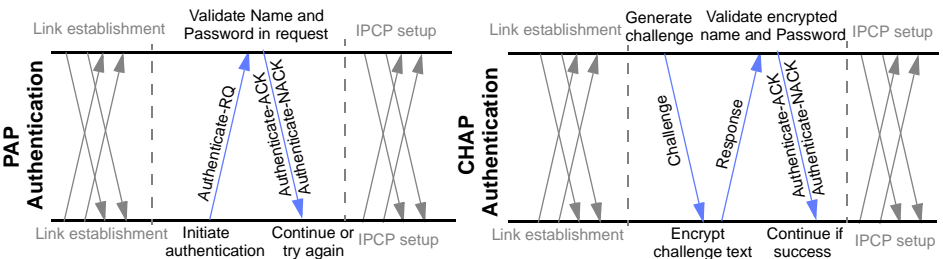
Flag: 7Eh  
 Address: FFh  
 Control: 03h

Protocol: 0001h - Padding,  
 0021h - IP,  
 C021h - LCP  
 C023h - PAP,  
 C223h - CHAP

Figure 12 PPP encapsulation

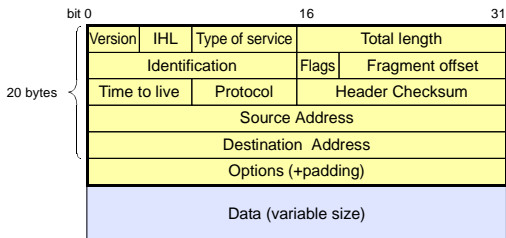


LCP Option	Purpose
Maximum-Receive-Unit	Maximum size of the packet that can be received
Authentication-Protocol	Authentication protocol to be used
Quality Protocol	Quality monitoring protocol to be used
Magic-Number	To detect looped-back links and other anomalies
Protocol-Field-Compression	Compression of the PPP Protocol field
Address-and-Control-Field-Compression	Compression of the Data Link Layer Address and Control fields

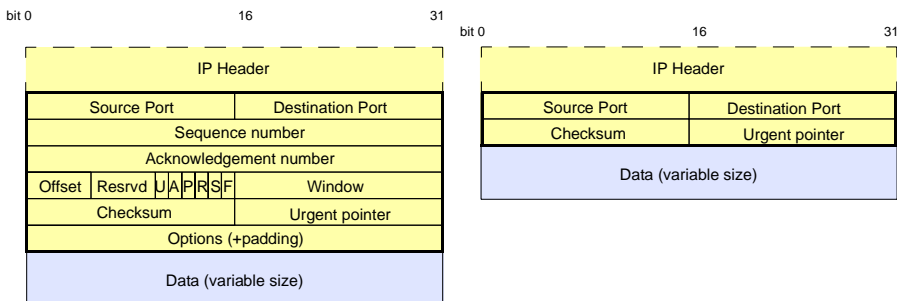


IPCP Option	Purpose
IP-Compression-Protocol	Van Jacobson TCP/IP header compression to save bandwidth
IP-Address	Specify or request IP address to be used by the initiator

Figure 13 PPP Sessions



**Figure 14** IP Header



**Figure 15** TCP and UDP headers

Protocol	Port	TCP/UDP	Description
echo	7	TCP + UDP	Echo protocol
discard	9	TCP + UDP	Discard protocol
daytime	13	TCP + UDP	Daytime protocol
qotd	17	TCP + UDP	Quote of the day Protocol
ftp-data	20	TCP	File transfer protocol (default data port)
ftp	21	TCP	File transfer protocol (control)
ssh	22	TCP	Secure shell
telnet	23	TCP	Telnet protocol
smtp	25	TCP	Simple mail transfer protocol
time	37	TCP + UDP	Time protocol
whois	43	TCP	Whois protocol
dns	53	TCP + UDP	Domain name system protocol
tftp	69	UDP	Trivial file transfer protocol
gopher	70	TCP	Gopher protocol
finger	79	TCP	Finger user information protocol
http	80	TCP	Hypertext transfer protocol (world wide web)
pop3	110	TCP	Post office protocol version 3
nntp	119	TCP	Network news transfer protocol
ntp	123	UDP	Network time protocol
imap	143	TCP	Internet message access protocol
snmp	161	UDP	Simple network management protocol
bgp	179	TCP	Border gateway protocol
https	443	TCP	Hypertext transfer protocol over secure sockets layer
rip	521	UD	Routing information protocol

**Figure 16** Application 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	Symmetric High Bit rate 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	L(S) Extension byte; byte inserted in the transmitted frame structure		



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More information in:

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