

SIEMENS

FastLink

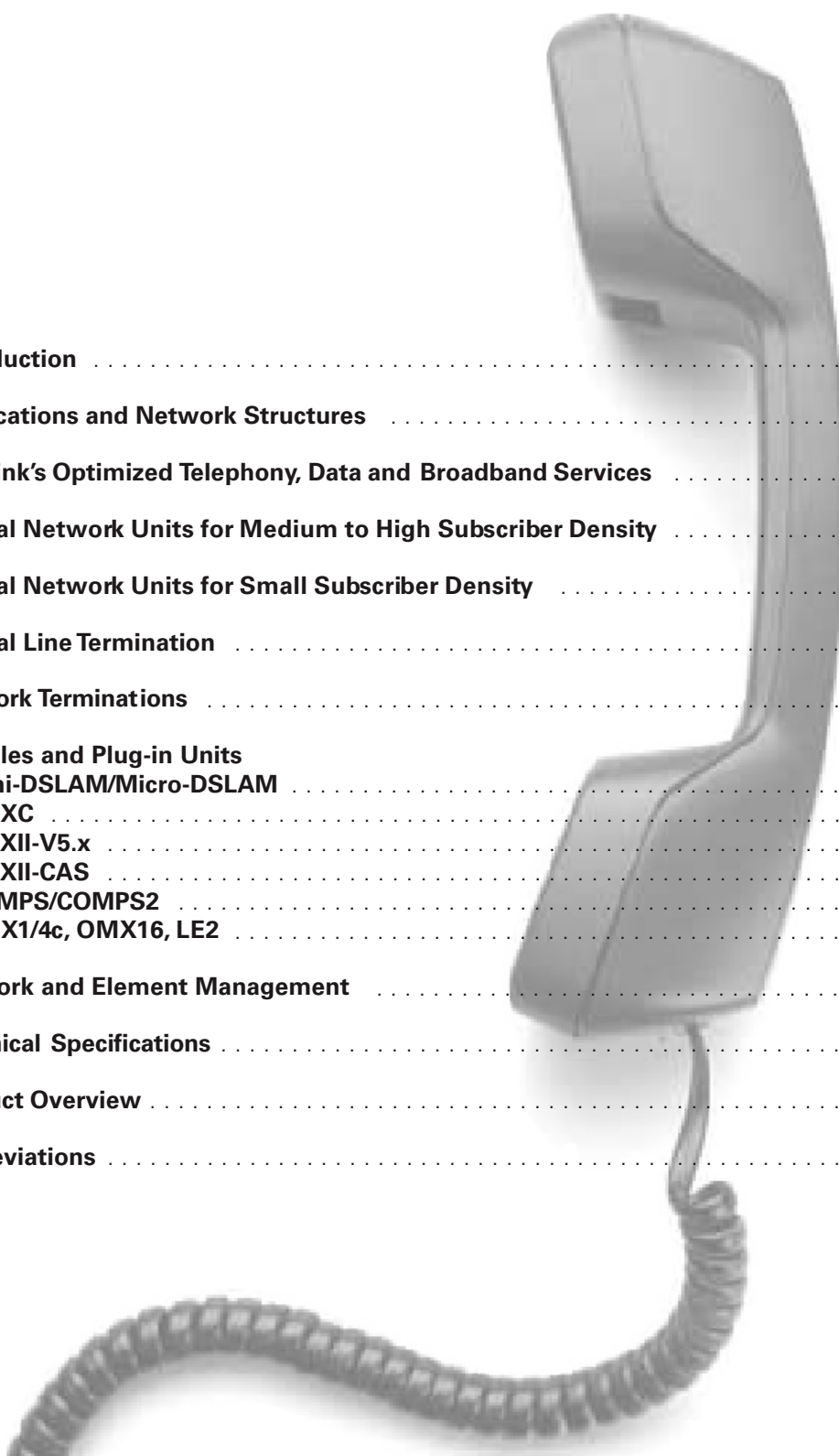
the Multiservice Access System

for Telephony, Data and Broadband Services



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Introduction

In today's climate establishing their own access networks is the key to profitability in the fixed network business for every network operator. With the Siemens **FastLink** product users are offered DLC and FITL solutions which make the business of arranging such networks simple, flexible and economical.

Even today, the most important sources of income remain the telephony services (POTS, ISDN). Starting with a simple telephone connection and progressing through a second line for internet and fax to ISDN access, **FastLink** supports these services and puts the network operator in a position to make high profits. For servicing business and high-end private customers **FastLink** also makes it possible to provide leased lines (voice and data) as well as broadband data services, via DSL for example.

Its modularity and open architecture make **FastLink** quick and easy to integrate into any network environment. Additional services such as broadband data services via DSL can be provided through integration of broadband components and powerful upgrade kits. Connection to any type of exchange via standardized V5 interfaces has long been normal practice for many network operators with **FastLink**. Preconfigured outdoor technology proven on the world market makes it unnecessary to use special air-conditioned operat-

ing rooms and significantly shortens the time between delivery and operational deployment.

The telephony, data and broadband services are based on:

The **Optical Network Unit (ONU)** as a compact unit for subscriber access, protocol, routing and transport. The following modules are available for the ONUs:

- Access Multiplexer AMXC
- Access Multiplexer AMX or Multiplexer FMX2R3.1 (only for ONU 20 FTTO and ONU 30 FTTB)
- ATM Multiplexer Mini-DSLAM or Micro-DSLAM
- Synchronous Multiplexer SMX1/4c or SMA1K-CP
- Optical Multiplexer OMX16
- 2-Mbit/s Line Equipment LE2
- Terminal panels and distributors
- Power supply with/without battery backup
- Double-walled shelter without active cooling for the outdoor operation
- ETS racks with side panel and front doors (optional) for the indoor operation

The **Optical Line Termination (OLT)** as a central access to the local exchange, the data networks and ATM/IP networks. The following

modules are available for the OLT:

- Crossconnect Multiplexer CMXII-V5.x/CAS as gateway to V5.1/V5.2 exchanges, for routing data channels and for CAS/V5.x conversion
- IP router or ATM switch XP140 for inclusion of broadband
- Synchronous Multiplexer SMX1/4c or SMA1/4c
- Optical Multiplexer OMX16
- 2-Mbit/s Line Equipment LE2
- Terminal panels and distributors

The **Network Termination (NT)** as compact desktop unit complementing the ONUs for leased lines, online services, multimedia and broadband applications.

The user-friendly management system **AccessIntegrator (ACI)** for central operation and monitoring is used for all **FastLink** components.

The **AccessIntegrator** administers, monitors and manages the entire access network, which significantly reduces both the service and implementation costs as well as the ongoing operating costs. A tool for the mass provisioning of subscribers (MASSPROVI) considerably eases the task of creating large numbers of subscribers. The major advantage of such an arrangement is the reduced outlay needed for commissioning. The **ACI** with its client-server architecture can be used not only as a multi-station or standalone system but also as a local craft terminal (LCT).

FastLink

Main features:

1. Flexible mix of services
 - Voice services (POTS/ISDN)
 - Broadband data services (ATM/IP)
 - Narrowband data services (TDM)
2. Indoor and outdoor ONUs with complete infrastructure
3. Open V5.1/V5.2 interfaces at ONU and OLT
4. Integrated PDH, SDH, ATM or GbE transport
5. Convenient operation and complete supervision by the ACI
 - Network element management
 - End-to-end management for narrowband services
 - Traffic management
 - Subscriber line testing
6. Evolution to next generation access

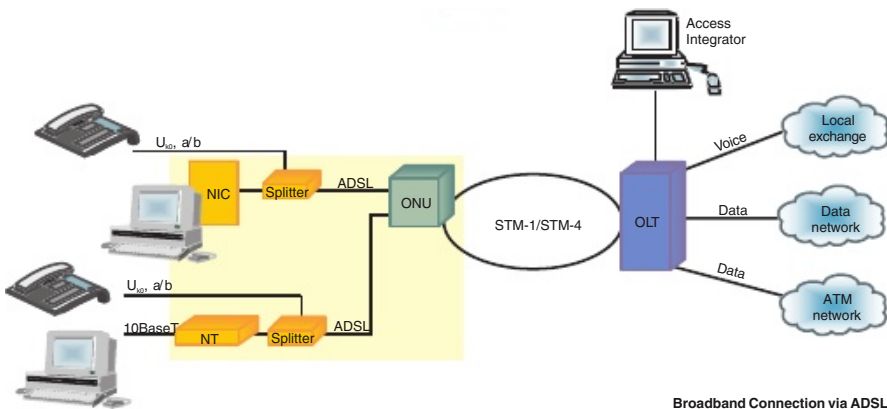
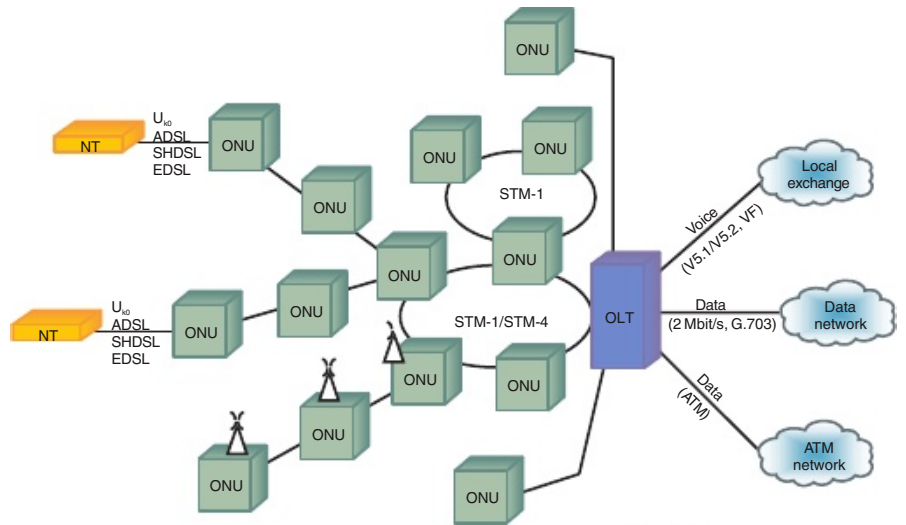
Advantages:

1. Uniform system concept for all services
2. Faster and lower cost network setup through preintegration and pre-installed software
3. Protects existing investment through incorporation into any network environment by using open interfaces
4. Low cost setup
 - Low power consumption
 - Field-proven outdoor systems without active cooling for external environmental conditions
 - High fault tolerance through redundancy concept
 - Early fault detection through automated subscriber line checks
 - Low maintenance costs through transregional fault management with ACI
 - Optimum use of transport/resources by (duplicated) concentration
5. Best-in-class quality
6. Future-proof investment by continuous further development and evolution

Applications ...

FastLink's telephony, data and broadband services can be linked into a wide range of network structures, as it supports point-to-point, point-to-multipoint, tree and ring architectures. This provides the network operator with maximum flexibility in selecting a suitable structure for his network.

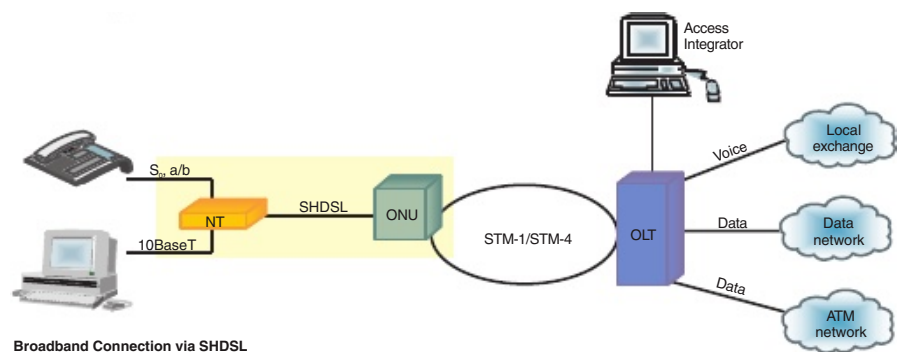
There are powerful upgrade kits available for both setting up new networks and safeguarding current and future investments, ensuring the provision of broadband services with the aid of xDSL-technology.



The integration of ADSL and/or SHDSL components into FastLink networks will supplement the TDM-based narrowband signals by ATM-based broadband signals. This means that ATM-based broadband transmission over the entire transmission link, from the ISP interface in the OLT up to the DSL modem (broadband NT or NIC) at the subscriber is possible.

Using existing twin copper cables in the subscriber access area, ADSL can be employed to transfer data at up to 8 Mbit/s (downstream) and 800 kbit/s (upstream) between subscriber and Internet Service Provider.

With high-speed Internet access via SHDSL data and voice is transported using ATM at speeds of up to 2.3 Mbit/s.



... and Network Structures

The **Optical Network Unit (ONU)**, as the central system component for telephony, data and broadband services, combines multiplexer and transport facilities for optimum configuration of telecommunication, city or corporate networks.

The network operator has a choice of different ONU types for connecting up to 2048 narrowband and up to 80 broadband subscribers; FTTC variants for outdoor use or FTTO/FTTB variants for indoor operation.

A number of ONU variants provide the option of ODT functionality, so that the ONU can also be used as an active hybrid distribution unit and thereby making a significant contribution to reducing costs.

The number of multiplexers and the number of interfaces can be expanded as required, ranging from the small starter system through to the comprehensive network.

A wide range of the latest transmission technologies is employed to ensure that the ONU can be used in all network areas.

Transmission with wavelength division multiplexing (WDM) on an optical glass fiber can span up to 50 km (without repeaters) and whereas transmission with HDSL on e.g. 0.8-mm copper cable can span up to 8 km (dependent on cable type).

The **Optical Line Termination (OLT)** is the FastLink component which terminates the glass fiber and/or copper cable network and implements the interfaces to the exchange, to the data network and the ATM network. The connection to the exchange is made directly via digital 2-Mbit/s interfaces, with signaling complying with the international V5.1/V5.2 standards. If these interfaces are not available, the OLT is connected using voice frequency (VF) or 2-Mbit/s interfaces with Channel Associated Signaling (CAS).

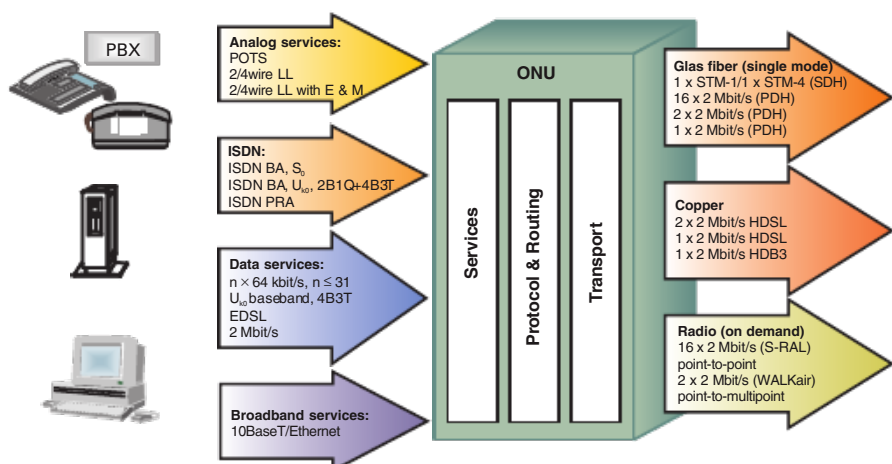
The broadband connection to the Internet Service Provider (ISP) is made using IP routers or an ATM switch function either via an Ethernet interface or via an optical STM-1 point-to-point connection.

In addition the OLT is the central access point for the AccessIntegrator network management system both via a QD2 interface and via an SNMP interface.

FastLink's **Network Terminations (NTs)** provide subscribers directly with both high-speed digital interfaces for online services and multimedia applications, such as video-on-demand, fast Internet or tele-learning, and also for all other standard bit rates.

The NTs are compact desktop units that connect via copper or fiber-optic cable to the ONU or the OLT cover a wide range of attractive subscriber services.

Thus e.g. the ADSL NTs provide an Ethernet interface for high-speed Internet connections and simultaneous S₀ or a/b interfaces for voice transmission.



Compact ONUs

- **Compact shelves**
 - Up to 32 POTS or 8 ISDN interfaces per line card (LC)
 - Up to 512 POTS or 128 ISDN interfaces per shelf
- **Integrated broadband application with Mini-DSLAM or Micro-DSLAM**
 - Up to 32 ADSL or 16 SHDSL interfaces per LC
 - Up to 64 ADSL or 80 SHDSL interfaces per shelf
- **Complete infrastructure**
 - Outdoor shelter for operation in the open air
 - Rack-mounted or special desktop or wall-mounted housing for operation within buildings
 - Internal or external power supply with and without battery backup
 - Intelligent temperature and battery management
 - Flexible solutions for system and subscriber interfaces (MDF) and 2-Mbit/s-distribution frames (DDF)
 - Integrated feeders (STM-1, STM-4, 34 Mbit/s, 2 Mbit/s)



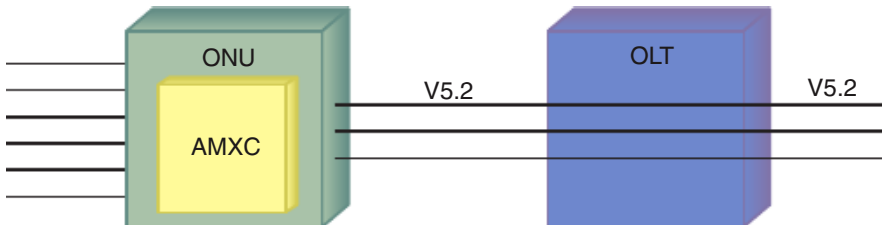
ONU 1000 FTTC

- **Optimized outdoor shelter**
 - Does not require air conditioning
 - Guarantees optimum security and functionality and a defined range of operating temperatures
 - Side doors and front doors offer easy access to the distribution units for cabling as well as for operation and maintenance of the components
- **Small size**
 - Small footprint
 - Easy installation through pre-mounted shelter and rack

are characterized by ...

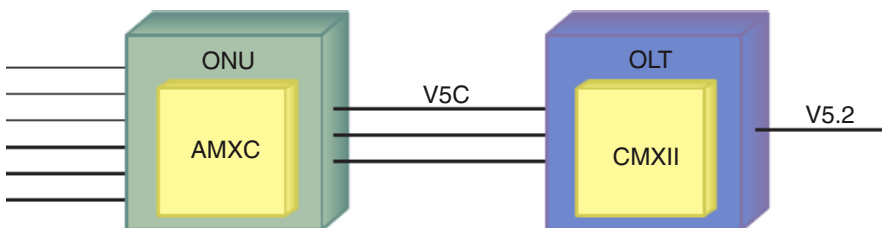
Various Concentration Concepts

• Single-step concentration



- V5.2 direct at the ONU
- Single-stage voice concentration
- Minimum number of network elements

• Two-step concentration

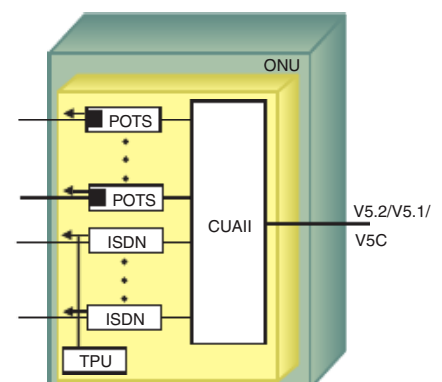


- V5C at the ONU, V5.2 at the OLT
- Two-step voice concentration
- Consolidation of leased lines (LL) and thereby reduction of the transport capacity needed
- Internal control channel ECC to monitor the ONUs and thus use of available transport infrastructures
- Reduction in the number of V5.2 interfaces to the exchange

Integrated Line Test for POTS and ISDN (ILTF/PAT)

- POTS: Line test integrated on the line cards (LCs)
- ISDN: Line test with Test Probe Unit (TPU)
- All necessary measurements performed (voltages, resistances, capacitances,...)
- On-demand measurements supported

- Periodic line testing (PAT)
- High performance due to line test running in parallel
- High customer satisfaction due to better service



Optical Network Units

ONU 250 FTTB



Equipping example with **Mini-DSLAM**

Shelves and Modules

- ASMXS2 with AMXC, SMX1/4c, OMX16, LE2
- UMX4MS with Mini-DSLAM
- COMPS2

or

- ASMXS2 with AMXC, SMX1/4c, OMX16, LE2
- Micro-DSLAM
- COMPS2

or

- UMX2S2 with AMXC, LE2
- Micro-DSLAM
- SMXLS2 with SMX1/4c, OMX16, LE2 or
- SNUS with SMX1/4c, OMX16, LE2 or SMA1K-CP
- COMPS2

With FastLink's "medium to large" Optical Network Units, the **ONU 250 FTTB/FTTC** and **ONU 1000 FTTB/FTTC**, up to 2048 narrowband and up to 80 broadband subscriber lines can be provided.

The ONUs are available for both indoor operation (FTTB) and outdoor operation (FTTC) and contains all the infrastructure components such as shelter/rack, internal or external power supply with and without battery backup, terminal panels for system and subscriber interfaces (MDF), 2-Mbit/s distribution frames (DDF) and optical distributor (ODF).

The enclosures for outdoor deployment offer optimum security, operating temperature and operability. The enclosed, double-walled shelter keeps out e.g. moisture and small animals, as well as maintaining a predetermined operating temperature range.

ONU 250 FTTC



Equipping example with **Mini-DSLAM**

Shelves and Modules

- ASMXS2 with AMXC, SMX1/4c, OMX16, LE2
- UMX4MS with Mini-DSLAM
- COMPS2

or

- ASMXS2 with AMXC, SMX1/4c, OMX16, LE2
- Micro-DSLAM
- COMPS2

or

- UMX2S2 with AMXC, LE2
- Micro-DSLAM
- SMXLS2 with SMX1/4c, OMX16, LE2 or SMA1K-CP
- COMPS2

Side doors and front doors provide easy access to the distributors for the cabling as well as for operating and maintaining the components.

For indoor operation the ONUs are installed in racks. The racks comply with the ETS standard and can mount up to five subracks as required.

Multiplexers and transport systems of the ONUs consist of one or more plug-in units in double Eurocard format. These units are mounted in 19" or ETS shelves. The shelves (beside UMX2S2 and UMXLS) are equipped with terminal panels, which significantly reduces the work of installation.

The central management, measuring and power supply functions are realized in the COMPS2 (ONU 250 FTTB/FTTC) or COMPS (ONU 1000 FTTB/FTTC) shelves.

ONU 1000 FTTB



Equipping example with **Mini-DSLAM**

Shelves and Modules

Basic rack

- SMXLS2 with SMX1/4c, OMX16, LE2 or SMA1K-CP or OMX16S with OMX16, LE2
- COMPS

Extension racks

- UMX2S2 with AMXC, LE2
- UMXLS (optional) with LE2
- UMX4MS with Mini-DSLAM
- COMPS

or

- UMX2S2 with AMXC, LE2
- Micro-DSLAM
- UMXLS (optional) with LE2
- COMPS

ONU 1000 FTTC



Equipping example with **Mini-DSLAM**

Shelves and Modules

- UMX2S2 with AMXC, LE2
- UMX4MS with Mini-DSLAM
- SMXLS2 with SMX1/4c, OMX16, LE2 or SMA1K-CP or OMX16S with OMX16, LE2
- COMPS

or

- UMX2S2 with AMXC, LE2
- Micro-DSLAM
- SMXLS2 with SMX1/4c, OMX16, LE2 or SMA1K-CP or OMX16S with OMX16, LE2
- UMXLS (optional) with LE2
- COMPS

With FastLink's "smallest" ONUs, the **ONU 20 FTTO** and the **ONU 30 FTTB**, up to 20 or 30 subscriber lines can be provided. The compact unit in a desktop housing (ONU 20 FTTO) or in a wall housing (ONU 30 FTTB) for use within buildings with a strongly distributed subscriber structure guarantees fast connection of new subscribers and is particularly suitable of use by business customers.

These ONUs are constructed from the following components:

- Access Multiplexer AMX with max. 2 LCs (ONU20 FTTO) or max. 3 LCs (ONU 30 FTTB)
- Flexible Multiplexer FMX2R3.1 of the system FMX2R3.1 with max. 2 LCs (only ONU 20 FTTO)
- 2-Mbit/s Line Equipment LE2
- Supervision unit COSU (only ONU 20 FTTO)
- Measurement and supervision unit MSUE (only ONU 30 FTTB)

- Terminal panels for system and subscriber interfaces
- AC connecting unit and splice cassette (only ONU 30 FTTB)

The ONU 20 FTTO is supplied with power via an external power adapter or by a backup battery. Direct power supply with -48 V is also possible.

The ONU 30 FTTB is supplied with the required operating voltage via the local power grid. The internal power supply module with backup battery converts the operating voltage into the necessary direct current supply.



ONU 30 FTTB

Subscriber Interfaces

The subscriber interfaces are implemented by the LC of the multiplexer and the 2-Mbit/s line equipment.

Line Interfaces

Depending on requirements:

- 1 x optical 2 x 2 Mbit/s
- Max. 2 x 2 Mbit/s SHDSL/U_{k2}/G.703 optical (U_{g2})
- 1 x 2 Mbit/s HDSL



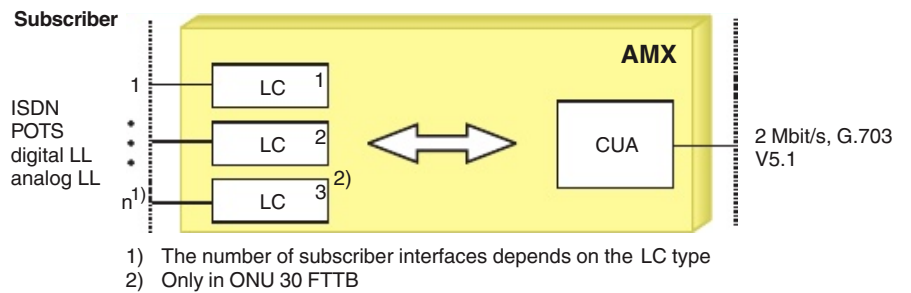
ONU 20 FTTO

Access Multiplexer AMX

As an access multiplexer with V5.1 signaling the AMX provides up to 30 subscriber interfaces with each 64 kbit/s for a wide range of services. Subscriber channels and V5.1 signaling channel, multiplexed to form a 2-Mbit/s signal, are transmitted to the exchange via fiber-optic or copper cable. The AMX can be connected directly via the 2-Mbit/s interface to a digital exchange.

The following units are part of the AMX:

- Central unit CUA
- Line cards (LCs) for narrowband applications



Each interface type is implemented by a special line card:

	Interfaces, Services	IF per LC	LC
ISDN	ISDN-BA, U _{k0} for 2B1Q	4	I4UK2V5
	ISDN-BA, U _{k0} for 4B3T	8	IUL84
POTS	POTS, a/b	10	SUB102
Digital LL	G.703, n x 64 kbit/s, n ≤ 31	6	DSC6-nx64G
	X.21, n x 64 kbit/s, n ≤ 30	2	DSC2-nx64X
	V.35, n x 64 kbit/s, n ≤ 30	2	DSC2-nx64V35
	V.36, n x 64 kbit/s, n ≤ 30	2	DSC2-nx64V36
Analog LL	2/4wire	10	LLA102/104

Optical Line Termination

The **OLT**, as a central access to the local exchange, the data networks and ATM/IP networks, is physically installed in one or more ETS racks which are set up within buildings on the exchange site.

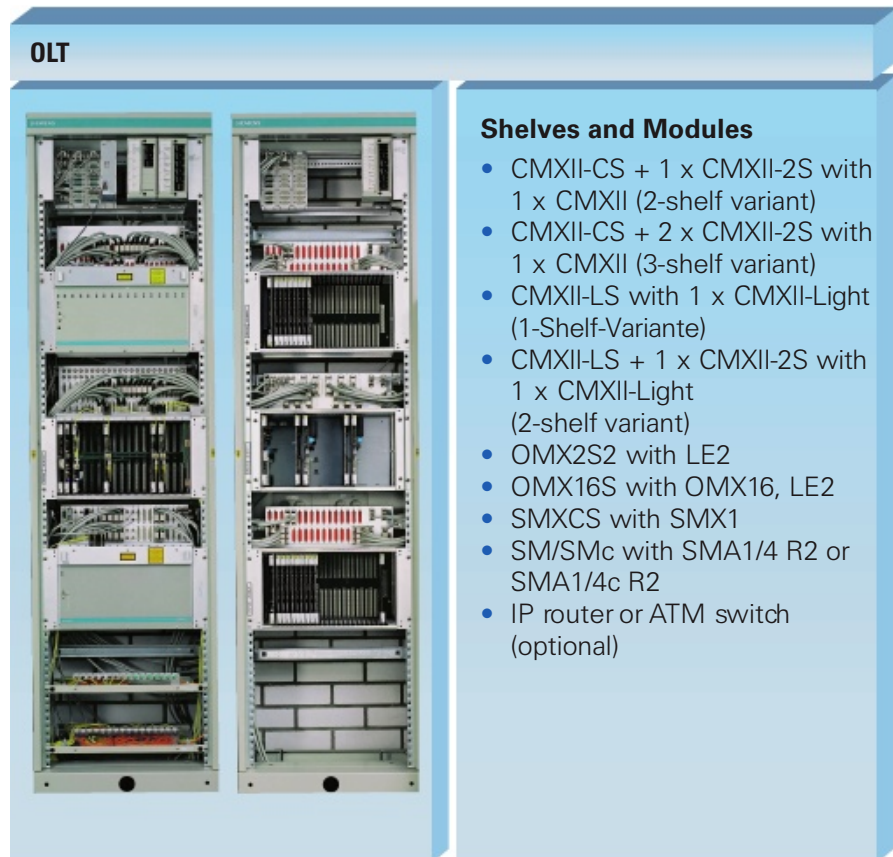
The racks can be equipped with up to four shelves. In addition each rack contains a terminal panel for power supply, QD2 and clock distribution.

For connecting glass fiber cables, depending on the number of connections required and the local circumstances, a splice box or an optical distribution frame (ODF) can be mounted in the rack.

For broadband connection to the Internet Service Provider an IP router with ATM switch function is installed in the OLT rack.

The number of racks concerned and how they are equipped, as well as the rack cabling are project-dependent.

The units are connected via the backplane of the shelf, on which the terminal panel with its connectors for external and internal cabling is also mounted. The internal connections typically include connections between the individual shelves and connections between the shelf and the rack terminal panel. All other connections, to the exchange, the data network, the Internet or to the ONU, are external connections.



Network Terminations

The Network Terminations (NT) are deployed on the subscriber side, but can also be used on the network side as Line Terminations (LT). The NTs are linked to either a line card of the corresponding multiplexer or to a line termination unit of the 2-Mbit/s line equipment via copper or fiber optic cable.

Network Termination Unit NTU

Up to two data terminals with interfaces in acc.to ITU-T recommendations can be connected via the NTU at a U_{k0} interface with 2B1Q-encoding. The U_{k0} interface can be implemented e.g. by the IUL82 line card of the multiplexer AMXC.

The NTU can be equipped with up to two (also different) interface modules which each implement one of the following interfaces:

- V.24, V.35, V.36, X.21 with subrates up to 64 kbit/s
- V.35, V.36, X.21 for 64 kbit/s or 128 kbit/s
- G.703 codirectional for 64 kbit/s

Power is supplied locally to the NTU via an AC/AC adapter, with the option of 230 V or 115 V.

Data Network Unit DNU01SD

The DNU01SD is used for synchronous data transmission with high data rates of $n \times 64$ kbit/s (maximum 512 kbit/s) via copper cable. Following interfaces are realized:

- X.21
- V.35 or V.36

The DNU01SD is equipped as standard with the X.21 interface. Data interfaces V.35 or V.36 are implemented by additional interface modules.

The network interface is provided by a transmission module which must also be included in the line card CPF2 of the AMXC. Following modules are available:

Data interfaces

V.24/V.35/V.36/X.21
≤ 64 kbit/s

V.35/V.36/X.21
64 kbit/s/128 kbit/s
G.703 codirect.
64 kbit/s

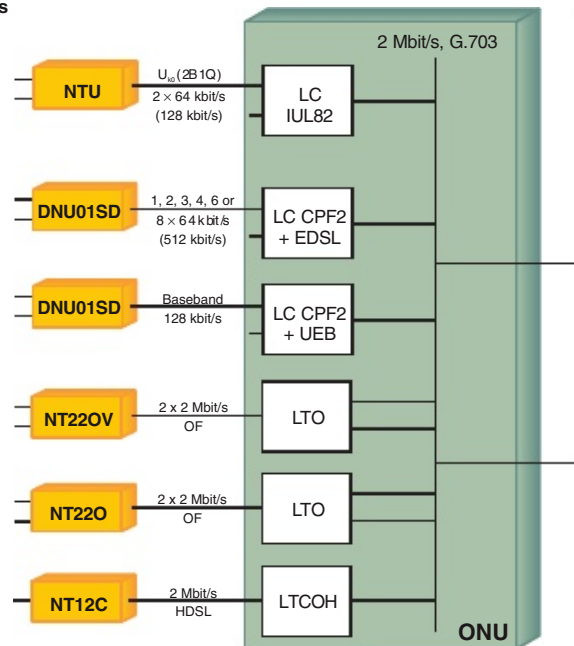
X.21
 $n \times 64$ kbit/s
V.35/V.36

X.21
64 kbit/s/128 kbit/s
V.35/V.36

V.35/V.36/X.21
 $n \times 64$ kbit/s
V.35
2 Mbit/s transparent

2 x 2 Mbit/s
transparent

1 x 2 Mbit/s
transparent



- EDSL transmission with 64, 128, 192, 256, 384 or 512 kbit/s
- Baseband transmission with 2 x 64 kbit/s or 128 kbit/s

Power is supplied locally to the DNU01SD via an AC adapter suitable for either 230 V or 115 V supply, depending on the version.

Network Termination NT22OV

Digital leased lines $n \times 64$ kbit/s ($n = 1$ to 31) via a glass fiber can be set up with the NT22OV for the following interfaces:

- V.35
- V.36
- X.21

The NT22OV can be equipped with up to two (possibly differing) interface modules.

The V.35 and V.36 interfaces operate either in transparent or in protocol mode. In protocol mode point-to-multipoint connections can also be set up.

In addition transparent transmission of 2 Mbit/s acc. to ITU-T V.35 is possible.

On the network side the unit is connected to an optical line termination unit LTO/LT via 2 x 2 Mbit/s. For this connection the NT22OV uses a wavelength of 1300 nm.

Power is supplied to the NT22OV via an external AC adapter either with 115 V or with 230 V AC or directly with 24 V DC.

Network Termination NT12C and NT22O

This NTs each contain one 2-Mbit/s line termination units:

- NT12C: 1 x LTCOH
- NT22O: 1 x LTO/NT

Both NTs are used for transparent 2-Mbit/s transmission.

Power is supplied via an external AC adapter either with 115 V or with 230 V AC.

Modules and Plug-in Units

ATM Multiplexer Mini-DSLAM or Micro-DSLAM

The ATM multiplexers Mini- and Micro-DSLAM are a cost-optimized variant of the broadband equipment of FastLink and offer an ATM-based network solution combining both broadband and narrowband services. All services are transmitted in end-to-end connections with the aid of ATM cells from the ATM network to the subscriber and back again.

For simultaneous transmission of voice and for example Internet data on a shared twin copper wire different xDSL techniques are used:

- ADSL with bit rates up to 8 Mbit/s for the transport of data in the direction of the subscriber (downstream) and

800 kbit/s in the opposite direction (upstream)

- SHDSL with bit rates of 2.3 Mbit/s in both directions

The Mini-/Micro-DSLAM terminates the subscriber network, concentrates all the broadband and narrowband traffic and directs it via STM-1, E3 or IMA interfaces to the ATM network.

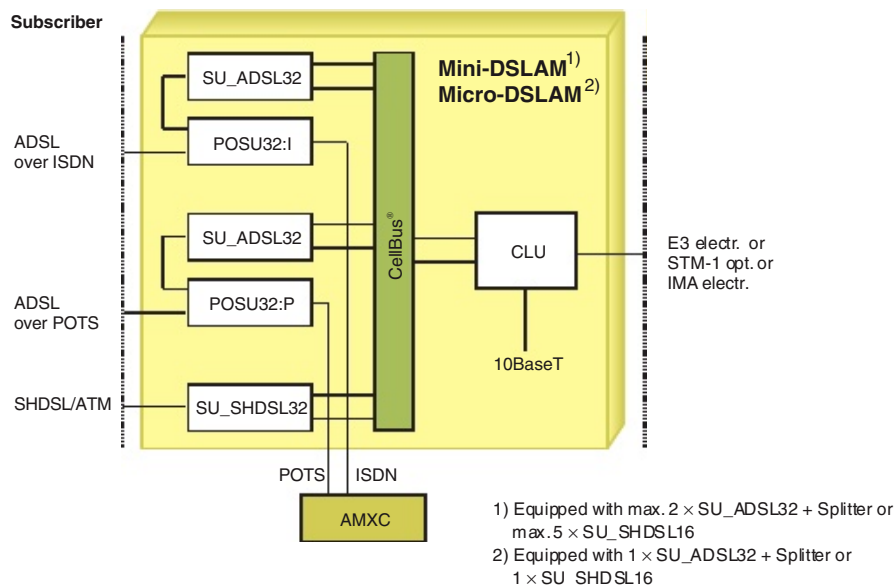
The Mini-/Micro-DSLAM is monitored, supplied and controlled via the 10BaseT interface which is on a central unit.

The following units are part of the Mini-/Micro-DSLAM:

- Central Unit CLU
- Service Units (SUs) for broadband applications
- Splitter units

Advantages of the Mini-/Micro-DSLAM

- ATM-based broadband transmission over the entire transmission link, from the ISP interface in the OLT to the DSL modem (broadband NT, NIC or IAD)
- Broadband and telephony services (ISDN/POTS) are transmitted via the ADSL interface on a shared twin copper wire between ONU and subscriber. The telephony and data signals are split and merged using the splitter units.
- Data and voice are transmitted symmetrically as SHDSL multiplex signals via a twin copper wire between the Mini-/Micro-DSLAM in the ONU and IADs installed at the subscribers. No splitter units are necessary.
- Transmission of $n \times E1$ ($n \leq 8$) by inverse multiplexing over ATM (IMA).
- Alternatively to E1 (IMA) an E3 or STM-1 opt. or IMA electr.
- Interoperability with Voice over DSL (VoDSL) since the same components and interfaces are used on the CPE and OLT side.
- Capacity increase to max. 160 SHDSL interfaces in the Mini-DSLAM and max. 32 SHDSL interfaces in the Micro-DSLAM (SU_SHDSL32) and expandable by additional VDSL services (SU_VDSL8) (on request)



Each interface type is implemented by a special service unit:

	Interfaces, Services	Interfaces per LC	LC
ADSL over ISDN	ADSL to splitter unit POSU32:I	32	SU_ADSL32I
	ADSL over ISDN to subscriber	32	POSU32:I
ADSL over POTS	ADSL to splitter unit POSU32:P	32	SU_ADSL32P
	ADSL over POTS to subscriber	32	POSU32:P
SHDSL	SHDSL with PAM16	16	SU_SHDSL16

Access Multiplexer AMXC

Access multiplexer AMXC is a further development of the AMX and a cost-optimized implementation of the subscriber-side access to FastLink, which, by concentrating subscriber interfaces, makes it possible to connect large numbers of subscribers using the same transmission capacity.

The AMXC provides on the exchange side both the open V5.2 or V5.1 interface and an FastLink-internal concentrating V5C interface in conjunction with crossconnect multiplexer CMXII-V5.x. Thus, concentration rates of e.g. 4 : 1 are possible within the ONU itself.

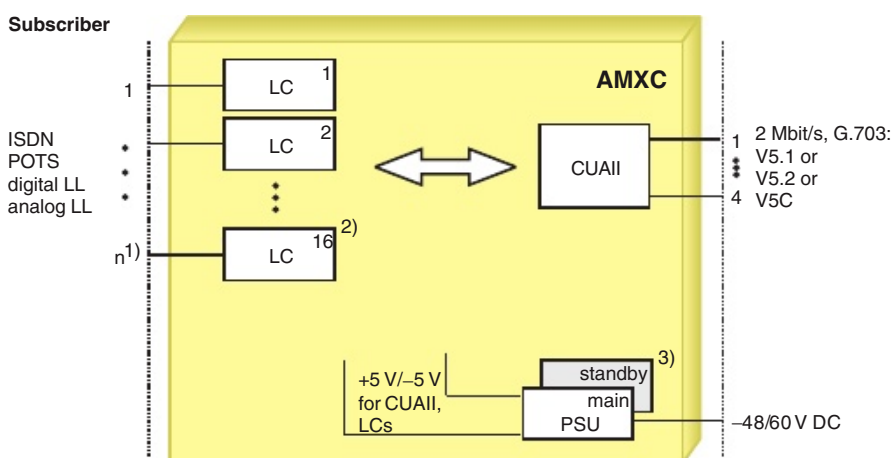
Monitoring, supply and control of the AMXC is performed over the QD2-slave interface by the central measurement and power supply module COMPS or COMPS2.

The following units are part of the AMXC:

- Central unit CUAll
- Line cards (LCs) for narrowband applications
- Power supply unit PSU

Advantages of the AMXC

- Increase in subscriber concentration per multiplexer: A CUAll serves up to 16 LCs. For each LC up to 8 ISDN or 32 POTS interfaces are available. This means that for each AMXC up to 512 subscribers (POTS) can be connected.
- Saving transmission capacity on the systems side through the proprietary V5C interface between AMXC and CMXII. For each CUAll up to four 2-Mbit/s signals are transmitted from the AMXC to the CMXII. When the full concentrator function is utilized the capacity of max. four 2-Mbit/s signals can be transmitted over one 2-Mbit/s link (feeder).
- Saving the CMXII and transmission capacity on the system side by direct connection of the AMXC to the exchange via 2-Mbit/s interfaces with V5.2 protocol. When the full concentrator function is utilized the capacity of max. four 2-Mbit/s signals can be transmitted over one 2-Mbit/s link (feeder). In the standard variant two 2-Mbit/s links are provided (protection mode).
- AMXC concept for individual 2-Mbit/s signals allows different transport paths in the direction of the OLT. If, for example, an individual 2-Mbit/s transport channel fails, the AMXC traffic load can be routed via the remaining transport channels. To minimize the number of subscribers who are affected by the failure of a module or a transport channel, two CUAll units can be used. Both CUAll units divide up the traffic load and each serve eight LCs.



- 1) The number of subscriber interfaces depends on the LC type
- 2) Eight LCs per CUAll if two CUAll are equipped per shelf
- 3) Active when more than eight ISDN LCs are equipped

Each interface type is implemented by a special line card:

	Interfaces, Services	Interfaces per LC	LC
ISDN	ISDN-BA, U_{k0} for 2B1Q	8	IUL82
	ISDN-BA, U_{k0} for 4B3T	8	IUL84
	ISDN-BA, S_0	8	I8S0P
POTS	POTS, a/b	16	SUB162
	POTS, a/b	32	SUB322
Digital LL	G.703, $n \times 64$ kbit/s, $n \leq 31$	4	DSC6-nx64G
	EDSL to DNU01SD, $n \times 64$ kbit/s, $n=1, 2, 3, 4, 6$ or 8	4	CPF2
	U_{k0} -baseband with 4B3T to DNU01SD, $n \times 64$ kbit/s, $n \leq 2$		
	V.24/V.28, subrates to 64 kbit/s		
	V.35, subrates to $n \times 64$ kbit/s, $n \leq 31$		
	V.36, subrates to $n \times 64$ kbit/s, $n \leq 31$		
X.21/V.11, subrates to $n \times 64$ kbit/s, $n \leq 31$			
Analog LL	2/4wire with E&M signaling	6	UAC68

Crossconnect Multiplexer CMXII-V5.x

As a gateway for POTS and ISDN services between the dedicated network and the public network, the crossconnect multiplexer converts CMXII-V5.x channel-associated signaling (CAS) either into V5.1 or into V5.2 switching protocols.

Through connections of leased lines or of CAS are also possible.

The CMXII-V5.x consists of the following units:

- Central unit CCU
- Frame Relay unit V52FR
- 2-Mbit/s interface unit PUCAS and/or PU2+
- SISA interface unit PUSISA (optional)
- Supervision unit MCU
- Power supply PSC

The CCU, V52FR and PSC can be duplicated if module redundancy is required.

With the PU2+ on the subscriber side, 2-Mbit/s signals with V5.1 protocol can be switched or also concentrated in accordance with V5.2. In addition, via FastLink-internal signaling protocol (V5C) a concentration of the subscribers can additionally be undertaken.

Interfaces

- 2 Mbit/s as per ITU-T G.703
- Clock interfaces T3in and T3out for external synchronization
- QD2 interface for connection to a management system
- F interface for local management access (with LCT)
- Alarm interface as floating relay contacts

PUCAS and PU2+ each possesses 4 x 2-Mbit/s interfaces. If the shelves are fully equipped on the subscriber side with PUCAS and on the network side with PU2+, the resulting switching capacities are per magn:

Simultaneous operation of V5.1 and V5.2 in the direction of the exchange is not possible.

The CMXII-V5.x is available in four different capacity stages:

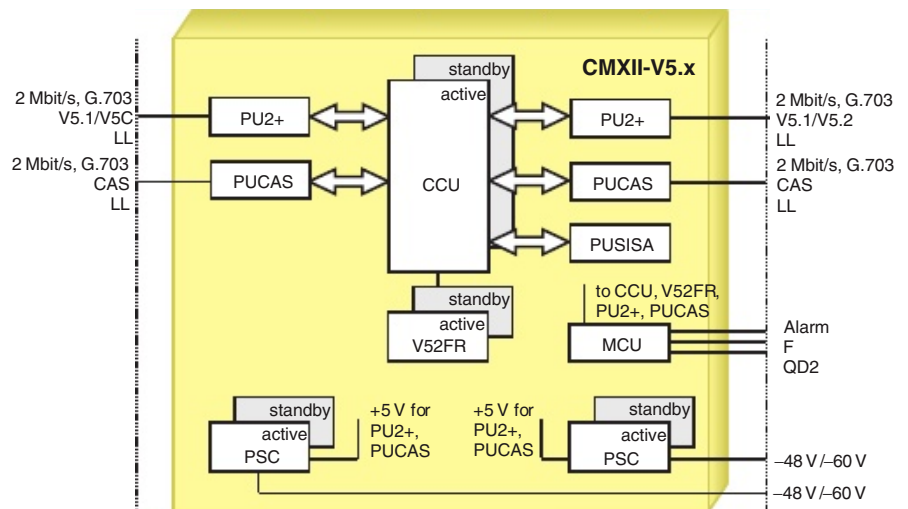
- Single shelf (CMXII-LS)
- Combination of two shelves (CMXII-LS and CMXII-2S or CMXII-CS and CMXII-2S)
- Combination of three shelves (CMXII-CS and 2 x CMXII-2S)

This means that its overall capacity can be adapted very variably to the requirements of the network.

Power supply to the CMXII-V5.x is -48 V/-60 V.

Operating Modes

- Connection types:
 - 64 kbit/s
 - 2 Mbit/s structured as per ITU-T G.704
 - LL n x 64 kbit/s
- Connections either bidirectional, unidirectional or also broadcast
- Conversion of CAS into V5 protocols
- Through connection of CAS
- Switching of V5 signaling information
- V5.2 concentration in the direction of the exchange
- Implementation of timer jobs
- 2-Mbit/s path protection



CAS-V5 conversion with V5.1 interfaces in the direction of the exchange

1 shelf CMXII-LS		2 shelves CMXII-CS + CMXII-2S		2 shelves CMXII-LS + CMXII-2S		3 shelves CMXII-CS + 2xCMXII-2S	
2 Mbit/s	64k ch	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.
24/24	720	36/56	1080	72/68	2040	92/92	2760

CAS-V5 conversion with V5.1 interfaces in the direction of the exchange

1 shelf CMXII-LS		2 shelves CMXII-CS + CMXII-2S		2 shelves CMXII-LS + CMXII-2S		3 shelves CMXII-CS + 2xCMXII-2S	
2 Mbit/s	64k ch	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.
32/16	960	36/32	1080	124/16	3720	128/32	3840

Crossconnect Multiplexer CMXII-CAS

For routing the services via a larger network node crossconnect multiplexer CMXII-CAS is used. The non-blocking switching is undertaken at the 64-kbit/s level.

The CMXII-CAS consists of the following units:

- Central unit CCU
- CAS unit CASU
- 2-Mbit/s interface units PU2+
- SISA interface unit PUSISA (optional)
- Supervision unit MCU
- Power supply PSC

The PUSISA is used if remote equipment (up to 128) is to be controlled via 64-kbit/s channels (ECC).

The CCU, CASU and PSC can be duplicated if module redundancy is required.

The CMXII-CAS is available in four different capacity stages:

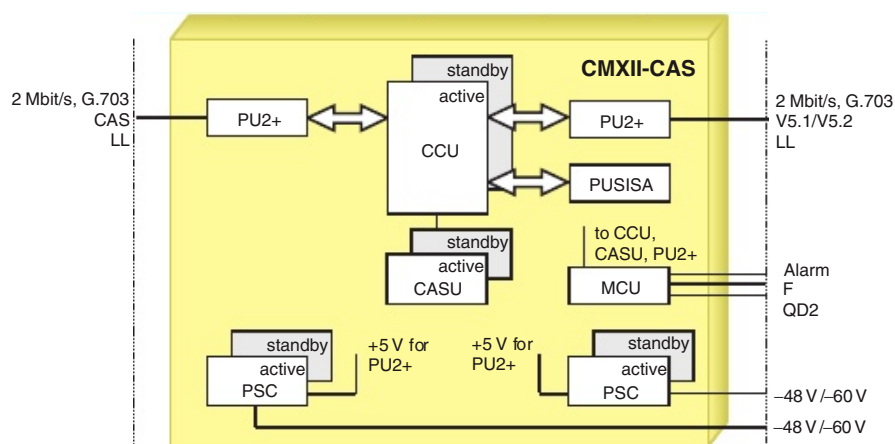
- Single shelf (CMXII-LS)
- Combination of two shelves (CMXII-LS and CMXII-2S or CMXII-CS and CMXII-2S)
- Combination of three shelves (CMXII-CS and 2 x CMXII-2S)

This means that its overall capacity can be adapted very variably to the requirements of the network.

Power supply to the CMXII-CAS is -48 V/-60 V.

Operation Modes

- Connection types:
 - 64 kbit/s
 - 2 Mbit/s as per ITU-T G.703, transparent
 - 2 Mbit/s structured as per ITU-T G.704
 - LL n x 64 kbit/s
- Connections either bidirectional, unidirectional or also broadcast
- Cross connection of channel-associated signaling (CAS)
- Digital conference circuits for up to 128 x 64-kbit/s subscribers
- Implementation of timer jobs
- Path protection at 2-Mbit/s level



Interfaces

- 2 Mbit/s as per ITU-T G.703
- Clock interfaces T3in and T3out for external synchronization
- QD2 interface for connection to a management system
- F interface for local management access (with LCT)
- Alarm interface as floating relay contacts

Port unit PU2+ possesses 4 x 2-Mbit/s interfaces. If the shelves are fully equipped, the switching capacities are as shown in the table below:

1 shelf		2 shelves		2 shelves		3 shelves	
CMXII-LS		CMXII-CS + CMXII-2S		CMXII-LS + CMXII-2S		CMXII-CS + 2xCMXII-2S	
2 Mbit/s	64k ch.	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.	2 Mbit/s	64k ch.
48	720	92	1380	140	2100	184	2760

Central Measurement and Power Supply Module COMPS/COMPS2

The central measurement and power supply modules COMPS or COMPS2 handle the central management and measurement functions in the ONUs as well as power distribution and for the COMPS2 the AC/DC conversion as well. Whereas the COMPS is primarily used in large ONUs (ONU 1000 FTTB/FTTC), the COMPS2 is used in smaller ONUs (ONU 250 FTTB/FTTC).



Central Measurement and Power Supply Module **COMPS2**

Functions

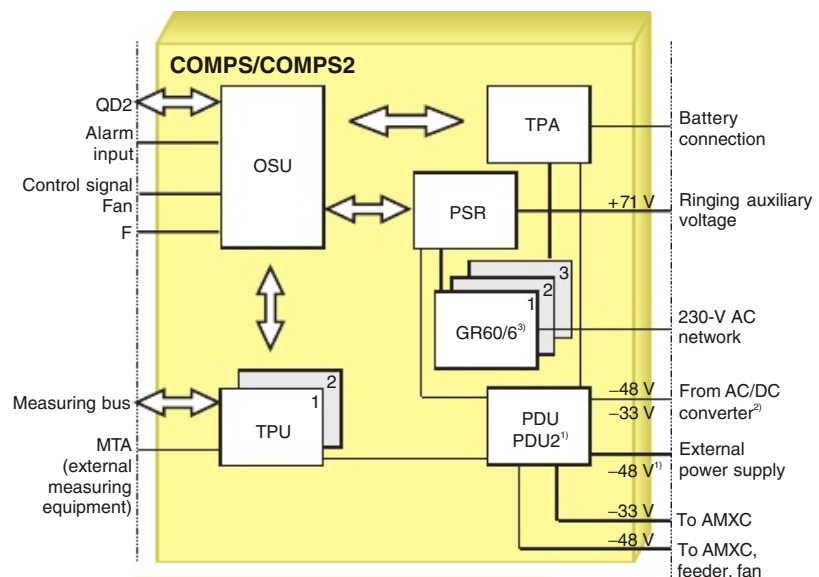
- Central operation and supervision of the ONU via the supervision unit OSU
- Centralized measurement function for ISDN line cards IUL82 and IUL84 via test probe unit TPU
- DC/DC power supply for auxiliary ringing voltage of POTS via power supply unit PSR
- AC/DC conversion and thereby direct access to the 230-V AC network via the GR60/6 unit (COMPS2 only)

- Control of battery backup via the supervision unit of battery back-up TPA
- Power distribution and fusing of -48 V and -33 V battery voltages (only for COMPS with external AC/DC converter) via power distribution unit:
 - PDU for 230-V AC power supply of the ONU or
 - PDU2 for external supply of the ONU with -48 V
- Control signals for power supply

- Fan control

Supervision Unit OSU forms the access for the operations system to the ONU and implements functions to operate and supervise the individual functions within each ONU and to control measurement sequences between the TPU and the analog LCs.

The OSU has interfaces for connecting a TMN system and an F interface for connecting a local craft terminal (LCT).



1) With external DC power supply
 2) Only COMPS
 3) Only COMPS2

Synchronous Multiplexer SMX1/4c

Plesiochronous 2-Mbit/s, 34-Mbit/s and/or electrical STM-1 signals to a synchronous network via an optical or electrical STM-1, or an optical STM-4 interface are connected with synchronous multiplexer SMX1/4c.

Depending on the configuration of the SMX1/4c with optical or electrical add/drop multiplexer units **ADM1o**, **ADM1e** or **ADM4** and expansion units **TC21E1**, **TC21E1R**, **TC1E3** and **TC1STM1e** the interfaces and operating modes listed below are implemented.

Interfaces

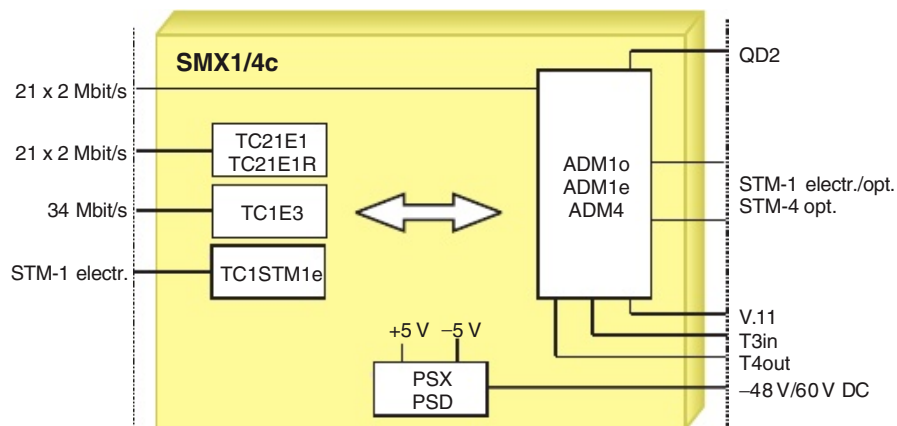
- Up to 63 x 2 Mbit/s
- 1 x 34 Mbit/s
- 1 x STM-1 electrical
- 2 x STM-1 or 2 x STM-4 optical or 2 x STM-1 electrical
- Clock interfaces T3in and T4out for external synchronization
- QD2 interface as access for the management system
- Interfaces to overhead control channels as per V.11

Operating Modes

- Synchronous multiplexer level 1 or level 4
- Operation in both line and ring structures
- Add/drop function for filling up the STM-1/STM-4 signal in ring structures
STM-1 with max. 63 x 2 Mbit/s
STM-4 with max. 252 x 2 Mbit/s
- SNC/I protection switching as per ETS 300 417

Operating voltages +5 V and -5 V for the units of the SMX1/4c are provided by the power supply unit **PSX** or **PSD**.

Alternatively to the SMX1/4c **Synchronous Multiplexer SMA1K-CP** can also be used for linkage to a synchronous network with optical STM-1 interface.



Optical Multiplexer OMX16

The optical multiplexer OMX16 comprising multiplexer unit **DSMX34**, optical transceiver unit **OTRU36** and supervision unit **OTSU2M** combines sixteen 2-Mbit/s signals into one 34-Mbit/s signal and conditions them for transmission over one single-mode optical fiber.

2-Mbit/s Line Equipment LE2

2 Mbit/s are prepared by the 2-Mbit/s line equipment for transmission on copper cable or optical cable.

The line equipment consists of units, which can be used on both the network side and the subscriber side.

Line Termination Unit LTCOH

As HDSL line equipment the LTCOH is used for transparent transmission of 1 x 2 Mbit/s on copper cables. Connections between two LTCOH or between LTCOH and network termination unit NT12C are possible.

Line Termination Unit LT2ME1

Line termination unit LT2ME1 can be equipped with up to two plug-in modules. This means that up to two line interfaces (including different ones) from the following assortment are available:

Interfaces

- Up to 16 x 2 Mbit/s
- 34 Mbit/s electrical or 36 Mbit/s optical
- QD2 interface as access for the management system
- Interface to overhead control channel as per V.11

- 2 Mbit/s, U_{k2} as per FTZ 1TR221
- 2 Mbit/s, G.703 (short haul)
- 2 Mbit/s optical, U_{g2} as per FTZ 1TR222
- 2.3 Mbit/s SHDSL

Module U_{k2mp} also possesses a remote feed unit and can thus supply intermediate regenerators.

Line Termination Unit LTO

The optical line termination unit LTO uses a single mode glass fiber for transmission of 2 x 2 Mbit/s in send and receive direction. Using the 1550 nm optical window for the LTO/LT and the 1300 nm window for the LTO/NT separates the directions.

Management access for both units (LT and NT) is via the network-side unit. The management data are transmitted in the overhead channel.

Network and Element Management

The AccessIntegrator (ACI), Siemens' network management solution for access products, supports the entire scope of FastLink's telephony, data and broadband services and provides control of the entire network with all its services, transport functions and network elements from the topography level, the ONU view, down to the plug-in unit view.

With their IP interface to the Data Communication Network (DCN) the network elements can be controlled via QD2 and also via SNMP. The management channels are routed inband or outband. A higher-ranking operation and maintenance system can use the CORBA or SNMP interface to conduct alarm supervision, service creation and service activation as well as line tests via the ACI.

In this way it is possible to control the entire network centrally from one operator terminal with complete path management.

Features of the ACI

- Graphical user interface based on Windows NT® including support for various languages
- Client-server architecture with distributed tasks
- Optimum scalability for networks small and large
- Fully object-oriented application software
- Standard interfaces for integration into superordinate networking or management systems (CORBA, SNMP)

The ACI runs with the Windows operating system and can be configured from single user up to multi-user including high-availability as warm standby.

Network Management

The entire network is displayed and can be adapted to the real network topology with the network editor.

Configuration Management

Special software is loaded to each plug-in unit. The element and path parameters can be configured for operational as well as for test purposes.

Performance Management

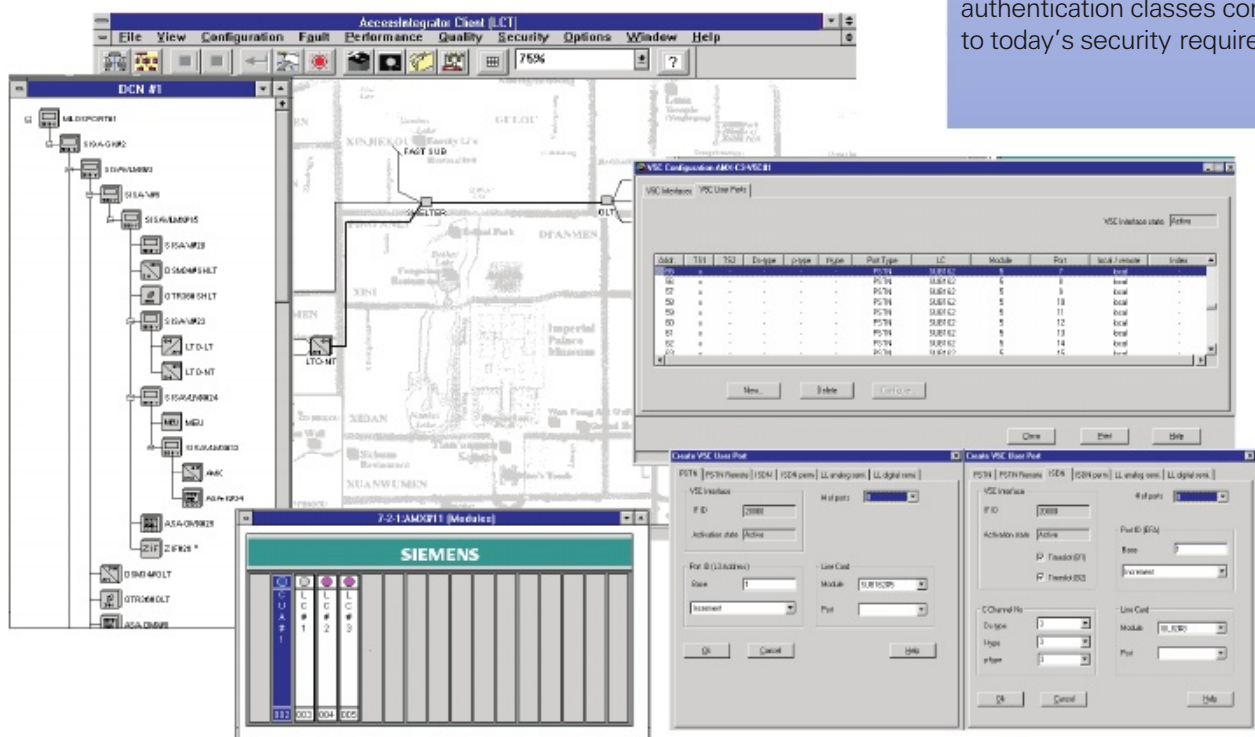
Performance data can be displayed on screen or be recorded in log files.

Fault Management

The entire network and every fault are displayed down to the smallest element. In the case of permanent faults the relevant functional unit is disconnected and an alarm is sent over the Telecommunications Management Network (TMN).

Security Management

Access control with subdivided authentication classes conforms to today's security requirements.



Technical Specifications

Access Multiplexer AMXC

CUAII

Number of 2-Mbit/s interfaces	4 (G.703/6)
Bit rate	2048 kbit/s
Operating voltage	+5 V
Power consumption	6 W

CPF2

Interface modules	4
Number of interfaces per module	1
Operating voltage	+5 V
Power consumption (without module)	2.5 W

Interface module UEB128-04E

Transmission method	U_{k0} baseband with 4B3T
Bit rate	64 kbit/s, 128 kbit/s
Reach with 0.6-mm conductor diameter	8 km

Interface module EDSL

Transmission method	pseudo-ternary baseband
Bit rate	$n \times 64$ kbit/s ($n = 1$ to 8)
Reach with 512 kbit/s and 0.6-mm conductor diameter	3.8 km

Interface module CIM-V.24

Electrical characteristics	V.28
Bit rate	asynchronous . . . 0.3 to 38.4 kbit/s, 115.2 kbit/s synchronous 0.6 to 64 kbit/s, 128 kbit/s
Reach with 19.2 kbit/s and 0.6-mm conductor diameter	15 km

Interface module CIM-V.35

Electrical characteristics	V.28/V.35 All
Bit rate	asynchronous . . . 0.3 to 38.4 kbit/s, 115.2 kbit/s synchronous 0.6 to 48 kbit/s, 56 kbit/s $n \times 64$ kbit/s ($n = 1$ to 31)
Reach with 64 kbit/s (V.35 All) and 0.6-mm conductor diameter	1000 m
Reach with 19.2 kbit/s (V.28) and 0.6-mm conductor diameter	15 m

Interface module CIM-V.36/RS530

Electrical characteristics	V.10/V.11
Bit rate	asynchronous . . . 0.3 to 38.4 kbit/s, 115.2 kbit/s synchronous 0.6 to 56 kbit/s, $n \times 64$ kbit/s ($n = 1$ to 31)
Reach with 64 kbit/s (V.11), 1 kbit/s (V.10) and 0.6-mm conductor diameter	1000 m

Interface module CIM-X.21

Electrical characteristics	X.21/V.11
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Bit rate	asynchronous . . . 0.3 to 38.4 kbit/s, 115.2 kbit/s synchronous 0.6 to 56 kbit/s, $n \times 64$ kbit/s ($n = 1$ to 31)
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Reach with 64 kbit/s and 0.6-mm conductor diameter	1000 m
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DSC6-nx64G

Codirectional mode

Number of interfaces	6
Electrical characteristics	G.703, 2w
Bit rate	$n \times 64$ kbit/s ($n = 1$ to 8)
Reach with 0.6-mm conductor diameter	64 kbit/s 300 m 512 kbit/s 50 m

Contradirectional mode

Number of interfaces	2
Electrical characteristics	G.703, 4w
Bit rate	$n \times 64$ kbit/s ($n = 1$ to 31)
Reach with 0.6-mm conductor diameter	64 kbit/s 400 m 2048 kbit/s 50 m

Centralized clock mode

Number of interfaces	6
Electrical characteristics	G.703, 2w
Bit rate	64 kbit/s
Reach with 64 kbit/s and 0.6-mm conductor diameter	400 m

Operating voltages	+5 V
Power consumption	1.75 W

I8S0P

Number of interfaces	8 (S_0)
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Point-to-point connection	Subscriber count 1 Reach 1000 m
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Point-to-multipoint connection	Subscriber count ≤ 8 Reach 150 m
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Short passive bus	Subscriber count ≤ 8 Reach 150 m
Point-to-multipoint connection	Subscriber count ≤ 4 Reach 500 m

Extended passive bus	Subscriber count ≤ 4 Reach 500 m
Operating voltages	-48 V, +5 V, -5 V
Power consumption (without feeding at S_0)	1.8 W

IUL82/IUL84

Number of interfaces	IUL82 8 (U_{k0} with 2B1Q) IUL84 8 (U_{k0} with 4B3T)
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Function	IUL82 subscriber access via NTBA, NTU IUL84 subscriber access via NTBA
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Transmission method bit transparent, duplex
 Reach with
 0.6-mm conductor diameter max. 8 km
 Power-feeding voltage -95 V
 Operating voltages -48 V, +5 V, -5 V
 Power consumption 5 W

SUB162/322

Number of interfaces 16/32 (POTS, VF, 2w)
 Operating voltages +5 V, -5 V
 Operating voltage for
 ringing signal generation +71 V (+66 V to +72 V)
 Input voltage for
 Subscriber loopbacks -48 V (-36 V to -72 V)
 Power consumption with 0.25 Erl
 SUB162 ≤ 9.5 W
 SUB322 ≤ 15 W

UAC68

Number of interfaces 6 (2w/4w, VF)
 6 (signal wires S21, S22)
 Operating voltages -48 V/-60 V, +5 V, -5 V
 Power consumption ≤ 4.7 W

PSU

Input voltages -36 V to -72 V
 Output voltages
 for 2 x CUAII +5 V
 for LCs +5 V, -5 V
 Max. output power 18 W

Mini-DSLAM/Micro-DSLAM

CLU_STM1o

Optical STM1 interface
 Bit rate 155.520 Mbit/s
 Line code NRZ
 Optical fiber (bidirectional) single mode
 Laser category S-1.1 (1310 nm)
 L-1.1 (1310 nm)
 Power consumption 35 W

CLU_E3

Electrical E3 interface
 Bit rate 34 Mbit/s
 Coding HDB3

CLU_IMA

Electrical IMA interface
 Type E1
 Bit rate 8 x 2048 kbit/s per IMA interface
 Coding HDB3

POSU32I/POSU32P

Number of interfaces 32

Power consumption 1 W

SU_ADSL32

Number of ADSL interfaces 32
 Standards according to ITU-T G.992.1
 Max. bit rate
 Upstream 800 kbit/s
 Downstream 8160 kbit/s
 Frequency range ADSL over ISDN
 Upstream 140 kHz to 257 kHz
 Downstream 257 kHz to 1104 kHz
 Frequency range ADSL over POTS
 Upstream 24 kHz to 132 kHz
 Downstream 136 kHz to 550 kHz
 Transmission method DMT
 Operating voltage -48 V/-60 V
 Power consumption 70 W

SU_SHDSL16

Number of SHDSL interfaces 16
 Standards according to ITU-T G.991.2
 Line connection twisted pair (Cu)
 Bit rate 200 kbit/s to 2320 kbit/s
 Frequency range 0 to 400 kHz
 Coding PAM16 according to ITU-T G.991.2
 Operating voltage -48 V/-60 V
 Power consumption 34 W

FCU

Power consumption
 Active 10 W
 Standby 2 W

FUMS

Power consumption 11 W

Access Multiplexer AMX

CUA

Number of 2-Mbit/s interfaces 1 (G.703/6)
 Bit rate 2048 kbit/s
 Input voltage -36 V to -72 V
 Operating voltages internal and for LCs . . . +5 V, -5 V

BEC

Input voltage -36 V to -72 V
 Operating voltage internal and for LCs . . +5 V, -5 V
 Power consumption (without LC feeding) . . ≤ 0.1 W

DSC2-nx64V35

Number of interfaces 2
 Electrical characteristics . . according to ITU-TV.35/V.28

Operation mode synchronous (duplex)
 Bit rate $n \times 64$ kbit/s ($n = 1$ to 30)
 Operating voltage +5 V, -5 V
 Power consumption 2.25 W

DSC2-nx64V36

Number of interfaces 2
 Electrical characteristics . . . according to ITU-T V.11/V.10
 Operation mode synchronous (duplex)
 Bit rate $n \times 64$ kbit/s ($n = 1$ to 30)
 Operating voltage +5 V, -5 V
 Power consumption 2.5 W

DSC2-nx64X

Number of interfaces 2
 Electrical characteristics X.21/V.11 according to
 ITU-T V.11 or
 V.24/V.28 according to ITU-T V.28
 Operation mode synchronous/asynchronous
 Bit rate
 synchronous $n \times 64$ kbit/s ($n = 1$ to 30)
 asynchronous 0 to 64 kbit/s
 Reach with 0.6-mm conductor diameter
 64 kbit/s ≤ 1000 m
 1024 kbit/s ≤ 100 m
 1984 kbit/s ≤ 50 m
 Operating voltage +5 V
 Power consumption 1.5 W

DSC6-nx64G

see AMXC

I4UK2V5

Number of interfaces 4 (U_{k0} with 2B1Q)
 Transmission method bit transparent, duplex
 Power-feeding voltage 48 V, 60 V, 95 V
 Reach with
 0.6-mm conductor diameter max. 8 km
 Operating voltages -48 V/-60 V, +5 V, -5 V
 Power consumption 1.1 W

IUL84

see AMXC

LLA102/104

Number of interfaces 10 (2w/4w, VF, switchable)

2wire operation

Impedance 600 Ω
 Input level -8 dBr to +9 dBr
 Output level -14 dBr to +4 dBr

4wire operation

Impedance 600 Ω
 Input level -14 dBr to +4 dBr

Output level -14 dBr to +4 dBr
 Operating voltage -48 V/-60 V, +5 V, -5 V

SUB102

Number of interfaces 10 (POTS, VF, 2w)
 Operating voltages -48 V/-60 V, +5 V, -5 V
 Power consumption with 0.5 Erl ≤ 7.5 W
 Dissipation power (typ.) with 0.5 Erl ≤ 4.5 W

MSUE

F interface (point-to-point) V.24/V.28
 2 x QD2 master interface EIA RS485
 QD2 slave interface EIA RS48
 ECC interface EIA RS485
 Send-enable interface EIA RS422
 Input voltage -36 V to -72 V
 Power consumption 4.5 W

Crossconnectmultiplexer CMXII

CCU

Clock interface G.703/10
 Operating voltage -48 V/-60 V
 Power consumption ≤ 12.5 W

CASU

Operating voltage -48 V/-60 V
 Power consumption ≤ 6.25 W

PUCAS/PU2+

Number of 2-Mbit/s interfaces 4 (G.703/6)
 Bit rate 2048 kbit/s
 Operating voltage +5.4 V
 Power consumption ≤ 2.5 W

PUSISA

Operating voltage +5.4 V ± 3 %
 Power consumption ≤ 1.5 W

V52FR

Operating voltage -48 V/-60 V
 Power consumption ≤ 6.25 W

MCU

F interface (point-to point) V.24/V.28
 Input voltage -36 V to -72 V
 Power consumption ≤ 4.5 W

PSC

Input voltage -36 V to -72 V
 Output voltage +5.4 V
 Max. output power 68 W

COMPS/COMPS2

GR60/6

Input voltage	230 V _{AC}
Output voltage	48 V _{DC}
Max. output power	370 W

OSU

F interface (point-to-point)	V.28
Alarm inputs	22
Operating voltage	+5 V
Power consumption	5 W

PDU/PDU2+

Input voltages	-30 V to -72 V
Output voltages	-30 V to -72 V
Max. dissipation power of the unit (with 4 times I _N = 6.3 A)	0.5 W

PSR

Input voltage	-36 V to -72 V
Output voltages for LCs and TPU	+70 V to +72.3 V
Max. output power	72 W
Max. dissipation power	13 W

TPA

Battery and power supply connection	
Voltage	-41 V to -59 V
Max. current loading	64 A
Power supply	
Input voltage	-36 V to -72 V
Power consumption	< 5 W

TPU

Measurement accuracy for all measurements	±10 %
Permissible test voltage	< 100 V
Permissible test current	< 100 mA
Max. permissible foreign voltages according to ITU-T K.20	
atmospheric discharges	1.5 kV; 10/700 μs
mains voltage	230 V _{eff} /50 Hz (60 Hz)
Input voltage	-36 V to -72 V
Power consumption	< 3 W
Outward measurement of the IUL82/IUL84	
DC voltage	-200 V to +200 V
AC voltage	< 230 V
Frequency	10 Hz to 70 Hz
Insulation resistance	100 Ω to 1 MΩ
Capacity	0.1 μF to 5 μF
Max. test voltage for insulation and Capacitance measurement between	
a- and b-wire	+15 V
a-wire/b-wire and earth	-30 V

Inward measurement of the IUL82/IUL84

Idle voltage	0 V to 120 V
Nominal current with R _L =3 kΩ	-40 mA to +40 mA
Overload current with R _L =1 kΩ	-60 mA to +60 mA

Synchronous Multiplexer SMX1/4c

ADM1o/ADM1e

Optical STM1 interface (only ADM1o)	
Bit rate	155.520 Mbit/s
Electr. characteristics	according to ITU-T G.707
Line code	NRZ
Optical fiber (bidirectional)	single mode 10/125 μm
Electrical STM-1 interface (only ADM1e)	
Bit rate	155.520 Mbit/s ±20 ppm
Electr. characteristics	according to ITU-T G.707
Coding	CMI
2-Mbit/s interface	
Bit rate	21 x 2.048 Mbit/s ±50 ppm
Electr. characteristics	according to ITU-T G.703
Coding	HDB3
Operating voltages	+5 V, -5 V
Power consumption ADM1o	15.5 W
Power consumption ADM1e	15 W

ADM4

Optical STM4 interface	
Bit rate	622.080 Mbit/s
Electr. characteristics	according to ITU-T G.707
Line code	NRZ
Optical fiber (bidirectional)	single mode 10/125 μm
2-Mbit/s interface	
Bit rate	21 x 2.048 Mbit/s ±50 ppm
Electr. characteristics	according to ITU-T G.703
Coding	HDB3
Operating voltages	+5 V, -5 V
Power consumption	18.5 W

TC1E3

34-Mbit/s interface	
Bit rate	1 x 34.368 Mbit/s ±50 ppm
Coding	HDB3
Operating voltages	+5 V, -5 V
Power consumption	5 W

TC21E1/TC21E1R

2-Mbit/s interface	
Bit rate	21 x 2.048 Mbit/s ±50 ppm
Coding	HDB3
Operating voltages	+5 V, -5 V
Power consumption TC21E1	8 W
Power consumption TC21E1R	9 W

TC1STM1e

Electrical STM-1 interface	
Bit rate	1 x 155.520 Mbit/s ±20 ppm
Coding	CMI
Operating voltages	+5 V, -5 V
Power consumption	8 W

PSD

Input voltage	-36 V to -72 V
Output voltages	+5 V, -5 V
Max. output power	
with +5 V	15 W
with 5 V	10 W

PSX

Input voltage	-36 V to -72 V
Min.	-36 V
Max.	-75 V
Output voltages	+5 V, -5 V
Max. output power	50 W

Synchronous Multiplexer SMA1K-CP

Optical STM-1 interface	
Bit rate	155.520 Mbit/s
Coding	NRZ
Wave length	1280 nm to 1335 nm
2-Mbit/s interface	
Bit rate	12 x 2.048 Mbit/s
Electr. characteristics	according to ETS 300 166
Coding	HDB3
34-Mbit/s interface	
Bit rate	1 x 34.368 Mbit/s
Electr. characteristics	according to ETS 300 166
Coding	HDB3
45-Mbit/s interface	
Bit rate	1 x 44.736 Mbit/s
Electr. characteristics	according to ETS 300 166
Coding	B3ZS
Power supply	
Operating voltage	-48 V/-60 V
Power consumption	< 25 W

Optical Multiplexer OMX16

DSMX34

Number of F1 interfaces	1 (HDB3)
Bit rate	34368 kbit/s
Number of F2 interfaces	16 (HDB3)
Bit rate	2048 kbit/s
Input voltage	-36 V to -72 V

Operating voltage (internal)	+5 V
Power consumption	9.3 W

OTRU36

Number of F1 interfaces (optical)	1 (NRZ)
Bit rate	36864 kbit/s
Optical fiber (bidirectional)	SM 10/125 µm
Number of F2 interfaces	1 (HDB3)
Bit rate	34368 kbit/s
V.11 interfaces	
Bit rates	512 kbit/s, 256 kbit/s, 64 kbit/s
Input voltage	-36 V to -72 V
Operating voltage (internal)	+5 V
Power consumption	7.1 W

OTSU2M

QD2-F interface	RS232 (LCT)
QD2-Q interface	RS485 & G.703 (ACI)
Functionality	SISA concentration
Input voltage	-36 V to -72 V
Power consumption	< 5 W

2-Mbit/s Line Equipment LE2

LTCOH

2-Mbit/s interface G.703	1
Bit rate	2.048 Mbit/s ±50 ppm
Impedance (switchable)	75 Ω/120 Ω
HDSL interface	
Bit rate	1.168 Mbit/s per wire pair
Frame structure	according to ETSI RTR/TM-03036
Line code	2B1Q, scrambled
Impedance	135 Ω

LT2ME1

2-Mbit/s interfaces G.703	2
Bit rate	2.048 Mbit/s ±50 ppm
Impedance (switchable)	75 Ω/120 Ω
Module Uk2mp	
Line interface	Uk2 according to FTZ 1 TR221
Bit rate	2.048 Mbit/s ±50 ppm
Pulse shape	sine half wave
Impedance, symmetrical	130 Ω
Remote feed voltage	114 V
Remote feed current	59 mA ±1 mA
Module G703sh	
Interface	G.703, short-haul
Bit rate	2.048 Mbit/s ±50 ppm
Pulse shape	approaching rectangular
Impedance, symmetrical	120 Ω
Module Ug2	
Optical line interface	Ug2 according to FTZ 1 TR 222

Bit rate 2.048 Mbit/s
 Optical fiber per direction single mode
 Wave length 1300 nm
 Optical fiber connector DIN
 Max. bridgeable attenuation 15 dB

Module SHDSL

Transmission method PAM16
 Symmetrical wire pair 1
 Bit rate 2.32 Mbit/s
 User rate 2.048 Mbit/s
 Management channel 64 kbit/s
 Typical reach with
 0.4-mm conductor diameter 3.9 km

LTO

2-Mbit/s interfaces G.703 2
 Bit rate 2.048 Mbit/s ± 50 ppm
 Impedance (switchable) 75 Ω /120 Ω
 Optical interface
 Bit rate total 8.704 Mbit/s ± 30 ppm
 Optical fiber,
 bidirectional single mode 10/125 μ m
 Fiber optic connector FC/PC
 Max. bridgeable attenuation 15 dB

ONU 20 FTTO

COSU

QD2 interface,
 intern. switchable. according to RS485
 F interface V.24/V.28

Power supply

Via external AC adapter 230 V
 Backup battery 48 V
 Power consumption (with 0.5 Erl) 56

Data Network Unit DNU01SD

Number of line interfaces 1
 EDSL
 Transmission method pseudoternary
 baseband with echo compensation
 Bit rates n x 64 kbit/s (n \leq 8)
 Impedance 135 Ω
 Max. bridgeable line attenuation 27 dB
 U_{k0} baseband
 Transmission method baseband with 4B3T
 Bit rates 1.5/3.6/12/24/48/64 or 128 kbit/s
 Impedance 150 Ω
 Max. bridgeable line attenuation 32 dB
 Number of subscriber interfaces 1
 Data interface X.21
 Electr. characteristics X.21/V.11

Operating mode synchronous
 Bit rates n x 64 kbit/s (n \leq 8)

Data interface V.35

Electr. characteristics V.28/V.35 All
 Operating mode synchronous
 Bit rates n x 64 kbit/s (n \leq 8)

Data interface V.36

Electr. characteristics V.10/V.11
 Operating mode synchronous
 Bit rates n x 64 kbit/s (n \leq 8)

Power feeding (local) 5.2 V ± 1 %
 Power consumption ≤ 12 W

Network Termination Unit NTU

Number of line interfaces 1
 Line interface U_{k0}
 Coding 2B1Q
 Medium 1 copper pair
 Reach
 with 0.6-mm conductor diameter max. 8 km
 Number of subscriber interfaces 2
 Subscriber interface G.703
 Operating mode synchronous, codirectional
 Bit rate 64 kbit/s
 Subscriber interface V.24
 Electr. characteristics V.28
 Bit rates
 asynchronous 0.3 to 19.2 kbit/s
 synchronous 0.6 to 64 kbit/s, 128 kbit/s
 Frame structure for substrates V.110
 Reach with 19.2 kbit/s and
 0.6-mm conductor diameter 15 m
 Subscriber interface V.35
 Electr. characteristics V.28/V.35 All
 Operating mode synchronous
 Bit rate 0.6 to 64 kbit/s, 128 kbit/s
 Frame structure for substrates V.110
 Reach with 64 kbit/s (V.35 All) and
 0.6-mm conductor diameter 500 m
 Reach with 19.2 kbit/s (V.28) and
 0.6-mm conductor diameter 15 m
 Subscriber interface V.36
 Electr. characteristics V.10/V.11
 Operating mode synchronous
 Bit rate 0.6 to 64 kbit/s, 128 kbit/s
 Frame structure for substrates V.110
 Reach with 64 kbit/s (V.11) and
 0.6-mm conductor diameter
 without 113 timing 500 m
 with 113 timing 1000 m
 Subscriber interface X.21
 Electr. characteristics X.21/V.11
 Operating mode synchronous

Bit rate	0.6 to 64 kbit/s, 128 kbit/s
Frame structure for substrates	X.30
Reach with 64 kbit/s and 0.6-mm conductor diameter	
without X timing	500 m
with X timing	1000 m

Power supply

Via external AC adapter	115V/230 V
Max. power consumption	3.5W

Network Termination NT22OV

Number of line interfaces	1
Bit rate total	8.704 Mbit/s ±30 ppm
Optical fiber, bidirectional	single mode 10/125 μm
Fiber-optic connector	DIN, optional FC/PC
Max. bridgeable attenuation	15 dB
Wave length	1300 nm/1550 nm

Number of subscriber interfaces	2
Subscriber interface V.36	
Electrical characteristics	V.10/V.11
Operation mode	synchronous
Bit rate	n x 64 kbit/s (n = 1 to 31)
Reach	
at V.10 with 1 kbit/s	max. 1000 m
at V.11 with 64 kbit/s	max. 1000 m

Subscriber interface V.35	
Electrical characteristics	V.28/V.35 All
Operating mode	synchronous
Bit rates	n x 64 kbit/s (n = 1 to 31)
Reach	max. 15 m

Subscriber interface X.21	
Electrical characteristics	X.21/V.11
Operating mode	synchronous
Bit rates	n x 64 kbit/s (n = 1 to 31)
Reach with 64 kbit/s	max. 1000 m

Power supply

Via external AC adapter	120 V/230 V
Max. power consumption	8 W

Environmental Conditions

ONU FTTO/FTTB

Environmental class	ETS 300 019-1-3.1E
Temperature range	-5 °C to +45 °C
Product safety	EN/IEC 60950
EMC	ETS 300 386-1, Tab. 2 or 4, ETS 300 386-2 for ONU 20 FTTO

ONU FTTC

Environmental class	ETS 300 019-1-4.1
Temperature range	-33 °C to +40 °C to +50 °C with 2-h solar radiation
Product safety	EN/IEC 60950
EMC	ETS 300 386-1, Tab. 4

OLT

Environmental class	ETS 300 019-1-3.1
Temperature range	+5 °C to +45 °C
Product safety	EN/IEC 60950
EMC	ETS 300 386-1, Tab. 2 or 4

Construction (B x H x T)

ONU 20 FTTO	370 x 165 x 247 mm
ONU 30 FTTB	440 x 535 x 260 mm
ONU 250 FTTB	600 x 2200 x 300 mm
ONU 250 FTTC	900 x 1700 x 400 mm
ONU 1000 FTTB (per rack)	600 x 2200 x 300 mm
ONU 1000 FTTC	1500 x 1600 x 400 mm 2200 x 1600 x 400 mm
OLT	1200 x 2200 x 300 mm

Shelves (B x H x T)

ASMXS2	535 x 400 x 240 mm
CMXII-2S	535 x 400 x 240 mm
CMXII-CS	535 x 400 x 240 mm
CMXII-LS	535 x 400 x 240 mm
COMPS	535 x 175 x 196 mm
COMPS2	535 x 175 x 240 mm
Micro-DSLAM	535 x 100 x 280 mm
OMX2S2	535 x 400 x 240 mm
OMX16S	535 x 450 x 240 mm
SMA1K-CP	535 x 108 x 223 mm
SMXCS	535 x 450 x 240 mm
SMXLS2	535 x 450 x 240 mm
SNUS	535 x 400 x 240 mm
UMX2S2	535 x 300 x 240 mm
UMX4MS	535 x 375 x 280 mm
UMXLS	535 x 300 x 240 mm

Product Overview

ONU types

ONU 20 FTTO	Table/wall-mounted enclosure for max. 20 NB subscriber
ONU 30 FTTB	Wall-mounted enclosure for max. 30 NB subscriber
ONU 250 FTTB with Mini-DSLAM with Micro-DSLAM	ETS rack for max. 256 NB and max. 80 BB subscriber ETS rack for max. 256 NB and max. 32 BB subscriber
ONU 250 FTTC with Mini-DSLAM with Micro-DSLAM	Shelter for max. 256 NB and max. 80 BB subscriber Shelter for max. 256 NB and max. 32 BB subscriber
ONU 1000 FTTB with Mini-DSLAM with Micro-DSLAM	ETS and MDF racks for max. 2048 NB and max. 160 BB subscriber ETS and MDF racks for max. 2048 NB and max. 32 BB subscriber
ONU 1000 FTTC with Mini-DSLAM with Micro-DSLAM	Shelter (small or large) for max. 1024 NB and max. 160 BB subscriber Shelter (small or large) for max. 1024 NB and max. 32 BB subscriber

Shelves

AMXMS	AMX shelf (MSUE, AMX, LTs)
ASMXS2	AMXC shelf (AMXC, SMX1/4c, OMX16, LE2)
CMXII-2S	CMXII shelf (2-Mbit/s interfaces)
CMXII-CS	Central CMXII shelf
CMXII-LS	Compact CMXII shelf
COMPS	COMPS shelf
COMPS2	COMPS2 shelf
Micro-DSLAM	Micro-DSLAM shelf
OMX16S	Feeder shelf (OTSU2M, OMX16, LE2)
OMX2S2	Feeder shelf (OTSU2M, LE2)
SMA1K-CP	Feeder shelf
SMXCS	Feeder shelf (OTSU2M, SMX1/4c)
SMXLS2	Feeder shelf (OTSU2M, SMX1/4c, OMX16, LE2)
SNUS	Feeder shelf (OTSU2M, SMX1/4c, OMX16, LE2)
UMX2S2	AMXC shelf (AMXC, LE2)
UMX4MS	Mini-DSLAM shelf (Mini-DSLAM, FCU, FUMS)
UMXLS	Feeder shelf (OTSU2M, SUE, LE2)

Plug-in units AMXC

CUAII	Central unit
CPF2	Line card for data
UEB128-E04	Transmission module U_{k0} baseband
EDSL-01	Transmission module EDSL
CIM-V.24	Interface module for V.24
CIM-V.35	Interface module for V.35
CIM-V.36	Interface module for V.36
CIM-X.21	Interface module for X.21
DSC6-nx64G	Digital signal line card, 64 kbit/s, G.703
I8S0P	ISDN line card S_0
IUL82	ISDN line card 2B1Q
IUL84	ISDN line card 4B3T
SUB162	Subscriber line card, subscriber side
SUB322	Subscriber line card, subscriber side
UAC68	Universal line card for 2w/4w without E&M
PSU	Power supply unit

Plug-in units AMX

CUA	Central unit
DSC6-nx64G	Digital signal line card, G.703, n x 64 kbit/s
DSC2-nx64X	Digital signal line card, X.21, n x 64 kbit/s
DSC2-nx64V35	Digital signal line card, V.35, n x 64 kbit/s
DSC2-nx64V36	Digital signal line card, V.36, n x 64 kbit/s
I4UK2V5	ISDN line card 2B1Q
IUL84	ISDN line card 4B3T
LLA102/104	Leased line analog 2w/4w
SUB102	Subscriber line card, subscriber side
MSUE	Measurement and supervision unit in AMX
COSU	Supervision unit ONU 20 FTTO

Plug-in units Mini-DSLAM/Micro-DSLAM

CLU_STM1o	Central unit for STM-1 optical
CLU_E3	Central unit for E3
CLU_IMA	Central unit for IMA
POSU32I	Combination splitter for ADSL over ISDN
POSU32P	Combination splitter for ADSL over POTS
SU_ADSL32	Service unit for ADSL
SU_SHDSL16	Service unit for SHDSL
FCU	Fan control unit in Mini-DSLAM
FUMS	Fan unit in Mini-DSLAM
UPL	User panel in Micro-DSLAM

Plug-in units CMXII-V5.x/CAS

CCU	Central unit
MCU	Supervision unit
CASU	CAS unit (in CMXII-CAS only)
PU2+	2-Mbit/s interface unit
PUCAS	2-Mbit/s interface unit for CAS/V5.x conversion (in CMXII-V5.x only)
PUSISA	SISA interface unit
PSC	Power supply unit
V52FR	V5.x Frame Relay unit (in CMXII-V5.x only)

Plug-in units SMX1/4c

ADM1e	Add/drop multiplexer unit (STM-1 electrical)
ADM1o	Add/drop multiplexer unit (STM-1 optical), short-haul and long-haul
ADM4	Add/drop multiplexer unit (STM-4 optical), short-haul and long-haul
TC1E3	Tributary extender unit (1 x 34 Mbit/s)
TC1STM1e	Tributary extender unit (1 x STM-1)
TC21E1	Tributary extender unit (21 x 2 Mbit/s)
TC21E1R	Tributary extender unit with retiming function (21 x 2 Mbit/s)
PSD	Power supply unit in shelf SNUS
PSX	Power supply unit in shelf SMXCS/SMXLS2

Plug-in units OMX16

DSMX34	Multiplexer unit
OTRU36	Optical transceiver unit
OTSU2M	Supervision unit

Plug-in units LE2

LTCOH	Line termination unit (1 x 2 Mbit/s, HDSL, copper cable)
LT2ME1	Line termination unit (base unit for max. 2 modules)
Uk2mP	1 x U_{k2} , module with remote feed, copper cable
G.703sh	1 x 2 Mbit/s, G.703 module, short haul
SHDSL	1 x 2.3 Mbit/s, SDSL module, copper cable
Ug2	1 x 2 Mbit/s, U_{g2} module optical fiber
LTO	Line termination unit (2 x 2 Mbit/s, optical fiber)

Plug-in units COMPS/COMPS2

GR60	AC/DC module (in COMPS2 only)
OSU	Supervision unit
PDU/PDU2	Power distribution unit
PSR	Power supply unit for aux. ringing voltage
TPA	Supervision unit of battery backup
TPU	Measurement unit for ISDN line cards

Network Terminations

NT12C	Network termination unit (with LTCOH)
NT22OV	Network termination unit (base unit for max. 2 interface modules)
NTOV36	DATA module V.36
NTOV35	DATA module V.35
NTOX21	DATA module X.21
NT22O	Network termination unit (with LTO/NT)
NTU	Network termination unit (base unit for max. 2 interface modules)
NTUV24	Module V.24
NTUV35	Module V.35
NTUV36	Module V.36
NTUX21	Module X.21
NTU64kCO	Module 64k-codirectional
DNU01SD	Data network unit (base unit)
EDSL-01	Module EDSL
UEB128-04E	Module U _{k0} baseband
IF-V.35/V.36	Module V.35/V.36
i210	Integrated Access Device (SHDSL, 4 x S ₀ , 10BaseT)
Twin NT4500	ADSL network termination unit (POTS or ISDN, 10BaseT)
POSU-R	ADSL/POTS splitter remote

Our contribution to environmental protection – ICN AS AN environmental declaration

The objective of the environmental declaration which comes with each system is to give you the most important environmentally-relevant information for the product concerned. You can thus be certain that you have chosen a supplier who develops, produces, packs and dispatches their products in an environmentally friendly way. All specifications are supplied unsolicited and far exceed legal requirements.

AC	Alternating Current
ACI	AccessIntegrator
ADSL	Asymmetrical Digital Subscriber Line
ATM	Asynchronous Transfer Mode
BA	Basic Access
BB/NB	Broadband/Narrowband
CAS	Channel Associated Signaling
CMI	Code Mark Inversion
CPE	Customer Premises Equipment
DC	Direct Current
DDF	Digital Distribution Frame
DLC	Digital Loop Carrier
DNU	Data Network Unit
DSL	Digital Subscriber Line
ECC	Embedded Control Channel
EDSL	Enhanced Digital Subscriber Line
EIA	Electronics Industries Association
EMC	Electromagnetic Compatibility
E&M	Earth & Minus
ETS	European Telecommunications Standard
ETSI	European Telecommunications Standard Institute
FITL	Fiber in the Loop
FTTB	Fiber to the Building
FTTC	Fiber to the Curb
FTTO	Fiber to the Office
GbE	Gigabit Ethernet
HDB3	High Density Bipolar of Order 3
HDSL	High Bitrate Digital Subscriber Line
IAD	Integrated Access Device
IEC	International Electrotechnical Commission
IF	Interface
ILTF	Integrated Line Test Function
IMA	Inverse Multiplexing over ATM
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITU-T	International Telecommunications Union, International Standardization Sector
LC	Line Card
LCT	Local Craft Terminal
LL	Leased Line
LT	Line Termination
MDF	Main Distribution Frame
MTA	Metallic Test Access
NIC	Network Interface Card
NRZ	Non Return to Zero
NT	Network Termination
NTBA	Network Termination Basic Access
NTU	Network Termination Unit
ODF	Optical Distribution Frame
ODT	Optical Distant Termination
OLT	Optical Line Termination
ONU	Optical Network Unit
PAM	Pulse Amplitude Modulation
PAT	Periodic Access Test
PBX	Private Branch Exchange
PDH	Plesiochronous Digital Hierarchy
POTS	Plain Old Telephone Service
QD2	Standard Interface to TMN
SDH	Synchronous Digital Hierarchy
SHDSL	Symmetric High-Bitrate Digital Subscriber Line
SISA	Supervisory and Information System for Local and Remote Area
SM	Single Mode
SNC/I	Inherently Monitored Sub-Network Connection Protection
SNMP	Simple Network Management Protocol
STM-1	Synchronous Transport Module Level 1 (155 Mbit/s)
STM-4	Synchronous Transport Module Level 4 (622 Mbit/s)
SU	Service Unit
TDM	Time Division Multiplex
TMN	Telecommunications Management Network
V5.x	Signaling Protocols for Access Networks
VDSL	Very High-Bitrate DSL
VF	Voice Frequency
VoDSL	Voice over DSL
2B1Q/4B3T	ISDN Transmission Codes
2w/4w	2wire/4wire
64k ch..	64-kbit/s channels



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