Alcatel LMDS Solution

Technical description

CONTENTS

1 - INTRODUCTION

1.1 - MARKET CONSIDERATIONS

Fixed wireless radio technology offers a cost-effective solution for densely-populated urban and suburban areas. High-capacity wireless local loop systems enable operators to rapidly provide a range of voice and data services to large numbers of customer sites. Point-to-Multipoint (PMP) wireless systems can also provide an attractive solution for mobile network operators seeking to link mobile base stations and controllers in busy downtown areas. What is more, a combined fixed and mobile operator can interconnect both customer sites and cellular base stations using the same fixed broadband wireless system.

The Alcatel LMDS range of products meets the need for a broadband PMP wireless system which can be used profitably by both incumbent and new telecom operators, cable TV system operators, and other wireless network providers. Because it is a member of Alcatel's extensive portfolio of products, it can be deployed as part of a fully integrated network solution which includes:

- Synchronous Digital Hierarchy (SDH) / Synchronous Optical Network (SONET) transmission technologies (fiber or radio) and ATM-based services

- Narrowband/broadband switches.

- Broadband Remote Access Node (RAN).

- Cellular/Wireless Local Loop products.

- Voice interconnection systems, such as SS7, V5.2 and TR-303

- Fullly integrated Network and Service Management.

1.2 - ALCATEL LMDS MAIN FEATURES

The following is a list of the valuable features that the Alcatel LMDS system offers:

- Microcellular point-to-multipoint distribution architecture.
- Broadband Wireless Network using internal Asynchronous Transfer Mode (ATM) Transport.
- Voice, data,IP and integration at very high speeds.
- Medium Access Control (MAC) which supports ATM Quality of Service and advanced IP CoS
- Efficient packet and voice transport with minimal throughput delay
- Dynamic Bandwidth Allocation (DBA) of services "over-the-air" with user definable contracts
- Multiple Quality of Service class support
- Both single carrier and multiple carrier architecture via cross pole or co-pole radio solutions
- Multiple frequency bands, type approved for world-wide use
- Sectored base station antennas
- High frequency re-use between sectors and cells.
- Large global range of downstream channeling: 14 and 28 MHz.
- Flexible, high throughput upstream channeling: 3.5 and 7MHz .
- Customer site Network Terminations providing: POTS/ISDN switched services, nx64 kbits/s - nxE1/T1 leased lines standard and advanced Ethernet 10BaseT/100BaseT interfaces with Dynamic Bandwidth Allocation
- Base Stations, with full redundancy providing network interfaces such as: ATM (OC3/STM1/E3/T3) for data connection and optional n x E1/T1 for services such as telephony orleased lines.
- Indoor and outdoor Base Station installations
- Advanced support for business-class IP services, for example VLANs, IP service priority, Service Contracts system and support of DiffServ
- Advanced Network and Service Management which includes Simple Network Management Protocol (SNMP) based Network Management System (NMS) using HP OpenView and integrated in the advanced Alcatel Management platform.

The best interests of both Service Providers and manufacturers are served by implementing well-recognized International standards. Therefore, the system is implemented according to DAVIC standards at the IF level. Alcatel is active in both the ETSI and IEEE working parties for modulation and physical standardization. Future releases of the Broadband Access platform will conform to these standards when harmonized.

2 - ARCHITECTURE

2.1 - GENERAL

The Alcatel LMDS is a high capacity, flexible point-to-multipoint broadband wireless solution, designed to meet the requirements of service providers who need to offer a mix of traditional and new exiting high speed services, to a mix of business and residential customers.

Broadband wireless is inherently faster to deploy than traditional wireless services and the Alactel LMDS has specifically enhanced features to ensure rapid planning and deployment of both cell sites and customer premises. The advanced Network and Service Management solution offered total end-to-end management with the collection of statistical and billing information. The ability to offer full "flow-through-provisioning" is a key feature in the reduction of operational expense by the service provider, the Alcatel LMDS ensures traditional and new services and applications can be supplied cost effectively, with the minimum of technical and operational staff involved.

The Alcatel LMDS has been designed with a highly flexible channel allocation plus supports a wide range of radio frequency variants, either in a cross-polar or co-polar configuration, with very high frequency re-use. This ensures that service providers maximize their investment in the valuable radio spectrum and are assured that initial deployments are cost effective and customer growth can be achieved easily.

The Alcatel LMDS enables service providers to cater for the small to medium business user, either in a single or multi-tenant building as well as the SOHO and even residential user in a multiple dwelling complex. Voice, data and IP based services can be offered simultaneously and cost effectively.
Service interfaces provide nxE1/T1, clear E1/T1, ISDN/POTS and either Ethernet 10BaseT and shortly the advanced 10/100BaseT module for enhanced IP service support.
Multiple network termination devices can be connected to a single customer site radio to increase the service port density. At the base station site, or central office interfaces to the data network are provided, either via ATM or high density TDM. Concentrated switched services can be connected to Class 5 PSTN offices via GR303 or V5.2, further reducing the cost of capital equipment and operational expense.
The Alcatel LMDS solution also offers switched voice solution with an SS7 interface.

Alcatel has developed an advanced traffic contracting and sharing mechanism, whereby bursty data and voice services flexibly utilize the available bandwidth across the radio links under given priorities and contracts defined by the service provider. This mechanism called Dynamic Bandwidth Allocation maximizes the efficiency of the valuable licensed spectrum whilst providing the QoS required by the end customer for the service level agreement contracted.

The Alcatel LMDS solution offers a wide range of services, whether leased lines, switched voice, high speed Internet access or advanced IP services support (e.g. VLANs), these services can be managed and deployed quickly whilst ensuring that valuable spectrum is used to its maximum.

2.2 - ARCHITECTURE

2.2.1 - ALCATEL LMDS General description

The Alcatel LMDS solution is a point-to-multipoint system designed to give an economic architecture for Broadband connection in urban environment. The system is installed with a common Base Station (BS) and many distributed customer Terminal Stations (TS).

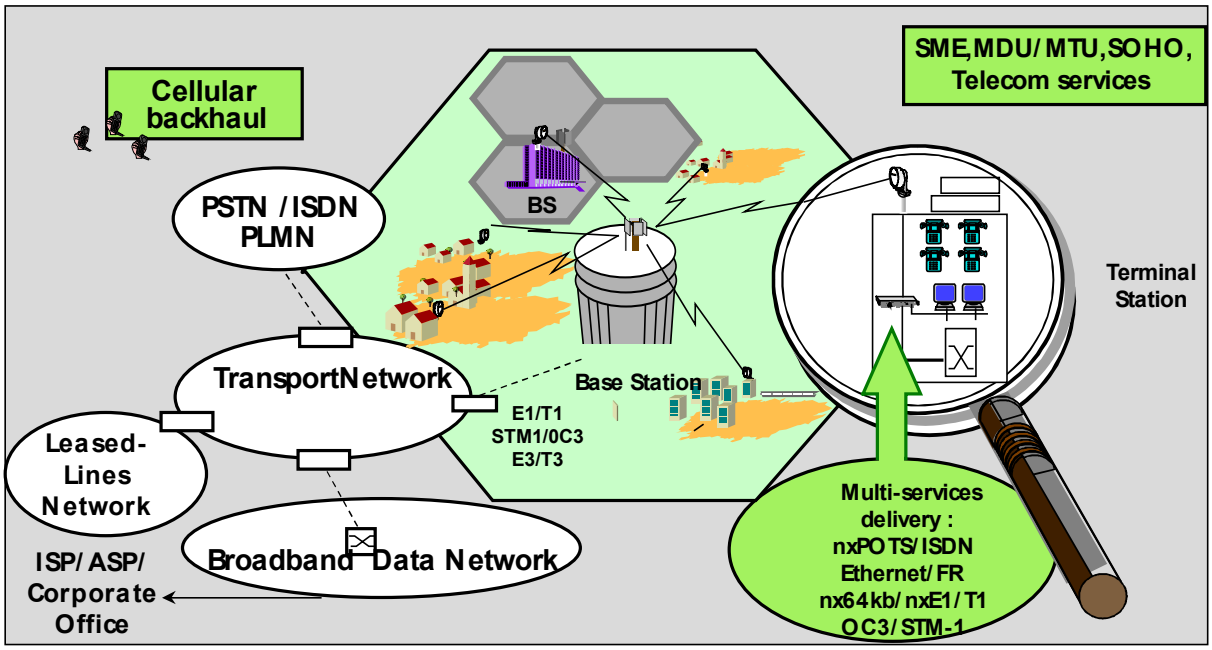


Figure 1
APPLICATION MODEL

The BS utilizes sector antennas to achieve cell coverage and the TS uses a small size parabolic antenna to access the BS.
Base Stations act as hubs, transmitting the telephone, data and IP based services to the customers over a line of sight range of approx. maximum 4 km (the range is system frequency not only dependent).

The Alcatel LMDS key sub-system features are:

- Cellular type network interconnected with PSTN/ISDN/PLMN/Leased-Lines/Broadband networks.

- Base Stations with split mounted indoor-outdoor architecture.

- Terminal Stations with split mounted indoor-outdoor architecture, and the possibility to connect several Network Termination (NT: Indoor Units) to the same Radio Termination (RT: Outdoor Unit).

A simple network is made up of:

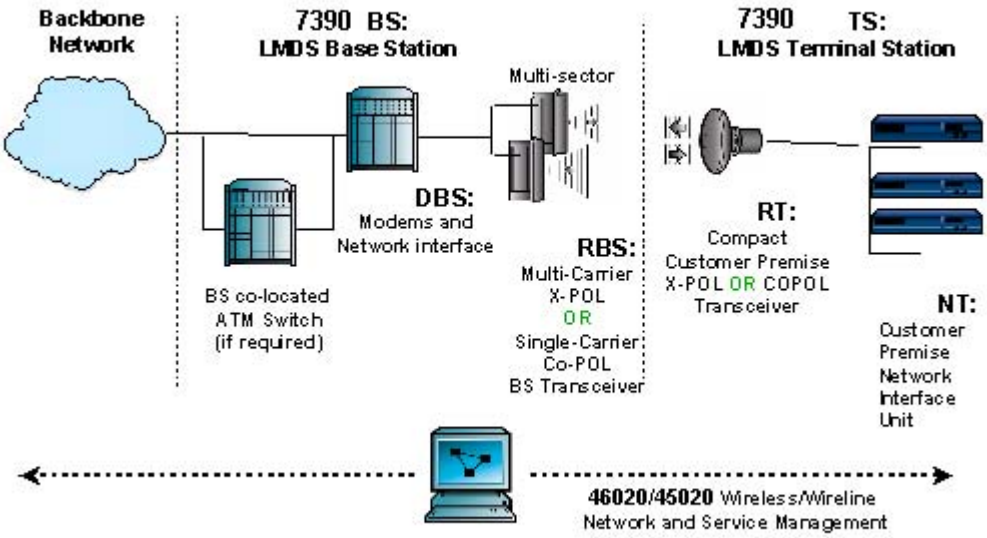
- multiple Terminal Stations: Each customer is equipped with a TS which provides the access and adaptation required for the system, customers are installed using unobstructed, clear Line-of-Sight (LOS) radio links to the respective host base station.

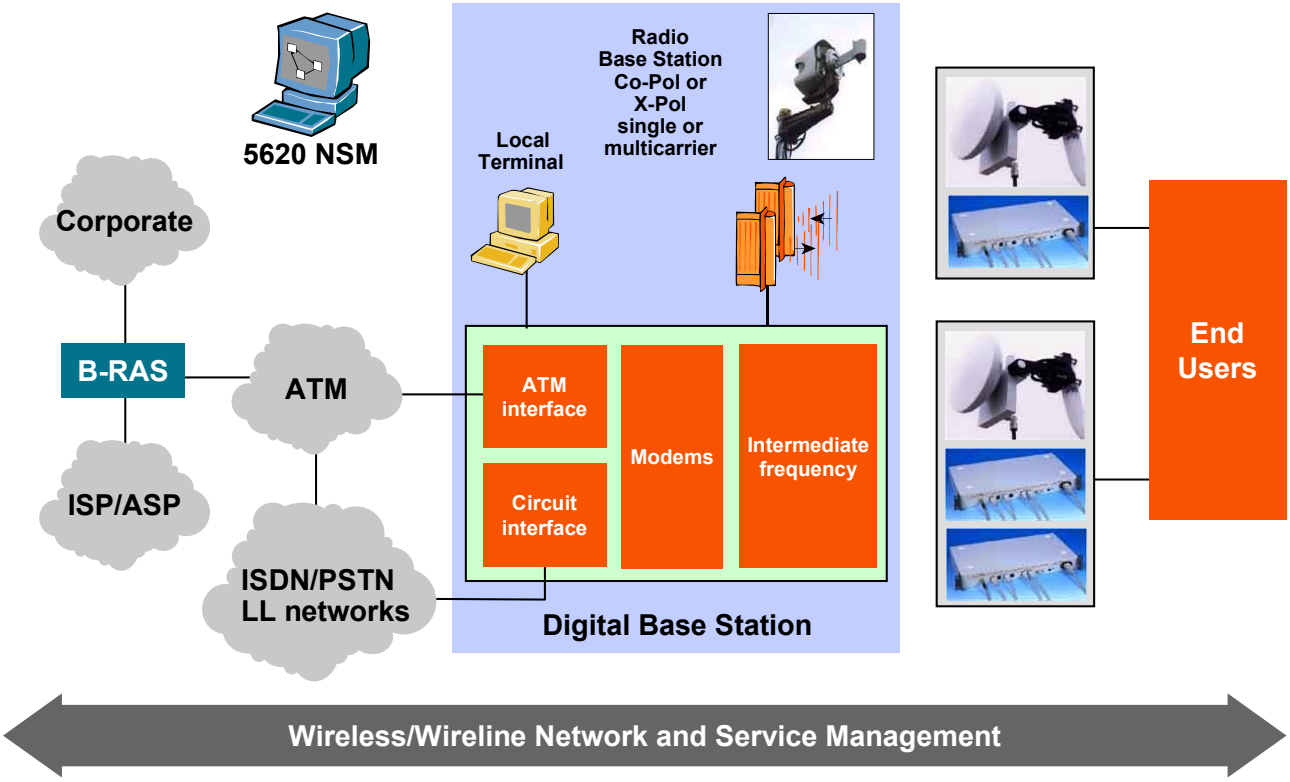
- a Base Station: The BS serves many TSs from a central location with line of sight to the TSs. The BS provides the appropriate interfaces between the radio access and the backbone networks together with the management centre,

- a Management Center common to multiple cells. The management center provides the interfaces for the operator.

2.2.2 - Hardware description

The figures below shows the system block diagram:


Backbone Network
7390 BS:
LMDS Base Station
Multi-sector
DBS:
Modems and Network interface
RBS:
Multi-Carrier X-POL OR Single-Carrier Co-POL BS Transceiver
BS co-located ATM Switch (if required)
7390 TS:
LMDS Terminal Station
RT:
Compact Customer Premise X-POL OR COPOL Transceiver
NT:
Customer Premise Network Interface Unit
46020/45020 Wireless/Wireline Network and Service Management



The system consists of three main different location types:

- " **Terminal Station**", which contains the user equipment
- " **Base Station**", which contains the central equipment
- "**Central Office**", which contains all the components common to the network.

The **Terminal Station** consists of:

- Radio Termination (**RT**) including the directional transmit/receive antenna and the Radio Frequency (RF) transceiver unit. The customer site dish antenna (either a 30cm or 60cm version) provides system gain and directivity. The RF unit is bidirectional, enabling it to access the BS.

Co-POL RT

X-POL RT

- Network Termination (**NT**) which provides the power and coaxial interconnection to the RT: it acts as the interface between the modulated data on the radio channel and the end-user's terminal equipment. It provides a range of interfaces to the end customer, such as ISDN/POTS, nX64k, T1/E1, Clear T1/E1, ATM, 10 BaseT and Premium 10/100 Base T. The NT connects to the RT via coaxial cable, which can be repeatered with amplifiers if necessary to cater for up to 200m cable runs at the customer premise. Upto 8 NTs can be connected to a single RT through a series of amplifiers and passive splitter networks.

Network Termination

FRON T VIEW

REAR VIEW

The range of NTs will be expanded to support a QUAD E1/T1 configuration, a premium Ethernet 10/100 Base T interface will also be supported for multiple QoS, VLAN and traffic policy services.

The larger multiple tenant/multiple business unit market place requires a specific NT with high fan-out of voice, T1/E1 and 10/100 Base T interfaces. The Alcatel MDU/MBU 250 will provide the service provider with a high density multi-service NT with expansion for integral VPN, NAT and Firewalling support at the customer premise. The 250 is planned to support xDSL interfaces at the customer site to allow for high fan-out residential services, such as high speed Internet access and voice.

The **Base Station** consists of:

- One or more Radio Base Stations (**RBS**), allowing radio communications with the terminal stations. The RBS includes the actual channelized radio element and a sectored antenna. The area to be served by the BS is covered typically by antennas with 90° horizontal beamwidth, four are required for full 360° cell coverage.

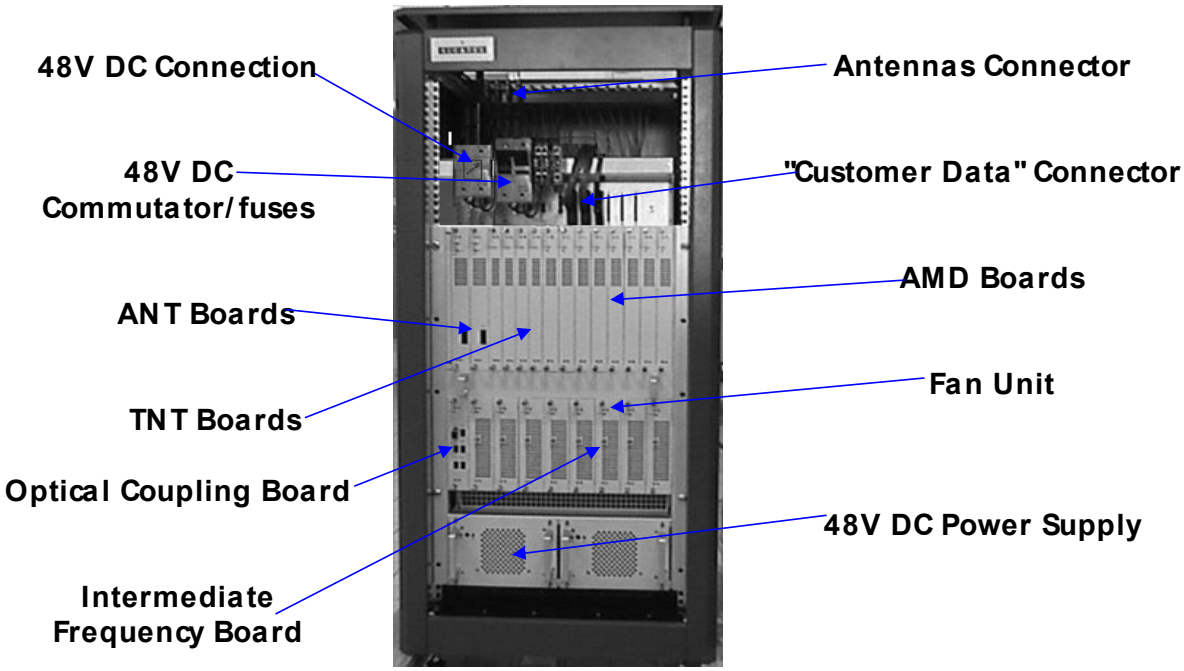
  The radio base station can be supplied as a single carrier system, one modem per radio or multi-carrier system, multiple modems per radio. The decision on whether a single or multiple carrier solution is chosen depends usually depends on the available bandwidth owned by the service provider.

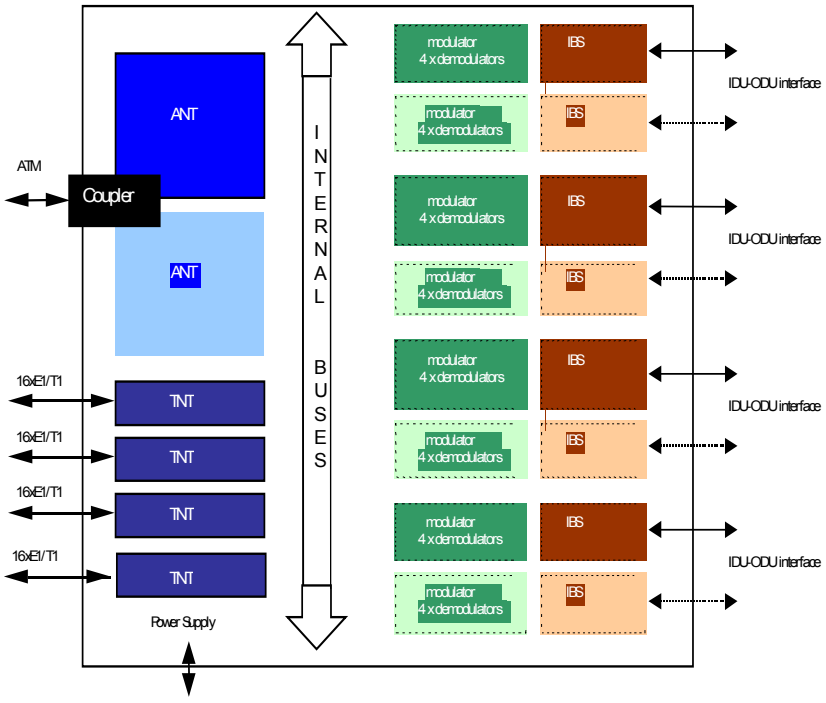
Co-POL RBS

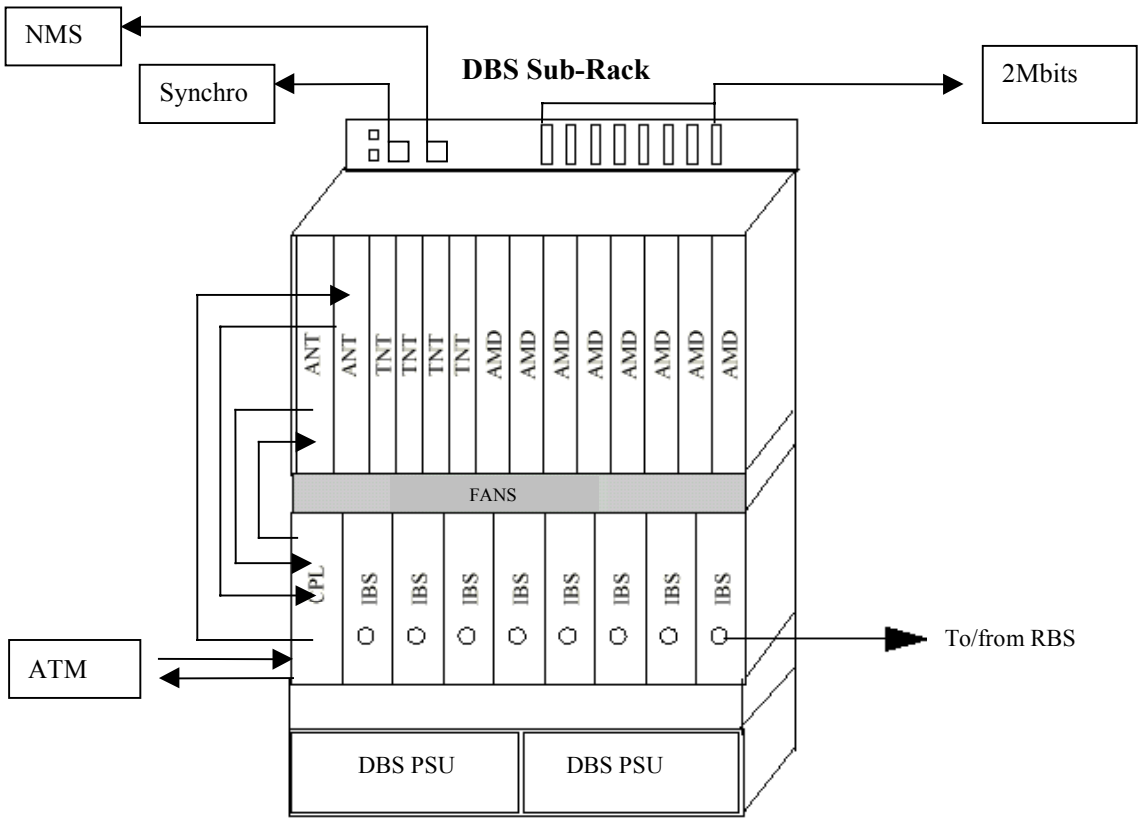
X-POL RBS

- Digital Base Station (**DBS**). The DBS is the interface between the aggregate networking interfaces (e.g. OC3/STM-1, T1/E1) and the external radio element mounted on a tower, mast or building rooftop. The DBS converts either the ATM or TDM datastreams to an intermediate frequency (IF) within the modem section and communicates with the external radio devices.

  The base station design is flexible and scalable, a single base station can be located and connected back to a hub or central site via a range of equipment, point-to-point radio, leased lines, SONET/SDH etc. As the cell site increases in capacity switching equipment can be installed to concentrate and switch traffic from multiple base stations. Alcatel can provide a complete end-to-end solution, fully managed by the Network and Service Management platform.


48V DC Connection
48V DC
Commutator/ fuses
ANT Boards
TNT Boards
Optical Coupling Board
Intermediate
Frequency Board
Antennas Connector
"Customer Data" Connector
AMD Boards
Fan Unit
48V DC Power Supply


ATM
Coupler
ANT
ANT
16xE1/T1
16xE1/T1
16xE1/T1
16xE1/T1
TNT
TNT
TNT
TNT
Power Supply
INTERNAL BUSES
modulator
4 x demodulators
IBS
IDU-ODU interface



Central Office Equipment is usually located in the regional central office is the core networking equipment, Alcatel can supply a full range of multi-protocol scalable networking core and edge solutions to complement the Alcatel LMDS access solution.

For switched voice and ISDN Alcatel offer a solution for V5.2 and GR303, concentrating voice switching interafaces as well as a SS7 gateway for an IP based telephony solution.

The design of the network (both RF/Cellular and Core) are integral parts of the systems performance. Alcatel offers complete end-to-end design of city (single or multi) networks which allow the customer to meet required performance goals needed to properly support applicable business cases. This includes coverage, frequency reuse, % roof-tops hittable, core network design and capacity analysis, location and design of PoP interfaces, etc.