East West University

Internship Report:

BTS,GSM& 3G Services

&

Network Overview of Grameenphone Bangladesh LTD.

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Declaration:

This is certified by this internship was done by me under the **course Industrial Training, ETE498.It has not been submitted elsewhere** for the requirement for any degree or diploma or for any other purposes for publications.

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ID: 2012-1-55-033

Acceptance

This internship report is submitted to the Department of Electronics &Communications Engineering East West University, Dhaka in partial fulfillment of the requirement for the degree of B.Sc in Electronics & Telecommunications Engineering under complete supervision of undersigned.

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Content

Part-1

INTRODUCTION:

A telecommunication network is a complete technical system for transmission of signals over a distance. There are different kinds of telecommunication networks that may have different structure and may utilize various technologies. The purpose of every kind of telecommunication network is to transmit signals in the network. Transmission of signals is done through different kinds of transmission media. It is possible to differentiate between the types of media depending on how the signals are transmitted and the transmission capacity of the media. The Telecommunications sector includes establishments providing telecommunications and the services related to that activity. The Telecommunications sector is primarily engaged in operating, maintaining and providing access to facilities for the transmission of voice, data, text, sound, and video. A transmission facility may be based on a single technology or a combination of technologies. Establishments primarily engaged as independent contractors in the maintenance and installation of broadcasting and telecommunications systems are classified under Construction. The mobile communications industry has been one of the most flourishing sectors within the ICT industry and, in general, within the economy. Grameenphone is the biggest mobile phone operators in our country and their contribution is very great to our economy in the field of telecommunication.

ORIGIN OF THE REPORT:

- Internships are of vital importance to engineering students who prepare for careers in private industry, consulting, government and research. Internships bridge the gap between theory and practice, and provide students with practical, field-based, real-world experiences during their years of study.

- It enables a student to compare theoretical ideas learned in the classroom within the world of work.

- I have prepared this report after the three months internship program in Grameenphone ltd. This report is based on "Base Transceiver station (BTS) at Grameenphone. I have also covered information regarding the organizational overview and what I did and learned every-day in Grameenphone Ltd.

OBJECTIVE OF THE REPORT:

There are two kinds of objectives on this report. They are:

- **Broad Objective**

&

- **Specific Objective**

BROAD OBJECTIVE:

The main objective of the report has been done to show the total working procedure of Base Transceiver Station, fibber, etc at Grameenphone Ltd.

SPECIFIC OBJECTIVE:

The specific objectives of this internship report are:

- focusing on the overview of Grameenphone Ltd
- focusingon the work environment, employee behavior and have a quick glimpse of the corporate culture of Grameenphone Ltd.
- focusing on how does the total networking management system worked.
- focusingon the recruitment and selection process of Grameenphone and learn how this process takes place in reality

SCOPE OF THE REPORT:

This study was undertaken aiming to know about the operation and maintenance of Base Transceiver station(BTS). The scope of this study includes reviewing the technical, commercial and customer service quality of Grameenphone and identifying tolls and techniques used by Grameenphone to achieve remarkable performance level. Moreover, I have been worked under system operation and system protection unit in Grameenphone and thus provide me the way to get myself familiarized with the official environment for the first time. I had an experience by working in the department. I had the opportunity to have close view of their activities. The area of concentration of this report is confined in investigating different aspect of implementation technical division

METHODOLOGY:

We know that research method is 2 types, Qualitative and Quantitative research method. I Used for my report Qualitative research method. Qualitative research method applied for getting any result or making decision.
This report was prepared in a systematic manner. My academic supervisor assigned the topic of the report. All the information was collected from two sources:

1. PRIMARY SOURCES:

I interview with the sub-center manager face to face in several times, he gave me all the necessary information that I needed. In addition I have also gathered information by observing and by participating in recruitment and selection process.

2. SECONDARY SOURCES:

I browsed the internet for as much information I could get. From the internet I got the background information of the company

LIMITATION:

Disclosing of much information is confidential. For that reason I was unable to disclose forms that they use in the time of joining or what kind of information they keep in their personnel file. In the following chapter I have given a glimpse of GP - their mission, vision, principles, purpose, products, shareholders etc. This will help us to know about Grameenphone in a broader way.

PART-02

History of the Organization

AN OVERVIEW OF THE ORGANIZATION:

Grameenphone launched in 1997, Grameenphone was the first Telenor venture in the Asian telecom market. Telenor and its partners have boosted network capacity and extended coverage to new and often remote areas, connecting millions of previously unconnected people.

Grameenphone Ltd., the largest telecommunications service provider in Bangladesh, received its operating license in November 1996 and started its operation from March 26, 1997, the Independence Day of BangladeshGrameenphone now provides voice, data and other value-added services on prepaid and contract bases. Grameenphone has been a pioneer in bringing innovative mobile-based solutions to Bangladesh. Notable among these are the Healthline, a 24-hour medical call center manned by licensed physicians, Mobicash, for electronic purchase of train and lottery tickets, and BillPay for paying utility bills through mobile phones, Mobicash also allows mobile-to-mobile funds transfers with certain handsets.

Other initiatives include Online Schools, which uses video conferencing technology to impart high quality education in remote areas, the provision of internet facilities for 250 rural schools and the establishment of over 330 community information centres across Bangladesh. These centers bring affordable internet access and other information-based services to people in rural areas.

Grameenphone launched a new, refreshed logo in November 2006. The logo expresses the values Grameenphone is known for: trust, reliability, quality and constant progress. It also signals the company's continued focus on securing the best possible communications services for its customers. It reflects the continuous efforts to evolve the organization and its dynamics to serve the customers even better in the future.Now, after 18 years of successful operations, Grameenphone is the largest mobile phone service provider in Bangladesh, with more than 55 million subscribers as June 2015. The Company was successfully listed on the stock exchanges in November 2009- after completion of the largest IPO in the history of the Bangladesh capital

market.As at 31 March 2015, Grameenphone had 52 million subscriptions, while the estimated mobile penetration (SIM cards) and number of inhabitants in Bangladesh were 73.7% and 167.9 million, respectively.

COMPANY MISSION:

Grameenphone is the only reliable means of communication that brings the people of Bangladesh close to their loved ones and important things in their lives through unparalleled network, relevant innovations & services.

COMPANY VISION:

Grameenphone's vision is always there to help the customers get the full benefit of communications services in their daily lives. They want to make it simple for the customers to get what and when they want it.

COMPANY'S OBJECTIVES:

Grameenphone (GP) has been established to provide high-quality GSM cellular service at affordable prices. Grameenphone has a dual purpose: To receive an economic return on its investment
To contribute to the economic development of Bangladesh where
telecommunications can play a critical role The Company has developed its strategies so that it earns healthy returns for its share holdersand at the same time, contributes to genuine development of the country. This is why Grameenphone, in collaboration with Grameen Bank and Grameen Telecom, is aiming to place one phone in each village to contribute significantly to the economic benefit of the poor. It is on the way to get a total uprising in the telecommunication field.

COMPANY'S STRATEGY:

Grameenphone Limited's strategy was to effectively become the second national operator in Bangladesh. Instead of focusing on a high-end, niche market; it pursued a low tariff strategy designed to compete directly with BTTB

COMPANY'S VALUE:

Grameenphone believes that they are sensible. Everything they create is easy to appreciate and use as they never fail to remember that they are trying to make their customers' lives easier.

Grameenphone believes that they are imaginative. They convey energy and thoughts to their network. Grameenphone wants to be a collaborator in the progress of our society. They are passionate about our business, customers and country.

Everything Grameenphone set out to do should work. If it does not, they are there to putting right. They are about delivery, not over promising - actions not words.

Grameenphone shows acknowledgement and admiration the local culture. They are courteous and professional in regard to all interactions, both internally and externally. They are open, helpful and friendly.

PART -3

Microwave link PNMS (Paso link Network Management System)

SYSTEM DESCRIPTION:

On this part gives the detailed description of the equipment features and subsystems that have not been given in the previous part. Information given in the following is:

a. Components andFunctional description.
b. IDU functional description.
c. ODU functional description.
d. Networkmanagement system.
e. System- management unit.

COMPONENTS AND FUNCTIONAL DESCRIPTION:

On this paragraph summarize the equipment functions and defines its components from the SW point of view:

1. Functions and configurations
2. IDU and ODU Components:
    a. IDU
    b. ODU
    c. Allowed Equipment Types
    d. Remote Inventory Management

FUNCTIONS AND CONFIGURATIONS:

ULS NE has the aim to multiplexer/DE multiplexer the main tributaries (up to 16 E1 or 1 E3) with different modulation format.

Table: Market, tributaries and modulations forecasted

Market	Tributary	Modulation
ETSI	2xE1	4QAM
	4xE1	4QAM / 16QAM
	8xE1	4QAM /16QAM
	16xE1	4QAM / 16QAM
	1xE3	4QAM / 16QAM

The main functions performed by IDU and ODU of ULS equipment are the following:

Multiplexer/DE multiplexerthe multiplexer function receives main tributaries and generates a PDH frame. The DE multiplexer function receives a PDH frame and generates main tributaries.

IDU AND ODU COMPONENTS:

The ULS NE is composed by two different parts: the indoor and the outdoor part. In the following they are described from physical and management point of view.

IDU:

An IDU, or In-Door Unit, is a telecommunication device that is used in satellite television and Internet service to receive and decode satellite transmissions. An IDU is a box that connects to the user's television and/or router and contains a built-in satellite receiver that may also be connected to a satellite dish on the roof or exterior wall of the user's home. An IDU is responsible for receiving the satellite signals broadcasted by the user's satellite service provider and decoding them in order to provide the user with satellite television and/or Internet access.

How IDU Works:

When a satellite provider broadcasts a transmission, that data is received by a satellite in Earth's orbit and retransmitted to a specific area on the Earth's surface. Any satellite dish in that area that is setup to receive that transmission's frequencies can then receive the transmission and convert it into electrical impulses that are sent to the user's IDU. The IDU can then convert the information into digital data and display it on the user's television screen or pass it through the user's modem and/or router in order to provide the user with Internet access.

Applications:

An IDU is used solely for the purpose of receiving and converting satellite transmissions into usable data for television service and Internet access. While IDUs have been modified in the past to provide users with additional services, such as Pay-Per-View channels or non-related satellite-based transmissions, this is often illegal and may result in loss of the user's regular services if the IDU becomes damaged.

Advantages:

IDUs are advantageous because they sit near the user's television and provide television and Internet access without being exposed to the open environment. IDUs are relatively easy to operate and can provide the user with services such as Channel Guide and On Demand. IDUs are also lightweight and do not usually need to be directly operated in order to provide services to the user.

Fig01: IDU in a BTS room.

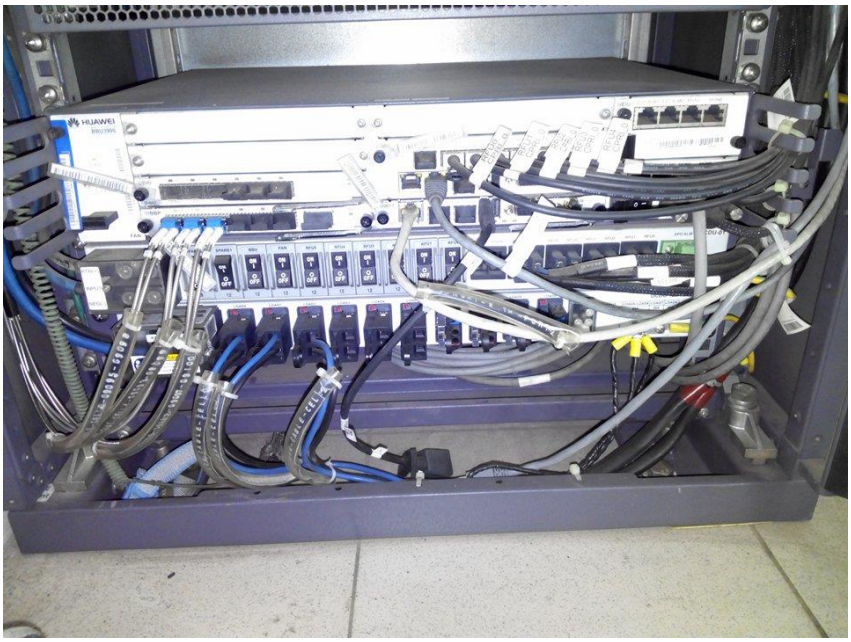


Fig02: IDU in a BTS room.

The Main unit is used both in 1+0 and 1+1 configurations. Software Key (Flash Card) is plugged onto the Main board allowing flexibility in choosing user interfaces. The IDU Extension Unit contains the MONOE (including the Hitless Switch function) and the Power Supply units. Optional 8xE1 or E3 unit (alternative between them) can be plugged onto this Extension unit. The Extension unit is used only in 1+1 configurations.

B ODU:

According to the configuration type, one or two electrical ODU are managed in the Outdoor part. Each ODU contains a PQECRC unit. It implements the ODU controller functions.

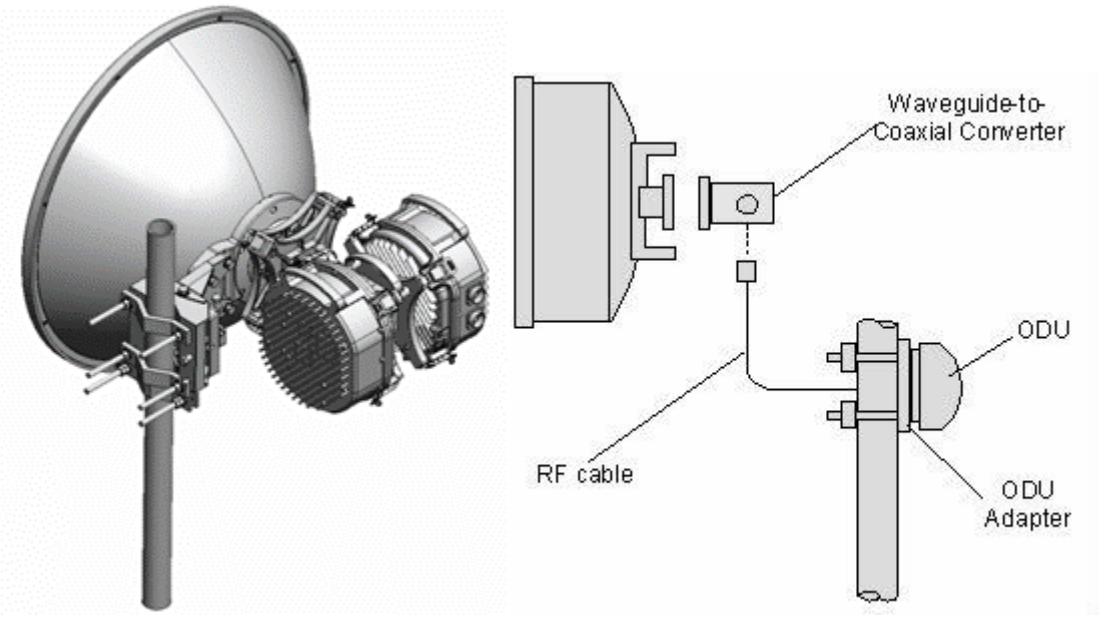


Fig03: ODU with MW antenna in a BTS tower.

KEY FEATURES:

• 6-38GHz frequency bands available

• Supports QPSK and 16 to 256QAM

• Option: standard output power and high output power

• 3.5-56MHz RF channel bandwidths

• Designed to meet FCC, ETSI and CE safety and emission standards

• Supports popular ITU-R standards and frequency recommendations

• Very high frequency stability (+/-2.5 ppm)

• Compact and handy design

• Wide operating temperature range (-40°C to +65°C)

ODU SUPERVISORY UNIT:

The ODUC has in charge the PMMF/U–ODU. This function requires a real time processing of the data coming from the ODU ASIC. The ODUC has the aim to provide a uniform interface towards the EC avoiding an EC dependency from the ODU HW.

Inside the IDU there is one single internal communication interface: the IDU SPI interface.

IDU FUNCTIONAL DESCRIPTION:

INTRODUCTION:

The Indoor Unit (IDU) performs all customer interface requirements both as voice and data:

I. NxE1/E3 for ETSI market
II. NxDS1/DS3 for ANSI market
III. EOW
IV. Service channels
V. OS–TMN

And feeds the Outdoor Unit (ODU) via a single coaxial cable carrying:

VI. Base Band Transmission Signal (from IDU to ODU)
VII. Base Band Receiver Signal (from ODU to IDU)
VIII. ODU Supply Voltage

The IDU is available in 2 configurations:

- 1+0 IDU

IDU MAIN UNIT:

As shown in Figurer, the components of the IDU Main unit are:

- The MONOM unit (the motherboard), which includes:
- The interface for 8E1 tributaries and for all the other channels whose connectors are present on its front plate
- The Mux/Demux (block diagram), which carries out the following functions:

Network Management System

- Multiplexing/DE multiplexing of the signal toward the ODU interface as framed unframed implementing the following processes:

Scrambler/Descrambler

- Coding/Decoding (Reed–Solomon) + Interleaving
- Cable interface functions: cable Interface circuit adds to this signal the ODU supply voltage and ODU connector management information, feeding the "N" connector available on the front panel of the board.
- The microprocessor platform (PQ/ECRC).

- DC/DC converter plug–in board (PSU). It is a module including DC/DC converters and filters. The power distribution for 1+1 systems is described (in 1+0 systems the IDU extension board is not equipped).
- The connector for the flash Card, which stores the SW of the terminal,
- The connectors for an optional tributary plug–in.

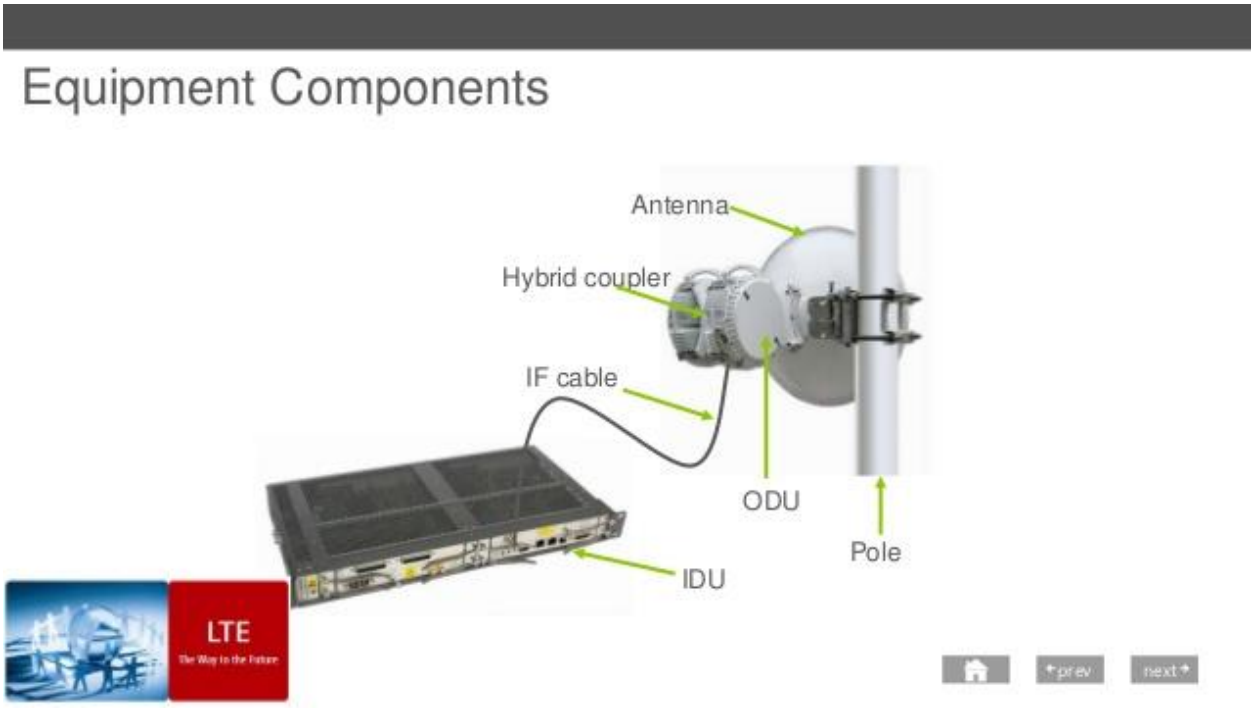


Fig04: Components of the IDU Main unit

- Multiplexing/DE multiplexing of the Tributary signals, and the insertion/extraction from the main stream of the following signals:
- EOW
- Service Channel

IDU POWER SUPPLY UNIT:

The PSU is a plug–in of the Main mono–board and Extension mono–board. The PSU is functionally made up of three main blocks Input Section (IS): common to both LVS and HVS

- Low Voltage Section (LVS): for internal IDU power supply
- High Voltage Section (HVS): for external ODU power supply

And two auxiliary blocks:

- Alarm generation: for external supervision
- Remote Inventory: for factory identification

The following versions are foreseen:

a. Floating (48–60) V nom. ±20%;
b. Floating 24V nom. ±20%

Input is designed as floating, meaning that either plus or minus of battery input could be externally connected to ground input, without affecting any required characteristic or functionality. Following alarms are provided by the PSU Unit and connected to spider's pins:

- Fail IS: IS not working properly or standing input voltage outside the normal service range
- FailLVS: Low Voltage Section (+3,3V and 1,5V) not working properly.

ODU FUNCTIONAL DESCRIPTION:

The Outdoor unit is produced of the following sections:

1. Modem and IF section
2. Local Oscillator
3. Tx IF section
4. Rx IF section
5. RF section
6. Diplexer
7. DC/DC converter

MODEM AND IF SECTION:

CABLE INTERFACE:

The cable interface between IDU and ODU allows carrying over the coaxial cable:

- The transmit and receive data streams (and interface these streams to the modem on ODU side),
- The control signals and service channel.
- The DC power supply from the IDU to the ODU

MODEM SECTION:

The modem section performs the 4 QAM or 16 QAM modulation and demodulation functions, with embedded digital filtering and equalization. It also incorporates the analog to digital and digital to analog conversions.

IF SECTION:

The IF section incorporates the quadrature modulator (respectively the quadrature demodulator) for the up–conversion (respectively down–conversion) to a transmit IF (respectively from a receive IF). It performs base–band filtering and AGC. IF frequencies are variable in order to cope with all frequency spacing.

LOCAL OSCILLATOR:

There is one single Local Oscillator both for transmit and receive RF units.It is electronically tuned, by software, to the requested frequency, providing frequency agility over a quarter of the frequency plan.

DIPLEXER:

The Diplexer separates transmit and receive signals at the RF antenna port.

DC/DC Converter:

The DC/DC Converter provides the DC/DC conversion to generate the secondary voltages from the remote supply voltage. It interfaces with all active modules of the transceiver.

IDU (Indoor Unit):

The IDU incorporates the base–band processing and offers tributaries interfaces as well as service channel and supervision. The IDU is frequency–independent.

As shown in figure up to 2 sub–racks (each of them being 1U high) are used as basic elements to build the following configurations:

- 1+0 this configurations: includes one main IDU unit (height 1U)
- 1+1 this configurations: includes one main IDU unit (height 1U) and one Extension IDU unit (height 1U).

900 MRFU:

In any site of this tower in Grameenphone are used in 900 MRFU module. It is used for 1G Network.In primary level of network this Module are used**.**

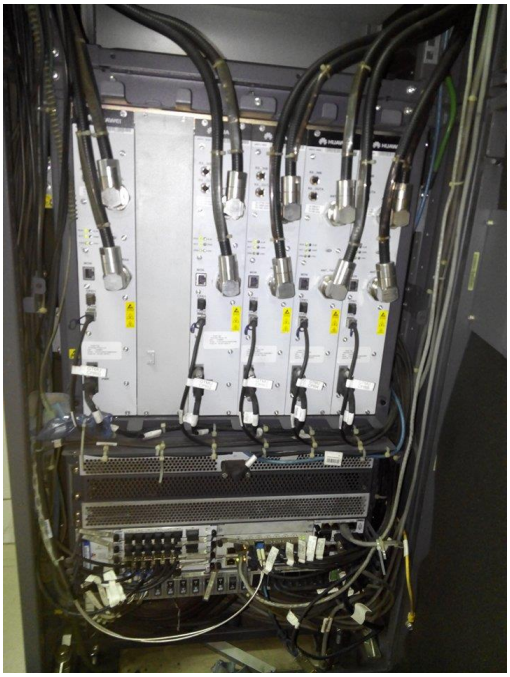


Fig05: 900 MRFU

1800 MRFU:

In 1800 MRFU Module are used for 2G Network. For adding this kinds of module the network are increasing from 1G Network.

2100 MRFU:

In 2100 MRFU are used for 3G.Maximum location of our country are coverage of 3G Network**.**

Fig06: 2100 MRFU

DVS:

DC ventilation system (dvs) is used in every BTS room. It is used for controlling the room temperature. Some times in our country the temperature are increased so much. For this reason it is used so that the temperature are decrease .For protected this equipment's of BTS room this DVS contribute lot of work.

Fig07: DVS at BTS room

ANTENNA CONFIGURATIONS:

The ODU can be connected to:

- An integrated antenna of 30 cm (1FT) or 60 cm (2FT) diameter
- If larger diameters are necessary from a separated antenna, the antenna is interconnected by a flex twist directly to the ODU, or the coupler, depending on the protection used. For the outdoor section different 1+1 configuration can be implemented:

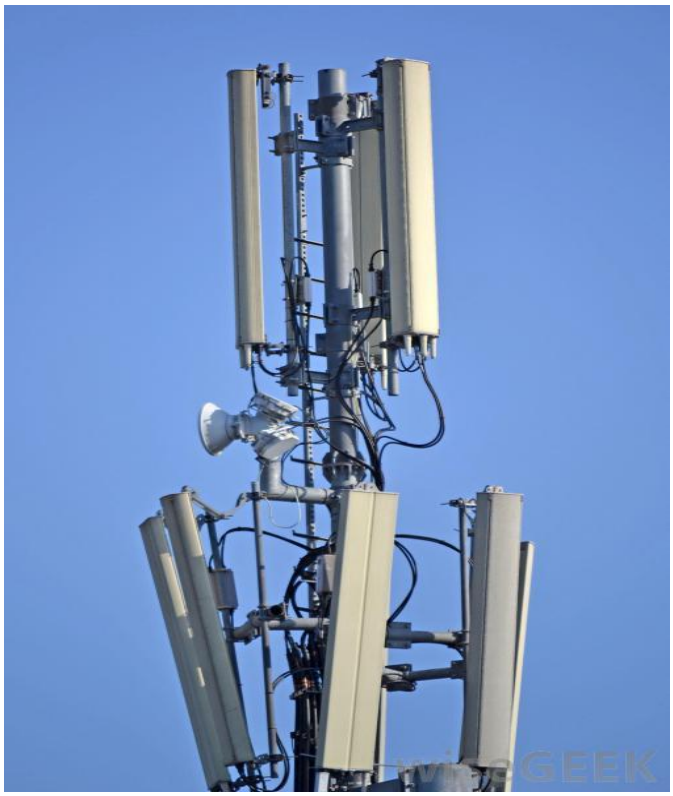


Fig08: ODU with antennas

- Basic HSB with a 1 dB/10 dB asymmetrical coupler and 1 antenna: this configuration optimizes the infrastructure using only one antenna; a 10 dB coupling has been chosen to minimize the losses on the normal path (1 dB only).
- HSB configuration is also available with a 3 dB symmetrical coupler and 1 antenna

MICROWAVE LINK PNMS SOFTWARE UPLOAD:

- After installing the antenna ODU, IDU it is required to install the software indoor unit. This software is called PNMS (Paso link Network Management System) software.

Part-04

Network Management System (NMS)

Definition - What does Repeater mean?

A repeater is a network device that retransmits a received signal with more power and to an extended geographical or topological network boundary than what would be capable with the original signal.

A repeater is implemented in computer networks to expand the coverage area of the network, Repeater a weak or broken signal and or service remote nodes. Repeaters amplify the received/input signal to a higher frequency domain so that it is reusable, scalable and available.

Repeaters were introduced in wired data communication networks due to the limitation of a signal in propagating over a longer distance and now are a common installation in wireless networks for expanding cell size.

Repeaters are also known as signal boosters.

Explains Repeater:

Every operational computer or data communications network has a specific boundary in which it can service the connected and authorized hosts/nodes. It is a planned network scope, but sometimes the network needs to extend its routing domain further to accommodate a new/existing host, or to improve the service level in a specific topological domain. In such scenarios, a network uses the service of a repeater, which amplifies the received signal to an ideal or near-ideal strength so that destination/receiving nodes can receive the data.

The installation of repeaters is critical in those domains, where attenuation and signal loss is very crucial. Repeaters are generally considered to be no logical devices because they propagate every signal regardless of its size, type, etc. Repeaters support both analog and digital signals and can repeat electrical and light-based signals.

Indoor Repeater is designed for indoor operation in the required band. It is designed primarily for network coverage within residential apartments, offices, lifts and small tunnels. Band-specific linear amplifier and IF filtering effectively amplify the desired BTS carriers and provide superior out-of-band rejection. Complete local and remote control & monitoring function is possible via PC or wireless modem with the OMT or OMC. The repeater comes in a sealed, well-ventilated cast aluminum enclosure and is suitable for indoor and sheltered outdoor environment.

Fig09: Indoor Repeater

Mini Indoor Repeater is designed for indoor operations. It is a bi-directional amplifier that is used to enhance signal strength in small-and-medium-sized areas in network. The system gain is compensated automatically according to the temperature variation within the enclosure, which ensures stable operation under ambient temperature functions. It is best suitable for provision of signal coverage within offices and residential apartments.

Fig10: Mini Indoor Repeater

Outdoor repeater is designed for outdoor operation in the required band. Band-specific linear amplifier and filter effectively amplifies the desired BTS signal and provides superior out-of-band rejection. Remote configuration and surveillance is possible through Comba's remote control and monitoring system, via PC or wireless modem to the OMC. The repeater comes in a completely sealed, well-ventilated cast aluminum enclosure, suitable for all weather conditions.

Fig11: Outdoor Repeater

Part-05

Global System for Mobile communication

GSM (Global System for Mobile communication) is adigital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital Wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band. Mobile services based on GSM technology were first launched in Finland in 1991. Today, more than 690 mobile networks provide GSM services across 213 countries and GSM represents 82.4% of all global mobile connections. According to GSM World, there are now more than 2 billion GSM mobile phone users worldwide. GSM World references China as "the largest single GSM market, with more than 370 million users, followed by Russia with 145 million, India with 83 million and the USA with 78 million users."

Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries.SIM cards (Subscriber Identity Module) holding home network access configurations may be switched to those will metered local access, significantly reducing roaming costs while experiencing no reductions in service.

GSM, together with other technologies, is part of the evolution of wireless mobile telecommunications that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio System (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS).

Definition - What does *Base Transceiver Station (BTS)* mean?

A base transceiver station (BTS) is a piece of network equipment that facilitates wireless communication between a device and network.

A BTS consists of the following:

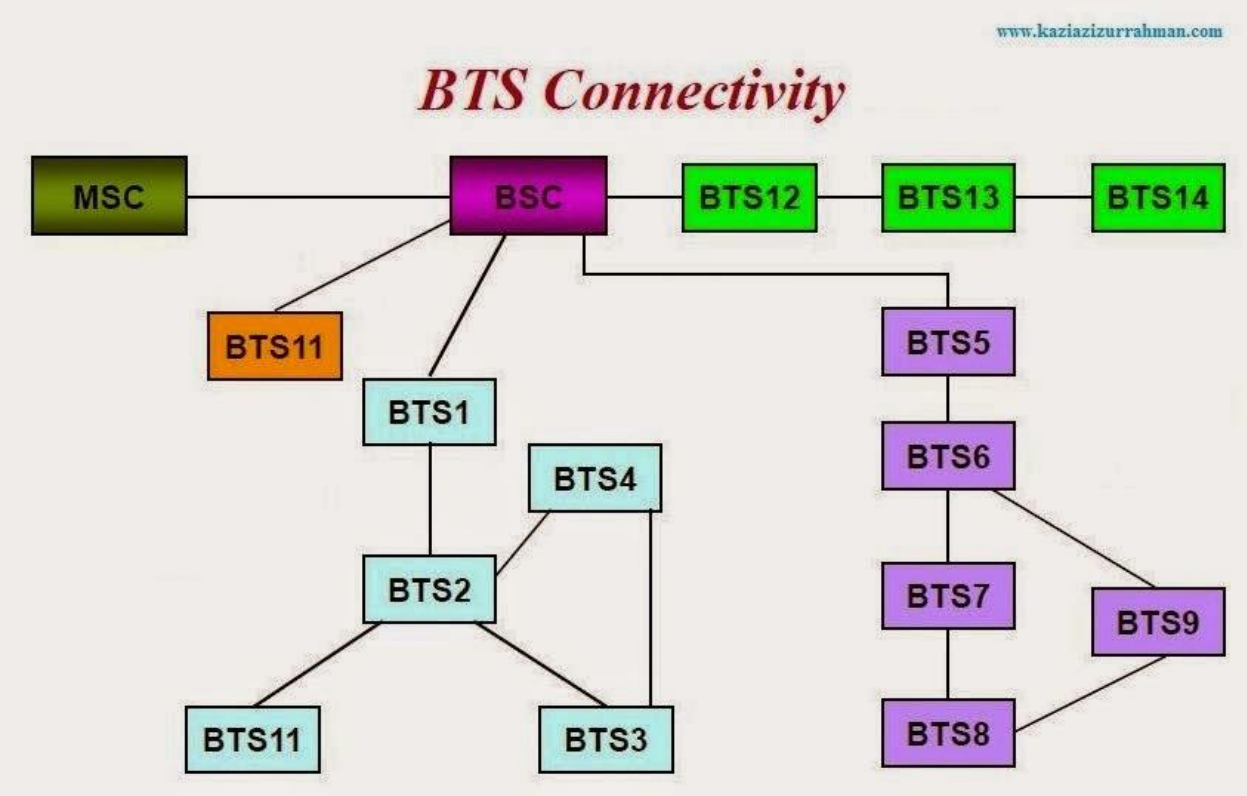
- Antennas that relay radio messages
- Transceivers
- Duplexers
- Amplifiers

Explains *Base Transceiver Station (BTS)*

A network may be any wireless technology, like Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), Worldwide Interoperability for Microwave Access (WiMAX) or Wi-Fi. However, because a BTS is associated with mobile communications technologies, it refers to the equipment that creates the "cell" in a cellular network. Sometimes, an entire base station, plus its tower, are improperly referred to as a BTS or cellphone tower.

As part of a cellular network, a BTS has equipment for the encryption and decryption of communications, spectrum filtering equipment, antennas and transceivers (TRX) to name a few. A BTS typically has multiple transceivers that allow it to serve many of the cell's different frequencies and sectors.

A parent base station controller (BSC) controls all BTSs via the base station control function (BCF) - either a separate unit or integrated with the TRX for compact base stations. The BCF provides a connection to the network management system (NMS) and manages the transceiver's operational states.



GSM Network Architecture:

Definition:

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

Overview:

This tutorial provides an introduction to basic GSM concepts, specifications, networks, and services. A short history of network evolution is provided in order set the context for understanding GSM.

Topics:

1. Introduction: The Evolution of Mobile Telephone Systems

2. GSM

3. The GSM Network

4. GSM Network Areas

5. GSM Specifications

Introduction: The Evolution of Mobile Telephone Systems:

Cellular is one of the fastest growing and most demanding telecommunications applications. Today, it represents a continuously increasing percentage of all new Telephone subscriptions around the world. Currently there are more than 45million cellular subscribers worldwide, and nearly 50 percent of those subscribers are located in the United States. It is forecasted that cellular systems Using a digital technology will become the universal method of telecommunications. By the year 2005, forecasters predict that there will be more than 100 million cellular subscribers worldwide. It has even been estimated that some countries may have more mobile phones than fixed phones by the year2000 .The concept of cellular service is the use of low-power transmitters where frequencies can be reused within a geographic area. The idea of cell-based mobileradio service was formulated in the United States at Bell Labs in the early 1970s.However, the Nordic countries were the first to introduce cellular services forCommercial use with the introduction of the Nordic Mobile Telephone (NMT) in 1981

Cellular systems began in the United States with the release of the advanced mobile phone service (AMPS) system in 1983. The AMPS standard was adopted by Asia, Latin America, and Oceanic countries, creating the largest potential market in the world for cellular.In the early 1980s, most mobile telephone systems were analog rather than digital, like today's newer systems. One challenge facing analog systems was the inability to handle the growing capacity needs in a cost-efficient manner. As a result, digital technology was welcomed. The advantages of digital systems over analog systems include ease of signaling, lower levels of interference, integration of transmission and switching, and increased ability to meet capacity demands.

GSM:

Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. This presented many problems directly related to compatibility, especially with the development of digital radio technology. The GSM standard is intended to address these problems. From 1982 to 1985 discussions were held to decide between building an analog or digital system. After multiple field tests, a digital system was adopted for GSM. The next task was to decide between a narrow or broadband solution. In May 1987, the narrowband time division multiple access (TDMA) solution was chosen.

The GSM Network:

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers.

The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS). The basic GSMnetwork elements are shown in

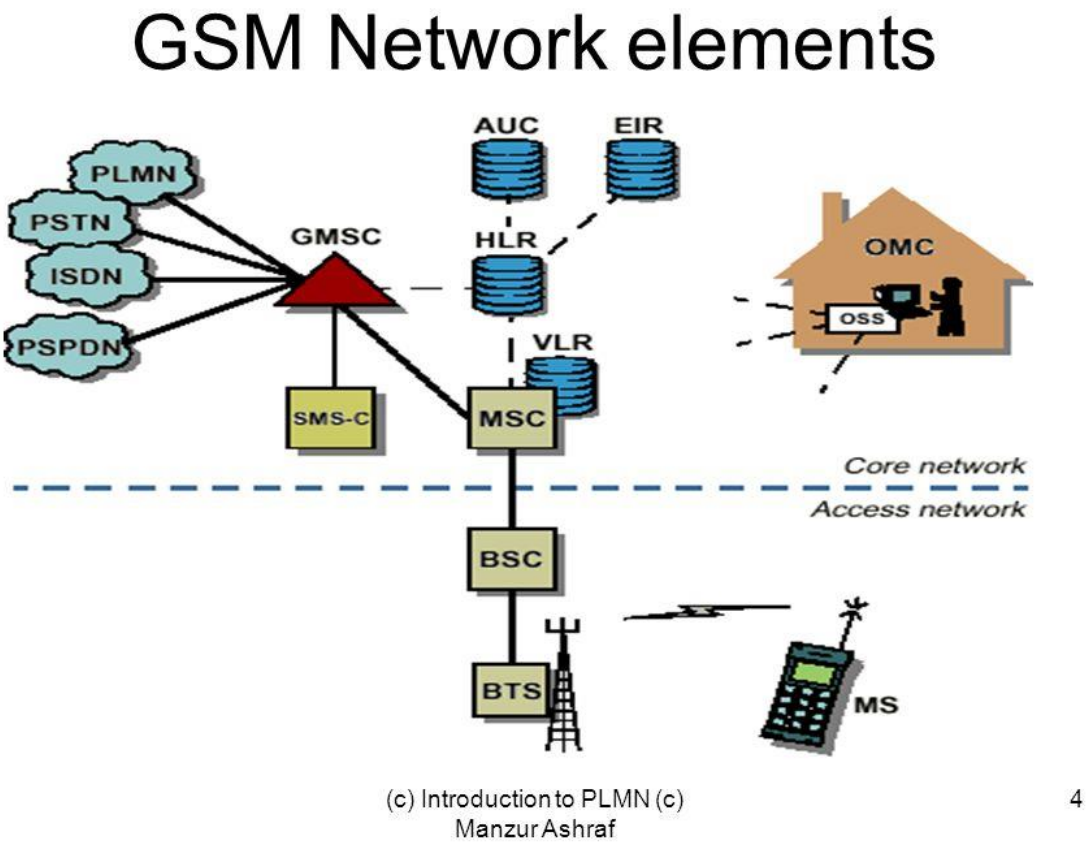


Fig12: GSM Network Elements

The Switching System

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The switching system includes the following functional units:

Home location registers (HLR)—

The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator

Mobile services switching center (MSC)—

The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

Visitor location registers (VLR)—

The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC.Area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

Authentication center (AUC)—

A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

Equipment identity registers (EIR)—

The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

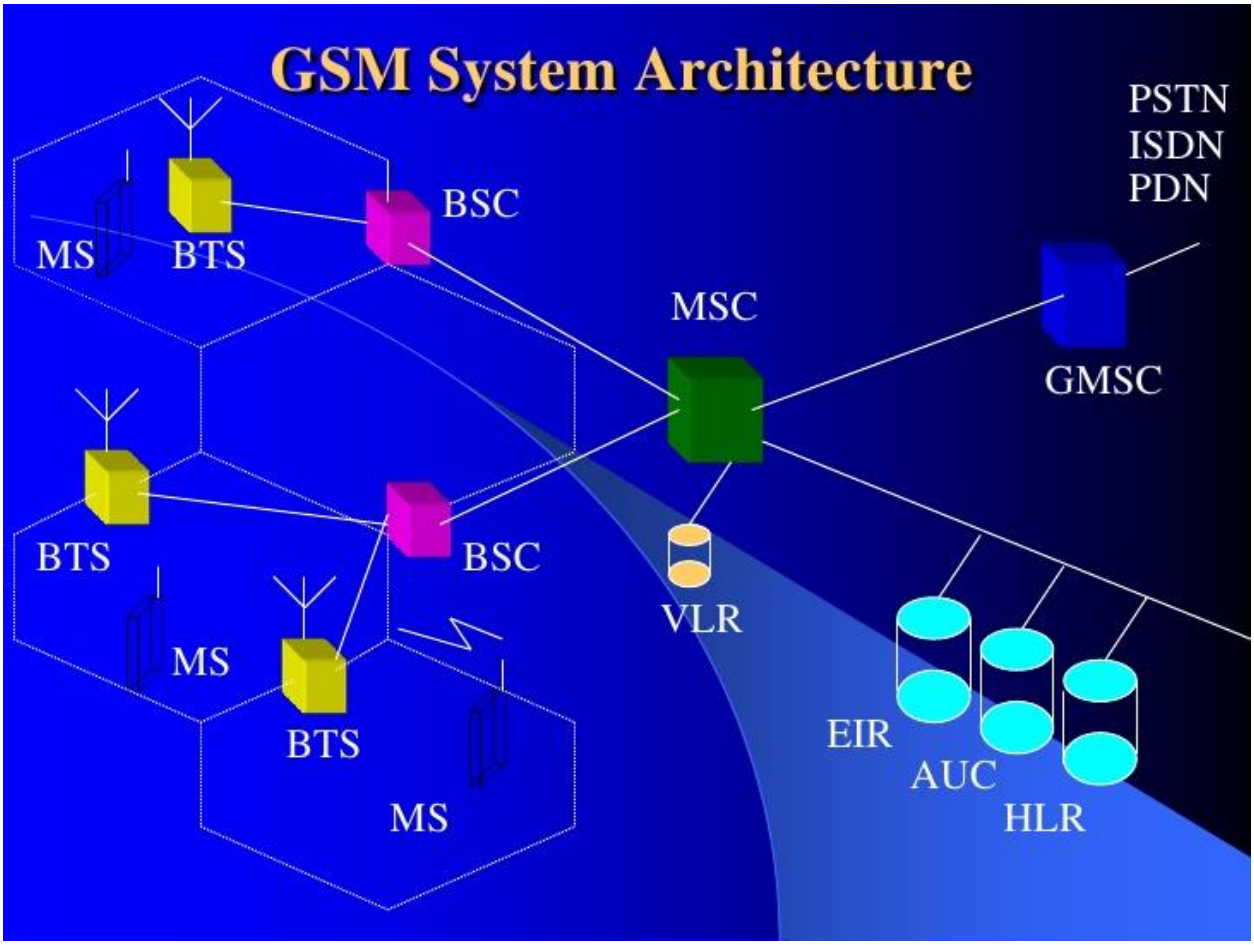


Fig13: GSM System Architecture.

The Base Station System (BSS)-

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTS)

BSC—

The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.

BTS—

The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.

TRANSMISSION NETWORK:

In Telecommunication, Transmission network is divided in to two main parts.

(a) Access Network

(b) Backbone network.

Access Network:

Access network is mostly spar links connecting terminal station to an access point of the Backbone Transmission Network. Mostly low capacity Transmission Equipment are used in the Access Network.

Backbone network.

Back Bone Network is mainly the Core t transmission Network connecting the Main Nodes TAX, Gateway MSC etc of the Network and in which Access Network can merge in.

Base Station System (BSS):

- The BSS is mainly responsible for all radio–based functions in the system.
- It manages radio communication with the mobile units.
- It also handles the handover of calls in progress between cells controlled by the BSC.
- The BSS is responsible for the management of all radio network resources and cell configuration data. The BSS consists of two or three nodes depending on how the functions are implemented, they are
- The BSC (Base Station Controller),
- Transcoder Controller (TRC)

The BSC (Base Station Controller):

The basic functional responsibilities assigned to the BSC are –

- Radio network management
- Radio network performance monitoring
- Operation, maintenance and administration of BTS
- Speech coding and rate adaptation
- Transmission management towards RBS
- Handling of the radio resources during mobile station connection

Transcoder Controller (TRC):

- The primary functions of a TRC are to perform transcoding and to perform rate adaptation.
- Transcoding: The function of converting from the PCM coder information (following A/D conversion) to the GSM speech coder information is called transcoding. This function is present in both the MS and BSS

.

Rate Adaptation: Rate adaptation involves the conversion of information arriving from the MSC/VLR at a rate of 64 kb/s to a rate of 16 kb/s for transmission to a BSC (for Full Rate call). This 16 kb/s contains 13 kb/s of traffic and 3 kb/s of in band signaling information

PART -06

3G Network

3G SERVICES:

3G refers to the third generation of wireless technology.

The 3G network enabled you to make video calls, watch live TV, access high speed internet and enjoy live streaming for an enhanced mobile internet experience

BENEFIT OF 3G:

With 3G you should be able to do the following

- Multimedia streaming & download
- High speed mobile broadband
- Video calling
- Live streaming TV
- Download of large email attachments very fast
- Video call conference

3G DIFFERENT FROM 2G:

Grameenphone 3G is different from 2G. Grameenphone 3G network will run on best in class HSPA technology to give you access to high speed internet, video call and richer multimedia experience within 3G coverage area.

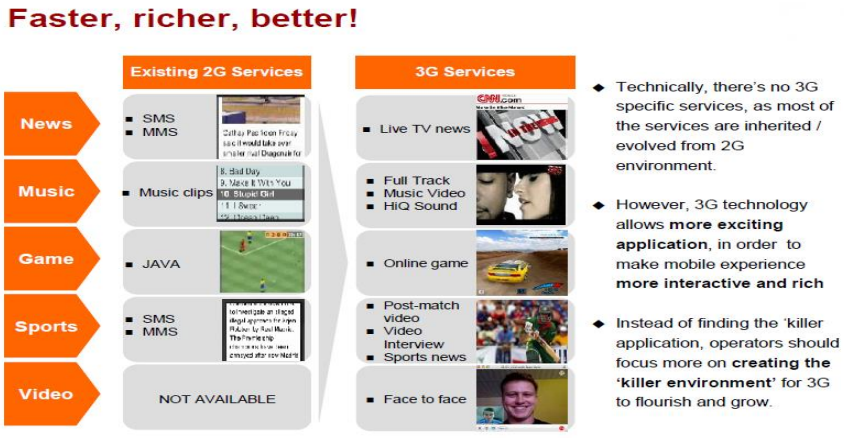
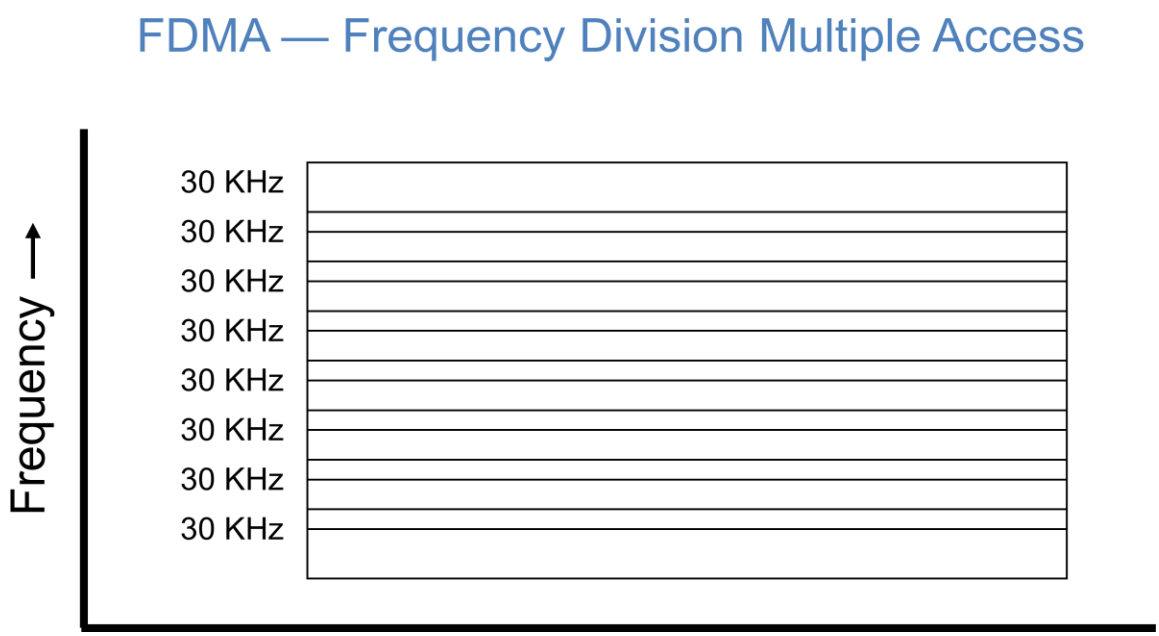


FIG14: DIFFER 3G 2G

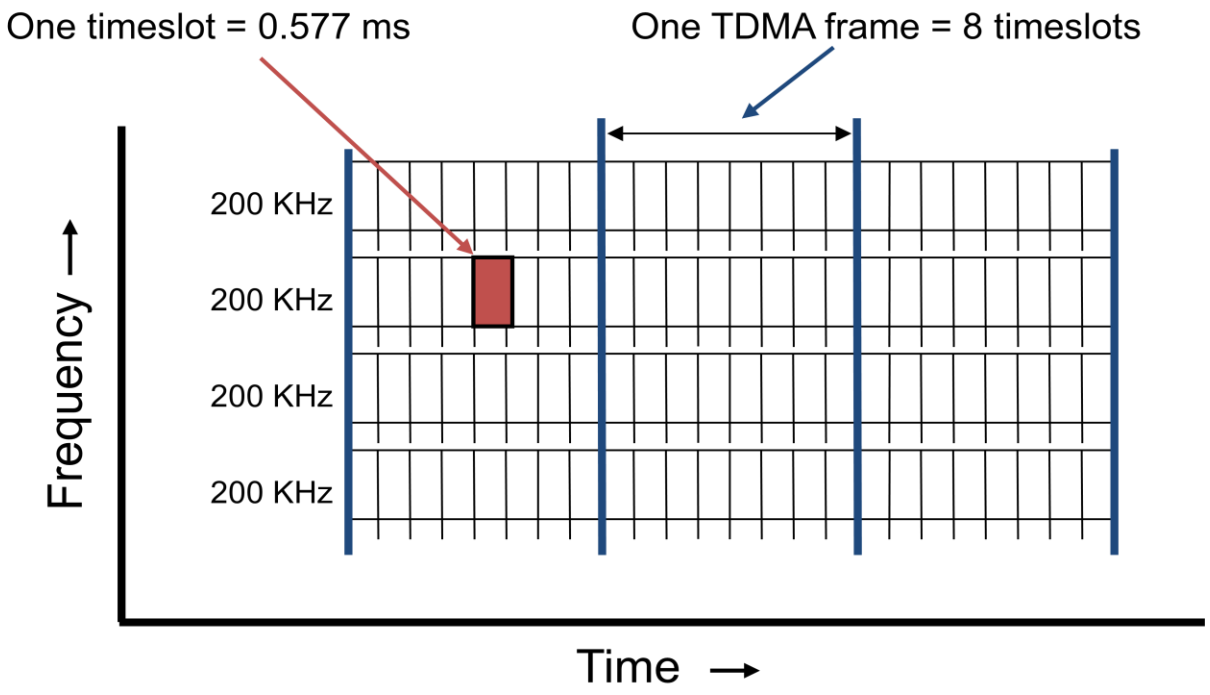
TECHNOLOGICAL EVALUATION OF MODULATION SYSTEMS:

1G — SEPARATE FREQUENCIES:



2G — TDMA:

Time Division Multiple Access:



2G & 3G — CDMA:

Code Division Multiple Access:

- Spread spectrum modulation
  - Originally developed for the military
  - Resists jamming and many kinds of interference
  - Coded modulation hidden from those w/o the code
- All users share same (large) block of spectrum
  - One for one frequency reuse
  - Soft handoffs possible
- Almost all accepted 3G radio standards are based on CDMA
  - CDMA2000, W-CDMA and TD-SCDMA

UNIVERSAL MOBILE TELECOMMUNICATION SYSTEM (UMTS):

• ETSI/ARIB Proposal of deploying WCDMA is largely accepted by vendors like Ericsson and operators like NTTDoCoMO

• It uses GSM Mobile Application Part (MAP) which is a SS7 protocol communicating between 3G and 2G service

• It enables that 2G operation will not be hampered for deployment of 3G

• This proposal is called UMTS and the radio part is called UTRAN (UMTS Territorial Radio Access Network).

• Later a global umbrella for UMTS and CDMA was developed which is called IMT-2000

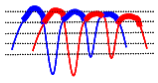
√ IMT-direct spread/ UMTS-FDD

√ IMT-Multicarrier/CDMA 2000

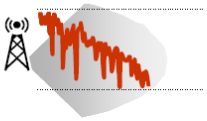
INTRODUCTION TO HSPA:

HSDPA CONCEPT:

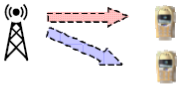
- Max Throughput – 14.4 Mbps
- HS-DSCH
- SF-16
- QPSK, 16QAM
- TTI=2 ms
- HARQ
- New Channel: HS-SCCH, HS-DPCCH
- No Fast Power Control



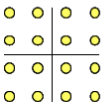
Fast Radio Channel Dependent Scheduling
Scheduling of users on 2 ms time basis



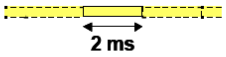
Fast Link Adaptation
Data rate adapted to radio conditions on 2 ms time basis



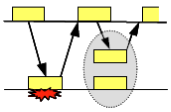
Shared Channel Transmission
Dynamically shared in time & code domain



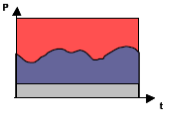
Higher-order Modulation
16QAM in complement to QPSK for higher peak bit rates



Short TTI (2 ms)
Reduced round trip delay



Fast Hybrid ARQ with Soft Combining
Reduced round trip delay



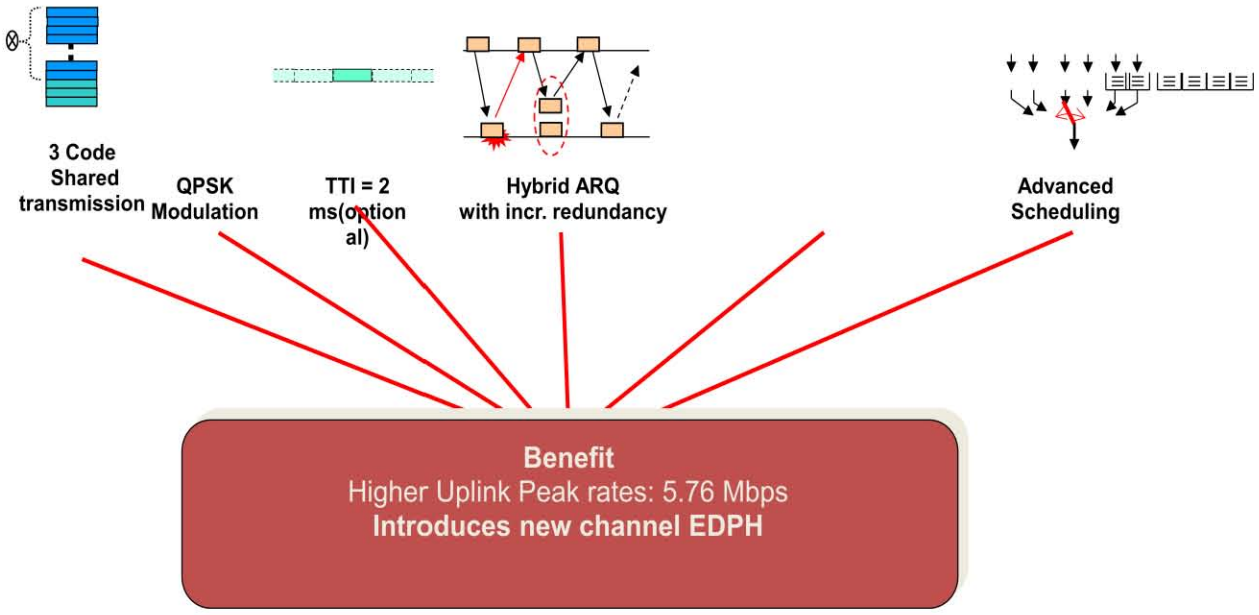
Dynamic Power Allocation
Effecient power & spectrum utilisation

HSDPA:

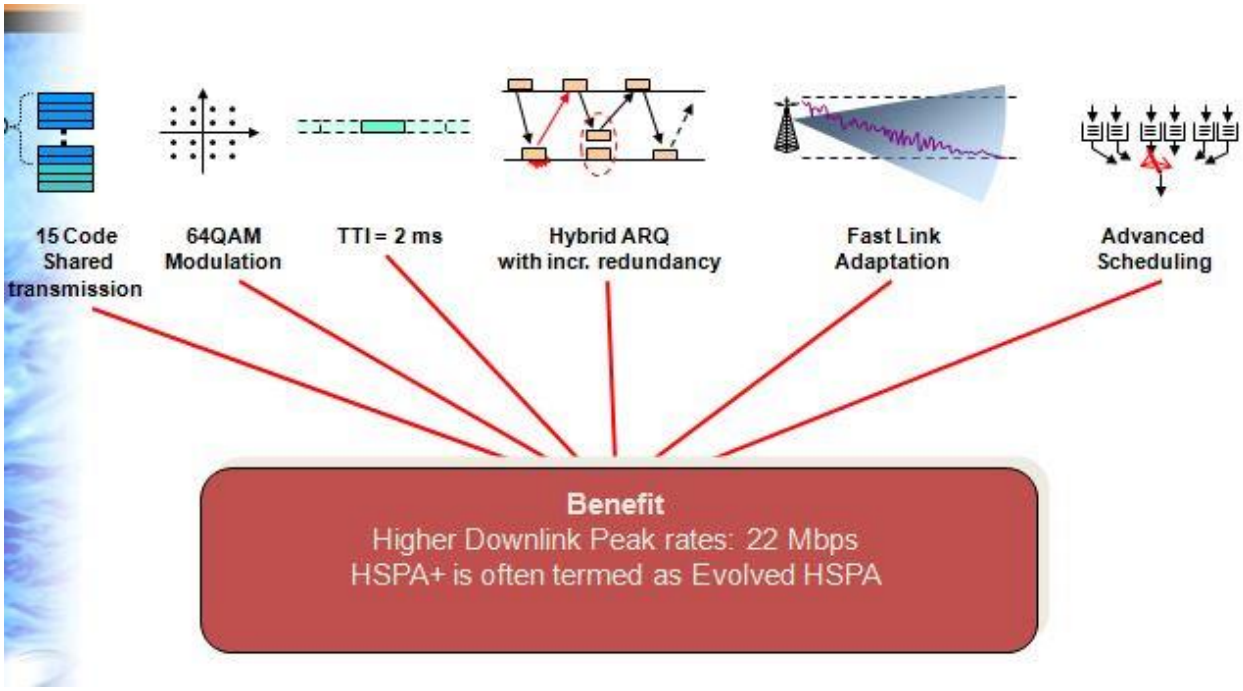
HSDPA (High-Speed Downlink Packet Access) is a packet-based mobile telephony protocol used in 3G UMTS radio networks to increase data capacity and speed up transfer rates. HSDPA, which evolved from the WCDMA standard, provides download speeds at least five times faster than earlier versions of UMTS, allowing users of HSDPA networks a broader selection of video and music downloads. HSPDA specifies data transfer speeds of up to 14.4 Mbps per cell for downloads and 2 Mbps per cell for uploads. In practice, users are more likely to experience throughput speeds of 400-700 Kbps, with bursts of up to 1 Mbps. It is a release 5 feature. It achieves its aim by using the following techniques:

- Use of sharedchannelconcept
  Rather than constantly allocating and deallocating dedicated channels to individual

users,users share a high bandwidthchannel – the HS-DSCH (High Speed Downlink Shared Channel). This allows the system to operate with a “fat pipe”



HSPA+ Overview:



Transmission Media:

Air (Microwave Radio):

- Flexibility +
- Quick installation +
- Sensitive to ambient disturbance. (Rain and Multipath fading).-
- Time and frequency dependent.+
- Modulation /Demodulation.+
- Low bit error (BER) in bursts.+
- Radio license fees.-

OPTICAL FIBER:

1. Immunity to Electromagnetic Interference.

2. Data Security.

3. Non Conductive Cables.

4. Eliminating Spark Hazards.

5. Ease of Installation.

6. High Bandwidth over Long Distances.

COPPER CABLE:

Corrosion.

Shock Hazard.

Low bandwidth (-).

Cost.

Sensitive to crosstalk and noise (-).

Attenuation per Km depends on wire diameter (0.4-1.1mm) and frequency.

Reliable (+)

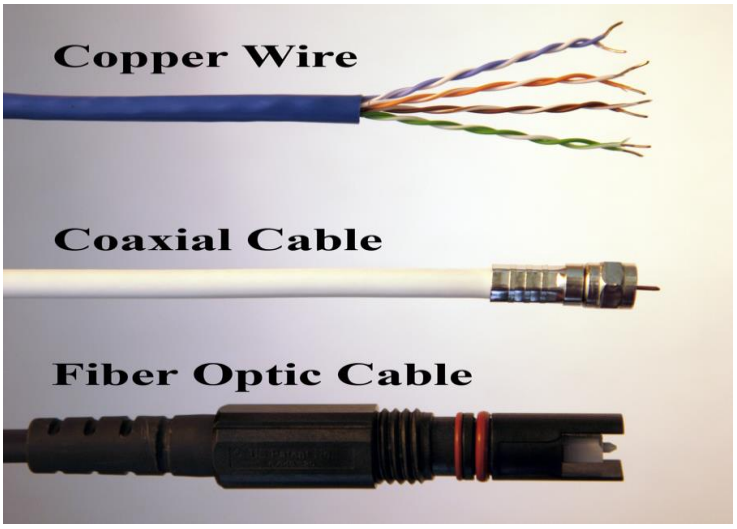


Fig15: Cable wire

Part-07

BTS Visit in Indoor & Outdoor

In my intern period I visited a number of indoor and outdoor BTSs. Indoor BTS all parts of it is separated into a room.But outdoor BTS all parts are along with a box except the antenna.

Some Pictures Shown billow

Indoor BTS

Fig16: IDU

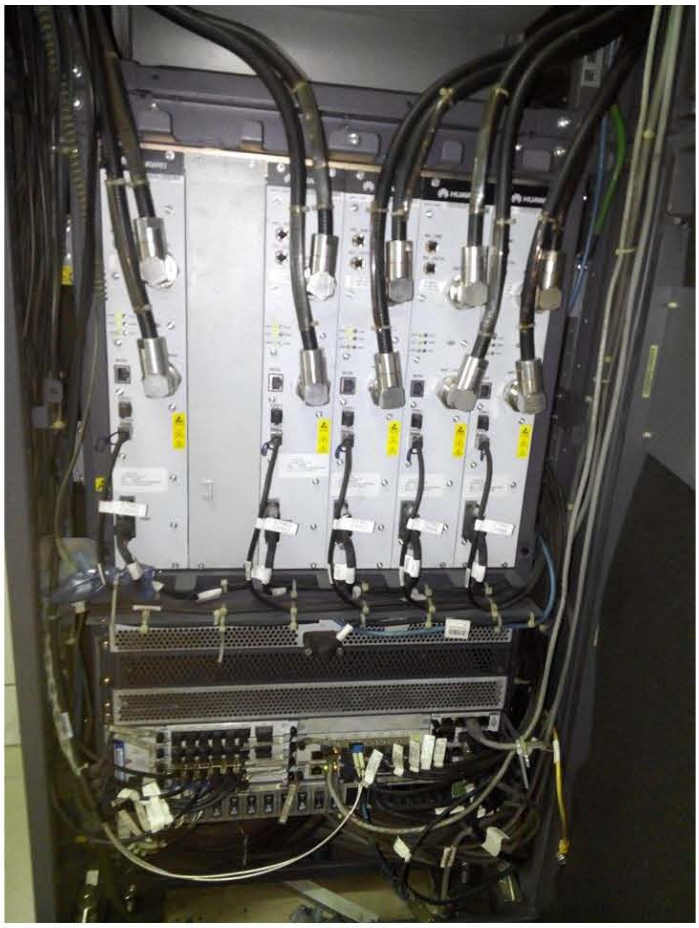


Fig17: MRFU-1800/1900/2100

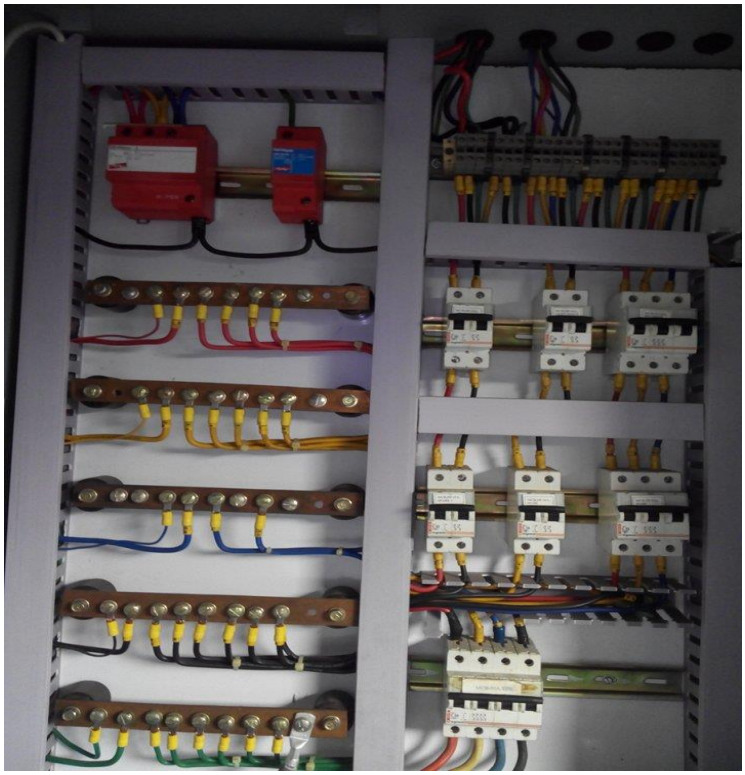


Fig18: AC Power Distribution Cabinet.

Fig19: Rectifier Module.

Fig20: DVS

Fig21: Battery.

Fig22: BTS Cabinet

Fig23: Indoor BTS room

Out-Door BTS

Fig24: BTS Tower.

Conclusion:

On the whole, this internship was a useful experience. I have gained new knowledge, skills and met many new people. I achieved several of my learning goals, however for some the conditions did not permit. I got insight into professional practice. I learned the different facets of working within a Grameenphone .

The internship was also good to find out what my strengths and weaknesses are. This helped me to define what skills and knowledge I have to improve in the coming time. It would be better that the knowledge level of the language is sufficient to contribute fully to projects. After my master I think that I could start my working career. However I could perform certain tasks in research better if I practice and know more the research methodologies applied in cetacean studies. It would also be better if I can present and express myself more confidently.

After above discussion it is apparent that working with Network over view and services is very interesting. Working with a new network and services adds an extra value to my interest and knowledge. Finally I would like to say that, working with Grameenphone Bangladesh LTD experienced me a lot.

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