Study on Transmission network of GSM at Grameenphone Ltd.

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Electronics and Telecommunication Engineering

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APPROVAL

This Project titled “Study on Transmission network of GSM at Grameenphone Ltd.”, submitted by A.H.M.Kamal to the Department of Electronics and Telecommunication Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Electronics and Telecommunication Engineering and approved as to its style and contents. The presentation has been held on *28-8-2012*

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First I express my heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this intern successfully.

I feel grateful to and wish my profound my indebtedness to Md. Taslim Arefin, Assistant Professor, Department of ETE Daffodil International University, Dhaka. Deep Knowledge & keen interest of my supervisor in the field of wireless network influenced us to carry out this project . His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism , valuable advice ,reading many inferior draft and correcting them at all stage have made it possible to complete this project.

My heartfelt gratitude to, **Monirul Islam Rana and AHM Quamrul Ahsan,** ROM, Operations Technology division at GrameenPhone Ltd, for inspiration and necessary support during the preparation of this report, that I had completed. I gratefully thank to **Md Helal Uddin** DGM ROM, and Operations Technology division for always providing me a helping hand.

Finally, I must acknowledge with due respect the constant support and patients of My parents.

DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Md. Taslim Arefin, Assistant Professor, Department of ETE** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Grameenphone Ltd. is the leading mobile telecom operator of Bangladesh with more than 20 million subscribers. It provides of GSM based service. It is a joint venture enterprise between Telenor and Garman Telecom. Telecommunication industry is becoming more competitive with the entrance of new competitor. As competition is increasing in this industry so to hold the leadership position Grameenphone will have to be very much cautious about its sorts of operations. Being an intern of Grameenphone, I prepared this report focusing on "GSM Structure and coverage area of Grameenphone Telecom Ltd."The Grameenphone have been given an opportunity to intensify their rivalry as they battle to win customers in Bangladesh that are to be opened for mobile telephony. Grameenphone now have their network coverage in whole Bangladesh.They are now trying to develop the fiber optic communication system which may play an important role in communication technology. I would like to design the details of GSM Structure.

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CHAPTER 1:

INTRODUCTION

Introduction:

This internship report is originated as a partial fulfillment of the ETE(Electronics & Telecommunication Engineering) of Daffodil International University. This three months internship period has helped us to match our theoretical knowledge with practical understanding .As an intern of GrameenPhone I was provided with the topic "Study on Transmission Network in GSM at Grameenphone Ltd. "will be submitted to Md. Taslim Arefin, Associate Professor Department of Electronic & Telecommunication Engineering.

1.1) Objective of the report:

Primary objective:

To gain practical job experiences and work the application of theoretical knowledge in the real field.

To Know Transmission network & its spare parts management

Secondary objective:

Adjust Corporate level Office

To know about the process of SPM (Spare Parts Management)

1.2) **Methodology:**

The internship program generally starts with visit and observation. However, in respective areas of the study different methods can be used where necessary. In preparing this report some sources were followed as preparing a report about the activities of any telecommunication organization is a difficult and complicated task and no single data is appropriate for preparing the report.

- Discussion with GP Engineers
- Personal observation.
- Site visit
- Employees of GP & from the website.
- Academic knowledge

CHAPTER 2: THEORETICAL BACKGROUND OF CELLULAR NETWORK

2.1) Cellular network standards

0 Generation (radio telephones)

MTA · MTB · MTC · IMTS · MTD

1G

AMPS Family(AMPS · TACS · ETACS)
Others(NMT DataTAC)

2G

GSM/3GPP family (GSM · CSD)
3GPP2 family (cdma One (TIA/EIA/IS-95)
AMPS family (D-AMPS (IS-54 and IS-136))

2G transitional (2.5G, 2.75G)

GSM/3GPP family (HSCSD · GPRS · EDGE/EGPRS)
3GPP2 family (CDMA2000 1X)

3G (IMT-2000)

3GPP family (UMTS (UTRAN) · WCDMA-FDD · WCDMA-TDD)
3GPP2 family (CDMA2000 1xEV-DO Release 0)

3G transitional(3.5G, 3.75G, 3.9G)

3GPP family (HSPA · HSPA+ · LTE (E-UTRA)

3GPP2 family (CDMA2000 1xEV-DO Revision A)

IEEE family (Mobile WiMAX (IEEE 802.16e) · Flash-OFDM · IEEE 802.20)

4G (IMT-Advanced)

3GPP family (LTE Advanced (E-UTRA)

IEEE family (WiMAX-Advanced (IEEE 802.16m)

5G

Research concept, not under formal development.[1]

2.2) Detail of GSM Technology

The important system specifications for the GSM network are:

Frequency band Uplink: 890 MHz – 915 MHz

Downlink: 935 MHz – 960 MHz.

Extended GSM Including 880 - 890 MHz on uplink and 925 - 935 MHz on downlink.

The carrier separation is 200 kHz, (the first carrier at 890.2 MHz)

Access method is TDMA

Each carrier contains 8 channels. This means 8*25000000/200000=1000 channels of simultaneous calls.[2]

2.3) Architecture of the GSM network

A GSM network is composed of several functional entities, whose functions and interfaces are specified. Figure 2.1 shows the layout of a generic GSM network.

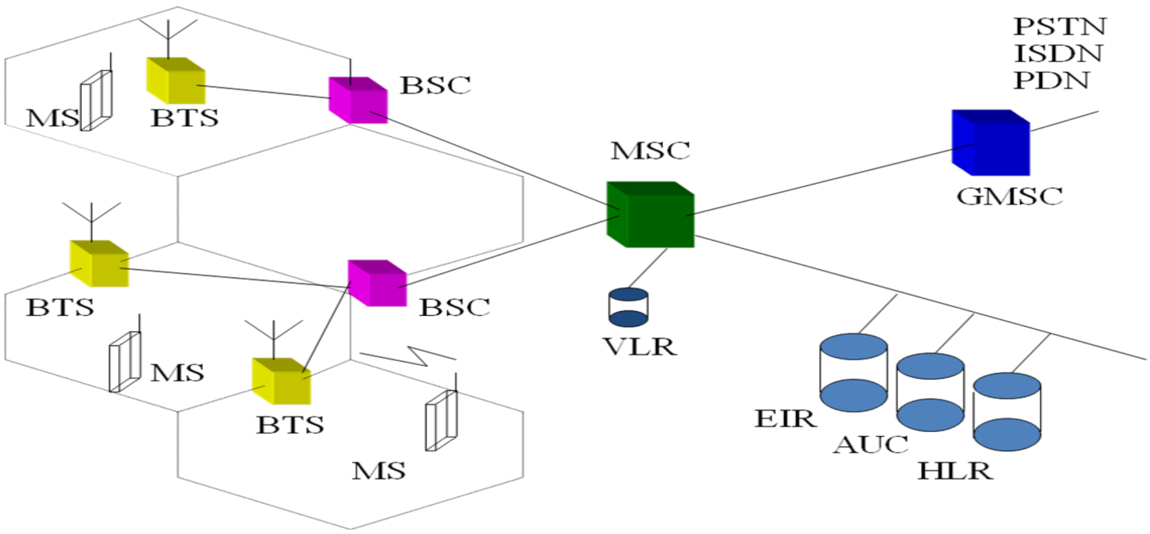


Figure 2.1: General architecture of a GSM network

The GSM network can be divided into three broad parts

The Mobile Station is carried by the subscriber

The Base Station Subsystem controls the radio link with the MS

The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users.

Mobile Station: The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

Base Station Subsystem: The Base Station Subsystem is composed of two parts,

The Base Transceiver Station (BTS) and

The Base Station Controller (BSC).

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages number of BTS. BSC reserves radio frequencies, manages handoff of mobile unit from one cell to another within BSS, and controls paging.[13]

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

Mobile services Switching Center (MSC)—

Mobiles Services Switching Center. Its performs switching, handover, subscriber services and charging

Visitor Location Register (VLR)—

Visitor Location Register. A database belonging to each MSC ,containing a list of all MSs presently being in that MSC's service area. The list includes present location area of the MS and information about subscriber category.

GMSC:

Gateway MSC is an MSC capable of connecting a call from the fixed network to the mobile network.

Gateway MSC is an MSC capable of connecting a call from the fixed network to the mobile network.

Home Location Register (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.

Authentication Center (AUC)—

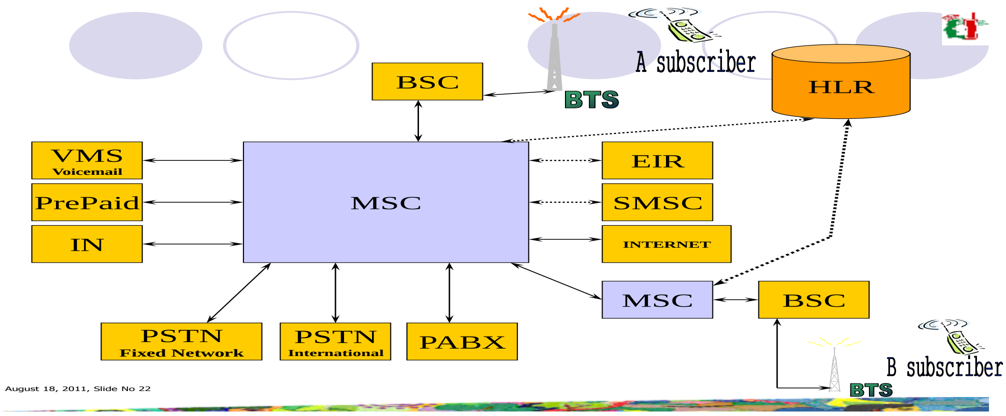
Also there are AUC (Authentication Center) and EIR (Equipment Identity Register). These are databases and are actually protection against fraud.

Equipment Identity Register (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.

2.4) The GSM Call Setup

The following figure shows the whole block diagram of a GSM network infrastructure along with the role and connection of BTS,BSC,MSC (mobile switching center),etc. when a call is made from one subscriber to another :

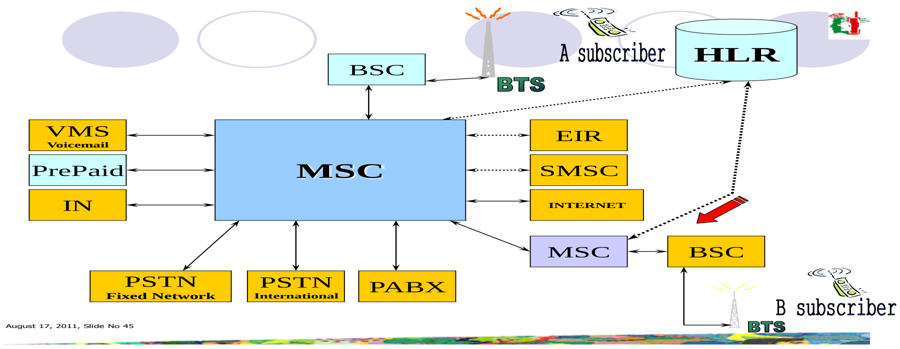


Fegure 2.2: The GSM call setup 1

The following steps are followed in the GSM network when Subscriber A uses his/her MS to call Subscriber B's MS :

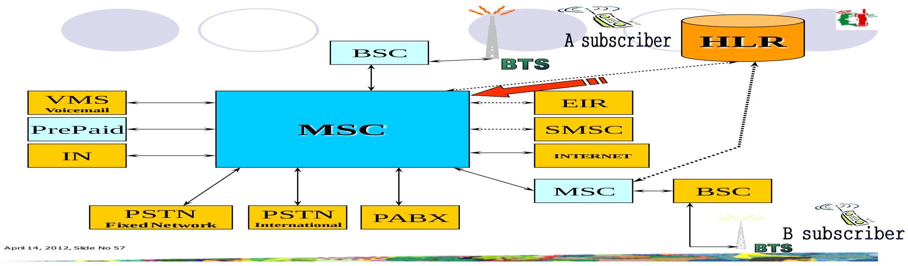
- When a call is made from Subscriber A's cellular phone, the signal is received by the **BTS**.
- The call request reaches the **BSC** from the BTS and is forwarded to **MSC**. After call is established, the BSC will perform decoding of the call (in typical config.)

- The MSC checks the number of subscriber A number and to whome he or she is calling (i.e. the number of subscriber B).
- For example, suppose Subscriber A has GP prepaid account then the call request wil be sent from the MSC to th **PrePaid Node**. The Prepaid Node checks if Subscriber A has any money left on his/her account, when the call is established and if its on-going. The subscriber's account is decremented accordingly.
- The signal is then passed back to the MSC, which interrogates the **HLR** (Home Location Register) of Subscriber B's number.
- The HLR responds by searching and identifying location of the B subscriber i.e. which **VLR**(Visitor Location Register) its belongs to.
- The HLR requests this VLR to pass a visitor address for this subscriber(i.e. the roaming number).
- The HLR then passes the signal to the other MSC (hosting MSC) or VLR which returns a temporarily assigned visitor/roaming address for Subscriber B back to the HLR (as shown) :



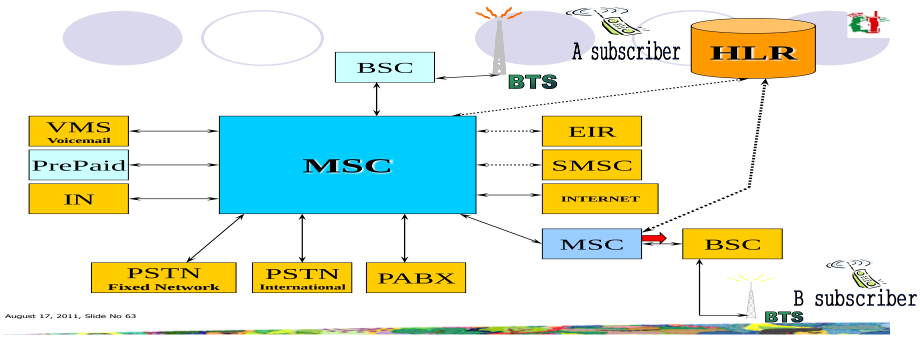
Fegure 2.3: The GSM call setup 2

- The HLR acknowledges receiving the address and sends it to the MSC as requested :
- The MSC recives and confirms to set up the speech connection path towards the hosting MSC/VLR where the B subscriber is presently located.



Fegure 2.4: The GSM call setup 3

- The hosting MSC Sets up a speech connection towards BSC and delivers Subscriber B's ID to **BSC**(Base Statiton Controller) and asks to page for the subscriber using that ID(as shown):



Fegure 2.5: The GSM call setup 4

- The BSC now sends a paging message to all the BTSs that it covers and controls.
- This is done when the BSC carries the paging response from the called MS(mobile station) back to the MSC. It also allocates a radio channel through a BTS with best available and allowable signal strength for the called MS. Finally it performs speech coding when the call is established.
- Subscriber B now has all the following choices:

  (i)He/she may answer the call and Subscriber A hears him/her.

  (ii)He/she may reject the call.

(iii)He/she may be busy with another call and still can hold or answer the new call if he/she has multi call option with his/her subscription and mobile (MS).[8]

2.5) Handover

In a cellular network, the radio and fixed links required are not permanently allocated for the duration of a call

Changing to a new traffic channel during call set-up or busy state is called handover.

GSM uses mobile assisted handover (MAHO), which means that the MS assist by measuring the signal strength and transmission quality of the traffic channel in use, and also the signal strength neighboring base stations.

MS reports those measurement values to the BSC.

The BS is also measuring on the active channel, this measuring and reporting is continuously going on when the MS is busy.

There are four different types of handover in the GSM system, which involve transferring a call between:

- Channels (time slots) in the same cell
- Cells (Base Transceiver Stations) under the control of the same Base Station Controller (BSC),
- Cells under the control of different BSCs, but belonging to the same Mobile services Switching Center (MSC), and
- Cells under the control of different MSCs.

2.6) Modulation

- The modulation method used in GSM is Gaussian Minimum Shift Keying, (GMSK).
- It is a digital modulation form, i.e. the information to be sent is digital. It could be data or digitized speech.
- The modulator could be looked upon as a phase modulator. The carrier changes phase depending on the information bits sent into the modulator.
- GMSK includes the desirable feature of a constant envelope modulation within a burst. To get smooth curve shapes when changing the phase, the base band signal is filtered with a Gaussian pass band.
- With GMSK we get narrower bandwidth compared to ordinary MSK, but the price for this is less resistance against noise.

2.7) The channel concept

2.7.1 Logical Channels:

A great variety of information must be transmitted between the BTS and the MS, e.g. user data and control signaling.

Depending on the kind of information transmitted, we refer to different logical channels, i.e. the different types of information are transmitted on the physical channels in a certain order.

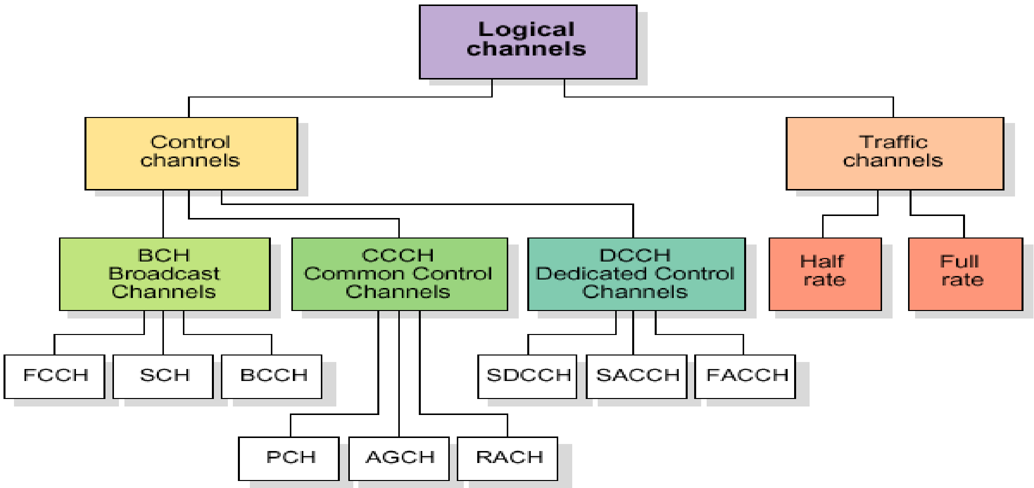
These logical channels are mapped on to the physical channels. For example speech is sent on the logical channel "Traffic channel" which during the transmission is allocated a certain physical channel, say TS 6 on carrier 0.

The logical channels are divided into two groups;

- **control channels and**

- **Traffic channels.**

Fegure 2.6: Control Channel & Trafic Channel



- When the MS is switched on it will be searching for an adequate RBS to register with and listen to. This is done by scanning the whole frequency band, or, optionally, use a list containing certain frequencies allocated for this operator.

- When the MS has found the strongest carrier it has to find out whether this is a BCCH carrier.

- A BCCH carrier is the frequency used to carry the broadcast channels. There is one per cell and it is called c 0.

2.7.2) Broadcast Channels, BCH:

- Frequency Correction channel – FCCH:

FCCH serves two purposes; one is to make sure this is the BCCH-carrier, the other is to allow the MS to synchronize to the frequency. FCCH is transmitted on the downlink, point-to-multipoint.

- Synchronization channel – SCH:

Next thing for the MS is to synchronize to the TDMA frame structure within this particular cell, and also to make sure that the chosen base station is a GSM base station. Listening to the Synchronization channel, SCH, the MS receives the TDMA frame number and also the Base Station Identity Code, BSIC, of the chosen base station. BSIC can only be decoded if the base station belongs to the GSM network. SCH is transmitted on the downlink, point to multipoint.

2.7.3) Broadcast Channels BCH:

Broadcast Control channel – BCCH:

- The last information the MS must receive in order to start roaming, waiting for calls to arrive or making calls, is some general information concerning the cell.
- This is broadcasted on the Broadcast Control channel, BCCH, and does among others include the Location Area Identity (LAI), maximum output power allowed in the cell and the BCCH-carriers for the neighboring cells, on which the MS will perform measurements.
- BCCH is transmitted on the downlink, point-to-multipoint.
- Now the MS is tuned to a base station and synchronized with the frame structure in this cell.
- The base stations are not synchronized to each other, so every time the MS decides to camp on another cell, its FCCH, SCH and BCCH have to be read.

2.7.4) Common control channels, CCCH:

- Paging channel – PCH:

Within certain time intervals the MS will listen to the Paging channel, PCH, to see if the network wants to get in contact with the MS. The reason could be an incoming call or an incoming Short Message. The information on PCH is a paging message, including the MS's identity number (IMSI) or a temporary number (TMSI). PCH is transmitted on the downlink, point-to-point.

- Random Access channel – RACH:

If listening to the PCH, the MS will realize it is being paged. The MS answers, requesting a signaling channel, on the Random Access channel, RACH. RACH can also be used if the MS wants to get in contact with the network, e.g. when setting up a mobile originated call. RACH is transmitted on the uplink, point-to-point.

- Access Grant channel – AGCH:

The network assigns a signaling channel (the Stand alone Dedicated Control channel, SDCCH). This assignment is performed on the Access Grant channel, AGCH. AGCH is transmitted on the downlink, point-to-point.

2.7.5) Dedicated control channels, DCCH:

- Stand alone Dedicated Control channel – SDCCH:

The call set up procedure is performed on the SDCCH as well as the transmission of textual messages (Short Message and Cell Broadcast) in idle mode. SDCCH is transmitted on both up- and downlink, point-to-point. The MS is on the SDCCH informed about which physical channel (frequency and time slot) to use for traffic (TCH).

- Slow Associated Control channel – SACCH:

On the uplink MS sends averaged measurements on own base station (signal strength and quality) and neighboring base stations (signal strength). On the downlink the MS receives system information, which transmitting power and what timing advance to use. SACCH is transmitted on both up- and downlink, point-to-point.

- Fast Associated Control channel - FACCH

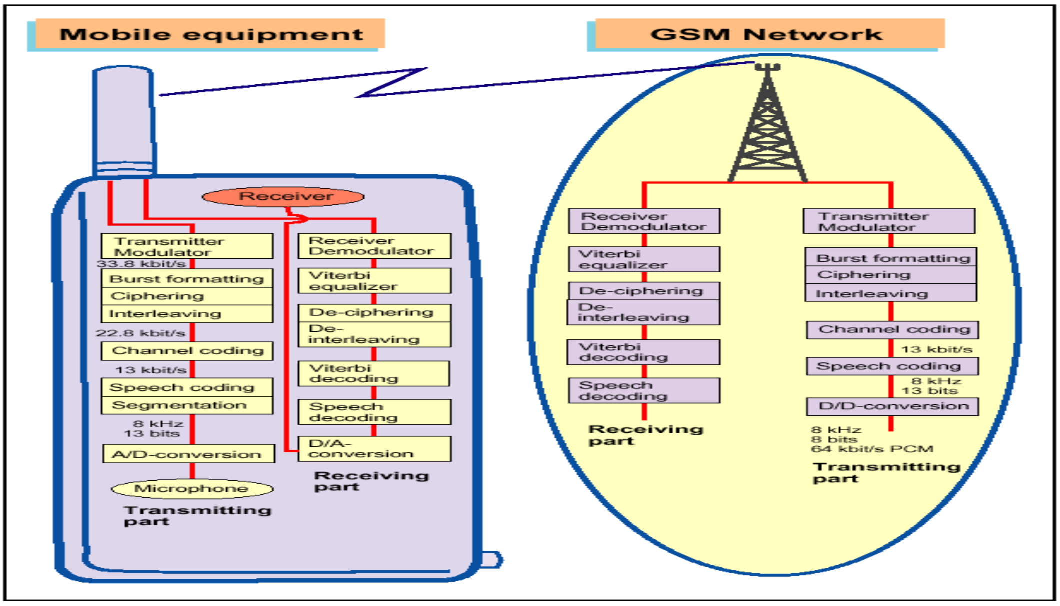
Handover is performed on FACCH. FACCH works in stealing mode, meaning that one 20 ms segment of speech is exchanged for signaling information necessary for the handover. The subscriber will not recognize this interruption in speech since the speech coder will repeat the previous speech block.

2.7.6) Traffic channels, TCH:

The traffic channels are of two types: full rate and half rate.

- One full rate TCH occupies one physical channel (one TS on a carrier), while two half rate TCHs can share one physical channel

Fegure 2.7: Schematic Signal Processing



CHAPTER 3: TRANSMISSION PART

3.1) Transmission:

A cellular network or mobile network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighboring cells, to avoid interference and provide guaranteed bandwidth within each cell.

shows the signal processing blocks very schematically. We can see that signal processing is performed both in the mobile equipment and on the network side

Mobile transmitting side

Mobile Receiving side

GSM Network Receiving part

GSM Network Transmission Part

3.2)Call Transmission in Network:

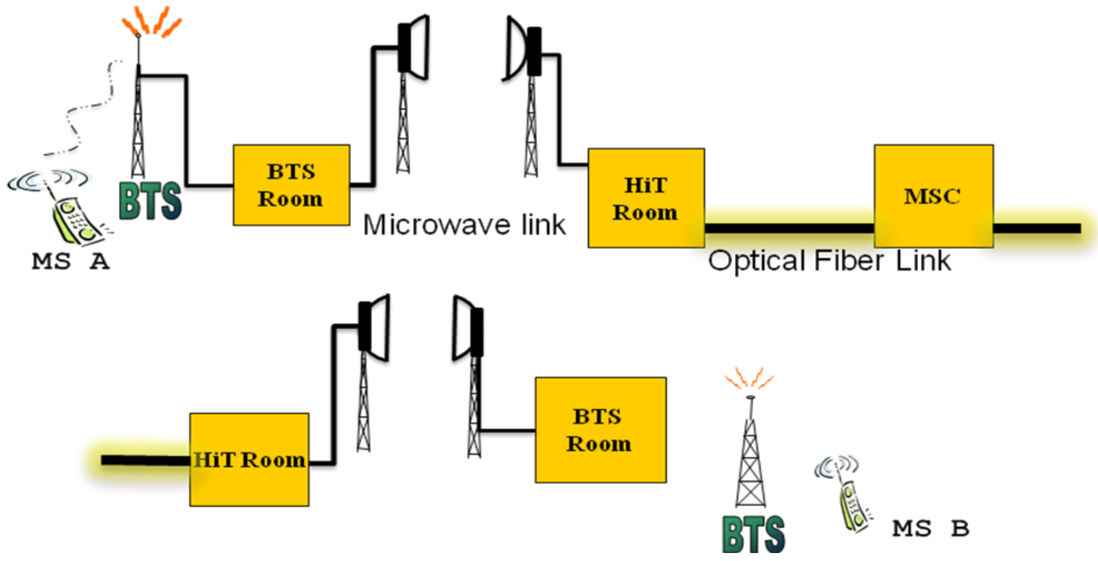


Figure 3.1: Call Transmission between Two mobile

If mobile unit A and communicate with mobile unit B. Suppose MS Unit connected by BTS DHDHNC and MS B connected DHMPC if Communicate each Other then at first create link between them.

3.3)Antenna:the mobile unit Connected BTS by GSM antenna

All of the antenna parameters are expressed in terms of a transmission antenna. In telecommunication

Its may be GSM Panel antenna and GSM dual band (GSM900 and GSM 1800) antenna. And GSM Panel antenna

FIGURE 3.2: Variable tipe of antenna

Antena Parameters:

- Resonat frequency:Effective range of the frequencyuasally centered on that resonant frequency
- Antenna gain: Gain is the parameter measures the directionality of of a antenna

- Radiation pattern: The radiation pattern of an antenna is the geometric pattern of the relative field strengths of the field emitted by the antenna.

- Impedence: impedance matching is the practice of designing the input impedance of an electrical load to maximize the power transfer or minimize reflections from the load.

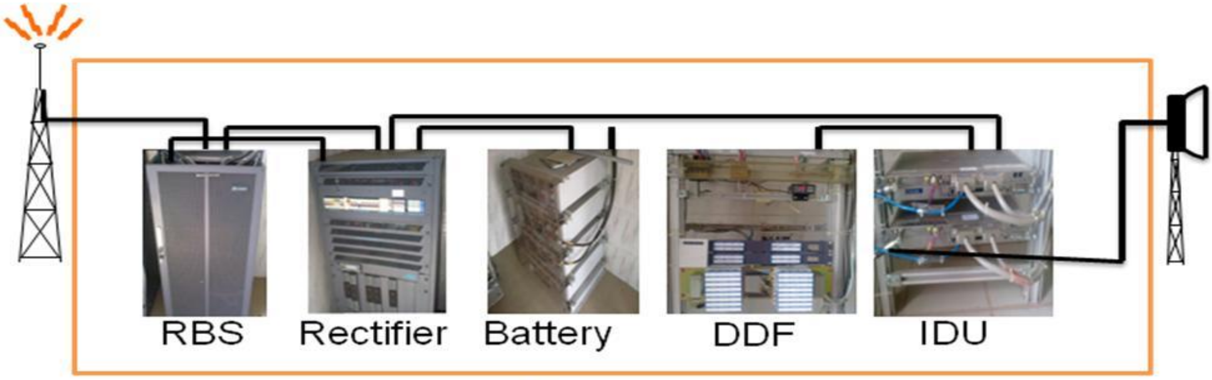
- Efficiency: The ratio of the total radiated power to the total input power

- Polarization : The polarization of an electromagnetic wave is defined as the orientation of the electric field vector. The polarization is described by the geometric figure traced by the electric field vector upon a stationary plane perpendicular to the direction of propagation, as the wave travels through that plane[9].

3.4)BTS:

The BTS includes all radio and transmission interface equipment needed on the radio site. Each BTS operates at a given pair of frequencies. One frequency is used to transmit signals to mobile stations, and the other one to receive signals from mobile stations

Transmission interface equipment contain RBS,Rectifier,Battery,DDF(Digital board frame),IDU(Indoor Unit),Tx rack,PDB,DVS.



Figure(3.3): BTS Room

RBS(Radio base station):

its takes signal from antenna by feeder cable and Transmit PCM signal to DDF. It basically does transmission and reception of signals. Also does sending and reception of signals to and from higher network entities. Its also provide Control and manages the various units of BTS including any software. On-the-spot configurations, status changes, software upgrades, etc. and BTS also detect the location of MS. If MS is Handoff or move different cell then bts provide message to VLR.

IDU:

Indoor Unit its connected through Out Door Unit by IF cable, IDU also perform call processing to DDF (Digital distributed board) where adjust to Tx and Rx.

Rectifier:

Rectifier acts as converter which converts AC to DC. Its input Ac current from power board and provide suitable DC voltage (53.4Vdc) for others equipment. Also protection the equipment from over voltage and low voltage.

Battery:

Battery provide dc voltage (48 volt) and backup others BTS equipment when electricity is off. if battery cannot carry voltage then link is down so another option is generator which produce current.

DVS(DC ventilation system):

DVS is the external part of BTS equipment. Its introduced replace to AC. Ac machine takes high power & increase high cost. So DBS used. When room temperature is high at hot season about 38c then its automatic on and adjust room temperature with outer room temperature

Indoor Unit its connected through Out Door Unit by IF cable then signal pass through Microwave Horn antenna through.

DDF: DDF means digital board frame where drop Tx and Rx signal.

3.5)HiT Room: The HiT room Contain IDU, ODU, Hybrid Converter, Rectifier

And HiT(Surpass 7070) ,Battery and AC. The HiT connected another HiT Or its directly connected MSC.

Figure(3.4): HiT Room

HiT:

The SURPASS HiT is an optical MUX. The SURPASS HiT 7070 series enables true multi-service provisioning, using the same infrastructure for all services and thus meeting the needs of future converged networks. It is a platform that covers the whole range of network applications required for the regional and metro core.

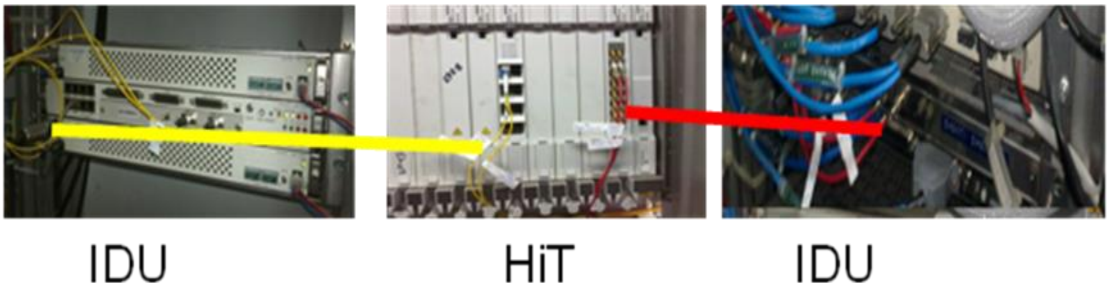


Figure 3.5: Signal pass through Optical fiber Or Electrical

The HiT is an Optical Multiplexer its combine SDH signal. And occur:

Digital Cross Connect (DXC)

Figure 3.6: Digital Cross Connect

CHAPTER 4: POINT TO POINT LINK

4.1) Point to point link:

Point to Point connection may be two type microwave link and optical fiber link. When signal transmission between BTS to BTS or BTS to HiT then used microwave link. The optical fiber link used mainly HiT to MSC.

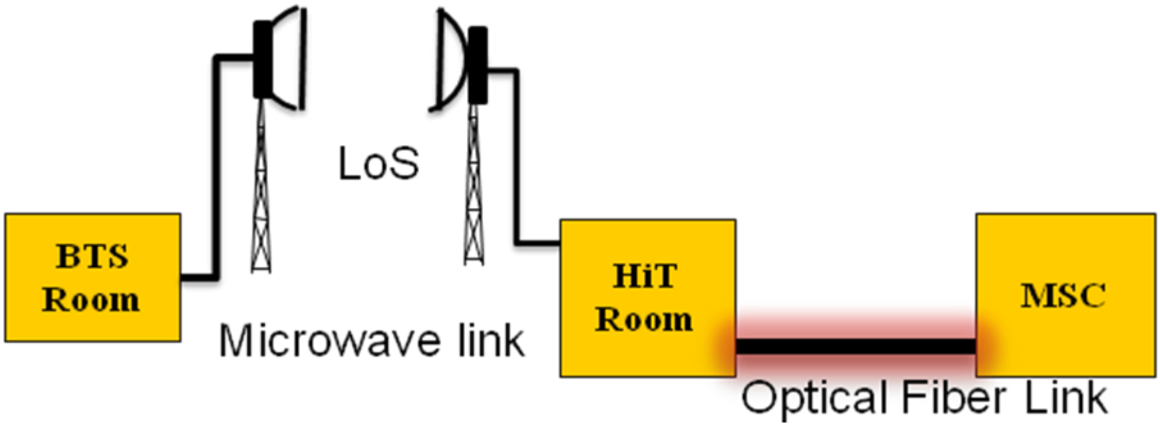


Figure:4.1: Point to Point Link

4.2) Transmission antenna: point to point link use microwave antenna. A microwave link is a communications system that uses a beam of radio waves in the microwave frequency range to transmit video, audio, or data between two locations

The position of two microwave antennas always communicates with line of sight direction.

Refers to the department of Engineering where information is transmitted with the help of radio waves of the wavelength of centimeter range by using various electronic technologies. Microwave antennas are equipped in higher place in order to achieve better transmission effect

In the microwave frequency band, **antennas** are usually of convenient sizes and shapes, and also the use of metal waveguides for carrying the radio power works well.

These microwave antennas are also known Microwave horn antenna .Horn antennas are used typically in the microwave region (gigahertz range) where waveguides are the standard feed method.

4.3) Line-of-Sight Equations:

Maximum distance between two antennas for LOS propagation:

$$3.57\left(\sqrt{Kh_1} + \sqrt{Kh_2}\right)$$

- h_1 = height of antenna one
- h_2 = height of antenna two

4.4) ODU: ODU means outdoor unit which performance transmitting and receiving frequency with microwave antenna. Its connected with Indoor unit by If cable (black color), ground connected by white cable.

Figure 4.2: ODU with transmission antenna

Some ODU Name:

Type	Category	Transmission
PGRD	SRAL XD	Tx:37604-38178

	ODU38G(low)	Rx:38864-39438 Shifter:570 Mhz
PGRD	PASOLINK ODU 2G	

Shifter 570 MHz means, this guard band Tx and Rx band .its prevent interference

4.5) Optical fiber Link: Optical fiber link mainly used HiT to MSC.

Optical fiber is made up of 3 parts

- **Core:** The inner most part is the core which contains one or more thin fibers that are made up of plastic or glass
- **Cladding**:- Each of the fiber in the core is covered by a cladding which has different optical properties from the core
- **Jacket:-** The outer most part of the optical fiber is made up of plastic or other materials, which is called the jacket

4.6) Types of optical fiber:

Guided Optical Communication:

- Uses an optical carrier: 1013 - 1014Hz

- Can carry 10 to 100 THz of information
- Analog voice: 20KHz bandwidth (500million channels)
- Digitized voice at 64kbps (160 million channels)
- Analog video:5MHz (2 million channels)
- Digitized voice at 100Mbps (100k channels)

Unguided Optical Communication

- Atmospheric link: requires line of sight
- High attenuation

4.7) Suitable Media for Optical Communication:

- Air
  - Air is vulnerable, which leads to interference of signals with other light waves present in the atmosphere
  - Due to the presence of fog, moisture etc in the atmosphere there will be a lot of distortion introduced to light waves
- Glass
  - Glass is known since ancient times as the most suitable transmission medium for light
  - To use light for long distance transmission, light is required to be carried in glass. This problem is solved with the invention of glass fiber which is popularly known as Optical fiber
  - Light should have enough power so that signal can be sustained for long distance, which is solved by the invention of LASER and LEDs [10]

CHAPTER 5: CALCULATION PART

5.1) Measurements of signal strength by mobile station:

Measurements are performed in both idle mode (when MS is switched on and moving around, roaming) and in active mode.

Idle mode: Cell selection is made at "power on" of the mobile

1.The mobile scans all radio frequencies in the GSM system and calculates average levels for each of them. The mobile tunes to the strongest carrier and finds out if it is a BCCH-carrier. If so, the mobile reads BCCH-data to find out if the cell can be locked to (chosen PLMN, barred cell, etc.). Otherwise the mobile tunes to the second strongest carrier etc.

5.2) Idle mode:

The mobile may optionally include a BCCH-carrier memory of valid BCCH-carriers in the home PLMN. In that case it will only have to search these carriers. If this ends unsuccessfully, the mobile performs as in 1.

On BCCH, the mobile is informed which BCCH-carriers it is to monitor for cell re-selection purposes. A list of the six strongest carriers is updated regularly by the mobile as a result of the measurements.

5.3) Active mode:

- During a call, the mobile continuously reports (via SACCH) to the system how strong the received signal strength is from the BTSs in its surroundings.
- These measurements are used by the BSC to make fast decisions of target cells when a handover is required.
- The measurements on neighboring cells during a call take place when the mobile is not doing anything else, i.e. between transmission and reception on the allocated time slot.
- The signal strength of the serving cell is monitored during the reception of the TS allocated to the mobile.

- On SACCH, the mobile is informed which BCCH-carriers are to be monitored for handover purposes, and the signal strength of these are measured one by one.
- The working schedule is therefore:

  Transmit - measure - receive - transmit - measure - receive, and so on.
- A mean value of the measurements for each carrier is then derived and reported to the BSC.
- Now, to be sure that the measured values correspond with the proper BTS, the identity of the BTS must also be determined. The identity of a BTS is given in BSIC, sent on SCH on c 0 , TS 0.

Active Mode:

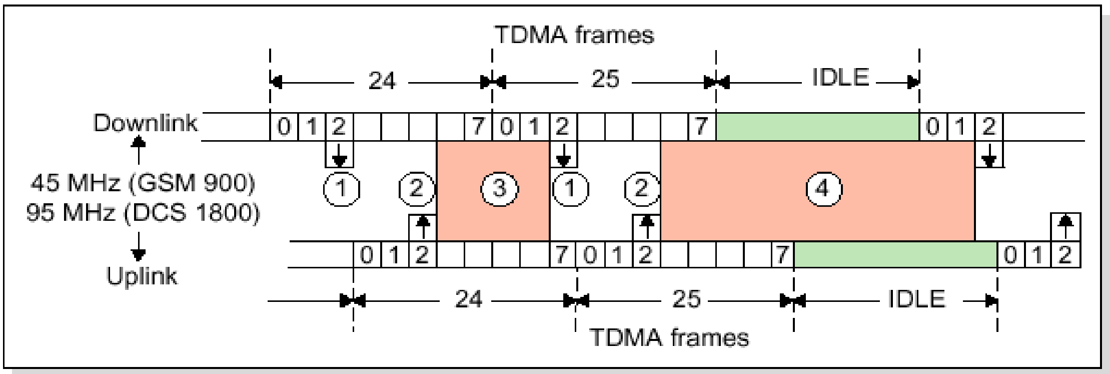


Figure 5.1: measurement principle of TDMA frame

- 1. MS receives and measures signal strength and BER on serving cell, TS 2.
- 2. MS transmits.
- 3. MS measures signal strength for at least one of the neighboring cells.
- 4. MS tries to read BSIC on SCH (TS 0) for one of the neighboring cells
- The six neighboring cells with highest mean signal strength value and valid BSICs are then reported via SACCH to BSC.

- Since the MS might not be synchronized with a neighboring cell for which it is trying to determine the identity, the MS does not know when TS 0 on that BCCH-carrier will occur. Therefore it has to measure over a time period of at least 8 TS to be sure that TS 0 will occur during the measurement.
- This is accomplished with an IDLE frame as shown in Figure(4.1), step 4.[12]

5.4) Link budget:

A link budget is the accounting of all of the gains and losses from the transmitter, through the medium (free space, cable, waveguide, fiber, etc.) to the receiver in a telecommunication system.

It accounts for the attenuation of the transmitted signal due to propagation, as well as the antenna gains**,** feedline and miscellaneous losses

- A simple link budget equation looks like this: Received Power (**dBm**) = Transmitted Power (dBm) + Gains (**dB**) − Losses (dB)

- For a **line-of-sight radio** system, a link budget equation might look like this:

$$P_{RX} = P_{TX} + G_{TX} - L_{TX} - L_{FS} - L_M + G_{RX} - L_{RX}$$

where:

- *PRX* = received power (dBm) [$db_{m=}10\log_{10}$(power in mw)]
- *PTX* = transmitter output power (dBm)
- *GTX* = transmitter **antenna gain** (dBi) [dBi=ratio of effecitve ant gain to isotropic antenna gain]
- *LTX* = transmitter losses (coax, connectors...) (dB)

- *LFS* = **free space loss** or **path loss** (dB)
- *LM* = miscellaneous losses (**fading** margin, body loss, polarization mismatch, other losses...) (dB)
- *GRX* = receiver **antenna gain** (dBi)
- *LRX* = receiver losses (coax, connectors...) (dB) [13]

Transmit Power

Transmit power at the radio RF connector specified in dBm. If your radio specifies the transmit power in mW (milli-Watt) you can convert to dBm using the equation:

Tx power in dBm = 10 * log (Tx power in mW)

Cable loss

This parameter includes all the losses between the radio RF connector and the antenna, which include the signal attenuation as it propagates through the cable and losses in any connectors along the way. The cable loss calculator at the bottom allows you to compute these losses for specific cables. Use the drop down menu to select the cable type or select "other" and enter the cable loss per 100 feet (or per meter) at the frequency of operation. The calculator assumes an additional loss of 0.25 dB for each connector in the cable.

Receiver Sensitivity

Minimum signal strength at the input of the radio at which point the "Bit Error Rate (BER)" in the link is at a specified value. Most manufacturers use a BER of $1x10^{-6}$ (1 bit error in one million bits) to specify the radio receiver sensitivity. However make sure you check the specifications when comparing the sensitivity in radios from different manufacturers.

You can configure each of our pulsAR radio models to operate a four different RF speeds. Lower speeds give you a better sensitivity. The table below shows you the sensitivity values of each model when operating it at its maximum speed. Refer to the pulsAR data sheet for the sensitivity values at all the speeds supported:

Model:	AR-9010E	AR-9027E	AR-24010E	AR-24027E	AR-24110E
Maximum Speed (Mbps):	1.1	2.75	1.1	2.75	11.0
Rx Sensitivity (dBm):	-95	-92	-92	-90	-86

Fade Margin

The Fade Margin is the difference between the Received Signal Strength and the radio Receiver Sensitivity . When you deploy a link you want to have a Receive Signal Strength that is sufficiently above the radio Receiver Sensitivity in order to survive signal fading due to a variety of factors. These factors might include slight misalignment of the antennas, losses due to fog and rain, etc. As a rule of thumb you should try to get at least 15 dB of fade margin in your links.

Free Space Loss

Free Space Loss refers to the reduction of the signal strength as the signal radiates away from its source. When there are no obstructions every time you double the distance the signal is reduced by a factor of 4. This is equivalent to subtracting 6 dB from your signal strength. The Free Space Loss assumes no obstructions in the link path which is sometimes referred to as having "line of sight". However, note that "line of sight" means that at least "60% of the first Fresnel Zone " is clear of any obstructions. Refer to our Fresnel Zone Calculator page for more details.

Example of a 50 km 7GHz link:

	Power	Gain	Losses
Transmitter power P_T	30dBm		
Tx Antenna Gain (3m diam.)		42.5 dB	
Free Space loss 143.3dB			
Rx antenna Gain (3m diam.)		42.5 dB	
Recived Power P_R	-28.3dBm		

A more complete Link Budget example (50 km 7GHz link) is:

	Power	Gain	Losses
Transmitter power P_T	30dBm		
Tx Feeder & Branching Loss			1.4dB
Tx Antenna Gain (3m diam.)		42.5dB	
Free Space loss 143.3dB			
Additional Propagation Losses 3.0dB Rx			
Antenna Gain (3m diam.)		42.5dB Rx	
Feeder & Branching Loss			1.4dB
Net Path Loss			64dB

Recived Power P_R -34dBm

Assuming the RX Threshold PTH = -77dBm, then the Fade Margin is;

$$FM = PR- PTH = 43dB$$

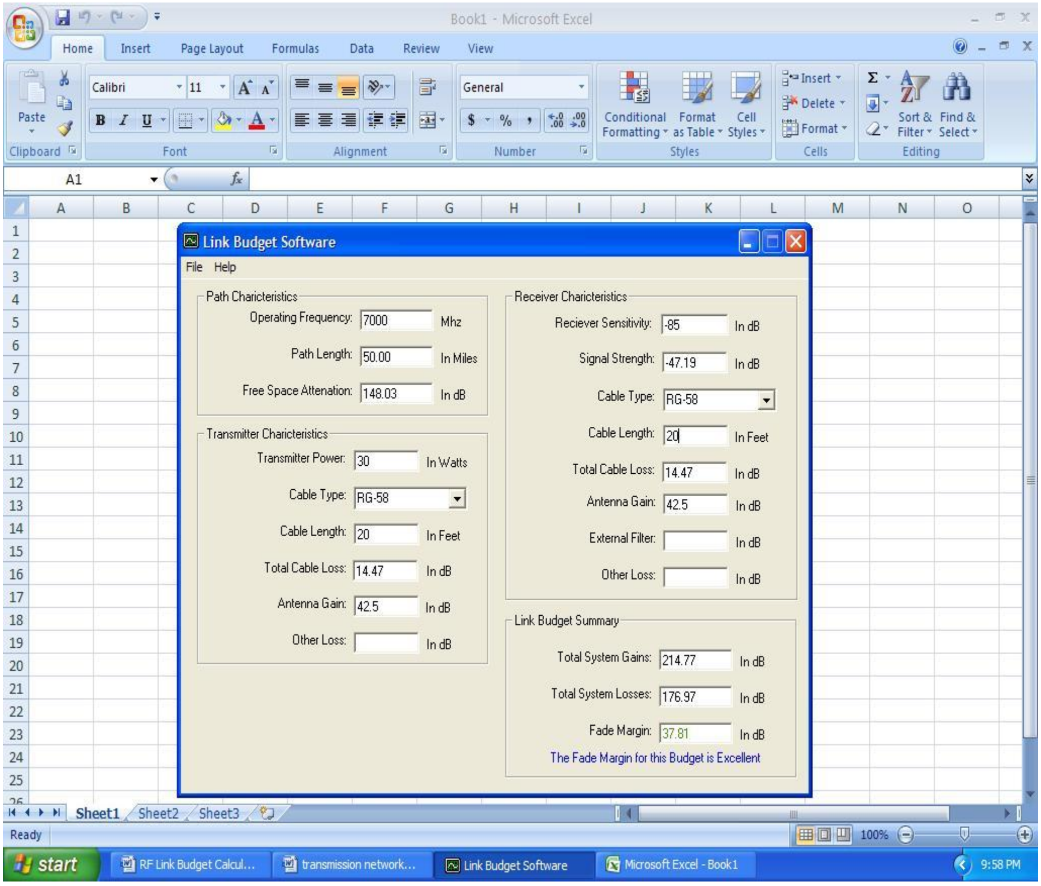


FIGURE 5.2: Example of a 50 km 7GHz link

Conclusion:

5.1) Conclusion:

In this paper, I optimized the Total transmission in GSM technology. During my internship at the GP house I had the great experience of working alongside very smart and capable system engineers from whom I had learnt a great deal from regarding both my field of study and work life. The visit to the BTS sites, which is the actual equipments, towers, outdoor BTS, switching room, HiT room etc, were very interesting and knowledgeable for me as I got to observe the BTS equipments first hand. It was a very fulfilling experience overall for both my academic and professional career.

Providing telecommunications and Internet services to all areas of Bangladesh, e has become a national priority. Bangladesh has evolved in a new era of great opportunity in the field of telecommunications technology. Previously this field had been limited only to the major cities of the country. As a result 95% of the people had been deprived from this privilege. Therefore, Telecom sector has come forward to help these underprivileged people in rural areas as well hill districts with the aim to give them a brighter future.The Grameenphone operators have been given a new opportunity to intensify their rivalry as they battle to win customers in hill districts that are to be opened for mobile telephony. Grameenphone Telecom's GSM network is set to cover 64 districts of Bangladesh to ensure that their service can seamlessly reach out to every corner of the country.

5.2) Future Work

There are maney rural area in Bangladesh where no power. If there use the solar energy we can provide the network on that area. I like to work to this field.

Appendix:

- ROD: Regional operation Dhaka
- SPMS: Spare Parts Management System
- ROM: Regional Operation Management
- NM: Networking Management

- BTS: Base station
- BSS: base station subsystem
- MS: Mobile station
- BSC: Base station Controller
- BTS: Base station
- RBS: Radio base station
- MUX: Multiplexer
- IDU: Indoor Unit
- ODU: Outdoor Unit
- LOS: Line Of Sight
- BSC: Base Station Controller
- DDF: Digital Distributed Board

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