Empirical Study on 2G-3G Optimization

Of Star link Engineering Limited

By

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This Internship Report is presented for fulfil the requirements of the Bachelors Degree of Electronics and Telecommunication Engineering.

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June-2019

APPROVAL

This Internship Report Titled "Empirical study on "2G-3G Optimization" of "Star link Engineering Limited" is submitted by Abdullah Al Maruf to the Department of Electronics &Telecommunication Engineering, Daffodil International University, has been accepted as fit for the partial fulfilment of the condition for the Degree of BSc (Hon's) in Electronics &Telecommunication Engineering & approved as to its style and guts. The Presentation will be held on June-2019

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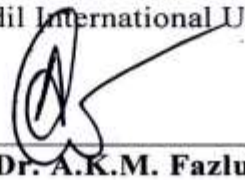

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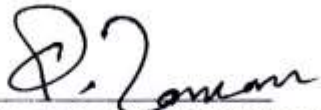

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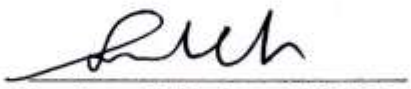

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DECLARATION

I proudly declare that this Internship Report has been done by me under the supervision of Engr. Md. Zahirul Islam, Assistant Professor, Department of ETE, and Daffodil International University. I also declare that this report has been submitted away for any degree.

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ACKNOWLEDGMENTS

Firstly, I would like to thank to Almighty ALLAH for helping me from any trouble & he got me an opportunity to work with my internship Company named "STARLINK ENGINEERING LIMITED". This company helps and guides me easily and fulfil my work experience in these four months. Some issues are creating while visiting the network site but experience is so good to work and visit with them.

Creating this internship report would not be possible without the support and direction of Honourable **Engr. Md. Zahirul Islam, Assistant Professor,** Department of Electronics and Telecommunication Engineering, Daffodil International University, Dhaka.

I would like to thank my Honourable **Md. Taslim Arefin, Associate Professor and Head**, Department of Electronics and Telecommunication Engineering, for his inspiration which makes me more and more active to gain the knowledge while visiting the site.

Abdullah Al Maruf

ABSTRACT

3G (Third Generation) network technologies are also already, specified and in many parts of the world operational. The 3G version in Europe is named UMTS (Universal Mobile Telecommunications System). Its air interface will be based on WCDMA (Wideband Code Division Multiple Access) transmission. 3G networks provide substantially higher capabilities than 2G. RF PLANNING stands for "Radio frequency & Planning". Achieving maximum capacity while maintaining an acceptable grade of service and good speech quality is the main issue for the network planning. RF Planning is the process of assigning frequencies, transmitter locations and parameters of a wireless communications system to provide sufficient coverage and capacity for the services required. The RF plan of a cellular communication system has two objectives: coverage and capacity. With the proper RF planning we not only save the huge wastage of the money spent in putting up the Transceiver setup but also provide a QOS with the current network. The basic approach to RF planning is to first analyze the present quality of network and then providing a proper recommendation to improve QOS. The report covers various aspects of network optimization in 2G and 3G empirically.

CONTENTS/TITLE

LIST OF FIGURES:

CHAPTER 1

INTRODUCTION

1.1 Introduction

Today we are living in modern era. Here we introduce new technology day by day. In before, we use 1G-2G network which minimum speed is so low but now we use 3G-4G-5G network or technology within some couple of years. When we get this, our social & knowledgeable movements are increasing day by day. Our technology is also improved day by day. We can easily solve any problems using internet in a certain time. Internet makes our day more enjoyable. 2G-3G network activation and motorization are very important because without this, we cannot communicate with each other.

1.2 About Star link Engineering Limited:

Star link Engineering Limited is an Engineering servicing company providing full scope of engineering services like initial Site Survey, Planning, Installation, Commissioning, Operation and Maintenance as well as network optimization in the field of Telecommunication and Information Technology.

Star link Engineering Limited was started in 2008 by a group of young and passionate Engineering Team to partnership with different vendors, Telecom operators and corporate enterprises in Bangladesh. Star Link believes to maintain the world class standard of its quality products and services and promised to deliver its solution always on time, for making our customer's life easy and making work simple. Star Link is working for all Telecom Operator in Bangladesh has its head office in Dhaka, Bangladesh with 556 employees all are well trained

and efficient of doing most of the scope of Telecom Engineering services. (GP, ROBI, AIRTEL, BANGLALINK etc. and so on).

Star link Engineering Limited is well organized by a qualified professional management team. A group of passionate Engineering team leading Star link towards meeting the mission. All members are well trained in diverse discipline.

Customer	Major Scope	Remarks
grameenphone	i. Rollout Services	Working Since 2013
	i. 2G and 3G Site Integration ii. Power and electrical renovation works	Working Since 2012
রবি	1. Resource support for Drive Test service	Working Since 2013
HUAWEI	i. Rollout Service ii. RNO/P iii. Enterprise Services	Working Since 2010
ERICSSON	i. Rollout Service ii. Site Maintenance (Passive)	Working Since 2015
NOKIA	i. Rollout Service	Working Since 2015
e.co	i. Site Audit and Asset Reconciliation ii. PAT Services	Working Since 2015

Star link works as a contractual company since 2008 and now its capital is so high. Almost all SIM companies are get contracted with this company. This company works or optimizes 2 things- **"Rollout services and Radio network".** In rollout services, BTS, MSC, IBS installation and so on are available. Radio network only works for radio frequency optimization for any tower. E.co, Nokia, Ericsson also contracted the star link company for network and frequency optimization

1.3 Company Profile

Name:	**Star link Engineering Limited**
Address:	
	Gulshan-Badda link road,
	NEAR PRAN-RFL Center, Dhaka-1212
Telephone:	+88029862208
Email:	info@starlinkengineering.com
Website:	www.starlinkengineering.com

1.4 Objective of the report:

The main objectives of this report are:

1. To recognize the 2G BTS (Base Transceiver Station) site.
2. 3G BTS site.
3. IBS site.
4. Optimize 2G-3G network technology.

1.5 Summary of the Report

The summary of my Internship is to improve an effective knowledge of 2G & 3G Network Optimization of Star link Engineering Limited. In before, I express the Details & objective of overall view during this internship work and I would describe the background of Star link Engineering Limited.

CHAPTER 2

2G TECHNOLOGY

2.1 Definition

This technology is the firstest technology while invention the network. It's also a second-generation technology which frequency are 1.8GHz digital telecommunication system, bandwidth 900MHz digital characteristics, only for text messages services. Digital cellular & GSM technology supports and data rate is 64kbps.

Fig-2.1: 2G Networks

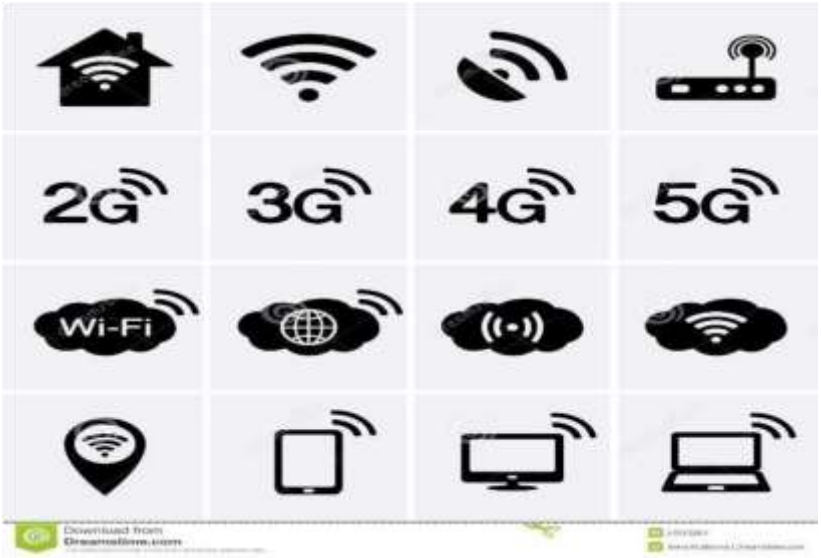


Fig2.2: Evaluation of 2G, 3G, 4G, 5G

2.2 2G calling process

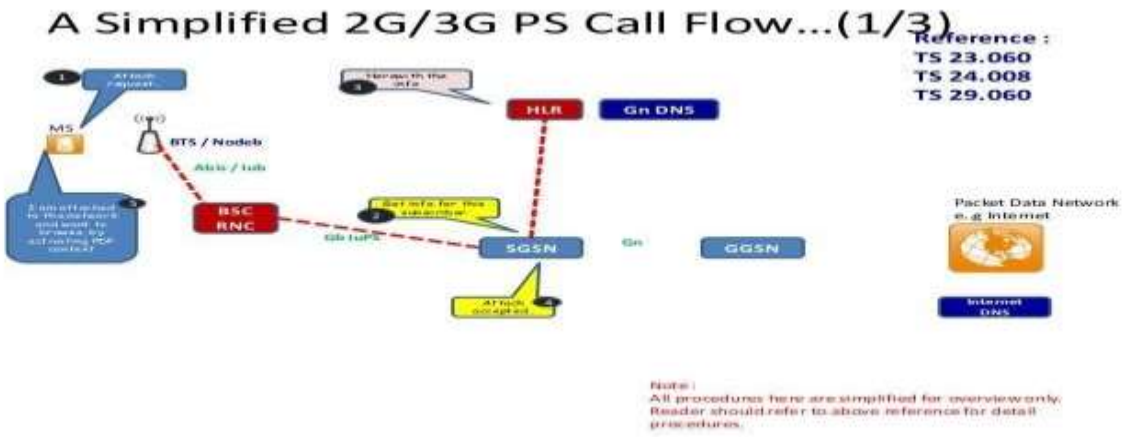


Fig-2.3: 2G Calling Flow

At first, subscriber establishes a call through dialling a number. Then it goes to BTS tower and receives the signal and it moves to the maintenance office of the network. Then it recognizes the number (Bangla link, GP whatever) & sends the signal to tower and go through the

maintenance room. Then observes the other subscriber number and establishes the connection to the receivers. This whole process is done within few seconds & we talk with each other for short and long distance.

2.3 Features of 2G technology

The features are- Phone calls.

- Sends/receives Email messages.
- Web browsing.
- Only camera phones.
- Take a time 6 to 10 min for downloading an mp3 song.

2.4 Advantage Disadvantage

Advantages are-

- Increases the sound quality.
- Noise levels are low.
- Allows SMS & Email.

Disadvantages are-

- High data rate does not support.
- Complex data enable for handle.
- Reduces range of sound.
- Weak signal passes

2.5 Summary of 2G technology

Now a days, 2G technology are weakest for the communication system. We cannot send or receive files easily through using this. When we try to know anything through GOOGLE, we get too slow speed for browsing and don't download easily any type of file or mp3 song. By changing the devices, network capacity also changes so one day this 2G services will be vanished and new technology are invented for more and better communication.

Fig 2.4: Robi 2G RRU box

Fig 2.5: RX Box

CHAPTER 3

3G TECHNOLOGY

3.1 Introduction

3G technology is the third-generation technology which are better than 2G system. Its frequency is 1.6 to 2GHz. 100 MHz bandwidth, digital broadband characteristics, and CDMA UMTS EDGE technology supports. Allow for video calls, mobile TV supports, data rate is 144kbps to 2Mbps.

3.2 3G calling process

2G & 3G networks calling process are same but some differences are maintaining both. 3Gs calling process are much faster than 2G network system. Here minimum data rate are countable and call flows one to another easily.

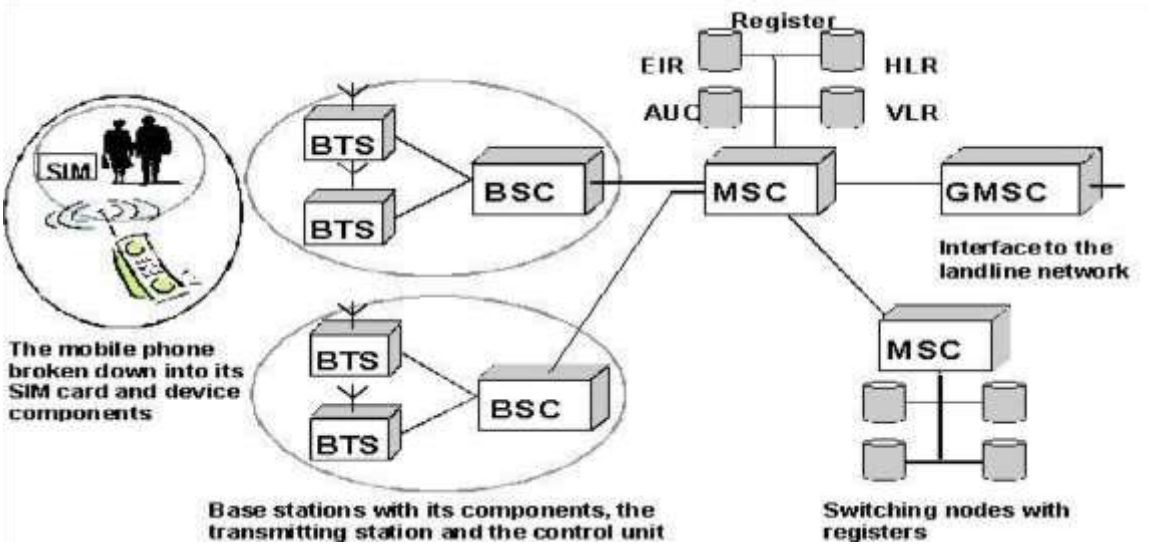


Fig-3.1: 3G Calling Flow

3.3 Features of 3G:

Features are-

- Faster communication provides.
- Large Email/messages sends & receives.
- High speed web security maintains.
- TV streaming & phone calls allows.
- Large broadband capabilities.

3.4 Advantage Disadvantage

Advantages are-

- Supports multimedia data applications.
- Data transfer rate are faster.
- Call rates are cheap.

- Geographic position of mobiles is determined.

Disadvantages are

- If fails the 3G connection, new 3G system installs.
- More power requires.
- Compatible 3G handsets.

3.5 Summary of 3G technology

Now a days, 3G technology are more useful in our day to day life. We browse the website easily and make a call establish easily through the 3G system. We get more knowledgeable things from website and we have learnt more & more valuable things using 3G technology. Easily data transferring, browsing websites, secure the network compatibility are successfully done by this 3G system. So, this system are the blessings of modern technology.

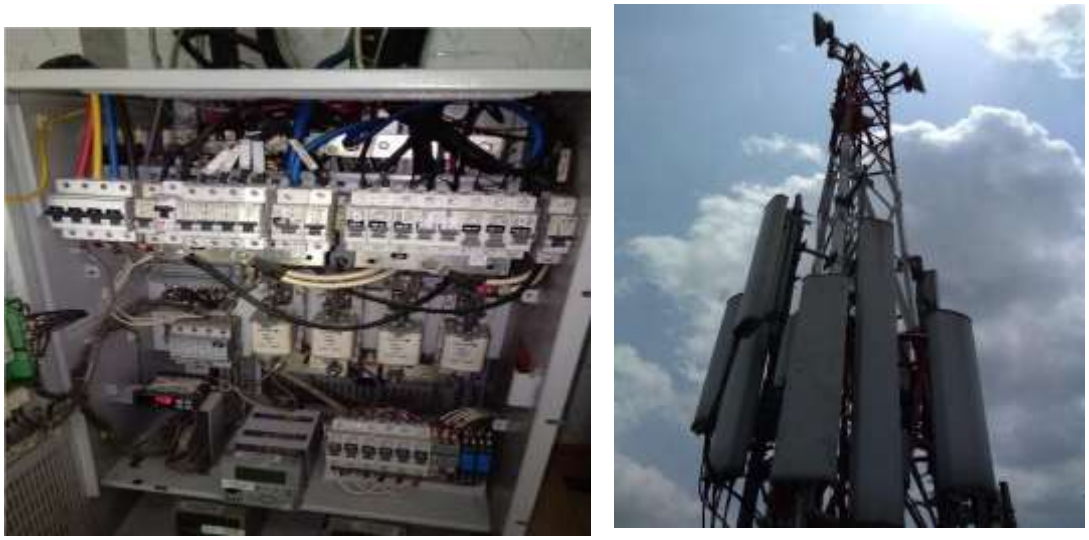


Fig-3.2: Airtel 3G Tower & Switchboard

CHAPTER 4

GSM SYSTEM

4.1 Introduction

Global System for Mobile communication (GSM) system is a standard system developed by ETU (European Telecommunication Union) which is used for mobile phones or Tablets. It achieves almost 90% market share for establishing a strong calling process. GSM antenna & module are available used in mobile phones or tablets for better communication.

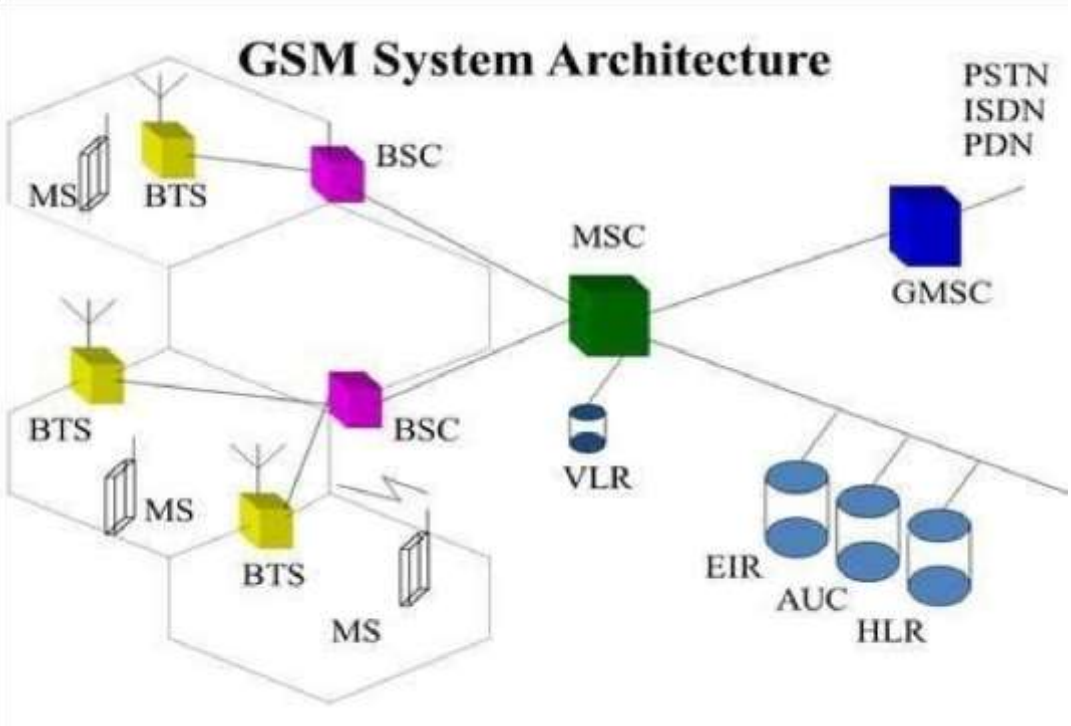


Fig 4.1: GSM System and Architecture

4.2 Features of GSM antenna

Features are-

- Compatibility are good.
- Removes noise.
- Flexibility & capability increases.
- Confidentiality & security improves.
- ISDN compatibility.

4.3 Features of GSM module

Features are-

- GSM module normally used in GSM network.
- Module communicate PIC microcontroller using normal protocol.
- Communication done by GSM modems.

4.4 Components of GSM system

Components are-

- NSS (Network & Switching Subsystem).
- BSS (Base Station Subsystem).
- MS (Mobile Station).
- OSS (Operation & Support Subsystem).

4.5 Summary:

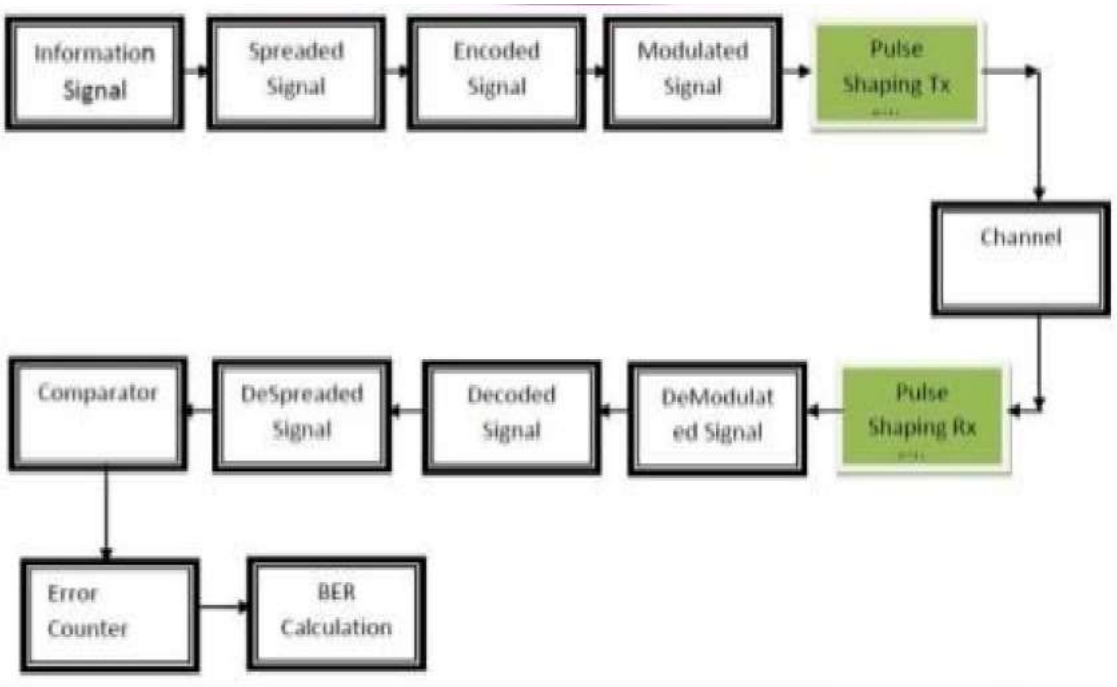
GSM system are so much essential for communication process. Its antenna & module are works like a heart of a telecommunication system. Its components are also an establishment of a GSM calling system & without components, communication are not properly active. So, each & every single element of GSM system are more and more important.

CHAPTER 5

W-CDMA

5.1 Introduction

Wideband Code Division Multiple Access (W-CDMA) is a standard communication used in 3G networks. It also supports cellular voice, MMS, high speed data transmission and so on.



5.2 Working Principle

WCDMA technology provides the UMTS system some of the new functionalities on the air interface. The main features provided by WCDMA physical layer are: Spreading and Scrambling.

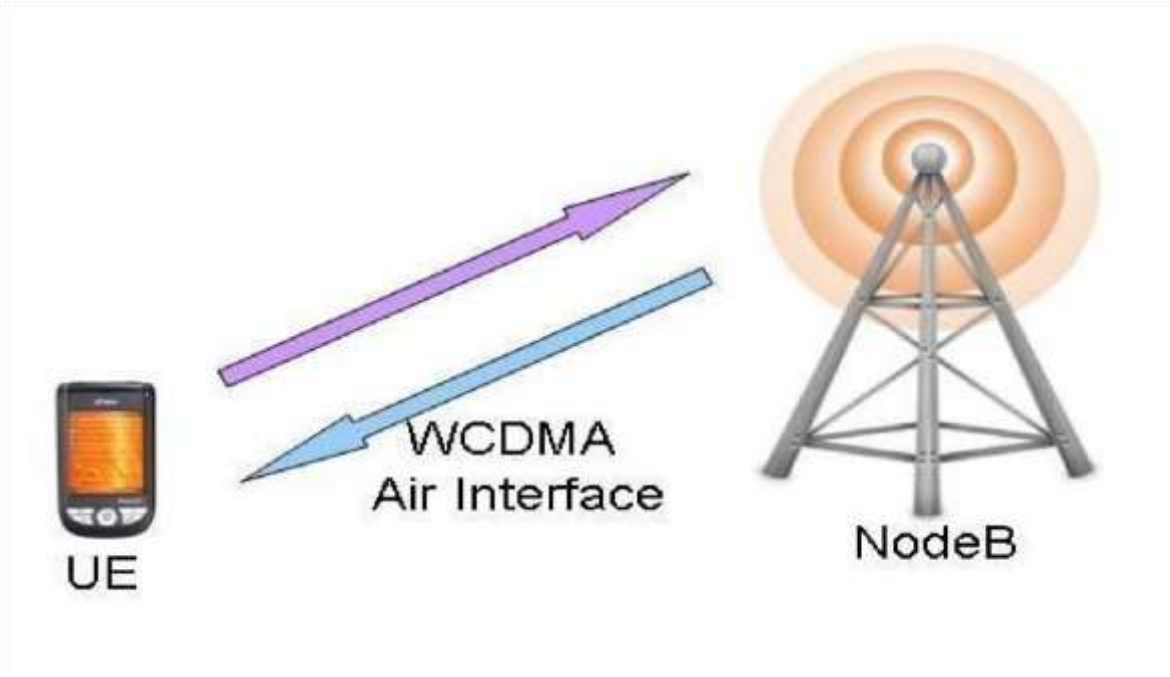


Fig-5.1: 3G Technology

- When this process occurs, ultimate Ears (UE) to any tower has make a connection. Both are connected to each other to establishment the W-CDMA process.
- UE is a manufacturer company based in California.

5.3 Features of W-CDMA

Features of W-CDMA

- 5 or 10 or 20MHz Bandwidth.
- Spreading codes OVSF (Orthogonal Variable Spreading Factor).
- Data modulation are for DL-QPSK & UL-BPSK.
- Data rates are different- 144kbps, 384 kbps & 2Mbps.
- FDD Duplexing.

5.4 Advantage Disadvantage

Advantages are:

- Large number of user & code are permitted and generated.
- Maximum users have limited interference.
- Without spreading code, transmitted data will not be recovered.
- For this, 3G provides minimum 2Mbps & maximum 28Mbps data speed.

5.5 Summary

W-CDMA refers a standard technology which are very helpful to communicate to each other. UE company establishes this system for better data speed requirements & limited interference. Here duplexing system also provides for FDD (Floppy Disk Drive). Data rates also varies for better data transfer for one to another. For this, easily Email & data sends properly and Faxes also.

CHAPTER 6

SWAP: 2G with 4G

6.1 BBU (Base Band Unit)

A low pass one (BBU) is a one that anapophysis low pass in telecom systems. An exemplary Wireless telecom employment comprise of the low pass procedure one and the RF advance One (clicker radio one - RRU). The low pass one is office in the furnishing lodge and joined With RRU via optical fibre. The BBU is trustworthy for news through the purgative interface. A BBU has the sequential characteristics: modular intend, mean bulk, burn sway decay and can be smoothly extend.

Fig-6.1: Baseband Unit

A BBU in a comb drop a line corpuscle place is include of a digital foreshadowing central processing unit to prosecute onward expression memorable for transmission to a liquid one and to anapophysis reversed judgment sign embrace from the changeable one. The digital token

central processing unit also obey to bear a first supervisory sound drift (SAT) for transmission to the excitable one by breed hereditary digital SAT prospect which are evident into a protracted character. Finally, the digital foreshadowing CPU lay bare the person of a backer SAT procreate by the liquid one by try and narrative contiguous example of the other SAT and mensurative the influence. The BBU back multimode applications. When being configured with boards back GSM, UMTS, and LTE, a BBU can stay these modes. In divide-MPT scenarios, one BBU second two modes, and two BBUs uphold three or four modes. In co-MPT scenarios, one BBU second three or four modes. RRUs and RFUs are radio crowd one and nurture multimode and

6.2 Typical BBU Configurations

The BTS is the Base Transceiver Station within a GSM Network & supports the GSM Cells, normally between 3 & 6 Cells. The BTS & the BSC are forming the Base Station Subsystem (BSS) / GERAN which is connected to the Network Subsystem (Core Network). BBU Slot Assignments.

<table>
<tr><td rowspan="4">Slot 16</td><td>Slot 0</td><td>Slot 4</td><td rowspan="2">Slot 18</td></tr>
<tr><td>Slot 1</td><td>Slot 5</td></tr>
<tr><td>Slot 2</td><td>Slot 6</td><td rowspan="2">Slot 19</td></tr>
<tr><td>Slot 3</td><td>Slot 7</td></tr>
</table>

FIG-6.2: DCDU (Direct Current Distribution Unit)

BASEBAND UNIT(BBU)

MRFU

Fig-6.3: Baseband Unit Configuration

6.3 GTMU (GSM Transmission & Management Unit for BBU)

The GSM transmission, timing, and management unit for BBU (GTMU) controls and manages the entire BTS. It provides interfaces related to the reference clock, power supply, OM, and external alarm collection. Maintenance and Transmission Unit for GSM – always in Slot 5&6.

The GTMU performs the following functions:

- Controls and manages the BTS.
- Monitors fans and power modules.
- Provides transmission over 4xE1 ports.
- 2xFE ports – FE0 (electrical) & FE1 (optical).
- Provides 6 CPRI ports for communication between GTMU and GSM RRUs/RFUs.
- Support fault management system, configuration management system, performance management system and security management service.
- Provides Ethernet Port "ETH" for local Commissioning.

Fig-6.4: GTMU (GSM Transmission & Management Unit for BBU)

6.4 UMPT (universal main processing and transmission)

- The entire capital narrative and transmission one (UMPT) can obey as a force rule entrain operation in any method. Maintenance and Transmission Unit for GSM always in Slot 7. The UMPT consummate the profession service:
- Manages configurations and devices.
- Oversee feat, and • procedure indication.
- Provides the USB porthole.
- Transmission transport.

signal transmission, and BBU interconnection. the types of UMPT boards-

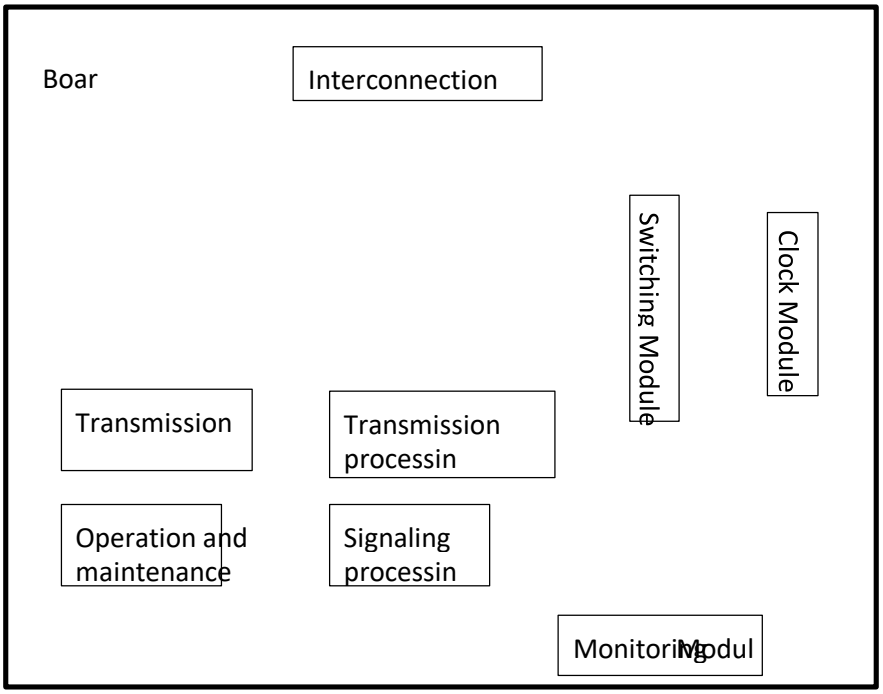


Fig-6.5: UMPT (universal main processing and transmission)

From SRAN9.0 onwards, UMPT boards are classified into the following types:

- l UMPTa series boards: UMPTa1, UMPTa2, and UMPTa6.
- l UMPTb series boards: UMPTb1 and UMPTb2.

Board Type	Applicable Mode
UMPTa1 or UMPTa2	GSM, UMPT, LTE(FDD), and co-MPT multiple modes
UMPTa6	LTE(FDD), LTE(TDD)

The application scenarios of those UMPT boards:

We use umptb1 card for multimode. Because multimode work GSM, UMTS, LTE FDD, and LTE TDD modes.

The Working mode of a UMPT: Indicators R0, R1, and R2 on the UMPT panel are used to determine the working mode of the UMPT board.

R0 Green	R1 Green	R2 Green

Fig6.6:Workingmode of a UMPT

 R0 Green = The Board is working GSM mode. R1 Green = The Board is working UMPT mode R2 Green = The Board is working LTE mode.

5.5 UBRI: Fibre Port Extension Unit in case more than 6 RRUs need to be connected to 1 BBU. 1 UBRI Board can only support 1 Technology, if more than 6 RRUs are needed for GSM and more than 6 RRUs for UMTS, 2 UBRI Boards are needed. UBRI will be installed in slot 2.

Fig-6.7: UBRI

UBBP:

- The entire low pass outgrowth one (UBBP) can assist as a low pass prosecute pasteboard practical in any degree.
- The duty and operation maxim of a UBBP plank. UBBP consummate the succeeding office: multiplexes low pass resort among distinct modes, thereby protect multimode concurrence.
- Provides CPRI transport for conference with RF modules and protuberance uplink and downlink low pass extraordinary.
- The working principle of the UBBP is shown in the following figure.

Fig-6.8: UBBP

Modes are supported by UBBP boards.

We use UBBPd6 model UBBP boards. The UBBPd6 application mode are:

- l GSM single mode.

- l UMTS single mode.
- l LTE FDD single mode.
- l LTE TDD single mode.
- l GU baseband concurrency.
- l GL baseband concurrency.
- l UL baseband concurrency.
- l GUL baseband concurrency.

If the base station now works in GSM mode and needs to work in GUL mode in the future, only the UBBPd6 board can be used. UBBP boards in different slots provide different capabilities. l In UMTS mode, only the UBBP board in slot 2 or 3 can provide CPRI ports.

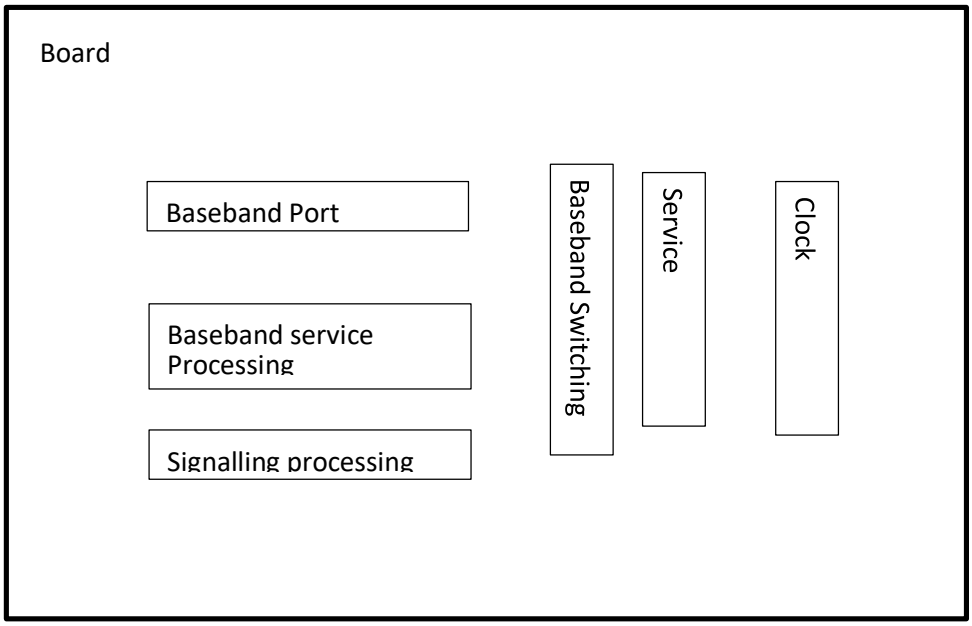
5.7 WBBP: A WBBP is a WCDMA baseband processing unit and can be installed in a BBU3900. The WBBP is classified of WBBPf3 and baseband processing board in slot 2 or 3 in a BBU3900 can transfer received CPRI data to other boards.

Board	Number of Cells	Number of UL CEs	Number of DL CEs	Number of HSDPA Codesb	Number of HSDPA UEs	Number of HSUPA UEs
WBBPf3	**6**	**384**	**512**	**6x15**	**256**	**256**

Fig-6.9: WCDMA baseband processing unit

Function:

- A WBBP narrative uplink and downlink low pass token.
- A WBBP contribute CPRI carry for intercourse with RF modules.
- A WBBPd assist interference cancellation (IC) within the plank.
- When CPRI cablegram hyphenize RF modules carrying answering cells to a WBBPD, the WBBPd instate in slam 2 or 3 back interference cancellation (IC) of uplink data.
- A WBBPf instate in hold 2 or 3 assist low pass interconnection between BBUs.



5.8 MRFU (Multi-Mode Radio Frequency Unit).

One Multi-Mode Radio Frequency Unit (MRFU) supports a maximum of six carriers.

The MRFU has the following functions:

- Modulates and turn the token to the TX belt by up-neophyte the IF sign, filter out and expand the sign, and then transmits the extraordinary to the feeler through the duplexer.
- Receives RF remarkable from the aerial and fulfil down-transmutation, enlargement, analog-to-digital transmutation, digital down-change, suits trainer, and Digital Automatic Gain Control (DAGC), and then transmits the sign to the BBU for further outgrowth.
- Performs sway direct.
- Provides Voltage Standing Wave Ratio (VSWR) perception.
- Supplies influence to the TMA and government the RET feeler.
- Controls DPD audio feedback conspicuous l.
- Generates the CPRI timepiece, come the CPRI timepiece from detriment of synchronicity, and detected affright.
- The MRFU subsist of the lofty-success interface one, remarkable prosecute one, influence amplifier, and twofold one. Figure 4-39 reveal the competent form of the MRFU. The proud-success interface one has the sequacious service: limit

1. 

Fig-6.10: MRFU

5.9 Remote Radio Unit

RRU Definition and Overview-

Radio Remote Unit (RRU) is the distributed and integrated frequency unit that connects to an operator’s network with the User Equipment's (UE's) like Cell Phone and mobile devices.

Fig-5.7: Remote Radio Unit (RRU)

The legitimate conditions "diversified and intermingled" is inasmuch as traditionally the radio workmanship for honeycombed system is supported on a honest-standalone system (Base Stations) mainly in state domestic but now, the favas ecclesiology is disunited. So now the BTS (Base Transceiver Station) is the integration of uncertain radio one inclination BBU and RRU. Despite installation only in domestic, radio one are now induct in the pagoda below the Antenna. The RRU is constant to the bastard posture via the fibre visual meander which is bi-directional bond. The optical interface connect is also given as CPRI (Common Public Radio Interface).interface procedure improved by conspiracy of greater telecom appointment's manufacturing society. The RRU remedy to subjugate the coaxial pasture rope losing’s,

advance system ability and contribute full steady of willowiest in loculamentose place sense. Undoubtedly, this sustain in upgrading to newly equipage's and devices more willingly. The RRU3959 is an outdoor remove e radio unit which is powered by a power cabinet. It is the RF module of the distributed base station and is installed close to the antenna. The RRU3959 performs modulation, demodulation, data processing, and combination and division of baseband signals and RF signals. The RRU3959/RRU3959w has a dual-transmitter and dual-receiver design, which further improves the output power and the carrier capacity.

RRU Functions:

1. Acts as a transceiver: transmit and suffer the use eminent to the infamous situation and fault-versa.
2. Provides back to back maintain and connectivity between use provision's preferences might, linger etc.
3. Control and progress the EM sign retain from the Antenna via Jumper (Hollow Guide).
4. Provide interface between two curative bond: Optical and EM (Electromagnetic).
5. Provide Controlling assist of the Auxiliary provision's resembling RCU (Remote Control Unit) for electrical lean arrangement commonly assumed as RET(Remote Electrical Tilt).

Generate and mail the distinct indication similar VSWR, RET, ACT etc. RRU Hardware Description: RRU consist in of separate portal for dissimilar example. I have recapitulate the portal that are ordinary among uncertain fraternity likely Huawei, ZTE, Ericsson,

CHAPTER 7

CONCLUSION

7.1 Conclusion

Through my internship program, 2G and 3G system optimization are essential part for me. In a maintenance room, so much devices are arranged and connected there. Room also sensitive because all devices are kept safely and I also follow the safety rules. I also visit both BTS & IBS site but BTS site has so many devices than IBS site. 2G-3G tower height, distance all are important for a survey team leader. Every information related to the tower are so much confidential.

7.2 Requirements

- While visiting the site, site visited Instructions must be follows.
- Using safety belts & dresses while go to nearest tower.
- Drinking Plenty of Water.
- Stay safely while working on the tower.
- Optimize clearly the whole process of 2G-3G technology.
- Neat & clean the maintenance room properly.
- Safety shoes and don't wear too much weighable cloths.
- If I go anywhere, inform the survey team leader obviously.

SITE PICTURE

Now I am showing some site pictures where I visit. I visited BTS & IBS site both. My area was in UTTARA & Mohammadpur.

Fig 8.1: ROBI Tower & Switchboard

Fig-8.2: RRU Box (BTS)

Fig-8.3 - RX Rack with switches & Battery And RRU Connector Board(BTS)

Fig-8.4 Battery with tx rack switch boards

Fig-8.5- BTS site Pictures.(2G & 3G Network) Boards, TXRac .

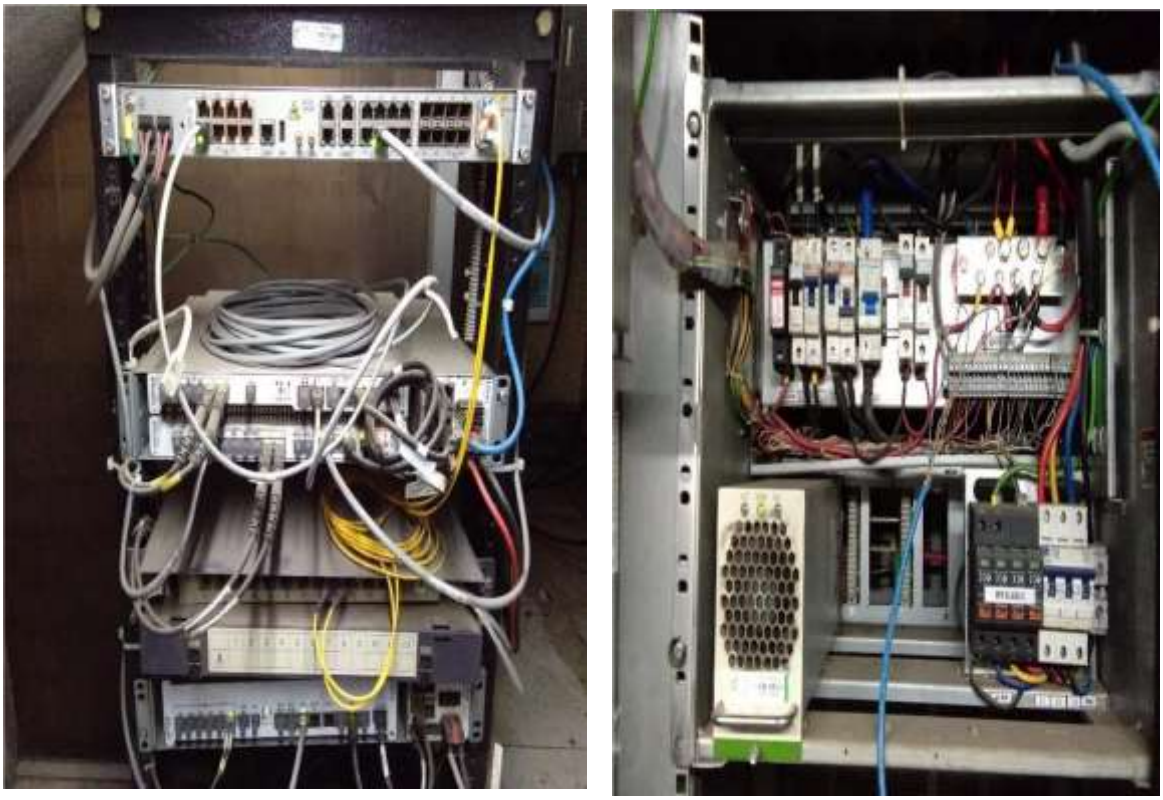


Fig-8.6 TX Rack and Switches

Fig-8.7: Battery & RRU Boards