INTRENSHIP REPORT
ON

BTS INSTALLING, COMMISSIONING; MICROWAVE LINK PLANNING, INSTALLING; RECTIFIER COMMISSIONING AND OPTIMIZATION

BY

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Submitted to the

Department of Electrical and Electronic Engineering

Faculty of Science and Engineering

East West University

In partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering

(B.Sc. in EEE)

Fall- 2010

Approved By

Academic Advisor

KAlam 17/01/2011

Dr. Khairul Alam

Department Chairperson

AHaque

Dr. Anisul Haque

Approval Letter

To whom it may concern

This is to certify that Iftekharul Alam having student ID 2005-3-80-003 has successfully completed the project work that was assigned to them as part of the internship program. We really feel proud to know about the proposal and select our organization for internship opportunities. We will arrange all kinds of possible support from our side to make the internship program successful.

17/02/2011

Md. Moniruzzaman
Chief Operative Officer (C.O.O)
Eminence Communication

Acknowledgment

At first we wise to convey my heartfelt thanks to almighty Allah to complete the Internship successfully and also those who all work hard and cooperating to making this report. Without their assistance we could not have completed our Internship.

We thank Eng. Mr. Joy Ullah, Project Manager, Eminence Communication. I have completed my internship under his supervision.

We would like to thank Engr. Md. Moniruzzaman, C.O.O, Eminence Communication, given me time to discuss about telecommunication technology also giving us opportunity to do Internship. We would also like to thanks Dr. Khairul Alam, Associate Professor, Department of Electrical and Electronic Engineering (EEE) East West University.

We also would like to thank to all the respected officers and employees of Eminence Communication, for their endless support.

We are also very grateful to all of our teachers for their encouragement and cooperation throughout our Internship and academic life.

At last we were grateful to our parents for their encouragement and patience.

Executive Summary

I have completed my internship from Eminence Communication which is located at Nikunjo-2, Khilkhet, Dhaka-1229. I have done all of my internship tasks in different BTS sites such as Dhaka, Norshingdi, Sylhet, Jessore and Shatkhira. The main purpose of Eminence Communication is installation of network equipments and to provide different communication solution for GP (Grameene phone), Robi, Banglalink and Warid telecom. The service provided by Eminence communication is to install new BTS (Base Transceiver Station) tower, Collocation, Rellocation, 3rd cabinet, Huawei swap, Optimization, Microwave link, loss survey, RF, Rectifier commissioning etc. I have done collocation, 3rd cabinet, Huawei swap, Optimization, Microwave link, loss survey and Rectifier commissioning.

Different types of equipments are used to accomplish above task. Equipments include BTS, RBS, GSM antenna, IDU, ODU, Microwave antenna, Coaxial cable etc. with several brands like Ericsson, Nokia, Huawei, Siemens, and Alkatel, NSN, NEC etc. Also different tools are required such as site master, laptop, USB cable, DDF puncher, torque range, spinner, screw driver, vacuum cleaner, measuring tap etc. During Installation, assembling of equipments and proper connection is a very important issue. Otherwise fault can be occurring.

When I work on Eminence got opportunity to see and learn the entire task about communication technology and I completed all of the work successfully. I tried my best to learn and know everything from the respective persons of the Eminence.

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1. Introduction

In Fall-2010 I got an opportunity to do internship in Eminence Communication. Eminence gave me the opportunities to learn practically which we learnt theoretically about latest communication technology. Eminence is one of the top most companies (Subcontract) in Bangladesh. It has a great contribution in developing telecommunication sector in our country. We think Eminence is one of the suitable places to gather practical knowledge about communication technology.

1.1. Company Profile:

Eminence Communication Ltd

a) Foundation:

Eminence communication Ltd started their communication services in the year 2003 with a strong team of telecommunication background. Eminence Communication Ltd is a premier communications company specializing in the high quality installation, repair, maintenance, project management and logistic support you need to meet all your communication requirements. It has built a reputation with cooperative, responsible and reliable delivery of your system needs. The process, methods, workmanship, and expertise deliver customer satisfaction that is managed and guaranteed.

b) Management:

- Chief Operative Officer (C.O.O): Eng. Md. Moniruzzaman
- Project manager: Eng. Joy Ullah
- Installation Manager: Eng. Md. Saifur Rahman
- Administration Manager: Kazi Abu Samun

c) Continuous Improvement:

The ambition to always learn more and improve our skills is key to Eminence employees. As we make achievements or turn milestones our first reaction is to look ahead for the next challenge and try to perform even better. The search for improvement is however balanced with a sound principle of "good enough" when we are engaged in our projects - this to make sure that our customers get the job done at the right cost and time spent.

d) Service Policy:

Eminence Communication Ltd has provided reliable, quality services to the communications industry since its inception. The services are used by many of the most prominent network operators and integrators in the marketplace. Eminence delivers the highest quality and innovation to installation and maintenance services management. We can help you plan, implement and support network applications that leverage your existing investments, avoid delays, and save time and expense as you move toward performance enhancing technologies. The goal is to provide you with a complete solution with results that allow you to focus on your core business and make the installation or upgrade a positive experience for you and your customers.

e) Professional Pride:

Both as a company and as individuals we shall be highly respected among our peers and customers for our professional and straight forward way of doing business. We take great pride in keeping our promises and being open and honest, both to each other and to our customers.

1.2. Objective of the Internship:

The objective of internship was to gather practical knowledge and experiencing the implementation of theoretical study on communication technologies in real world. To this regard this report is contemplating the knowledge and experience accumulated from the internship program. With the set guidelines by the EEE Department of East West University and our internship Supervisor this report comprises of an organization part and a project part. The prime objective of the organization part is to present a background and introduction of Eminence Communication Ltd. And the prime objective of the project part is to make an analysis and implementation of Swap, Collocation, 3rd cabinet, Rectifier commissioning, GSM antenna optimization and Microwave alignment.

1.3. Scope and Methodology:

This report is completely representing the basic networking implementation process of communication technology. It also contains different communication equipments and tools which are needed to finish the services.

This report is written on the basic of two ways information collection, one is talking and discussing with technicians and employee and personal observation and another resource is web site and equipments manuals.

2. Detail of Internship Work

The services I have done in Eminence as my internship work are given below:

1. Huawei swap
2. Collocation
3. 3rd Cabinet
4. Rectifier commissioning
5. Antenna optimization
6. Microwave link

2.1.Huawei swap:

Replacement of one BTS (Base Transceiver Station) against another BTS is called swap.

2.1.1. Why swap is required:

1. **To increase telecommunication traffic:** Telecommunication traffic engineering is a method of optimizing the performance of a telecommunications network by dynamically analyzing, predicting and regulating the behavior of data transmitted over that network. The frequency range of existing BTS is 900 MHz. It allows a specific number of users within supported area. If the no. of user in this area increase, then another 1800MHz BTS is required which can allow more number of users by increasing network capacity. In this case swap is required. Due to upgraded technology, the old BTS (900MHz) cannot support another 1800MHz BTS. So we need to replace new BTS (900MHz) which can support another 1800MHz BTS. 900MHz BTS allows less no. of user within larger area. But 1800MHz BTS allows more no. of user within smaller area.

   Let,
   □*900=*□□
   3□*108900*■*106*
   (Less frequency, more wavelengths)

   □*1800=3*□*1081800*□*106*
   (More frequency, less wavelength)

   □*900>*□*1800.* So the coverage area for 900MHz BTS is larger than 1800MHz BTS.

2. To update G (generation): Mobile communication is now viewed as a necessity and is one of the fastest growing and most demanding technologies. Mobile systems have evolved over time. When discussing different developments we speak of system generations. First generation (1G) systems were analog with reasonably reliable networks but limited service offerings. Second generation (2G) mobile systems are digital and bring significant advantages in terms of service sophistication, capacity and quality. The increasing demand for wireless access to the Internet has led to further developments within 2G systems. Thus we speak of 2.5G systems. General Packet Radio Services (GPRS) is an example of a 2.5G technology. Since there are several 2G systems using incompatible radio technologies, on different frequency spectra, they cannot capture a real worldwide mass-market in the long-term. These factors have led to the concept of third generation (3G) systems which will allow communication, information and entertainment services to be delivered via wireless terminals. To upgrade these G (generation), swap is required.

2.1.2. Equipments used:

1. BTS 3900 (Base Transceiver Station)
2. GSM antenna
3. Feeder cable (coaxial cable)
4. CPRI cable
5. Grounding cable
6. Short jumper
7. Connector
8. L-connector
9. Tap

BTS (Base Transceiver Station):

Model: HUAWEI 3900 (2 sets)

1) 900 MHz
2) 1800 MHz

Figure 2-1: Huawei 3900 BTS

HUAWEI BTS3900 Hardware Structure: (both 900 and 1800)

- The BTS3900 developed by Huawei is an indoor macro BTS. The BTS3900 mainly consists of the BBU and DRFUs. Compared with traditional BTSs, the BTS3900 features simpler structure and higher integration.
- I'll mainly introduce the hardware system structure, basic functions of modules and networking mode of the BTS3900.

BTS3900 System Description:

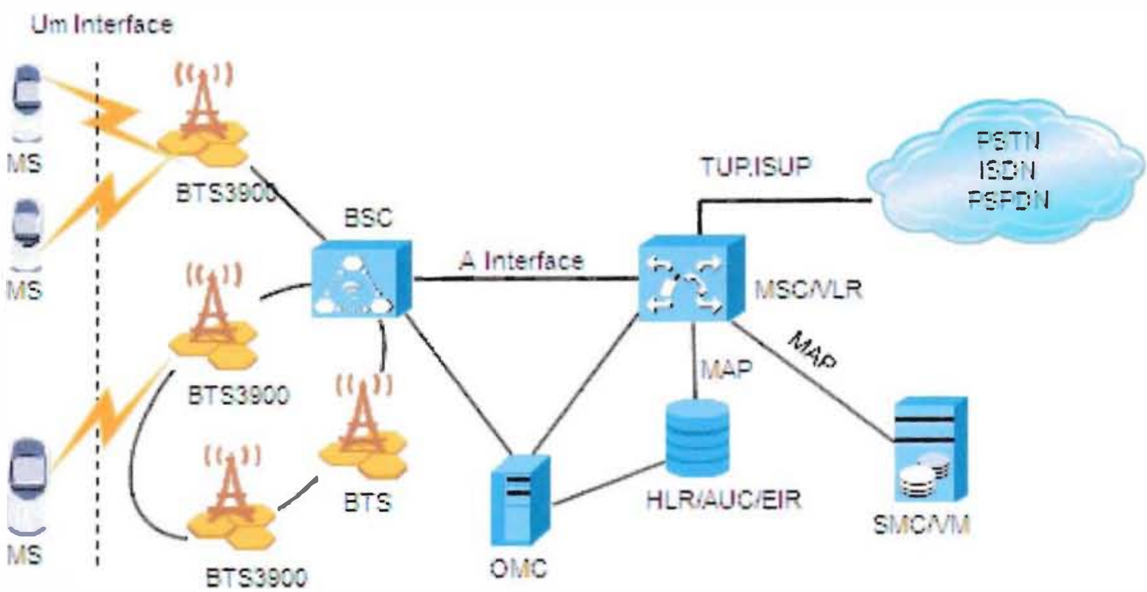


Figure 2-2: Location for 3900BTS

MS: Mobile Station	BTS: Base Transceiver Station	BSC: Base Station Controller
HLR: Home Location Register	AUC: Authentication Center	EIR: Equipment Identity Register
MSC: Mobile Switching Center	VLR: Visitor Location Register	SMC: Short Message Center
VM: Voice Mailbox	OMC: Operation and Maintenance Center DBS：Distributed Base Station	

Table 2-1: System Description

Hardware Component:

Board/ Module	Full Name	Parts in a Single Cabinet	
		Full Configuration	Minimum Configuration
BSBC	Universal BBU Subrack Backplane type C (2U)	1	1
UEIU	Universal Environment Interface Unit	≥3	1
GTMU	GSM Transmission and Management Unit for the BBU	1	1
UELP	Universal E1/T1 Lightning Protection Unit	0	0
UBFA	Universal BBU Fan unit type A (2U)	1	1
UPEU	Universal Power and Environment interface Unit	2	1
DRFU	Double Radio Filter Unit	6	1
DCDU-01	Direct Current Distribution Unit	1	1
GATM	GSM Antenna and TMA Control Module	1	0
PMU	Power and Environment Monitoring Unit	1	0
PSU (AC/DC)	Power Supply Unit (AC/DC)	3	0
PSU (DC/DC)	Power Supply Unit (DC/DC)	4	0
FAN Box	FAN Box	1	1

Table 2-2: Hardware Component

BTS3900 Cabinet Structure:

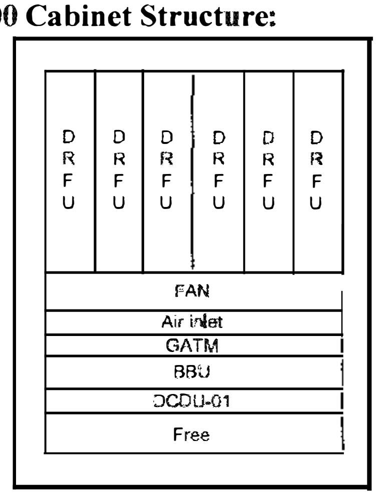


Figure 2-3: Fully configured cabinet

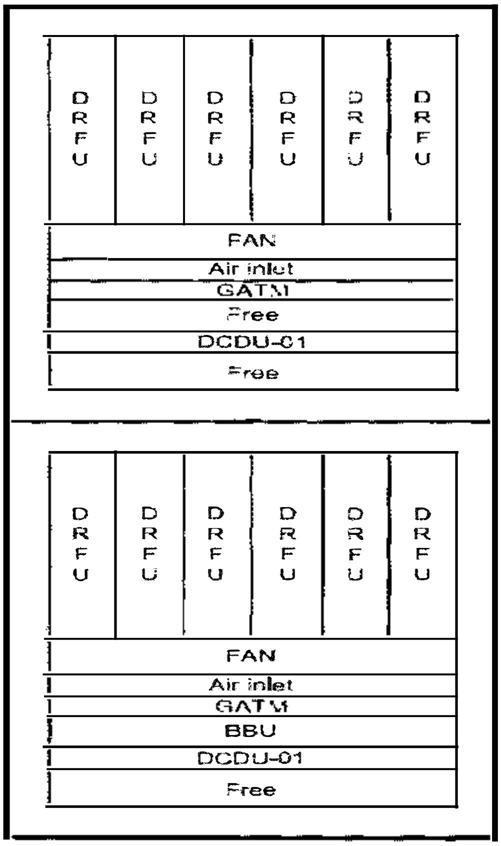


Figure 2-4: Stacked cabinets in full configuration

BTS 3900 Hardware consists of:

- BBU
- DRFU
- DCDU-01
- GATM
- PMU
- PSU
- FAN BOX

Figure 2-5: BTS 3900 Indoor view

BTS3900 Logical Structure:

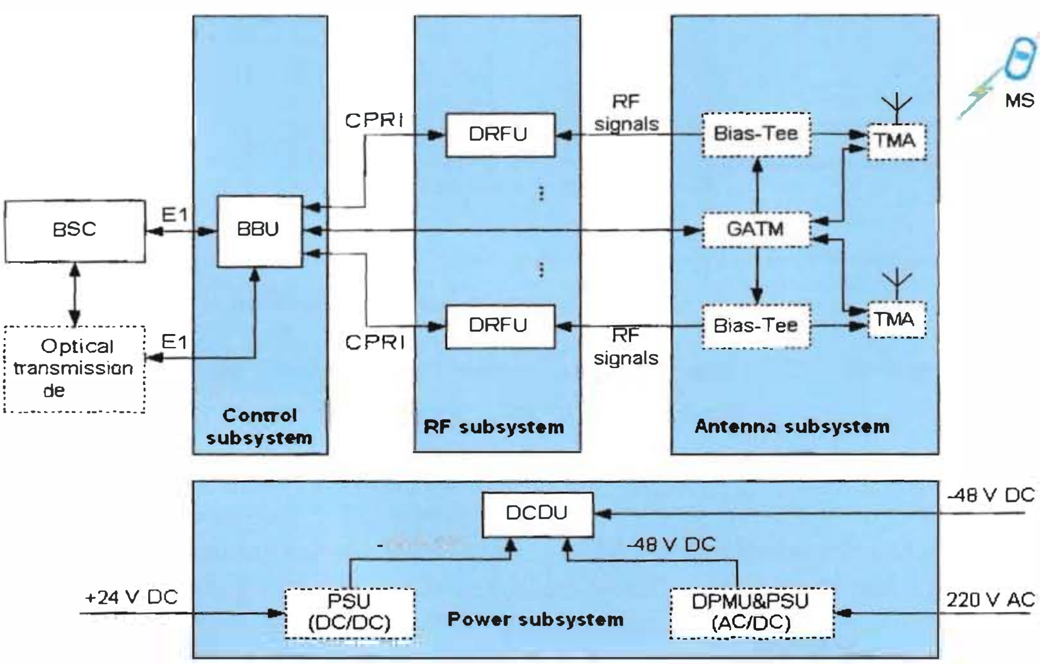


Figure 2-6: BTS3900 Logical Structure

BBU Hardware Structure:

- The typical power consumption of the BBU is 50 W.
- The BBU is a small box with all the external ports on the front panel.
- The BBU3900 boards consist of the BSBC, UEIU, GTMU, and UELP; the BBU3900 modules consist of the UBFU and the UPEU.

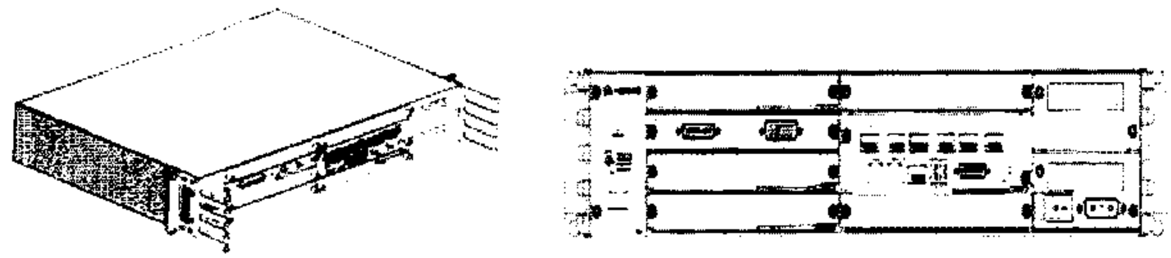


Figure 2-7: BBU Hardware Structure

DRFU Structure:

- The DRFU performs modulation and demodulation between baseband signals and RF signals, processes data, and combines and divides signals.
- The DRFU consists of the high-speed interface unit, signal processing unit, power amplifier, and dual-duplexer.

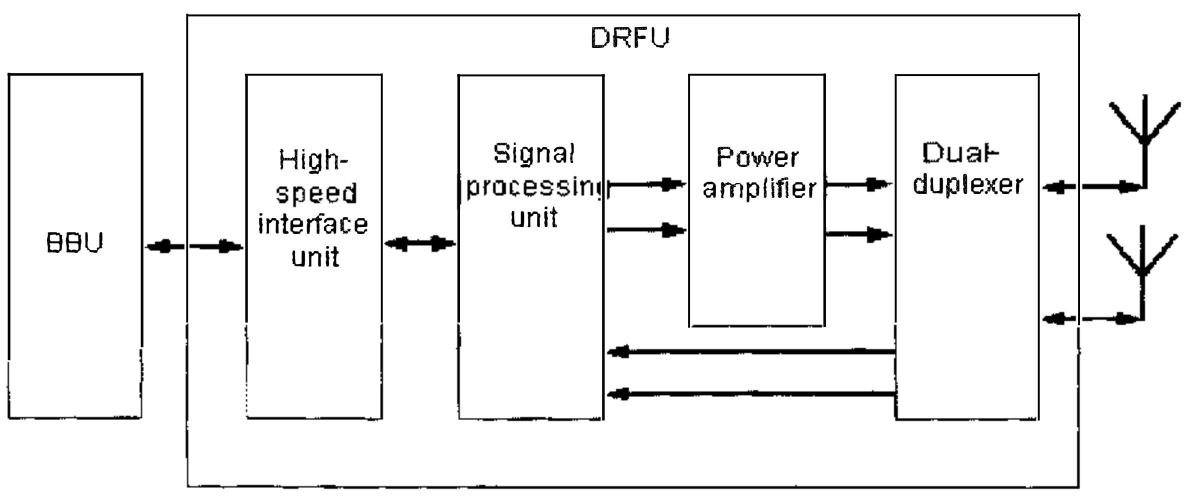


Figure 2-8: DRFU Logical Structure

DCDU-01 Module: The direction current distribution unit (DCDU-01) provides -48V DC power of 10 outputs.

The functions of the DCDU-01 are:

- Receiving -48 V DC power input.
- Distributing the -48 V DC powers of 10 outputs for boards and modules in the cabinet.
- Providing surge protection of 10 kA in differential mode and 15 kA in common mode and providing dry contact for surge protection failure.

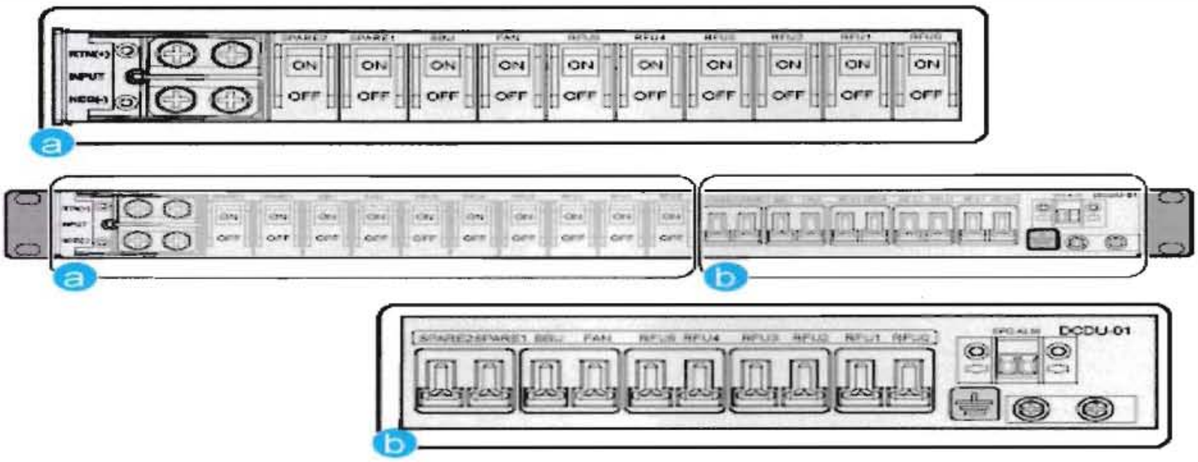


Figure 2-9: DCDU-01 module structure

GATM Module: The GSM antenna and TMA (tower mounting amplifier) control module (GATM) is a module that controls the antenna and TMA. The GATM is optional.

The GATM performs the following functions:

- Controls the RET antenna
- Feeds power to the TMA
- Reports the RET control alarm signals
- Monitors the current from the feeder

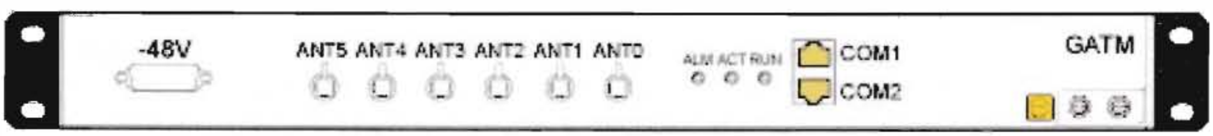


Figure 2-10: GATM structure

PSU Module: The Power Supply Unit (PSU) converts the ~220V AC or +24V DC power into the -48V DC power.

- **The PSU (AC/DC) has the following functions:**
  - Converts the 220 V AC power into the -48 V DC power.
  - Monitors alarms related to module faults (such as output over-voltage, no output, and fan faults), alarms related to module protection (such as over-temperature protection, and input over-voltage/under-voltage protection), and power failure alarm.
  - Monitors the charging and discharging of the batteries.

- **The PSU (DC/DC) has the following functions:**
  - Converts the +24 V DC power into the -48 V DC power.
  - Monitors alarms related to module faults (such as output over-voltage, no output, and fan faults), alarms related to module protection (such as over

temperature protection, and input over-voltage/under-voltage protection), and power failure alarm.

PMU Module: The PMU manages the power supply and batteries. The PMU is the core of the power monitoring system.

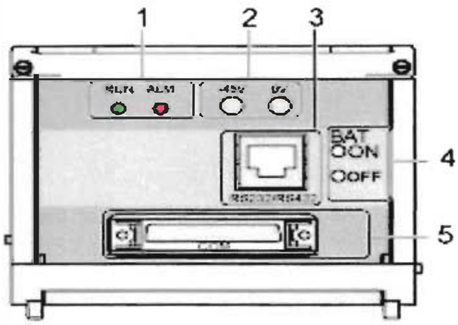


Figure 2-11: PMU (Power Supply Unit)

The PMU performs the following functions:

- Communicates with the central processing unit through the RS232/RS422 serial port.
- Manages the power system and the battery charging and discharging.
- Detects and reports water damage alarms, smoke alarms, door status alarms, and standby Boolean value alarms; reports ambient humidity and temperature, battery temperature, and standby analog values.
- Detects power distribution and reports alarms, and also reports dry contact alarms.

FAN Box: The fan box regulates the temperature at the air inlet of the cabinet and in the fan box. It can adjust the rotation speed of the fans to implement ventilation and dissipation for the cabinet.

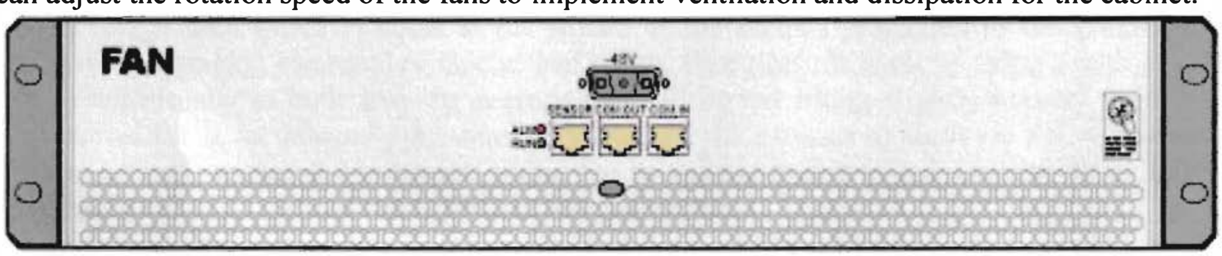


Figure 2-12: Fan box

The fan box performs the following functions:

- Provides forced ventilation and dissipation for the cabinet.
- Supports two modes of adjusting the rotation speed of the fans: adjustment based on the temperature and adjustment controlled by the central processing unit.
- Detects the temperature.
- Communicates with the central processing unit to report alarms and the adjusted rotation speed of the fans based on the temperature to the central processing unit.
- Stops the rotation of the fans when the ambient temperature is low.

GSM antenna:
An antenna is a transducer that transmits or receives electromagnetic waves. In other words, antennas convert electromagnetic radiation into electric current, or vice versa. Antennas generally deal in the transmission and reception of radio waves, and are a necessary part of all radio equipment.

Figure 2-13: GSM Antenna

A typical GSM antenna is depicted in the figure. At the bottom, there are RF connectors for coaxial cable feed line and adjustment mechanism (Electrical tilting). For its outdoor placement, the main reflector screen is produced from aluminum, and all internal parts are housed into a fiberglass radome enclosure to keep its operation stable. Grounding is very important for an outdoor antenna so all metal parts are DC-grounded.

The coverage area which is equal to the square of the sector's projection to the ground can be adjusted by changing electrical or mechanical tilting. Electrical tilt is set by using a special control unit which usually is built into the antenna case. Electrical tilting slightly reduces beam width. Mechanical tilt is set manually by antenna tilt meter. To increase or decrease the coverage area, antenna tilting is required. Mechanical tilting can be upward or downward. Upward tilting increases coverage area but downward tilting reduces coverage area.

3600.

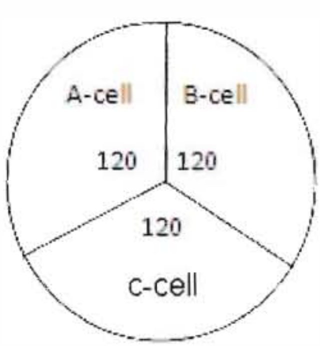


Figure 2-14: GSM cell alignment

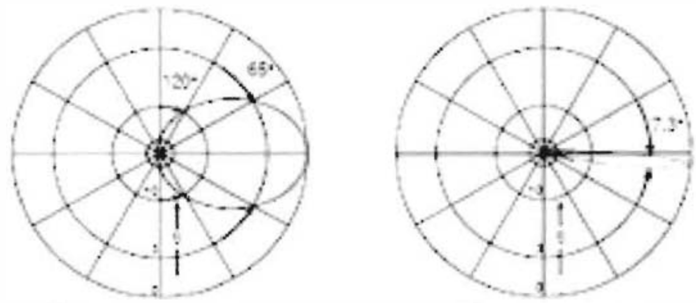


Figure 2-15: Horizontal and vertical radiation patterns, the latter with a pronounced downward beam tilt

GSM antenna Brand: There are different type's antenna brands like Ericsson, Nokia, Siemens, Motorola, Huawei etc.

Feeder cable (coaxial cable):
A type of wire that consists of a center wire surrounded by insulation and then a grounded shield of braided wire. The shield minimizes electrical and radio frequency interference. Coaxial cable is called "coaxial" because it includes one physical channel that carries the signal surrounded (after a layer of insulation) by another concentric physical channel, both running along the same axis. The outer channel serves as a ground. Many of these cables or pairs of coaxial tubes can be placed in a single outer sheathing and, with repeaters, can carry information for a great distance. Different widths of feeder cable is used like ½ cable, 7/8 cable, 15/8 cable.

Figure 2-16: Coaxial cable

CPRI cable:
CPRI is one type of coaxial cable used to BTS to BTS, BTS to IDU (microwave indoor unit) and IDU to ODU (microwave outdoor unit) etc.

Grounding cable:
Normal aluminum cable used to grounding all equipments in BTS room.

Short jumper:
Sometimes short jumper is used to connect between feeder cable and BTS and between feeder cable and GSM antenna.

Connector:
Connecter is used to make connection between BTS and short jumper, short jumper and feeder cable, feeder cable and GSM antenna etc.

L-connector:
L-connector is one types of connector which is L-shaped.

Tap:
Tap is used for tapping on leaky surface and joint section in feeder cable so that it can reduce signal loss.

2.1.3. Tools used:

- Site master
- Laptop
- USB cable
- DDF puncher
- Torque Range
- Spinner
- Screw driver
- Vacuum cleaner
- Measuring tap

2.1.4. Working Procedure:

During my internship period I joined with an installation team. We went to Norshingdi under supervision of Eng. Mr. Aziz for Huawei Swap. At first Mr. Aziz made a short speech about swap. From the speech, I tried to gather knowledge about swap. Here, I am giving the hole installing procedure briefly.

First we made the short jumper by adjusting connector (feeder cable side) and L-connector (BTS side) with the both side of ½ inch coaxial cable (feeder cable). Then we made connection between DRFU and BBU by CPRI cable. We connect the PSU with rectifier by power cable. Each DRFU has 2TRX (transmitter and receiver). For 222 configurations, 3 DRFU is used. 3 DRFU is internally connected with 3 GSM antennas respectively. For 444 configurations, we used 6 DRFU (2 DRFU for each antenna). We made connection between 2 DRFU by cross cable with TX and RX. We also connected another 2 pair of DRFU following previous procedure. We connected the BTS E1 (electric signal) port with IDU port (Indoor unit of microwave) using E1 cable. Then we adjusted three sensors in suitable place. 1. Door sensor, 2. Water level indicator, 3. Smoke detector. These sensors are connected with EMU (Environment Monitoring Unit) which is finally connected with BTS. Finally we checked all cable connection.

Now, we turned on the BTS power switch. To login with BTS, we connected BTS with a laptop by USB cable and opened BTSM software. From this software we checked three sensors whether they are working or not.

2.2. Collocation: (Ericsson)

Cascading one Ericsson RBS **(Radio Base Station)** with another Master RBS is called Collocation.

2.2.1. Why Collocation is required:

To increase telecommunication traffic: Normally the existing RBS (900 MHz) in the BTS room which can allows a specific number of users within a selected area. If the no. of user in this area increases, then another RBS (1800MHz) has to be installed. This installing process is called collocation. In this case, the existing RBS (900MHz) can support another 1800MHz RBS. So replacement is not required for existing RBS. After collocation, existing 900MHz RBS is working as master RBS and the cascaded 1800MHz RBS is called slave RBS.

2.2.2. Equipments used:

1. RBS 2206 (Ericsson)
2. GSM antenna
3. Feeder cable (coaxial cable)
4. CPRI cable
5. Grounding cable
6. Short jumper
7. Connector
8. L-connector (if required)
9. Tap

RBS 2206:
Model-Ericsson RBS 2206 (Version 2)
The RBS 2206 is a high-capacity indoor base station. It is used for indoor applications with up to six double Transceiver Units (dTRU). The RBS 2206 is designed to be transported as a fully-assembled cabinet to the site. All units in the cabinet are easily accessible from the front of the cabinet, which means that the cabinets can be mounted side by side with their backs against a wall.

Main Features
The RBS 2206 supports the following features:

- 1, 2 or 3 sectors in one cabinet using Combining and Distribution Unit (CDU-F or CDU-G)
- Co-siting (antenna sharing) with GSM, TDMA or WCDMA systems

- Discontinuous transmission/reception
- Duplex filters
- Dynamic power regulation
- Encryption/ciphering
- EDGE, hardware prepared
- Expansion by TG-synchronization
- External alarms
- Frequency hopping
- Link Access Procedures on D-channel (LAPD) concentration and LAPD multiplexing are used to make the transmission resource more efficient
- Positioning with GPS
- Radio configurations supported on 800, 900, 1800 and 1900 MHz
- Receiver diversity
- Transmission Interface: The following transport network interface alternatives exist:
  - ✓ T1 1544 kbit/s, 100 Ω, with PLM synchronization
  - ✓ E1 2048 kbit/s, 75 Ω, with PCM synchronization
  - ✓ E1 2048 kbit/s, 120 Ω, with PCM synchronization
- Wide range power input 120 – 250 V AC

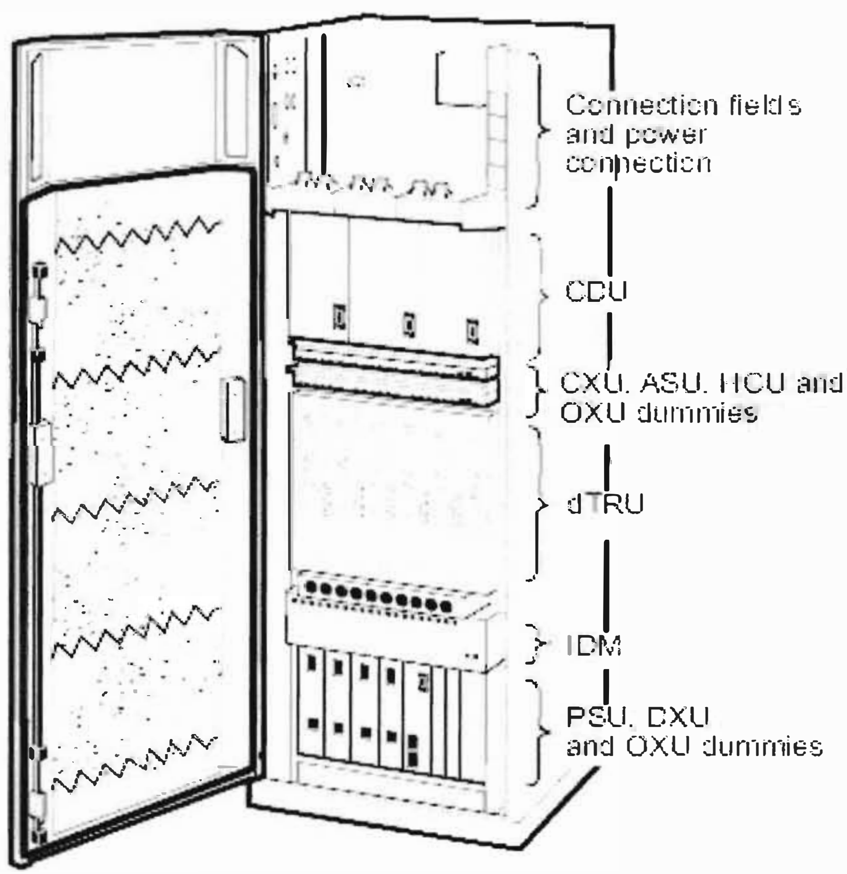


Figure 2-17: RBS 2206

RBS 2206 (Ericsson) Hardware Structure: (both 900 and 1800 MHz)

The RBS 2206 is developed by Ericsson is an indoor macro RBS. The RBS mainly consists of the CDU (Combining and Distribution Unit), dTRU (double Transceiver Unit), DXU (Distribution Switch Unit), CXU (Configuration Switch Unit) and PSU (Power Supply Unit).

CDU: The Combining and Distribution Unit (CDU) is the interface between the transceivers and the antenna system. All signals are filtered before transmission and after reception by means of band pass filters. The CDU allows several dTRUs to share antennas. There are a maximum of three CDUs in one RBS 2206.

The CDU combines transmitted signals from several transceivers, and distributes the received signal to several transceivers. The CDU is hardware-prepared to support EDGE. Two different CDU types are used in the RBS 2206 to support all configurations:

- **CDU-F** is a filter combiner intended for high capacity solutions.
- **CDU-G** can be configured either for high capacity or for high coverage. It is a combiner that can be used for synthesizer hopping.

CXU: The Configuration Switch Unit (CXU) cross-connects the CDU and the dTRU in the receiver path. The CXU makes it possible to expand or reconfigure a cabinet without moving or replacing any RX cables. The RX inputs/outputs on the dTRU and the CDU are placed in such positions that they minimize the amount of cable types for connecting the CXU with the dTRUs and the CDUs. The CXU is configured by means of software.

dTRU: The double Transceiver Unit (dTRU) contains two TRXs for transmission and reception of two radio carriers. It has a built-in combiner with the optional possibility of combining two TX signals into one TX output. It is also prepared for four-branch RX diversity for further improvements in sensitivity. Variants of the dTRU support both GMSK and EDGE.

DXU: The Distribution Switch Unit (DXU) is the central control unit for the RBS. It supports the interface to the BSC, and it collects and transmits alarms. The DXU controls the power and climate equipment for the RBS. It has a removable compact flashcard which makes it possible to replace a faulty DXU without the need for loading RBS software from the BSC. The DXU is also provided with four ports for transmission interfaces. The DXU-21 has hardware support for EDGE on 12 TRXs.

PSU: The Power Supply Unit (PSU) is available in two versions, PSU AC for connection to AC mains, or PSU DC for connection to -48 or -60 V DC power supply.

- The PSU AC converts 120 – 250 V to regulated +24 V DC
- The PSU DC converts -48 or -60 V DC to regulated +24 V DC

RBS 2206 Radio Configurations:

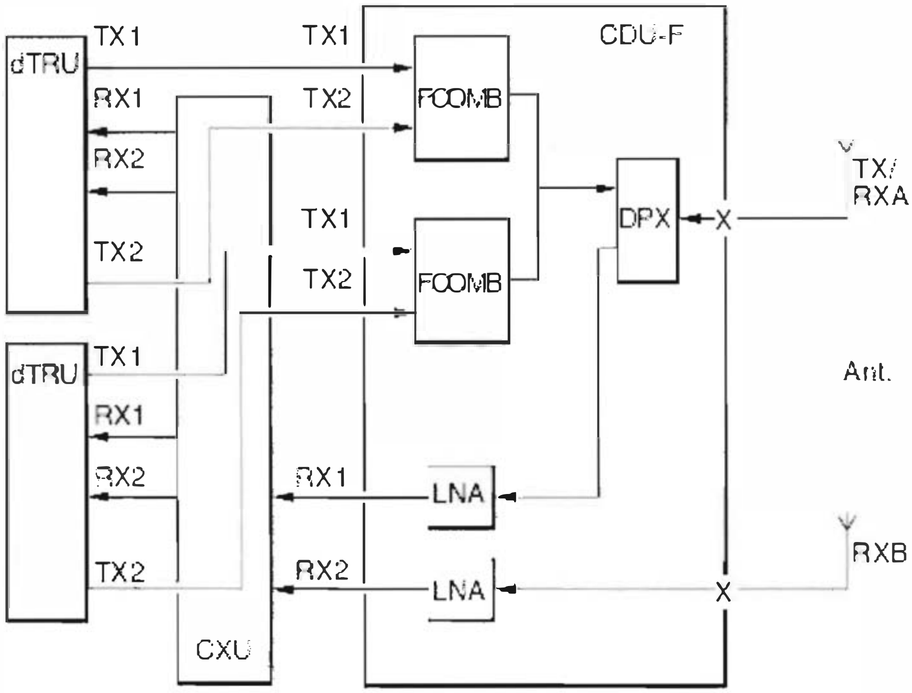


Figure 2-18: Radio configuration

Other equipments are same as used in Huawei swap.

2.2.3. Tools used:

- Site master
- Laptop
- USB cable
- OMT cable
- DDF puncher
- Torque Range
- Spinner
- Screw driver
- Compass
- Measuring tap

2.2.4. Working procedure:

During my internship period I joined with a collocation installation team. We went to Malitola, Dhaka under supervision of senior Eng. Mr. Zahid. He made a short speech about collocation. From the speech, I got an overview about installation and tried to gather knowledge about this. Here, I am giving the hole installing procedure briefly.

RBS internal wiring: First we made connection between RBS internal components. There are three CDU in a RBS. We made connection between them. For 2+4+4 TRU configuration, five dTRU is required. Then we connected three CDU with three GSM antennas TX and RX by connector. Then we connected CDU TX with dTRU TX and CDU RX with dTRU RX.

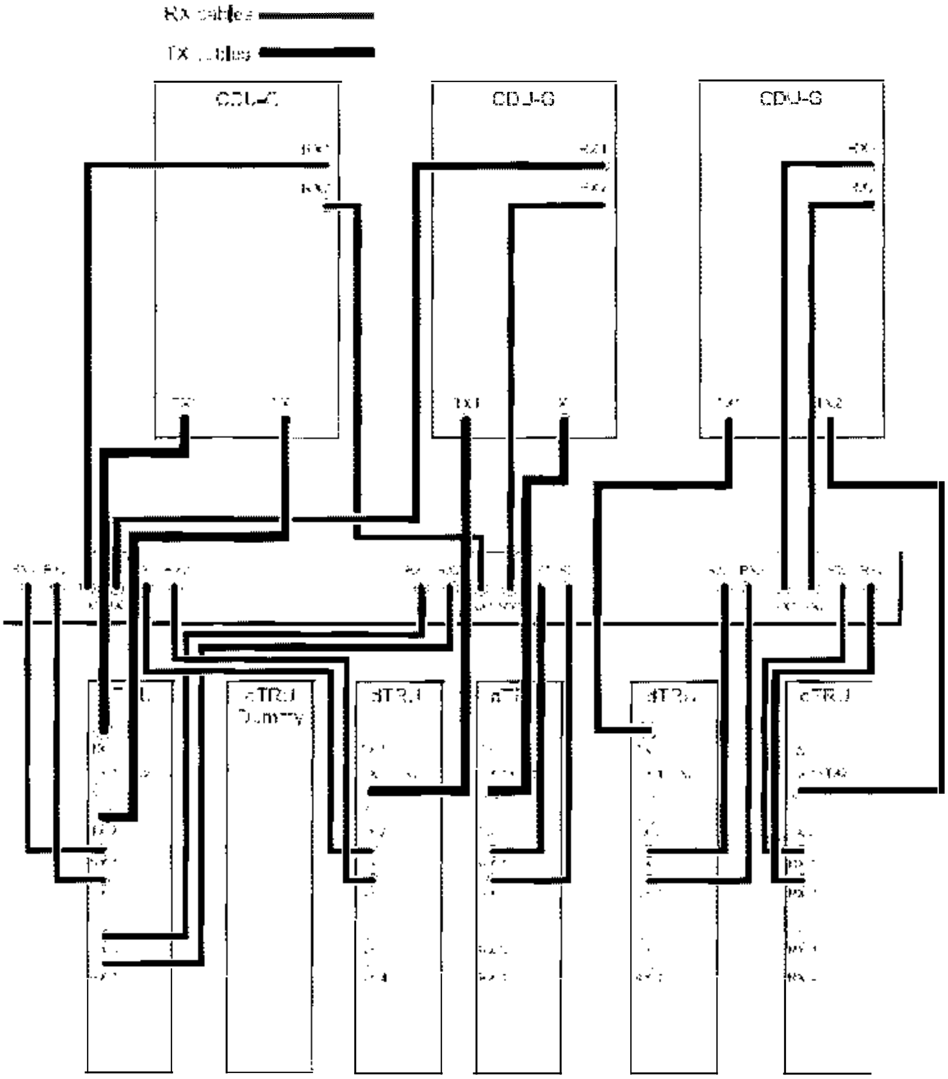


Figure 2-19: CDU Connections to CXU and dTRU with 2+4+4 Configuration

Installing the antenna system: We installed antenna with tower pole following the given plan. We set up antenna electrical and mechanical tilting according to plan. Then we taped feeder port of antenna properly. Tapping is very important issue otherwise signal loss can be occur.

Grounding the RBS: We made grounding connection with RBS body properly by grounding cable.

Connecting a power supply to the RBS: We connected the RBS with rectifier using power cable to give electric power supply.

VSWR (Voltage Standing Wave Ratio) measurement: VSWR is one of the major issue for feeder cable. So we have to be careful during VSWR measurement. Before VSWR measurement, we calibrated the site master. We connected the feeder cable with site master through connector and measured the value and save it. The value of VSWR should be less than 1.40. If it is greater than 1.40, then we have to change feeder cable. Otherwise the site will be rejected.

Connecting the antenna system to the RBS: If the length of cable between RBS and antenna is within 29m, short jumper is not required. But for more than 29m, short jumper is required in the both side of feeder cable. In this case, feeder length is greater than 29m. So we made short jumper and connected it with both side feeder cable. We connected the one end with RBS and other end with GSM antenna.

Connecting PCM (Pulse Code Modulation) cable: We connected the RBS with microwave IDU (Indoor Unit) port using PCM cable.

Synchronization: To do this, we made connection between ESB (External Synchronization Bus) ports of the collocated RBS (1800MHz) and master RBS (900MHz) by ESB cable. ESB is required for giving time delay between master and collocated RBS. The value of ESB delay is,
For both RBS (Master and Slave) version-1: 4638ns
One is version-1 and another is version-2: 4625ns
Both RBS is version-2: 4612ns

Checking main supply power: For collocated site, commercial power supply should be remaining within 8 to 10 KW. So we checked it and saw it is 10KW.

Installing battery backup: We have to replace battery set for collocation. In this case, 48V double capacity (500 Ah) battery is required instead of single capacity (300 Ah) battery set. We used 24pcs battery (2V each battery). We connected 24pcs battery in series to make the set 48V. Using multimeter, we checked the output voltage and got it 48V. Finally we connected the battery set with rectifier by battery power cable and battery set started to charged. During load shedding, RBS get power from battery.

Rectifier setting: For single RBS, two rectifier modules are required. But for double RBS, three rectifier modules are required. So an extra module we installed in the rectifier. For single capacity, rectifier maximum current limit has 60A. But for double capacity, we have changed it to 100A. So we changed it to 100A from rectifier function.

IDB load: To operate RBS, loading IDB must be required. To do this, we need OMT (Operation and Maintenance Terminal) software. Using OMT cable, we connected RBS with laptop. We created an IDB using OMT software. After following some steps, we loaded IDB. Finally RBS came to operating condition.

Alarm checking: We checked the previously installed alarm such as door open, water level high, temperature high, main power supply fail, rectifier module fail, aviation light fail etc.

RBS monitoring: After coming operation, we monitored the performance of the RBS. RBS can be monitor using laptop connected with RBS by OMT cable.
We monitor,

- SSI (Diversity Supervision Mass) value: SSI value should be -3<SSI<3.
- Check IDB
- Faulty RUs (Replaceable Unit)
- MO (Managed Object) fault map
- Absolute radio frequency for TX (Transmitter)
- Absolute radio frequency for RX (Receiver)
- DC system voltage
- ESB (External Synchronization Bus) delay
- Forward power on
- TS (Time Slot) channel combination
- PSU average voltage
- PSU total current
- TF compensation
- TSSP configuration
- RF loop test parameter
- VCO control value

2.3. 3^{rd} Cabinet:

If no. of user increases again in a collocated site, then another cabinet is required to support excess user. This process of installation is called 3^{rd} cabinet. The RBS can be 900MHz or 1800MHz. It depends on no. of user increase within this supported area. If the no. of user increases within wide area then 900MHz RBS is required. But if no. of user increases nearly to the BTS center, then 1800MHz RBS is required. In this case, 3^{rd} cabinet is cascaded with master RBS and collocated 1800MHz RBS make stand alone.

2.3.1. Equipments used:

Same as collocation

2.3.2. Tools used:

Same as collocation

2.3.3. Working procedure:

During my internship period I joined with a 3^{rd} cabinet installation team. We went to Navaron, Jessore under supervision of senior Eng. Mr. Sultan. 3^{rd} cabinet is almost same as collocation. So I had known what we will go to do. Although I tried to gather more knowledge about this. Here, I am giving a short description about 3^{rd} cabinet.

I have already mentioned that the procedure for 3^{rd} cabinet is almost same as collocation. Main difference is for collocation, cell alignment just same as existing 900 RBS. But for 3^{rd} cabinet, cell alignment and number of cell are depends on density of user. Number of cell can be 1, 2 or 3 for 3rd cabinet. So we adjusted GSM cell according to plan. Then we followed the procedure which we did in collocation.

2.4. Rectifier commissioning:

There are two types of power supply is used to operate BTS and other equipments in BTS room. One is commercial supply and another is DC supply. All the equipments in BTS room is operated by DC source. To convert commercial AC supply to DC, a rectifier is used. To operate rectifier, commissioning is required. The process of commissioning is called rectifier commissioning.

2.4.1. Equipments used:

- Rectifier (Brand: Eltech, Delta)
- Module

2.4.2. Tools used:

1. Laptop
2. USB cable
3. Screw driver

2.4.3. Working procedure:

During my internship period I joined with a collocation installation team. We went to Shatkhira under supervision of Eng. Mr. Aziz. Before commissioning, he made a short speech about this. From the speech, I got an overview about commissioning. Here, I am giving a short description about this.

First we connected the rectifier with laptop by USB cable. Using commissioning software, we set up maximum current and voltage range following the given plan. After setting all set up in this software, we saved all. Then the rectifier was coming operation. The rectifier brand was Eltech. So we used Eltech Valarie software.

2.5. GSM antenna optimization:

The process of changing antenna alignment is called GSM antenna optimization.

2.5.1. Why optimization is required:

Three antennas can cover 360 degree angular area within a specified distance. The density of user within this distance is not same and it is varying. If density of user is increase in a side, then we have to change the antenna alignment and position. This process is called optimization.

2.5.2. Tools used:

1. Mechanical tilting meter
2. Magnetic compass
3. Screw driver

2.5.3. Working procedure:

For antenna optimization, I joined with a team under supervision of Eng. Mr. Sultan. We went to Sylhet for optimization. Here I am giving a short description about this.

According to plan, we changed the position of the antenna and adjusted it. Then we checked the antenna alignment using magnetic compass. Using tilting meter, we adjusted the mechanical tilting of antenna according to plan. Finally we adjusted electrical tilting.

2.6. Microwave alignment:

Microwave link is required for data transmission. To transfer data, alignment of microwave is a very important issue.

2.6.1. Tools used:

1. Design document
2. Multimeter
3. Laptop
4. Telecommunication tool: includes interphones and mobile phones.
5. Spanner
6. Telescope
7. Magnetic compass

2.6.2. Prerequisites for Installation:

- The microwave equipment must be ready for the telecom (RFT) test.
- Security check must be conducted.
- The antenna must be installed and the outdoor operations must be performed. These operations must be performed in favorable weather.
- The IF cable and the elliptical wavelength must be installed.
- The indoor operations, which can be performed during unfavorable weather and at night, must be performed.
- All the cables and links must be labelled.
- Grounding must be performed.
- The installation field must be cleaned after the installation is complete.
- The power-on operation must be performed.

:.6.3. Commissioning Preparations:

ccording to the network planning document, first we checked the service capacity and modulation heme of the IF board, and checked whether the transmit frequency and power of the ODU are nsistent with the actual configuration of the NE. Then we set up the working attribute of the ODU Transmit. We disabled the ATPC function. In the case of 1+1 protection configuration, we set up e working attribute of the standby ODU to mute or forcibly switched to the working board. Finally checked the alarms of the ODU.

:.6.4. Method of Adjusting the Antenna Support:

- The elevation of the antenna is adjusted at point 1, and the azimuth of the antenna at point 2.

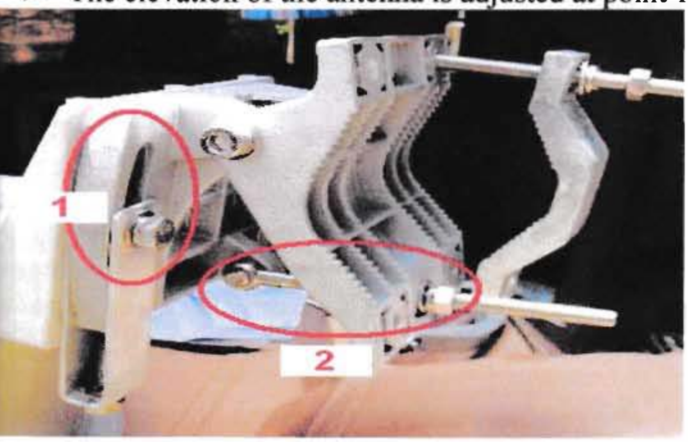
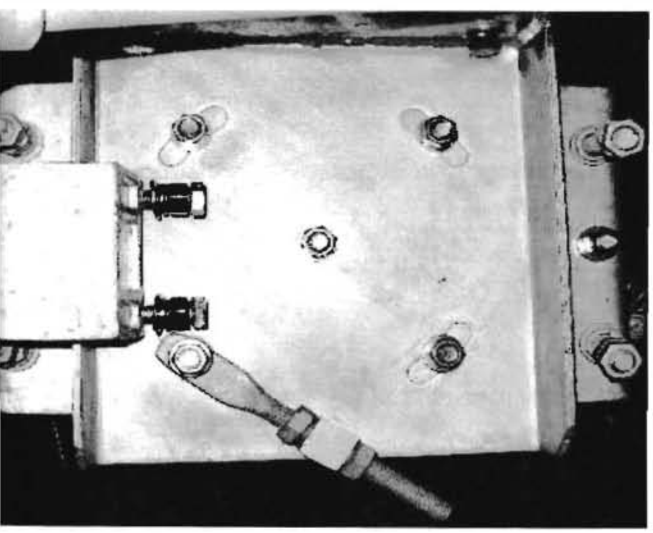


Figure 2-20: Antenna adjusment-1

- The azimuth of the antenna is adjusted by moving the support at point 1, and the elevation of the antenna at point 2.



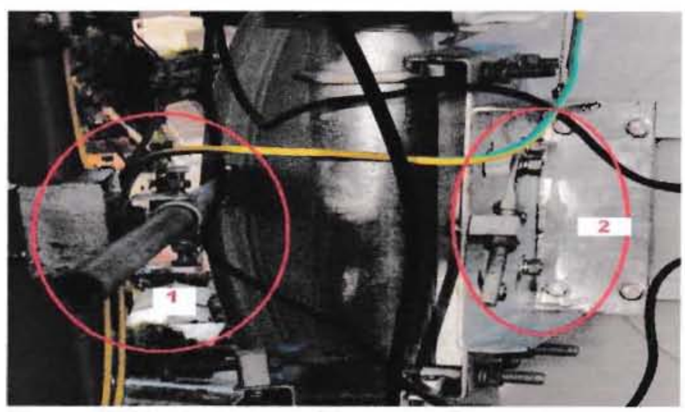


Figure 2-21: Antenna adjusment-2

Figure 2-22: Over-head view at point 2

.6.5. Working procedure:

ıring my internship period I joined with a microwave antenna installing team. We went to ›rshingdi for installing a microwave antenna. From that tour I gathered knowledge about the crowave antenna alignment. I will give the hole installing procedure briefly.

the distance between the two antennas is more than 2 km, we have to place the two antennas rizontally. If the distance between the two antennas is no more than 2 km, we have to adjust the evation of the antenna slightly according to the actual situation. In this case, the distance was 4km. ɔw, we connected the multimeter to the port of the local ODU. We measured the V_{BNC} of the RSSI rt and adjusted the azimuth of the antenna. Then we kept the opposite antenna fixed. We measured e V_{BNC} by using the multimeter. During measurement, we moved the antenna from left to right and e have to make sure that the antenna tracks at least three peak signals of the V_{BNC}. The voltage of e second peak signal should be the maximum one. Then we adjusted the elevation of the antenna at ch peak V_{BNC} so that the V_{BNC} can reach the maximum value. We have to adjust the antenna to a ›sition where the V_{BNC} reaches the highest value. In this position we fixed the local antenna where e V_{BNC} is of the maximum value. Then we adjusted the antenna on the opposite side following ove procedure. After the RSL of the opposite antenna reaches the maximum value, we fixed the pposite antenna. We have to follow above procedure to four times to make the receive signal levels both ends reach the maximum value. Finally we fixed the antennas at both ends. We measured ;ain the VBNC at both ends by using the multimeter to obtain the current RSL by referring to the ırve diagram and the RSL of the VBNC of the ODUs at both ends.

:.6.6. Resolution for Aligning the Antennas:

oarse Adjustment:

e locked the antenna at one side and loosen the adjusting nut of the antenna at the other side. ccording to the network planning design, we adjusted the azimuth and elevation of the antennas so at the antennas at both ends can be aligned. The RSL should be within –80 dB. When one antenna adjusted, the other antenna is locked. That means, the antennas at both ends are adjusted ternatively.

ıtenna adjustment by Using Multimeter:

e have to connect the multimeter to the received signal strength indicator (RSSI) port of the local DU. Multimeter setting should be 10 V DC. Then we have to measure the V_{BNC} of this port.

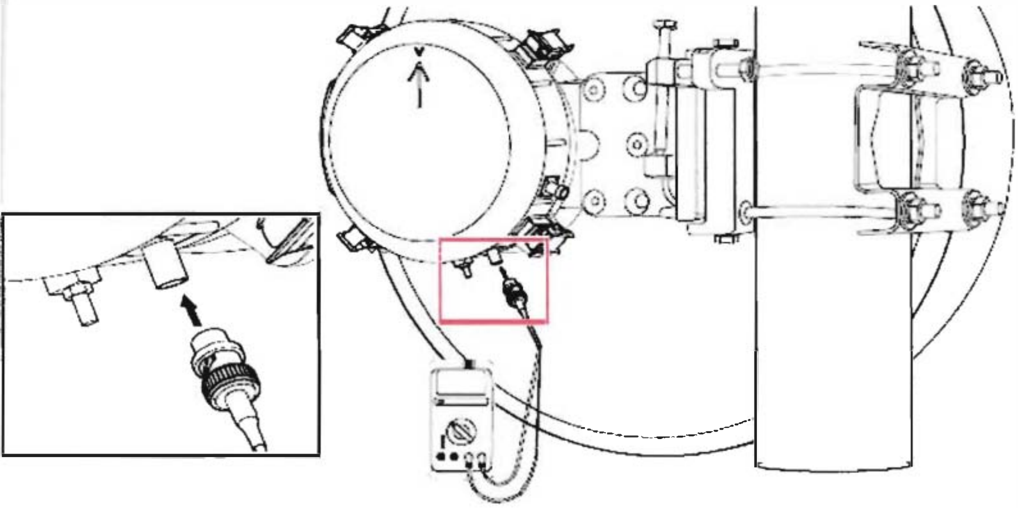


Figure 2-23: Multimeter adjustment

V_{BNC} of the RSSI port varies directly with the RSL of the antenna corresponding to the ODU. t is, the higher the RSL, the higher is the V_{BNC}. So we adjusted the antenna until the voltage hes the peak value so that the main lobes can be aligned properly. The following curve (Fig: 2- shows the relationship between the V_{BNC} (RSSI) and the RSL.

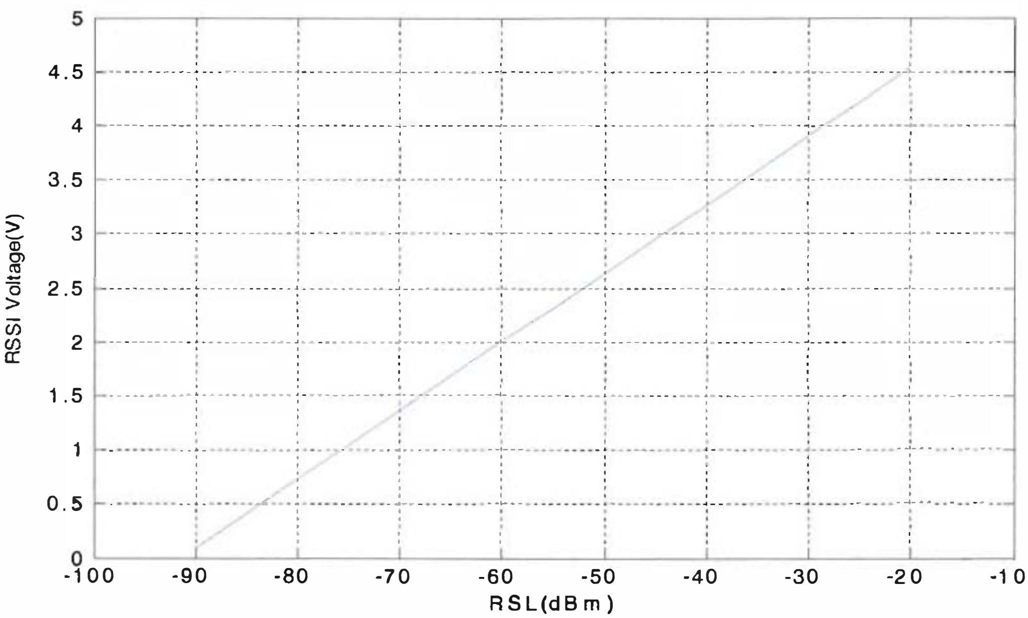


Figure 2-24: Relationship between RSL and V_{BNC}

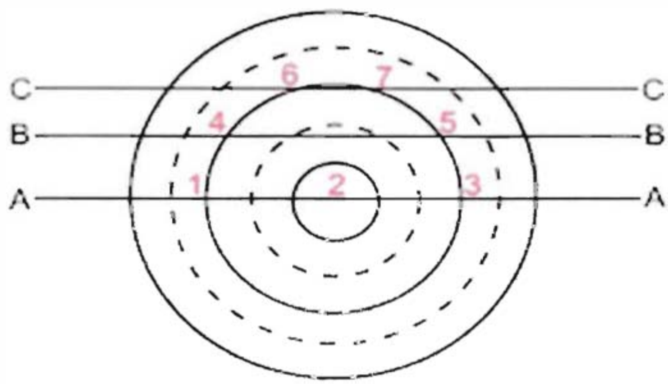


Figure 2-25: Tracking path at different elevations

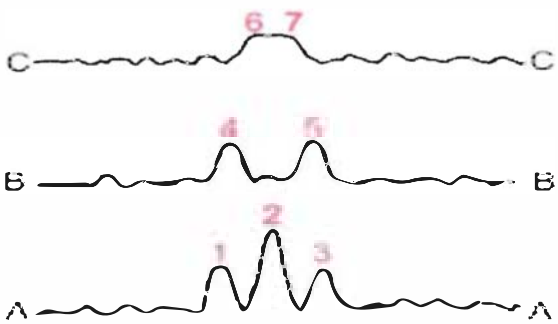


Figure 2-26: VBNC changes during the path tracking

e kept the opposite antenna fixed and moved the local antenna left to right at different elevations. ıen we measured the VBNC. Lines AA, BB, and CC are different tracking paths of the antenna. ccording to the corresponding VBNC change curve, I learn that line AA is the path where in the ain lobes of the antennas are aligned properly. Three points reached the peak value on the curve. ıe main lobe is at point 2. The first side lobes are at points 1 and 3.

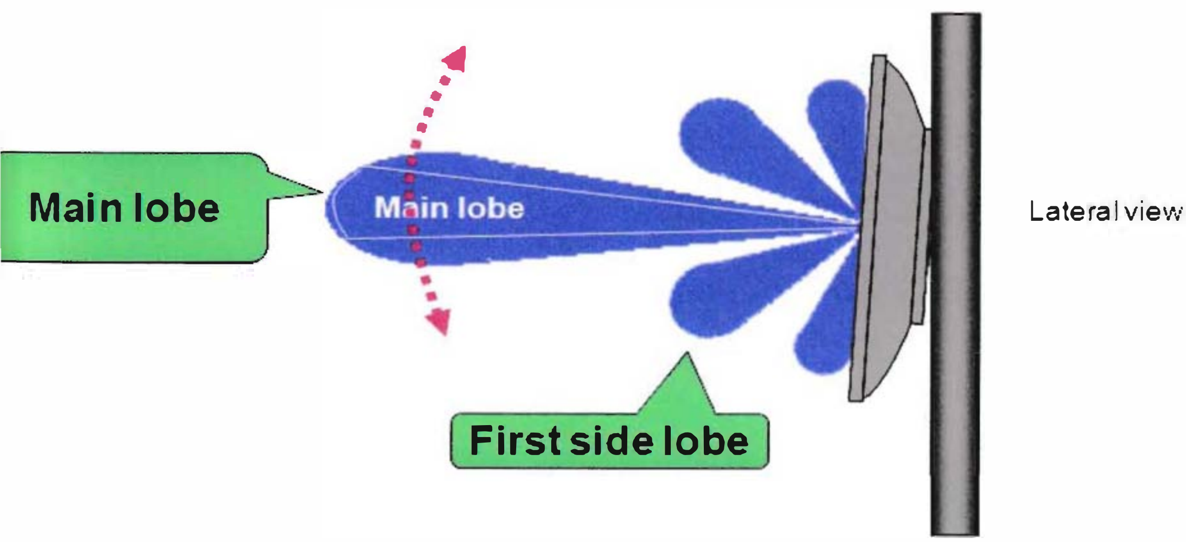


Figure 2-27: Lateral view

al Alignment:

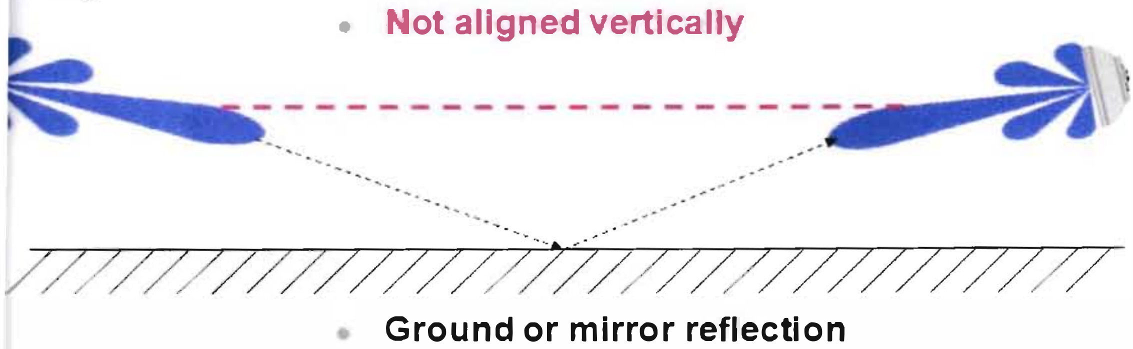


Figure 2-28: Wrong alignment

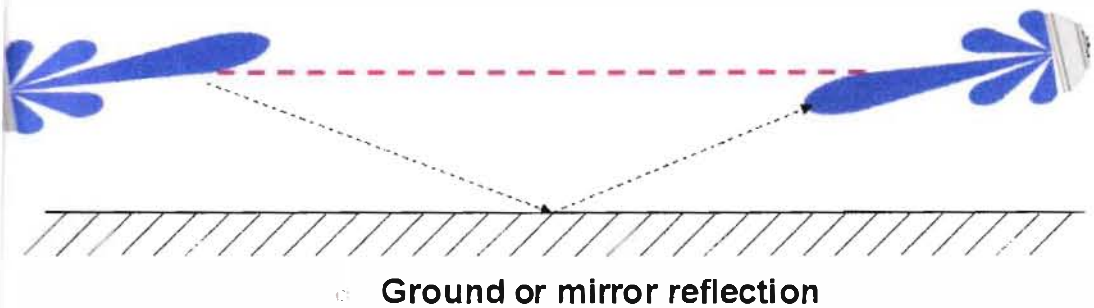


Figure 2-29: Wrong alignment

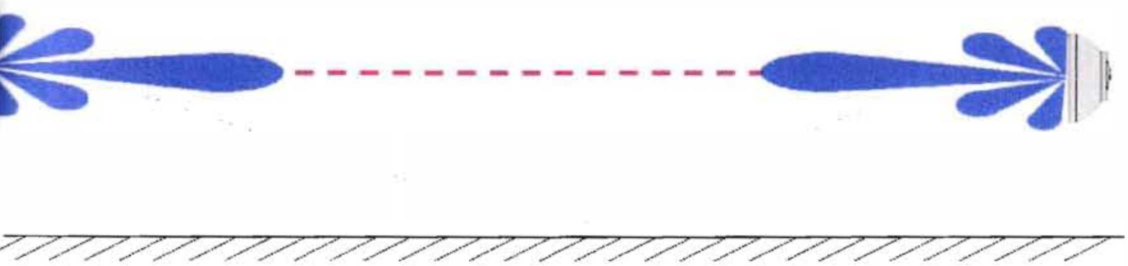


Figure 2-30: Proper alignment

al adjustment in the case of multipath fading caused by the reflection during the long-ice transmission:

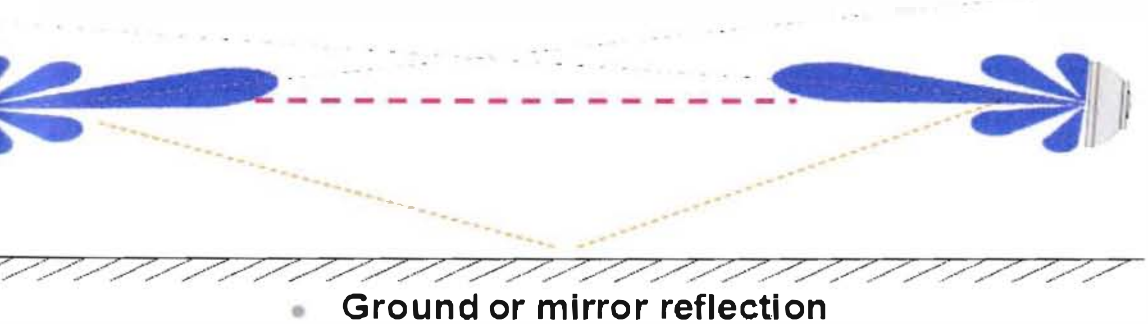


Figure 2-31: Proper alignment

the antennas are aligned properly, we raised the elevation of the antennas slightly (by 0.35 to egree). In this manner, the multipath fading caused by the reflection during the long-distance nission over the water surface is reduced.

zontal Alignment:

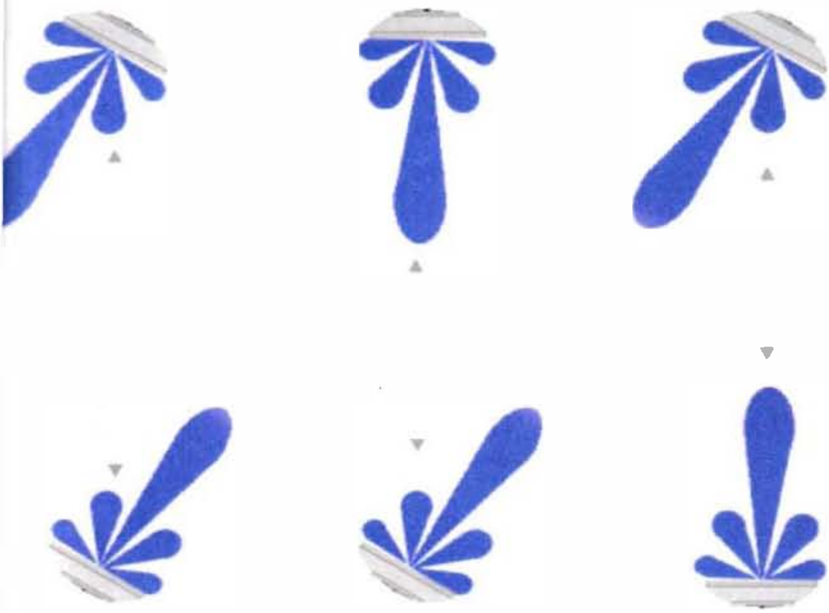


Figure 2-32: Not aligned properly

Figure 2-33: Aligned properly

3. PROBLEMS AND RECOMMENDATIONS

earn about most of the things practically about telecommunication technology, here we face difficulties which are unexpected. Here we have mentioned some unexpected problems which ce in time of working. Most of the problem arises after sudden period of time.

vei swap:

we swap a BTS then we have to connect our new BTS feeder cable with jumper cable. time the cable connection may be mismatch. So we should connect the feeder cable TX and ith jumper cable carefully. When we check our indoor alarm, we have to login with BTSM are. To login this, we have to put an IP address. If we put wrong IP, we couldn't login to BTS ouldn't check alarm. So we should put IP address carefully.

cation and 3rd Cabinet:

times the value of VSWR is above 1.40 for a cell. This problem occurs due to loose connection lamaged feeder cable. So, first we have to all the connection between BTS and GSM antenna. If onnection is correct then we have to change the feeder cable to solve this problem. Sometimes TS shows the RBS fault alarm. This problem occurs due to high temperature in BTS room. So ve to cool the BTS room by Air conditioner to solve this problem.

fier commissioning:

o miss set up of voltage and current, we didn't get proper output from rectifier. In this case, we to set up rectifier again to solve this problem.

nna optimization:

tenna optimization, sometimes antenna azimuth electrical tilting, mechanical tilting and antenna t from ground may not be appropriate as per plan. We should check all of above things when for antenna optimization.

owave link:

crowave link, the link between two sites may not be established due to mismatched direction een two microwave antennas. It is more important for a microwave link to alignment of two wave antennas. If the antennas are not properly aligned, then no networks will be established. e should be careful about this alignment.

4. CONCLUSION

ei swap, Collocation, 3rd cabinet, Rectifier commissioning, Optimization and Microwave ment, installing and commissioning is quite a large sector in telecommunication site. We give best effort to learn as much as possible in this short period of internship. From this nship we joined in a team. The initial work was done earlier and we were given a basic of how it was done. Then we learned about the whole thing mentioned above. We also ed how to check the alarms of BTS and eventually we monitored the alarms of some BTSs. We also familiarized with a corporate environment. From our internship we have gathered lots of ledge and many experiences.

5. REFERENCES

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