INTRENSHIP REPORT

ON

"GSM STRUCTURE; OPERATION OF BSS; IDU, RECTIFIER, BTS INSTALLING AND COMMISSIONING"

BY

KAZI MAZHARUL ISLAM
ID: 2005-2-80-015

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Approved By

Academic Advisors

04.10.2011
S.M. Shahriar Rashid

Department Chairperson

04.10.2011
Dr. Anisul Haque

Teletalk Bangladesh Ltd.
Government Owned Mobile Phone Operator in Bangladesh

House # 41, Road # 27
Block-A, Banani
Dhaka 1213, Bangladesh
Phone : 880-2-885 10 60
Fax : 880-2-988 28 28

No: TBL/SO/Internee/08/86/2010-2011/10 Date: 03 October 2011

Approval Letter

To Whom It May Concern

This is to certify that Kazi Mazharul Islam, Student ID 2005-2-80-015 student of East West University has successfully completed the Industrial Training that was assigned to him as part of the internship program form 2nd May 2011 to 23rd June 2011. At the time of his tenure in Teletalk I found him punctual, polite and obedient. I wish him every success.

03/10/2011

(Kazi Fazlul Haque
Deputy General Manager (HR)

Tel Talk

Acknowledgment

First of all I would like to convey my heartfelt thanks to almighty Allah to complete my Internship successfully. I also thanks all who cooperate me to complete my internship successfully and help me to make this report.

First of all I would like to thank A.R.M. Monjur Rahi, Assistant Manager (System Operation) my superintendent Engineer and the engineers of Operation division of Teletalk Bangladesh Ltd. for allowing me to do the internship and work in their team.

I would also like to thank my advisor S.M. Shahriar Rashid, Lecturer, Department of Electrical & Electronic Engineering, East West University, Bangladesh.

I would also like to mention the name of Dr. Anisul Haque, Chairperson and Professor of the Department of Electrical & Electronic Engineering for being so kind during the period of my internship. I am also grateful to all my teachers and friends for their cooperation and encouragement throughout my whole academic life in EWU.

Executive Summary

Currently, the telecom sector in Bangladesh is dominated by a state-owned telephone company, Bangladesh telegraph and telephone Board (BTTB), which has a virtual monopoly in fixed line telephone service, and which enjoys monopoly rights in domestic long distance and international (terrestrial) services.

Teletalk Bangladesh Ltd is a GSM based state-owned mobile phone company in Bangladesh. TeleTalk started operating on 29 December 2004. It is a Public Limited Company of Bangladesh Government, the state-owned telephone operator. TeleTalk provide GPRS and EDGE internet connectivity and now waiting for the license from Government to start the 3G which is the latest cellular information service. Teletalk is the first operator in the country that gave BTTB (now BTCL) incoming facility to its subscribers.The mission statement of Tele Talk is "Desher Taka Deshey Rakhun" ("Keep your Money in your Country").TeleTalk is the 6th largest mobile phone operator in Bangladesh with 1.147 million subscribers as up to JUly, 2010

I have completed my internship from Teletalk Bangladesh Ltd. I have done all of my internship tasks under Operation department. The Operation department of Teletalk Bangladesh Ltd. includes BSS department and NSS department. I have done my tasks at different BTS sites of Teletalk. The internship we did in Teletalk Bangladesh Ltd, gave us the opportunity to learn about how the planning, installing and commissioning is really done in the practical field. So this report is about the topics that we have learned in our short intern period. Form this internship we have learned how to work in a team. We have also familiarized with a corporate environment. In our internship we have gathered lots of knowledge about many real life problems. When I work on Teletalk, I got opportunity to see and learn the entire task about communication technology and I completed all of the work successfully.

Internship schedule

Date	Subject	Instructor	Time	hour
02.05.2011	Welcome Speech & Introduction to Teletalk Bangladesh Ltd.	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
03.05.2011	BTTB project, License, Company overview, Project cost, Service.	Shah Md. Zobair (Deputy Manager)	10 Am to 5 Pm	6
04.05.2011	Introduction and procedure of RSS, MS, ME, SIM Card.	Shah Md. Zobair (Deputy Manager)	10 Am to 5 Pm	6
05.05.2011	Fundamentals and working procedure of BSS, BSC, BTS, TRAU.	Shah Md. Zobair (Deputy Manager)	10 Am to 5 Pm	6
08.05.2011	Fundamentals and working procedure of NSS, VLR, HLR, AC,EIR	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
09.05.2011	Fundamentals and working procedure of OSS.	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
10.05.2011	Interfaces and nodes of GSM, GSM layered structure	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
11.05.2011	Radio Subsystem, The Mobile Stations, Mobile Equipment	Haseeb Nabi (Assistant Manager)	10 Am to 5 Pm	6
12.05.2011	Overview of Base Station Subsystem, Base Station Controller	Haseeb Nabi (Assistant Manager)	10 Am to 5 Pm	6
14.05.2011	Overview of Operation Subsystem and interfaces	Muntasirul Haque (Assistant Manager)	10 Am to 5 Pm	6
15.05.2011	Installing a Microwave Site,(Installation)	Shah Md. Zobair (Deputy Manager)	01 Pm to 5 Pm	4
16.05.2011	Configuring a Microwave Site(Configuration)	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 2 Pm	4
18.05.2011	Microwave IDU Alarm monitor	Shah Md. Zobair (Deputy Manager)	10 Am to 2 Pm	4
19.05.2011	ETH-OAM Test and Ethernet Bandwidth Test	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
21.05.2011	Swap	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
22.05.2011	External Alarms Checking	Muntasirul Haque (Assistant Manager)	01 Pm to 5 Pm	4
23.05.2011	External Alarms Checking	Muntasirul Haque (Assistant Manager)	10 Am to 2 Pm	4
24.05.2011	Rectifier commissioning	Muntasirul Haque (Assistant Manager)	01 Pm to 5 Pm	4
25.05.2011	Mains Fail	Haseeb Nabi (Assistant Manager)	10 Am to 2 Pm	4
26.05.2011	Swap	Muntasirul Haque (Assistant Manager)	10 Am to 5 Pm	6

29.05.2011	Battery Disconnected Pre-Alarm, Rectifier Module Fail, Aviation Light Failure, Generator Running, Fuel Level Low	Muntasirul Haque (Assistant Manager)	01 Pm to 5 Pm	4
30.05.2011	Commissioning of iPasolink	Haseeb Nabi (Assistant Manager)	10 Am to 2 Pm	4
31.05.2011	Ethernet Bandwidth Test	Haseeb Nabi (Assistant Manager)	01 Pm to 5 Pm	4
01.06.2011	Commissioning of iPasolink	Haseeb Nabi (Assistant Manager)	10 Am to 2 Pm	4
02.06.2011	Ethernet Bandwidth Test	Shah Md. Zobair (Deputy Manager)	10 Am to 5 Pm	6
05.06.2011	Different alarm monitor	Shah Md. Zobair (Deputy Manager)	01 Pm to 5 Pm	4
06.06.2011	Rectifier commissioning	Muntasirul Haque (Assistant Manager)	10 Am to 2 Pm	4
07.06.2011	Rectifier commissioning	Muntasirul Haque (Assistant Manager)	01 Pm to 5 Pm	4
08.06.2011	International roming	Haseeb Nabi (Assistant Manager)	10 Am to 2 Pm	4
09.06.2011	Extra Cabinet installation	Haseeb Nabi (Assistant Manager)	10 Am to 5 Pm	6
12.06.2011	Different alarm monitor	Haseeb Nabi (Assistant Manager)	01 Pm to 5 Pm	4
13.06.2011	Rectifier commissioning	Muntasirul Haque (Assistant Manager)	10 Am to 2 Pm	4
14.06.2011	International roming	Haseeb Nabi (Assistant Manager)	01 Pm to 5 Pm	4
15.06.2011	International roming	Haseeb Nabi (Assistant Manager)	10 Am to 2 Pm	4
16.06.2011	Extra Cabinet installation	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 5 Pm	6
19.06.2011	Microwave IDU Alarm monitor	Haseeb Nabi (Assistant Manager)	01 Pm to 5 Pm	4
20.06.2011	International roming	A.R.M Monjur Rahi (Assistant Manager)	10 Am to 2 Pm	4
21.06.2011	International roming	A.R.M Monjur Rahi (Assistant Manager)	01 Pm to 5 Pm	4
22.06.2011	Microwave IDU Alarm monitor	Shah Md. Zobair (Deputy Manager)	10 Am to 2 Pm	4
23.06.2011	Swap	Muntasirul Haque (Assistant Manager)	10 Am to 5 Pm	6
		Total Hour		194

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Chapter 01

1.1. Report Origin

This report entitled "GSM Structure; Operation of BSS; IDU, Rectifier, BTS installing and commissioning" is a connived depiction of the Two months long internship program at the "Teletalk Bangladesh Ltd.".

1.2. Purpose of Study

The objective of internship was to gather practical knowledge and experiencing the implementation of theoretical study in real world. To this regard this report is contemplating the knowledge and experience accumulated from the internship program. With the guidelines by the EEE Department of East West University and our internship Supervisor this report comprises of an organizational part and project part. The prime objective of the organization part is to present a background and GSM Structure of "Teletalk Bangladesh Ltd." And the prime objective of the project part is to make an analysis of the work of BSS department of Teletalk Bangladesh Ltd. such as installation and commissioning of IDU (Indoor unit), BTS etc.

1.3. Objective of Study

The objective of this project is to visualize:

- GSM Structure of Teletalk Bangladesh Ltd.
- Details structure, design, Service, installation, at different Sites of Teletalk Bangladesh Ltd.

1.4. Data Collection Methods and Sources

To conduct the project the following sources have been used.

- **Primary Information:** The primary source of information is based on the collecting reports of different BSC (Base Station Conroller) of different mobile companies.
- **Secondary Information:** The secondary source of information is based on Internet Searching, Reference Books etc.

1.5. Benefits of Study

The analysis and brief discussion in the project part of this report is based on work of BSS department of Teletalk Bangladesh Ltd. such as installation and commissioning of different vendor's IDU (Indoor unit), BTS etc at different sites. I hope this report will be helpful for the students who have interest to work under Base Station Subsystem of any GSM-PLMN company.

Chapter 02

Overview of Teletalk Bangladesh Ltd.

2. Introduction

Teletalk is a GSM-PLMN company of Bangladesh. This company is the only one PLMN owned by the Government. Teletalk is surving in the market fighting foreign Telecom giants company Grameen phone, Robi airtel Banglalink, reducing its call rate with a heiger degree of frequency. Till now Teletalk is the lowest call rate proveider in this country taking new challenges of globalization effects.

2.1. BTTB to execute the Project:

In ECNEC it was decided to form a separate public limited company for implementation and operation of the project. Bangladesh telegraph and telephone board (BTTB), having longest experience of serving the telecom sector in Bangladesh, undertook initiatives to form the desired company in public sector. In view of the fact that formatives, it was decided that BTTB should implement the project and later on the assets out of this process would be taken over by the desired company to be formed for maintenance and operation.

2.2. Incorporation of Teletalk

Teletalk Bangladesh Limited (the "Company") was incorporated on 26 December, 2004 as a public limited company under the Companies Act, 1994 with an authorized capital of Tk.20, 000,000,000 being the only government sponsored mobile telephone Company in the country. On the same day the Company obtained Certificate of Commencement of Business.

2.3. Operating license

The company has obtained the cellular mobile phone operator license from Bangladesh Telecom Regulatory Commission (BTRC) on 1 September, 2004 for a period of 15 years. Initially the license was issued in the name of BTTB and subsequently upon application; BTRC has changed the name of the operator as Teletalk Bangladesh limited in place of BTTB. The company has to operate within the frequency 890.0-895.2/935.0-940.2 MHz of GSM band allocated by BTRC for GSM technology.

2.4. Company Overview

Teletalk Bangladesh Limited is a public limited company, registered under the Registrar of the Joint stock companies of Bangladesh. Total shares owned by the Government of the Peoples Republic of Bangladesh. Teletalk continue to grow and engage their customers through clear commitment to offering high quality products and services as well as leading customer retention and loyalty programmers. Teletalk continues to be a part of the revolution that's connecting millions of Bangladeshi people and around the world.

Teletalk Bangladesh limited was established keeping a specific role in mind. Teletalk has forged ahead and strengthened its path over the years and achieved some feats truly to be proud of, as the only Bangladeshi mobile operator and the only operator with 100% native technical and engineering human resource base, Teletalk thrives to become the true people's phone – "Amader Phone".

2.5. The project

Basic Objectives for which the Company was formed are highlighted below:

1. To provide mobile telephone service to the people from the public sector
2. To ensure fair competition between public and private sectors and thereby to safeguard public interest
3. To meet a portion of unmitigated high demand of mobile telephone
4. To create a new source of revenue for the government.

2.6. Phase wise and total project cost

In order to ensure timely implementation of the project, competitiveness and mainly to avoid future dependence on any single supplier the entire project has been divided into packages. Geographically packages I cover grater Dhaka, Shylet, Faridpur, Barishal and its peripharial areas. Packages ii covers greater Chittagong, khiulnsa Bogra and most of the North Bengal districts Accordingly, BTTB executed supply, installation, testing and commissioning agreements on turn-key basis, with:

- Simens AG , Germany , at a cost US$40.88 million and
- Huawei Technology Co. ltd, China at a cost of US$35.17 million.

2.7. Scope to be explored

M-Governance is derived from e-governance refers to government's use of information and communication technology to exchange information and services with citizens, businesses, and other arms of government. Teletalk is ready to provide with the help of third party software, mobile interactivity for the citizens of Bangladesh with m-Governance. This may includes, but not limited to

1. Mobile based Live Citizen Reporting Solution
2. Mobile User Info bank (Database of Mobile Users of Bangladesh)

3. Agriculture information services for the farmers and also for the end users, like product price in different parts of the country.
4. Product ID for all consumer products/ Organization.
5. Interactivity between Government and the Citizens.

2.8. Visions & Mission

To innovate and constantly find new ways to enhance our services to our customer's current needs and desires for the future. Our vision is to know our customers and meet their needs better than anyone else.

2.9. Services

Teletalk offers a wide range of services to its customers. Following are an outline of the services presently available with Teletalk:

GPRS

Teletalk offers internet browsing facility for both post-paid and pre-paid subscribers. One can use this facility by using data-cable in computer also. Handsets with GPRS option enable this facility. Through Teletalk GPRS, the subscribers can use the facilities like browsing, email, internet chatting, data transfer etc.

Push-pull services

Like ordinary SMS, one can receive answer to a question s/he asks. By using this push-pull service, one can have the latest updates of important cricket matches. Besides, other important information like weather forecast, prayer time, quotes, horoscopes and especially sehri-iftar timing during ramadhan are also available.

SMS

An SMS of 160 characters each available both in English and Bangla.

ISD and EISD

Every subscriber of Teletalk gets the opportunity of Economic ISD or EISD in 55 countries @ reduced rate per minute. Under this facility, the subscriber should dial 012, then country code, then area code and finally the desired number – instead of dialing access code 00.

DESA Load shedding push-pull service

First time in Bangladesh, Teletalk with co-operation from DESA has instituted a service for consumers to obtain evening load shedding schedule through SMS. With minimal charging of Taka 1.00 per SMS, this service is a welcomed addition to the citizens of Dhaka Metropolitan area that comes under auspices of DESA services.

Mobile Applications through GPRS

Teletalk has also introduced in collaboration with various content providers some Java Mobile applications. Notable among them are "Cricket Update" and "Bangla SMS".

Voice SMS

Teletalk has introduced "Voice SMS" service for it customers to send voice message.

Other unique services

Teletalk has instituted some other unique value added services to accommodate growing customer needs as well as to be in the top edge of current mobile telephony advancements.

Chapter 03

GSM-PLMN

3. Subsystems

A GSM-PLMN is subdivided into the following subsystems:

1. Radio Subsystem (RSS)
2. Network Switching Subsystem (NSS)
3. Operation Subsystem (OSS)

The subsystems functions are grouped into functional units or network elements. Functional units may be realized either as standalone Hardware (HW) units or associated with other GSM functional units in one HW unit.

3.1. Radio Subsystem (RSS)

The Radio Subsystem RSS consists of following functional units:

1. The Mobile Stations (MS)
2. The Base Station Subsystem (BSS)

3.1.1. The Mobile Stations (MS)

The Mobile Stations represent the mobile network components. They consist of two things.

1. The Mobile Equipment (ME)
2. The Subscriber Identity Module (SIM)

The Mobile Equipment (ME)

The Mobile Equipment (ME) unites the tasks of many functional elements of the fixed GSM-PLMN network by using the data of the SIM card, the speech is digitalized, compressed, secured against loss of data (redundancy + interleaving), encrypted to prevent interception and modulated onto the Radio Frequency (RF) created by the mobile station. Directly after, the signal is amplified and transmitted.

In the opposite direction; the process runs inversely, beginning with the reception of the radio frequency (RF).

The MS represents the counterpart to BSC, MSC, HLR, VLR and EIR as regards signaling. As a whole, ME and SIM cards are almost a complete GSM system as regards their functionality

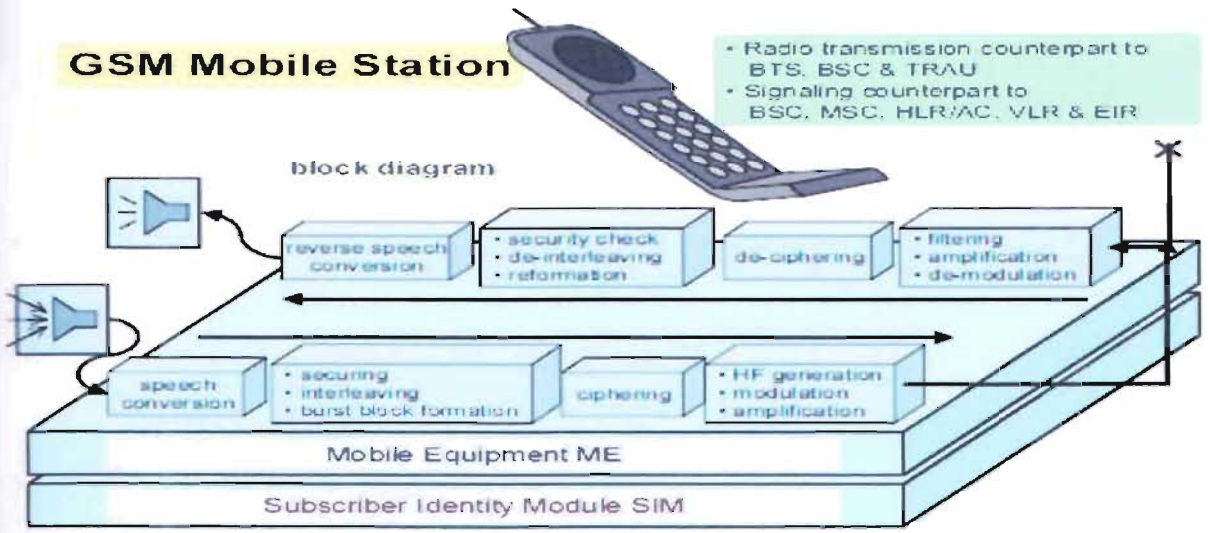


Figure 3.1: Mobile station function block diagram

The SIM card

The SIM consists of a microchip, which uses either a check card or a plate made of a synthetic material as a carrier. Without a SIM card, the use of an MS is normally not possible. An exception is the emergency call, which should always be possible with a functioning ME. The SIM card carries the subscriber-related information and codes, so that a GSM subscriber with a SIM card can use different ME. The main task of the SIM is the storage of data: permanent and temporary administrative data as well as data concerning security. Personal telephone lists may be stored and using the SIM toolkit with enhanced memory space, it is possible to enable applications such as Mobile Banking, etc.

Important stored codes are:

- Personal Identity Number – PIN
- PIN Unblocking Key – PUK
- Mobile Station ISDN number – MSISDN
- International Mobile Subscriber Identity – IMSI
- Temporary Mobile Subscriber Identity - TMSI

Important data relating to security are:

- The individual key - Ki
- The cipher key - Kc
- The algorithms for authorization and ciphering (A3, A8)

3.1.2. The Base Station Subsystem (BSS)

The Base Station Subsystem (BSS) is composed of the following functional units:

1. BSC: Base Station Controller
2. BTS: Base Transceiver Station
3. TRAU: Transcoding and Rate Adaption Unit
4. LMT: Local Maintenance Terminal

The BSS architecture shall be selected to achieve maximum flexibility with regards to the various operator requirements. All BSS components can be installed in the same geographical location or in different locations where the transmission paths can be used via public networks. The ability of the BSC to manage several BTSs in different cell locations enables optimal adaptability to the traffic requirements in urban and rural areas

In terms of function, the main task of the BSC is the handling of the call connections (switching), sampling of operational/maintenance information of all BSS (BSC, BTSs and TRAUs), as well as their transfer to OMC-B. The BTS handles the radio specific aspects
Base Station Controller BSC

Base Station Controller (BSC)

The Base Station Controller BSC is, as the controlling element, the heart and center element of the BSS BSC Location: between the interfaces Asub and Abis

BSC Functions:

- Switching of the user traffic between individual TRAUs and BTSs
- Control and monitoring of the connected TRAUs and BTSs
- Sampling of operation and maintenance information of BSC, TRAUs and BTSs as well as transfer to OMC-B
- Evaluation of signaling information from MSC via TRAU and MS via BTS
- Radio Resource Management for all connected BTSs
- Storage of the BSS configuration
- Back-up storage of the total BSS Software for fast system rest

Base Transceiver Station (BTS)

A BTS is the module which operates an individual cell and realizes the radio interface. A BTS encompasses all applications concerning radio transmission (sending, receiving), as well as the air interface specific signal processing. The BTS is connected via the Abis interface with the BSC and via Um interface to the MSs

Functions:

- **Channel coding:** To protect the transmission, incoming information is provided with parity check bits and redundancy (convolutional coding) and spread in time over several HF bursts (interleaving).
- **Ciphering:** After channel coding, the transmission of message information and the subscriber data is coded to prevent illegal interception
- **Burst block formation:** The information is organized in blocks of a particular length (burst blocks). A so-called training sequence is added for synchronization and analysis of transmission quality.
- **Modulation:** The carrier frequency is created in the 900/1800/1900 MHz range and the information is modulated upon this carrier.
- **Power Control PC:** Control of the power level of the BTS and MS.

- **Timing Advance TA:** Calculation of the distance of the MSs from the BTS; the MSs are informed of necessary transmission advance
- **Frequency Hopping:** a feature which enhances the reliability of information transfer
- **Synchronization:** Providing of mobile stations with frequency and time synchronization information

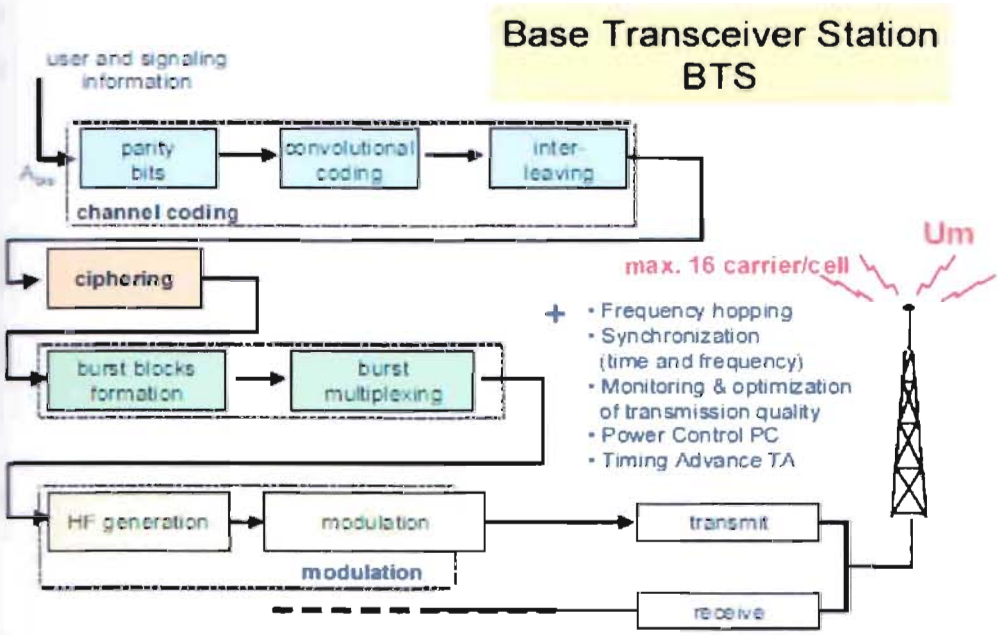


Figure 3.2: Base Transceiver Station diagram

Transcoding and Rate Adaptation Unit TRAU

The TRAU is used for speech compression (Transcoding) and adaptation of data to the requirements of the air interface (Rate Adaptation). It lies between A and Asub interface.

Functions:

- Transcoding TC defines speech compression: compresses / decompresses the incoming speech data from 64 kbit/s to 13 kbit/s, 12.2 or 5.6 kbit/s (embedded in 16 or 8 kbit/s channels).

- Rate Adaptation RA filters out the useful data (0.3 – 9.6 kbit/s in Phase 1/2) coming from the MSC (64 kbit/s) signal and forms a 16 kbit/s signal toward the BSC
- The user data are sub-multiplexed into 16 kbit/s subslots on the Asub interface

Remarks:

- TC and RA are implemented as algorithms in the same hardware unit as th TRAU (Siemens solution).
- The TRAU is logically allocated to the BSC. Consequently, it belongs to the Base Station Subsystem (BSS), but is generally installed at the MSC node in order to keep line costs to a minimum
- In contrast to user information signaling information passes the TRAU transparently.
- The users' information (data / speech) is embedded into 16 kbit/s channels. The additional space is filled with proprietary inband-signaling (i.e. information, which are directly exchanged between BTS and TRAU)

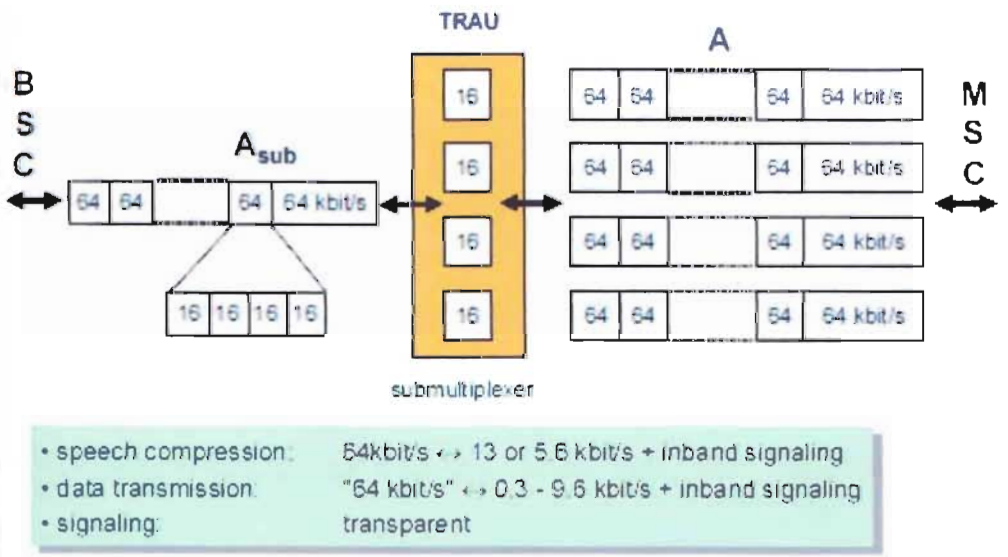


Figure 3.3: Transcoding and Rate Adaptation Unit TRAU diagram

3.2. Network Switching Subsystem (NSS)

The Network Switching Subsystem NSS (Phase ½) consists of the following functional units:

1. Mobile services Switching Center MSC
2. Visitor Location Register VLR
3. Home Location Register HLR
4. Authentication Center AC
5. Equipment Identity Register EIR.

3.2.1 Mobile services Switching Center MSC

The MSC is concerned with the central tasks of the NSS and covers the service areas of several BSSs. These tasks can be compared to those of an exchange in a fixed network. These tasks are supplemented by mobile specific tasks of the sub-scriber administration. The MSC handles connection tasks in the PLMN, i.e. set-up of circuit connections to the BSS, between each other and other networks (e.g. PSTN). The MSC visited by a customer is described as a VMSC (Visited MSC). A MSC, which represents an interface to other networks, is called GMSC (Gateway MSC).

MSCs connect the other networks with the Base Station Subsystem BSS, as well as the other NSS units with the BSS via the signaling highways.The MSC is a stored program controlled switching system for national and international GSM-PLMN applications. The MSC is a switching center that carries out all switching for the mobile stations which are actually located in the MSC area. Other functional units of the NSS (e.g. HLR, VLR, AC...) can be associated to the MSC.

Overview of call processing functions

The MSC follows the functions of a fixed network exchange as regards its functionality. Consequently, varied proven call handling functions form the basis for mobile specific supplementary services

- Switching of user connections
- Routing functionality (path selection)
- Signaling with other MSCs and external network exchanges
- Evaluation of available signaling information for destination routing:
- Digit translation
- Legal interception
- Coping with abnormal signaling conditions, e.g. loss of signaling information
- Supplementary Service support
- Processing of transmission path attributes, e.g. echo compensation
- Call supervision
- Overload protection
- Control of priority calls, e.g. emergency call
- Charging
- Traffic measurement and traffic observation
- Support of maintenance and administration functions, e.g. connection cut off, trunk test and measurement

Mobile specific functions

Additional to normal fixed network exchanges, the MSC has many mobile specific functions due to the users' mobility.

Mobile specific functions are for example:

- Signaling with BSC, MS & NSS databases (EIR, HLR, VLR)
- Processing of mobile-specific services

- Mobility Management, e.g. Paging, Inter-MSC Handover, Location Update...
- Overload handling, e.g. OACSU
- Interworking Function for data services
- Mobile specific Announcements

3.2.2 Visitor Location Register VLR

The Visitor Location Register VLR is responsible to aid the MSC with information on the subscriber, which is temporarily in the MSC service area. Therefore, in praxis it is always associated with an MSC.

The VLR request the subscriber data of user with activated MS on the MSC service area from the HLR and stores them temporarily. Temporarily means as long as the subscriber is not registered in a new MSC/VLR, even if he deactivated the MS

Additional to the semipermanent subscriber data received from the HLR the VLR stores temporary data, e.g. information on the subscribers current location (the Location Area), the state of activation (Attached / Detached),Furthermore, the VLR is responsible for the initiation of security functions, e.g. the Authentication procedure, the start of ciphering and the TMSI re-allocation.

Examples of subscriber data in the VLR:

- MSISDN: Mobile Subscriber ISDN number
- IMSI: International Mobile Subscriber Identity
- TMSI: Temporary Mobile Subscriber Identity
- HON: Handover Number
- LMSI: Local Mobile Subscriber Identity
- MSRN: Mobile Station Roaming Number
- Triples (Authorization parameters)

3.2.3 Home Location Register HLR

The Home Location Register HLR is the main data base of the mobile subscriber. The subscription of a user / his subscription data is stored in one HLR only. There may be one or more HLRs in a GSM PLMN.
The HLR is always associated with an Authentication Center AC.

The HLR performs the following important tasks:

- It sends all necessary data to the VLR.
- It supports the call setup in case of Mobile Terminating Calls MTC by sending routing information to the Gateway MSC (Interrogation)
- It transmits the Triples from AC to VLR on request

An HLR contains different semi-permanent mobile subscriber data, e.g.

- IMSI: International Mobile Subscriber Identity
- MSISDN: Mobile Station International ISDN number
- Bearer Services BS
- Tele Services TS
- Supplementary Services SS
- Restrictions

An HLR contains different temporary information of the mobile subscriber, e.g.:

- VLR address
- Local Mobile Subscriber Identity LMSI
- Mobile Station Roaming Number MSRN
- SMS flags

3.2.4 Authentication Center AC

An Authentication Center AC contains all necessary means, keys and algorithms forthe creation of security related authorization parameters, the so-called Triples. The Triples are created on VLR request and delivered via HLR to the VLR. An AC is always associated with an HLR.

Central information contained in the AC is:

- IMSI: International Mobile Subscriber Identity
- Ki: Individual Key (top secret mobile subscriber identity)
- Algorithms for authentication and encryption: A3, A8.

3.2.5 Equipment Identity Register EIR

The Equipment Identity Register EIR contains the Mobile Equipment identity: the International Mobile Equipment Identity IMEI. An IMEI clearly identifies a unique Mobile Equipment ME and contains information about the place of manufacture device type and the serial number of the equipment.

EIR are an optional feature in GSM. They have been defined by ETSI to enable theft prophylaxis. They carry out equipment identification functions: monitoring of stolen or not allowed MEs.There are three validity lists in EIRs: "white", "gray" and "black" lists for valid, to be observed and to be blocked equipment.A Common EIR (CEIR) in Dublin (Ireland) enables the world-wide identification of stolen mobile equipment

3.3. Operation SubSystem (OSS)

The Operation SubSystem OSS consists of Operation & Maintenance Centers (OMC). In Teletalk:

- The Operation & Maintenance Center for the Base Station Subsystem called OMC-B
- The Operation & Maintenance Center for the Switching Subsystem called OMC-S.

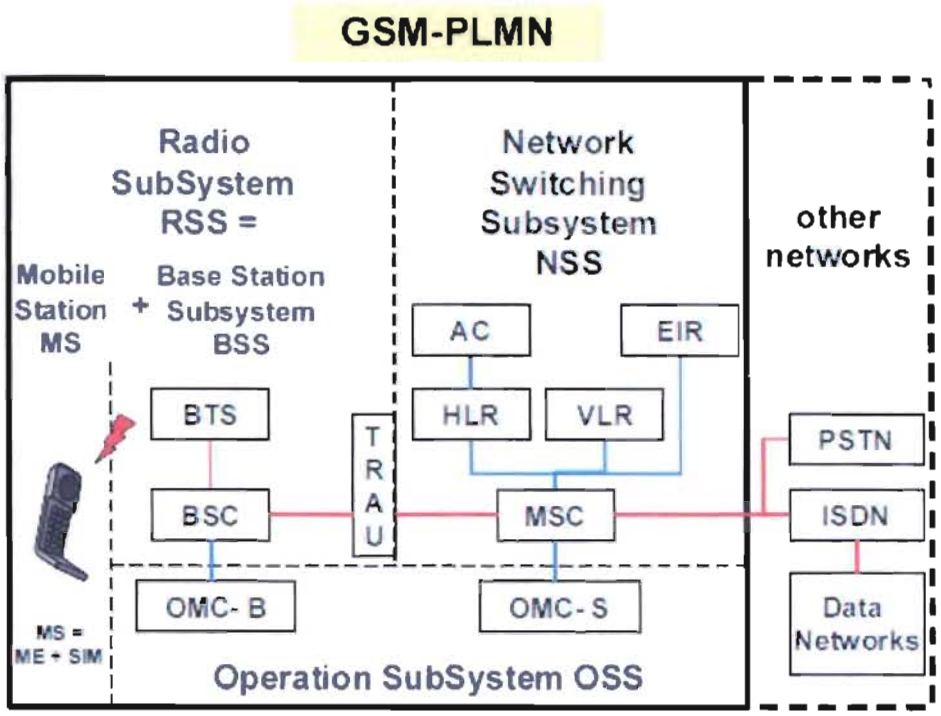


Figure 3.4: Operation SubSystem diagram

3.4. Interfaces:

The individual network elements are connected to each other for user data and/or signaling transfer. Some of the interfaces are specified by ETSI as open interfaces allowing connecting equipment of different network manufacturer. Others are not specified or "weakly" specified; so that only proprietary solutions are possible.

The following GSM Phase 1/2 interfaces are open interfaces:

1. Um: MS - BSS (Air interface)
2. A: MSC - BSS (BSC)
3. B: MSC - VLR
4. C: MSC – HLR
5. D: HLR - VLR
6. E: MSC - MSC
7. F: MSC - EIR
8. G: VLR - VLR.

The following interfaces are proprietary solutions:

1. **Asub**: BSC - TRAU
2. **Abis**: BSC - BTS
3. **T**: BSC, BTS, TRAU - Local Maintenance Terminal LMT
4. **O**: BSC - OMC-B
5. **HLR** - AC (no name)

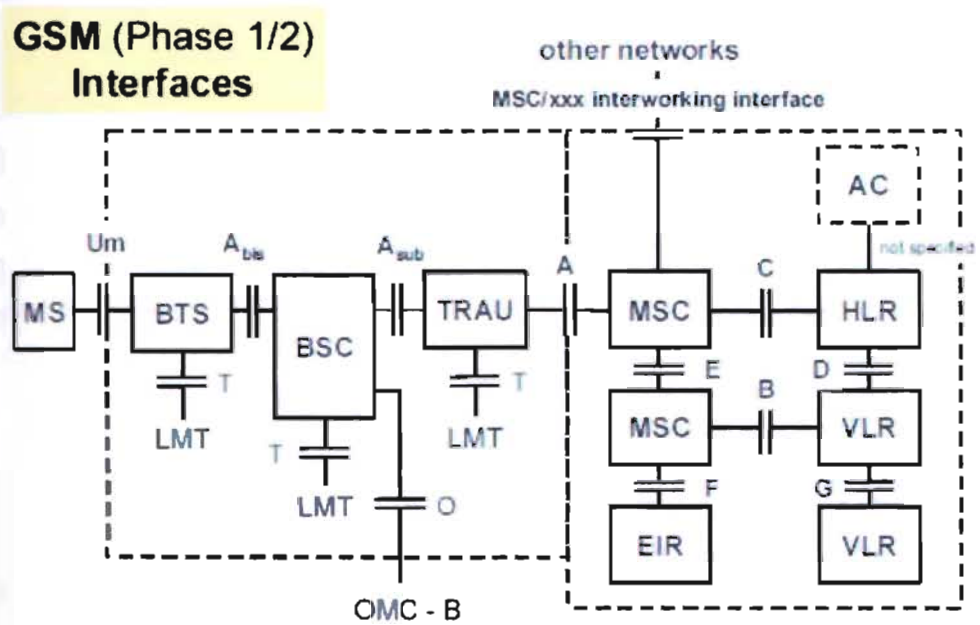


Figure 3.5: GSM (phase ½) interfaces

Chapter 4

Work Details

ernship Work

rvices I have done in Teletalk Bangladesh Ltd. under BSS department internship work are given below:

nstalling a microwave site

Microwave IDU Alarm monitor

Pasolink Installation

Swap

External alarms Checking

Rectifier commissioning

Extra Cabinet installation

Installing a Microwave Site

. Working procedure

My internship period I joined with a RF antenna installing team. We went to "Gozaria Thana" Manikgong district" for installing a microwave site. There I gathered knowledge about the g process. At the very fast I am providing some small description of different part of RF site and e hole installing procedure is given.

Microwave site

The System needs two types of equipment, indoor equipment and or equipment for a microwave link. These two are called:

1. Indoor Unit (IDU)
2. Outdoor Unit (ODU)

or Unit (IDU)

door equipment (IDU) is in a protected room. The IDU contains the ary, modems, alarm control unit and some auxiliary service units. The ystem deals with the entire digital network interfaces and generates s which are transmitted via unique coaxial cable to ODU unit.

IDU rack is made up of th0e following units:

1. Modem
2. Controller
3. Fan Unit
4. Alarm Unit

IDU function:

Equipment's power supply management
Supervision and configuration/management of the equipment
IDU-ODU cable interface management (from/to ODU)
Base band digital signal processing
Control management
System interfacing to external world

oor Unit (ODU)

utdoor equipment (ODU) is near the antenna. The possible cable length en IDU and ODU may be about 300 to 400m. The ODU contains the RF There is a necessity of only one connection between IDU and ODU. A ltage supply is required for ODU.

DU function:

upervision and configuration/management of the ODU

odulation of base band digital signal (from IDU)

DU-ODU cable interface management

anagement of communication channel from/to IDU CONTROLLER

end and receive signal.

emodulation of the received RF signal (to IDU)

Installation:

ame is connected to the pole using U-BOLT. The figure below is g the process how the frame should connect with the pole.

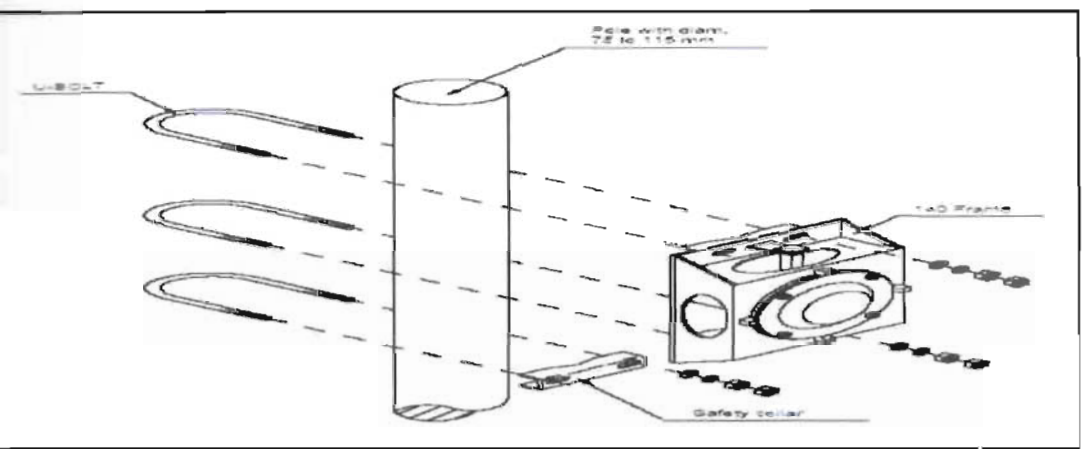
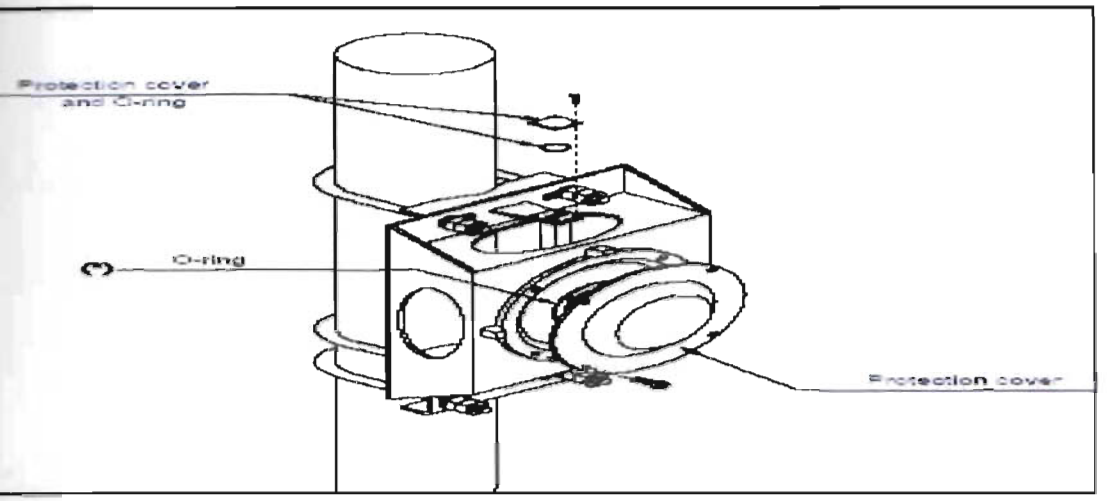


Figure 4.1: Pole mounting (1+0 vertical frame)

s shown how to connect The O-ring and the Protection cover, the s is given in below.



gure 4.2: O- Rings and protection cover (1+0 vertical frame)

eguide is connected to the ODU in figure below

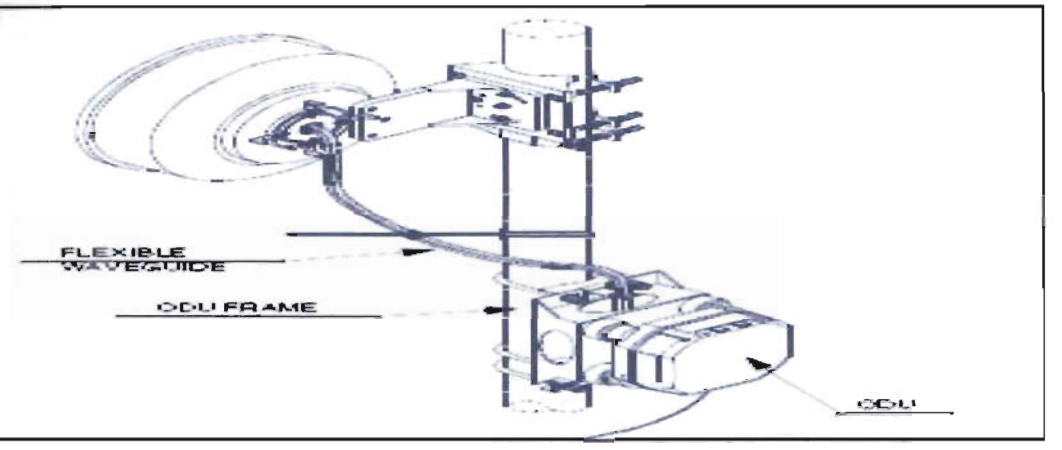
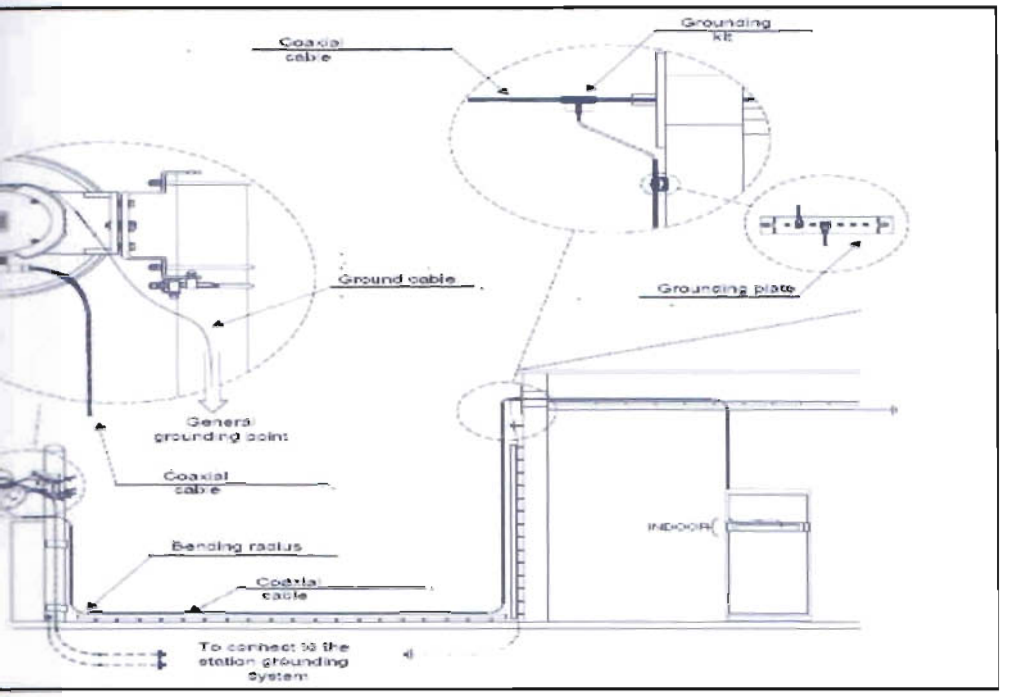
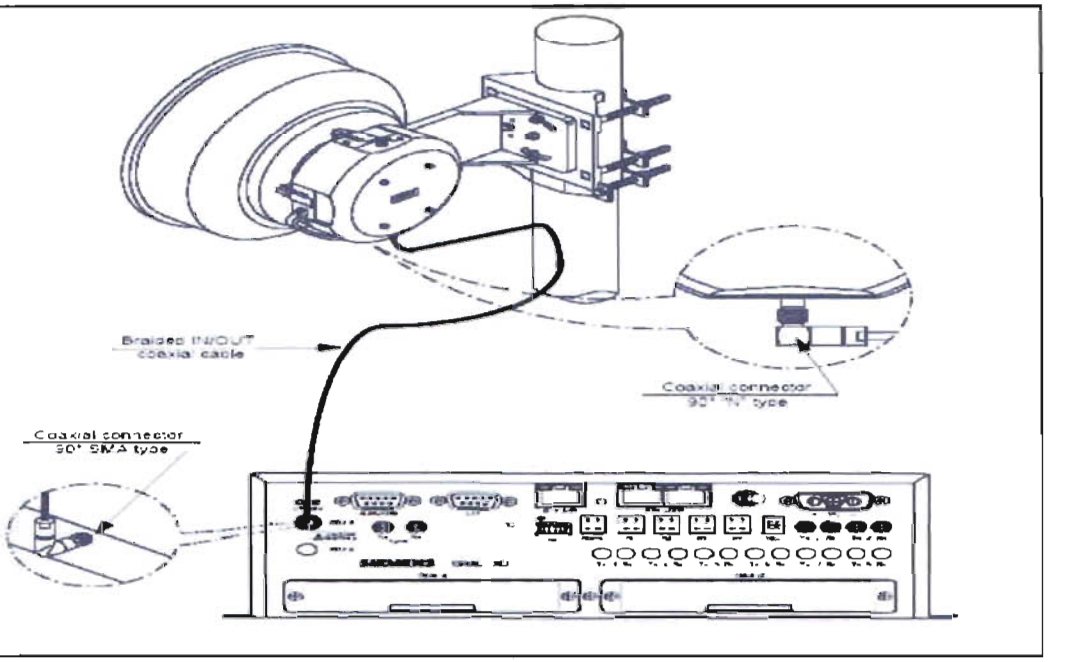


Figure 4.3: Independent antenna (1+0 system)



4: Coaxial cable & Grounding connections (Integrated Antenna)



4.5: IDU/ODU typical connection with braided coaxial cable

al cable is used to connect an IDU and ODU. After the physical ion the commission is required to install the site. For that different interface and indicator lights should be known.

Configuration:

n of Memory Key on the IDU and Switch ON ODU and IDU Power:

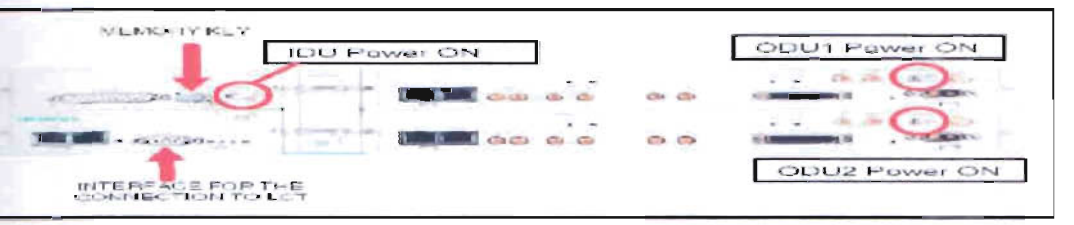


Figure 4.6: IDU and ODU power connections

irst check that the Backup Memory Key is properly inserted on the quipment.

witch ON the IDU unit and after the ODU Units.

Vait until controller unit ends the boot phase (about30 / 60 sec.).

nection:

witch ON the PC and connect it to the IDU using the serial cable by F nterface (Direct pin to pin cable).

C connection are available if on the IDU are connected the Memory ey.

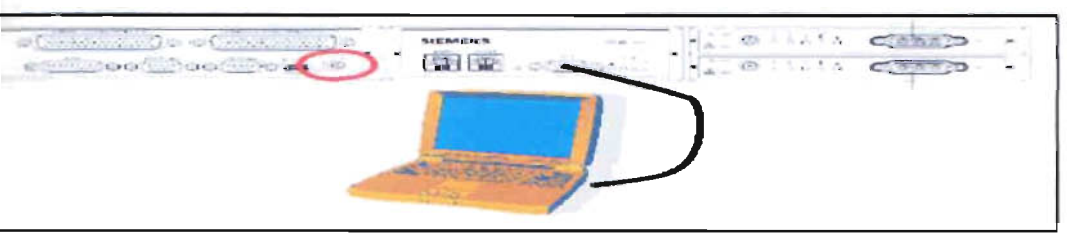


Figure 4.7: Pc connection with IDU

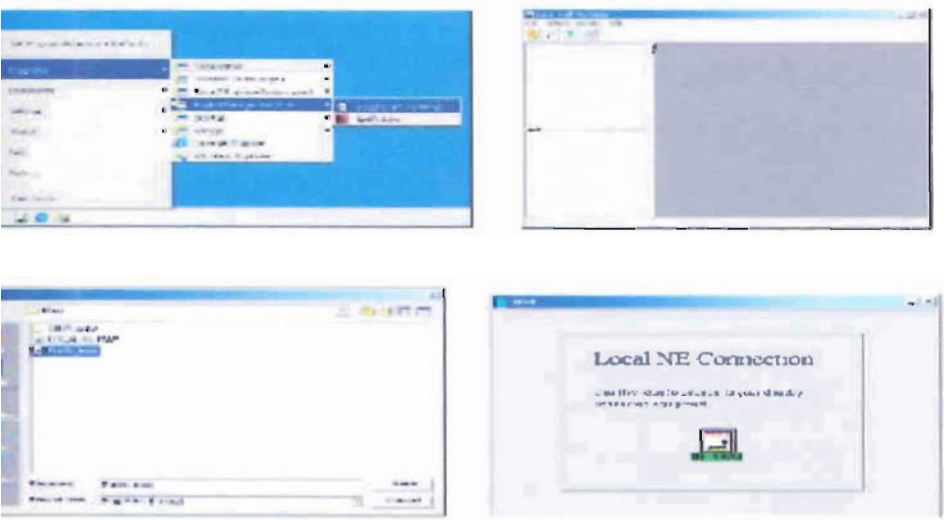
irst configure a Dial-up connection. (Note that the Dial up connection nd modem is configured at **38400** bps).

un the "direct connection" dial up connection and verify that TCP/IP s running before Continue.

Vaiting that the window showing time and speed connection connection established).

Figure 4.8: Window showing time and speed connection

he "Radio Management, and run the Local Craft Terminal application that the properly Plug-in SW is installed in the PC) and opening the ie" Map.



ure4.9: Window shows connecting Radio Management and Local Craft Terminal

urity window will appear with a user class and password to be filled
er as ***Admin User*** class with ***sysmanager*** for password.

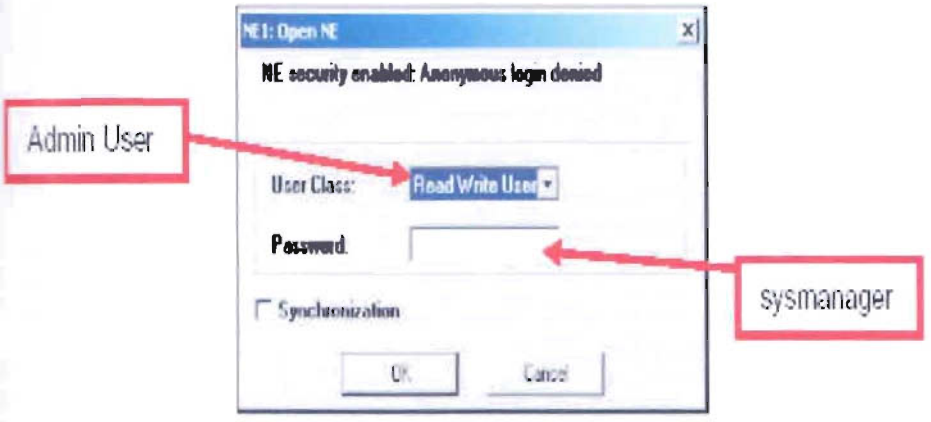


Figure 4.10: User name and password fillup.

e acquisition of all NE data the GUI interface of the LCT are descript
llowing figure

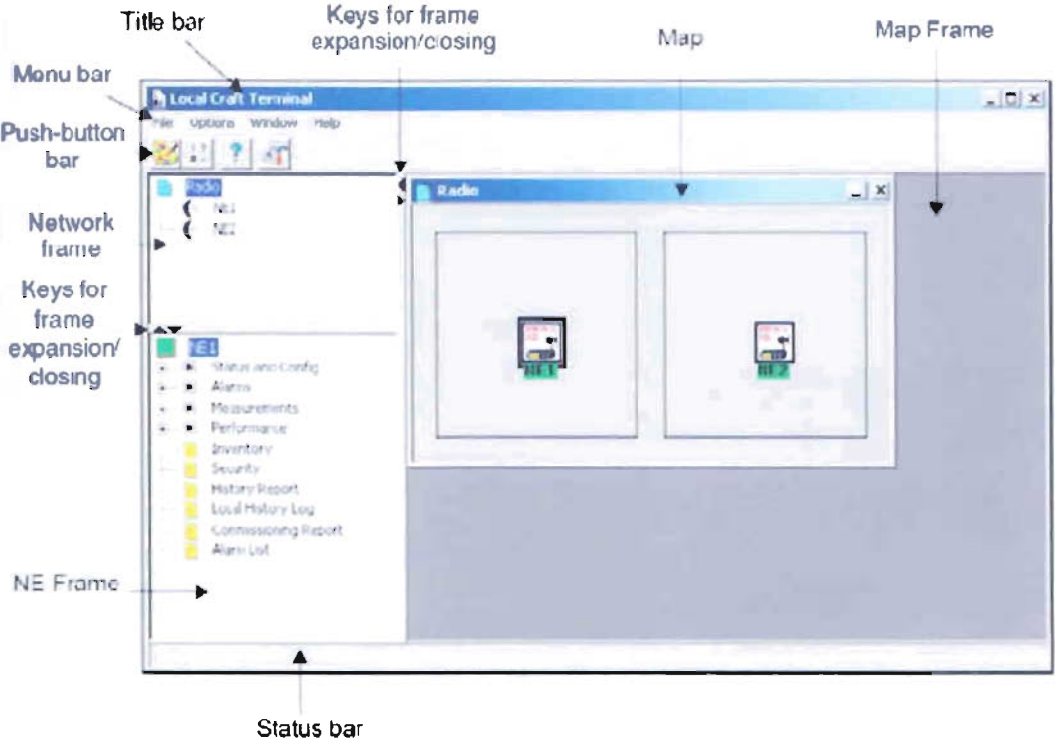


Figure 4.11: GUI interface of the LCT

ing to the planning and the equipment, it must be configured with the system. Type configuration from the main menu, Status and Config > ment > System:

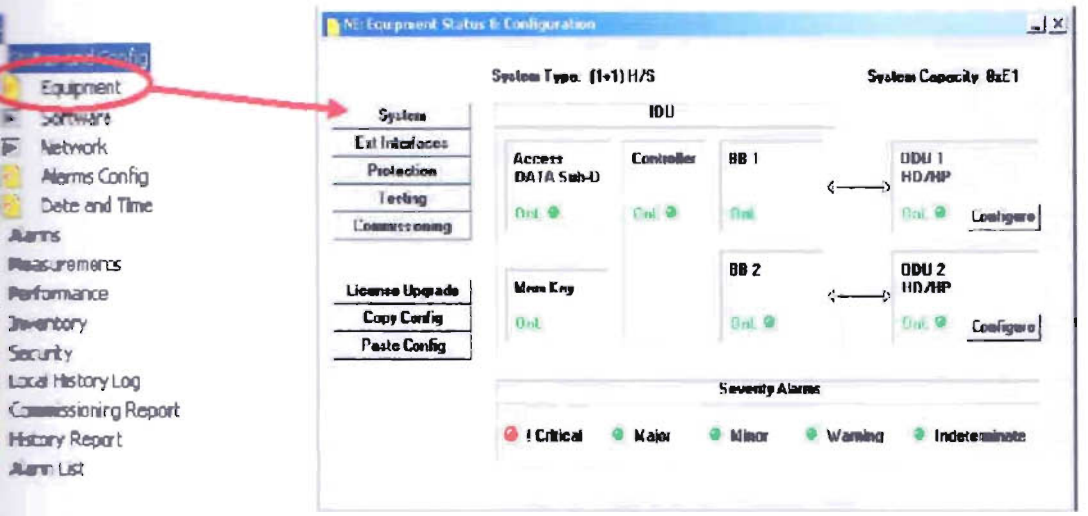


Figure4.12: Configuration of Equipment

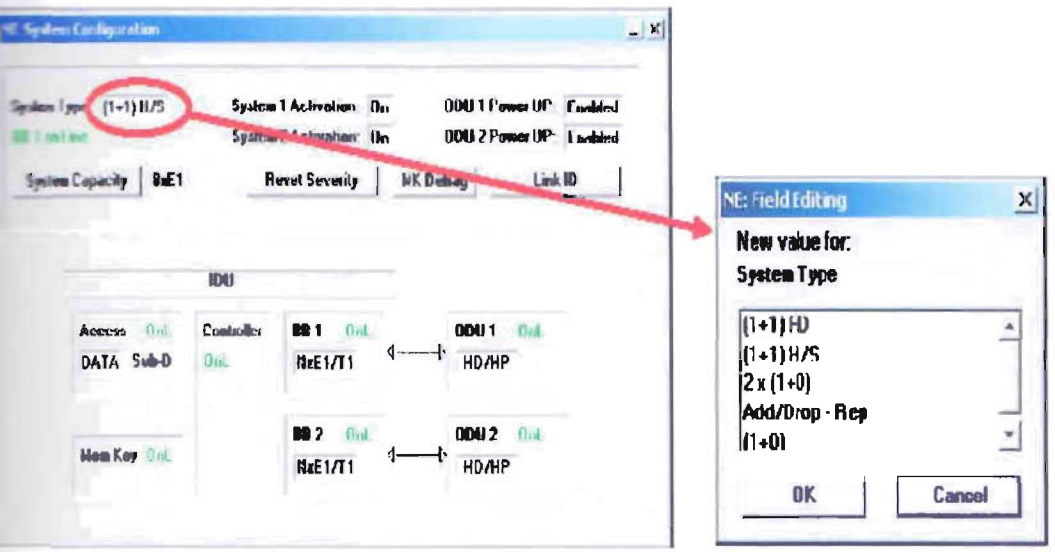


Figure 4.13: Configuration of Equipment

ı parameter settings:

d to the Project specification, set and configure all the relevant data in
ɔ insert the System on line.
ıin system settings are:

Capacity
Frequency mode
Frequency value settings
ransmission power mode
Transmission power value
Tributaries configuration
Other services (User interface, Alarms)

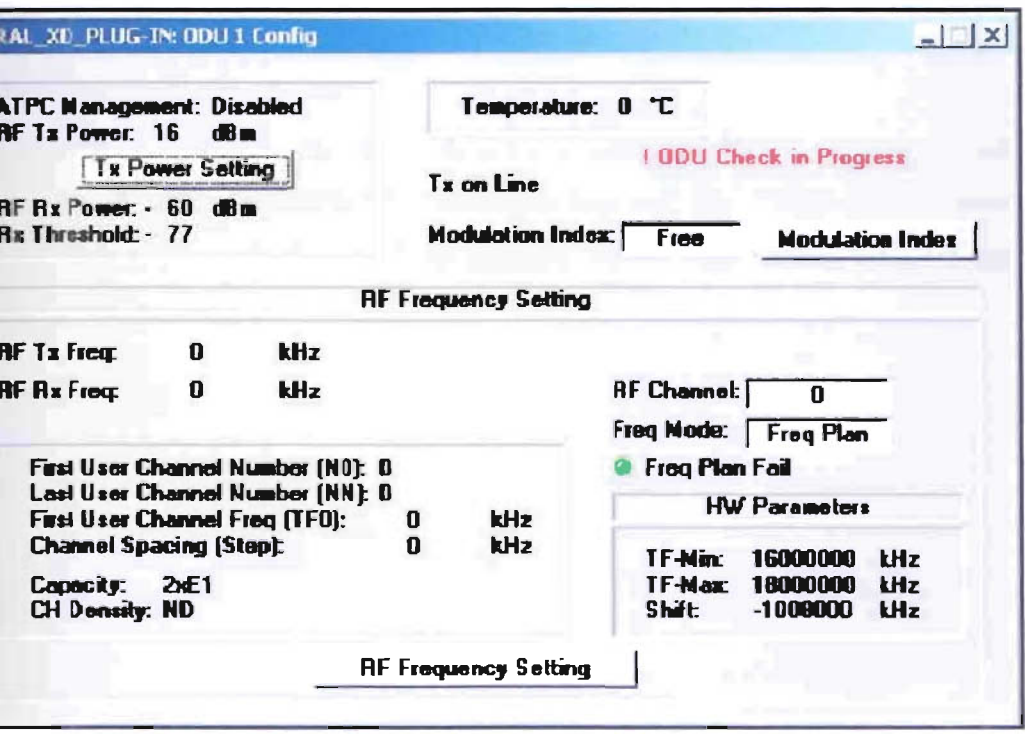


Figure 4.14: System parameter settings

Microwave IDU Alarm monitor

are two ways to check Microwave alarms. One from the MSC and r is from BTS. From MSC alarms are checked by visual monitors. are some visual monitors to check the alarm in MSCs. From BTS are checked by the alarm lights manually. There are three ways to ne faults which cause the alarm lights to blink.

are given below:

1. Soft reset
2. Hard reset
3. Remove the faulty part from IDU.

set: This process is usually done from MSC without going to BTS.

eset: This process is done from BTS.

e the faulty part from IDU: This process is done from BTS.

Working Procedure:

nternship, first I did the commissioning part and then I monitored the alarms manually from the BTS. We have also learned the Controller & Maintenance (CMM) alarms. Different IDU alarms, CMM alarms and their descriptions en below respectively:

4.1: IDU Alarms

Alarm Type	Description
Cable alarm	Green Blink: Cable OK
	Red Blink: Fault occurred
Power alarm	Green: Power supply Normal
	Red: Fault in power supply
Transmitter alarm	M: Main Transmitter Active
	D: Diversity (Redundancy) Transmitter Active
Receiver alarm	M: Main Receiver Active
	R: Diversity (Redundancy) Receiver Active
Synchronizing alarm	Synchronizing Problem Detected
Radio signal alarm	Radio signal problem Detected
Remote BTS alarm	Problem in neighbor BTS connected
General alarm	Other problem

Table 4.1: IDU Alarms Monitor

4.2: CMM Alarm

Alarm Name	Alarm Type	Description
PWR	Power Alarm	Green Blink: OK Red Blink: Problem occurred in power supply
RUN	Running Condition alarm	Green blink: OK Red blink: CMM can't Run
SYN	Synchronizing alarm	Green blink: OK Red blink: CMM can't synchronized with BSC
CLK	Clock Alarm	Green blink: OK Red blink: BTS cabinets has different clock cycle
MST	Master-Slave Alarm	If OFF: OK Red blink: Master CMM down, Slave CMM up; NO Backup
STA	Statistical Alarm	Green blink: OK Red blink 1time per sec: CMM can't communicate with BTS Red blink 4time per sec: CMM can't communicate with CDU or TRMD

Table 4.2: CMM Alarm Monitor

Figure 4.15: Controller & Maintenance Module (CMM) Alarm

iPasolink Installation

Working Procedure:

My internship period I joined with a Transmission team. We went to installing a microwave site. There I gathered knowledge about the ng process of an IDU (Vendor name of that IDU is called iPasolink). do some work with them. These are given below:

1. Commissioning of iPasolink
2. Ethernet Function Setting
3. ETH-OAM Test
4. Ethernet Bandwidth Test

am providing brief description of my work one by one.

Commissioning of iPasolink

have to open the internet explorer and put IP in the web bar- .254.253 and then Press Enter...

lowing window will be opened...

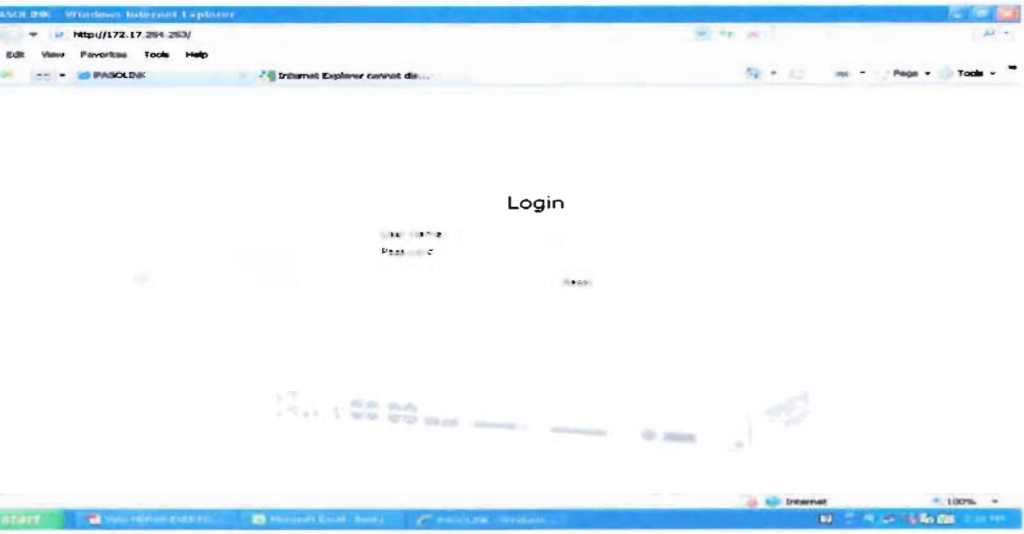


Figure 4.16: Log in Window

have to put, User Name:**Admin** , Password:**12345678** .And press ok ait a while for coming a new window open....

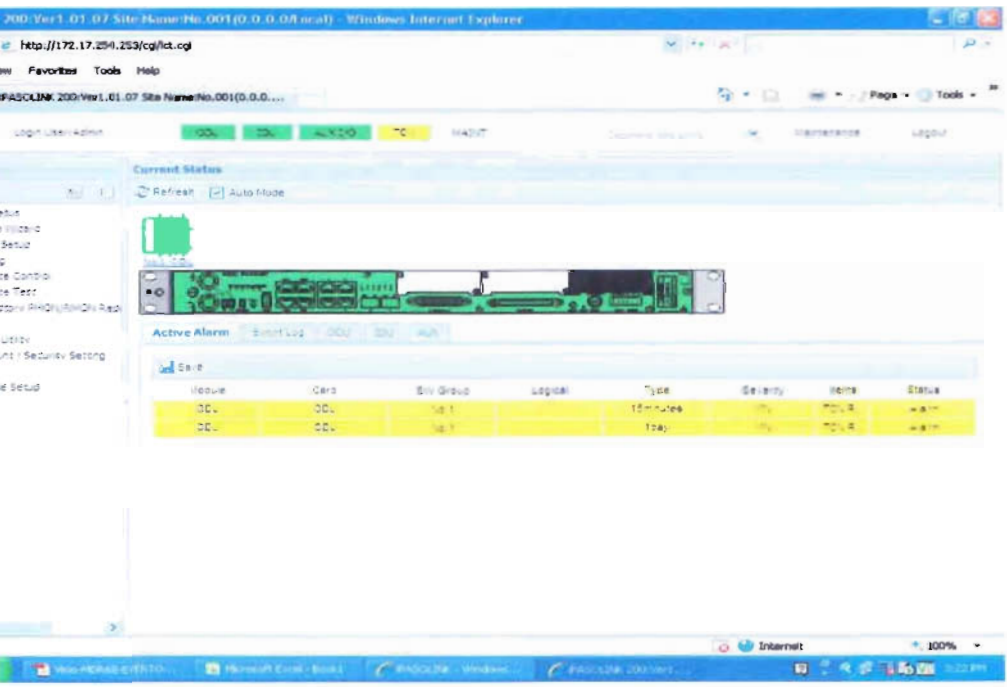


Figure 4.17: Commissioning First Window

et ready for commissioning...

he left side of the window...click on Easy setup Wizard tab.

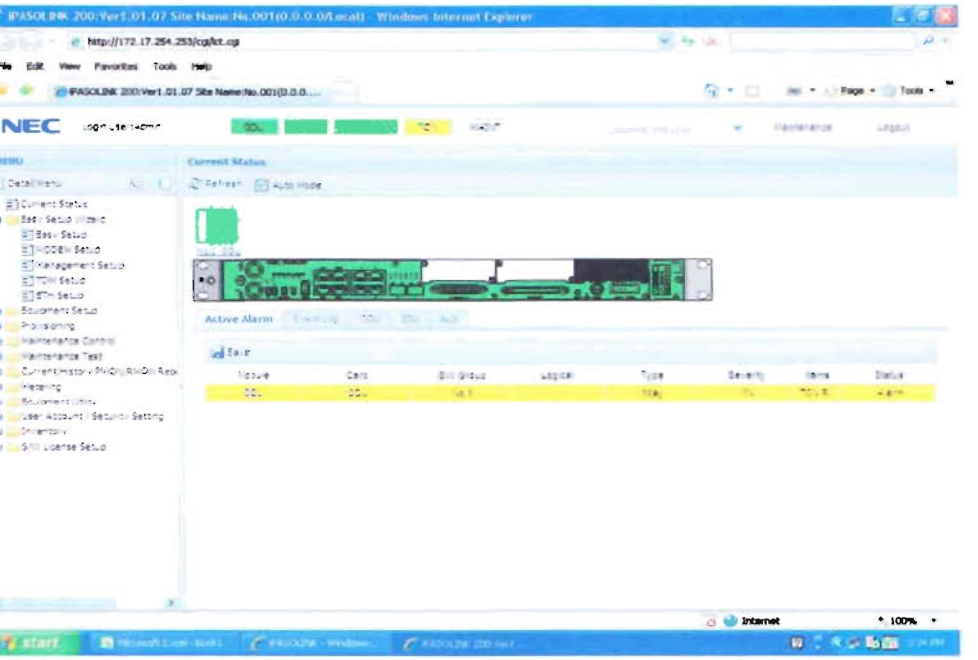


Figure 4.18: Commissioning Second Window

on Easy setup. Get the thing like...

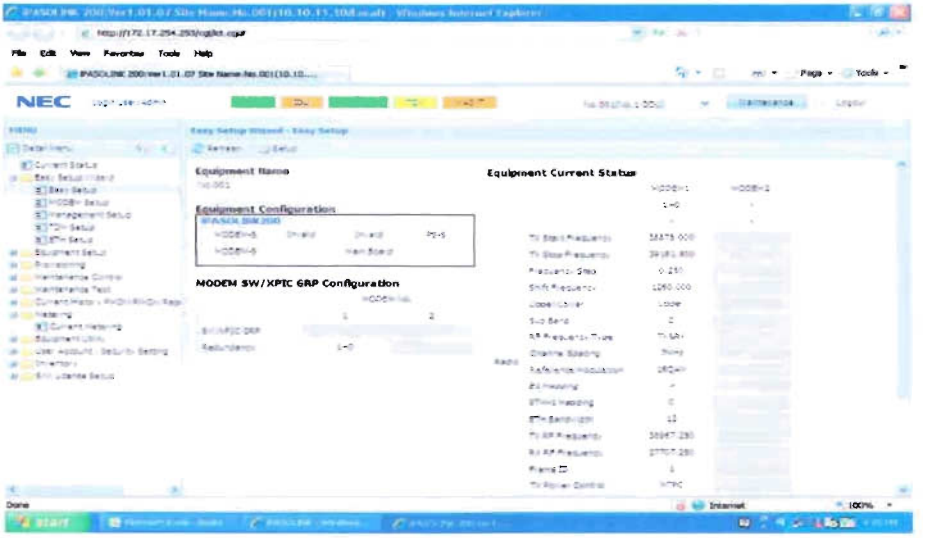


Figure 4.19: Commissioning Third Window

ng is need to know that if ODU connection is ok the information of ll show on the right side....

n setup, to give data...

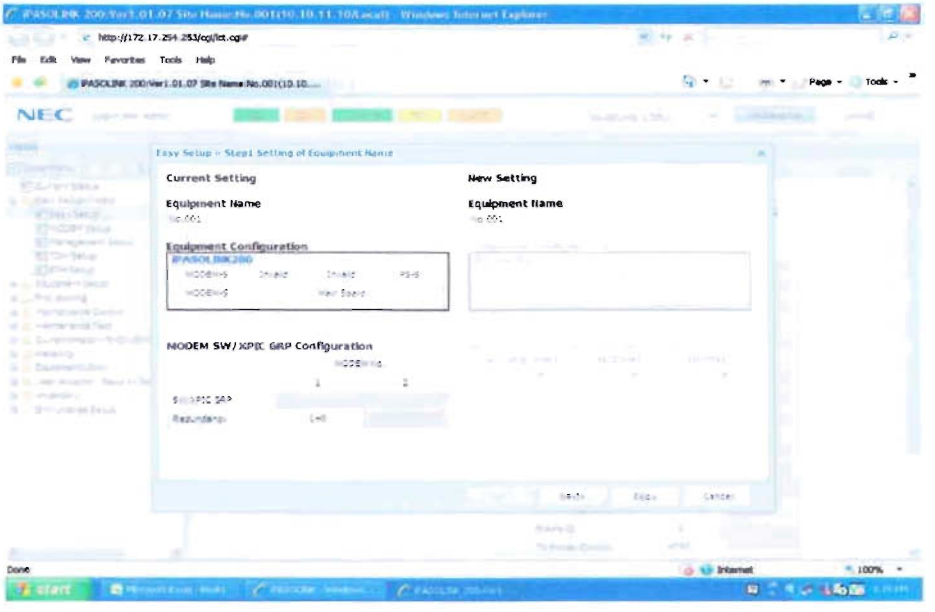


Figure 4.20: Commissioning Fourth Window

click next...

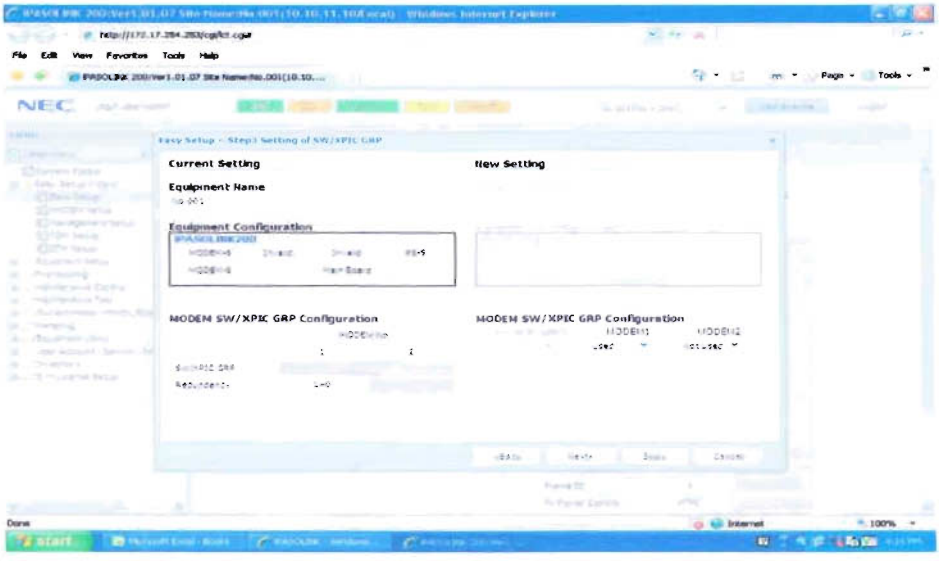


Figure 4.21: Commissioning Fifth Window

stem is (1+0), then I have to select used for modem1 and if 1+1, ed for both modem and then again next...

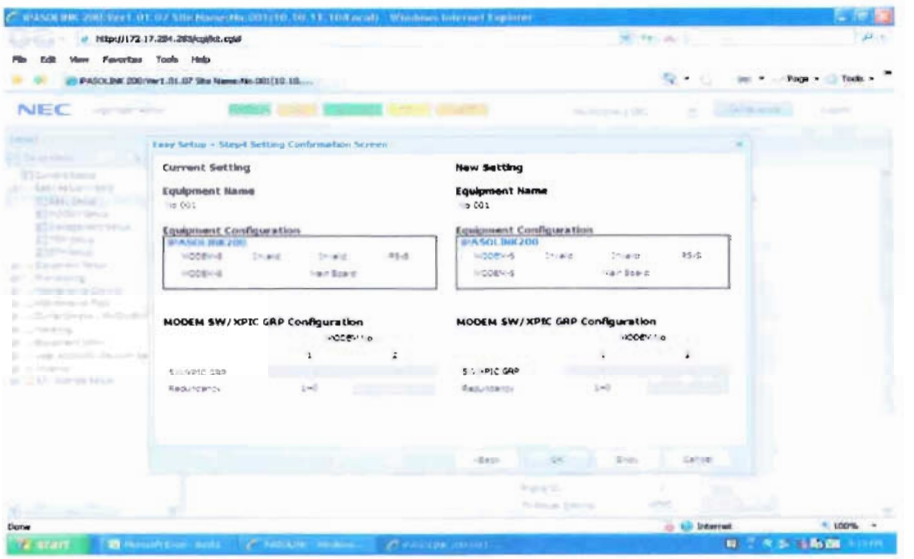


Figure 4.22: Commissioning Sixth Window

lick ok to complete and another new page will be open like...

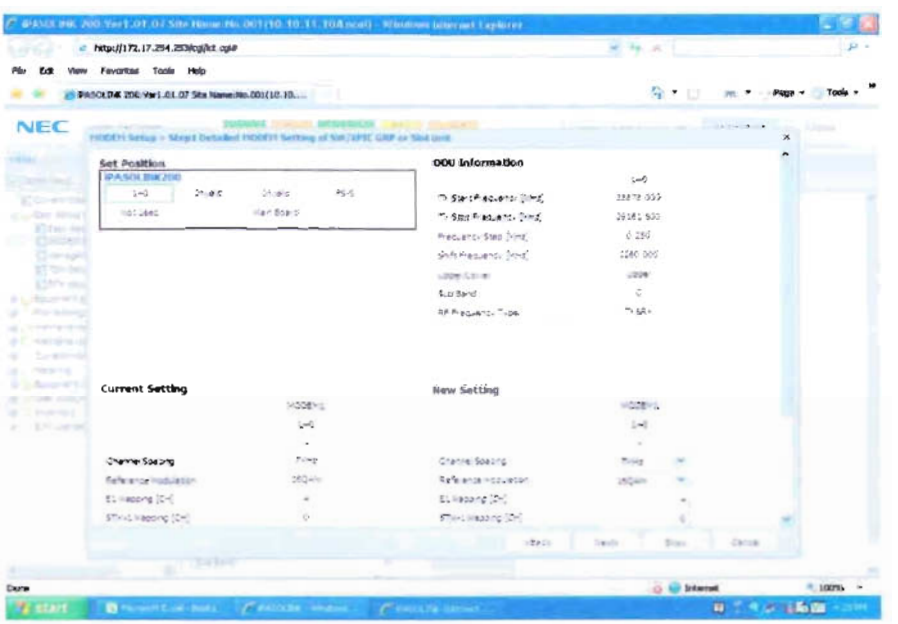


Figure 4.23: Commissioning Seventh Window

setting I have to put my instructed data is according to plan...like ce modulation, E1 mapping (how many E1 will be used by plan)...Tx cy...

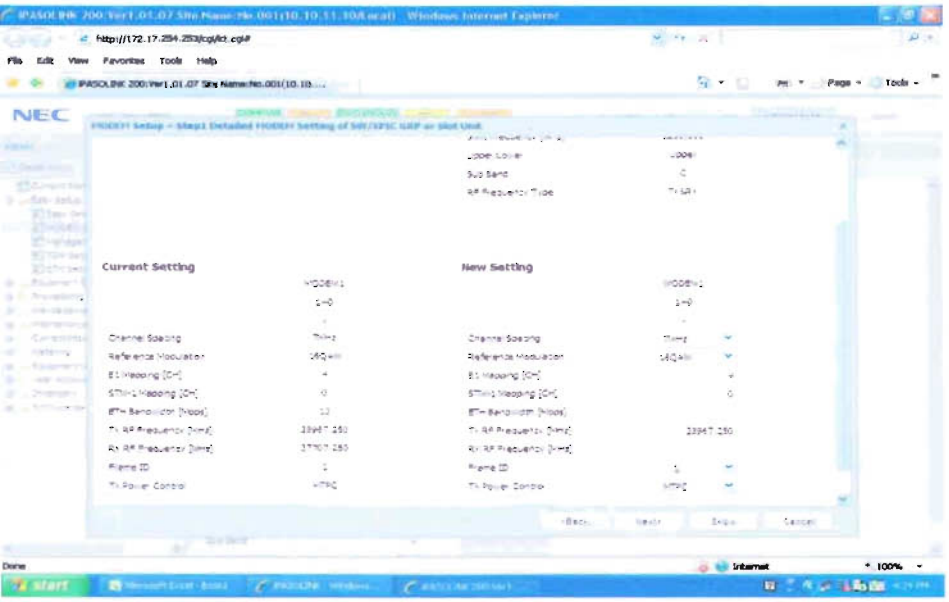


Figure 4.24: Commissioning Eighth Window

gain next and page like below will come.

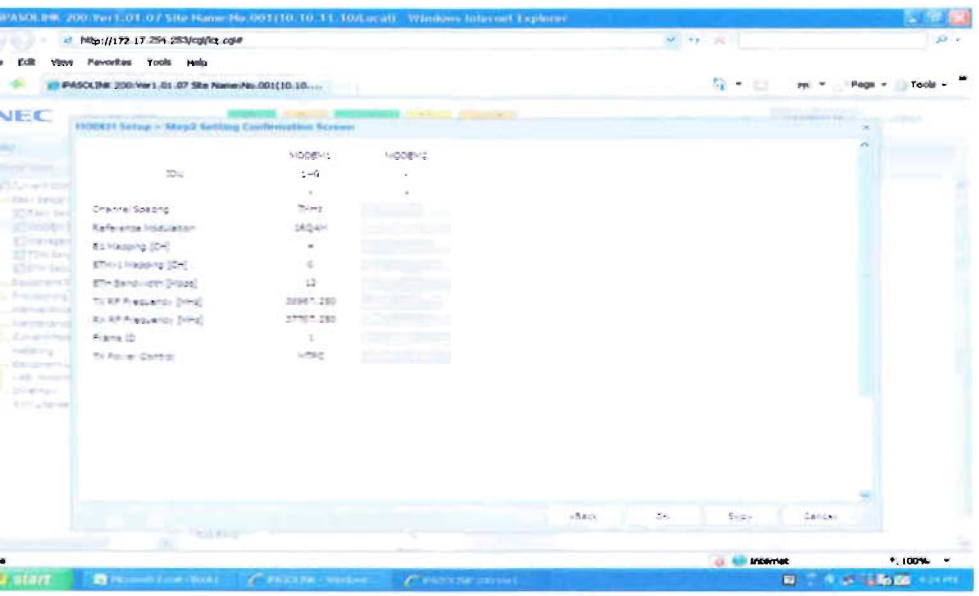


Figure 4.25: Commissioning Ninth Window

d complete, similarly another page will be appeared like.

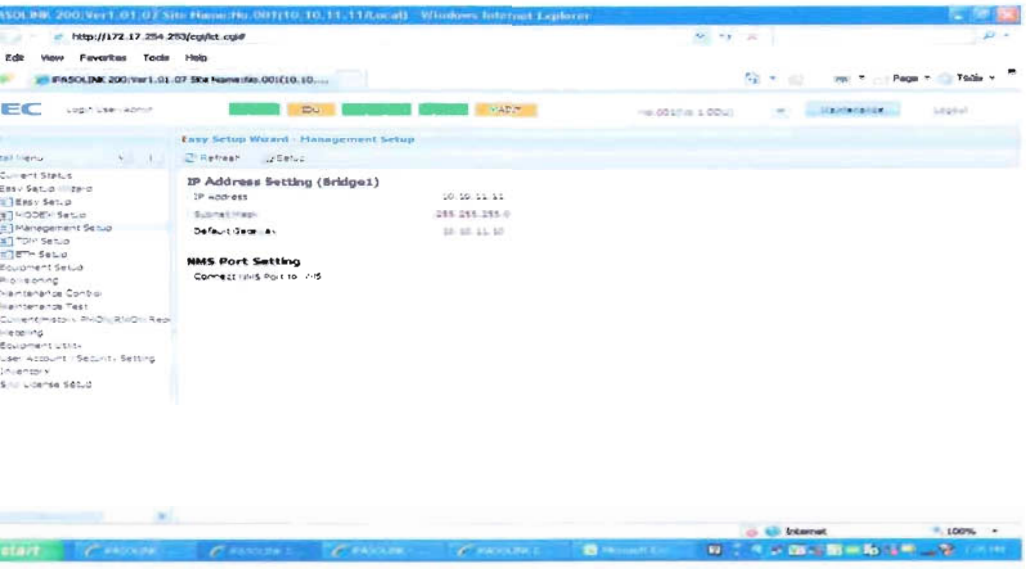


Figure 4.26: Commissioning Tenth Window

to write the IP address.... And click ok

power settings now I click on the provisioning (on the left)>Modem

on settings>Tx power setting...like

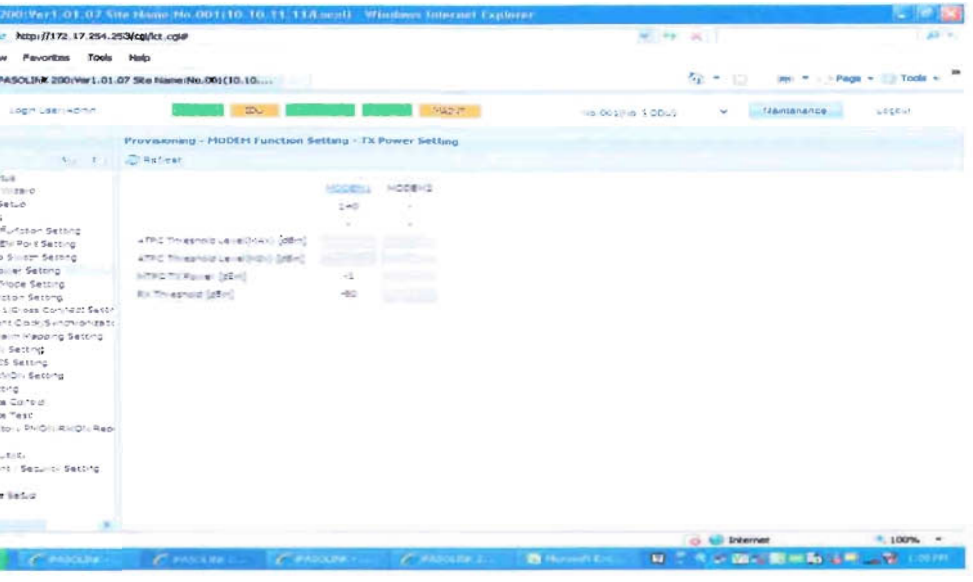


Figure 4.27: Commissioning Eleventh Window

k on Modem1 for Tx power setting...a window will be appeared like.

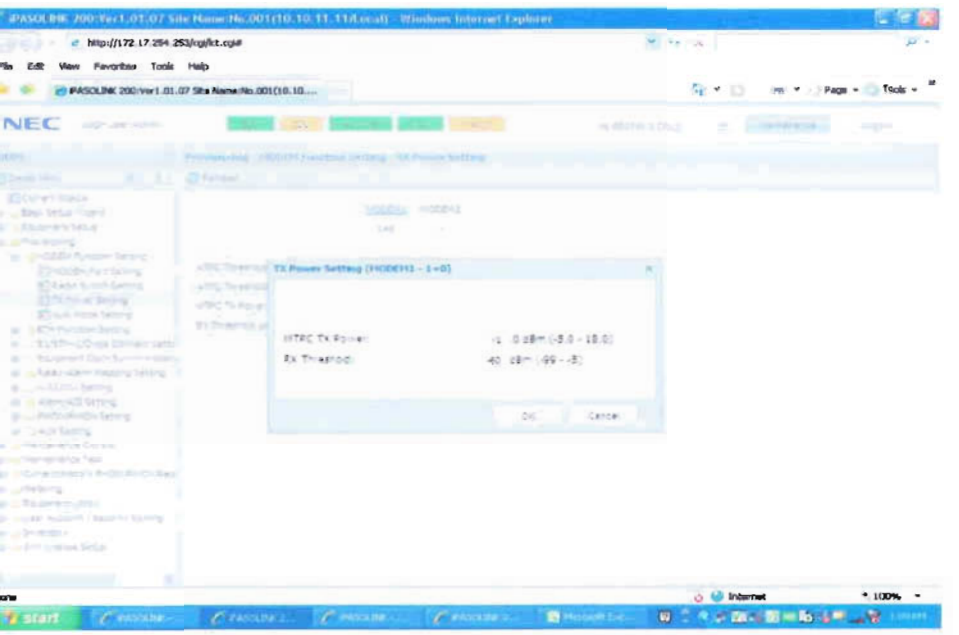


Figure 4.28: Commissioning Twelfth Window

power and click ok only.....

evel observation, click on Metering and watch Rx level....like.

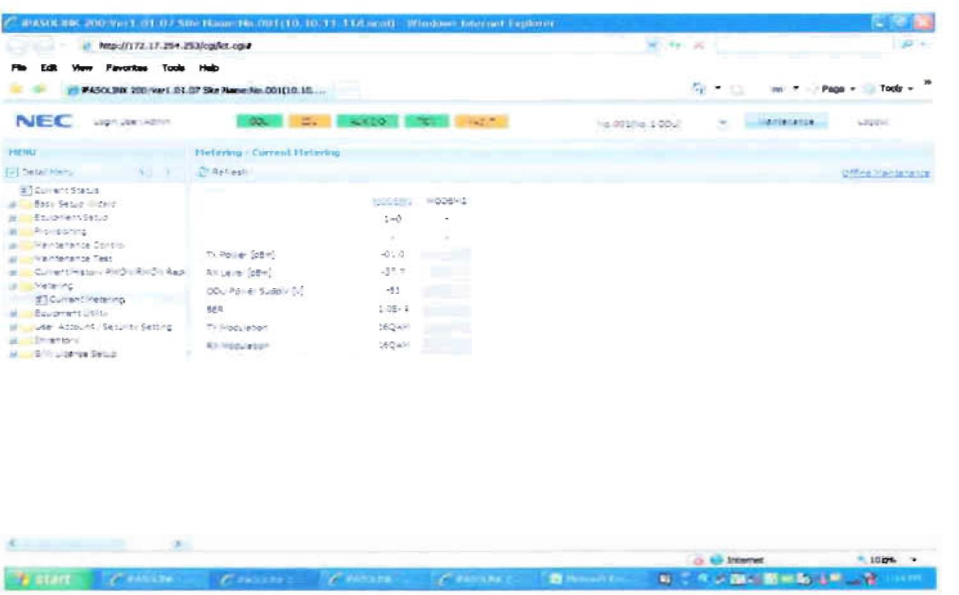


Figure 4.29: Commissioning Thirteenth Window

y information...to get the both of side data, have to input two different
?..like.....

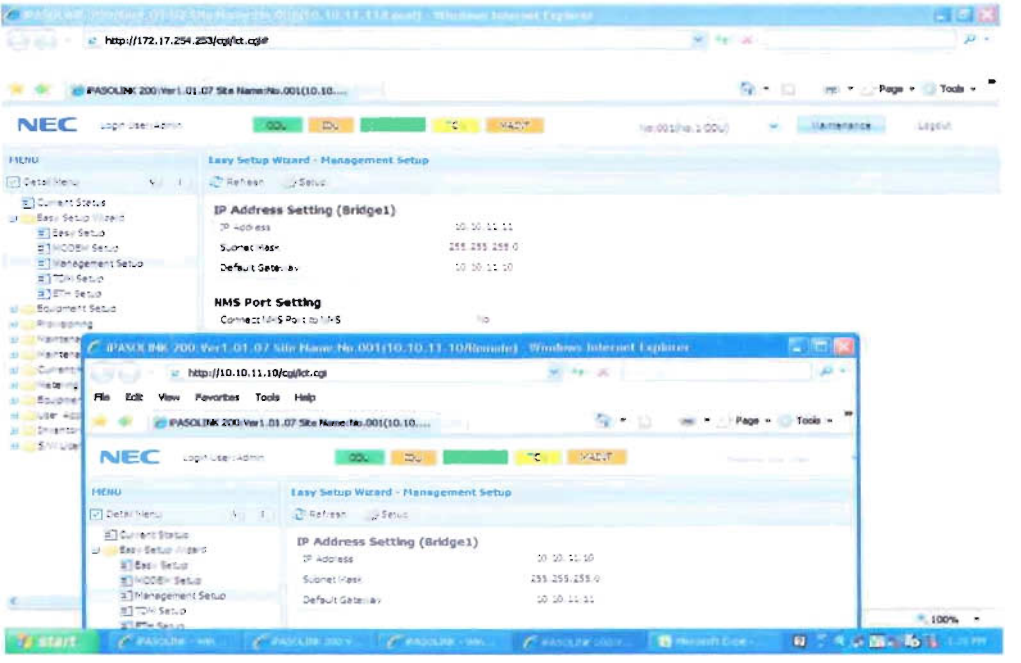


Figure 4.30: Commissioning Fourteenth Window

nore thing is...for get two side's data one more thing has to do that is.
sioning>V.11/ow setting>ow setting>Click modem1>used...like

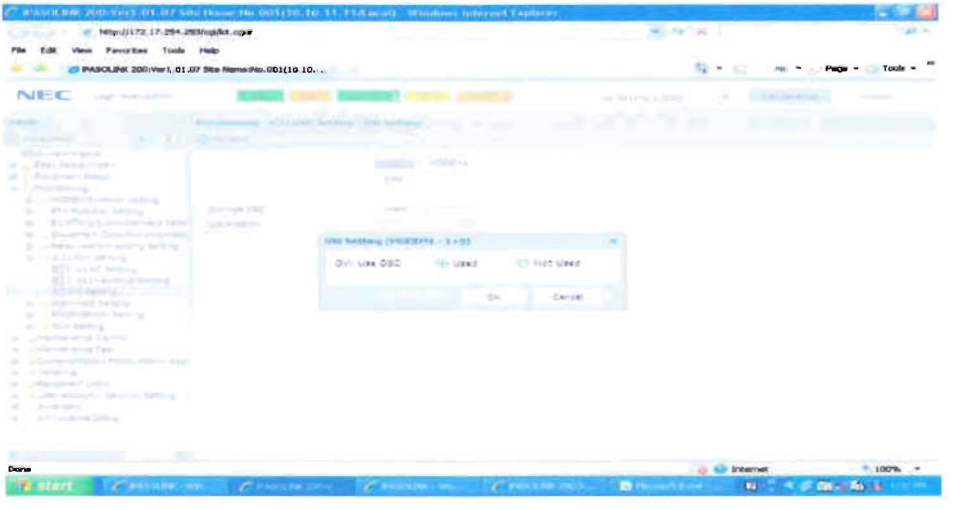


Figure 4.31: Commissioning Fiftieth Window

all for link establishment, But for complete commissioning I have to ort while....

on Maintenance mode....then Click provisioning>E1/STM-1/Cross t setting>

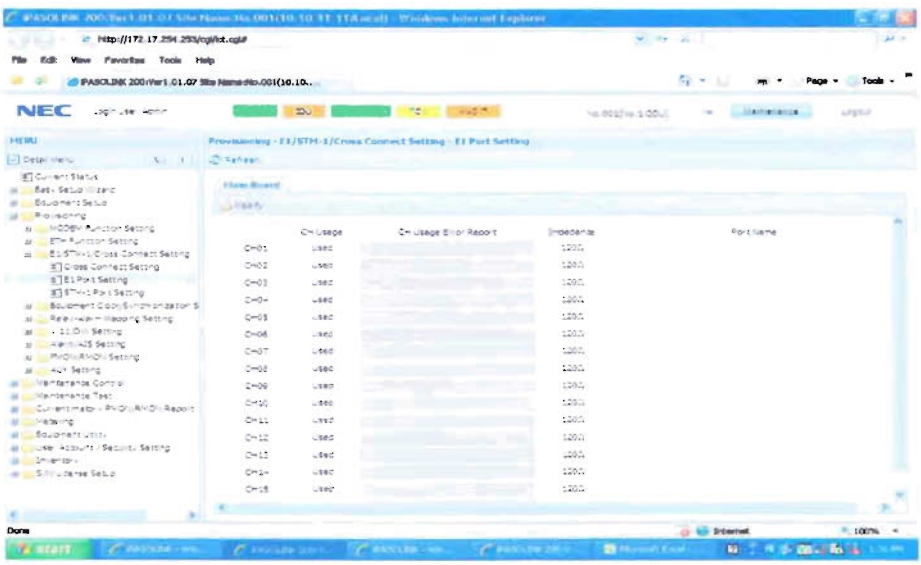


Figure 4.32: Commissioning Sixteenth Window

on modify tab & set all used (as per plan), all reported, and all m...get like....

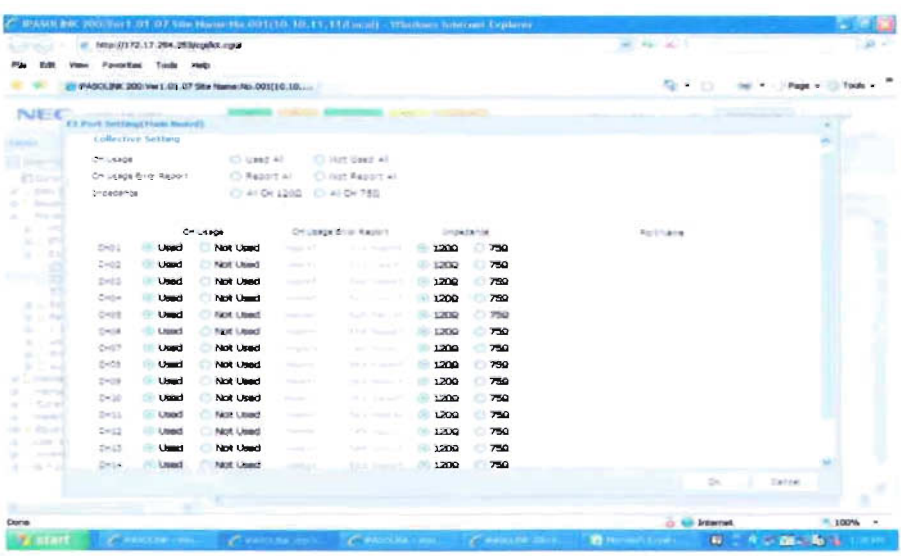


Figure 4.33: Commissioning Seventieth Window

)link, I have to cross connect internally between Main Board and
l...This is just as...

rovisioning, I have to click cross connect setting>+Add>Put service
'om EDGE-A, Now I select main board>from EDGE-B, select
l>now select 1(port/CH)

nain board by mouse and select 1(port/CH) from MODEM1 by
...

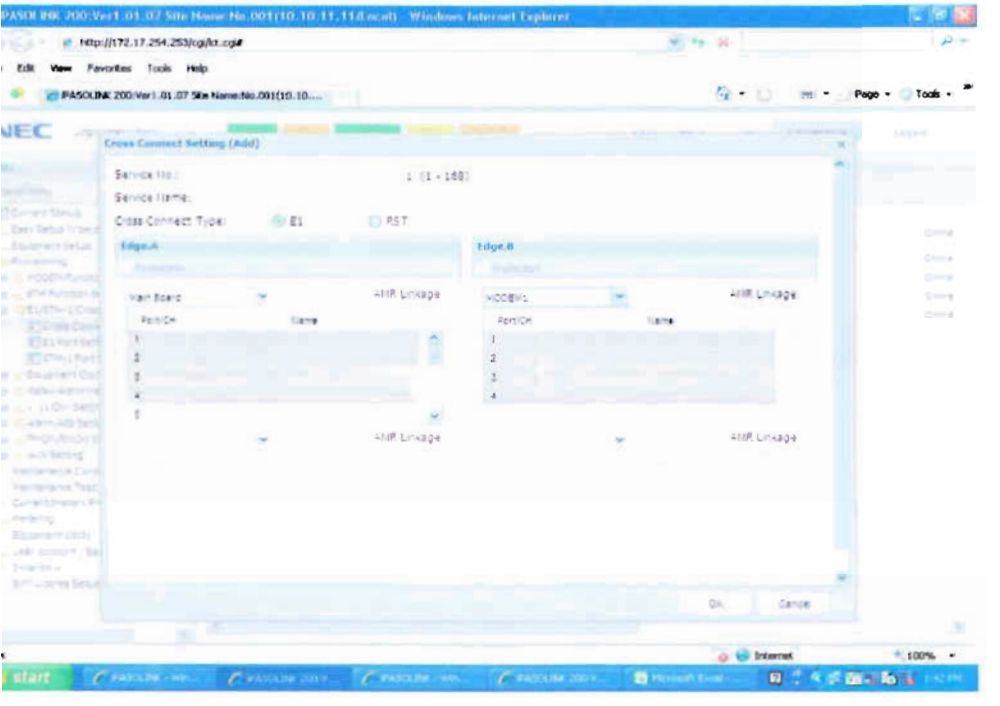


Figure 4.34: Commissioning Eightieth Window

k...and similarly go on.....upto 16 port/CH...and you will get like...

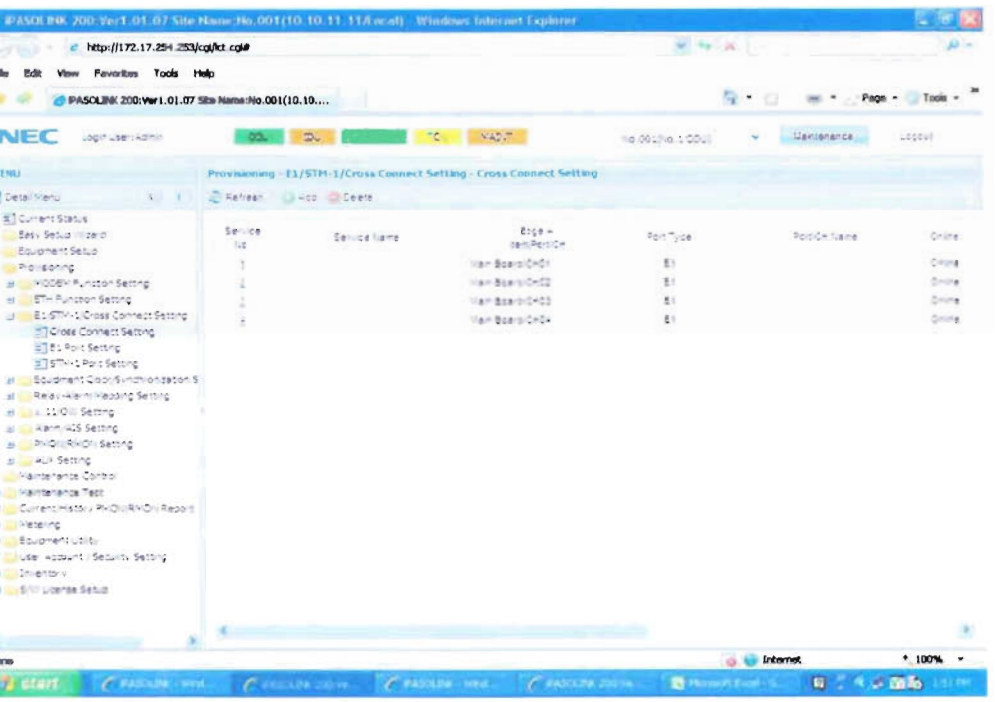


Figure 4.35: Commissioning Last Window

nore tasks remaining but upto this, site can be given on air.

Ethernet Function Setting

: first I go to

ioning→ETH Function Setting→ETH Port Setting→ Enable port-

-2/port-3/port4

:

oning→ ETH Function Setting→VLAN Setting→VLAN List→ Add VLAN

Create VLAN 10/20/30/40

:

ioning→ ETH Function Setting→VLAN Setting→VLAN Setting→

Change port type to "Trunk" for Main board Port-1/Port-2/Port-3/Port-4

Select VLAN ID 10 for Main board port-1

Select VLAN ID 10 for MODEM-1

:

ioning→ ETH Function Setting→ETH OAM Setting→OAM MEG→ Add

ple for setting: put

NDEX = 1 [if there is no any previous index otherwise put 2 or 3 etc.]

D = NEC-GP [any word, I have to keep in mind that far-end must be word]

LEVEL =7 [any value 1~7, I have to keep in mind that far-end must be value]

C =3.3ms

:

ioning→ ETH Function Setting→ETH OAM Setting→OAM MEP→ Add

ple for setting: put

NDEX = 1 [if there is no any previous index otherwise put 2 or 3 etc.]

D = 2 [any number, I have to keep in mind that far-end Peer MEP ID be same]

riority =7 [any value 1~7, I have to keep in mind that far-end must be
alue]
=MODEM1
Port01

ssigning, it will show the Source MAC address. Now I write down the
MAC address.
Enable the VLAN service as showing below-

Enable MEG Configuration as showing below-

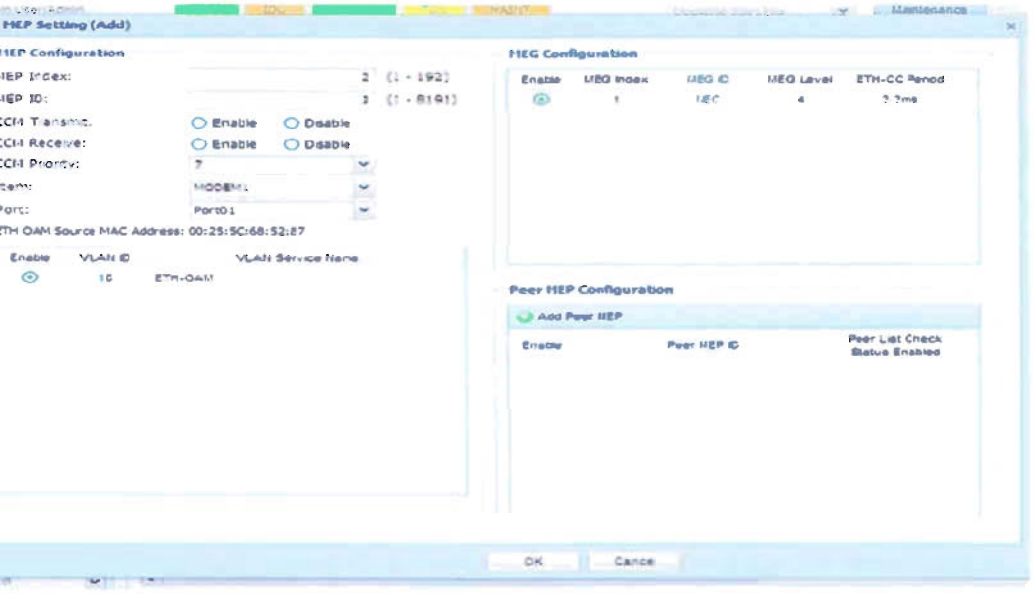


Figure 4.36: Enable MEG Configuration

Add MEP Configuration, put "Peer MEP ID = far-end MEP ID" and
on "Peer List check Status Enabled.
have to do the same configurations for far-end site.

4 ETH-OAM Test

5:

enance Test→ETH OAM LB/LT Control→Modify Test Type

Choose LB

MEP Index =1 [must be the same value as given in Step-5]

Destination MAC address = Source MAC address of far-end MODEM1 as got during Step-5.

OK

show the following successful LB result-

Figure 4.37: Showing LB result

Here the Result must show "Receive".

again I do the same test for far-end. Make sure that LB result is ng the same VLAN ID/MEP ID/MEG ID and MEG LEVEL which are gured in earlier steps.

7:

tenance Test→ETH OAM LB/LT Control→Modify Test Type

Choose LT

MEP Index =1 [must be the same value as given in Step-5]

Destination MAC address = Source MAC address of far-end MODEM1 as got during Step-5.

OK

show the following successful LT result-

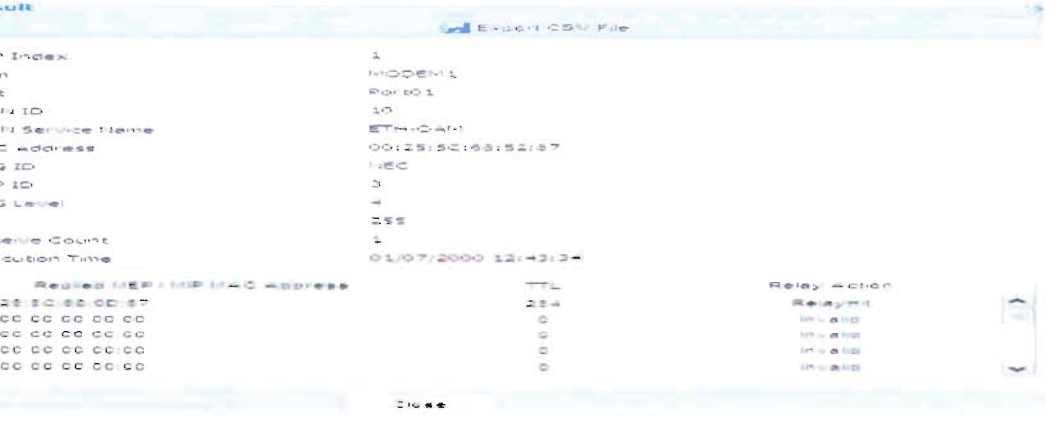


Figure 4.38: Showing LT result

lt must show TTL =254 for your testing MAC address.

in do the same test for far-end. Make sure that LT result is showing the VLAN ID/MEP ID/MEG ID and MEG LEVEL which are configured in er steps.

After completion the test, it is recommended to remove MEG, MEP, port type and VLAN ID.

Ethernet Bandwidth Test

quired to assign IP address in two PC as given example

: Assign IP address on near-end PC
ress: 192.168.210.10
t mask: 255.255.255.0
ay: 192.168.210.11

: Assign IP address on far-end PC
ress: 192.168.210.11
t mask: 255.255.255.0
ay: 192.168.210.10
have to try to ping the far-end PC, if it replies then IP assignment and ctivity is OK.

: How to ping-in my PC goes to
→Run→ write "CMD"→OK
92.168.210.11 –t
IP is 192.168.210.10, otherwise "Ping 192.168.210.11 –t" and vice

ple-
C:\Documents and Settings\Sushil>ping 192.168.210.11 -t

few minutes
Press CTRL+C
I see the following example result.

ng 192.168.210.10 with 32 bytes of data:

rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64
rom 192.168.210.11: bytes=32 time<1ms TTL=64

atistics for 192.168.210.11:

Packets: Sent = 17, Received = 17, Lost = 0

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

the above sample test result, it means my IP assignment as well as
00 ETHERNET port setting is correct.

: Now I share one drive/one folder at far-end PC. Then I make copy
ared file at near-end PC. Make sure downloading big size file like 1/2

: Check downloads speed, Press keyboard on your PC

alt+ctrl+delete"

Go to "Networking" Tab

Check Local Area "Network Utilization" as mentioned in following captured picture

Check Local Area "Link Speed" as mentioned in following captured picture

: Calculate the bandwidth

mission bandwidth = Network Utilization x Link Speed

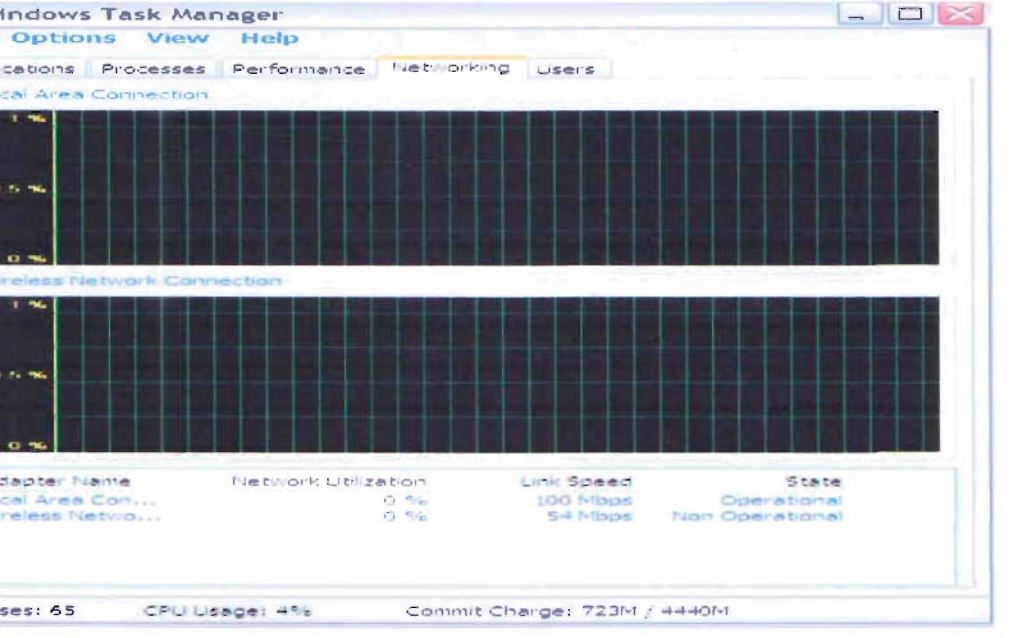


Figure 4.39: bandwidth Calculation

wap

Definition of Swap:

ement of one BTS (Base Transceiver Station) against another BTS is called

Necessity of swap:

discussing different developments we speak of system generations. First ition (1G) systems were analog with reasonably reliable networks but limited offerings. Second generation (2G) mobile systems are digital and bring cant advantages in terms of service sophistication, capacity and quality. The sing demand for wireless access to the Internet has led to further pments within 2G systems. These factors have led to the concept of third ition (3G) systems which will allow communication, information and ainment services to be delivered via wireless terminals. To upgrade these G ation), swap is required.The frequency range of existing BTS is 900 MHz. It a specific number of users within supported area. If the no. of user in this ncrease, then another 1800MHz BTS is required this can allow more number rs by increasing network capacity. In this case swap is required.

Equipments required for swap:

ntenna, CPRI cable, Grounding cable, Connector, L-connector, Feeder coaxial cable), BTS 3900, Short jumper, Tap

Tools required for swap:

aster, Laptop, USB cable, DDF puncher, Torque Range, Spinner, driver, Vacuum cleaner, measuring tap

Working Procedure:

g my internship period I joined with an installation team. We went to akhra" under supervision of Eng. Mr. Muntasirul Haque for Swap. f all he gave me a short lecture about swap. Then I saw the whole ure of swap. Here, I am providing the hole installing procedure briefly.

First of all 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).

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).

3 DRFU is used for 222 configurations.

3 DRFU is internally connected with 3 GSM antennas respectively.

We used 6 DRFU (2 DRFU for each antenna) For 444 configurations.

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. These are:

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.

we on the power switch of BTS. And login. To login with BTS, we cted BTS with a laptop by USB cable and opened BTSM software. From oftware we checked three sensors it is working or not. This is the n we done that day.

Description of the Equipments required for swap

ım providing brief description of the Equipments required for swap

cable:

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

ıding cable:

aluminum cable is used to grounding all equipments in BTS room.

:r cable (coaxial cable):

pe of wire that consists of a center wire surrounded by insulation and grounded shield of braided wire. The shield minimizes electrical and requency interference. Coaxial cable is called "coaxial" because it :s one physical channel that carries the signal surrounded (after a f insulation) by another concentric physical channel, both running he same axis.

jumper:

umper is used to connect between feeder cable and BTS. It is also etween feeder cable and GSM antenna.

ector:

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

nector:

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

used for tapping on leaky surface and joint section in feeder cable so can reduce signal loss.

antenna:

tenna is a transducer that transmits or receives electromagnetic waves. er words, antennas convert electromagnetic radiation into electric t, or vice versa. Antennas generally deal in the transmission and ion of radio waves, and are a necessary part of all radio equipment.

BTS 3900 (Base Transceiver Station 3900):

all the equipment BTS3900 is the most vital equipment. So I am ing a brief feature about BTS3900 here. This is a Huawei product. am describing the hardware structure, cabinet and the component of S. These things are shown to me.

900 Product Description

TS3900 is comprised of the BBU3900, MRFU, and indoor macro t. The BBU3900 and the MRFU are installed in the indoor macro t. The PS4890 meets the requirements of different applications when ckup power or transmission equipment space is required.

l

EI 3900 (2 sets)

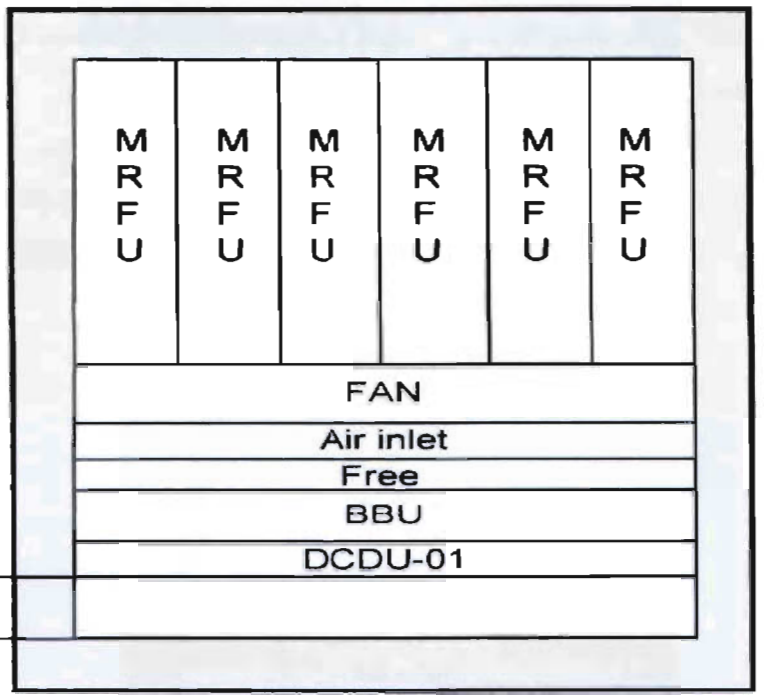
1) 900 MHz

2) 1800 MHz

ware Structure of the BTS3900 (-48V)

The BTS3900 cabinet (-48V) uses the external -48V DC input. The DC power is directly led into the DCDU-01 and the DCDU-01 distributes the DC power to each component in the cabinet.

The BTS3900 cabinet (-48V) consists of the following components: the MRFUs, BBU, DCDU-01, and FAN unit. You can optionally install devices of 3U in height in the spare space of the cabinet.

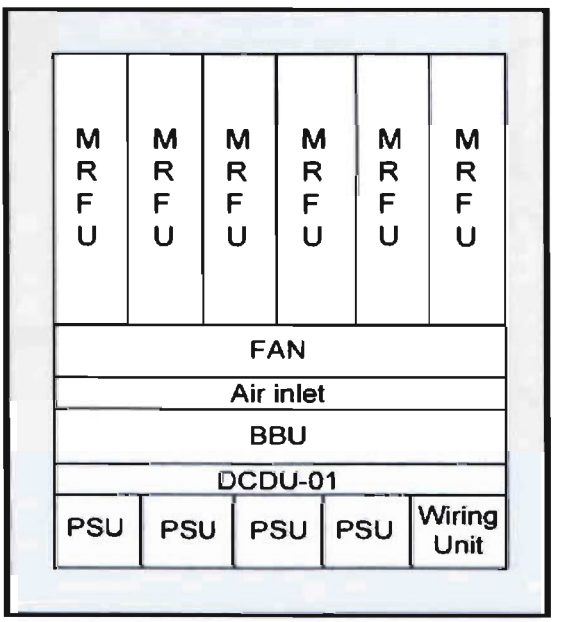


4.40: Typical configuration of the BTS3900 cabinet (-48V)

ıre Structure of the BTS3900 (+24V)

.e BTS3900 cabinet (+24V) uses the external +24V DC input. The PSUs C/DC) convert the external input power into -48V DC power and supply e -48V DC power to the DCDU-01.Then; the DCDU-01 distributes the -V DC power to each component in the cabinet.

.e BTS3900 cabinet (+24V) consists of the following components: the RFUs, BBU, DCDU-01, PSUs (DC/DC), and FAN unit.

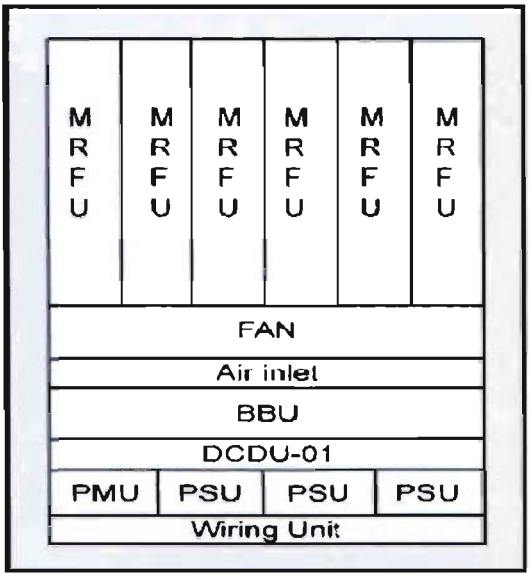


ıre 4.41: Typical configuration of the BTS3900 cabinet (+24V)

ıre Structure of the BTS3900 (~220V)

ıe BTS3900 cabinet (~220 V) uses the external 220 V AC input. The SUs (AC/DC) convert the external input power into -48 V DC power and ıpply the -48 V DC power to the DCDU-01.Then, the DCDU-01 stributes the -48 V DC power to each component in the cabinet.

ıe BTS3900 cabinet (~220 V) consists of the following components: the RFUs, BBU,DCDU-01, PMU, PSUs (AC/DC), and FAN unit.



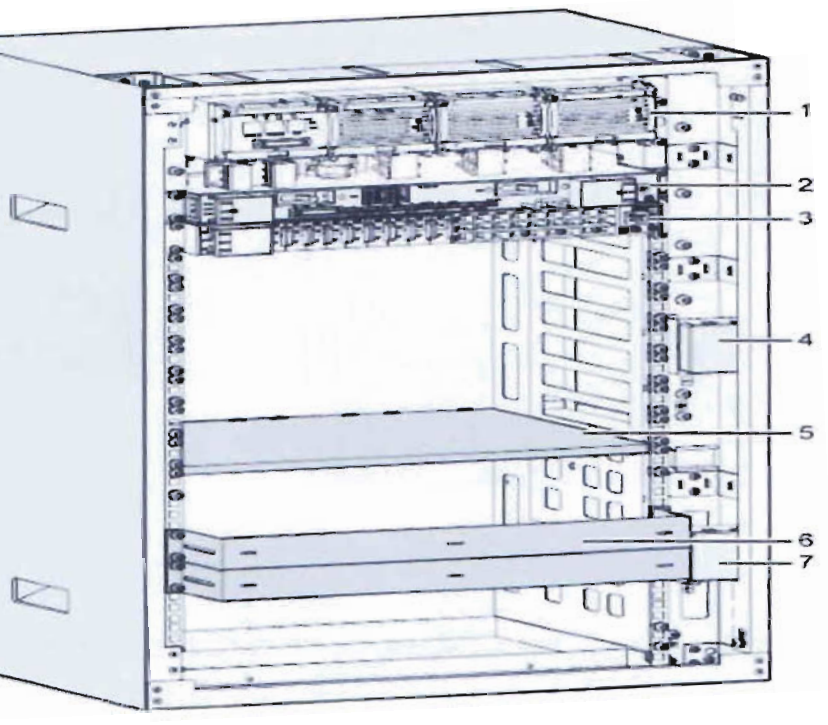
ure 4.42: Typical configuration of the BTS3900 cabinet (220 V)

vare Structure of the PS4890

he PS4890 cabinet contains the power system and modules such as CDU-04 and DCDU-03.

he PS4890 cabinet configured with 48V 50 Ah, 48V 92 Ah, or 48V 184 h battery groups provides the following functions:

- The power system converts the AC power into -48 V DC power and provides three outputs to the battery groups, DCDU-04, and DCDU-03 through power distribution.
- The DCDU-04 provides two DC outputs to the BTS3900 cabinet or other primary BTSs.
- The DCDU-03 provides nine DC outputs to the transmission equipment.

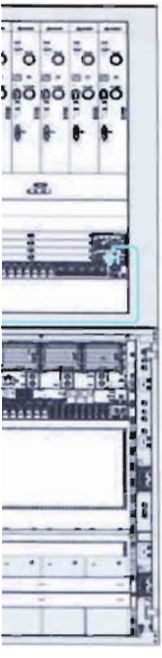


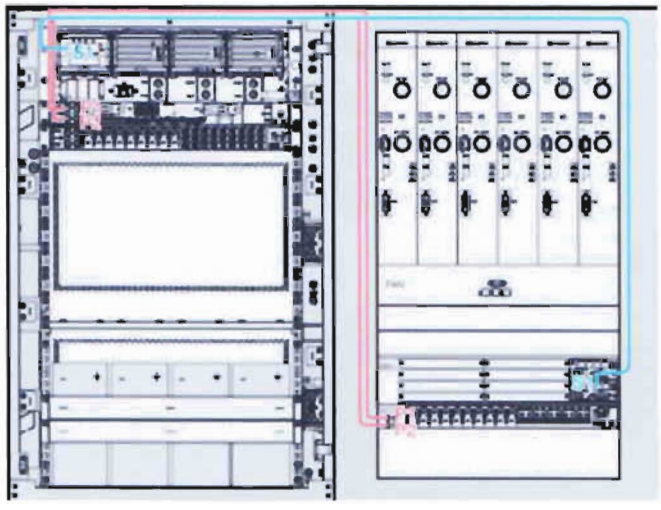
1 AC/DC power system
2、DCDU-04
3、DCDU-03
4、Copper bus bar for the negative poles of the battery group
5、Battery support plate
6、Baffle plate
7、Copper busbar for the positive poles of the battery group

Figure 4.43: Structure of the PS4890

tallation of BTS3900 and PS4890 Together

- Installation of BTS3900 and PS4890 in stack mode and side-by-side mode.





:e4.44: Installation of BTS3900 and PS4890 Together first left side
ıecond right side.

3900 Components

BTS3900 Hardware includes:

- BBU3900 Equipment
- MRFU (Multi carrier Radio Filter Unit)
- DCDU-01 (Direct Current Distribution
- FAN Unit
- GATM(GSM Antenna and TMA Control module)
- SLPU Signal Lightning Protection Unit
- PMU module
- Power subrack DC/DC
- Power subrack AC/DC

Figure 4.45: BTS 3900 Indoor

3900 Equipment

The BBU3900, which features a case structure, can be installed in a 19-inch-wide and 2U-high indoor space or outdoor protective cabinet.

BBU3900 equipment includes:

- GTMU
- WMPT
- WBBP
- UTRP
- UPEU
- UEIU
- UELP
- UFLP
- UBFA

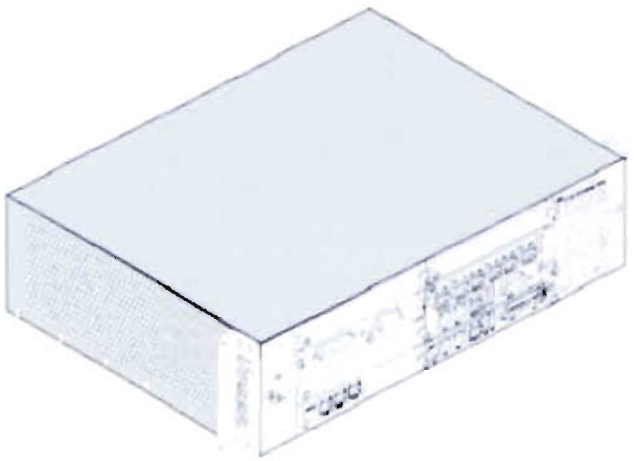


Figure 4.46: Picture of the BBU3900

here I am not discussing the component of BBU3900

ctions of the BBU3900

- Provides an OM channel between the base station and the LMT or the M2000 to operate and maintain the base station.
- Processes uplink and downlink data.
- Manages the entire dual-mode system in terms of OM and signaling processing.
- Provides the system clock.

3900 Slots

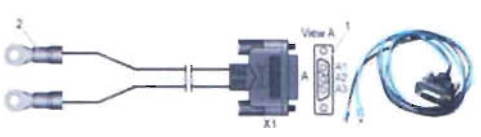
ots of the BBU3900 GSM, BBU3900 GU, and BBU3900 UMTS are the

Slot 0	Slot 4	PWR1
Slot 1	Slot 5	
Slot 2	Slot 6	PWR2
Slot 3	Slot 7	

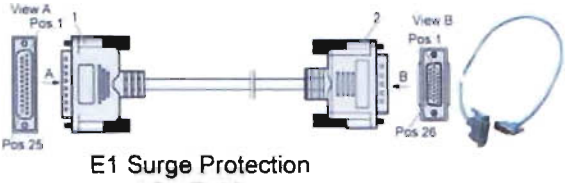
Figure 4.47: BBU3900 Slots

Cable

escribes the BBU3900 cables. The BBU3900 cables are the BBU PGND BBU power cable, E1 cable, E1 surge protection transfer cable, CPRI l cable, inter-CPRI signal cable, BBU alarm cable, monitoring signal between the APMI and the BBU, FE cable, FE surge protection er cable, monitoring signal cable for the EMUA, and GPS clock signal

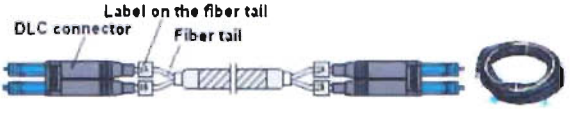


Power Cable



E1 Surge Protection Transfer Cable

FE Cable



CPRI Optical Cable

Figure 4.48: Picture of different BBU3900 Cable

U (Multi carrier Radio Filter Unit)

IRFU is a multi-carrier RF filtering unit. One MRFU supports a ıum of 6 carriers in GSM mode, 4 carriers in UMTS mode, and 6 s in GSM + UMTS mode.

tions:

- Implements the direct frequency conversion technique in the transmit channel, modulates the baseband signals to GSM RF signals; then, sends the signals to the antenna for transmission through the duplex filter after filtering, amplifying, and combining the RF signals. The combining can be performed as required.
- Receives RF signals from the antenna and performs down-conversion, amplification, analog-to-digital conversion, digital down-conversion, matched filtering.
- Provides power sharing. Improves the network coverage, reduces the interference and power consumption and save the device cost.

Unit

AN unit, also called the fan box module, dissipates the heat in the ɛt. One FAN unit has four independent fans.

AN unit has the following functions:

- Providing forced ventilation and dissipation for the cabinet.
- Supporting the temperature detection.

AN unit supports:

- Adjustment based on the temperature and adjustment controlled by the main control unit.
- Fan rotation control function. The FAN unit stops the rotation of the fans when the ambient temperature is low.

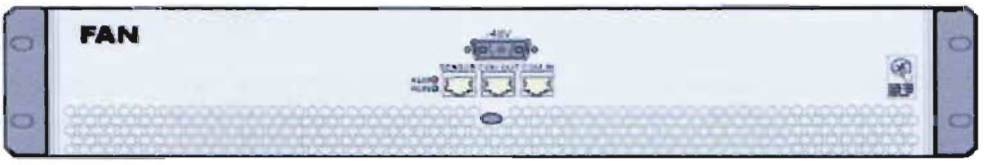


Figure 4.49: picture of The FAN unit

M (GSM Antenna and TMA Control module)

SM antenna and TMA control module (GATM) is a module that controls ntenna and TMA. The GATM is optional. The GATM is optionally ed in the power cabinet or transmission cabinet when the MRFU e is configured.

ATM has the following functions:

- Controlling the RET antenna.
- Supplying power to the TMA.
- Reporting the RET control alarm signals

re 4.50: picture of GATM (GSM Antenna and TMA Control module)

Signal Lightning Protection Unit

signal lightning protection unit (SLPU), which can be optionally ured with the UFLP or UELP, provides the signal surge protection. The is an optional module of the BTS3900 cabinet (-48 V) or the power ution cabinet.

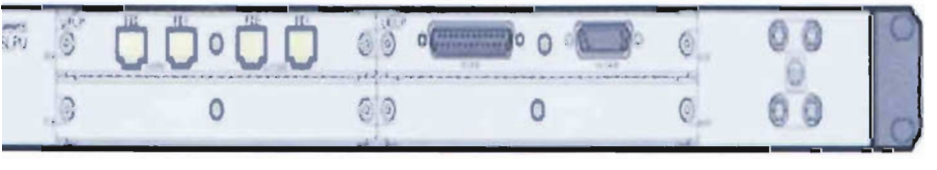


Figure 4.51: picture of SLPU (Signal Lightning Protection Unit)

er subrack DC/DC

ower subrack (DC/DC) provides access for the external +24 V DC. In ower subrack, the PSU (DC/DC) converts the +24 V DC power into the -DC power, and then leads the -48 V DC power to the DCDU-01 over the cable through the wiring unit of the power subrack.

- PSU (DC/DC).
- Wiring Unit (+24 V).

er subrack AC/DC

power subrack (AC/DC) consists of the PMU, PSU (AC/DC) and the g unit of the power subrack (220 V). The power subrack (AC/DC) rts the 220 V AC power to the -48V DC power.

- PMU
- PSU (AC/DC)
- Wiring Unit (220 V)

External Alarms Checking

9 External Alarms Exists Physical Position at Crone block. These s are given below:

A1. Over Temperature & Over Humidity
A2. Mains Fail
A3. Battery Disconnect Pre-Alarm
A4. Rectifier Module Fail
A5. Aviation Light Failure
A6. Generator Running
A7. Fuel Level Low
A8. Water Level High
A9. Door Open

Working procedure:

3TS installation and commissioning we have to set the alarms. we have to ion & Deactivation Alarm Manually. I have seen the process. Now I am ing the process briefly

4.5.2 A1.Over Temperature and Over Humidity

ck the alarm manually, we have to follow these steps:

- Get current temperature and humidity by OMC from environment monitoring option. Compare the temperature (that you got by OMC software) with the temperature indicated in thermometer. If comparison result is OK then the sensor is OK.
- Set temperature and humidity much lower than the current temp. and humidity, over temperature and over humidity alarm will be activated.
- Now set the temperature at the threshold value, over temp. alarm will be deactivated.
- Set the humidity at the threshold value, over humidity alarm will be deactivated.

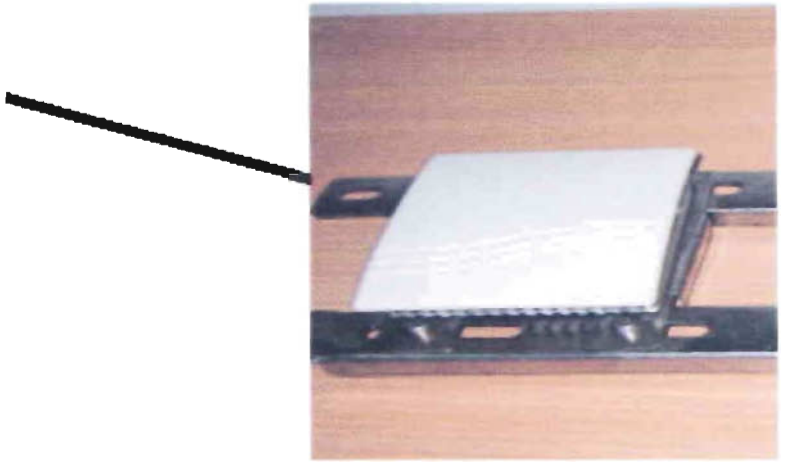


Figure 4.52: Temperature and Humidity sensor

result got in OMC software does not match with the temperature in the ıometer, follow the steps:

- Short the Temperature/Humidity cable pair of the BTS end, alarm will be activated. Open the cable pair, alarm will be deactivated. If the process is OK follow the steps below.
- Check whether the connection in the crone block is OK or not. Check the cable from BTS end is connected with the cable from sensor end as per specification (Color code should not be mismatched).
- Check whether the punching in the crone block is OK or not. Use LED to be sure of that.
- If everything is OK described earlier, then it is sure that the sensor is faulty.
- Take initiative to solve the problem.

4.5.3 A2.Mains Fail

switch off the MCB from the rectifier or from the DB the mains fail ı will be activated. If we switch on the MCB the alarm will be ivated.

Main Circuit Breaker (MCB)

Figure 4.53: Main Circuit Breaker (MCB)

ains failure alarm does not give proper result, follow the steps below:

Check whether the connection in the crone block is OK or not. Check the cable from BTS end is connected with the mains failure alarm cable from rectifier end as per specification (Color code should not be mismatched).
Short the white-blue cable pair of the BTS end, alarm will be activated. Open the cable pair, alarm will be deactivated. If the process is OK follow the steps below.
Check whether the punching in the crone block is OK or not. Use LED to be sure of that.
Check the connection in the rectifier whether connection is at the right position or not.
Take initiative to solve the problem.

A3.Battery Disconnected Pre-Alarm

gle set battery

witch off the Battery bank breaker then battery disconnected pre-vill be activated.

uble set Battery

switch off any of the two Battery bank breaker then battery nected pre-alarm will be activated.
reaker is on Battery disconnected pre-alarm will be deactivated.

disconnected pre-alarm checking can be done by changing rectifier s. Follow the steps:

ELTA/ASCOM rectifier....

Increase Us min, then Increase Ua min; battery disconnected pre-alarm will be activated.

Change the settings (of Us min & Ua min) to its previous value, alarm will be deactivated.

LTEK rectifier....

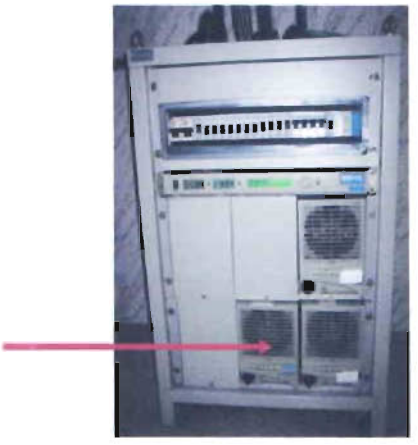
Increase Battery Low voltage 1 to its maximum value, alarm will be activated.

Change the setting to its previous value, alarm will be deactivated.

battery disconnected pre-alarm does not give proper result, follow the as it was described for the mains failure alarm

5 A4.Rectifire Module Fail

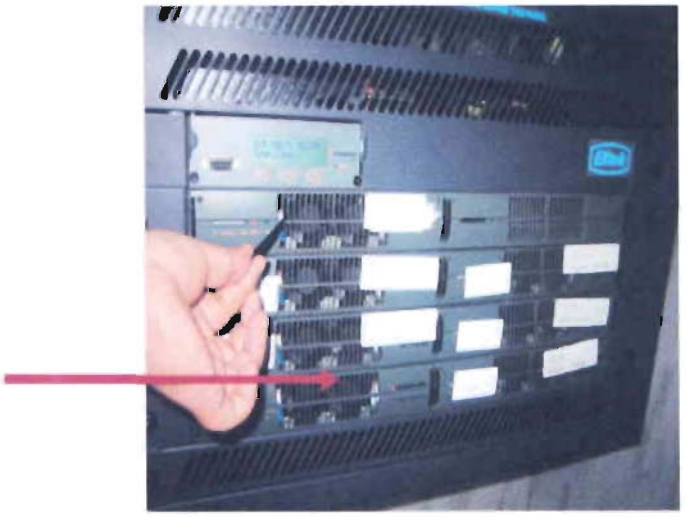
se of BSMC rectifier if we pull out the module from its slot module fail n will be activated. Push the module in the slot again, alarm will be ivated.



BSMC Rectifier Module

Figure 4.54: Rectifire Module

e of ELTEK Rectifier we have to stop the module FAN by inserting a tie, ıen the rectifier module fail will be activated. If we pull out the tie alarm deactivated.



ELTEK Rectifier Module

Figure 4.55: ELTEK Rectifier Module

ɛ of DELTA/ASCOM switch off the breaker of the module, alarm will be ted. If we switch on the breaker alarm will be deactivated.

Delta Rectifier Module

Figure 4.56: Delta Rectifier Module

6 A5.Aviation Light Failure

heck this alarm manually, follow the steps:

First we have to cover the sensor by black tape.

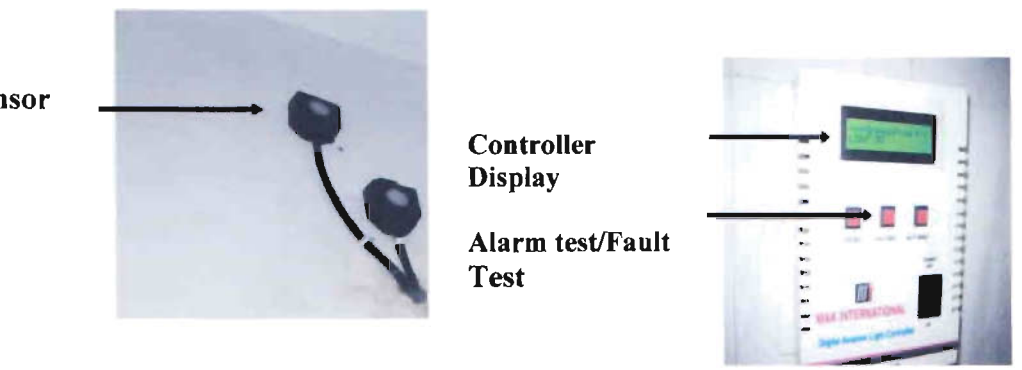
We'll find "100% light on" on the aviation light controller display.

Now we have to press the alarm test/fault test button, then display will

Show "50% light on" and there will be a continuous beep. Wait and see Aviation light failure alarm activated.

Aviation light failure alarm will be deactivated automatically.

e: Don't uncover the sensor before the alarm is deactivated.



gure 4.57: Aviation Light Failure (Sensor/ Controller Display/ Alarm test/Fault test)

ne Aviation Light Failure alarm does not give proper result, follow the s below:

- Check whether the connection in the crone block is OK or not. Check the cable from BTS end is connected with the Aviation Light Failure alarm cable from the controller end as per specification (Color code should not be mismatched).
- Check whether the cable pair is connected to the 'NO' and 'C' point of the controller board properly or it is mismatched.

- Short the cable pair of the controller end, alarm will be activated. Open the cable pair, alarm will be deactivated. If the process is OK, it is obvious that connection from BTS to controller is fully OK.
- If all the procedure discussed above is OK, then it is obvious that the Sensor or the controller is not OK. Use MultiMeter to check the sensor. Then it will be clear, in which point the problem is!
- Sometimes alarm is not recovered. To avoid this problem be sure that you do not uncover the sensor before alarm is recovered automatically.
- Take initiative to solve the problem.

7 A6.Generator Running

e generator runs, Generator Running alarm is activated. To check rator running alarm manually follows the step:

First choose Manual option on the generator display board.
If we switch off the generator Ckt Breaker manually, Generator running alarm will be deactivated.
If we switch on the generator manually, generator running alarm will be activated.

: Generator runs automatically by a special device, named VDTC age Dependent Timer Controller).

Generator Running alarm does not give proper result, follow the steps v:

- Check whether the connection in the crone block is OK or not. Check the cable from BTS end is connected with the Generator Running alarm cable from generator end as per specification. It must not be mismatched with Fuel Level Low alarm cable (Color code should not be mismatched).

- Check whether the connection to the running sensor in the ATS board is OK or not.
- Short the cable pair at the sensor end, alarm will be activated. Open the cable pair, alarm will be deactivated. If the process is OK follow the steps below.
- Use MultiMeter to check whether the sensor is connected with the generator or not.
- Take initiative to solve the problem.

A7.Fuel Level Low

el Level Low sensor is sink under the fuel. To check this alarm nually, follow the step:

- Pull out the sensor from the fuel; wait a bit, alarm will be activated.
- Put the sensor inside the fuel alarm will be deactivated.
- If there are two generators, any generator's Fuel Level is low,

rm will be activated.

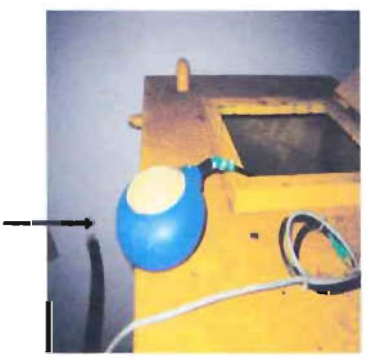


Figure 4.58: Fuel level Low sensor

Fuel Level Low alarm does not give proper result, follow the steps as it en discussed for Generator running alarm.

A8.Water Level High

k Water Level High alarm manually, follow the steps:

ll up the sensor a bit higher, alarm will be activated.

ıt it down to its previous position, alarm will be deactivated.

ater Level High alarm does not give proper result, follow the steps:

Open out the alarm cable of the sensor from crone block. Use MultiMeter to check whether the sensor is OK or not.

Open out the alarm cable pair of the BTS end from crone block, short them, alarm will be activated and open those, alarm will be deactivated.

Check the color code is ok or not.

You will find the solution.

Water Level High Sensor

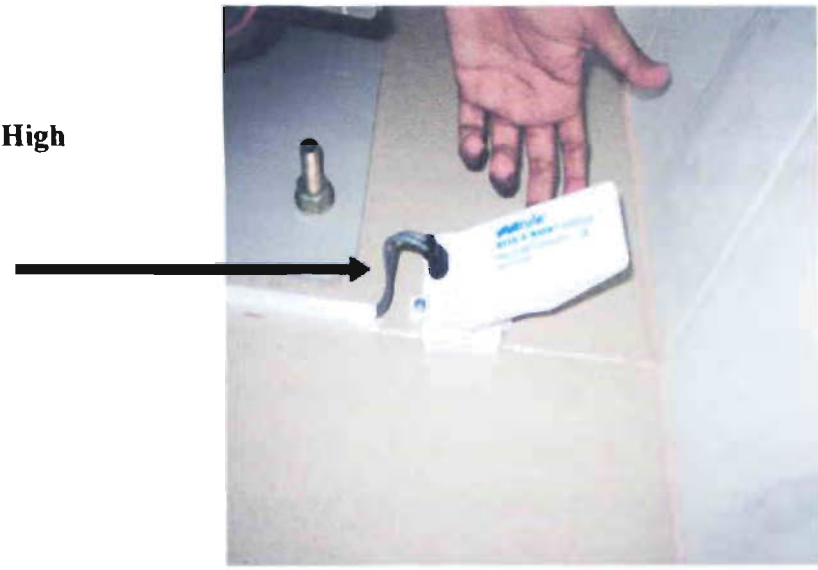


Figure 4.59: Water Level High Sensor

0 A9.Door Open

eck Door Open Alarm manually follows the steps:

- Open the door, Door open alarm will be activated.
- Close the door, select "clear robbery alarm" in the OMC software, Alarm will be deactivated.

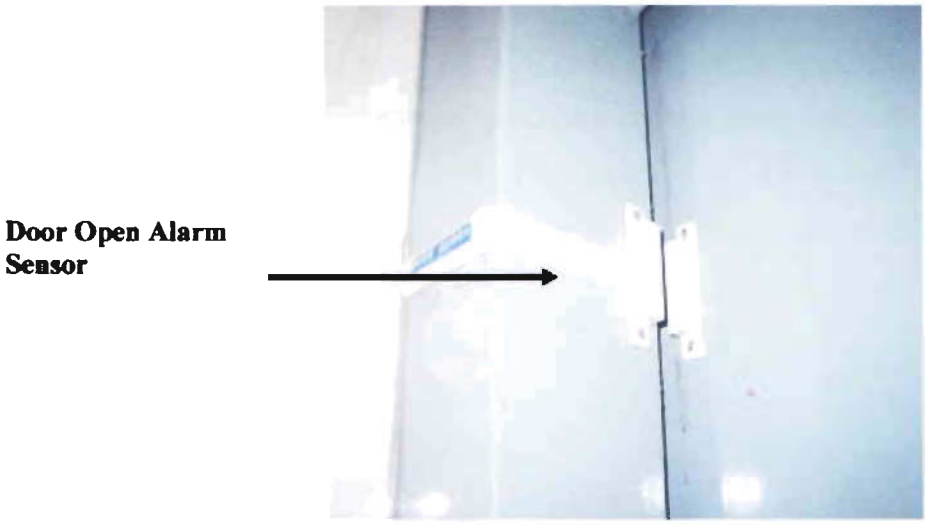


Figure 4.60: Door Open Alarm Sensor

Door Open alarm does not give proper result, follow the steps:

- Open out the alarm cable of the sensor from crone block. Use MultiMeter to check whether the sensor is OK or not.
- As for the Door Open alarm activation open circuit is used, Open the cable pair at the sensor end, alarm will be activated. Short the cable pair, alarm will be deactivated. If the process is OK follow the steps below.
- Check the color code is ok or not.
- Check the connectivity of the two parts of the sensor.
- You will find the solution.

Rectifier commissioning:

BTS room there are two types of power supply are needed. These are:

AC power supply

DC power supply

power supplies are required to operate BTS and other equipments in room. A commercial AC power supply is taken from the Power bution Company and then a rectifier is needed to convert the AC power y to DC power supply. All the equipments in BTS room are operated by burce. First of all the required rectifier is installed at the bts room. To te rectifier, commissioning is required. The process of commissioning is rectifier commissioning. For the purpose of commissioning we need p, USB cable, Screw driver.

Working procedure:

am providing the process step by step.

First I connected the rectifier with laptop by USB cable.

I use commissioning software.

I set up maximum current and voltage range following the given plan.

After setting all set up in this software, we saved all.

The rectifier brand was Eltech. So we used Eltech Valarie software.

Extra Cabinet installation:

y site if number of users increases previous connected BTS cabinets are ufficient to support all the excess users. So another cabinet is required pport excess user. The process of installation is called Extra Cabinet.
of user increases again in a collocated site, then another cabinet is red to support excess user. The process of installation is called Extra net. The BTS can be 1800MHz or 900MHz. It depends on number of increase in an area. If the number of users increases within wide area 900MHz BTS is required. But if number of users increases nearly to the center, then 1800MHz BTS is required. In this case, Extra Cabinet is ded with master BTS and collocated 1800MHz BTS make stand alone. his purpose we need some tools. These are: Site master, Laptop, USB , OMT cable, DDF puncher, Torque Range, Spinner, Screw driver, pass, Measuring tap. And also we need some equipment. These are: GSM antenna, Feeder cable (coaxial cable), CPRI cable, Grounding , Short jumper, Connector, L-connector, Tap.

1 Working procedure:

procedure for Extra cabinet is given below step by step:

nna system Installing: First of all we installed antenna at the tower as per the plan. Then we set up antenna electrical and mechanical g and taped feeder port of antenna properly. Tapping is very important otherwise signal may loss.

Grounding: We made proper BTS grounding.

power supply: We connected the BTS with rectifier using power cable to electric power supply.

R (Voltage Standing Wave Ratio) measurement: we have to be careful g VSWR measurement because VSWR is one of the major issue for cable. So Before VSWR measurement, we calibrated the site master. onnected the feeder cable with site master through connector and ured the value and save it. The value of VSWR should be less than 1.40. greater than 1.40, then we have to change feeder cable.

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

(Pulse Code Modulation) cable Connection: We connected the BTS DU port using PCM cable.

hronization: for **Synchronization**, we made connection between ESB rnal Synchronization Bus) ports of the collocated RBS (1800MHz) and er BTS (900MHz) by ESB cable.
oth BTS (Master and Slave) version-1: 4638ns
s version-1 and another is version-2: 4625ns
RBS is version-2: 4612ns

Power Supply Check: Commercial power supply should be remaining n 8 to 10 KW. So we checked it and saw it is 10KW.

ery backup installation: We have to replace battery set for collocation. is case, 48V double capacity (500 Ah) battery is required instead of e capacity (300 Ah) battery set. We used 24pcs battery (2V each battery).

nnected 24pcs battery in series to make the set 48V. Using multimeter, ecked the output voltage and got it 48V. Finally we connected the set with rectifier by battery power cable and battery set started to d. During load shedding, RBS get power from battery.

ier setting: For single BTS, two rectifier modules are required. But for BTS, three rectifier modules are required. So an extra module we ed in the rectifier. For single capacity, rectifier maximum current limit 0A. But for double capacity, we have changed it to 100A. So we ed it to 100A from rectifier function.

ad: To operate BTS, loading IDB must be required. To do this, we need Operation and Maintenance Terminal) software. Using OMT cable, we cted RBS with laptop. We created an IDB using OMT software. After ng some steps, we loaded IDB. Finally BTS came to operating ion.

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

nonitoring: After coming operation, we monitored RBS how well it is ng. BTS can be monitor using laptop connected with BTS by OMT Monitoring events are:

TS (Time Slot) channel combination
PSU average voltage
PSU total current
TF compensation
TSSP configuration
RF loop test parameter

VCO control value

Faulty RUs (Replaceable Unit)

MO (Managed Object) fault map

Absolute radio frequency for TX (Transmitter)

Absolute radio frequency for RX (Receiver)

SSI (Diversity Supervision Mass) value: SSI value should be -3<SSI<3.

Check IDB

DC system voltage

ESB (External Synchronization Bus) delay

Forward power on

PROBLEMS AND RECOMMENDATIONS

ıve tried my best to collect detailed information about the mobile munication structure Teletalk Bangladesh Ltd. But still I believe that the rt would be vaster and technically more minutiae. Due to company cy I couldn't able to disclose some information in this project. For some s I just have to gather information from secondary sources. We face e difficulties which are unexpected. Here we have mention some xpected problems which we face in time of working. Most of the problem es after sudden period of time.

n we swap a BTS then we have to connect our new BTS feeder cable with per cable. Sometime the cable connection may be mismatch. So we uld connect the feeder cable TX and RX with jumper cable carefully. en we check our indoor alarm, we have to login with BTSM software. To ı this, we have to put an IP address. If we put wrong IP, we couldn't login 3TS and couldn't check alarm. So we should put IP address carefully. ietimes the value of VSWR is above 1.40 for a cell. This problem occurs to loose connection and damaged feeder cable. So, first we have to all the nection between BTS and GSM antenna. If the connection is correct then ıave to change the feeder cable to solve this problem. Sometimes the BTS ws the RBS fault alarm. This problem occurs due to high temperature in room. So we have to cool the BTS room by Air conditioner to solve this blem.Due to miss set up of voltage and current, we didn't get proper out from rectifier. In this case, we have to set up rectifier again to solve problem.

CONCLUSION

ling a microwave site, Microwave IDU Alarm monitor, iPasolink lation, Swap, External alarms Checking, Rectifier commissioning, Cabinet installation is quite a large sector in telecommunication Ve give our best effort to learn as much as possible in this short d of internship. From this internship we joined in a team. The work was done earlier and we were given a basic idea of how it one. Then we learned about the whole thing mentioned above. We earned how to check the alarms of BTS and eventually we monitored larms of some BTSs. We have also familiarized with a corporate nment. From our internship we have gathered lots of knowledge nany experiences.

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Appendix

Network Switching Subsystem

Operation Subsystem

The Mobile Stations

The Base Station Subsystem

The Mobile Equipment

The Subscriber Identity Module

Personal Identity Number –

DN Mobile Station ISDN number

International Mobile Subscriber Identity –

Temporary Mobile Subscriber Identity -

The individual key

The cipher key

Base Station Controller

Base Transceiver Station

Transcoding and Rate Adaption Unit

Local Maintenance Terminal

Mobile services Switching Center

Visitor Location Register

Home Location Register Authentication Center AC

Equipment Identity Register

DN Mobile Subscriber ISDN number

International Mobile Subscriber Identity

Temporary Mobile Subscriber Identity

Handover Number

Local Mobile Subscriber Identity

N Mobile Station Roaming Number

International Mobile Subscriber Identity