East West University

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An Industrial Training Report
on
"Radio Frequency Optimization"

Submitted by
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2014-3-50-025

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This Project submitted in partial fulfilment of the Requirement for the Degree of Bachelor of Science in Information and Communications Engineering (B.Sc. in ICE)
To the
Department of Electronics and Communications Engineering
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Disclaimer

This is to declare that this internship report based on Radio frequency Optimization from Decon Telecom Solutions (BD) LTD, has not been submitted elsewhere for any purpose.

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Department of ECE

Acceptance

This internship report has been presented to the department of Electronics and Communications Engineering, East West University and submitted for the partial fulfillment of the requirement for degree of B.Sc. in Information and Communications Engineering, under complete supervision of the undersigned.

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General Manager

Decon Telecom Solutions (BD) LTD

Acknowledgements

First I am grateful to almighty Allah for blessing me with such opportunity of learning and ability to successfully complete the task.

A special thanks with honor to my supervisor Iffat Alam, Senior Lecturer, Department of Electronics and Communications Engineering, East West University, who was kind enough to allocate her valuable time to provide me with humble guidance, motivating thought and encouragement.

I thank and express my gratitude to Mohammad Faijul Islam, General Manager of Decon Telecom Solutions (BD) Ltd, for giving me opportunity to do Internship and providing lots of his support during the training phase.

I also thanks to my supervisor Quazi Shah Newaz Rahman from the core of my heart , and all the senior officials of Decon Telecom Solutions (BD) Ltd, with whom I have spent one of the most important stages of life.

Finally, I am forever grateful to my parents and all my honorable faculty members for their patience and love.

Noushad Hasan Jabin

2014-3-50-025

Abstract

Decon Telecom Solutions (BD) LTD is now one of the telecommunications service provider situated in the capital city of Bangladesh. As a part of the industrial training I was assigned to this prominent company for a 3 months training from 6 May, 2019 to 5 August, 2019. The objective of this report is to provide the detail information of the company as well as to describe about all the tasks or projects I did during my training period.

I would like to break up this report into several phases. 1st phase of the report gives the different aspects of the company as well as the scopes of the training along with the analytical part associated with the survey and frequency planning. 2nd phase gives all the tasks or projects that have been conducted during the training. 3rd phase give the overview of analysis of some problems concerning voice calls. Last but not the least phase of this report contains the outcomes and comments about this wonderful experience of my life.

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Chapter 1

Scope of Training

I was assigned to the RF Optimization Department of Decon Telecom Solutions Bd. I had to work on RF (Radio Frequency) drive testing which is related to my courses.

When I was assign then there has been two phases of my training, first one is theoretical understandings about the drive testing and its terminologies and second one is the implementation of this knowledge for the practical purpose. While performing that I was able to learned the followings –

* Basic GSM channels, WCDMA channels and LTE features study.
* Customer complain management - Why a customer complain about his/her services and how the problem solved.
* RF Site Survey - Involves a site visit for planning and design a network.
* Post Performance Monitoring - Checking Traffic, Resource utilization and QOS (Quality of Service) of a new site.
* To study and participate in overall Cell design process - why/when new site requirement triggered, site survey, best option judge, designing new site - key consideration, coverage prediction
* Very basic GSM feature study - Hopping, Power control.
* Radio capacity analysis - Erlang B Table.
* Drive Test

Chapter 2

Company Profile

Company Name: **Decon**

Dismantling barriers, CONstructing carriers

2.1 About Decon

Decon started its operations in October 1993 as a proprietary organization. The company was initially engaged in infrastructure development; executing projects with private sectors like hospitals, schools and residential buildings. In 1998, the company got registered with the Government organizations (PWD Uttar Pradesh, Noida Development Authority, UP Jal Nigam, Ghaziabad) and got involved in Road and other development works.

Later in 2004, it diversified into Telecom Infrastructure Development and Wireless Services for telecom operators the former including Tower Foundation, Tower Erection and Electrical works while the latter includes RF Planning, Optimization, Transmission Planning and Network Performance.

In 2016-17, We started looking opportunities in overseas market and opened local registered office in Hong Kong, Bangladesh, Vietnam, Indonesia, Kenya and Tanzania.

We are focusing to provide end to end services to our esteemed customers which includes NPO and NI services together.
We are ISO 9001 Certified Company with Certificate No. Q-DCU.I7.026

2.2 Vision Mission and Core Values

Vision - Our Vision is to be the most preferred and trusted Telecom Consulting Company operating worldwide.
Mission - Our mission is to ensure that, we bring success to our customers, by efficient and cost effective delivery, build an environment of mutual trust, respect and growth for our employees, whilst maximizing shareholder profits as overall company growth.
Core Values All of our employees are proudly committed to the following values:- Integrity – Always dealing with our customers and our colleagues in a fair and ethical manner; gaining trust through our actions.
Knowledge – The value we place on our ability to develop leaders and the need to contin-

ually grow our collective technical expertise to meet the needs of ever more sophisticated customers.

Service – Encompasses the concept of quality in everything we do, having a service-mind-set when dealing with our customers.

Respect – Respect for one another in the office will lead to greater productivity and staff satisfaction, our growth is the customer's growth.

Leadership – Leadership both within the company with respect to developing our next generation of leaders and within our market segment with respect to being recognized by current and prospective customers as a firm that is the leading expert in the field.

Enthusiasm – Employing and nurturing staff with a passion for providing the highest-level quality service to our customers.

2.3 Our Major Achievement

Figure 2.1: Major Achievements

OUR PRESENCE

- India
- Bangladesh
- Hong Kong
- Vietnam
- Indonesia
- Myanmar (In process)
- Kenya
- Tanzania
- Nigeria (In process)
- DRC (In process)

Chapter 3

GSM

GSM stands for Global System for Mobile Communication, is a digital cellular technology used for transmitting mobile voice and data services. GSM is the most widely accepted standard in telecommunications and it is implemented globally. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz and 1900 MHz.

3.1 GSM Network Architecture

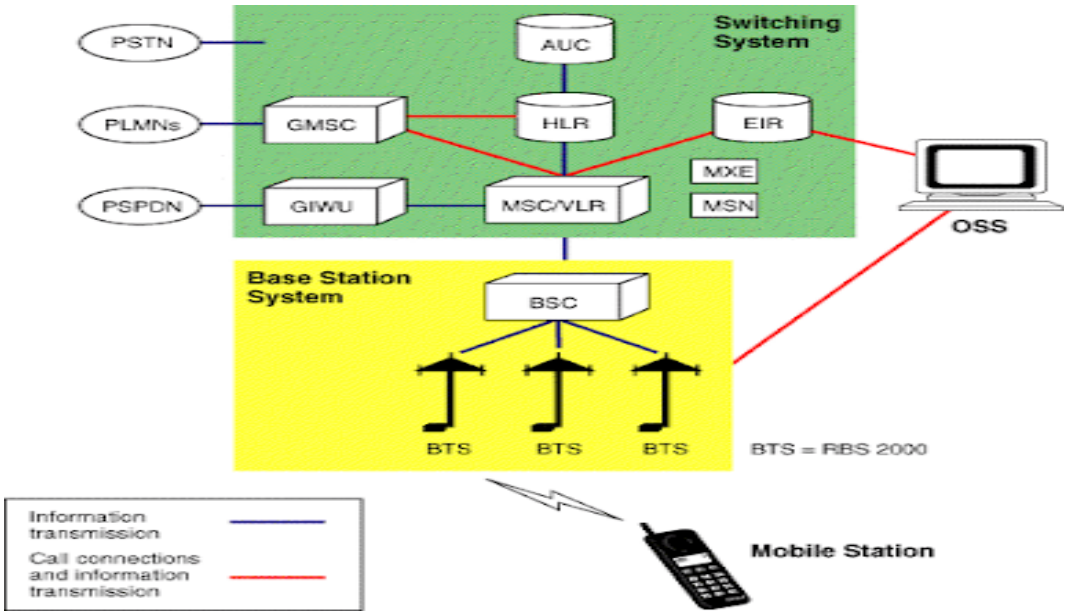


Figure 3.1: GSM Network Architecture

3.2 GSM Frequency and Spectrum

1. GSM 900 Band
    - Uplink = 890 MHz - 915 MHz
    - Downlink = 935 MHz - 960 MHz
2. GSM 1800 Band
    - Uplink = 1710 MHz - 1785 MHz
    - Downlink = 1805 MHz - 1880 MHz

Chapter 4

WCDMA

The **3rd** generation wideband code division multiple access (WCDMA) system is a mobile radio communication system that provides for high-speed data and voice communications service. WCDMA is one of two technologies that are being used to fulfill the radio access requirements of universal mobile telecommunications system (UMTS).

Installing a new WCDMA system or upgrading existing systems to WCDMA allows mobile service providers to offer their customers wireless broadband (high-speed Internet) services and to operate their systems more efficiently (more customers per cell site radio tower).

The WCDMA system has been designed to interoperate with GSM systems. This allows for the gradual migration of GSM customers to advanced WCDMA digital services.

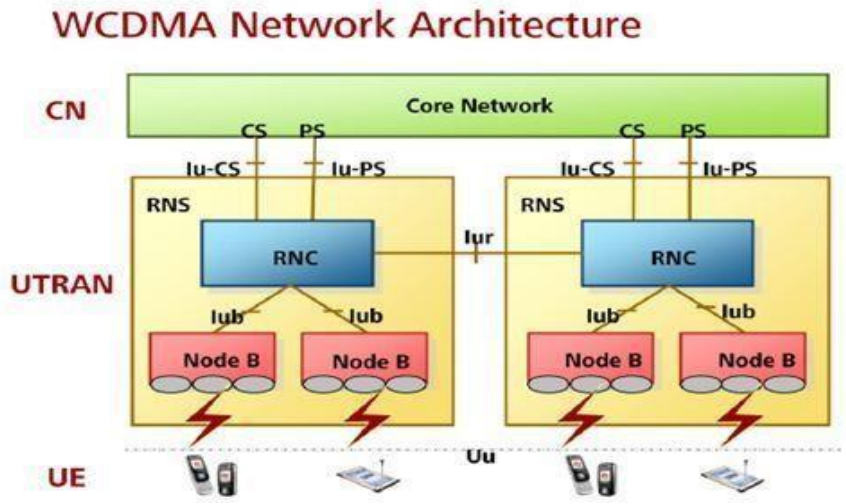


Figure 4.1: WCDMA Network Architecture

4.1 WCDMA Services

The services that WCDMA can provide include voice services, data services, multicast services, location based services (LBS), and multimedia communication services that have various levels of quality of service (QoS).

4.2 UMTS

UMTS, stands for Universal Mobile Telecommunications System, is a 3G networking standard used throughout much of the world as an upgrade to GSM mobile networks. UMTS is a packet-based transmission of text, digitized voice, video, and multimedia at data rates up to 2 megabits per second (Mbps).

4.3 UE (User Equipment)

In the Universal Mobile Telecommunications System (UMTS) user equipment (UE) is any device used directly by an end-user to communicate. It can be a hand-held telephone, a laptop computer equipped with a mobile broadband adapter.

Functionality of UE

- Mobility Management
- Call Control
- Session Management
- Identity Management

Chapter 5

LTE

LTE (Long Term Evolution) is a standard for 4G wireless broadband technology that offers increased network capacity and speed to mobile device users.

LTE offers higher peak data transfer rates up to 100 Mbps downstream and 30 Mbps upstream. It also provides reduced latency, scalable bandwidth capacity and backward-compatibility with existing GSM and UMTS technology.

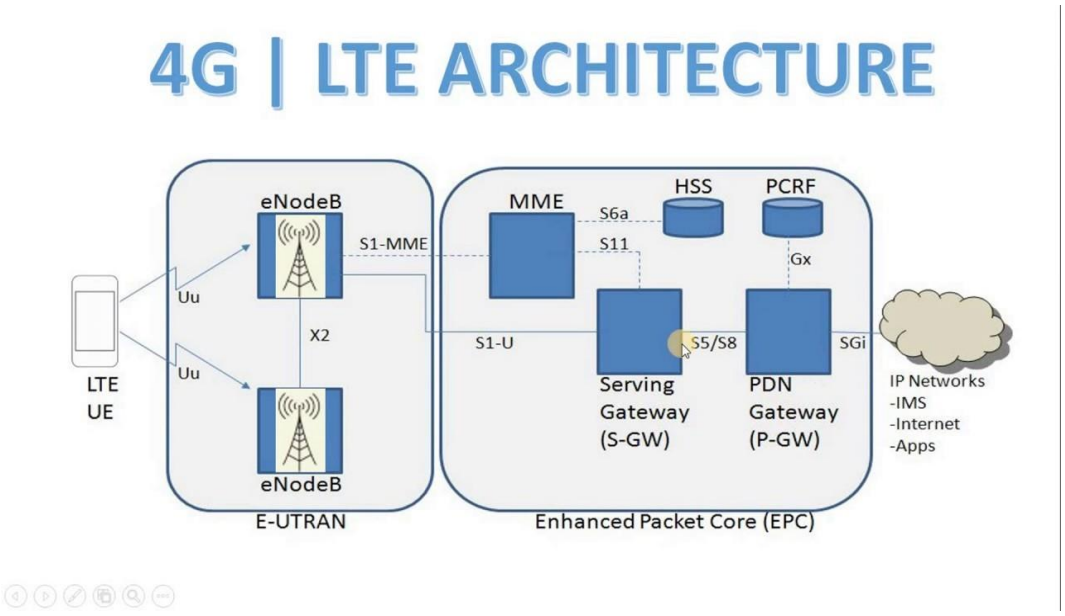


Figure 5.1: LTE Network Architecture

5.1 LTE Features

LTE has introduced a number of new technologies when compared to the previous cellular systems. It is able to be operate LTE more efficiently with respect to the use of spectrum, and also to provide the much higher data rates that are being required.[2]

- **OFDM (Orthogonal Frequency Division Multiplex):** OFDM technology was used for the signal format for LTE because it enabled high data bandwidths to be transmitted efficiently while still providing a high degree of resilience to reflections and interference. As data was carried on a large number of carriers, if some were missing as a result of interference from reflections, etc, the system was still able to cope. The access schemes differed between the uplink and downlink: OFDMA (Orthogonal Frequency Division Multiple Access was used in the downlink; while SC-FDMA (Single Carrier - Frequency Division Multiple Access) was used in the uplink. SC-FDMA was used in view of the fact that its peak to average power ratio is smaller than for OFDMA - the lower peak to average power ratio enabling better levels of final RF power amplifier to be achieved - this was and is an important factor for mobile handset battery life.

- **MIMO (Multiple Input Multiple Output):** One of the main problems that previous telecommunications systems has encountered was that of multiple signals arising from the many reflections that are encountered. By using MIMO, these additional signal paths could be used to advantage and were able to be used to increase the throughput.

- When using MIMO, it is necessary to use multiple antennas to enable the different paths to be distinguished. Accordingly schemes using 2 x 2, 4 x 2, or 4 x 4 antenna matrices could be used. While it is relatively easy to add further antennas to a base station, the same was not true of mobile handsets, where the dimensions of the user equipment limited the number of antennas which should be placed at least a half wavelength apart.

- **SAE (System Architecture Evolution):** With the very high data rate and low latency requirements for 3G LTE, it was necessary to evolve the system architecture to enable the improved performance to be achieved. One change was that a number of the functions previously handled by the core network were transferred out to the periphery. Essentially this provided a much”flatter” form of network architecture. In this way latency times could be reduced and data routed more directly to its destination. As part

of the upgrade an Evolved Packet Core, EPC was developed to ensure that the packet data was routed as efficiently as possible.

- **IP data:** 4G LTE is an all IP data system. 3G UMTS had included circuit switched voice, but LTE had not provision for any circuit switched voice. Originally it had been anticipated that operators would supply the data capability and voice would be via OTT applications. As operators would lose out significant revenues as voice, at the time, constituted a major element of the revenue. To overcome this GSMA set the standard for voice connectivity as the Voice over LTE scheme, VoLTE.

- VoLTE required the implementation of an IMS core and this slowed roll out of this capability in view of the expense. To help operators overcome this, a limited implementation of IMS was developed and this considerably reduced the capital expenditure required by operators.

4G LTE became the mainstay mobile communications technology. Both first and second generation technologies were focused on voice and 3G then moved towards mobile data. 4G LTE improved on the mobile data aspects of mobile communications, focusing mainly on this aspect to enable general mobile data connectivity.[2]

Chapter 6

RF Site Survey

RF Survey is the collection of data from the site or in the field required to install a new site. This is essential for various reasons such as cell site analysis, determining coverage region of proposed new cell Site, for deciding the type of link connectivity with another cell site. This task will result into physical changes in the existing network due to modification or addition of new sites.

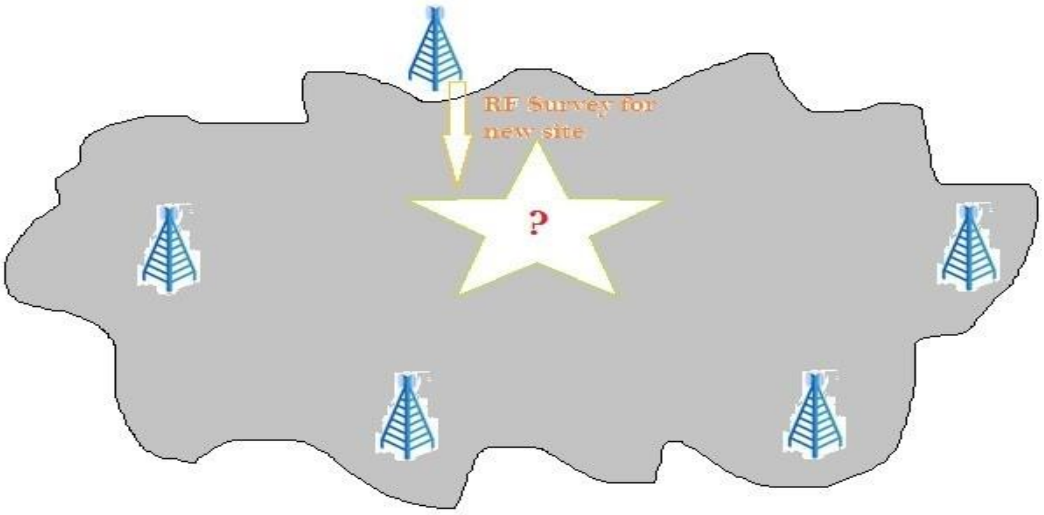


Figure 6.1: RF Site Survey

In order to perform RF survey work customer will usually provide following details referred as nominal point or reference point.

- Latitude value and longitude value
- X-Y co-ordinates
- Details of North/East co-ordinate

- Location Area name

RF Survey can also help in analyzing issues in the existing GSM/CDMA/LTE or VSAT networks. Issues can be interference or multi path distortion or construction of new building near to the existing cell tower. By doing RF Survey, we can eliminate these problems so the installed RF network will function satisfactorily. Like other project planning, RF site survey work also should be well planned so that its execution as well as final network roll-out will be executed effectively and efficiently. Before going for RF site survey of the earth region, it is essential to analyze the region first. For this all the available resources should be used such as aerial photos, Google Maps, Google Earth etc.

There are different types of tower for which RF survey need to be done:

- Ground Base Tower (GBT) - Avg. Tower height-30-60 meter
- Roof Top Tower (RTT) - Avg. Tower Height-18-27 meter
- Roof Top Pole (RTP) - Standard Height of Roof Top Pole is 3M, 6M and 9M from ARL (Above Roof Level).

Figure 6.2: Different Types of RF Antenna

The procedure or steps to perform a RF site survey are as follows:

1. Identify the potential probable RF obstacles using facility diagram.
2. Visually inspect the location to look for any barriers in the path of RF signal propagation. Also identify metallic structures if any.
3. Identify highly congested mobile user areas as well as less congested areas.
4. Determine locations including the power and wired network access at the facility. Also determine cell coverage and overlap maps. Finalize frequency channel for the site as well as mounting structures to be build with proper specifications as per size of the antenna and other equipment etc.
5. Perform the actual surveying in order to verify and finalize the Base Station/Node-B/eNB/eNodeB location. Make sure to use the same Base Station model for the survey that is used in production for future network roll-outs. While the RF survey is being performed, relocate the Base Stations as needed and re-test to obtain max. signal strength condition.
6. Finalize and document the analysis made during the survey. Record the signal readings along with data rates as well as network logs (if any) at various locations of the facility. Do the same at outer boundary regions.

Chapter 7

Single Site Verification (SSV)

Single site verification (SSV) is an audit method, where we need to check the entire KPI (Key performance indicator), coverage and quality for a single radio base station site.

For GSM network a single site has more than twenty KPI, on the other hand for WCDMA including HSPA plus a single site has more than forty five Key performance indicators (KPI). But all the KPI doesn't carries the same morals, on the other hand less significant KPI values depends on the major KPIs. So, we often check major Key performance indicators for single site verification (SSV). The entire single site verification (SSV) can be categorized into three subcategory. [5]
These are:-

1. Radio frequency parameter verification (RF verification)
2. Radio frequency (RF) functionality test
3. Drive test and RNO (Radio network optimizer) verification

Chapter 8

Drive Test Overview

DRIVE TEST can be used as a tool for investigations and maintenance of cellular networks in order to ensure coverage, service quality. The main scopes are-

- Perform periodic measurements
- Checking coverage (receive level), accessibility (call setup success rate, location updating success rate) and quality (BER, FER, RxQual, Drop Call, Handover performance etc.)
- Test hardware (channel verification) and channel availability
- Investigate problems that are pointed out by OSS Statistics
- Respond to Customer complains

Drive Test group in Decon includes–

- Routine Drive test in defined route to assess Radio network performance and detect black spot
- Periodic monitoring of Coverage/Quality of a Radio network after high pace roll out
- Highway coverage tracking on regular basis
- Antenna optimization follow up of Radio network
- Handle Work Request from other section
- Assist in new Coverage requirement

In Decon, each group has to equip with the following set up-

- Complete TEMS setup-
  - TEMS SW loaded in Laptop with appropriate Handset
  - Test SIM
  - TEMS Accessories comprising data cable, dongle key etc.
- One GPS
- Antenna Tuning Tool kit comprising Digital Tilt Meter, Electronic Compass, Binocular etc.
- Antenna Mounting Tool kit –
  - Spanner
  - Screw Driver set
  - Safety Belt
  - Adjustable Wrench
  - Cutting Pliers
  - Measuring Tape
  - Safety show
- One dedicated vehicle
- LAN Connectivity

Each Drive Test group have a predefined routes to cover all major streets of that region and defined time schedule to perform Drive test. Each of the routes is rated with priority to be covered by Drive test.[5]

Chapter 9

Job Description

My responsibilities include -

1. Basic GSM channels concept study
2. To study in WCDMA and LTE
3. Site Surveys
4. Drive Test

9.1 Basic GSM, WCDMA and LTE features study

From the beginning of my training its my first job to know all the details about RF optimization department, like what are the basic things to know to work with Rf optimization team? and what the department does?

Actually Decon works on both GSM, WCDMA and LTE technology and it was quite obvious that I had to learn all the details regarding these technologies. From the 1st day of my training my supervisor sent me with a drive test team to see how they actually work and he told me to notice the channels which were used for optimization. By spending 1st week with a drive test team I understood what I need to know before a drive test. The 2nd and 3rd weeks of my training I used to learn about the GSM, WCDMA channels. I used to look up the procedure of a drive test and the standard values of different types of parameter from journals.

Some of the topic that I have covered are given below-

1.Channel Concepts

2.Base Station System (BSS)

3.Mobile Station

5.Site Survey

6.Single Site Verification

7.Customer Complain Management

9.2 Site Survey

During training period, I got couple of opportunity to do site surveys with the system engineers of the team that I was associated with. First phase was to know the proper settings for the site surveys. The soft wares that we used were Planet EV, Google Earth and Map source. 1st of all we find the potential site from where most of the traffic are generated then we do our research with that with the help of Planet EV and Google Earth.

With the help of GPS we go to the site on the day of survey. Then we collect data from that Place and talk with common people. It was quite exiting because every time I went for site survey, I have been to many new places and most importantly get to know many people from different parts of the society. The most important thing that I have learnt by doing this that I have to know the place and the people for whom I am designing a site or optimizing a new site.

I have been to mane places of Narayangonj, Munshigonj and Old Dhaka for the surveys. Here I would like to thanks thank MD. Faijul Islam General Manager, who gave me this opportunity and taught me how to do site surveys and other helps regarding this issue.

9.3 RF Drive Test

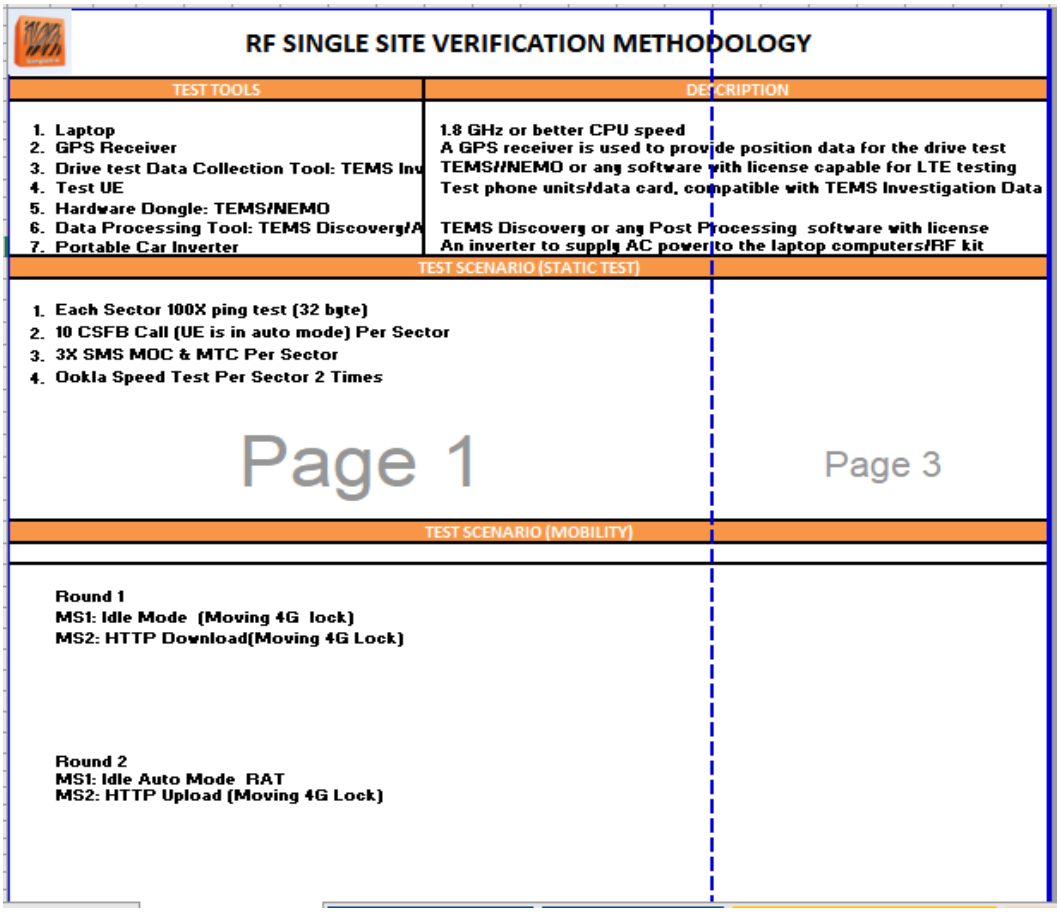
9.3.1 RF Single Site Verification

During my 4th week of my training, I was assigned to perform SSV (Single site verification) with Rubel Hasan (SSV Engineer). Before perform SSV we need details about the site we

were going to covered.

In below I add some snap from my field experience.

9.3.2 RF Single Site Verification Methodology



RF SINGLE SITE VERIFICATION METHODOLOGY

TEST TOOLS	DESCRIPTION
1. Laptop	1.8 GHz or better CPU speed
2. GPS Receiver	A GPS receiver is used to provide position data for the drive test
3. Drive test Data Collection Tool: TEMS Inv	TEMS//NEMO or any software with license capable for LTE testing
4. Test UE	Test phone units/data card, compatible with TEMS Investigation Data
5. Hardware Dongle: TEMS/NEMO	
6. Data Processing Tool: TEMS Discovery/A	TEMS Discovery or any Post Processing software with license
7. Portable Car Inverter	An inverter to supply AC power to the laptop computers/RF kit

TEST SCENARIO (STATIC TEST)

1. Each Sector 100X ping test (32 byte)
2. 10 CSFB Call (UE is in auto mode) Per Sector
3. 3X SMS MOC & MTC Per Sector
4. Ookla Speed Test Per Sector 2 Times

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TEST SCENARIO (MOBILITY)

Round 1
MS1: Idle Mode (Moving 4G lock)
MS2: HTTP Download(Moving 4G Lock)

Round 2
MS1: Idle Auto Mode RAT
MS2: HTTP Upload (Moving 4G Lock)

Figure 9.1: SSV Methodology

9.3.3 Site Details

SITE DETAILS			
SITE ID:	DHK3678	SITE NAME:	DHK_L3678
LATITUDE:	23.69991	LONGITUDE:	90.40698
Cluster	N/A	SITE TYPE:	RTP
TECHNOLOGY	LTE FDD 5 MHz	OPTIMIZATION CLUSTER NO:	N/A
SSV ENGINEER:	Rubel Hasan	SSV DATE:	31-Jul-19
SITE ADDRESS:	Keranganj, Dhaka		

Figure 9.2: Site Details

Site Location

Based on Latitude and Longitude I found the location of the site on google map.

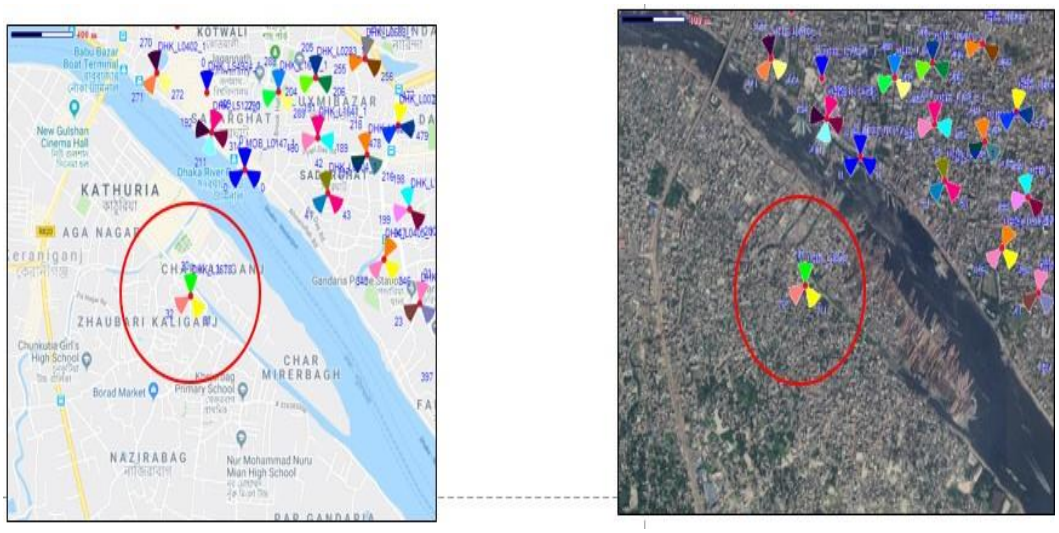


Figure 9.3: Site Location

9.3.4 RF Single Site Verification Report

I collected the log files from the site access road of SSV (Single site verification) radio base site to neighbor site access road, collect the log files in both way, that means from the SSV radio base site to neighbor radio base site and neighbor radio base site to SSV radio base site.

RF CELL CONFIGURATION						
CARRIER:	1800MHz(band 3)					
SECTOR:	S1		S2		S3	
	Planned	Actual	Planned	Actual	Planned	Actual
RF ANTENNA HEIGHT (m):	22	22	22	22	22	22
AZIMUTH (deg):	350	0	140	140	250	240
M-TILT (deg):	0	0	0	0	0	0
E-TILT (deg):	8	1	8	2	8	1
CELL ID:						
PCI:	30	30	31	31	32	32
TAC:	1004	1004	1004	1004	1004	1004
DL EARFCN:	1751	1751	1751	1751	1751	1751
UL EARFCN:	19751	19751	19751	19751	19751	19751
MIMO Configuration:	1x1	1x1	1x1	1x1	1x1	1x1

Figure 9.4: SSV report

SSV Testing Summary

DHK_L3678

SSV TESTING SUMMARY

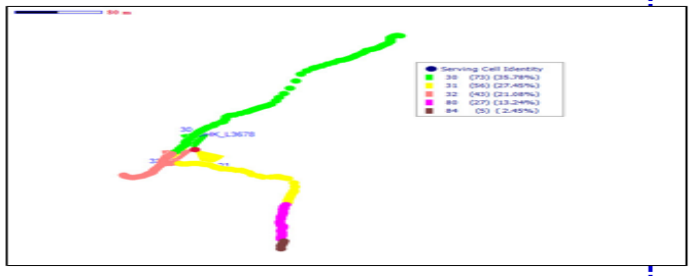
Test Type	Test Method		Sample Count	KPI	Target value	Test Result			Comments	Result (Pass / Fail)	Test Position
						Sector 1	Sector 2	Sector 3			
Stationery test	Attach Success Rate	4G PCI Lock		Success Rate	>= 99%	100%	100%	100%			
	PS Drop Rate	4G PCI Lock		Rate	<= 1%	0%	0%	0%		Pass	
	HTTP DL	4G PCI Lock	500MB	Avg.	≥ 10 Mbps	1.37 Mbps	3.7Mbps	2.54Mbps	Cell is not unloaded condition		
		4G PCI Lock		Max	≥ 28 Mbps	3.15Mbps	10.21Mbps	5.43Mbps			
	HTTP UL	4G PCI Lock	150MB	Avg.	≥ 6 Mbps	5.64Mbps	6.13Mbps	4.86Mbps			
		4G PCI Lock		Max	≥ 10 Mbps	9.53Mbps	9.85Mbps	7.73Mbps			
	PING	4G PCI Lock	100x	Latency	<= 50 ms	20ms	17ms	21ms		Pass	
	CSFB	4G PCI Lock	10x	MO Setup SR	>= 99%	100%	100%	100%		Pass	
	CSFB	4G PCI Lock	10x	MT Setup SR	>=99%	100%	100%	100%		Pass	
	SMS	4G PCI Lock	3x	MO	OK(100%)	100%	100%	100%		Pass	
	SMS	4G PCI Lock	3x	MT	OK(100%)	100%	100%	100%		Pass	
	Handover	unlock	5x	IRAT to 3G/2G	OK	ok	ok	ok		Pass	
	Reselection	unlock & forcefully lock to 3G & 2G separately	5x	Lte>UMTS; UMTS>Lte, Lte>GSM, GSM>Lte	OK	ok	ok	ok		Pass	
Moving	Idle Mode RSRP	4G PCI Lock	G No coverage of the	RSRP	Plot added						
	Idle mode RSRQ/SINR	4G PCI Lock	G No coverage of the	RSRQ/SINR	Plot added						
	Auto Mode Idle RAT selection check(G/U/L)	unlock	Till RAT change event occurs successfully(4G->3G/4G->2G/3G->4G/4G->4G) x	Reselection-Lte>UMTS; UMTS>Lte, Lte>GSM, GSM>Lte							
	FTP DL	4G PCI Lock	G No coverage of the	Avg.	Plot added						
	FTP UL	4G PCI Lock	G No coverage of the	Avg.	Plot added						
	PING	4G PCI Lock	G No coverage of the	Latency	30ms						
	CSFB	unlock	G No coverage of the	SR & Fallback Time	99%,3s(3G) & 5s(2G)						
	HTTP Test	4G PCI Lock	G No coverage of the	Data service Accessibility	99%						
	Handover	4G technology lock	lover occurs with NBR	4G inter & inter crossed	OK(100%)						

Figure 9.5: Test Summary SSV

PCI Plot and Graph

DHK_L3678

Physical Cell Id Plot



Cell /Sector Name	Azimuth	Physical Cell ID (PCI)
DHK_L3678_1	0	30
DHK_L3678_2	120	31
DHK_L3678_3	240	32

DESCRIPTION: All sectors are transmitting PCI as designed in particular direction.

Figure 9.6: PCI Plot

RSRP Plot and Graph

Cell Name: DHK L3678

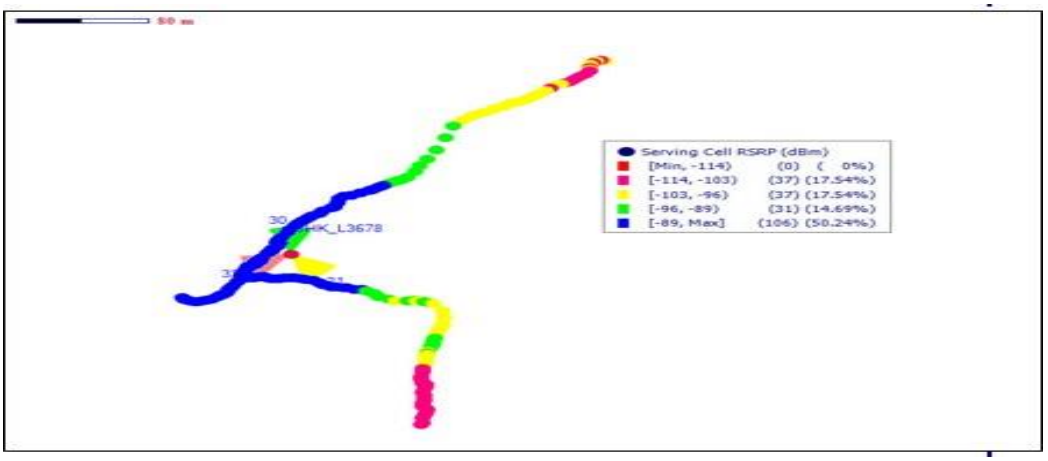


Figure 9.7: RSRP Plot

Cell /Sector Name	Azimuth	Physical Cell ID (PCI)
DHK_L3678_1	0	30
DHK_L3678_2	140	31
DHK_L3678_3	240	32

Figure 9.8: RSRP Level

RSRP level is satisfactory in most area.

Handover Plot and Event

Cell Name: DHK L3678

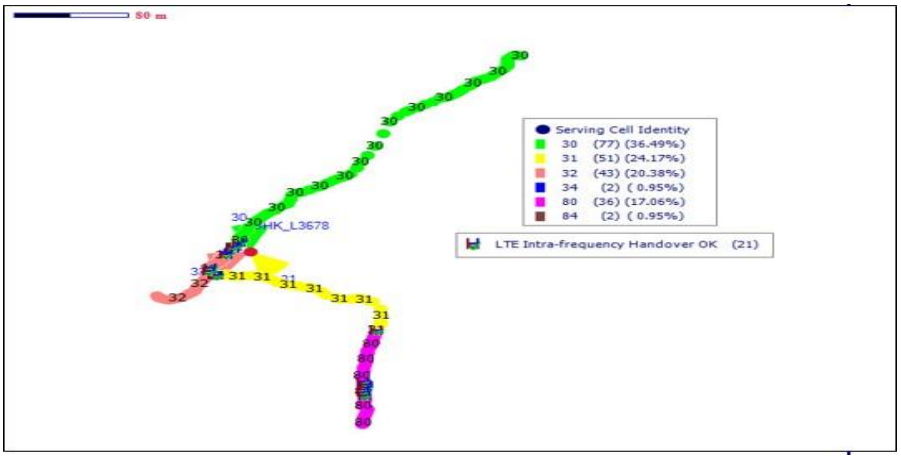


Figure 9.9: Handover Plot

Intra-frequency handover events are working normally on the inter sector transition.

9.4 To study and participate in overall Cell design Process

To study and participate in overall Cell design Process:

- Why/when new site requirement triggered
- Best option judged
- Designing new site - key consideration
- Coverage prediction.

Based on the traffic and the quality of the signal, new sites are created. One of the most important parts of the cell design process is to define cell parameters for new sites. For the 900 MHz frequency Banglalink has (92-124) channels for frequency allocation system. This process is important in terms of avoiding co-channel interferences and adjacent interferences and also to define the potential neighbors' cells.

9.5 Drive Test

Though I don't have so much time to do drive test but it was well enough to have an idea regarding drive test. There are basically 2 types of analysis for DT (Drive Test). Route and data analysis, for the recording purpose and to create log files we used the route analysis and to read and investigate we used data analysis.

While attending one of the drive test along with the drive test engineer of Dhaka, I have learnt how to create the log files, how to use MS1 and MS2 for the dedicated and idle mode, in fact the whole set up.

By doing the data analysis on the log files, we got the idea about the signal strength on a particular area. Then we can decide about what are the changes that need to do to sustain a good quality network. Now I got a bit of idea about drive test which will definitely help me for my future works.

9.5.1 Physical Connection Diagram for DT

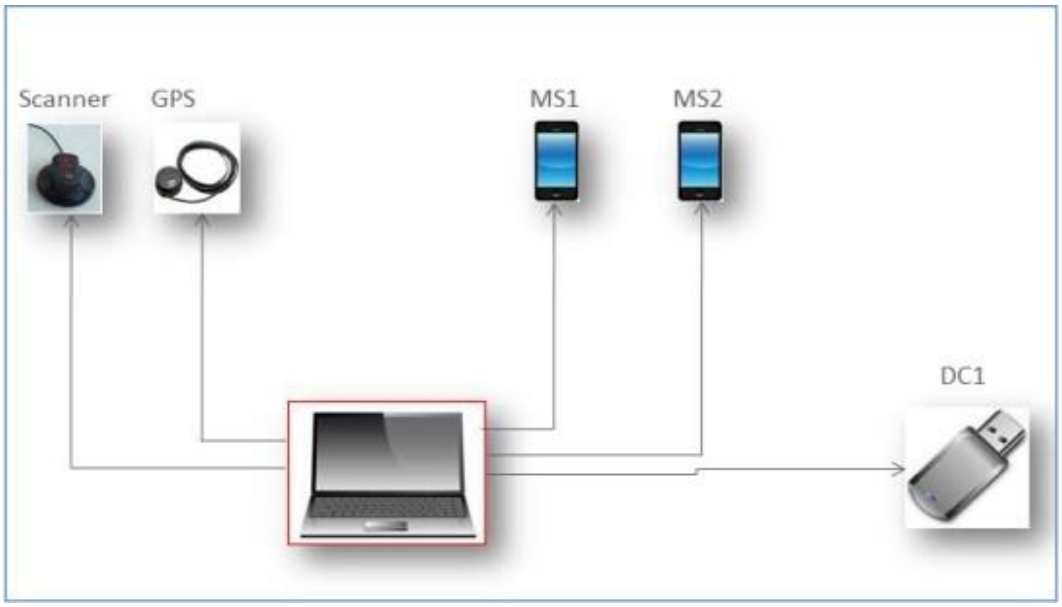


Figure 9.10: Physical Connection

Equipment	Technology	Usage	Procedure
MS1	3G Locked	Short Voice call	60 second call with 10 second wait and then repeat
MS2	Dual Mode	Long Voice call	Long ongoing call. If dropped, reconnect in 5 sec. 60Sec duration will betreated as 1 call for calculations
DC1	Dual Mode	FTP download and Upload	50MB Download, Wait 5Sec, 10MB Upload and repeat

Table 9.1: Signal Testing Procedure

Chapter 10

Finale

10.1 Benefits from the Internship Program

I always have a thirst to learn something new and this industrial training has helped me a lot. As I believe during the past 3 months I have learnt a lot which will develop my skills. The variety of task made it an interesting work environment.
Research, investigation and technical work made the training more interesting and these aspects really helped me to understand and link up with the theoretical knowledge. Doing a good practice and learning new techniques will add the great value to my future career.

10.2 Conclusion

Working for Decon was the best experience of my life. Besides practical work I got the opportunity to meet all the employees who are working for Decon. I have learnt the practical knowledge about drive testing and how to optimize a site after drive test. I have also learnt how to meet the deadlines for the assigned project also how to organize them for the maximum benefit of the company. As a telecommunications major student its needful for me to do an internship before going to the present job market.

In past 3 month, Decon provided me such a kind of unforgettable experience and I believe these experiences and knowledge will help me to take new challenges in my future life.

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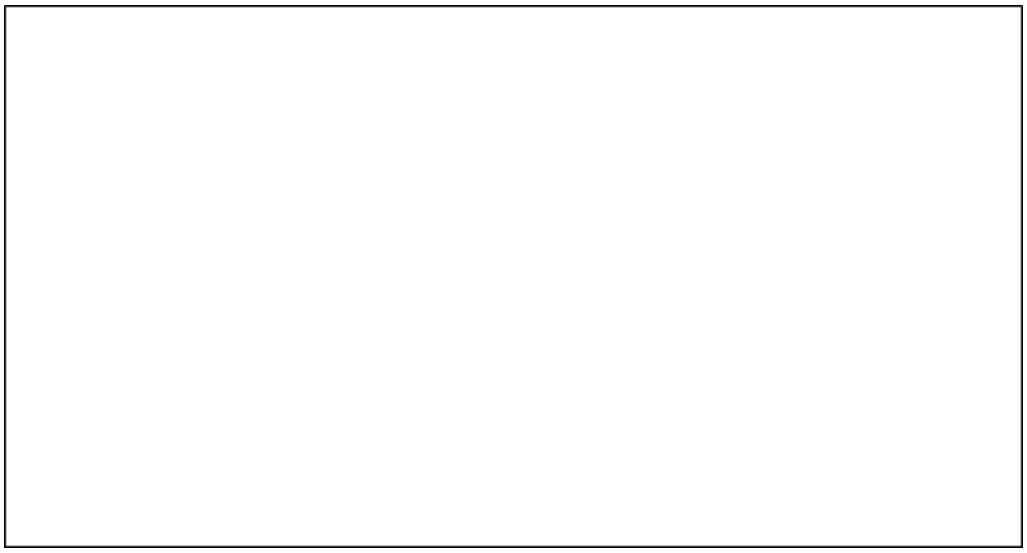
Supervisor's endorsement _____



Mohammad Faijul Islam

General Manager

Decon Telecom Solutions (BD) LTD

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Signature:

Date: