

National Apprentice & Industrial Training

Authority

Report on Industrial Training

At

Hutchison Telecommunications Lanka (Pvt) Ltd

Colombo 04.



Sri Lanka Technological Campus

Padukka

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Acknowledgement

Industrial training improves the skills needed for students to achieve their relevant career objectives by improving the awareness about the Technologies they have learnt about in the academic curriculum.

I would like to express my gratitude and appreciation to all those who gave me the possibility to completing my first industrial training of 24 weeks at Hutchison Telecommunication Lanka (PVT) Ltd. Special thanks is due to Our Training Coordinator, Staff of Sri Lanka Technological Campus, and Staff of the National Apprentice and Industrial Training Authority (NAITA) For giving me an opportunity to have a good training experience. I also sincerely thanks for the time spent proofreading and correcting my many mistakes.

Further, I would also like to acknowledge with much appreciation to Eng. Sasanka Gamage, Senior Manager of Radio Networking and Optimization, Eng. Yasanka Lakshitha Manager of Radio Network Planning and Optimization, and Network staff in Hutchison Telecommunication for their friendly support and spending their most valuable time for making my industrial training period a successful one.

Preface

As a partial fulfillment of the BSc. Engineering (Hons) degree course in Electronics and Telecommunications of the Sri Lanka Technological Campus, I completed my internship of six months from 8th September 2020 to 8th March 2021 at Hutchison Telecommunications (Pvt) Ltd. I assigned to Radio Network Planning and Optimization which under the Network Division of Hutchison Telecommunications.

This report consists of three main chapters. The first chapter of this report demonstrates a brief introduction to Hutchison Lanka (Pvt) Ltd. Including business nature, marketing practices, business strategies, recruitment, benefits, and environmental safeguards.

The second chapter describes the training experience that I got from Hutchison Lanka (Pvt) Ltd. The chapter further subdivided into training activities, the managerial capacity of staff, supportive tools, and analytical skills.

The third chapter gives the conclusion of the training program adopted by the SLTC and NAITA.

I wish to express my gratitude again to all those people who helped me towards the success of my Industrial Training.

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List of Abbreviations

- ACI – Adjacent Channel Interference
- ARFCN - Absolute Radio Frequency Channel Number
- BSC - Base Station Controller
- BTS - Base Transceiver Station
- CCI - Co Channel Interference
- CDR – Calls Detail Record
- CEO – Chief Executive Officer
- CTO – Chief Technical Officer
- DT - Drive Test
- GPRS – General Packet Radio Service
- GPS – Global Positioning System
- GSM – Global System for Mobile communication
- IDD – International Direct Dialing
- KPI – Key Performance Indicator
- LTE – Long Term Evolution
- QoS – Quality of Service
- SDCCH – Standalone Dedicated Control Channel
- SMS – Short Message Service
- STO – Senior Technical Officer
- TCH – Traffic Channel
- TO – Technical Officer
- UMTS – Universal Mobile Telecommunication Service

Chapter 1 - Learning managerial practices

1.1 Training organization

1.1.1 Business nature

I have complete my training at Hutchison Telecommunications, Bambalapitiya. Hutchison Telecommunications Lanka (Private) Limited is an associate of Hutchison Asia Telecom, a portion of CK Hutchison Holdings Limited (CKH), a multinational company based in Hong Kong. CKH has five main businesses-ports and related services, retail, infrastructure, energy and telecommunications. Hutchison Asia Telecommunications operates under the 3 brand in Indonesia, the hutch brand in Sri Lanka, and the Vietnamobile brand in Vietnam. Hutchison Telecommunications Lanka (Pvt) Ltd., as a mobile telephone operator, it began operations in Sri Lanka in 1998. It is a subsidiary of Hutchison Asia Telecom. Hutch began its GSM operations in 2004 and its 3G activities in 2012. Hutch began 4G service in 2018, with a maximum download speed of 3.6Mbps and a minimum upload speed of 512Kbps. Hutch will continue to monitor the progress of 5G around the world, but will only deploy full-scale 5G services in Sri Lanka after there is a clear demand for anything better than the current 4G service. Furthermore, on November 30, 2018, Hutchison Telecommunications bought Etisalat Sri Lanka operations and currently serves both subscribers.



Figure 1. Hutch Logo

For dependable infrastructure companies, CKH is one of the world's major port operators and retailers. CKH also owns an energy company as well as important mobile telecommunications networks. The diversity and scope of CKH's operations are reflected in the multicultural mix of executives and staff. CKH is committed to upholding the greatest levels of corporate governance, transparency, and accountability, as evidenced by the numerous honors and awards it has received. By completing user acceptability testing after product launch, monitoring agent handling, and

monitoring customer experience, Hutch has been able to develop long-term connections with customers, as evidenced by the growing customer base.

1.1.2 Marketing practices

In Sri Lanka, Hutch is one of the biggest mobile operator. They offer great value products and services on island wide advanced 2G, 3G and 4G. In 2019, Hutch had merged with Etisalat Sri Lanka and now serve subscribers on both 072 and 078 prefixes with affordable 4G services. The majority of the subscribers are prepaid subscribers. And the company is improving its postpaid customer base also at the moment. Hutch provides many product and services to its customers.

Table 1. Products of the Hutch product and services.

Type of Products and Services	Description
Internet Product	Unlimited internet packages, Day and night packages for suitable individual needs
Local voice and SMS product	One rate per second and one rate per minute to any network
IDD	IDD packages to call any destination
Roaming	Out roaming to 50 countries, A special partnership with UK
SMS Gift Services	Gift a SMS to on-net customers
Credit-Related Service	Transfer credit from an available credit balance to on-net customer
Tune Services	Regular Hello Tune charges will apply for each song you activate. Gift Tune. You can gift any song as a Hello Tune or Dial Tune to anyone you like

Instant Loan Service	A loan can get up to Rs 180/= depending on recharge behavior and number of years in Hutch network
E-Channeling Service	Channel a doctor through Hutch E-Channeling
SMS Banking Services	Make reload and bill payments, check bank account

URL: <https://hutch.lk/vas/life-enhancement/>

1.2 Business strategies

1.2.1 Vision and Mission

Vision

- To become a pioneer in high-efficiency service provider for the telecom industry.

Mission

As the first objective to get a mobile phone into everyone's hand, Hutch have to address the fact;

- “What obstacles keep a person away from having a mobile phone?”
- “What are their problems? How Can we resolve them?”

In keeping with the commitment to the continuous improvement of our engineering services, to deliver cost-effective quality service expected by the customer.

1.2.2 Goal and objectives

Hutch Sri Lanka is set to take a new leap with the launch of an island-wide 4G network. “We want to inspire everyone who shares our optimistic, modern mindset, to make things happen and go places by being the first and only customer-focused network in Sri Lanka, leading the way by delivering what customer really want, in a better, easier and more open way”.

- The main objectives follows by Hutchison Telecommunications are;

- Invest in customer loyalty
- Explore more revenue streams
- Prepare for 5G networks
- Continue to improve cost efficiency

1.3 Management practice

1.3.1 Management structure

Hutch is a huge company with a lot of people working for it. As a result, a well-defined organizational structure with job descriptions is essential. It consists of mainly 5 divisions as transmission, power unit, network planning and optimization, project unit and cost management division each headed by a Manager. Senior engineers, engineers, senior technical officer, technical officers and technicians form a team in each subsection. Hutchison Telecommunications Lanka has 1,100 total employees across all of its locations.

A management structure is a system that specifies how certain tasks should be directed in order to fulfill an organization's objectives. These activities can include rules, roles, and responsibilities. The management structure also determines how information flows between levels within the company. For example, in a centralized structure, decisions flow from the top down, while in a decentralized structure, decision-making power is distributed among various levels of the organization. Having a management structure in place allows companies to remain efficient and focused.

- Management Board Chief Executive Officer – Mr. Thirukumar Nadarasa
- CTO Officer Network – Mr. Nalaka Peris
- General Manager Network – Mr. Dananjaya Ponnampерuma is the Head of Network
- General Manager IT – Mr. Asanga Ranasinghe
- General Manager HR & Admin – Mr. Ernest Perera
- Head of Finance – Mr. Bandunath De Silva
- AGM – Mrs. Sharmini Jayasuriya
- CTO – Mr. Nalaka Silva is the head of operation team in Network section.
- Senior Manager of Core Network and head of Walpola Engineering complex is Mr .Ajith

The following figure illustrates the company organizational structure in detail.

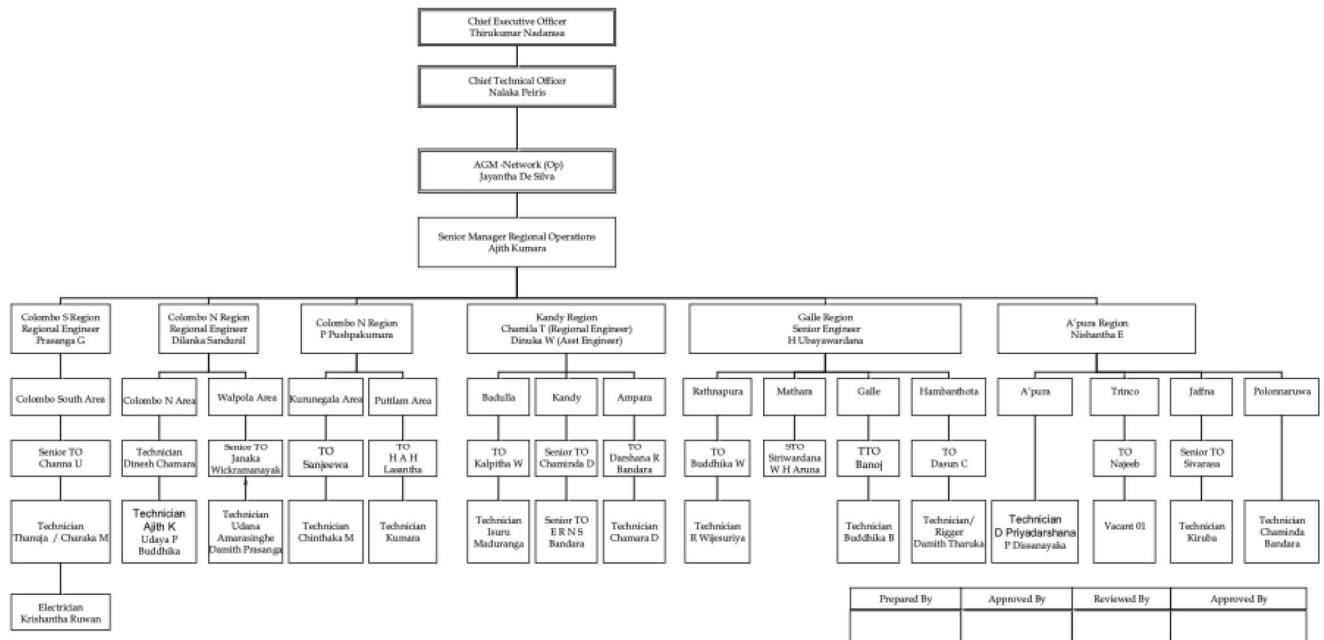


Figure 2. Management structure of the network section

Source: Hutchison Telecommunication Lanka (Pvt) Ltd Organizational Structure

URL: https://s.docworkspace.com/d/AP3hPvua1Ow_grzA6ImnFA

1.3.2 .Management style

It operates under the supervision of its Chief Technical Officer. Sasanka Gamage, a senior manager of radio network design and optimization with extensive experience. He was one of the people I was in charge of. He is in charge of examining the radio network's coverage and capacity, as well as developing plans for radio network expansion. Creating radio network notional plans, following up and completing site surveys, preparing site design and integration data, and increasing radio network coverage and performance are all part of the job description. Within the organization, the supervisory officer's line authority can be as follows: Senior engineers, engineers, senior technical officers, and technical officers. He is in charge of the Chief Technology Officer.

Once a month, committee meetings are held to analyze the network's performance over the previous month and to examine each division's commitment to achieving short-term targets that will play a key part in achieving the big vision for the near future. The term "development" usually refers to a more progressive and individualized experience. Job rotation, coaching, and certification are just a few examples. This is mainly concerned with the next or next level. The

most important aspect of development activities is to improve knowledge of new technology. Career development sessions, which are held at Hutch, are a form of development activity.

1.4 Recruitment, benefits, and safeguard

1.4.1 Recruitment, transfer, and termination

Hutch recruits possible applicants for open positions by posting job openings online, such as on the topsjob.lk website, and through internal relationships. Those with the best abilities, credentials, experience, and competences should be considered for the occupation.

For internal recruitment, there may be someone within the business who is qualified for the job. If there is, the existing workforce is moved to make room for the chosen individual in the new position. If there isn't somebody available within the firm, look for someone outside the company.

If Hutch requires additional personnel, outsourcing firms can assist. AEGIS Services Lanka, for example. Hutch obtained outsourcing workers for the CVBS project as well, in order to complete the project as quickly as feasible. Because it is company policy, the Hutch human resources department does not share any information about recruiting, transfer, or termination.

1.4.2 Working conditions, retirement benefits, and social responsibility

Staff employees work a maximum of 8 hours each week from Monday to Friday on a regular basis. Only operational workers are required to work for four hours on Saturday. Hutch does not have any flaxy hours. Employees can perform night shifts and overtime. Then you'll have to pay more for them. Employees at Hutch are entitled to 14 days of annual leave, 07 days of casual leave, Study Leave, and Special Leave. From Monday to Thursday, both men and women must adhere to a formal dress code. Only on Fridays are they allowed to dress casually.

On June 1, 1958, the Employee Provident Fund (EPF) Act No.15 of 1958 and the regulations enacted under it went into effect. Following that, the statute was revised multiple times. Hutch provides at least 12% of the employee's salary to the employee provident fund each month, and the employee contributes a minimum of 8% of their salary each month. The employee trust fund (ETF) was established by Act No. 46 of 1980, which requires companies to pay a percentage of an employee's income. According to that method, Hutch provides 3% of an employee's monthly salary to a trust fund for the employees.

In January, employees receive annual raises and bonuses. The corporation offers transportation for its employees. The annual awrudu festival, poson bathi gee, annual blood donation, and supper dance are all annual welfare activities. Each employee receives a welfare Sim from Hutch. The Hutch wellness team provides coconuts to employees at a very low cost. Tea is available in the morning and evening at the firm. Staff members will receive a 50% discount on lunch.

1.5 Environmental and social safeguard

1.5.1 Environmental safeguards.

Hutch has a sophisticated security system in place to keep the organization safe. Employees at Hutch are given unique identification cards. An employee's portrait, name, designation, and department are all included on that identity card. Inside the premises, everyone should have their identity card on them. Only personnel with an identity card can access their department by touching it to the RF (Radio Frequency) door lock. If a visitor comes to any department, he or she must provide their NIC (National Identity Card) or driver's license to the security office and write their name, the department to which they are going, their phone number, and the time on a piece of paper. Then he or she is granted authorization to visit the appropriate department and is required to wear the identity card while on the premises. Besides that, the entire company is protected by a surveillance camera system. A security officer inspects such cameras on a regular basis.

The most common and dangerous threat in the business environment is fire. As a result, fire detection systems are put in the company's required locations. Any fire in any department is detected by the fire detection system. Fire extinguishers are placed in various spots across the firm depending on the sort of fire that may occur. Several water hydrants have been installed. In addition, the fire engine must be used in an emergency.

Every three months, safety awareness training such as a fire drill is conducted. Two times a year, you will receive first aid training. Once a year, Hutch collaborates with Durdans Hospital on a medical initiative to improve staff health.

1.5.2 Social safeguards

Employees at Hutch are prioritized for their safety. If an employee is harmed while doing his or her tasks, Hutch will compensate him or her until he or she is able to return to work. Hutch provides

hospitalization and life insurance to permanent employees. They can claim the Hutch for compensation if they cause damage to public or private property.

Chapter 2 - Training experience and analytical skills

2.1 Training experience

2.1.1 Training activities performed

This chapter contains information about my experiences while working with Hutchison Lanka (PVT) Ltd. for a period of 26 weeks. From September 8, 2020, until March 8, 2021, I completed my industrial training. At Hutchison Telecommunication Lanka (PVT) Ltd.'s head office in Colombo 04 (Bambalapitiya) and the Hutch engineering facility in Walpola. We were interviewed by three engineers from the Network division before being chosen as undergraduate trainees, and after the interview. On the 8th of September 2020, we were instructed to report to work. First, I finished my training at Hutch Head Office Bambalapitiya in its entirety. I was assigned to the drive test and customer complaints section of the Network division's planning and optimization group under the supervision of three supervisor engineers. Mr. Nuwan Pathirana was in charge of the planning and optimization department; Ms. Dinushika Alahakoon was the Regional Engineer assigned to the Colombo area; and Mrs. Niroshani Sriyanthi was the Senior Manager Regional Operator in charge of the planning and optimization section. I spent most of my time in the planning and optimization division checking TSSR reports, learning how to make 2G, 3G, and 4G reports, and participating in drive testing, among other things. Apart from these types of routine office tasks, we also gave several lessons regarding Hutchison Lanka (PVT) Ltd.'s various processes. I also received valuable insight into how to conduct myself in a professional setting.

We had to go through an interview before Hutch Telecommunication Lanka (PVT) Ltd would accept us as trainees. It provided us with valuable experience in terms of how to conduct ourselves during a professional interview. Then, before beginning our training term, we had to complete some paperwork and agreements. This provided us with a clear grasp of how job recruitment operations are carried out in an office setting. After that, we were assigned to various sections.

During this time, I was assigned to the radio network planning and optimization division, where I gained valuable experience in mobile radio network optimization. The Hutch network department's planning and optimization division is also very essential. This division's primary task is usually to optimize and plan the radio network. Hutch's network department is divided into the following divisions:

- Radio Network optimization division
- Transmission planning division
- Power division Project unit and cost management division (The general functions or responsibilities of this division as follows)
- Radio Frequency Planning
- Optimization of the Radio Network
- BSC planning
- BTS planning
- Site Surveying
- Transmission Network planning

Before the corporation made a decision, all upcoming technologies had to be planned and examined in the planning division. The network must be properly planned based on current and future demands. They are also in charge of the network's present functioning and must continue to upgrade the system in order to keep up with emerging technology. The problems of network design and resource optimization have become more difficult as new wireless communication technologies and radio networks have grown in size. The main technique for building and increasing the performance of wireless networks is optimization.

This is a list of the work I did in the area on radio network planning and optimization.

- Frequency planning
- Drive Test
- Drive Test report making
- Daily and Hourly Traffic reports
- Improve Hutch coverage and quality in the SLTC premises

Frequency Planning

Within a specific frequency band, frequency planning is used to provide desired capacity and coverage. As a result, the frequency channels must be re-used, although care must be taken not to increase the level of interference. The types of interference are as follows:

Co-channel interference (CCI):

Co-channel interference is when two or more channels interfere with each other.

The use of the exact same frequencies in adjoining cells caused co-channel interference. It's the result of two radio transmitters operating on the same frequency. This type of interference is caused by mobile phones or cellular towers in different co-channel cells transmitting signals at the same frequency, but it also happens when mobile phones in the same cell transmit signals at different (but close or adjacent) frequencies, making it difficult for the cellular tower to filter out the different channels from each other. Co-channel interference can be reduced by using many directional antennas instead of a single omni-directional antenna.

Adjacent Channel Interference (ACI):

ACI is the interference between signals of similar frequencies. Adjacent channel interference is generated by extraneous power from nearby transmitters on different frequency channels leaking over to a different channel. The adjacent-channel interference can be severe due to the huge dynamic range of mobile radio broadcasts. It occurs when a transmission on the desired frequency channel causes unwanted energy to be transmitted on other channels.

There are two types of frequency planning,

Manual Frequency Planning:

The frequencies are manually assigned to the network's cells while minimizing co-channel and neighboring channel interference.

Automatic Frequency Planning:

In cellular networks, frequency planning is a difficult task. Manual frequency allocation for various cells in a cellular network has become increasingly problematic as a result of overshooting cells in the network and restricting the number of frequencies accessible in the range, resulting in cellular radio system waste. Automatic frequency planning solutions are required due to the widespread deployment and rapid expansion of cell networks. These tools ensure that wireless networks have the best possible coverage and performance. These technologies rely on a variety of evolutionary algorithms that play an important role in the progress of cellular networks and are frequently employed by cellular service providers to improve network frequency planning. The TEMS cell

planner and Map Info are mostly used for planning. Hutch's frequency planning is done with Map Info software.

Hutch spectrum ranges:

Table 2. Hutch spectrum range

Frequency Band	Uplink (Mhz)	Downlink (Mhz)
900 Band	(897.5 - 907.5)	(942.5 – 952.5)
1800 Band	(1725 - 1737.5)	(1820 – 1832.5)
2100 Band	(1940 - 1960)	(2130 - 2150)

The planning procedure must be completed using these constrained frequencies in order to provide the optimal coverage and capacity options. We were given the task of locating the interfering cells. For this, we used Map Info program. Overshooting, core channel, and adjacent channel interference were all requested. These were the steps we took, and they were as follows:

- 1) Create a piano file, according to given updated (Include merge sites) excel file
- 2) Then the piano file, imported from MapInfo software
- 3) MapInfo tool settings changed as needed for the imported piano file
- 4) After imported the file, MapInfo showed all the sites and its cells with detail according to the piano file data.
- 5) After all of it, co-channel interference, adjacent interference, and over shooting checked and allocated suitable frequency for interfered cells.

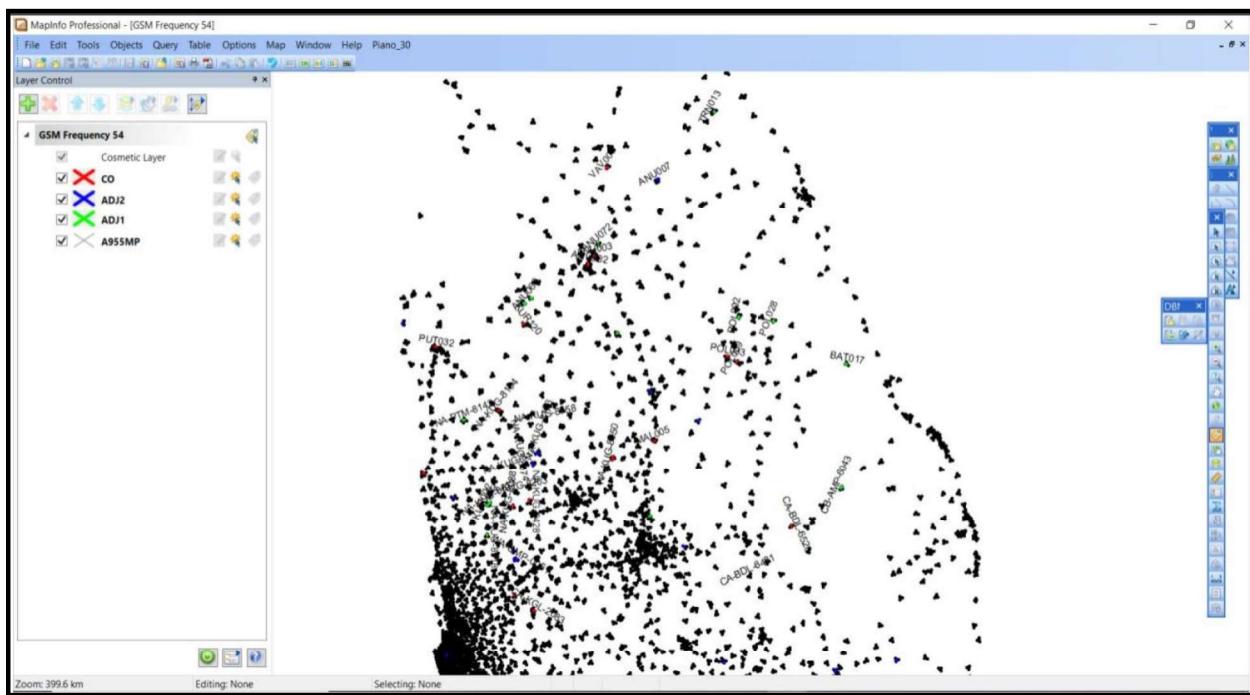


Figure 3. 2G Sites map in Sri Lanka GSM frequency 54 selected

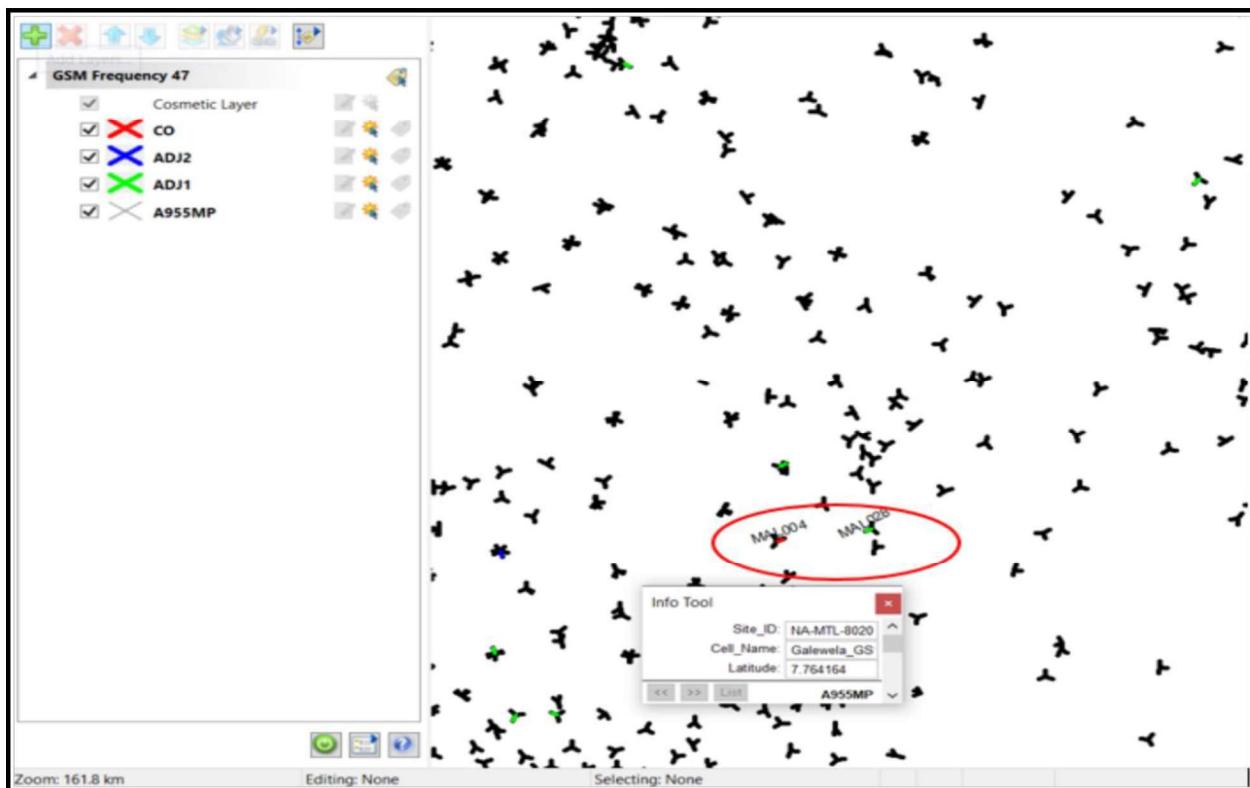


Figure 4. Adjacent Channel interference indicated by using MapInfo

Drive Test

Drive Test will assure network performance, which is directly related to network QoS. Technical Officers (TO) usually conduct drive testing under the supervision of an Optimization Engineer. We drive on a car that is well prepared to monitor network performance throughout the drive test. Data is gathered and recorded using a drive test tool, which we can examine later. The following are some of the reasons why you should take a driving test:

- To check network coverage of Hutch
- To identify network performance of an area
- For Network Optimization: changing antenna azimuths and tilts
- After a major change in the network
- To troubleshoot customer complaints
- To check signal levels after commissioning a new site

Normally, Hutch Technical Officers conduct outside testing with the TEMS Investigation tool (PC) and inside tests with the TEMS pocket tool (Mobile). In point form, the technique followed during the drive test is as follows:

The area where drive test is to be done is selected.

- 1) A laptop is interfaced with a GPS (Global Positioning System) and two or three phones connected to the laptop to measure the signal strength of the area.
- 2) A clear map is opened in the laptop and travel on every main and sub road to measure the signal strength.
- 3) The data from GPS indicates the position currently traveling by a path of dots, where the color indicates the signal strength level.
- 4) After covering the entire chosen area, all the data collected are stored in a file.

In addition, when there are concerns inside a building, we occasionally do indoor drive tests. Indoor drive tests are conducted in locations such as hospitals, restaurants, and workplaces. I took part in drive tests in Marino Mall, One Galle Face, TRCSL, Galle Face Hotel, Crescat, and Marino Mall's event hall. When conducting an interior driving test, each of the three technologies (2G, 3G, and 4G) were taken independently by phones equipped with the TEMS pocket tool and went inside the building where data was required. Before beginning the drive test, the technician demonstrated how to open a new session in the TEMS pocket tool. Before starting a session, I included a map

of the location where the drive test would take place. Because the map did not always provide it, we added a square-shaped map and conducted a drive test. I marked the exact beginning position on the map and completed the drive test there. When performing a drive test for 2G, the technician was instructed to initiate a session and then simply carry the phone (in idle mode) while performing the driving test. To do the drive test on 3G, make a call (Dedicated mode). When performing a 4G driving test, turn on mobile data (Dedicated mode) and run the 100mb script. There is a loop in the script that downloads 100mb continually till the drive test is completed.

This information from the drive test file is used to examine the cell and decide whether BTS will provide the expected coverage. The TEMS Discovery tool assessed all of the collected data. We delegated the task of creating driving test reports to the Discovery tool.

After each drive test, it is critical to create reports. Those reports contain the facts and findings. The outcomes of the parameters tested in the DT are included in the DT reports. Using log files, there was a common technique to generate reports. The following are the steps to creating a DT report:

- 1) Create a new project and import log files in to TEMS Discovery tool.
- 2) Add cell files.
- 3) Get 2G, 3G and 4G coverage, and quality detailed map. Only for 4G additionally get downlink (DL) throughput detailed map. To get those detailed maps we were used different parameters based on 2G, 3G, and 4G. (All parameters are shown below)
- 4) Include those maps into the PowerPoint template with suitable legends.

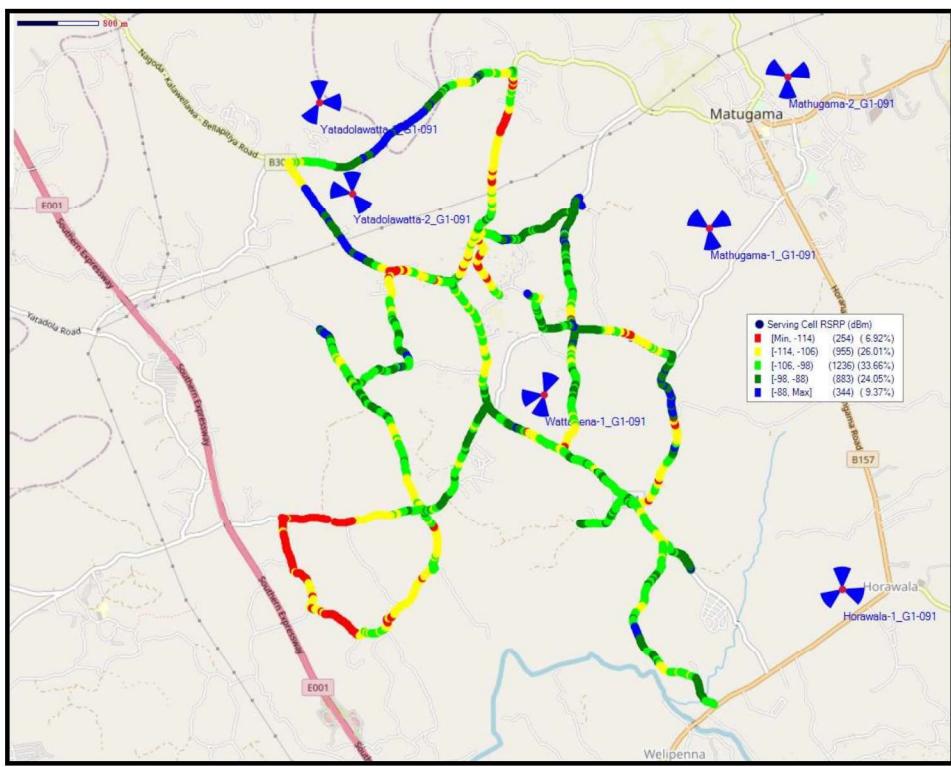


Figure 5. Screen shot of path signal strength points from TEMS Investigation tool 4G coverage in Wattehena outdoor DT

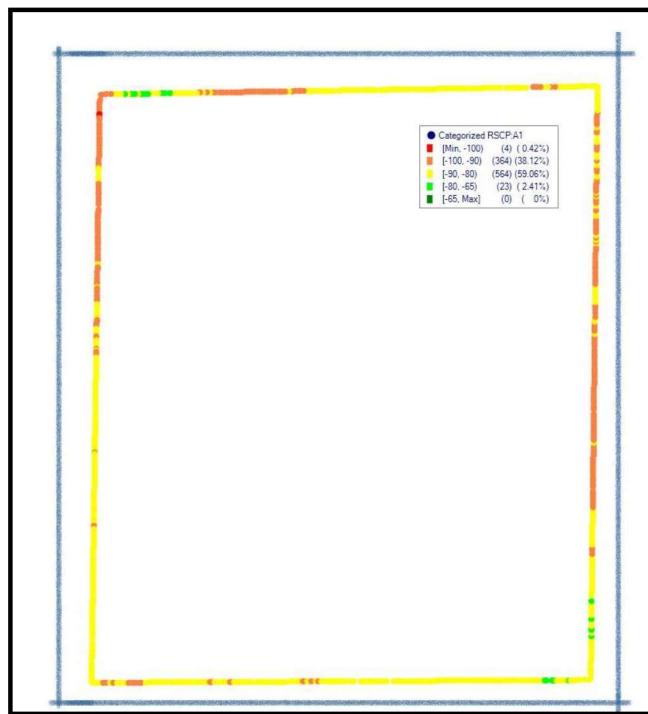


Figure 6. Screen shot of path signal strength points from TEMS Pocket tool 3G Coverage in Marino Mall Hotel indoor DT

Parameters measured in a Drive Test

Drive tests can be performed to measure a variety of network properties. These are some of the parameters I discovered during my drive test. The test mode varies depending on the necessary parameters or data. During the drive test, all of these parameters are recorded in a log file. The following are some of the parameters:

- Serving Cell - This is the current serving cell of the mobile phone.
- Neighboring Cells - Neighboring cells for the current serving cell of the mobile phone is an operand
- RxLev (Coverage of 2G) - This denotes the received signal level in dBm.
- RxQual (Quality of 2G) -This denotes the received signal quality, a GSM standard metric which is expressed in the range of 0 to 7 (0 means the best quality).
- RSCP (Coverage of 3G) - Signal Code Received the signal power received by the cell is referred to as power. The RxLev on the 2G network is the same as this. However, the capacity to process calls is not solely dependent on RSCP. When making a call or reselecting a cell on 3G networks, both Ec/lo and RSCP are taken into account.
- Ec / Io (Quality of 3G) - The ratio of bit energy to noise power. In UMTS networks, this is a critical metric. Data from one subscriber is viewed as noise by another subscriber since all of the cells use the same ARFCN and are multiplexed with different codes. The bit energy to noise power ratio has a direct impact on the UMTS network's quality. The network, too, has a decent RSCP. When Ec/lo is low, the quality suffers. A number of -12 Ec/lo is acceptable, and a value of -14 is regarded as the reselection threshold.
- RSRP (Coverage of 4G) Reference Signal Received Power is an RSSI type of measurement. It is the power of the LTE Reference Signals spread over the full bandwidth. 0 to -75dBm is the excellent level of RSRP.
- RSRQ (Quality of 4G) Reference Signal Received Quality. The RSRQ measurement provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. (TEMSTTM Pocket 14.1 Technical Product Description, 2014)

Daily and Hourly Traffic reports

I was assigned to compile 2G and 3G daily and busy hour reports. The reports offer information about the network's current performance. Engineers assigned to that sector monitored the entire network, which was organized into clusters. As a result, each cluster is checked on a daily basis, and any essential actions are done as soon as possible. We obtained four data sets from their database before creating the reports. 2G NPO, Huawei, and ZTE are just a few examples (v3, v4). After you've imported all of your data, create individual Excel macro files for each data collection. Following that, we received the daily and busy hour KPI reports. Cell name, cell ID, site Location area code (LAC), Operator (IITLL, ESL, Merge), Cluster owner, TCII traffic, GPRS traffic, available SDCCH, and other measurements and details are contained in the 2G report.

TCH traffic—Speech and data transmission are carried over the TCH traffic channel. Traffic channels are divided into two categories. TCH full rate can broadcast only one call per channel, but TCH half rate can transmit two calls per channel. TCH half rate aids in channel capacity expansion. 2G KPI reports include TCH traffic.

SDCCH is for self-contained, under the control channel, there is a dedicated control channel. It allows several people to listen to the same radio station at different times. The control channels share timeslots on the radio channel at different times to carry the conversation data.

GPRS traffic is a packet-oriented mobile data standard over the 2G network, with downlink traffic included in 2G KPI reporting.

Those terms I learnt in the sixth semester's tele traffic module. As a result, it was beneficial in understanding the facts contained in the reports.

2.1.2 Managerial capacity of staff

The entire corporation has been organized into departments, with some of those departments further subdivided into divisions. The head of the department is in charge of the division. The Network division includes the CTO, managers, engineers, technical officers, and maintenance employees. The senior manager of RNPO (Radio Network Planning and Optimization) oversaw my efforts. I was assigned certain assignments by him. Then technical officers led me to drive tests and software handling components. Also, some of the assignments completed by our campus trainees as well as other trainees.

2.1.3 Supportive tools, tests, models, software, and hardware

TEMS Investigation

TEMS Investigation is the industry standard for remote system investigation, confirmation, enhancement, and maintenance. TEMS Investigation supports every major advancement, making it the ideal testing tool for every stage of the system's life cycle. For the past two decades, TEMS Investigation has been the leading developer of drive-testing highlights and capabilities. It makes use of brilliant and selective functionality that addresses specific issues, advances cost-effective work forms, reduces human errors, and increases profitability, allowing administrators to focus on system quality assurance while also increasing understanding of the supporter point of view by performing administration testing directly on the end terminal. TEMS Investigation is a comprehensive, cost-effective, and time-saving solution for the mobile field engineer. As noted in the drive test experience section, this is the desktop version of the tool that we utilized for the drive test. The figure depicts the TEMS investigation tool's interface during an outside drive test,

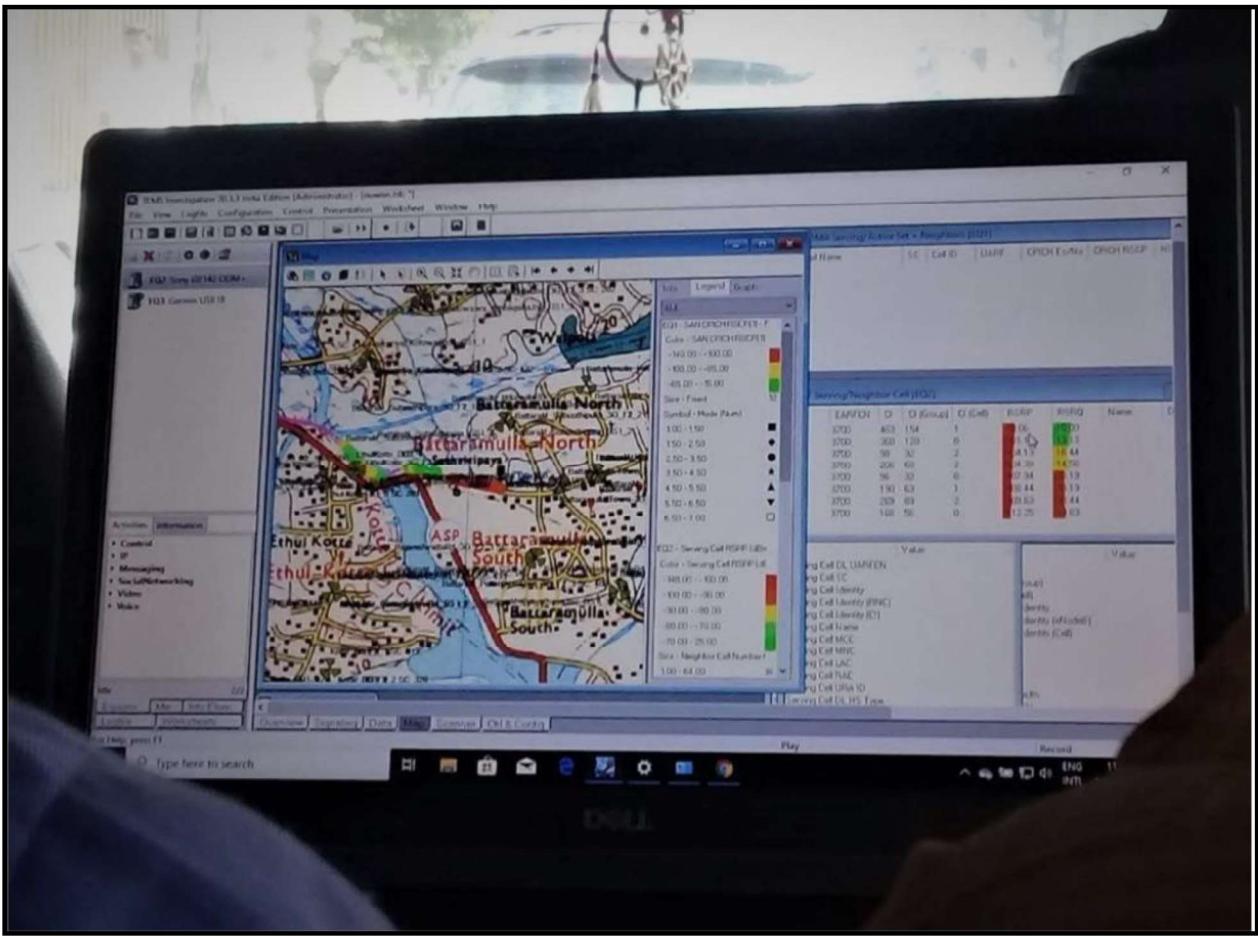


Figure 7. Outdoor drive test by using Temps Investigation software

TEMPS Pocket

TEMPS Pocket is a portable tool for analyzing, maintaining, and resolving mobile network issues, as well as basic cell planning. TEMPS Pocket, which is integrated into a commercial mobile phone or tablet, records measurements and events and displays them on the device's display. Other TEMPS products, such as TEMPS Discovery and TEMPS Investigation, can store the measurements for further examination. TEMPS Pocket is a convenient tool for day-to-day monitoring of mobile networks, especially in an indoor or pedestrian scenario, due to its tiny size and powerful testing functions. In addition, the mobile device can be used as a regular phone by the user. This encourages engineers and technicians to utilize the system on a regular basis, which takes longer to diagnose, document, and fix problems. TEMPS Pocket provides a cost-effective and efficient

solution to its users. This is the mobile version of the drive test tool that we used. The picture depicts the TEMS pocket interface during an indoor drive test.

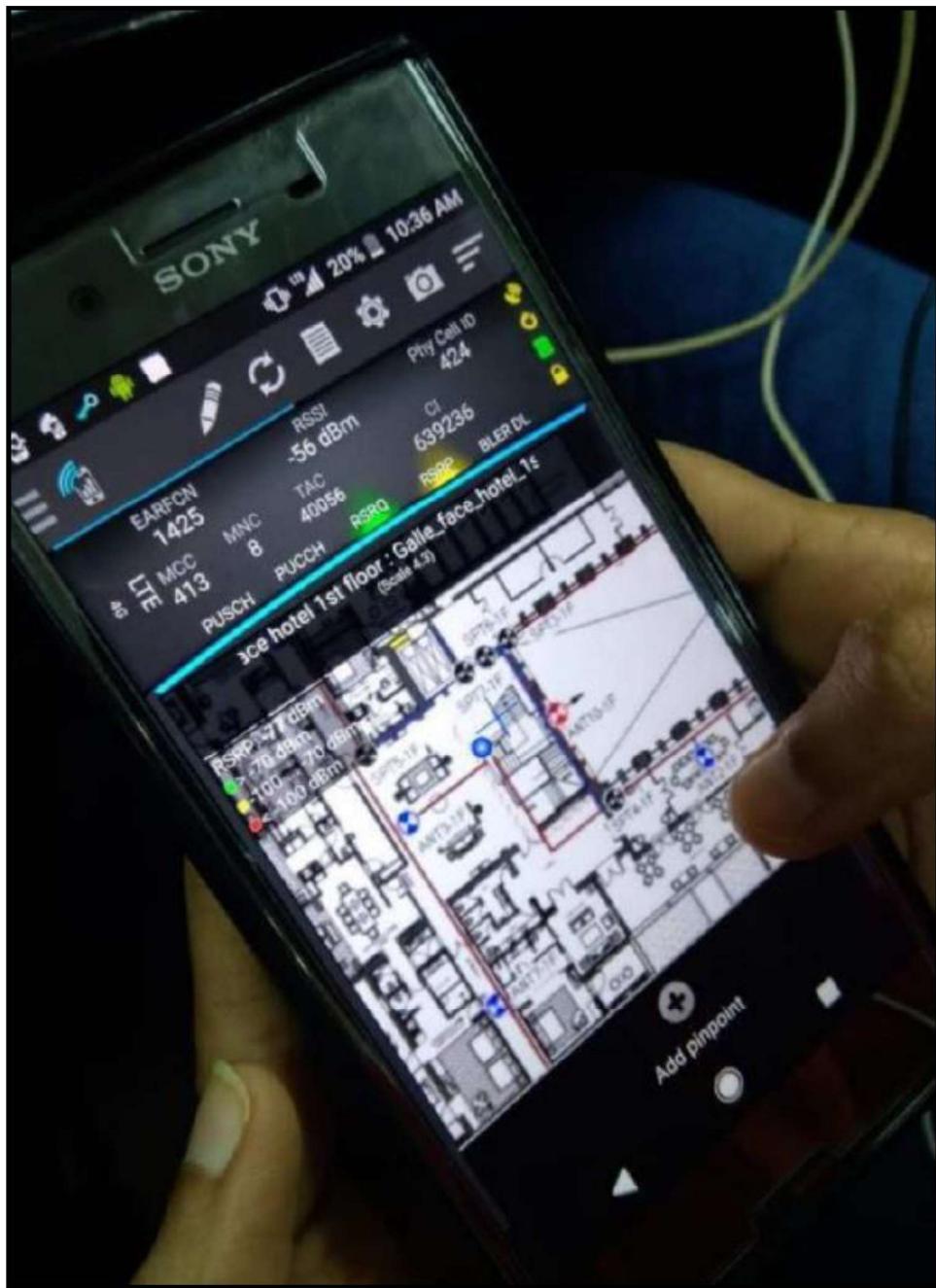


Figure 8. TEMS pocket DT image in Marino Mall Hotel

TEMS Discovery Tool

The TEMS discovery tool is a network optimization and measurement data analysis tool. It has a number of unique and innovative features that can help you increase your profits. Wireless operators must be able to quickly, easily, and affordably acquire and analyze data on the operation of their networks from a variety of sources. Drive test information may be handled in a timely and efficient manner with the TEMS Discovery remote system detailing and investigation apparatus, saving time, effort, and the possible loss of revenue associated with network outage. TEMS Discovery may generate a variety of predefined, customized summary reports based on this data. These users can delve deeper to find the source of a problem, address a specific consumer requirement, or collect the degree of data required to demonstrate the quality of the next generation of networks and services. This is the tool that is used to create drive test reports, as described in the processes for creating a drive test report.

Map Info Tool

MapInfo Professional is a GIS (geographic information system) that is used for mapping and area research. It enables users to visualize, analyze, interpret, comprehend, and output data in ways that highlight patterns, trends, and relationships. Expert GIS users or analysts utilize MapInfo Professional to perform complicated spatial analysis, create reports that describe their findings, and make decisions based on those findings. It's employed in a variety of industries for a variety of commercial purposes. We can do the following with MapInfo's features and capabilities:

- Interact with Google Earth
- Can concentrate on a particular region
- Can Import: .csv, ASCII, .jpg, .gif
- Less expensive
- Customizable legend
- Can save workspaces

This is a really basic tool that is also extremely easy to use. This is the tool we used to find overshooting, core channel interference, and adjacent channel interference. Hutch 2G locations in Sri Lanka are depicted in the screenshot.

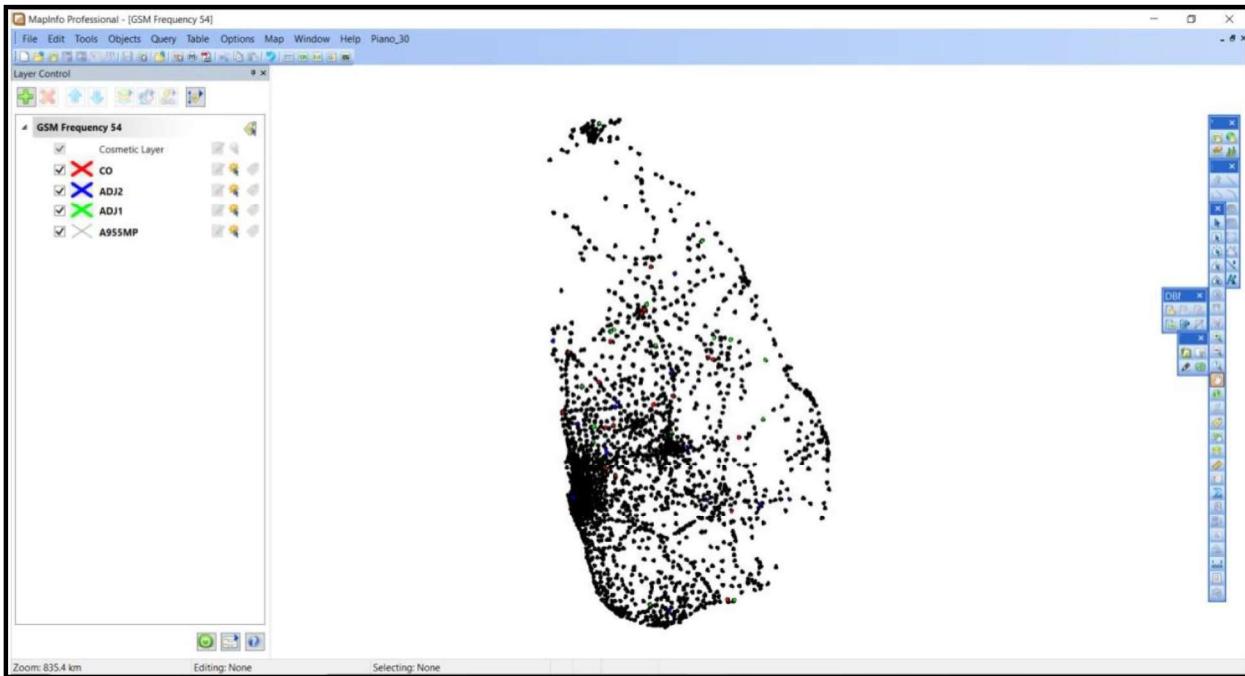


Figure 9. 2G site map in Sri Lanka by using MapInfo

2.1.4 Degree of achievement

The duties and responsibilities that were assigned to me were accomplished on schedule, with some tasks taking longer than others. Due to a lack of time, overtime was occasionally required to accomplish the remaining work. The final step was to increase Hutch coverage and quality. We completed all of the coverage and quality improvement work, but due to the Covid-19 scenario, the project report and presentation were done via an online platform (Zoom).

2.2 Analytical skills

2.2.1 Problem identification

When we were conducting duties, there were numerous issues that occurred as a consequence of our mistakes, as well as some technical concerns.

Some issues, such as when creating the drive test report after the drive test is done, some log files are not imported, and an error message appears that the file is corrupted. As a result, we had to repeat the Drive tests. When the outside Drive test began, the location was not always correct.

When creating KPI reports, each cluster traffic was not always equal to overall cluster traffic. Then we need to add those missing locations to the macro template. All site codes in the macro template are not up to date due to the merge procedure. As a result, KPI reporting failed to include several cluster owners and site codes.

When I first created the piano file (which was utilized by the MapInfo program), several columns were accidentally left out. When I entered a frequency, the cells of the sites did not appear.

2.2.2 Symptoms of the issue

Some test log files from Google Drive were not loaded appropriately. When compared to other log files, the size of the log file was about the same. It worked successfully when the log file was played on the TEMS pocket tool. It happened just after we finished working on the TEMS pocket tool. Furthermore, when performing an outside drive test on TEMS, the pocket tool is not properly positioned. When all of the tool settings were correct, it was not positioned.

Due to the merge procedure that occurred during that time period, several cluster owners and site codes are missing from the KPI report. If their database has been updated to include all merge sites, but the KPI report template has not been updated. As a result, several empty spots were displayed in the KPI report. Then the specifics of the KPI report do not match the data sets that were imported.

There should be some required columns in the piano file to identify the MapInfo tool (Site ID, Cell name, Longitude, Latitude, Azimuth, tilts, BCCH, etc.). If it didn't, it wouldn't have shown the correct map and couldn't have included any frequencies.

2.2.3 Diagnostic approach

Corrupt log files are mailed to the TEMS official service center. For the purpose of recovering log files. Some files can be recovered, but not all of them. The positioning problem can be fixed by restarting the TEMS tool settings, but it is not a long-term solution. This issue was thoroughly explored, using several elements such as costs and worker responsibilities, as well as the precision of the equipment utilized during the drive test. Finally, a conditional decision was made to move the log files to the analyzer in the head office during drive testing and verifying the dependability

and quality of the data obtained from the drive test. After the Drive test, the log files were verified using this way without any issues.

The issue with the KPI report is resolved by modifying the macro template to include all merge site details. When it comes to reporting, the fundamental reason for the delay has been recognized. Reports were sent as soon as concerns were recognized and self-training was improved.

Assume some duties at the start of your engineering career and manage them within a set time frame. Some decisions that were based on our recommendations were taken into account.

2.2.4 Supportive tools

In the TEMS Discovery tool, the root cause of corrupted drive test log files was detected by the error message. The red satellite icon of the TEMS pocket tool indicated a location positioned issue during outside drive testing. After that, I was unable to conduct any outdoor experiments using the TEMS pocket instrument. Uneven TCH traffic and empty spaces in the report were discovered as the root cause of the KPI report. Some sites reported that piano files were in the wrong place and that they couldn't insert any frequencies to validate the frequency planning process using the MapInfo tool.

2.2.5 Analysis

Analyzing and evaluating the planning and decision making, organizing and staffing, leading and directing, monitoring and controlling process can mainly affect positively and negatively an organization. Those can positively affect as,

- ❖ Improving the performance of the organization- When an organization plans its goals, organize them, leading, and controlling are the ways to improve their performance. Having a proper budget plan for the future, the company ensures that money isn't wasted through procedures and processes not support the business. Organizing training in the workplace can also improve company performance. Likewise, a company can improve its performance by properly following management functions.
- ❖ Being able to face challenges well- Managers or leaders lead the company to success by following proper management functions. Making correct decisions helps to face challenges.

- ❖ Easily lead to company goals - Almost all the companies face competition challenges.
So, it can easily achieve through proper management functions.

Negatively affect as,

As explained before planning, organizing, leading, and controlling is a management cycle. In the planning, stage the company sets goals and prepares a plan for the success of the organization. Once the plan is formulated the process will be organized directed and finally monitor to identify if there is a mismatch between the plan and any other steps in the management process the management practices might fail. To ensure the Success of the management practices the support of all three management levels (strategic level, functional level, operational level) are needed and the levels process and all the employees in the organization should be aligned to achieve the final goal.

2.2.6 Recommendations

Sustainability is the management and coordination of environmental, financial, and social conditions and issues to ensure responsible, legal, and continuous progress. Sustainability also archives from the triple bottom line (TBL). This topic is explained in the under the analysis of strategies adopted heading. The responsibility of an engineer is to efficiently and effectively utilize the scarce resources provided by the environment. It is a challenging task but engineers provide an option to get the maximum out of existing resources leaving sufficient resources to future generations there maintaining sustainability.

To archive a sustainable goal, need to analyze the existing macro-economic environment, global climate, and industry-specific indicators to maximize sustainable development through information and communication technology. The Hutch can align their goals with minimizing harm and maximizing value in the ecosystem. Hutch can participate reducing in poverty, integrating innovation, increase quality education, think business priorities through sustainability, increase sustainable development for the betterment of society, and think about a secure safe future. The examples for the Hutch can archive long-term sustainability.

- ❖ Hutch can give their services for an affordable price for society
- ❖ Use their data and voice services to strengthen national economic participation
- ❖ Develop digital resources for education such as a digital library.

- ❖ Empowering women by providing life-enhancing opportunities like financial services.

Chapter 3 - Conclusion

3.1.1 Self-development.

As an engineering undergraduate, my internship at Hutchison Telecommunications Lanka (Pvt) Ltd was a memorable experience in my industrial training since I gained expertise in both the telecommunications industry and networking section. I learnt the activities that I was performing from both my supervisor and other operational personnel, and they led me in learning tools, software, and the networking systems. I acquired a lot of life skills and how to work with people. Completing assigned responsibilities and tasks in a reasonable amount of time, working confidently, adaptability to any task assigned to them, and avoiding some anxiety of speaking with clients are examples of life skills.

3.1.2 Strengths and weaknesses

Flexibility for work, officially speaking, and time management were the self-weaknesses I recognized during my training session. Avoid any apprehension about speaking with clients about coverage problems. I completed all of the activities within the allotted time. These were the advantages I gained during my training period.

Practically, I worked with personnel, and the workload I was responsible for was completed on schedule, and because of the experience gained from the activities, I was certain that I was done with them. All of these flaws were fixed, and the strengths I earned would be highly valued once I started working as an engineer.

3.1.3 Potential opportunities

I was assigned to the project and network department during my training time. I didn't get an opportunity to learn core network division and transmission network division at the network department due to a lack of time. Those are the topics I'd like to learn more about. Finally, I am confident in my ability to advance in my sector of telecommunications based on the knowledge and experiences I have received from my industrial training.

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Appendix

i. Drive Testing:

- Drive testing is a technique for determining a mobile radio network's coverage, capacity, and Quality of Service (QoS).
- Drive testing is mostly used throughout the network development planning and optimization stages.
- Operators' most typical measurement method for probing the quality status and resolving network faults is through drive testing.

ii. Key Performance Indicators (KPI):

- A collection of quantitative measurements used by a firm or sector to assess or compare performance in accomplishing strategic and operational objectives. Companies and sectors use different KPIs depending on their priorities and performance criteria. "Key success indicators (KSI)" is another term for them.

