

3G Drive Test Analysis for Long Call in University Campus

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Drive testing is a method of measuring and assessing the coverage, capacity and Quality of Service (QoS) of a mobile radio network.

The technique consists of using a motor vehicle containing mobile radio network air interface measurement equipment that can detect and record a wide variety of physical and virtual parameters of mobile cellular service in a given geographical area [1].

By measuring what a wireless network subscriber would experience in any specific area, wireless carriers can make directed changes to their networks that provide better coverage and service to their customers.

Drive testing requires a mobile vehicle outfitted with drive testing measurement equipment. The equipment are usually highly specialized electronic devices that interface to OEM (Original Equipment Manufacturer) mobile handsets. This ensures measurements are realistic and comparable to actual user experiences.

A. Introduction to Third Generation (3G)

3G is also called third generation. It is named as such because it is the third generation of the standards of telecommunication hardware. It is also the general technology for mobile networking, passing the recent 2.5G. 3G is based on GSM and was launched in 2000. The aim of this technology was to offer high speed data. The original technology was improved to allow data up to 14 Mbps and

ABSTRACT

Mobile communication is developing very rapidly with passage of time, new technologies are being introduced to facilitate the mobile user more from the technology. The past technologies are replaced by new ones and needs are growing for the new technologies to be developed. Just within a decade, an evolution of wireless service people used every day can be completely dumb founded from the roots of analog based first generation service(1G) to today's truly broadband-ready fourth generation networks.

Drive Test is conducted for checking coverage criteria of a cell site with RF Drive Test tool. The data collected by Drive Test tool as log files is analyzed to evaluate various RF parameters of the network. And it's very important things for mobile service provider. This paper is to study about the analysis of long call Drive Test for third generation (3G) networks to evaluate the performance of QoS (Quality of Service) using TEMS Investigation 16.3.3 software and TEMS Discovery 10.0.6 software.

KEYWORDS: 3G, Drive Test, Quality of Service, TEMS Investigation, TEMS Discovery

I. INTRODUCTION

The Drive Test is a test performed in cellular networks regardless of technology (GSM, CDMA, UTMS, LTE, etc...). Drive Test is usually used in order to analyze and optimize the network quality. With the rapid growth of the wireless industry, GSM network are rolling out and expanding at a high rate.

more using packet switching. It uses Wide Band Wireless Network with which clarity is increased. It also offers data services, access to television/video, new services like Global Roaming. It operates at a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet service, video chatting.

The technology is founded on the ITU or International Telecommunication Union group of standards which belongs to the IMT-2000.

There are currently widely different views throughout the wireless industry as to what constitutes a 3G wireless access network. The problem is rapidly getting worse with the increased usage of 4G to describe, in many cases, technologies that are basically just evolutions of 3G technologies [2]. 3G is a global development of communication technologies and standards. As originally proposed, the idea behind 3G was to unify the different standards used in 2G wireless networks.

The third generation (3G) has been launched in several parts of the world, although the success story of 2G is hard to repeat. It has various release versions like 3.5G, 3.75G. It has more features like the data throughput is up to 3.1Mbps, has a peak upload rate of 5 Mbps. It uses turbo codes for error correction. It provides digital navigation but costly in implementation [2]. The people noticed the disadvantages of Third Generation (3G) such as 3G require closer base stations which are costly.

B. Introduction to DRIVE TEST System

Drive Test is a method of measuring and assessing of wireless network. Drive Test performance measurements are carried out for the following reasons: Test the network from the subscriber's point of view. Test the complete system, end to end. Bench mark performance against competitor networks. Test specific important routes and areas. Test in-building coverage for specific buildings (Metro, Airport, office etc.) called walk test [4].

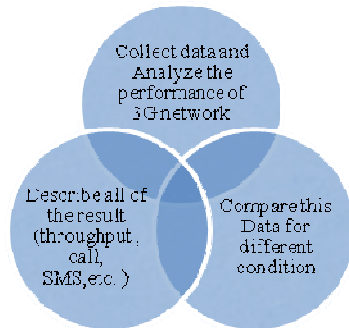


Figure 1 Drive Test System

C. Third Generation Long Call for Drive Test

Everything depends on the technology (GSM, CDMA, UMTS, etc. ...) and the purpose of the test as always. The Drive Test is performed according to the need, and the types of test calls are the same that the network supports - calls can be voice, data, video, etc. A typical Drive Test uses two phones. With this, the researcher collects specific data in IDLE and CALL modes for the network. The calls test (CALL) can be of two types: long or short duration. Long calls serve to verify if the handovers (continuity between the cells) of the network are working, i.e. calls must not drop.

II. REQUIRED COMPONENTS FOR DRIVE TEST

Every good RF design, after its implantation should be evaluated. There are few ways to do this, for example through analysis of KPI (Key Performance Indicator) or through prediction tools and signal interference. Other very common and efficient way to evaluate the network is conducting a Drive Test.

The name is intuitive: take a drive test. The Drive Test is a test performed in cellular networks regardless of technology (GSM, CDMA, UMTS, LTE, etc. ...). Means collecting data on vehicle movement. Its variation has also intuitive: Walk Test, i.e. collect data by walking areas of interest.

The analyses of drive test are fundamental for the work of any professional in the field of IT and Telecom comprising two phases: data collection and data analysis.

Although through the analysis of KPI's we can identify problems such as dropped calls, among others, the drive tests allow a deeper analysis in field. Identifying areas of each sector of coverage, interference, evaluation of network changes and various other parameters.

A. Drive Test

Drive Test, as already mentioned, is the procedure to perform a test while driving. The vehicle does not really matter; people can do a drive test using a motorcycle or bicycle. What matters is the hardware and software used in the test.

- A notebook - or other similar device

- with collecting Software installed and
- one GPS

Also is common the use of adapters and / or hubs that allow the correct interconnection of all equipment. The following figure is a schematic of the standard connections.



Figure 2. Drive Test Tools

The main goal is to collect test data, but they can be viewed / analyzed in real time (Live) during the test, allowing a view of network performance on the field. Data from all units are grouped by collection software and stored in one or more output files.

- GPS: collecting the data of latitude and longitude of each point / measurement data, time, speed, etc... It is also useful as a guide for following the correct routes.
- MS: mobile data collection, such as signal strength, best server, etc ...

The minimum required to conduct a drive test, simplifying, is a mobile device with software to collect data and a GPS. Currently, there are already cell phones that do everything. They have a GPS, as well as a collection of specific software. They are very practical, but are still quite expensive [2].

B. Drive Test Tools

There are two portions for TEMS Drive Test Tools hardware and software.

Hardware tools are as follows:

- Laptop
- GPS
- Dongle
- MDM 9200
- Sony Ericsson W995
- SIM Card

Software tools are as follows:

- TEMS Investigation 16.3.3
- TEMS Discovery 10.0.6
- MPT Cell File

C. Drive Test Route

Drive Test routes are the first step to be set, and indicate where testing will occur. This area is defined based on several factors, mainly related to the purpose of the test. The routes are predefined in the office. A program of a lot of help in this area is Google Earth. A good practice is to trace the route on the same using the easy paths or polygons. The final image can then be brought to the driver.

Some software allows the image to be loaded as the software background (geo-referenced). This makes it much easier to direct routes to be followed. It is advisable to check traffic conditions by tracing out the exact pathways through which the driver must pass. It is clear that the movement of vehicles is always subject to unforeseen events, such as congestion, interdicted roads, etc. Therefore, one should always have on hand - know - alternate routes to be taken on these occasions.



Figure 3 Rout Testing

Avoid running the same roads multiple times during a Drive Test (use the Pause if needed). A route with several passages in the same way is more difficult to interpret.

Types of Drive Test

The main types of Drive Test are:

- Performance Analysis
- Integration of New Sites and change parameters of Existing Sites
- Marketing
- Benchmarking

D. TEMS Investigation

TEMS Investigation used in more than 180 countries worldwide data collection. It is the industry standard tool for troubleshooting, verification, optimization and maintenance of wireless networks. It supports all major technologies, making it the ideal testing tool at every stage of the network's life cycle. It has been the leading originator of drive testing features and functions for two decades. It is a complete, cost-effective and conveniently compact solution for active field engineer.

E. TEMS Discovery

TEMS Discovery provides the ability to analyze drive test log files and generate reports.

- New post processing tool within the Ascom TEMS portfolio
- Designed but can also be used for Benchmarking and QoS verification
- Flexible tool that is easy to adapt to the working process
- Automated data processing
- User defined KIPs
- Inbuilt reporting
- Excellent post processing solution for TEMS Investigation and TEMS Pocket

F. Technology Support

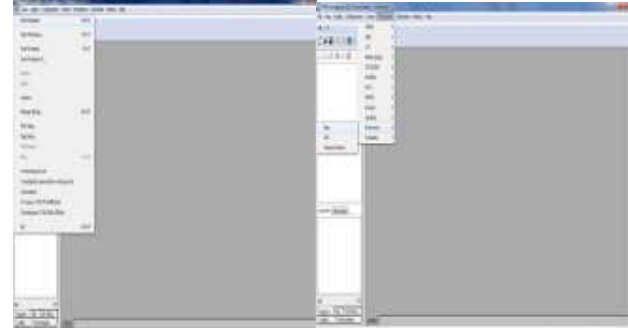
TEMS Discovery can support the following technology. So the network quality of these items can be analyzed by using TEMS Discovery.

- IS -95/CDMA2000 1x
- EV-DO (Rev.0/ Rev. A)
- GSM/GPRS/EDGE

- WCDMA/HSDPA/HSUPA/HSPA+
- TD-SCDMA
- WiMAX and
- LTE

III. IMPLEMENTATION OF TEMS INVESTIGATION

The Investigator goes to file menu option in order to create a new workspace and then selects new one as shown in Fig.4 (a).



(a) Creating New Workspace (b) Taking Map
Figure 4. Creating Workspace and Taking Map

After creating a new workspace, the investigator chooses the presentation menu and then selects positioning to take a map as shown in Fig 4(b).

In that presentation menu, it is needed to select GSM for 2G and chooses Serving/Neighbor Cell.

The user must select 2G radio parameters in GSM of presentation menu. The next step is choosing the current channel. After selecting radio parameters, radio current channel is chosen for GSM.

After finishing above procedures, the investigator got the events from signaling.

The following procedures are implementation for WCDMA. In that presentation menu, it is needed to select WCDMA for 3G and chooses Serving/Neighbor Cell as shown in Fig 5(a).

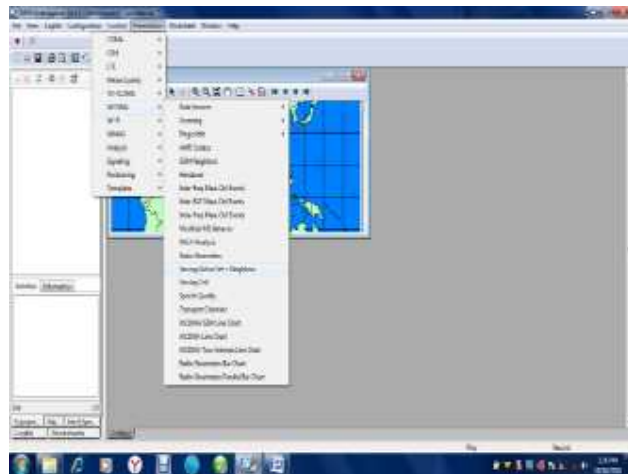


Figure 5. WCDMA Serving/Neighbor Cell

The user must select 3G radio parameters in WCDMA of presentation menu.

This step is choosing the serving cell. After selecting serving cell, serving call channel is chosen for WCDMA as shown in Fig 6.



Figure 6 WCDMA Serving Cell

When the user wants to view HSDPA analysis, it goes to presentation menu and selects Data Service in WCDMA. The user can choose HSDPA analysis as shown in Fig 7.

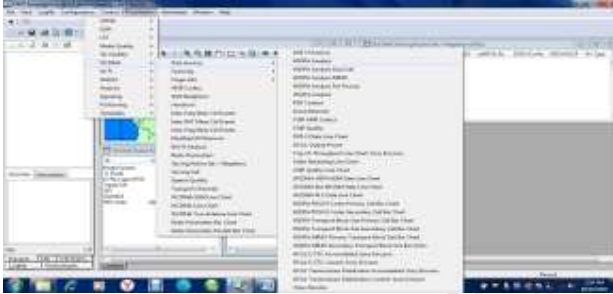


Figure 7 WCDMA Data Service

After finishing above procedures, the investigator got the events from signaling as shown in Fig 8.

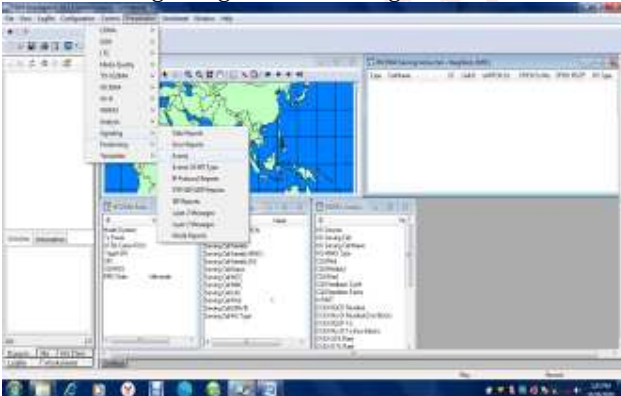
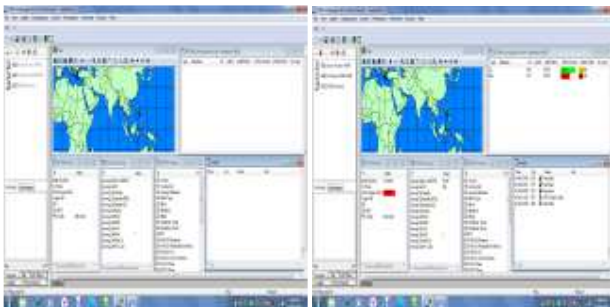


Figure 8 3G Events Option

The following fig 9 shows deactivated and activated saturation of MDM 9200, GPS and Sony Ericsson W 995.



(a) Deactivated Condition (b) Activated Condition
Figure 9 Deactivated and Activated Condition of Equipments

In order to lock WCDMA, goes to control option and then selects radio access technology. After selecting radio access technology, in this way, WCDMA can be locked. In order to

record the log files, goes to file menu and selects option and then selects recording. After finish recording option, to add cell file go to configuration menu select general and then add cell file. When it is complete all steps, the investigator can start overshooting (routing) and data collections. This condition is shown in Fig 10.

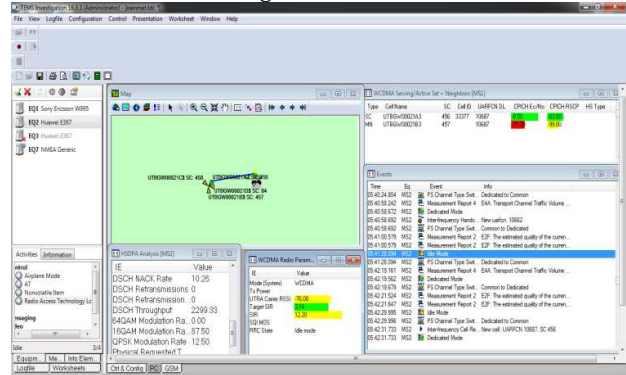
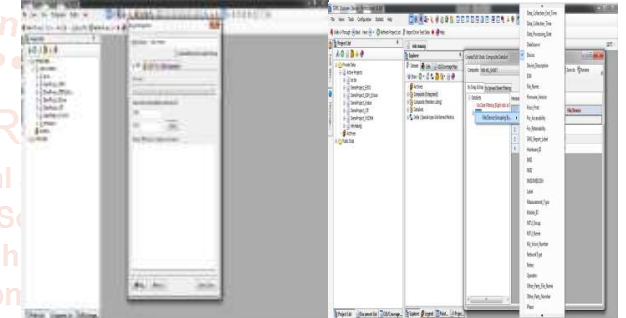


Figure 10 overshooting and Data collecting

A. Implementation of TEMS Discovery

Firstly, to create new project, go to project menu select new project and define project name after all select save and close as shown in Fig 11(a).



(a) Creating New Project (b) Defining Devices (MS1, MS2, etc)
Figure 11. Creating Project and Defining Devices

After creating new project, to define devices such as MS1, MS2 go to composite (integrated) and then select device is shown as Fig 11(b).

The investigator can take data from MS1, MS2 fill to the member of group select new menu and fill data. The Data Set tab displays drive test data in logical group: Archived, Composite and data Sets. Except for the archived dataset, each group is in a tree view layout that can be drilled down to the metric level shown in Fig 12.

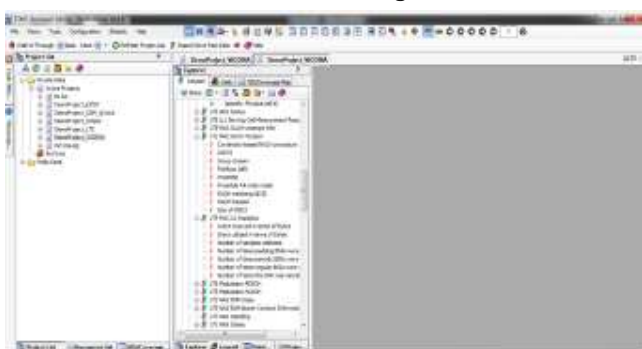


Figure 12 Data Set

IV. TEST AND RESULTS

In this paper, the analyzed results of the parameters such as Cell ID Server, RxLev Sub, Rxqual Full, and Handover Success

Rate by using TEMS Discovery 10.0.6 are described. Moreover, the analytical results of performance comparison of operators (MPT) are discussed.

A. Legend

The following Table is used in TEMS Discovery to define what color excellent, very good, good, average, weak and bad.

Color	Red	Green	Blue	Condition
	0	0	153	Excellent
	0	0	255	Very Good
	0	255	0	Good
	255	255	0	Average
	255	192	0	Weak
	255	0	0	Bad

Table 4.1 Legend Explanation

B. Comparison Agg.Active Ec/Io Result For MPT of 3G Day 1,2,3

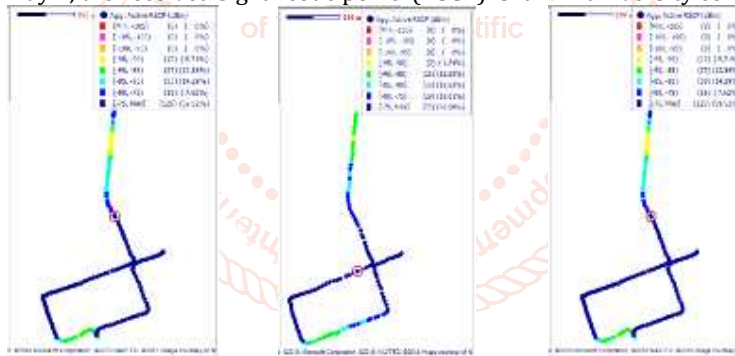
The following figure shows the Comparison Results of Agg.Active Ec/Io in 3G for MPT Day 1, 2 and 3. According to Fig. 4.13, in Day 1, the value of Agg.Active Ec/Io of 3G for MPT is (94.29%), in Day2, (99.38%) and the value of Agg.Active Ec/Io is only (94.29%) in Day3. Among these days, in Day 2, the value of Agg.Active Ec/Io of 3G for MPT is the best.



(a)MPT Day 1 (b)MPT Day 2 (c)MPT Day 3
Figure 13.Comparison Agg.Active Ec/Io Result For MPT in Day 1,2,3

C. Comparison Agg.Active RSCP Results For MPT of 3G in Day 1,2,3

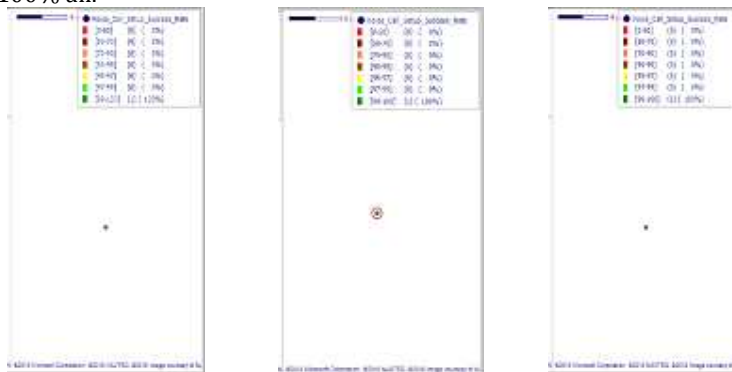
The following figure shows the Comparison Results of Agg.Active RSCP in 3G for MPT in Day 1, 2 and 3. According to Fig. 4.16, the value of Agg.Active RSCP of 3G for MPT is only (81.43%), in Day 2, (83.22%) and the value of Agg.Active RSCP Result of MPT is (81.43%) in Day 3. So in Day 2, the received signal code power(RSCP) is fair in university campus.



(a)MPT Day 1 (b)MPT Day 2 (c)MPT Day 3
Figure 14. Comparison Agg.Active RSCP Result For MPT in Day 1,2,3

D. Comparison Voice Call Setup Success Rate Result For MPT 3G Day 1,2,3

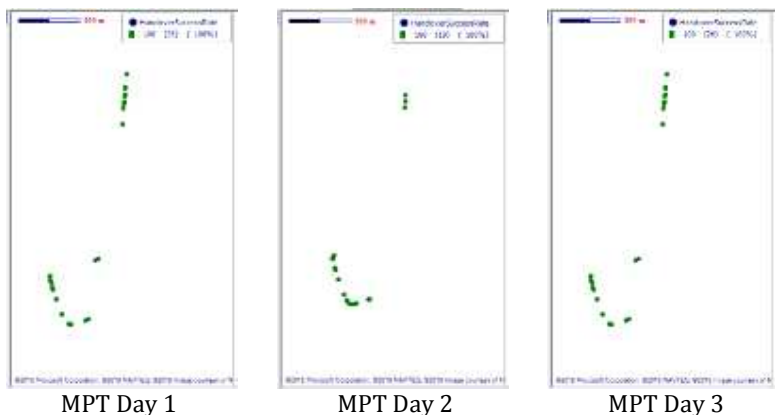
The following figure shows Comparison Results of 3G Voice Call Setup Success Rate For MPT in Day 1,2,3. In these days, Voice Call Setup Success Rate is 100% all.



(a)Day 1 (b)Day 2 (c)Day 3
Figure 15.Comparison Voice Call Setup Success Rate Result For MPT 3G Day 1,2,3

E. Comparison Handover Success Rate Result For MPT 3G in Day 1,2,3

The following figure shows Comparison Results of 3G Handover Success Rate For MPT in Day 1,2,3.

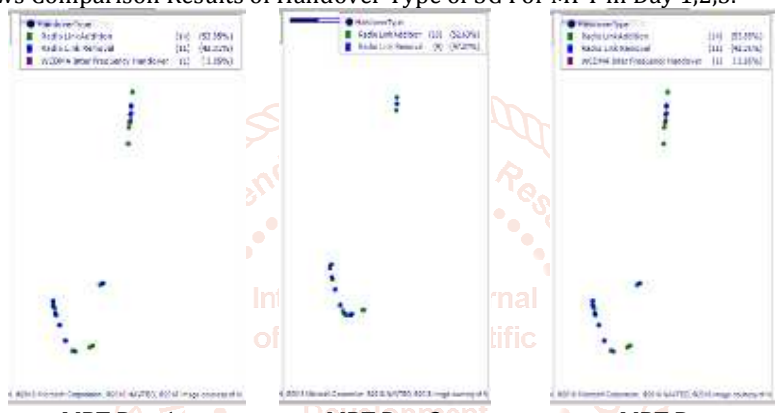


MPT Day 1 MPT Day 2 MPT Day 3
Figure 16. Comparison Handover Success Rate Result For MPT 3G Day 1,2,3

After investigating for three days, Handover Success Rate Results of 3G for MPT is 100% all, in author’s view, handover process is 100% good around the university campus in these days.

F. Comparison Result of Handover Type For MPT 3G in Day 1,2,3

The following figure shows Comparison Results of Handover Type of 3G For MPT in Day 1,2,3.

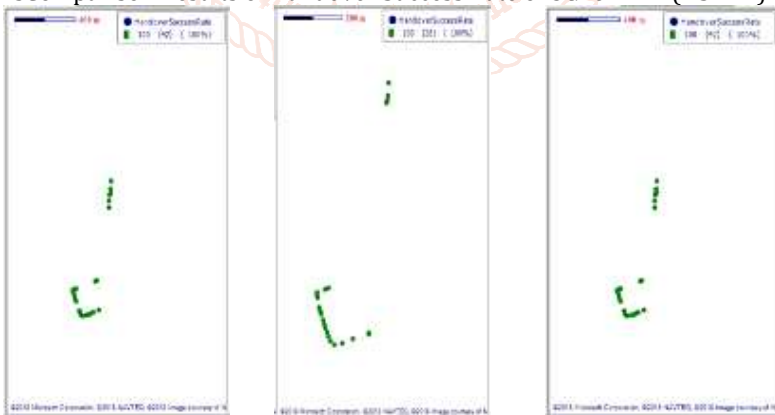


MPT Day 1 MPT Day 2 MPT Day 3

Figure 17. Comparison Handover Type For MPT 3G Day1,2,3

G. Comparison Handover Success Rate Result For 3G MPT (HSDPA) Day1,2,3

The following figure shows Comparison Results of Handover Success Rate of 3G For MPT (HSDPA) in Day 1,2,3.



MPT Day 1 MPT Day 2 MPT Day 3

Figure 18. Comparison Handover Success Rate For 3G MPT (HSDPA) Day1,2,3

For all three days, the investigation of Handover Success Rate (HSDPA) is 100% good around the university Campus.

H. Comparison HS Phy Served Throughput Result For MPT 3G in Day1,2,3

The following figure shows the Comparison Results of HS Phy Served Throughput in 3G For MPT in Day1. According to Fig. 4.27, the value of HS Phy Served Throughput of 3G for is only (51.73%) , in Day 2, (59.63%) and then the value of HS Phy Served Throughput of 3G for MPT is(51.73%) in Day 3.

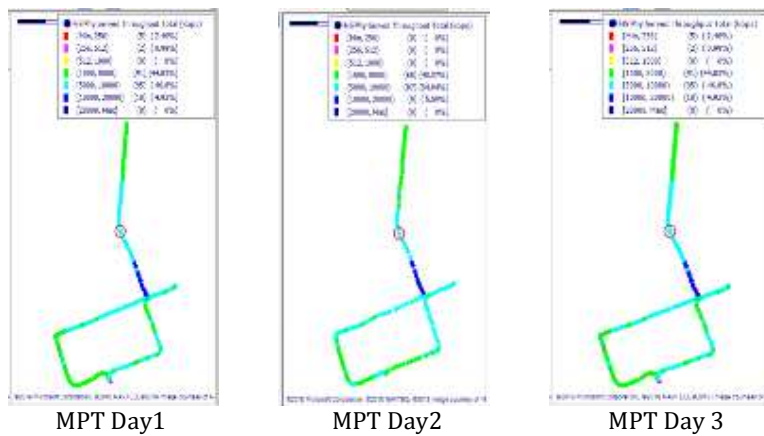


Figure 19. Comparison HS Phy Served Throughput Result For MPT 3G Day1,2,3

After investigating for three days, the value of HS Phy Served Throughput Result for Day2 is better than the other days.

V. CONCLUSION

This paper represents about Drive Test System used in university campus. In this paper, the author can analyze 3G network using Drive Test TEMS software for long call. Especially, the researcher can analyze the basic parameters such as Cell ID Server, RxQualFull, Handover Success Rate, Handover Type, Agg.Active Ec/Io, Agg.Active RSCP and HS Phy Served Throughput. The author can be remarked the parameters whether good or bad because of the help of legend. In this work, the people can study about the comparison of quality of network within three days for the operators MPT. After analysing, the researcher could know about the quality of network around the university campus. In the author's view, there were many problems in this analysis. The problems are that the matching of the software and the window of PC is necessary. Cell file is also a problem to PC. There is a problem to install some software. The author hopes for a better solution of this analysis if there is sufficient time.

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