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RF Optimization in GSM Network Coverage Area Using Agilent Tool

V.Gayathri[1] | P.Vasuki[2] | V.Vinitha[3] | R.Saraswathi[4] | N.Dhasarathan[5]

[1,2,3]UG Scholar, Department of ECE, Ponnaiyah Ramajayam College of Engineering and Technology, Thanjore, Tamilnadu.
[4,5]Professor, Department of ECE, Ponnaiyah Ramajayam College of Engineering and Technology, Thanjore, Tamilnadu.

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ABSTRACT

The process of radio frequency optimization in GSM network can be seen in this paper. Introduction about the GSM Technology, Mobile Communication, Wireless Communication and explanation of various channels are used in wireless communication. The drive test tool is a AGILENT E764A tool is explained here and this drive test is taken for both urban and rural areas to obtain signal strength and call drop. By using the result of map the quality of services determined. As the cellular communication has became one of the fast growing communication medium with dynamically increasing usage and users. Optimization is used to check the quality of service.

KEYWORDS: *RF optimization, GSM network, Quality of Service, Drive Test, Coverage, Call Drop, urban and rural areas.*

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I. INTRODUCTION

1.1TELECOMMUNICATION

Generally telecom has three domains for the purpose of communication. Let us see about that as follows

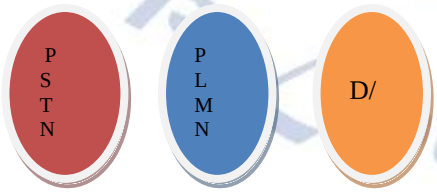

Figure 1: Domains in telecommunication

DOMAIN	NO OF BITS	BASED ON
Public Switched Telephone Network	7 bit	Wired communication
Public Land Mobile Network	10 bit	Wireless communication
DATA NETWORK	32 bit	IP Protocol

In these optimization process is fully based on the PLMN domain. Let us see about them

1.2Public land mobile network (PLMN):

The PLMN as defined in telecommunication regulation, is a network that is established and operated by an administration or by a recognized operating agency (ROA) for the specific purpose of providing land mobile. It based on the four aspects. Such as Air medium, EMF waves, RF frequencies and measurement in HZ.

II. GLOBAL SYSTEM FOR MOBILE COMMUNICATION

GSM (Global System for Mobile Communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM uses a variation of time division multiple access (TDMA) and is the most widely used for the three technologies (TDMA, GSM and CDMA).

2.1GENERATIONS OF GSM:

GSM generally consists of several generations such as,1G-ANALOG-(**Voice**),2G-DIGITAL- (**Voice and text**), 2.5G-GPRS- (**Voice, text and data**), 2.75G-EDGE- (**Voice, text, data and speed**), 3G-WCDMA- (**Voice, text, data, speed and video**), LTE-Long Term Evolution- (**Voice, text, data, speed and video**(high quality), 4G-High speed packet data access.

2.2GSM FREQUENCY:

Basically GSM is based on the wireless network. And it may contain the two different level of frequency. (uplink and downlink) Uplink frequency communicate through mobile to tower and it may have the Frequency range from 890MHz to 915 MHz and it's bandwidth range is 25MHz. Downlink frequency communicate through tower to mobile and it have the frequency range from 935 to 960 MHz and it's bandwidth range is 25MHz.

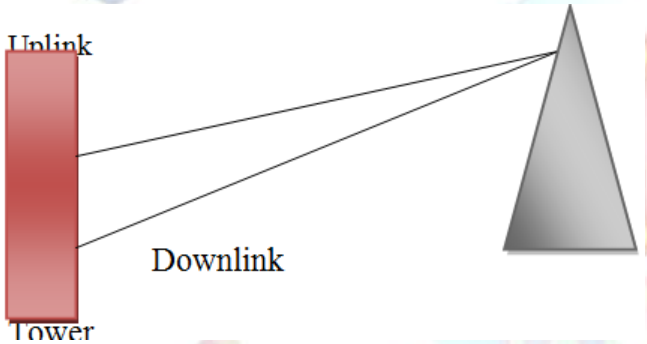

Figure2: Represent mobile to tower communication.

2.3GSM ARCHITECTURE:

Generally GSM architecture may contain the two parts such as USER PART and NETWORK PART. Let us see about them as one by one

USER PART:

MOBILE STATION:

The SIM:

The SIM is a smart card that identifies the terminal. By inserting the SIM card into the terminal, the user can have access to all the subscribed services. Without the SIM card, the terminal is not operational. The SIM card is protected by a four-digit Personal Identification Number (PIN). In order to identify the subscriber to the system, the SIM card contains some parameters of the user such as its International Mobile Subscriber Identity (IMSI).

NETWORK PART:

Network part may consist of radio part and switching part.Radio part may contain the Base Transreceiver System(BTS), Base Station controller (BSC),Transponderunit (TCU). BTS is a piece of equipment that facilitates wireless communication between user equipment (UE) and a network. BSC is a critical mobile network component that controls one or more base transceiver system (BTS).TCUis convert the data rate from 64 kbps to 16 kbps from BSC output to MSC input and vice versa.

Switching part may consists ofMobile switching centre (MSC), Home location register (HLR),Visitor location register (VLR), Equivalent identification register (EIR), Authentication centre (AUC). MSC performs all switching functions for all mobile stations, located in the geographic area controlled by its assigned BSS's. HLR used to identity of mobile subscriber called IMSI, Subscription information on services and Service restrictions. VLR always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC would request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR.Equipment identity register consists of identity of mobile station equipment called IMEI,White list-the terminal which is allowed to connect to the network. Black list-the terminal reported as stolen are not kept approved. They are not allowed to connect to the network.

AUC is associated with the HLR. It stores an identity key called Ki for each mobile subscriber. RAND (random number), SRES(signed response)-to authenticate IMSI.

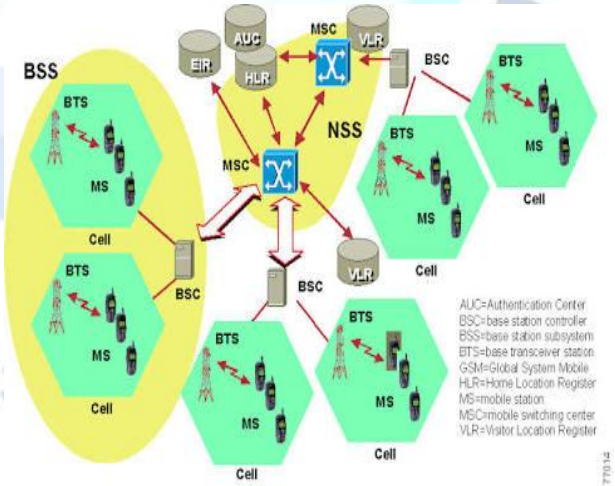

Figure 3: Represent architecture of GSM

III. RF OPTIMIZATION

It is the key challenges in any cellular network. Optimization is a continuous process and helps in understanding the shortcomings in the

network.Shortcomings in the term of coverage, Quality of service(QOS). can be set right with the appropriate measures.

3.1PURPOSE OF OPTIMIZATION:

To measure the quality of GSM network because Wireless network is unreliable network. While make call processing (100 % call) means 90% of call will connected remaining percentage may be disconnected due to error.

3.2ISSUES in GSM:

Call Drop, BTS Down,Dragging Cell,Coverage Holes ,Swap Feeder.Here we only optimize the call drop issues.

3.3REASON FOR CALL DROP:

Call drop mainly occurred during insufficient of RF carrier. Some configurations are used to optimization of call drop process.

IV. METHODS OF CONFIGURATION

RF Planning and optimization mainly consist in the configuration of the network by modifying the network parameters. Generally two type of configuration in optimization process such as Hotspot measurement, Drive test measurement

4.1 HOTSPOT MEASUREMENT:

These tasks derive the need of finding hotspot zone. We are taking the reading at one place. For example shopping complex. Old method is HUB arrangement using hotspot measurement. It is very expensive and handle is very difficult. So now overcome the old method we are using laptop arrangement for hotspot measurement. It is very simple and portable. Measurement is taken under by using hardware components such as, TWO mobiles, GPS Receiver, DONGLE KEY.

Using two mobiles one for long call and another one for short call. Long call means continuous process and short call means specify the call duration. GPS Receiver is used for the position. DONGLE KEY is the authentication key is very important for tool. It is connect to the network and all hardware packages. Hotspot measurement hardware setup as shown in figure

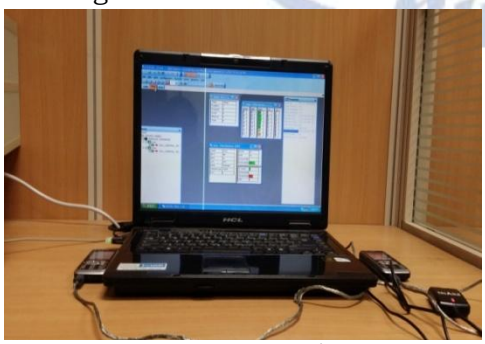

Figure 4: LAPTOP ARRANGEMENT (hotspot measurement

4.1.1 CALL PROCESSING

Subscriber make a call from one place it will connect to the nearest tower then the tower will connect to the other subscriber. Call process can be achieved by using two ways such as long call and short call.Generally different data items are used for the call process but here we used only few Data items are RX level (full),RX level (sub),C1(cell selection) , C2(cell selection) , RX quality (full), RX quality (sub).The data items are shown in figure.

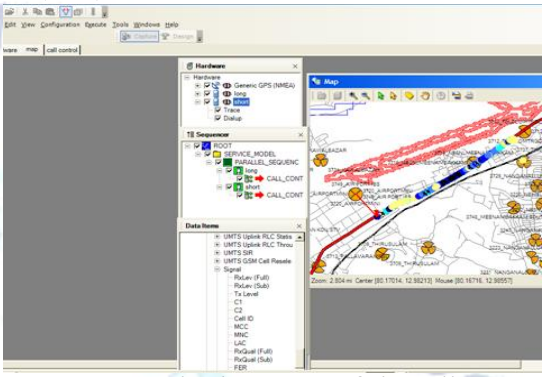

Figure5: Represent the data items of the call process and overview of map

4.1.2 LONG CALL PROCESS:

It is a continuous process does not have any time duration.let as see about the long call process. The long call will be connected long period .we will discus about the call process in long call as shown in figure.

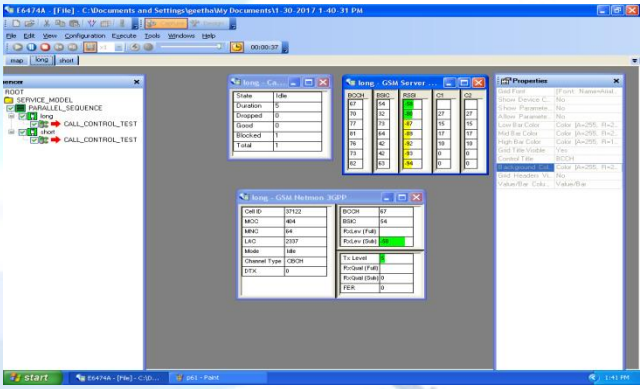

Figure 6: Represent the long call process

4.2.2 SHORT CALL:

It is not a continous process and have a time duration.let us see about the short call process. The short call after a short period the call will be disconnected and again connected viceversa. We will discuss about the call process in short call as shown in figure.

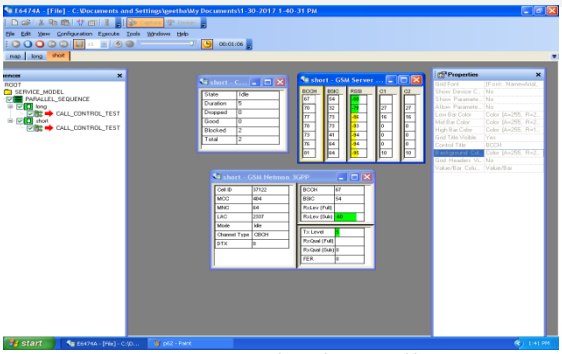

Figure7:Represent the short call process

4.2 DRIVE TEST MEASUREMENT:

We are taking the reading at some specific routes.The drive test equipement set up consists oflaptop,AGILENT software,AGILENT-enabled test mobile station(NOKIA 1900) with data cable , DONGLE KEY ,GPS receiver and vechicle. Drive test is a method of measuring and accesing the coverage, capacity and QoS of a mobile radio network.It is conducted for checking the criteria of the cellsite with the RF drive test tool.The data collected by drive test tool inform of logfiles.The data set collected can include information such as Signalintensity,Signal quality,Interference,Droppedcalls,Blocked calls,Call statistics,Service level statistics,QoS information,Hand over information,Neighbouring cell information and GPS location coordinates .In the drive test we record the files for the long call and short call.

V. ABOUT AGILENT TOOL

AGILENT E6474A drive test tool has reevaluationized and simplified end to end trouble shooting. The software allows user to correlate signaling procedures to detect and troubleshoot problem from the mobile phone to network.User friendly and application software.

5.1 BEFORE OPTIMIZATION

The GSM network may have many problem in the cellular network such as call drop, BTS down etc. To overcome the call drop issue we taken drive test measurement on the specific route. Here we find out the reason of the call drop and the reason is nothing but insufficient of RF carrier. Let us see about the call drop in long call and short call.

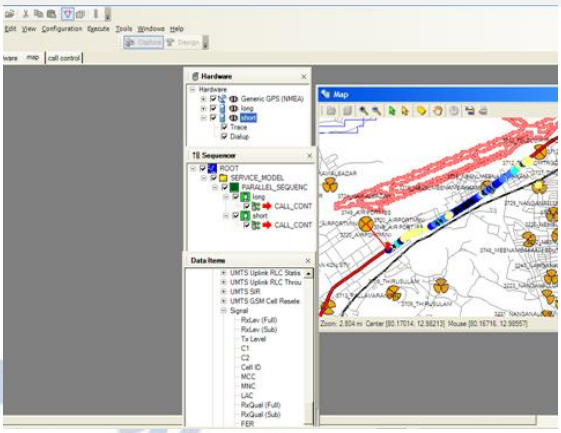

Figure 8:Represent the overview of before optimization drive test map.

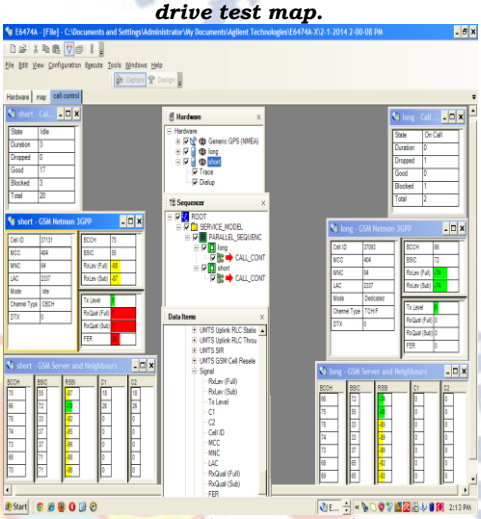

Figure 9: Represent a call process (Before Optimization).

AFTER OPTIMIZATION:

In above process we determine the reason of call drop .To overcome these reason by adding the RF carrier .The adding of carrier to improve the quality of call process .Let us see about the after optimization of call process.

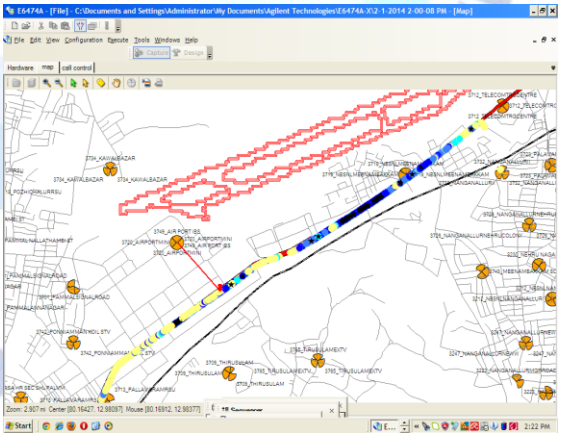

Figure 10: Represent the overview of after optimization drive test map.

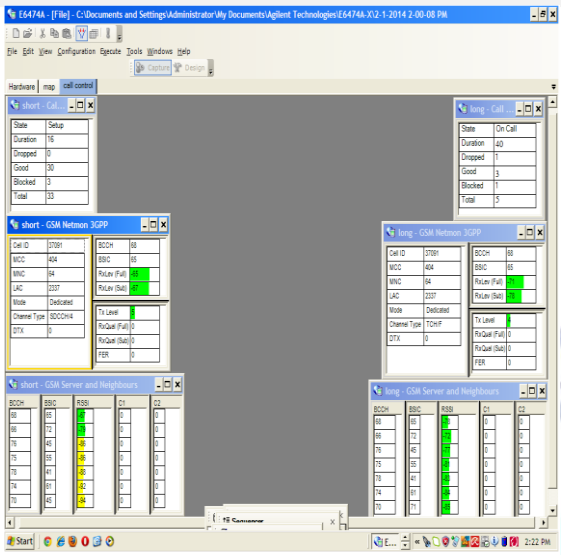

Figure11: Represent a call process (after optimization).

VI. CONCLUSION

The project describes simple procedure for cellular network performance estimation. In this project, it has been analytically provedthat we can optimize an existing cellular network using different methodologies and fine parameter tuning to offer remarkable QoS to the end users. Moreover, the issues discussed here are quite helpful for the analysis and performance evaluation of different cellular networks. Optimization teams use QoS reports in order to detect bad service quality areas .These reports also help to plan operators to enhance coverage, improve quality and increase capacity in the days to come. A mobile operator can also set its own QoS targets based on the KPIs in order to ensure end user satisfaction. QoS reports based on different KPIs are duly beneficial for Management team to compare network performance with the competitor's one (called benchmarking) and to plan network evolution and strategy. Moreover, it is hereby strongly recommended that all mobile operators must ensure a better QoS up to certain threshold and baselines in order to satisfy official regulatory bodies who penalize operators in case of customer complaints regarding service quality.

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