RF Optimization for call setup and analysis of GSM network using agilent tools

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Abstract: The Call Set up Success Rate, successful handovers, and maintaining the quality of call are most important features used by all mobile operators. So, it is extremely necessary and mandatory to identify possible means to measure these parameters and eliminate the existing problems in a GSM network. Therefore the different operators can use various type of optimization process. RF optimization is used to make proposals on how operators can optimize radio resources as well as provide the required of service quality to the subscribers. Since call drop and call failure are the major problems in the GSM networks. So this RF optimization technique helps to solve this problem.

Key words: RF optimization, GSM network, Drive test, Call drop, Call failure, Post processing, urban and rural areas, Quality of service (Qos), Coverage.

1. INTRODUCTION

Optimization is the most important step in the life cycle of wireless network. The post processing software is used to determine the RF coverage area and the interference problem and determine how these problems can be solved. Every node (BTS, BSC, and MSC) has its own counters; sometimes it can be incremented and sometimes decremented on occurrence of different events. These statistics are analyzed using the GSM event and the chart. If it is not satisfied, further it is analyzed to determine and troubleshoot the problems. As we have seen call rates and the call drop are the major problems in the GSM network. So this RF optimization is done in order to reduce such problems. In present wireless communication systems the customers demands the quality of service. The performance of GSM network is mainly based on radio network planning and optimization. Since there are many cells on the GSM network in which every cells transmit the signal to the end user. The main challenge of this research paper is to change the parameters of the transceiver stations in order to improve the signal quality and the coverage area. Due to increasing subscribers, the changing environments, rapid network expansion exceeding initial projections, capacity limitations due to lack of frequency resources and subscribers mobility profile changing, we need a continuous radio network planning (RNP) and Optimization process that is required as the network evolves. A system with good coverage will always be superior to a system with less good coverage. In this work the problem is analyzed first and then the test dive is carried out and then it is acted accordingly.

2. RF OPTIMIMIZATION

The mobile communication aims to offer anytime and anywhere communications between any objects.GSM network performance and QoS evaluation are the most important steps for the mobile operators as the revenue and customer satisfaction is directly related to network performance and quality. Radio frequency network optimization (RNO) teams play a very significant and vital role in optimizing an operational network to meet the ever increasing demands from the end users.RF Optimization is a very important process in any service providers operating lifecycle. It starts somewhere near the last phase of radio network planning, i.e. during parameter planning This means that the optimization process should be on-going, to increase the efficiency of the network leading to revenue generation from the network.

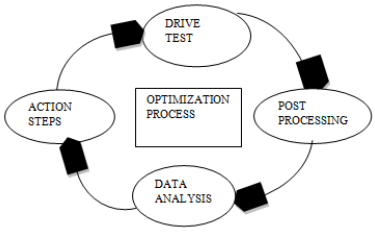

Figure 1: RF optimization process

3. OPTIMIZATION PROCESS

3.1. Drive Test

Agilent's JDSU E6474A v15.2 is the tool we have used for this work. Agilent's E6474A drive test tool has revolutionized and simplified end to end troubleshooting. The data as per the requirement are observed and recorded. The data is analysed for performance. Before starting the tests the engineer should have the appropriate kits that include mobile equipment, drive testing software, and a GPS (global positioning system) unit. When the drive testing starts, two mobiles are used to generate calls with a gap of few seconds. The third mobile is usually used for testing the coverage. The main challenge of this research is to provide the quality of service with low call rates and the data loss. Since the mobile user are increasing day by day, so the quality of signal from the same base station will be degraded and hence to increase the coverage area protect the call failure and call drop, such type of research is carried.

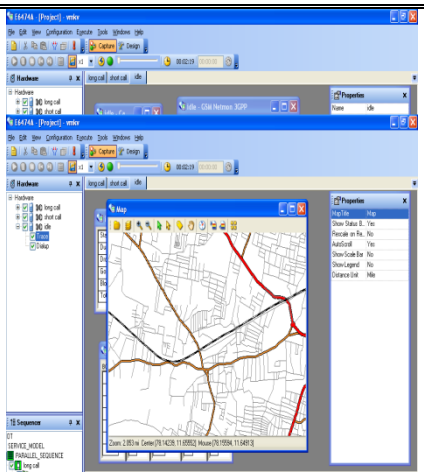

Figure 2: Road Map of drive test.

3.2. Post processing

Actix analyser is a software application from the Agilent that is normally used for the Network performance optimization. The post processing is RF optimization is done so as to provide feature testing. The GSN network may have many problem in the cellular networks such as call drop and call fail so this process helps us to determine the problems and the find the appropriate solution for the desired problem. This process also involves the competitive analysis of the different networks under different conditions. The post processing involves the one set of calls namely short calls and long calls. As we know the signal is received from the base station to the user. The received signal is determined by the base station. In cellular communication the frequency reuse is the most important parameter to be considered. If the user is at high speed, the network tower changes periodically and if handover is not performing at the threshold time then it results in call drop and call failure. The figure 2 and 3 shows the road map of GSM and the display of the proposed network. Data collected from the network management system is usually used to assess the capacity of the network. As coverage and capacity are interrelated, data collected from drive tests is also used for capacity assessment. The quality of the radio network is dependent on its coverage, capacity and frequency allocation.

3.3. Data analysis and Action steps.

From the GSM line chart window we have selected the corresponding line chart for long calls, short calls and idle calls. The line chart provide complete details of the serving cell BSIC, HSN, MAIO, Rx Qual, cell Id. Fig3 shows the analysis of the GSM network.

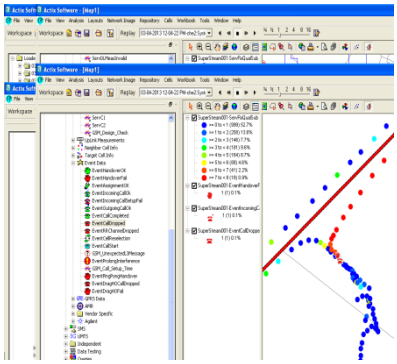

Figure 3: Display on map of the proposed GSM Network

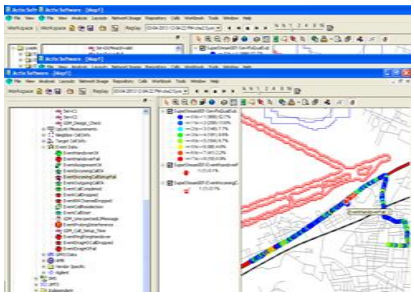

Figure 4: Plotting the event data of the proposed Network.

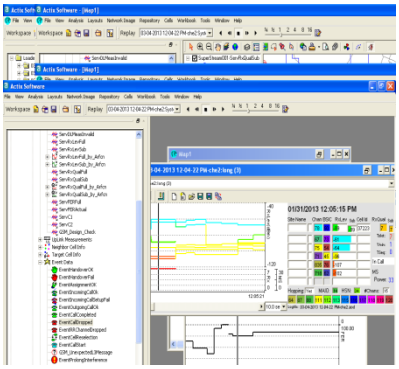

Figure 5: Plotting GSM charts

In the above figure, it is seen that the red line indicates the continuity of long call, the corresponding channel and BSIC are shown in the side column. Different channels are marked using different colours in the line graph. From the figure, the call drop is indicated by the termination of the red line. Moment the red line terminates, all the parameters such as RxQual, HSN, and MAIO are also terminated. This chart tells us about the time the call was dropped, the serving cell parameters, neighbour cells, BSIC. For short calls the calls are generated periodically for short duration of time say 10 seconds. Idle call does not perform any calls but remain idle.

4. CALL SETUP RESULTS AND EXPLANATIONS

The successful call set up consists of two procedures. The simplified description of these procedures is provided in the next text in such a way that the focus is only on the parts necessary to understand the philosophy of Call Set up Success Rate calculation correctly. First procedure is Immediate Assignment procedure which is used to create a signalling. Then comes the next signalization between the MS and network in order to activate the signalling. The MSC sends an ASSIGNMENT REQUEST message to the BSC requesting the assignment of a radio resource (RR). Then comes next signalization between BTS and BSC in order to allocate and activate a suitable RR (Traffic channel - TCH).If the TCH is successfully seized by MS, the BSC sends the ASSIGNMENT COMPLETE message. The call setup success rate is one of the key performance indicators (KPI) used by the network operators to assess the performance of networks and have direct influence on the customer satisfaction with the service provided by the network and its operator. CSSR is the number of successful attempts to make a call. Ideally, a network should be capable of accepting all the calls attempted to be made. The ideal value of CSSR is 1 i.e. the network should be capable of accepting 100 % of the calls made. CSSR is found out through a short call.

CSSR = Outgoing and incoming call setup/ Total number of Call attempts.

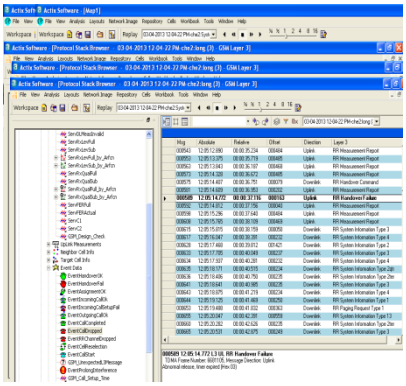

Figure 6: Detection of Handover failure.

In cellular telecommunication the handover refers to the transfer of ongoing call or data session from one channel of the core network to the other. The handover failure is occurred because frequencies cannot be reused in the adjacent cells. In cellular communication the when a user moves from one cell to another, a new frequency must be allocated for the call. In this research the handover failure is determined in the direction of uplink at an offset of 000163. In this case BTS is created in Chennai region considering 2 BTS, 0 and 1 which is 3 meter and 1 meter apart.

Agilent's JDSU E6474A v15.2 is preferred over other optimization tools because it can enable us to set the data at various levels in this project we have considered the maximum level up to 0 and minimum of -105 with the size of 12. This software can also be considered for multiple channels which are indicated by different colours and if we go on increasing in channels we found that the receive power level goes on increasing which ranges from -89 to -102. Using this tool enable us to easily determine the call setup failure and to troubleshoot them. Various failures include the low signal strength, channel congestion and hardware problems.

5. CONCLUSION

Due to the mobility of subscribers and complexity of the radio wave propagation, most of the network problems are caused by increasing subscribers and the changing environment. RF Optimization is a continuous process that is required as the network evolves. RF optimization is carried out in order to improve the network performance with the existing resources. Through RF Optimization, the service quality and resources usage of the network are greatly improved and the balance among coverage, capacity and quality is achieved.At present Drive Testing in GSM RF Optimization is being performing manually for the improvement of performance of the network. Instead of doing drive testing manually, there may be a scope of ANMS (Automatic Network Management System) process in which system, Drive Testing equipment can be attached to moving vehicle to serve in GSM test area and it can be monitored by the server. By using the internet, all the real time drive data can be simultaneously collected.

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