

Cluster Drive Test of Long Term Evolution using XCAL

Rakesh Patel, J. M. Keller, P. Mor

Abstract—Performance of a mobile communication Long Term Evolution Network depends on how the network is optimized. To optimize such network to deliver services (online gaming, video conferencing, video streaming, downloading, etc.), there is a need of collecting real time data which contains different network parameters details on which the network performance depends. The real time network parameters such as Drive Route, Coverage Plot (overall, sector Alpha, sector Beta, sector Gamma), Mac Layer Throughput Download, Mac Layer Throughput Upload and PCI Plot etc. plays an important role in mobile communication network and the major reason of network performance. To collect real time network parameters details drive test is performed using the drive test tool XCAL. This paper concentrates on the procedure of Cluster drive test and the results obtained after completion of the test.

Index Terms— LTE, SINR, PCI, PUSCH, RSRQ, DTDL, DTUL, FMS, VoL, VoS

1 INTRODUCTION

Drive test is a procedure of collecting real time data which contains mobile communication long term evolution network parameter details. In long term evolution drive test perform two test i.e. single cell function test and cluster drive test. In this paper the details of cluster drive test is given. Cluster test is perform to collect the data of network parameters details of more than one cell. This test is perform when the network is in working state and checking the interference between the two cells as well proper handover take place or not. The details of network parameters such as Drive Route, Coverage Plot (overall, sector Alpha, sector Beta, sector Gamma), Mac Layer Throughput Download, Mac Layer Throughput Upload, PCI Plot, Quality plots of RSRQ, SINR and PUSCH is collected and with the help of obtained result trying to optimized the long term evolution network to deliver service more efficiently. Cluster test is perform for both voice call and data call testing. One by one both the test perform and collect the real time data of Long Term Evolution network [1][8]

2 PROCEDURE

For performing Cluster drive test XCAL tool is used. XCAL is a mobile software installed in a LTE compatible handset and is registered via mobile communication vendor. Step by step procedure is shown below to perform cluster drive test:

Press the setting button on the mobile and select FMS (Fleet Management System) mode, and enter the basic details for which the Cluster Test is perform i.e. frequency band and destination,

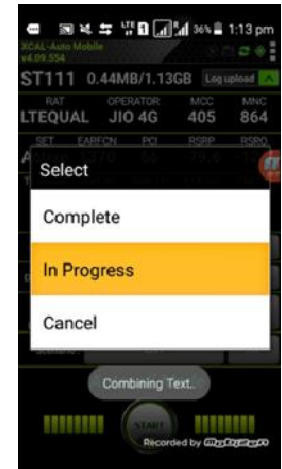
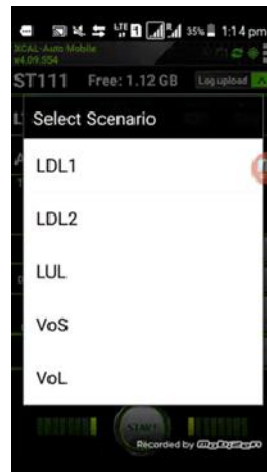
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Next, press setting three more fields are to be filled i.e. select Cluster from select type, enter Cluster details for which drive test is performed, select count 1 from cycle option because the test is performed only one time and press save button,

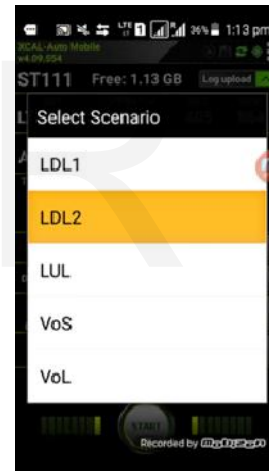
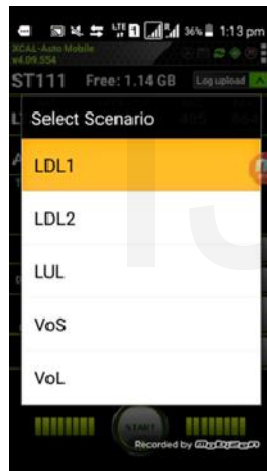


Next, press scenario option; there are five options in select scenario option i.e., LDL1, LDL2, LUL, VoS, VoL. Select above five option one by one and perform test,



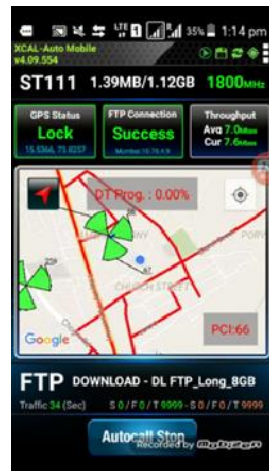
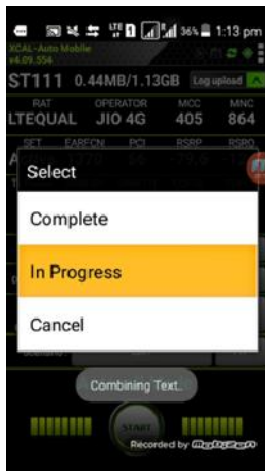
Now, select LDL1 and press Start button to perform LDL1 test

After completing LDL1, there is need to change scenario from LDL1 to LDL2 to perform LDL2 test, this test is perform to check for accuracy of LDL1 data transmission down link speed. The purpose of LDL1 and LDL2 are same i.e. to calculate the downlink speed. LDL2 test is perform to cross verify the LDL1 test,

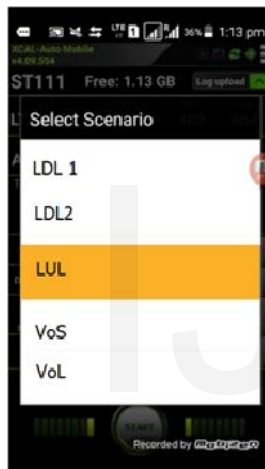


After selecting LDL1, the screen appears below which shows that the GPS value for which the test is perform is locked for testing purpose and File Transfer Protocol (FTP) connection successful to data transfer. It also shows the current RSRP network values as well as average and current Throughput. After LDL1 test is completed call is automatically stop and there appears queries to complete the test or the test is in progress, here option in progress is to be selected,

After selecting LDL2, the screen appears below which shows the details same as LDL1, it also shows the current GPS values where test is performed. After successful completing LDL2 call is automatically stop and there appears queries to complete the test or the test is in progress, here option in progress is to be selected,



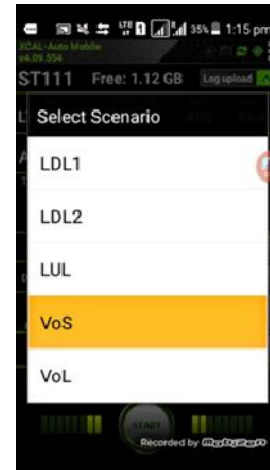
After completing LDL2, there is need to change scenario from LDL2 to LUL, the LUL test is perform to test the uploading speed,



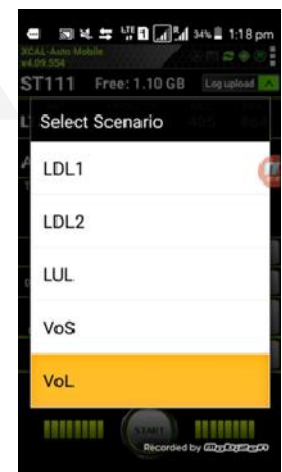
After selecting LUL, the screen appears below which shows the details of data uplink. By pressing detail view it also shows the Cluster PCI details of current and surrounding. After successful completing LUL call is automatically stop and there appears queries to complete the test or the test is in progress, here option in progress is to be selected,



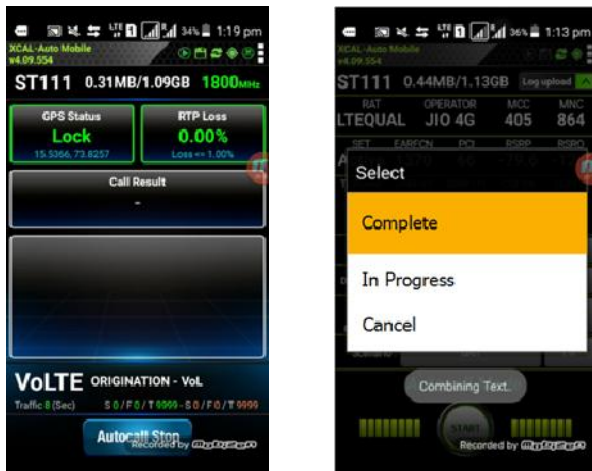
After completing LUL, there is need to change scenario from LUL to VoS, the VoS test is perform to test the Voice Calling



After selecting VoS, the screen appears below which shows the details of voice calling. The screen shows the GPS status, current cluster PCI, SINR value and how many times the call is attempt their success and failure. After collecting all the details of VoS call is automatically stop and there appears queries to complete the test or the test is in progress, here option in progress is to be selected,



After selecting VoL, the screen appears below which shows the details of long duration voice calling. The screen shows the GPS status and RTP Loss, VoL test is perform for long duration by moving from one cell to another and collecting the data of proper handover takes place or not, interference, call disconnection. After completion of the VoL test, as VoL is the last test performed the complete option is selected to complete all the tests.

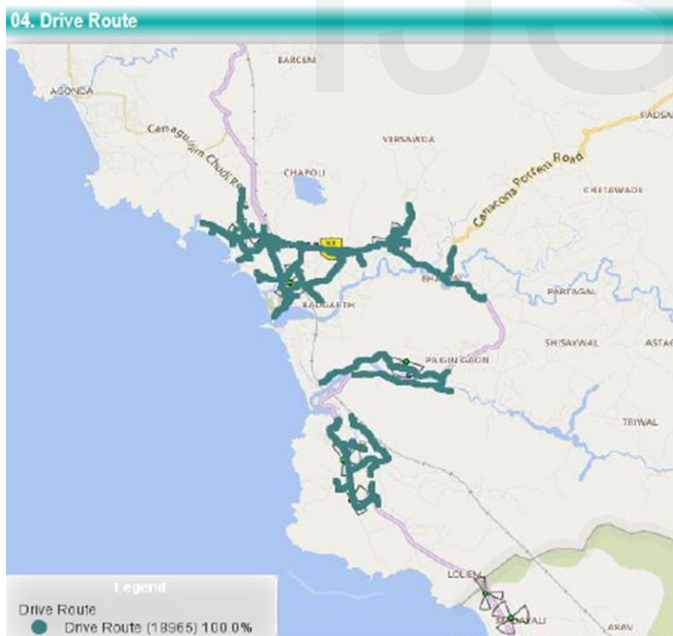


After perform Cluster Test the generated outputs which shows the complete details of network parameters for analysis purpose. The generated outputs Cluster Test are shown below:

3 RESULTS

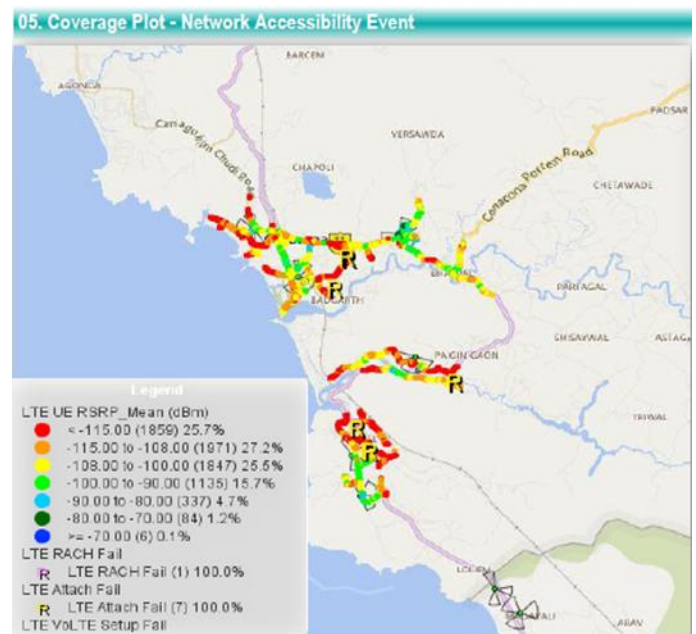
Following results are obtained after performing Cluster Test for both voice calling, data download and upload. The parameter details along with the desired range are also shown:

A. Drive Route



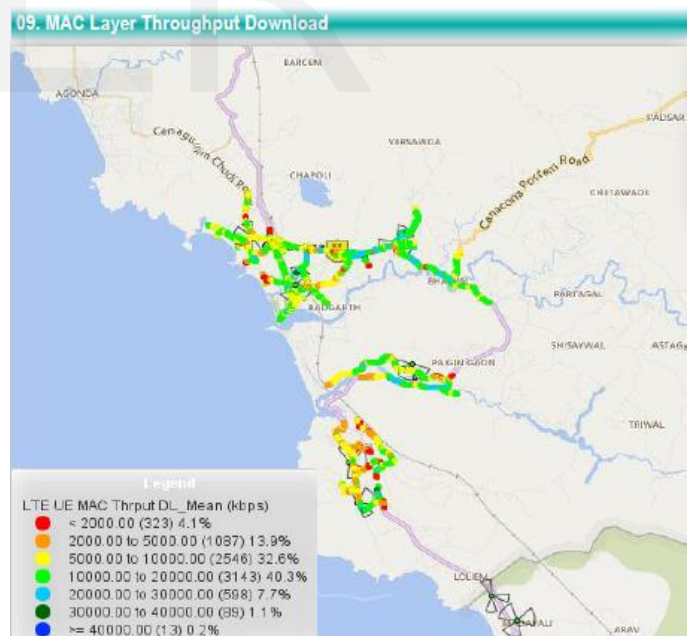
Drive route shows the complete area for which the cluster drive test is perform

B. Coverage Plot - Network Accessibility Event



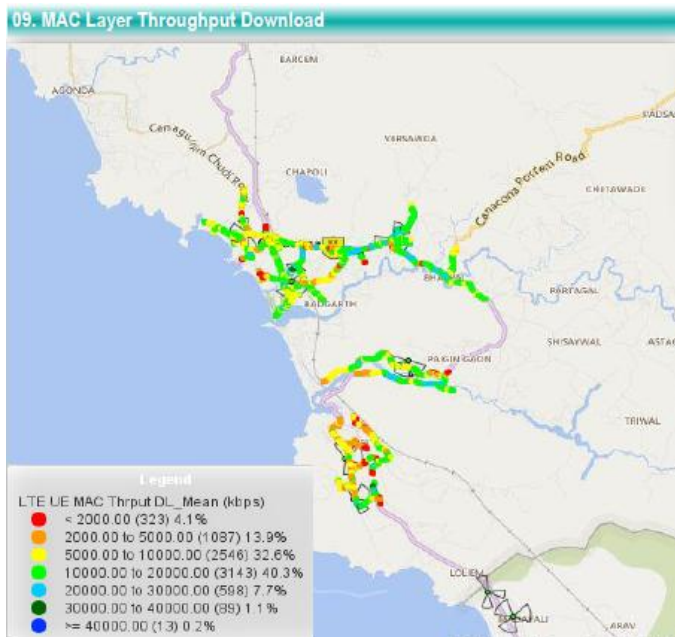
Coverage plot shows the network coverage details of mobile communication long term evolution network

C. MAC Layer Throughput Download



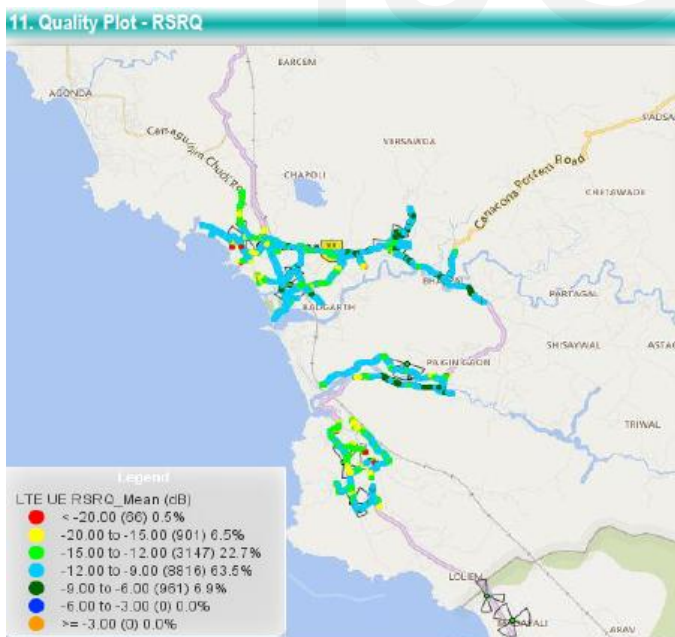
It shows the overall point to point MAC Layer Throughput Download values. Different colours shows the different range according to the transfer rate of packets [3][4]

D. MAC Layer Throughput Upload



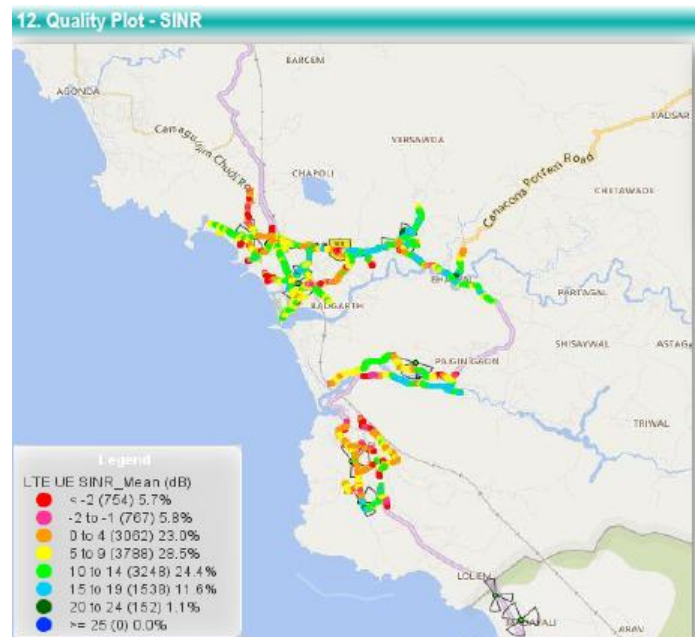
It shows the overall point to point MAC Layer Throughput Upload values. Different colours shows the different range according to the transfer rate of packets. [3]

E. Quality Plot – RSRQ



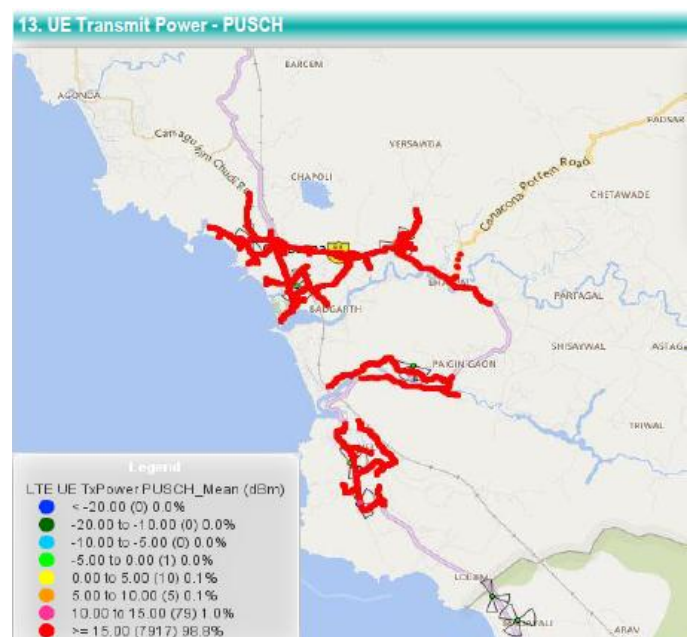
RSRQ (Reference Signal Received Quality): It is defined as ratio $N \cdot \text{RSRP} / (\text{EUTRA carrier RSSI})$ where N is the number of RB's (Resource Block) of the EUTRA carrier RSSI measurement bandwidth. [5][6]

F. Quality Plot – SINR



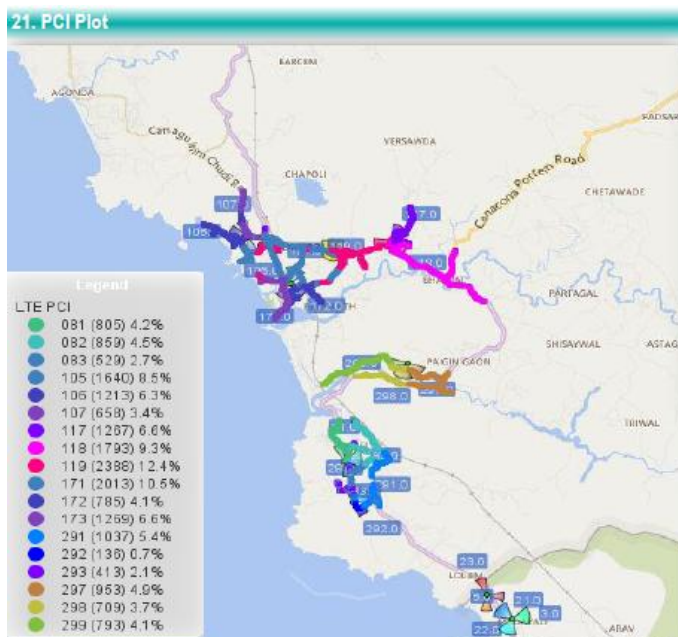
SINR (Signal to Interference - plus - Noise Ratio): It is a measure of the quantity of wireless connection and represents theoretical upper limit on channel capacity in wireless communication systems or the network. SINR can be defined as the power of desired signal divided by the sum of interference power and power of receiver noise.[6][7]

G. UE Transmit Power –PUSCH



This LTE channel is used to carry UCI(Uplink Control Information). If UE has application data OR RRC signalling then UCI is carried over PUSCH [10][11][12]

H. PCI Plot



PCI (Physical Cell Identity): The PCI uniquely identifies a cell on the LTE interface. PCI will determine the primary and secondary synchronization signal sequence. It has a range of 0 to 503. It is possible for the PCI to be repeated in the network. The two cells that share the same PCI should not be geographically close to each other otherwise they will interfere with each other. [10][11]

4 CONCLUSION

After performing Cluster Drive Test for Voice calling, Data Download DTDL and Data Upload DTUL, the above result is achieved. The result shows the details of parameters along with its desired range. The region for which the Cluster drive test is performed delivers the good signal strength and better coverage; the data transfer speed of data downlink and data uplink is also good and the area covered is maximum area where the test is performed.

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