A review on drive test and site selection for Mobile Radio Communication

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***Abstract*— In cellular system propagation models designed for the specific areas or terrain. When these models used in different environment, efficiency of the models is suffer. This change in efficiency affects coverage, capacity and Quality of Service (QoS) of cellular mobile network. Drive testing is method of measuring and assessing the QoS of mobile network. Different sites of recent technology 2G, 3G, HSPA, WCDMA, Long Term Evolution (LTE), WiMAX are analysed by drive testing with TEMS Investigation tools. These different sites analyses with different parameter like Rx Lev, Rx Qual, FER, BER etc. The aim of this paper is study of the drive test process and RF planning in Mobile communication. Different parameter of drive test is also discus in this paper.**

***Keywords*— drive test, RF parameter, TEMS Investigation.**

I. INTRODUCTION

In order to study the nature of radiation pattern and strength of signal for a particular terrain we require certain king of modeling. These models are used for predicting the path loss between transmitter and receiver site. Due to this prediction we analyses the characteristics of propagation models. Efficiency is major characteristic of propagation models. Efficiency of the propagation models suffer when these propagation models used in different areas. Changes in efficiency affect the QoS of mobile networks. Designing of the drive test is based on the following two objectives.

A. Pre-design drive test

B. Post-design drive test

A. Pre-design drive test:-

Pre-design drive test is used for measurement integration. It is the beginning of design phase, when no site has been selected or built. This step is most important for measurement of characterization of propagation and fading effects in channel. In this process the field data is collected and it is use for optimizing or adjusting propagation models.

B. Post-design drive test:-

Post-design drive test is use for site verification/optimization. In post-design phase the initial set of sites are selected. Coverage of the network is also analyzed in this process.

II. WHY DRIVE TESTING

Drive testing consists of test teams which drive on pre – defined routes of network region. In this process we analysis calls and measuring the strength of signal. Unsuccessful handovers, quality if audio and call drop etc. also analysis in drive test with test data collection.

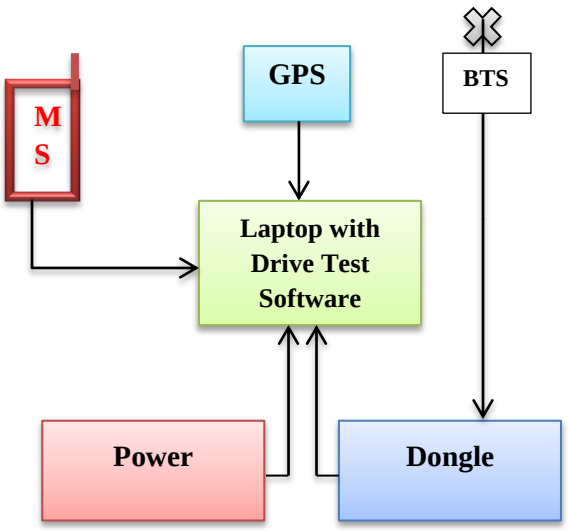

Fig01 – Drive testing system

These result are transferred from the MS to a dedicate PC. In drive test process various data groups are

processed in order to produce graphical and tabular data the complete process interpreted by the test engineer. Both radial and azimuthal routes are tested in drive process. In urban and sub-urban areas the effect of street orientations has to be considered in this process. In rural area the effect of foliage pattern is also considered in drive test process. Both line of site (LOS) and non-LOS position of the MS or receiver with respect to transmitter have to be included in the drive test.

Fig01 show the drive testing system, it consist GPS system, dongle, laptop with drive test software, mobile station and power system. GPS system, dongle and mobile connected with laptop. Drive testing software installed in laptop. Drive testing software provide interface between dongle and laptop. Laptop analyzes the complete drive testing process. Power system is important part of this process. GPS-system used for navigation. Dongle receive the signal which transmits by BTS. [1]

III. TEST SITE SELECTION

In the site selection maximum height of the building (in urban and sub-urban areas) and vegetation (in rural areas) is to be considered. Cluttering pattern of both building and vegetation also considered in the measurement. Location and height of the base station antenna is major parameter for the site selection.

At the time of drive test the collection of data processed from all sector of the transmitting antenna. All sector of transmitter antenna located at 120*.

The height of the base station antenna is 35m and above the ground. Base station antenna located at masts and few other were on rooftops. Bandwidth of the transmitted signal is 806-960MHz (806-880MHz/880-960MHz).

IV. RF PARAMETER FOR DRIVE TEST

Drive test are analyses by the different parameters. They are based on the strength of receiving signal, frame erasure rate, bit error rate, quality of speech and carrier – over – interference ratio. [2]

A. Receiving level (Rx Lev):-

Receiving level consider strength of the signal at receiver. Receiving level measure in dB. Range of the receiving level is -30dB to -110dB.

B. Quality of voice (Rx Qual):-

Quality of voice at receiving level measure be bit error rate (BER). Range of Rx Qual is 0 to 7.

C. Frame Erasure Rate (FER):-

Frame Erasure Rate represents the percentage of frames being dropped due to high number of non-corrected bit errors in the frame. FER indicate the quality in network.

D. BER Actual:-

It is the ratio of number of bits errors to the total number of bit transmitted in a given time interval. It measures the voice quality in network. BER depend on Rx Qual. BER useful and countable up to 12.8% which corresponds to Rx Qual of maximum 7.

E. SQI:-

SQI is best criterion to use for optimizing the speech quality in network. SQI dedicated to reflecting the quality of speech (as opposed to radio environment conditions). SQI is updated at 0.5s intervals. It is compute on basis of FER and BER. Ideal value for EFR30 is FR -21 & HR -17.

F. Carrier – over – interference ratio (C/I):-

It is the ratio of signal strength of the current serving cell and the signal strength of undesired signal components. It should be at least greater than 9.

V. LOSS AND FADING FOR DRIVE TEST

Strength of received signal is major factor for drive test. Lot of variations arises in strength of the received signal at the receiver site. Variation in signal is analyzed by the following three types of phenomena.

A. Propagation loss

B. Slow fading

C. Fast fading

A. Propagation loss:-

Propagation losses are depends on the environment of the site. Changes in environment also affect the propagation loss. Variation in propagation is 20-50dB per decade. Propagation loss over terrain, foliage and/or buildings may be attributed to various phenomena including, diffraction, scattering or absorption.

Propagation losses are important factor for mobile telephone and many different propagation models for built in different areas. Predication of the propagation loss is done between transmitter and receiver.

B. Slow fading:-

Fading describe the rapid fluctuation of the amplitude of a radio signal at travel distance over short time period. Slow fading is due to shadowing and usually modeled by a log-normal probability density function. Log-normal random process is used for analysis of slow fading. Slow fading is time-dispersive or frequency-dispersive. Doppler profile of the channel is also major factor for slow fading. [3]

C. Fast fading:-

Fast fading arise due to multipath effects in the received signal at receiver site. Rayleigh or Ricean distribution is used to analyses the fast fading. It describes the statistical time varying nature of the received signal. Rayleigh distributed signal envelope as a function of time. When strength of the signal is rapidly changed as compared to the rate of change of the channel is called fast fading. [3]

VI. DRIVE TEST STEPS

Drive test consist following step.

Step1- opens investigation software like TEMS (v8.1, 9.1, 10.1 and 13.1) in laptop. When system open, it show GSM window by default. Empty tables and charts on display meant for RF information.

Step2- Red color symbol indicate the disconnection status of both external device dongle and GPS. After clicking 'connected ALL' in connection toolbar both devices connected and red color change to green color.

Step3- in next step mobile is connected in the 'idle mode'. The GSM window started and shows latitude & longitude of the place and displaying live network data in the corresponding tables and charts.

Step4- now click to 'record' tool bar and save log file, followed by originating call on the place.

Step5- drive on that routs which covering the cell and neighboring cells.

Step6- coverage of cell, strength of received signal, call connection, FR parameter and many other considerations checked and record with log file.

Step7- finally log file is generated. It can be exported to different format for post processing requirements.

VII. DATA COLLECTION TOOLS

The TEMS Investigator dongle and software versions 8.1, 9.1, 10.1 & 13.1 used for the collection of data sample of measured signal at the time of drive test. It has the accuracy of ±4dBm. The calibrated power was -100 ≤ - ≤ -40dBm. A geographical positioning system (GPS) receiver collects the location information of the dongle as well as drive test vehicle. The accuracy of the GPS is ± 15m. This accuracy is better than previous value of ±200m - ±300m. The selective variability was switch off in the recent past, it improved the accuracy of the GPS dramatically. [3][4]

TEMS Investigation is the tool for troubleshooting, verification, optimization and maintenance of wireless networks. TEMS offers single equipment with multiple functions like data collection, real-time analysis, and post-processing, TEMS Investigation eliminates the need for multiple tools, reducing costs and saving time and effort for operations staff. TEMS investigation supports all major technologies, making it the ideal testing solution both for rolling out new networks and for ensuring seamless integration with existing networks.

Using TEMS Investigation, operators can increase accessibility, improve retain ability, and achieve

better service performance. TEMS Investigation support for LTE (FDD and TDD), GSM, GPRS, EDGE, WCDMA, HSPA, HSPA+, TD-SCDMA, CDMA(IS-95 TO EV-DO Rev B) and WiMAX, together with support for a wide range of services.[5]

The tool ensures seamless integration among LTE, WCDMA/HSPA, and GSM/GPRS/EDGE networks as well as LTE, CDMA EV-DO, CDMA200 and IS95 networks.

VIII. CONCLUSION

Drive testing help us to measuring and assessing the Quality of Service, coverage and capacity of mobile network. TEMS Investigation is main tool of drive testing. It consist both hardware and software. Resent version of TEMS Investigation software is 13.1. Hardware of TEMS Investigation is a dongle. TEMS Investigation support for LTE (FDD and TDD), GSM, GPRS, EDGE, WCDMA, HSPA, HSPA+, TD-SCDMA, CDMA(IS-95 TO EV-DO Rev B) and WiMAX, together with support for a wide range of services. Selection of test site based on the height of base station antenna, height of building and vegetation (in urban sub-urban and rural areas).

IX. REFERENCES

[1] RF Planning and Drive Test (E1-E2 consumer mobility).

[2] Performance assessment of HSPDA networks from outdoor drive test measurements.

Joaquin Matamales, David Martin – Sacristan, Jose F. Monserrat and Narcis Cardona. 978-1-4244-2517-4109. 2009 IEEE.

[3] Rapport T.S Wireless Communication Principles and Practice 2nd.
Ed. Upper Saddle River, NJ 07458 Prentice Hall PTR. 2002.

[4] Efficient path loss prediction in mobile wireless communication network,

Vishal Gupta, Sandip Vijay and S. C. Sharma, ISN2008, Feb. 22-24, 2008, Pg-271.

[5] TEMS Investigation release notes, ASCOM, document. NT11-21089, www.acom.com/networktesing, 2011.