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Performance Evaluation of Wide Band Channel At 900 MHz Using Lee Model

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Abstract: *In this paper, deterministic model using a Lee model developed for use at 900MHz and has two modes which is also used to characterize a wide band propagation channel in terms of received signal strength from which we computed the pathless Exponent of the environment, the power delay which enable profile of microcellular radio propagation at 900MHz band for Enugu Suburban environment in Nigeria. the predicated values of the received signal strength were compared with measurement conducted at the particular sets with reference EN001 and found to be in an agreement.*
Keyword: *Pathless Exponent, Lee Model.*

I. Introduction

Wireless network is the major medium of communication between the people in today's tremendous growing world. The demand for this type of communication is increasing day by day, therefore, to handle this demand, more wireless network has to be established to obtain the high data rate requirement [1]. This is also to say that communication is always necessary in building relation mankind, that is, when two individual meet, they need some medium to interchange their views but due to distance barriers some tools are require in order to communicate each other. Scientist has land the first wired base telephony equipment and it revered a voice communication for the people. After this, radio based communication system era started which was an extension of wired based network and propagation modeling's is an effort to predict how the propagation channel affect the transmitted signal. They are used extensively in network planning particularly for conducting feasibility studies and during initial deployment. These model can broadly categorize in to three categories empirical based on observation and measurement, stochastic deals with series of Radom variable while deterministic model of term require. A complete 3-D Map of the propagation environment. They are appreciate in cases when an accurate radio network planning is require often as a benchmark depending on the modeling approach they can provide, both narrow band and wide band analysis inclusive pathlos exponent, delay spread and angular spread of the propagating waves. [3].

II. Evaluation Of 3g Mobile Communications

The evolution of mobile communication from second Generation (2G) network to third Generation is shown in Figure 1. The wide spread god mobile communication has led to the development of new wireless systems and standards which are Global System of Mobile Communication (GSM), pacific Digital Cellular (PDC), integration a digital enhance network (IDEN), Interim Standard 136 (15-136) and interim standard 95A (15-95A). These are all' 2nd Generation (2G) mobile communication system [4]. General packet radio service (GPRS) part of enhanced Data rate for GSM evolution (EDGE) and 15-95B are 2-5 generation (2-5G). the universal mobile Telecommunication System (UMTS), 1XRT CDMA 2000 subdivided into 1XEV-DV, CDMA 2000 and JXEV-VD CDMA 2000 are third Generation (3G) mobile communication system. The GSM account for 65% of the word mobile digital market while CDMA 2000 is 20% [5].

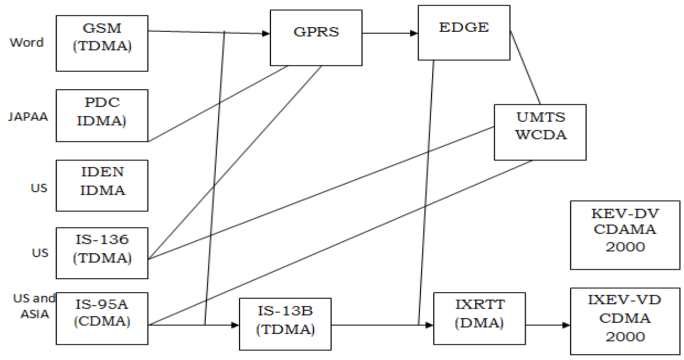

Fig. 1 : Evolution of 3G mobile communication

III. Lee Model

This model inclusive a frequency adjustment factor that can be used to increase the frequency range analytically. This radio propagation operations at 900MHz built as two different modes which includes an adjustment factor that can be adjusted to make the model more flexible to different regions of propagation.

The lee mode is define as

$$L = L_0 + yLogd.\ 10Log\ F_A \qquad [1]$$

Where L = the medium pathloss in (dB)

L_0 = the reference Pathloss along 1Km in (dB)

Y = the slope of the pathloss curve in decibels per decade.

d = The distance on which the pathloss is to be calculated.

E_A = The slope of the pathloss curve in decibels per Decade

The reference pathloss L_o is defined as

$$L_o = G_B + Gm + 20\ (Log\ A\text{-}Log\ d)\ \text{-}22.$$

Where G_B: Based antenna gain in dB

Gm = Mobile Station antenna gain in dB

X = Wavelength in meter (m)

d = The distance (m)

The adjustment factor is calculated as

$$F_A = F_{BH} \times F_{BH} \times F_{BG} \times F_{MH} \times F_{MG} \times F_F \qquad [2]$$

Where

F_{BH} = Base station antenna height correction factor.

F_{BG} = Based station antenna gain correction factor.

F_{MH} = Mobile station antenna light correction factor.

F_{MG} = Mobile station gain correction factor.

F_F = Frequency correction factor.

But $F_{BU} = \left(\frac{h_B}{30.48}\right)$ [3]

And $F_{BG} = \frac{G_B}{4}$ [4]

Where G_B is measured in decidable with respect to half wave Dipole antenna (dBd)

$$F_{MH} = \begin{cases} \frac{hm}{3} & \text{if } hm < 3m \\ \left(\frac{hm}{3}\right)^2 & \text{If, } hm \leq 3m \end{cases} \qquad [5]$$

But $F_{MG} = G_M$ [6]

Where G_M is the gain g mobile antenna. The frequency correlation factor is defined as

$$F_F = \left(\frac{F}{900}\right)^{-n} \quad \text{For } 2 \propto n \propto 3 \qquad [7]$$

Based on empirical data fairly general model, this model predicts the mean path loss L_P (d) [dB] at transmitter t D receiver separation d is

$$I_p\ (d)\ [dB] = L_P\ (d_o)\ [dB] + 10_n log\left(\frac{d}{d^0}\right) \qquad [8]$$

Where n = Pathloss exponent which is 2 for free space. The term L_p give the pathloss at a known close in reference distance do. Thus pathloss beyond some reference distance can be written as.

$$L_p\ (d) = L_p\ (d) + 10_n\ Log\ \left(\frac{d}{d^0}\right) + S \qquad [9]$$

Where S is the shadowing factor

IV. Result And Analysis

In his paper, the result collected as well as the simulated result is analyzed. The measurement was carried out in sub-urban region of Enugu, and the network is located at a point with longitude 6.45105 and latitude 7.52788. The measurement environment comprises of few buildings, tree and vegetation. The average building height of height of the test bed area is 15meters.

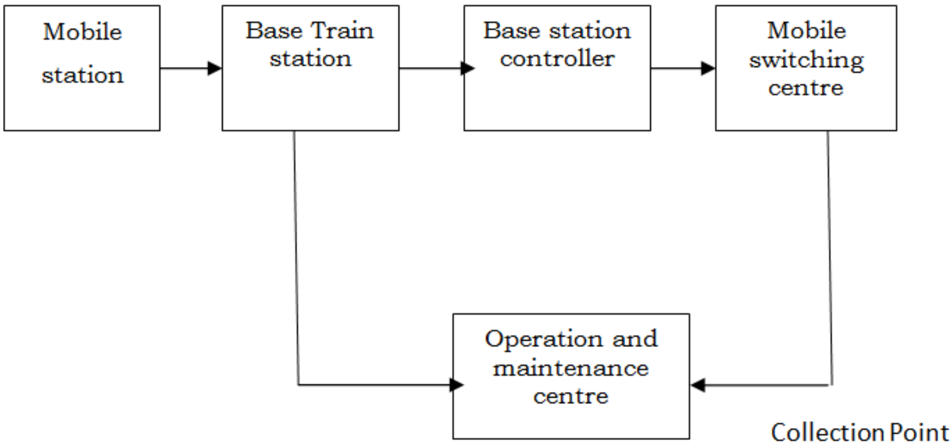

Fig. 2: Block Diagram of Collection Point

According to Equation (8) the pathloss exponent model was simulated using MATLAB. In these simulation, graphs difference parameters were optimized to improve the quality of service with best commotion regardless of device any time.

3.1 Computation of Pathloss Exponents

After carrying out the measurements of the received signal strength (RSS) that is pathloss exponents for real time measurement.

$$n = \sum_{L=1}^{m} = 1 \ \underline{\rho l(di) - pL(do)}$$

$$\sum_{h=1}^{m} = 10Log_{10}\left(\frac{d^1}{d^0}\right) \qquad - (10)$$

Where PL (do) = pathloss at close reference
Do = from transmitter
PL (di) = Pathloss at various distance form transmitter
$\frac{d^1}{d^0}$ = distance from transmitter with reference distance
Let N = $\sum_{1-1}^{m} = 10 \log \left(\frac{di}{do}\right)$

The received signal strength was measures with a reference point market 'x' from the base station. Measurement of receive signal strength was carried out at 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 --- 1700 meters. The distance between transmitter and receiver (Tx and RX) was provided with the help of GPS. The measurement was carried out from 08am-10am, 11am -1pm and 2pm – 6pm.

Table 1: Reference median pathloss for Lee' Model

Environment	L_odB	Y
Free space	85	20
Open space	89	43.5
Suburban areas	101.7	38.5
Philadelphia	110	36.8
Newark	104	43.1
Tokyo	124	30.5

Table 2: Shown that simplest model to improve received signal strength is to increase the transmit power.

Pathloss dB	Standard deviation	Transmitter power	Distance	RSS on BM)
2.0	6.0	0	100	3.2966
2.2	6.6	10	91	7.3611
2.4	7.2	20	82	11.4387
2.6	7.8	30	73	16.2481
20.0	8.4	40	64	21.9513
3.0	9.0	50	55	28.7800
3.2	9.0	60	46	37.0885
3.4	10.2	70	37	7.4238
3.6	10.8	89	28	60.8406
3.8	11.4	90	19	79.5113

V. Summary of Result

Table 2 shows that the simplest model to improve received signal strength is to increase the transmit power and as a result of this, as the distance of mobile host (MH) increases from the access point of wireless the signal strength becomes weaker. Therefore to engineer stability in the network system, the power of the desired signal dust be chosen such that the resultant interference is manageable.

VI. Conclusion

We have shown that with acceptable computation time, it is possible to compute important wideband channel parameter that are necessary to characterize this particular environment without necessarily going to base station to take real time measurement hence cutting short the tables of carrying out real time. Measurements in a base station in a bid to acquire parameters of interest which have important implication when designee a parameter for designed receivers that employ spatial diversity.

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