



MISSILE TELEMETRY DATALINK CALCULATION (A MATLAB PROGRAM)

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Abstract: This article describes a missile telemetry data link calculation analysed by executing matlab program. A missile of a length of 9 meters and a Launchpad of a height of 30 meters having a telemetry data link to a receiver at a distance of 30 to 150 meters.(MOVING OR MOBILE") The field strength is calculated by using matlab program using FRIIS Transmission formula and Empirical Loss models of propagation loss and polarization mis match loss and cable attenuation and reflection coefficient of both Transmitter and Receiver. The loss model taken is SAKAGAMI MODEL.

Indexing terms: f,d,W, THETA, hs, H, hb, hbo.

I. INTRODUCTION

The telemetry data link analysis is done by using a matlab program. The transmitting antenna is a simple patch of gain of 3dB. And frequency is 3GHz. The receiving antenna is a pyramidal horn of gain 7Db. The Source Tx.power is 25 watts. The power delivered(i.e.) The TX.power output is 10 watts. Propagation prediction models play an important role in the design of mobile radio communication system by specifying the key parameters such as Tx.power, frequency reuse and so on. For example one relatively long range prediction model for macrocell systems uses base and mobile station antenna heights and frequency. On the other hand a prediction model for short range estimation that was designed for micro cell systems uses building height, street width and so on.

The long range prediction models are OKUMURA-HATA Model and IBRAHIM-PARSON MODEL etc. In the models described above, the distance d is more than 1Km. and the base station antenna height hb is higher than the roof top level of surrounding buildings. This means that the models are suitable for macro cell systems.

II. DESCRIPTION OF MISSILE TELEMTRY DATALINK

A matlab program is executed for analysis of missile telemetry data link by selecting a range of less than 1Km.(i.e.50-300meters).and a prediction formula for loss factor is SAKAGAMI etal model.

The formula is as follows:

$$L(Db)=100-7.1\log(W)+0.023(\text{THETA})+1.4\log(hs)+6.1\log(H)-[24.37(H/hbo).^2]\log(hb)+[43.42-3.1\log(hb)]\log(d)+20\log(f)+\exp\{13[\log(f)-3.23]\}.$$

The parameters are

- F: frequency 3 GHz.
- D distance from transmission point (meters) 50-300
- W street width:-50 meters.
- THETA: street angle to the base station(degrees):90
- hs: building height above ground in meters:80
- H: average building height in meters-30
- hb: Transmitter station antenna height above the receiver:100meters
- hbo: missile and launch pad height above ground in meters:100.

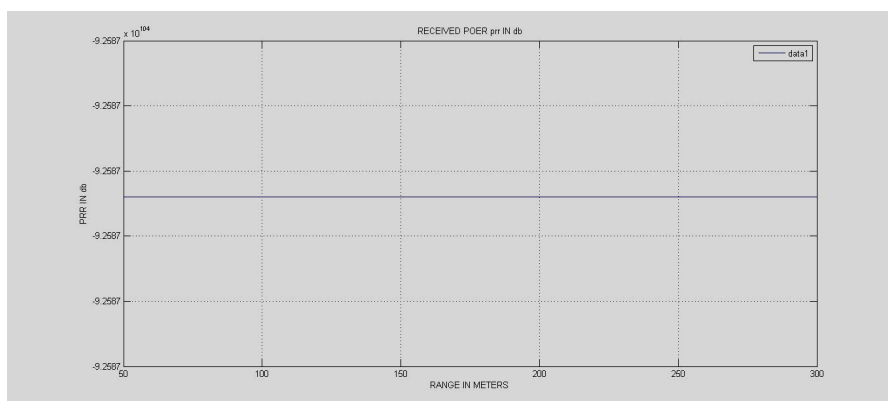
The matlab program is executed using the SAKLAGAMI MODEL and the results are plotted as figure1 & figure2.

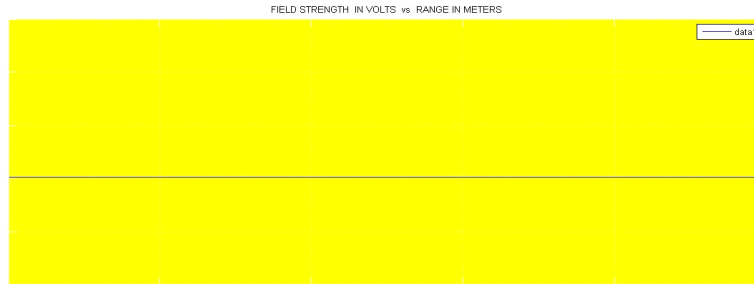
III. CONCLUSION

The simulation is done to calculate the field strength while for a fixed tx and a mobile receiver which moved from 50 to 300 meters. It is observed that the field strength and received power are constant and not varied. The SAKAGAMI MODEL may indicate the ultimate empirical formula for short range pathloss prediction. For smaller area prediction, it seems necessary to consider the actual propagation paths between base and m mobile station antennas using precise environment data of the prediction area.Although the details are taken for base and mobile communication the same holds true for missile telemetry.

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%APPENDIX-A MATLAB PROGRAM

```
ps=input('Enter the value of sourcr tx.power in watts=');
psdb=10*log10(ps);
f=input('Enter the value of frequency in Hz=');
c=3.0e+08;%velocity of light in meters
pt=input('Enter the value of tx.power in watts=');
ptdb=10*log10(pt);
Ltc=psdb-ptdb;
Lrc=Ltc;
gammat=1.0;
gammar=1.0;
R=50:1:300;%range from tx.in meters
%R=50:1:3000;
pant=pt;
pantdb=10*log10(pant);
GT=input('Enter the value of tx.antenna gain indb=');
GR=input('Enter the value of RX.antenna gain in db=');
lambda=c/f;
PR=pantdb+GT+GR+20*log10(lambda)-Ltc-Lrc-20*log10(4*pi*R);
```

% CALCULATION OF LOSS FACTOR

```
d=50:1:300;%distance from tx.in meters
W=50;%STREETWIDTH IN METERS.
THETA=90;%street angle in degrees.
hs=80;%building height above the ground in meters.
H=30;%Average building height in meters.
hb=100;%base station antenna height above the mobile station in meters
hbo=39;%missile and launchpad height above ground in meters
```

% FORMULA TO CALCULATE LOSS FACTOR IN db

```
LSdb=100-7.1*log10(W)+0.023*(THETA)+1.4*log10(hs)+6.1*log10(H)-[24.37-3.7*(H/hbo).^2]*log10(hb)+[43.42-3.1*log10(hb)]*log10(d)+20*log10(f)+exp(13.*(log(f)-3.23));
Lpdb=1;%polarization loss in db
PRR=PR-LSdb-Lpdb;
Prec=pinv(log10(PRR))/10;%RECEIVED POWER IN WATTS/MT.^2;
zo=50;
V=sqrt(Prec*zo);
figure(1)
plot(R,V);
figure(2)
plot(R,PRR);
```



CONCLUSION: This article gives a very interesting parameter field strength value which will not vary at any cost for short area. Also the propagation models are described such that loss factor can be calculated by using Matlab Program.

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