**Appendix II: MATLAB Scripts**

>> Nf=3.16; %equivalent of 5dB noise figure for LTE receiver

Nt=3.98e-10; %Thermal noise

Bw=20000000;

MDS=3.16e-20;

% the transmit power threshold will be determined by MDS

% i.e MDS sets transmit power threshold at a point greater than MDS by 4dBm

% the SNR threshold will be set for vlice(realtime) for best case

% path loss coefficient to be consider will include

% Urban area=3.5, indoor L/S = 1.8, Outdoor

Prm=1; %receive power of eNB 3.16e-20

Prf=1; %receive power of FeNBt 3.16e-20

Gt=1;

c=3e8; %speed of light

fr=2850000; %frequency in MHz

lamda=c/fr;

pie = 22/7;

BER\_v= 10e-3; % target BER taken as 10e-3 for voise

BER\_d= 10e-6; %target BER taken as 10e-6 for data

n= 0; %number of floors

df= [0.002,0.003,0.004,0.006,0.008,0.010]; %distance in meter between FeNB and FUE

%dfo= [4,6,10]; %distance in meter between FeNB and FUE, outdoor

dfm= [0.660]; % distance between FeNBs and eNB

dm= [0.660]; % distance between MUEs and eNBs (outdoor)

dmf1= [0.136,0.137,0.138,0.140,0.142,0.144]; % distance between indoor1 MUEs and eNB (4,6,10)

dmf2= [0.432,0.433,0.434,0.436,0.438,0.440]; % distance between indoor3 MUEs and eNB

dmf3= [0.652,0.653,0.654,0.656,0.658,0.660]; %distance between indoor3 MUEs and eNB

dmfi= [0.002,0.003,0.004,0.006,0.008,0.010]; %indoor MUE to FeNB

SINRf= 19.95; % FUE to FeNB SINR for good data speed thresholds for 13dB

SINRm= 3.98; % MUE to eNB SINR for an ok data speed threshold for 6dB

%Path loss (transmission path loss)

Lw=5.08; %wall loss in concrete 5.08dB

Wx=1;

PLmo=10.^((15.3 + 37.6\*log10(dm))./10); % MUE outdoor path loss

% Path loss for indoor MUEs

PLmi1=10.^((15.3 + 37.6\*log10(dmf1)+ Lw)./10); % MUE indoor path loss

PLmi2=10.^((15.3 + 37.6\*log10(dmf2)+ Lw)./10); % MUE indoor path loss

PLmi3=10.^((15.3 + 37.6\*log10(dmf3)+ Lw)./10); % MUE indoor path loss

PLmio= 10.^((15.3 + 37.6\*log10(0.011)+ Lw)./10); % MUE outdoor to FeNB indoor path loss

%Path loss for indoor FUEs

Lo=0;

PLfi=10.^((38.46 + 20\*log10(df) + 0.7 .\* df + (18.3\*n)^((((n+2))./((n+1))-0.46))+ Wx \* Lo)./10); %indoor FUE Path loss

%PLfo=((38.46+20\*log10(dfo) + 0.7 .\* dfo + (18.3\*n)^((((n+2))./((n+1) )-0.46) )+Wx \* Lw)./10); %Outdoor FUE path loss

%Path Gain

%MUE to eNB

Grm= 63.096; %10.^(-PLmi1./10); % indoor MUE channel gain 18dBi gain

Grm= 63.096; %10.^(-PLmi2./10); % indoor MUE channel gain

Grm= 63.096; %10.^(-PLmi3./10); % indoor MUE channel gain

Gtm= 1; %10.^(-PLmi1./10); 0dBi

Gtm= 1; %10.^(-PLmi2./10);

Gtm= 1; %10.^(-PLmi3./10);

%FUE to FeNB

Grf=1.9952; %10.^(-PLfi./10); % indoor channel gain for FUE to FeNB 3dBi

Gtf=1.9952; %10.^(-PLfi./10); %channel gain for MUE to eNB

%Channel capacity based on fixed BER and SINR for voice and data

Cmv=Bw\*log2(1+(BER\_v\*SINRm)) %channel capacity for voice MUE to eNB

Cfv=Bw\*log2(1+(BER\_v\*SINRf)) %channel capacity for voice FUE to FeNB

Cmd=Bw\*log2(1+(BER\_d\*SINRm)) %channel capacity for data MUE to eNB

Cfd=Bw\*log2(1+(BER\_d\*SINRf)) %channel capacity for data FUE to FeNB

% Transmit power with fixed received power

gamaf= 1.8; % provide gama for indoor and outdoor\_line-of-sight (pathloss coeficient)

gamam= 3.5;

Prm=3.16e-20; %Ptm=7.94e-20 : 2.51 : 199.53 equivalent of -191dBm to 23dBm with 4dBm interval

Prf= 3.16e-20;

%Indoor MUEs transmit power

Ptmi1 = (Prm ./(((Grm.\*Gtm)./PLmi1) .\* (((lamda/4\*pie)^2) .\* ((1./dmf1).^gamam))));

Ptmi2 = (Prm ./(((Grm.\*Gtm)./PLmi2) .\* (((lamda/4\*pie)^2) .\* ((1./dmf2).^gamam))));

Ptmi3 = (Prm ./(((Grm.\*Gtm)./PLmi3) .\* (((lamda/4\*pie)^2) .\* ((1./dmf3).^gamam))));

Po=1;

Ptmi11=Po + PLmi1; %Indoor MUEs transmit power

Ptmi22=Po + PLmi2;

Ptmi33=Po + PLmi3;

Ptmi=[Ptmi11, Ptmi22, Ptmi33];

% Outdoor MUEs transmit power

Ptmo1= (Prm ./(((Grm.\*Gtm)/PLmo) .\* (((lamda/4\*pie)^2) .\* ((1./dm).^gamam))));

Ptmo= Po + PLmo; %outdoor MUE tranmit power

% FUE indoor transmit power

Ptfi = Prf ./(((Grf.\*Gtf)./PLfi) .\* (((lamda/4\*pie)^2) .\* ((1./df).^gamaf))); %FUE indoor transmit power

Ptmo = Prm ./(((Grm.\*Gtm)./PLmo) .\* (((lamda/4\*pie)^2) .\* ((1./dm).^gamam))); %Outdoor MUE transmit power

Ptfi=Po + PLfi %FUE indoor transmit power

%calculate interference power

%Interference due to indoor MUE to FeNB

Prfi1 = Ptmi1 .\*((Grf.\*Gtf)./PLfi) .\* (((lamda/4\*pie)^2) .\* ((1./df).^gamaf)); %the interference when MUE is indoor (from MUE to FeNB)

Prfi2 = Ptmi2 .\*((Grf.\*Gtf)./PLfi) .\* (((lamda/4\*pie)^2) .\* ((1./df).^gamaf)); %the interference when MUE is indoor (from MUE to FeNB)

Prfi3 = Ptmi3 .\*((Grf.\*Gtf)./PLfi) .\* (((lamda/4\*pie)^2) .\* ((1./df).^gamaf)); %the interference when MUE is indoor (from MUE to FeNB)

Prfi1= Ptmi1 - PLfi; %the interference when MUE is indoor (from MUE to FeNB)

Prfi2= Ptmi2 - PLfi;

Prfi3= Ptmi3 - PLfi;

%Interference due to outdoor MUE to FeNB

Prfo1= Ptmo + PLmi1; %interference due to outdoor MUE to FeNB

Prfo2= Ptmo + PLmi2;

Prfo3= Ptmo + PLmio;

% Interference due to FUE to eNB

Prfo = Ptm .\*((Grf.\*Gtf)/PLfo) .\* (((lamda/4\*pie)^2) .\* ((1./df).^gamaf)); %the interference when MUE is outdoor (from MUE to FeNB)

Prfmi1 = Ptfi .\*((Grm.\*Gtm)./PLmi1) .\* (((lamda/4\*pie)^2) .\* ((1./dmf1).^gamam)); %the interference from indoor FUE to eNB

Prfmi2 = Ptfi .\*((Grm.\*Gtm)./PLmi2) .\* (((lamda/4\*pie)^2) .\* ((1./dmf2).^gamam)); %the interference from indoor FUE to eNB

Prfmi3 = Ptfi .\*((Grm.\*Gtm)./PLmi3) .\* (((lamda/4\*pie)^2) .\* ((1./dmf3).^gamam)); %the interference from indoor FUE to eNB

PrfmT = Prfmi1 + Prfmi2 + Prfmi3; %total FUE generated interference to eNB

Prfmi1 = Ptfi - PLmi1; %the interference from indoor FUE to eNB

Prfmi2 = Ptfi - PLmi2; %The Prmfi2 ans 3 result in -ve values of interference...

Prfmi3 = Ptfi - PLmi3; % Such interference is assumed to be negligible

%the total amount of interference received by eNB from FUE shows to degrade as FeNB spreads towards the cell edge

%this shows that the deployment of FeNB along the cell edge is a welcome develpment, which is why they were developed.

%the femtocells are meant to provide users who require better capacity, with better SNR in locations with...

%degraded network coverage such as cell edges of areas with high population

%SINR calculations for indoor FUE based on indoor MUE generated interference

SINRf1 = (Ptfi./(Nf + Prfi1)); %SINR for FUEs served by FeNB closest to eNB

SINRf2 = (Ptfi./(Nf + Prfi2)); %240m away from eNB i.e FUE at cell center FeNB

SINRf3 = (Ptfi./(Nf + Prfi3)); %cell edge FUE

%SINR calculations for indoor FUE based on outdoor MUE generated interference

SINRf1 = (Ptfi./(Nf + Prfo1)); %SINR for FUEs served by FeNB closest to eNB

SINRf2 = (Ptfi./(Nf + Prfo2)); %240m away from eNB i.e FUE at cell center FeNB

SINRfmo3 = (Ptfi./(Nf + Prfo3));

% Channel capacity based on indoor MUE interference (fixed BER and SINR for voice)

Cfmi1=(Bw\*log2(1+(BER\_v\*SINRf1))); %channel capacity

Cfmi2=(Bw\*log2(1+(BER\_v\*SINRf2))); %channel capacity

Cfmi3=(Bw\*log2(1+(BER\_v\*SINRf3))); %channel capacity

% Channel capacity based on outdoor MUE interference (fixed BER and SINR for voice)

Cfmo1=(Bw\*log2(1+(BER\_v\*SINRf1))); %channel capacity

Cfmo2=(Bw\*log2(1+(BER\_v\*SINRf2))); %channel capacity

Cfmo3=(Bw\*log2(1+(BER\_v\*SINRfmo3))); %channel capacity

%comparing FeNB capacity to power ratio in the presence of MUE indoor or outdoor

figure(1)

plot(Cfmo3,Ptfi)

hold on

plot(Cfmi3,Ptfi)

%Using LTE equations

Prm=0.5; %receive power of eNB 3.16e-20

Prf=1; %receive power of FeNB 3.16e-20

Po = Prm;

PL = PLfi;

b=[0.2,0.3,0.4,0.8,0.9,1];

c= b.\*PL;

Pt = Po + c;

Prfi1;

SINRf1 = (Pt./(Nf + Prfi1));

SINRmi= Ptm./(Nt + Prmf); % eNB channel SINR due to indoor MUE interference

SINRmo= Ptm./(Nt + Prfo); % eNB channel SINR due to outdoor MUE interference

Cmi=Bw\*log2(1+(BER\_v\*SINRmi)); %channel capacity for voice MUE to eNB

Cmo=Bw\*log2(1+(BER\_v\*SINRmo)); %channel capacity for voice FUE to FeNB

**Appendix II**

**Ploting Data**

hm= 0.7026;

hf= 0.7026;

Nf=3.16;

Pm=6.55;

a= hf.^4;

b= 2\*hf.^2\*Nf.^2;

c=Nf.^2-Pm.^2\*hm.^4;

Pf= (-b + sqrt(b.^2 - 4.\*a.\*c))/(2.\*a)

Pm= [6.55 18.68 33.85 50.56 68.14 86.26 123.49 142.39 161.48 200];

Pf= [0.048 6.5 18.68 33.85 50.56 68.14 104.74 123.45 142.39 180.69];

Interference threshold

When FUE is transmitting on these powers, the possible interference threshold is as given.

Pf= [0.05 6.5 18.68 33.85 50.56 68.14 104.74 123.45 142.39 180.69];

If= [-1.36 -1.03 -0.42 0.34 1.17 2.06 3.89 4.83 5.78 7.69];

0 0 0 -4.69 0.68 3.14 5.89 6.84 7.62 8.86 dBm

All negative values indicate poor network condition at SINR levels lower than set threshold <13dB 19.95.

For macro cell

SINRm threshold= 2dB = 1.58

Pm = [4.04 16.17 31.34 48.05 65.63 83.75 120.98 139.88 158.97 197.49];

Im= [1.19 8.87 18.48 29.05 40.18 51.65 75.21 87.17 99.25 123.63];

MUE show no issues with interference levels from FUE.

Pathloss cell centre and edge

PLmi2 = 4.65 4.69 4.73 4.81 4.89 4.98

PLmi3 = 21.86 21.98 22.11 22.36 22.62 22.88

**Plus NOISE**

Indoor MUE

Indoor MUE pathloss to FeNB is the same as those of FUE pathloss

PLmi2 = 7.81 7.85 7.89 7.97 8.06 8.14

PLmi3 = 25.02 25.14 25.27 25.52 25.78 26.04

Indoor FUE

PLfi = 3.19 3.22 3.27 3.41 3.61 3.86 noise added

PLfi = 0.0281 0.0632 0.1123 0.2528 0.4495 0.7026

**MUE interference threshold**

Im = 2.79 10.46 20.06 30.64 41.77 53.23 76.79 88.76 100.84 125.22

**FUE interference threshold**

SINRf= 13dB = 19.95

If = -1.36 -1.03 -0.42 0.34 1.17 2.06 3.89 4.83 5.78 7.69

**Interference by MUE to FUE**

Imf = -1.03 -0.42 0.34 1.17 2.06 2.96 4.83 5.78 6.73 8.66

If If >= Imf good, SINR threshold equal to or above threshold.

Else if If<Imf bad channel with SINR lower than SINRthreshold

SINR of FUE based on MUE interference to FUE

SINRf3 = 0.15 6.94 11.01 13.36 14.80 15.76 16.92 17.29 17.59 18.02

SINR of MUE based on noise and pathloss

SINRm3 = 2.2924 2.8967 4.1070 4.6815 5.2461 6.4270

Ifm = 2.31 3.09 4.74 5.52 6.29 7.89

Ifmc= [0.0022 0.2957 0.8449 1.5136 2.3133 3.0998 4.7374 5.5199 6.2943 7.8968];

MUE interference to FUE

Pm= [6.55 18.68 33.85 50.56 68.14 68.14 86.26 86.26 123.49 142.39 161.48 200.00];

PLfi = [3.19 3.19 3.22 3.22 3.27 3.27 3.41 3.41 3.61 3.41 3.86 3.86];

Imf = [2.05 5.86 10.51 15.70 20.84 20.84 25.29 25.29 34.21 41.76 41.83 51.81];

Pf = [16.26 20.73 23.24 24.98 26.20 26.20 27.04 27.04 28.35 29.21 29.22 30.15];

FUE interference to MUE

Pf=[0.05 6.50 18.68 33.85 50.56 50.56 68.14 68.14 104.74 123.45 142.39 180.69];

Ifm = [0.00 0.29 0.84 1.51 2.24 2.31 2.98 3.09 4.74 5.52 6.29 7.89];

PLmi3 = [21.86 21.86 21.98 21.98 22.11 22.11 22.36 22.36 22.62 22.62 22.88 22.88];

Prm = [0.2996 0.8545 1.5400 2.3003 3.0819 3.0819 3.8578 3.8578 5.4593 6.2949 7.0577 8.7413];

SINRm = Inf 2.9467 1.8334 1.5234 1.3758 1.3341 1.2946 1.2485 1.1518 1.1404 1.1220 1.1079

Prf = [Inf Inf Inf Inf 49.9555 49.9555 49.4485 49.4485 58.1760 68.5681 62.4709 79.2743];

SINRf = [0.0543 2.4677 2.5297 3.0687 2.3971 2.3971 1.9553 1.9553 1.7006 1.6420 1.4934 1.5301];

PLfi = 1.8004 2.2793 2.8149 3.4071 4.0560 4.7618

Imf2 = [2.6167 3.4733 3.4733 4.2150 4.2150 5.7017 6.9600 6.9717 8.6350];

>> SINRfm= Pf./(3.16+Imf2)

SINRfm = [1.1252 2.8161 5.1030 6.8556 9.2393 11.8194 12.1986 14.0539 15.3192];

Find MUE SINR

Imfdb =[3.1175 7.6790 10.2160 11.9590 13.1890 14.0295 15.3415 16.2149 17.1441];

Imf = [2.05 5.86 10.51 15.70 20.84 20.84 25.29 25.29 34.21 41.76 41.83 51.81];

SINRfmdb = [0.5123 4.4965 7.0783 8.3605 9.6564 10.7260 10.8631 11.4780 11.8524];

SINRfm = [1.1252 2.8161 5.1030 6.8556 9.2393 11.8194 12.1986 14.0539 15.3192];

Imf2 = [2.6167 3.4733 3.4733 4.2150 4.2150 5.7017 6.9600 6.9717 8.6350];

Pm= [6.55 18.68 33.85 50.56 68.14 86.26 123.49 142.39 161.48 200];

>> Pf= [0.048 6.5 18.68 33.85 50.56 68.14 104.74 123.45 142.39 180.69];

>> PLm = [18.47 20.78 21.03 21.58 21.86 21.98 22.11 22.36 22.62 22.88];

>> Pr=Pm./PLm

Pr = 0.3546 0.8989 1.6096 2.3429 3.1171 3.9245 5.5853 6.3681 7.1388 8.7413

>> Ifm=(Pf./PLm)./2

Ifm = 0.0013 0.1564 0.4441 0.7843 1.1565 1.5500 2.3686 2.7605 3.1474 3.9486

>> SINRm=Pr./(3.16+Ifm)

SINRm = 0.1122 0.2711 0.4466 0.5940 0.7221 0.8332 1.0102 1.0756 1.1318 1.2297

>> SINRmdb= 10\*log10(SINRm)

SINRmdb = -9.5009 -5.6694 -3.5008 -2.2621 -1.4137 -0.7924 0.0443 0.3165 0.5377 0.8979

Pf= [0.048 6.5 18.68 33.85 50.56 68.14 104.74 123.45 142.39 180.69];

>> Prf=Pf./PLfi

Prf = 0.0151 2.0166 5.7085 10.2483 15.1668 20.3082 30.6903 34.2014 38.0508 46.7794

>> Imf=Pm./PLfi

Imf = 2.0545 5.7955 10.3444 15.3073 20.4404 25.7086 36.1844 39.4487 43.1522 51.7786

Use equation derived to determine safe power vs safe interference

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pf | 0.048 | 6.50 | 18.68 | 33.85 | 50.56 | 68.14 | 104.74 | 123.45 | 142.39 | 180.69 |
| Prf | 0.0151 | 2.0166 | 5.7085 | 10.2483 | 15.1668 | 20.3082 | 30.6903 | 34.2014 | 38.0508 | 46.7794 |
| Imf | 2.0545 | 5.7955 | 10.3444 | 15.3073 | 20.4404 | 25.7086 | 36.1844 | 39.4487 | 43.1522 | 51.7786 |
| SINRf | 0 | 1.1252 | 2.8161 | 5.1030 | 6.8556 | 9.2393 | 11.8194 | 12.1986 | 14.0539 | 15.3192 |
| SINRm | 0.122 | 0.2711 | 0.4466 | 0.5940 | 0.7221 | 0.8332 | 1.0102 | 1.0756 | 1.1318 | 1.2297 |
| Ifm | 0.0013 | 0.1564 | 0.4441 | 0.7843 | 1.1565 | 1.5500 | 2.3686 | 2.7605 | 3.1474 | 3.9486 |
| Prm | 0.3546 | 0.8989 | 1.6096 | 2.3429 | 3.1171 | 3.9245 | 5.5853 | 6.3681 | 7.1388 | 8.7413 |
| Pm | 6.55 | 18.68 | 33.85 | 50.56 | 68.14 | 86.26 | 123.49 | 142.39 | 161.48 | 200.00 |

PLfi = 0.0281 0.0632 0.1123 0.2528 0.4495 0.7026

PLi= [3.1881 3.2232 3.2723 3.3029 3.3336 3.3553 3.4128 3.6095 3.7421 3.8626];

Maximum FUE Tx = 68.14 = 18dBm

68.14mW generate 1.55mW interference with a profit of 9.6564dB (9.2393) SINRf at 34Mbps data rate.

MUE is expected to transmit at 86.26mW=19.36dBm generating interference of 25.7086mW to enjoy 0.8332 SINRm quality

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pm(mW) | 18.68 | 33.85 | 50.56 | 68.14 | 86.26 | 123.26 | 142.39 | 161.48 | 200.00 |
| Pf(mW) | 16.92 | 29.05 | 44.22 | 60.93 | 78.51 | 115.11 | 133.82 | 152.76 | 191.06 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Prm | 0.3546 | 0.8989 | 1.6096 | 2.3429 | 3.1171 | 3.9245 | 5.5853 | 6.3681 | 7.1388 | 8.7413 |

The power levels that can connect to the base station (with MDS = 1.2589mW) are those in blue i.e

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 86.26 | 123.26 | 142.39 | 161.48 | 200.00 |

FUE Tx power restricted to 18dBm (68.14mW)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pf | 0.048 | 6.50 | 18.68 | 33.85 | 50.56 | 68.14 | 68.14 | 68.14 | 68.14 | 68.14 |
| Prf | 0.0151 | 2.0166 | 5.7085 | 10.2483 | 15.1668 | 20.3082 | 19.98 | 18.88 | 18.22 | 17.65 |
| Imf | 0.3424 | 0.9659 | 1.7241 | 2.5512 | 3.4067 | 4.2848 | 6.0307 | 6.5748 | 7.1920 | 8.6298 |
| SINRf | 0.0137 | 1.5754 | 3.8247 | 5.9270 | 7.6995 | 9.1527 | 7.4140 | 6.9996 | 6.5823 | 5.7796 |
| SINRm | 0.1122 | 0.2710 | 0.4466 | 0.5940 | 0.7221 | 0.8332 | 1.1858 | 1.3520 | 1.5157 | 1.8559 |
| Ifm | 0.0013 | 0.1564 | 0.4441 | 0.7843 | 1.1565 | 1.5500 | 1.5500 | 1.5500 | 1.5500 | 1.5500 |
| Prm | 0.3546 | 0.8989 | 1.6096 | 2.3429 | 3.1171 | 3.9245 | 5.5853 | 6.3681 | 7.1388 | 8.7413 |
| Pm | 6.55 | 18.68 | 33.85 | 50.56 | 68.14 | 86.26 | 123.49 | 142.39 | 161.48 | 200.00 |

PLi= [ 3.1881 3.2232 3.2723 3.3029 3.3336 3.3553 3.4128 3.6095 3.7421 3.8626];

PLm = [18.47 20.78 21.03 21.58 21.86 21.98 22.11 22.36 22.62 22.88];

FPC

Po=1;

>> Alpha= [1,0.9,0.8,0.7,0.6,0.5,0.4,0.3,0.2,0.1];

>> PL=22.88;

A= [1 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0];

>> Pt= Po+ (A.\*(PL))

Pt =

23.8800 21.5920 19.3040 17.0160 14.7280 12.4400 10.1520 7.8640 5.5760 3.2880 1.0000

PLf = 0.7026;

>> Ptf= Po + (A\*(PLf))

Ptf = 1.7026 1.6323 1.5621 1.4918 1.4216 1.3513 1.2810 1.2108 1.1405 1.0703 1.0000

PLf=3.8626;

>> Imf=Pt./PLf

Imf = 6.1824 5.5900 4.9977 4.4053 3.8130 3.2206 2.6283 2.0359 1.4436 0.8512 0.2589

>> Ifm=Ptf./PL

Ifm = 0.0744 0.0713 0.0683 0.0652 0.0621 0.0591 0.0560 0.0529 0.0498 0.0468 0.0437

PLf=3.8626;

>> Imf=Pt./PLf

Imf =

6.1824 5.5900 4.9977 4.4053 3.8130 3.2206 2.6283 2.0359 1.4436 0.8512 0.2589

>> Ifm=Ptf./PL

Ifm =

0.0744 0.0713 0.0683 0.0652 0.0621 0.0591 0.0560 0.0529 0.0498 0.0468 0.0437

SINRm= Pt./(3.16+Ifm)

SINRm = 7.3831 6.6821 5.9797 5.2759 4.5709 3.8645 3.1567 2.4476 1.7372 1.0253 0.3121

>> SINRf=Ptf./(3.16+Imf)

SINRf = 0.1822 0.1866 0.1915 0.1972 0.2039 0.2118 0.2213 0.2330 0.2477 0.2668 0.2925

Rf = 1.0e+06 \* 2.4153 2.4678 2.5276 2.5965 2.6768 2.7713 2.8844 3.0220 3.1932 3.4121 3.7016

>>Rm = 1.0e+07 \* 3.0675 2.9415 2.8032 2.6498 2.4779 2.2823 2.0554 1.7856 1.4527 1.0182 0.3919

Imf =

6.1824 5.5900 4.9977 4.4053 3.8130 3.2206 2.6283 2.0359 1.4436 0.8512 0.2589

>> Ifm=Ptf./PL

Ifm =

0.0744 0.0713 0.0683 0.0652 0.0621 0.0591 0.0560 0.0529 0.0498 0.0468 0.0437

ICR Table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pf | 0.048 | 6.50 | 18.68 | 33.85 | 50.56 | 68.14 | 73.16 | 78.19 | 83.21 | 93.26 |
| Prf | 0.0151 | 2.0166 | 5.7085 | 10.2483 | 15.1668 | 20.3082 | 19.98 | 18.88 | 18.22 | 17.65 |
| Imf | 0.3424 | 0.9659 | 1.7241 | 2.5512 | 3.4067 | 4.2848 | 6.0307 | 6.5748 | 7.1920 | 8.6298 |
| SINRf | 0.0137 | 1.5754 | 3.8247 | 5.9270 | 7.6995 | 9.1527 | 7.9602 | 8.0320 | 8.0382 | 7.9101 |
| SINRm | 0.1122 | 0.2710 | 0.4466 | 0.5940 | 0.7221 | 0.8332 | 1.1601 | 1.2974 | 1.4279 | 1.6817 |
| Ifm | 0.0013 | 0.1564 | 0.4441 | 0.7843 | 1.1565 | 1.5500 | 1.6545 | 1.7484 | 1.8393 | 2.0380 |
| Prm | 0.3546 | 0.8989 | 1.6096 | 2.3429 | 3.1171 | 3.9245 | 5.5853 | 6.3681 | 7.1388 | 8.7413 |
| Pm | 6.55 | 18.68 | 33.85 | 50.56 | 68.14 | 86.26 | 123.49 | 142.39 | 161.48 | 200.00 |

PLi= [ 3.1881 3.2232 3.2723 3.3029 3.3336 3.3553 3.4128 3.6095 3.7421 3.8626];

PLm = [18.47 20.78 21.03 21.58 21.86 21.98 22.11 22.36 22.62 22.88];

>> SINRf= [0.0137 1.5754 3.8247 5.9270 7.6995 9.1527 7.9602 8.0320 8.0382 7.9101];

>> SINRm= [0.1122 0.2710 0.4466 0.5940 0.7221 0.8332 1.1601 1.2974 1.4279 1.6817];

>>

>> Rmicr= (10000000.\*log2(1+SINRm))./1000000

Rmicr =

1.5342 3.4596 5.3267 6.7265 7.8417 8.7436 11.1110 12.0000 12.7971 14.2315

>> Rficr= (10000000.\*log2(1+SINRf))./1000000

Rficr =

0.1963 13.6480 22.7044 27.9223 31.2093 33.4379 31.6353 31.7505 31.7604 31.5544

>> Rfnon\_icr= (10000000.\*log2(1 + SINRf))./1000000

Rfnon\_icr =

0.1963 13.6480 22.7044 27.9223 31.2093 33.4379 30.7279 29.9993 29.2264 27.6120

>> Rmnon\_icr= (10000000.\*log2(1+SINRm))/1000000

Rmnon\_icr =

1.5342 3.4596 5.3267 6.7265 7.8417 8.7436 11.2816 12.3389 13.3096 15.1395