" EMPOWERMENT THROUGH TECHNOLOGICAL EXCELLENCE "

GENBA SOPANRAO MOZE COLLEGE OF ENGINEERING

Balewadi, Pune- 411 045.

Department of Electronics and Telecommunications

Experiment No. –

Subject: - Mobile Computing

Name of the Student:_____ Roll No._____

Date: _____ Marks & Signature:

Subject Teacher

Aim:

To study the outage probability, LCR & ADF in SISO for Selection Combining and MRC.

Theory

Small scale fading characterizes the fluctuation of signal (strength) over a spatial distance of fraction of wavelength. The fluctuation is also observed in both time and frequency domain at a gain location.

The variation of signal (strength) at the receiver is due to random interference between the different copies of the transmitted signal. The interference is sometimes constructive and sometimes destructive. The multiple copies of the transmitted signal are generated due to scattering, reflection, and diffraction due to obstacle present in the path of radio signal between the Tx and Rx movement of the Tx and Rx or the obstacle cause time domain variation of the signal (strength) and the phenomenon is called Doppler effect. Since each path of the radio wave may exhibit difference doppler its cumulative effect results in spread of the carrier/ frequency content of the signal and hence is also known as Doppler spread.

If v is the maximum velocity (m/s) then the maximum Doppler shift is given by

$$fm=\upsilon(m/s)c=$$

Where,

- c=velocitylight=3∗108m/s.=*h*=3∗10*8
- fc=carrierequency.

Coherence time is defined as interval in time over which the signal remains correlated. It is defined as

$$Tc= 9/16\Pi fm\ (s)$$

If symbol duration T_s << T_c it experience slow fading while if Ts>Tc it experience fast fading. The enveloped level crossing rate is defined as the rate at which the signal envelope crosses a specified level R in the positive (or negative) going direction.
It requires the joint pdf (α,.α) of the enveloped level α=|r| and enveloped slope .α=|r|

$$LR=\sqrt{2\pi}(k+1)fm\rho e-k-(k+1)\rho 2I0(2\rho\sqrt{k(k+1)})\rho=R\sqrt{\Omega p}=RRrms$$

Rrms=√Ωp is the enveloped level

Rayleigh fading (k=0) and isotropic scattering $LR=\sqrt{2\pi}fm\rho e-\rho 2$

Level Crossing Rate For Selection Combining

$Lr=fm\sqrt{\pi}M\gamma\sqrt{\sigma}\exp(-\gamma 22\sigma)[1-\exp(-\gamma 22\sigma)]M-1$

Where,

- fm is the Maximum doppler frequency.
- σ is the r.m.s value of the received signal voltage.
- γ is the threshold voltage.
- M = No. of channels

Average enveloped fade duration

The average duration the enveloped remains below a specified level R.

$t=1NRPr[r\leq R]$

Average fade duration For Selection Combining

$ADF=\sqrt{\rho}*\exp(\gamma 22\sigma-1)\sqrt{2\pi}fdM\gamma$

For Rayleigh distribution fading

$Pr[r\leq R]=\int R0Pr(dr)=1-\exp(-\rho 2)$

$\bar{t}=e\rho 2-1\rho fm\sqrt{2\pi}$

In case of flat fading the plot of signal enveloped of transmitting 'r' is given as

$p(r)=r\sigma 2\exp(-r22\rho 2)(0\leq r\leq\infty)$

$=0(r<0)$

Where,

- σ is the r.m.s value of the received voltage signal before detection.
- σ2is the time average power of the received signal before enveloped detection.

Probability of outage is defined as

$$P(R)=Pr(r\leq R)=\int R0p(r)dr=1-exp(-R22\sigma2)$$

The mean value rmean of rayleigh distribution is given by

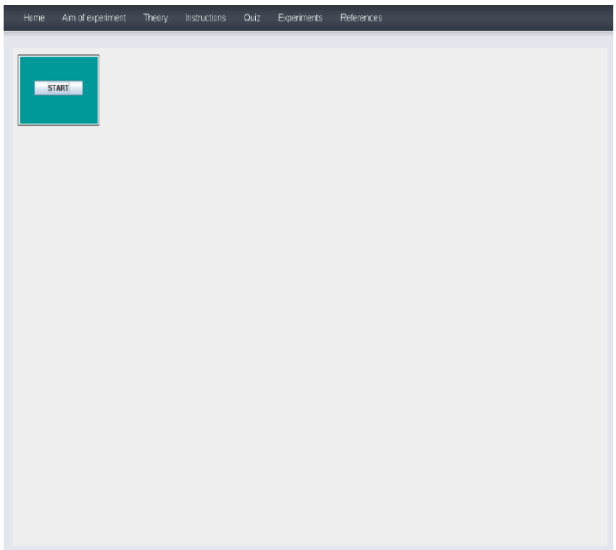
$$rmean=E[r]=\int\infty0rp(r)dr=\sigma\sqrt{\pi}2=1.2533\sigma=1.2533$$

$$\sigma2r=E[r2]-E2[r]=\int\infty0r2p(r)dr-\sigma2\pi2$$

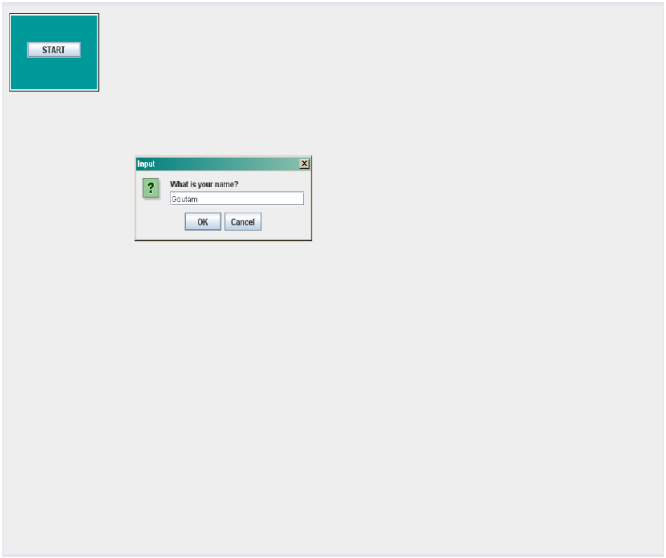
$$=\sigma2(2-\pi2)=0.4292\sigma2$$

Instructions for Experiment: - Flat Fading

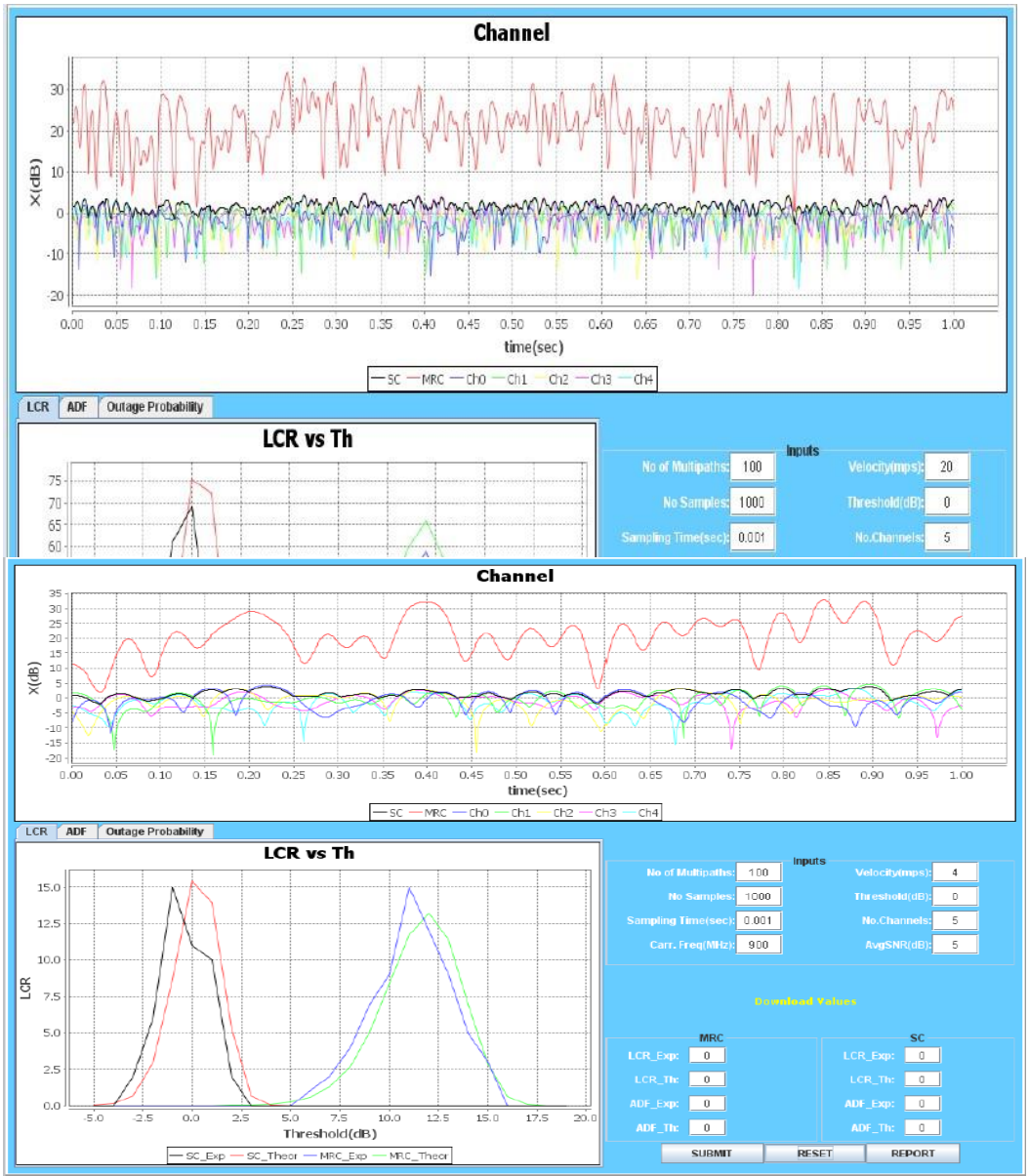
- Step1:- Click on the button START. A page appears with a dialogue box asking for your name.



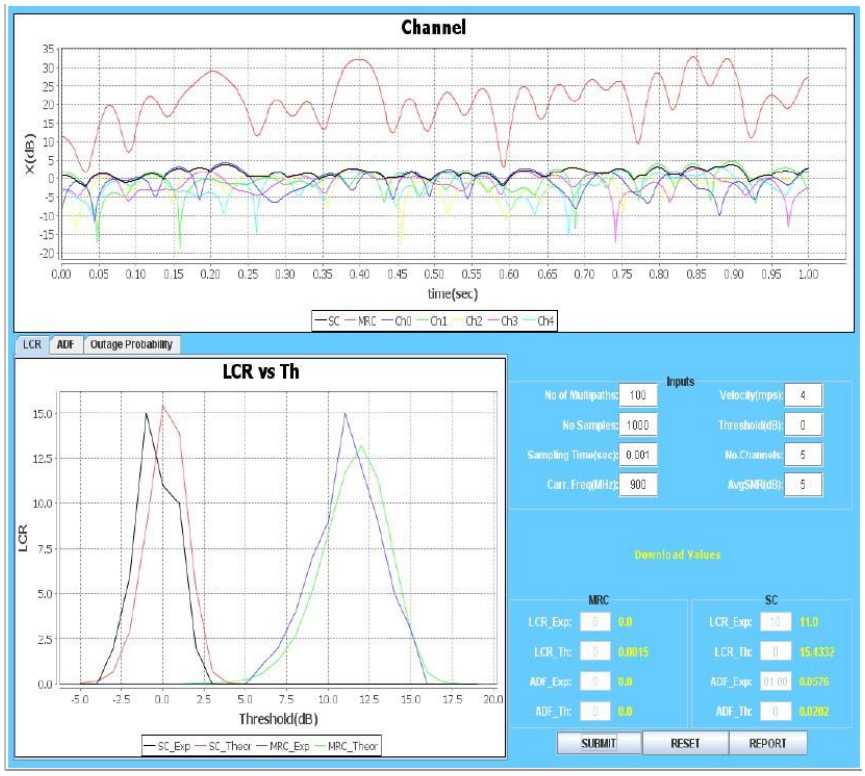
- Step 2:- Enter your name then Click Ok.



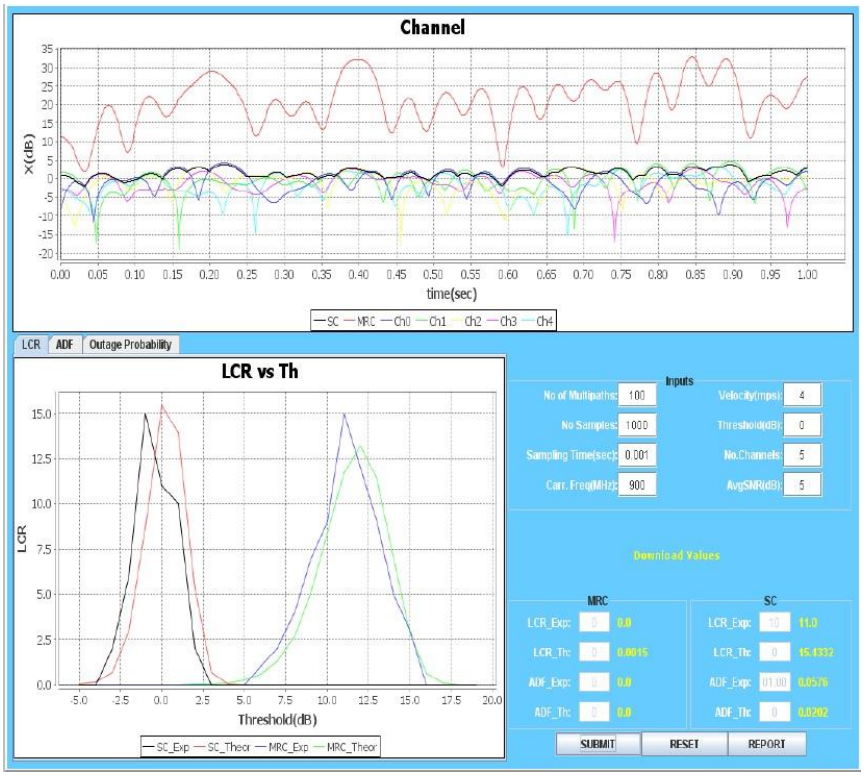
Step3: - Enter the input parameters value. Then click on "RESET" Button. Observed the waveform.



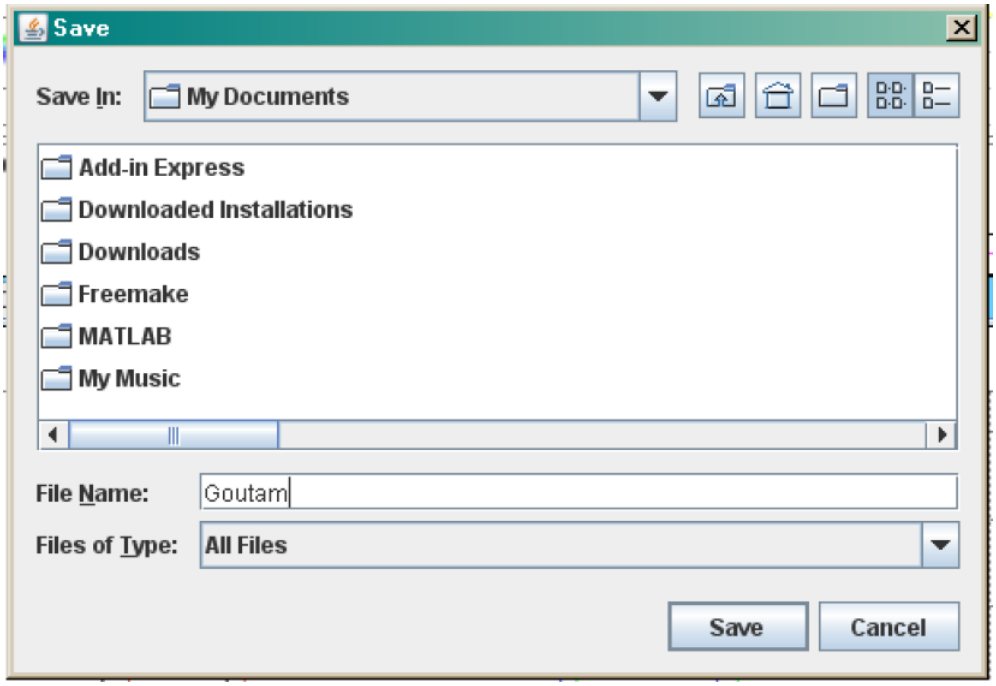
- Step4: - Enter value of LCR Exp and ADF Exp in both MRC and SC from the waveform. Then Click on "SUBMIT" Button.



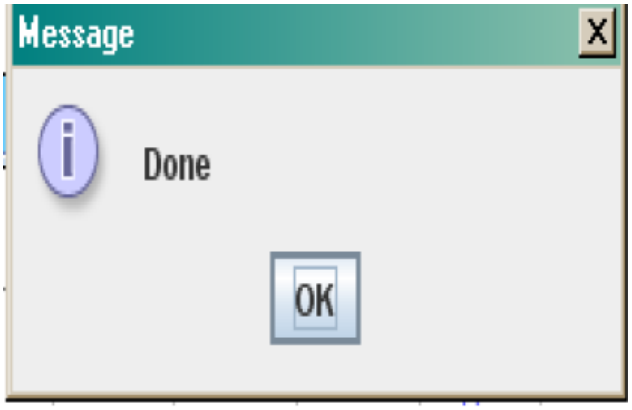
- Step5:- Click on the "Report" button.



- Step6:- PDF report of the experiment is generated.

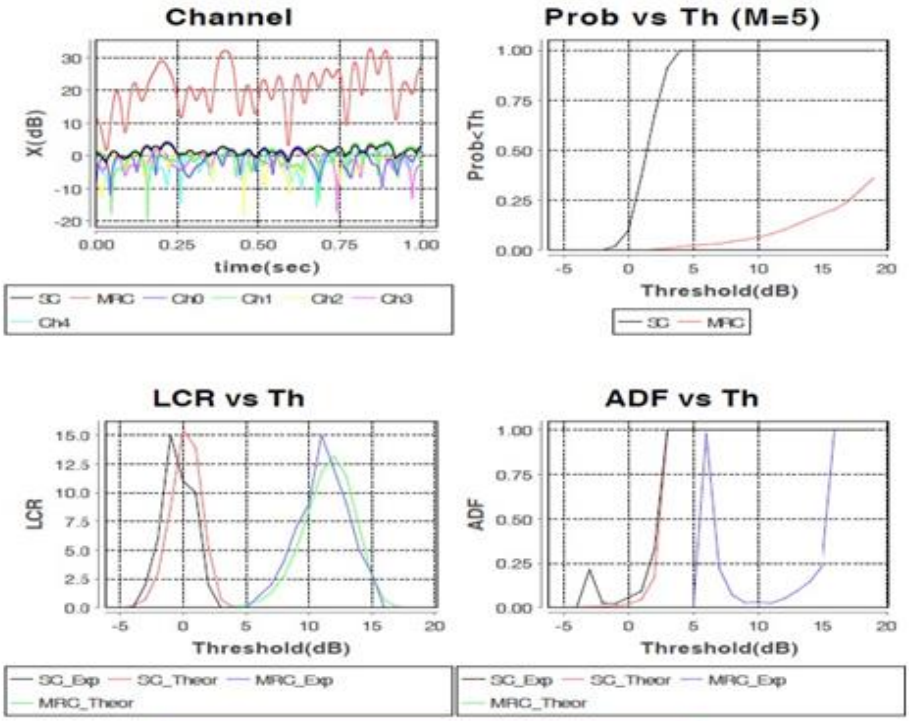


- Step7:-After generation of the Report you will get following message.



-

- Step8:- Click on the "Ok" and you will get your Report.



Input Parameters	
No.of Multipaths	100
No.Samples	1000
Sampling Time(sec)	0.001
fc(Hz)	9.0E8
Velocity(mps)	4.0
Threshold(dB)	0.0
No.of Branches	5
Avg SNR(dB)	5.0

Results				
Type	LCR(Exp)	LCR(Th)	ADF(Exp)	ADF(Th)
SC(Actual)	11.0	15.4332	0.0576	0.0202
SC(Entered)	10.0	0.0	1.0	0.0
MRC(Actual)	0.0	0.0015	0.0	0.0
MRC(Entered)	0.0	0.0	0.0	0.0

Step9: - To Redo the experiment click on "RESET" button

Conclusion:

FAQ;

1. What is Flat Fading?
2. What is the difference between flat and selective fading?
3. What are the types of fading?