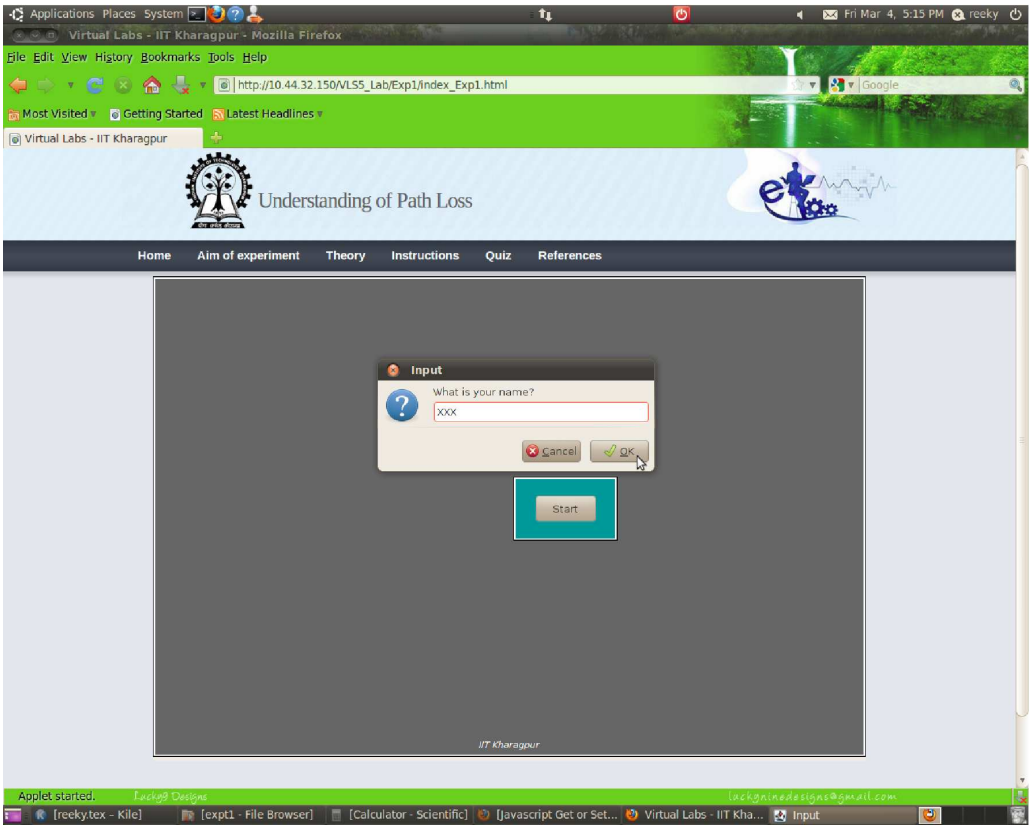
1 Instructions for Experiment 1:-Understanding Path Loss

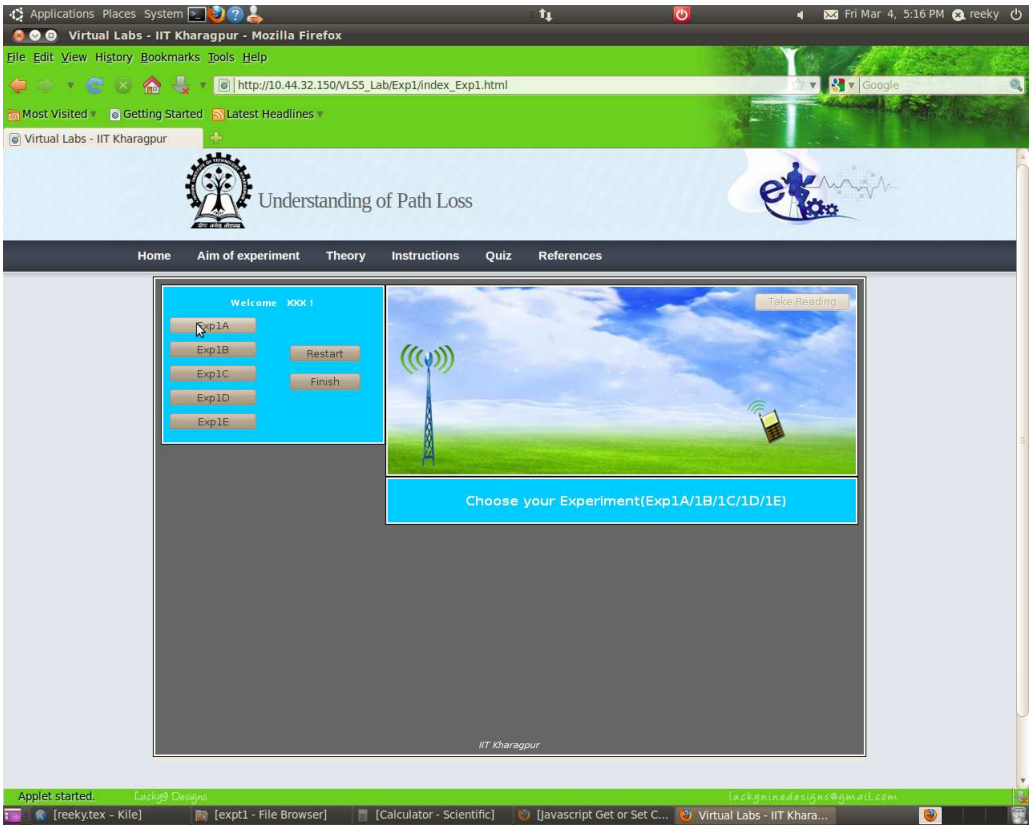
Follow the instructions given below to perform the experiments:-

1.1 Starting Experiment 1 :-

- Step 1:-Click on the START button.A page appears with a dialogue box asking for your name.Enter your name and click OK.

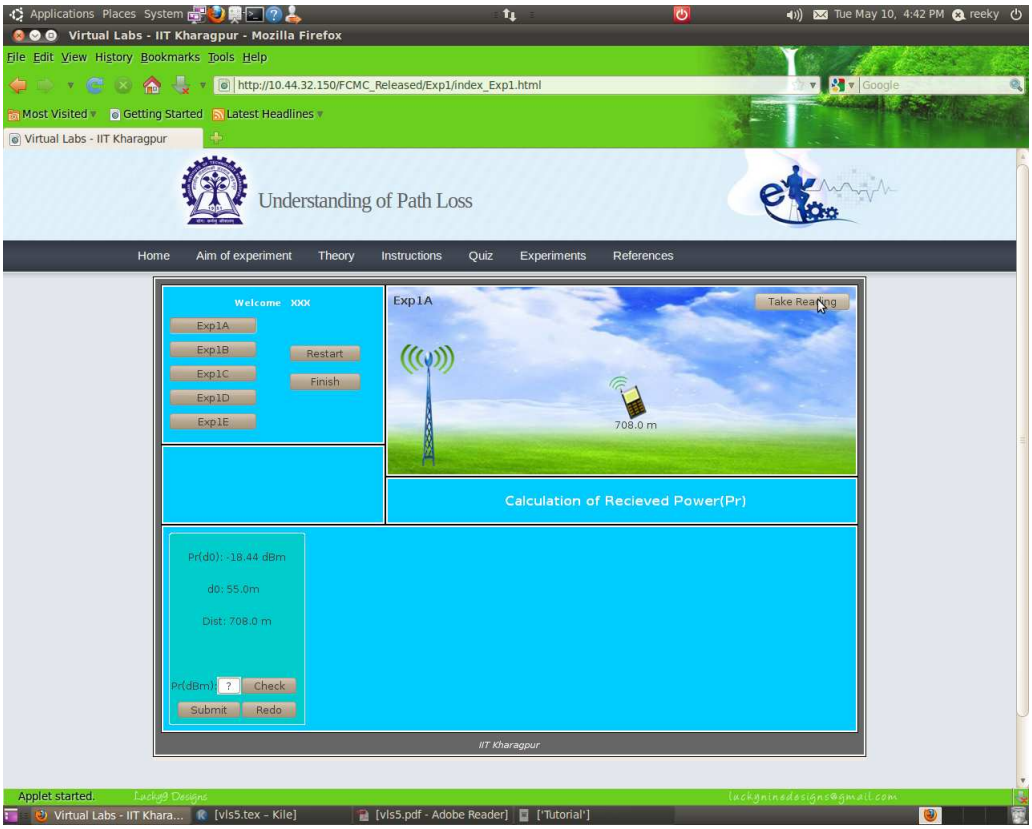


- Step 2:-Now the page appears where you can perform experiment1.There are 5 buttons(Exp1A Exp1B Exp1C Exp1D Exp1E) for five experiments to be performed. Choose which experiment you want to perform and click on any one of the button.



1.2 Performing Experiment 1A(Calculation of Received Power at a certain T_x-R_x separation distance) :-

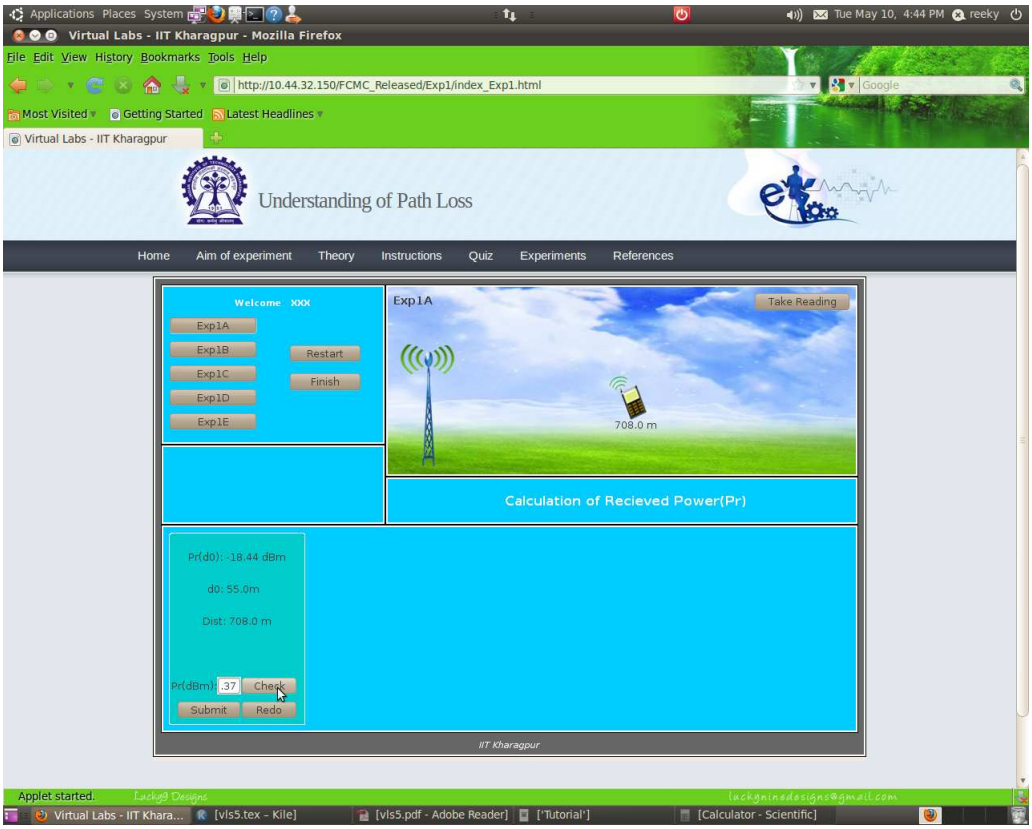
- Step 3:- Drag the mobile by placing the cursor on it and place it at a certain distance from the base station tower.
- Step 4:- Click on the button TAKE READING.Your input value get displayed.



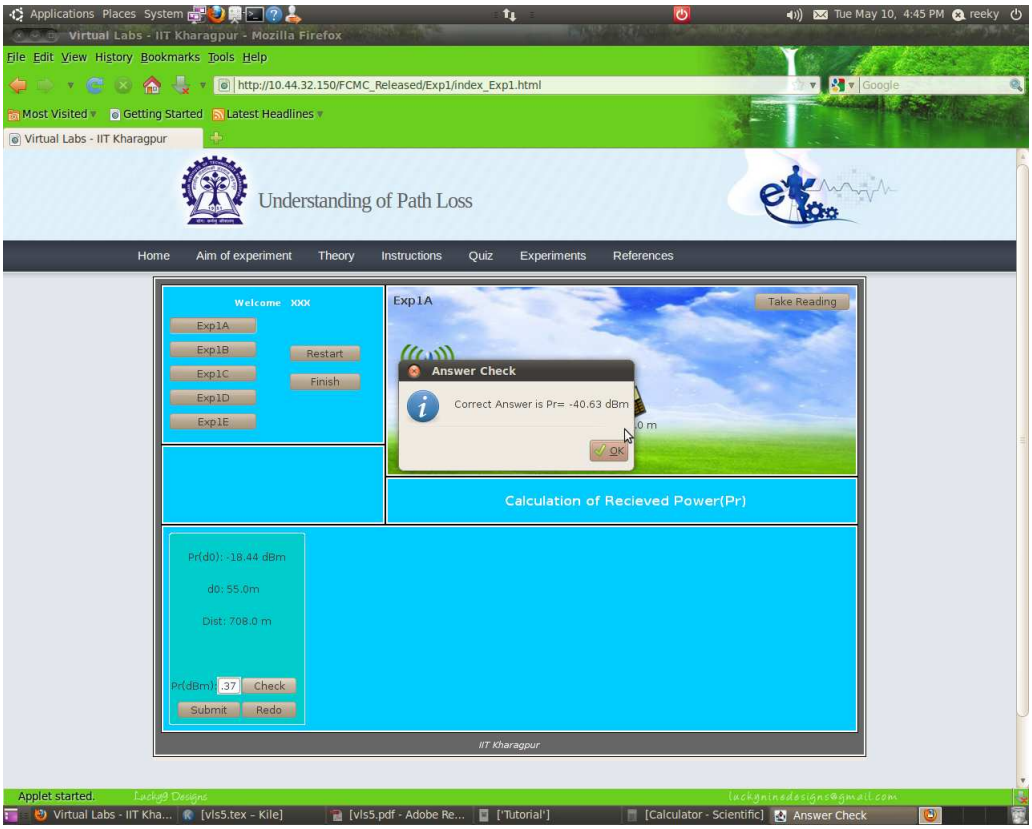
- Step 5:-Now,calculate the value of the unknown parameter(for e.g $P_r(d)$) manually by using the formulas given in the theory section. For example:-Given $P_r(d_0) = -18.44$ dB,T_x and R_x separation distance(d)= 708 m,$d_0 = 55$ meter.So,using this formula $P_r(d) = P_r(d_0) + 20log(d_0/d)$ you can find the value of $P_r(d)$, $P_r(d) = -18.44 + 20log_{10}(55/708) = -40.37$dBm.Similarly,with the help of the formulas given in the theory section for expt1b,expt1c,expt1d and expt1e you can find the value of the unknown parameter for each of these experiments.

- Step 6:-Now,enter your manually calculated value of the unknown parameter in the box provided in the page.

- Step 8:Click on the button CHECK to verify whether your manually calculated value matches with the computed value of the unknown parameter.



- Step 9:-If your manually calculated value of the unknown parameter doesn't match with the computed value of the unknown parameter then a message box will appear with the message that your calculated value is wrong and it will return the exact value of the unknown parameter.If your calculated value of the unknown parameter is same as the computed value of the unknown parameter then the message box will let you know that your result is correct.

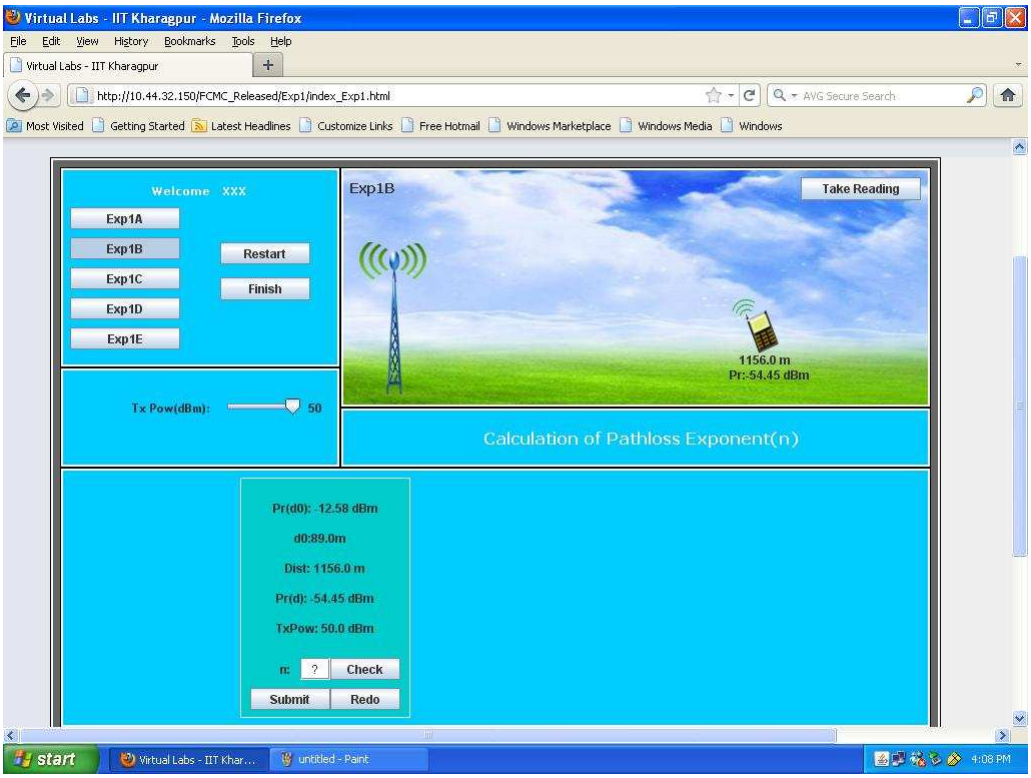


- Step 10:- Now, click on the button SUBMIT to submit your results
- Step 11:- You can redo the experiment by clicking on the button REDO.

1.3 Performing Experiment 1B(Calculating the path loss exponent) :-

Follow the steps given below to perform Expt 1B

- Step 1:- Follow Step 2 of Expt 1A and select Expt 1B to perform it.
- Step 2:- Follow Step 3-4 of Expt 1A to record the input parameters needed for calculating the value of n_p.You can adjust the slider to change the value of transmit power.



- Step 3:-Now,use this formula to calculate n_p .Input Parameters:- $P_t = 50$dBm,$P_r(d) = -54.45$dBm $P_r(d_0) = -12.58$ dBm ,d=1156 meters,$d_0 = 89$meters $PL(d) = PL(d_0) + 10 * n_p * log_{10}(d/d_0)$=$P_t(d) - P_r(d) = P_t(d_0) - P_r(d_0) + 10 * n_p * log_{10}(d/d_0)$,$50 + 54.45 = 50 + 12.58 + 10 * n_p * log_{10}(1156/89)$,$n_p = 3.76$

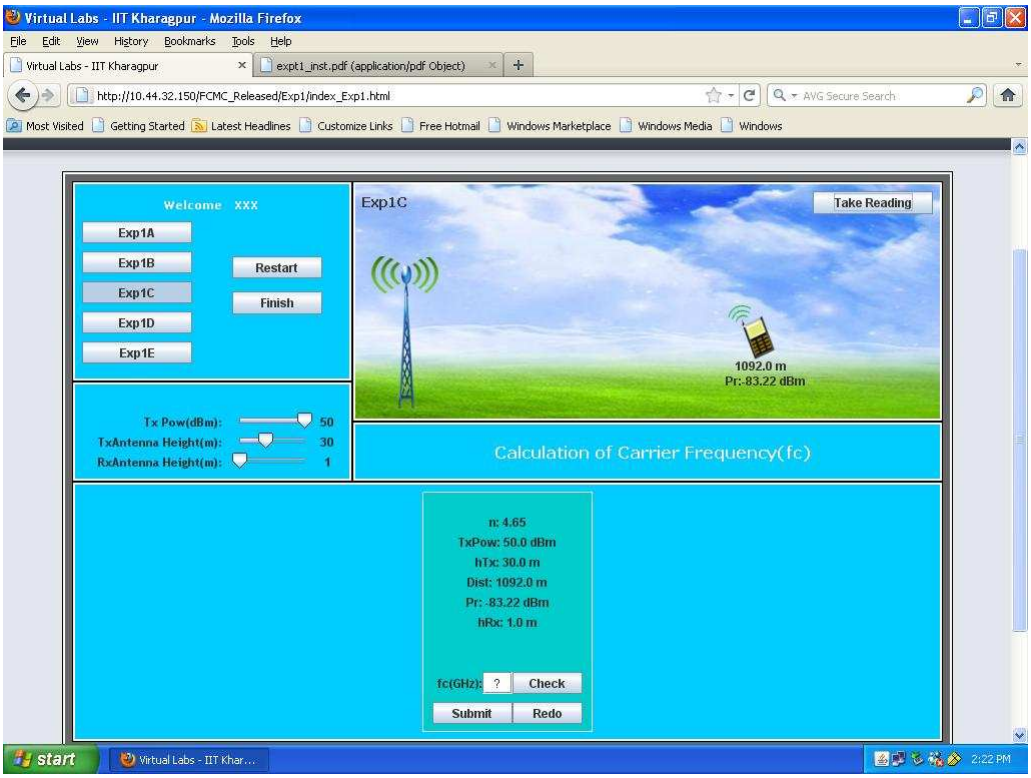
- Step 4:- Follow Steps 6-11 of Expt 1A to submit the results of Expt 1B.

1.4 Performing Experiment 1C(Calculating f_c) :-

Follow the steps given below to perform Expt1C

- Step1 :-Follow Step 2 of Expt 1A and select Expt 1C to perform it.

- Step 2:- Follow Step 3-4 of Expt 1A to record the input parameters needed for calculating the value of f_c.You can change the values of transmit power,transmit antenna height,receive antenna height by adjusting the sliders.



- Step 3:-Given , $h_{BS} = 30$m,$h_{UT} = 1$m,d=1092 m,$n_p = 4.65$,$P_t = 50$ dBm,$P_r(d) = -83.22$dBm . Now, calculate PL(d) using the formula:-$PL(d) = P_t - P_r(d)$=$50-(-83.22) = 133.22$ dBm. Now, use this formula to calculate f_c.$PL(d) = 10n_p log_{10}(d) + 7.8 - 18log_{10}(h_{tx}) - 18log_{10}(h_{rx}) + 20log_{10}(f_c)$.Putting the values, $133.22 = 10*4.65*log_{10}(1092) + 7.8 - 18log_{10}(30) - 18log_{10}(1) + 20log_{10}(f_c)$.So, $f_c = 3.44$ GHz.

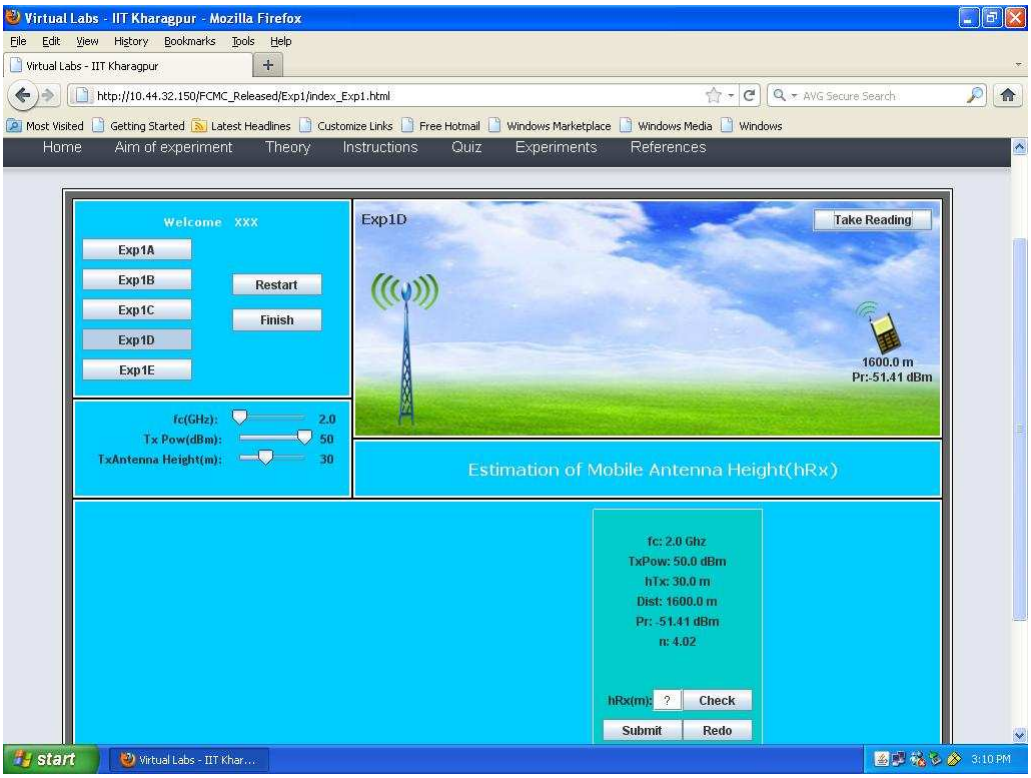
- Step 4:- Follow Steps 6-11 of Expt 1A to submit the results of Expt 1C.

1.5 Performing Experiment 1D(Calculating h_{UT}) :-

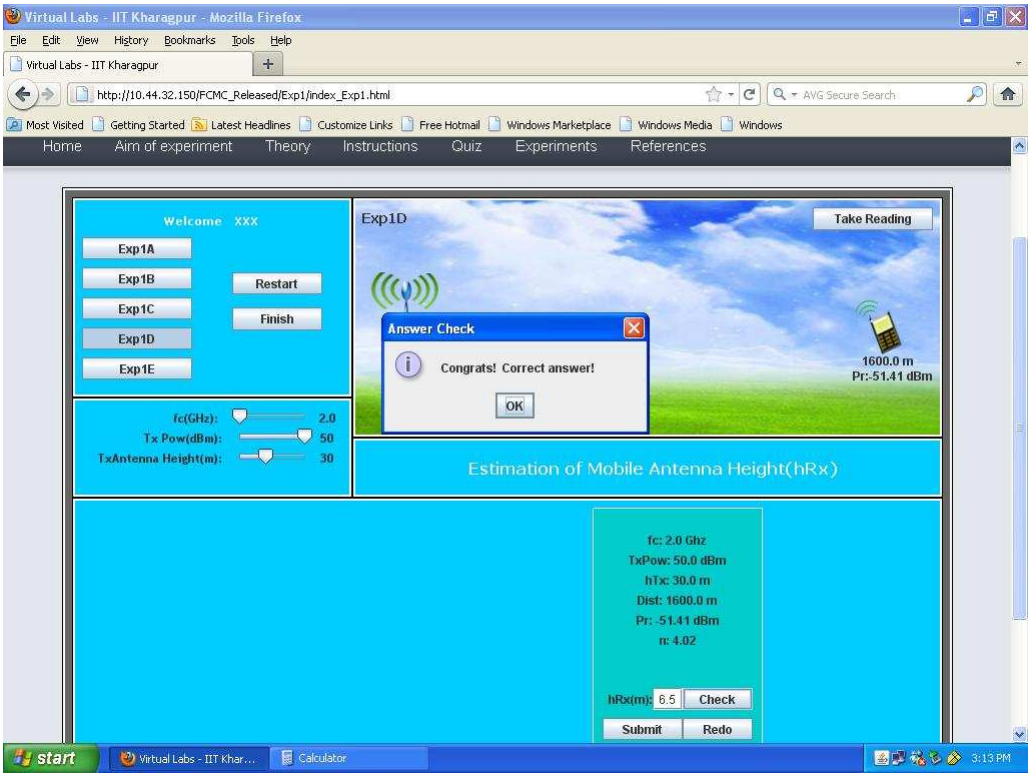
Follow the steps given below to perform Expt1D

- Step1 :-Follow Step 2 of Expt 1A and select Expt 1D to perform it.

- Step 2:- Follow Step 3-4 of Expt 1A to record the input parameters needed for calculating the value of h_{UT}.You can change the values of transmit power,frequency,transmit antenna height by adjusting the sliders.



- Step 3:- Given, $h_{BS} = 30$m, $f_c = 2$GHz,d=1600 m,$n_p = 4.02$,$P_t = 50$ dBm,$P_r(d) = -51.41$dBm . Now, calculate PL(d) using the formula:-$PL(d) = P_t - P_r(d)$=$50-(-51.41) = 101.41$ dBm. Now, use this formula to calculate h_{rx}.$PL(d) = 10n_p log_{10}(d) + 7.8 - 18log_{10}(h_{tx}) - 18log_{10}(h_{rx}) + 20log_{10}(f_c)$.Putting the values, $101.41 = 10*4.02*log_{10}(1600)+7.8-18log_{10}(30)-18log_{10}(h_{rx})+20log_{10}(2)$.So,$h_{rx} = 6.5$ meters.

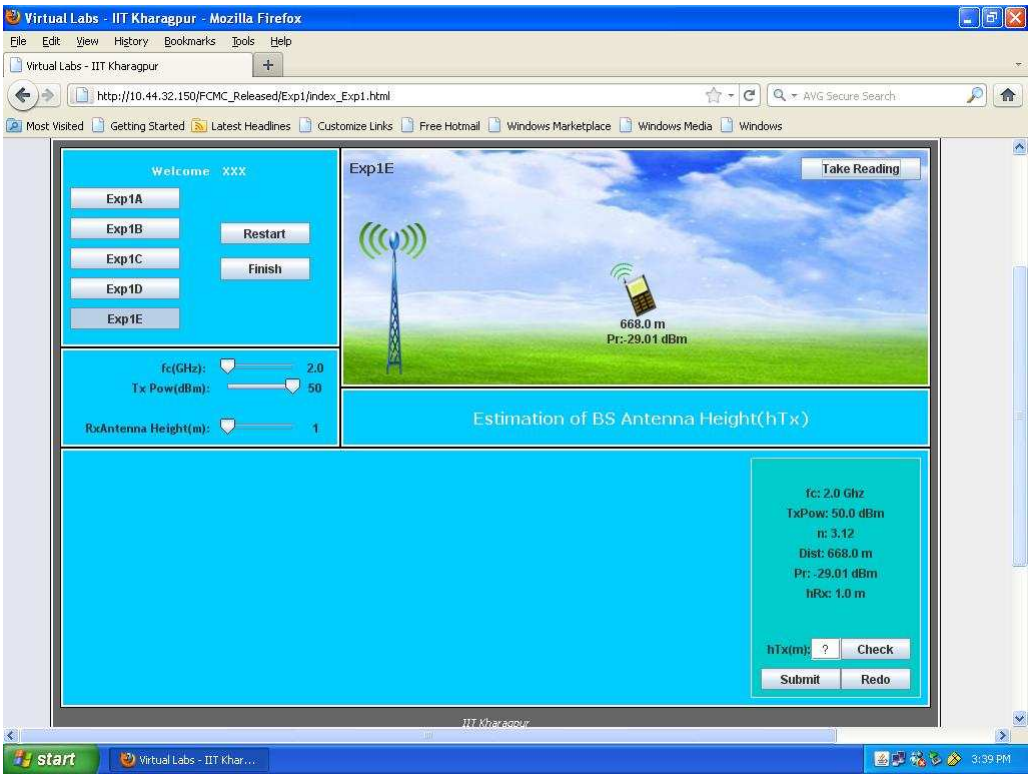


- Step 4:- Follow Steps 6-11 of Expt 1A to submit the results of Expt 1D

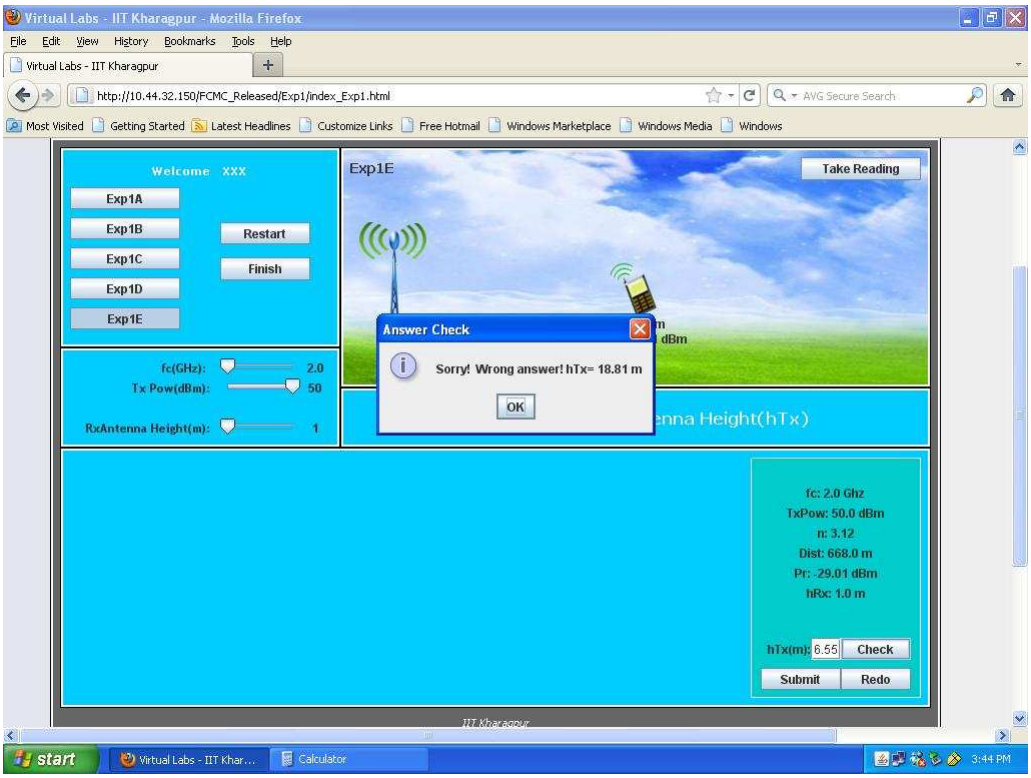
1.6 Performing Experiment 1E(Calculating h_{BS}) :-

Follow the steps given below to perform Expt1E

- Step1 :-Follow Step 2 of Expt 1A and select Expt 1E to perform it.
- Step 2:- Follow Step 3-4 of Expt 1A to record the input parameters needed for calculating the value of h_{BS}.You can change the values of transmit power,receive antenna height,frequency by adjusting the sliders.



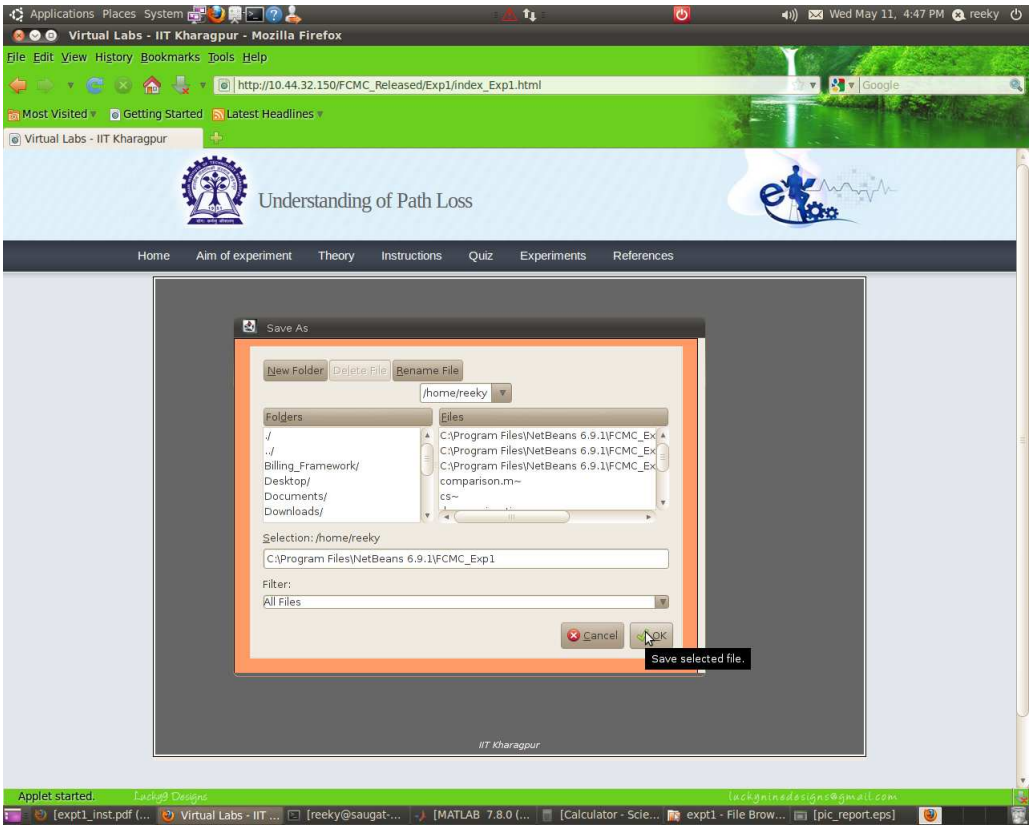
- Step 3:- Given, $h_{rx} = 1$m, $f_c = 2$GHz,d=668 m,$n_p = 3.12$,$P_t = 50$ dBm,$P_r(d) = -29.01$dBm . Now, calculate PL(d) using the formula:-$PL(d) = P_t - P_r(d)$=$50 - (-29.01) = 79.01$ dBm. Now, use this formula to calculate h_{tx}.$PL(d) = 10n_p log_{10}(d) + 7.8 - 18log_{10}(h_{tx}) - 18log_{10}(h_{rx}) + 20log_{10}(f_c)$.Putting the values, $79.01 = 10 * 3.12 * log_{10}(668) + 7.8 - 18log_{10}(h_{tx}) - 18log_{10}(1) + 20log_{10}(2)$.So,$h_{tx} = 16.55$ meters



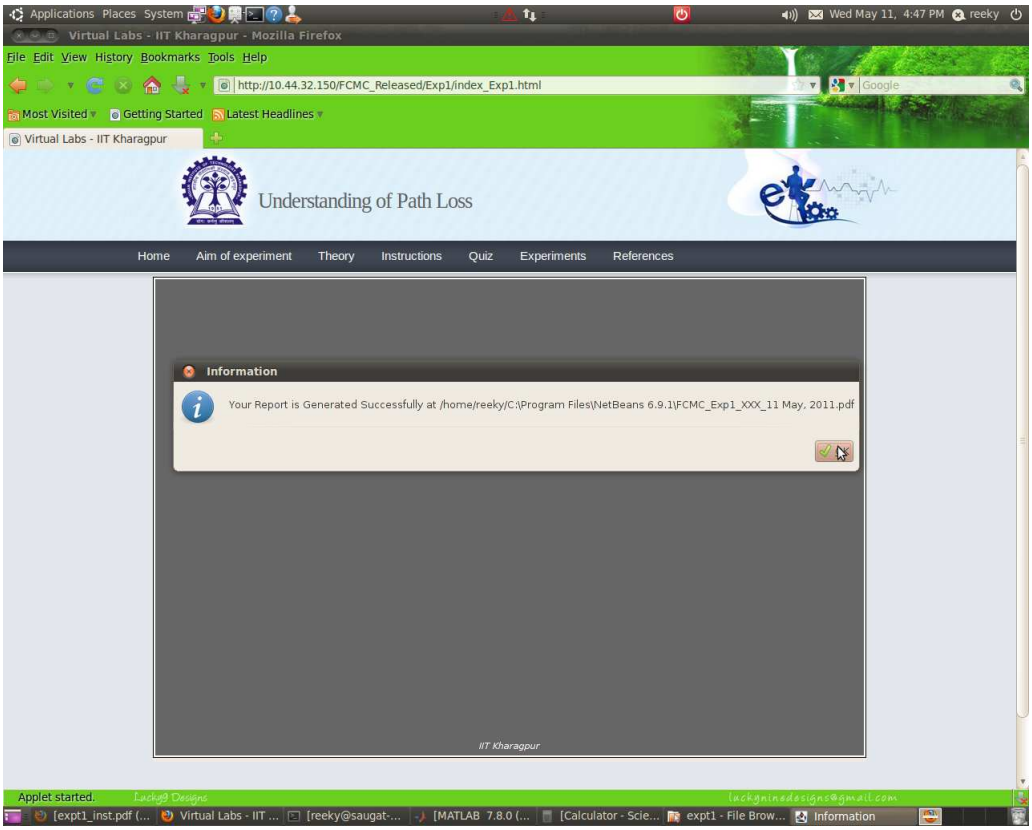
- Step 4:- Follow Steps 6-11 of Expt 1A to submit the results of Expt 1E.

1.7 Generating and saving the Report :-

- Step 12:Click on the GENERATE REPORT button once you finish doing all the experiments from Expt 1A to Expt 1E.
- Step 13:Click on the button SAVE to save your report.



- Step 14:Finally, a message will appear that your report has been generated successfully.After viewing the message click on the OK button.



- Step 15:You can view the pdf report of the experiment you have done.

Fading Channels & Mobile Communications
IIT Kharagpur

Date: 11 May, 2011

Exp 1: Understanding of PathLoss

Name: XXX

REPORT				
1A: Calculation of Received Power	1B: Calculation of Pathloss Exponent	1C: Calculation of Carrier Frequency	1D: Calculation of Receiver Antenna Height	1E: Calculation of BS Antenna Height
Pr(d0): -24.37 dBm	Pr(d0): -21.1 dBm	n: 4.57	fc: 2.0 Ghz	fc: 2.0 Ghz
Dist: 708.0 m	TxPow: 50.0 dBm	TxPow: 50.0 dBm	TxPow: 50.0 dBm	TxPow: 50.0 dBm
d0: 98.0m	Dist: 1092.0 m	hTx: 30.0 m	hTx: 30.0 m	n: 4.34
	Pr(d): -71.53 dBm	Dist: 1496.0 m	Dist: 1600.0 m	Dist: 516.0 m
	d0:87.0m	Pr(d): -82.58 dBm	Pr(d): -33.58 dBm	Pr(d): -53.03 dBm
		hRx: 1.0 m	n: 3.4	hRx: 1.0 m
Pr(Entered):-41.5461 dBm	n(Entered):4.59	fc(Entered):2.06 GHz	hRx(Entered):5.01 m	hTx(Entered):39.81 m
Pr(Actual):-41.55 dBm	n(Actual):4.59	fc(Actual):2.06 GHz	hRx(Actual):5.01 m	hTx(Actual):38.43 m

(Signature of the Candidate)

(Signature of Faculty)

Remarks:-

- Step 16:You can redo the entire experiment(Expt 1a to Expt 1e) by clicking on the button RESTART.