# Modelling Obstacles between UEs and eNB in NetSim LTE

Software Recommended: NetSim Standard v11.1 (32-bit/64-bit), Visual Studio 2015/2017

Follow the instructions specified in the following link to clone/download the project folder from GitHub using Visual Studio:

https://tetcos.freshdesk.com/support/solutions/articles/14000099351-how-to-clone-netsim-fileexchange-project-repositories-from-github-

Other tools such as GitHub Desktop, SVN Client, Sourcetree, Git from the command line, or any client you like to clone the Git repository.

**Note**: It is recommended not to download the project as an archive (compressed zip) to avoid incompatibility while importing workspaces into NetSim.

Secure URL for the GitHub repository:

# https://github.com/NetSim-TETCOS/MODELING\_OBSTACLES\_in\_LTE\_v11.1.git

#### Introduction:

Users can model obstacles and varied channel conditions between the eNB and the connected UEs, by modifying the underlying LTE code.

This is required because, as of **NetSim v11.0**, in the GUI, the wireless link (between one eNB and the connected UEs) properties are same i.e. if we change in one link it reflects in all the other links of UEs connected to same eNB.

Obstacles are modelled by adding an attenuation (in dB) value. Varying channel conditions are modelled by changing the pathloss exponent between the eNB and connected UEs.

### Steps:

• After downloading the project folder using the GitHub URL, Open NetSim Home Page click on **Open Simulation** option,

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Support Answers/FAQ Contact Technical Support Email - support@tetcos.com	Learn Videos Experiments Manual	Documentation User Manual Technology Libraries Source Code Help	Contact us Email - sales©tetcos.com Phone - +91767 605 4321

• Click on Workspace options

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• Click on More Options,

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• Click on **Import**, browse the extracted folder path and go into WorkSpace\_MODELING\_OBSTACLES directory. Click on Select folder and then on **OK**.

VetSim Star Jetwork Simulation/Emul Version 11.1.11 (32 Bit)	ndard lation Platfo	m			www.tetcos
		Current workspace: WorkSpace_MODELING_OBSTA			
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New Simulation C	curry	WorkSpace Analyse the content of your folder or a	rchive file to find projects and import	Export	TÎT
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Support		Learn	Documentation	Contact us	
Inswers/FAQ	t	Videos Experiments Manual	User Manual Technology Libraries	Email - sales@tet Phone - +91 767	cos.com 605 4321

• While importing the workspace, if the following warning message indicating Software Version Mismatch is displayed, you can ignore it and proceed.

N Warning	×						
Software Version Mismatch							
You are importing a workspace from 64 build of NetSim into a 32 build of NetSim. After import, reset binaries for this workspace, and then rebuild your code if you have made any changes to the source codes.							
OK							

• Go to home page, Click on **Open Simulation**  $\rightarrow$  **Workspace options**  $\rightarrow$  **Open code** 

LTE_Phy.c	a ×	-	Solution Explorer $\bullet \Psi \times$
🕾 LTE		•	00 <u>0</u> 0-500
13	*	÷	Search Solution Evolorer (Ctrl+1)
14	⊟#include "main.h"		Search Solution Explorer (earry)
15	#include "LTE.h"		👩 Solution 'NetSim' (1 project) 🔺
16	FILE *tp;		🔺 🕵 LTE
1/	static int fileupen = 0;	21	References
10	int UE count world in A flog - A		External Dependencies
19	deuble ve BL Attenuation Tx gain By gains		++ CA.c
20	Struct stru pathloss data		▶ 🖻 CA.h
21			++ D2D.c
23	int UE ID:		t+ Femtocell.c
24	double UE PL:		E Femtocell b
25	double ATTENUATION;		b the HARO c
26	double TX GAIN;		h to ITE -
27	double RX GAIN;		
28	};		P E LIE.n
29	<pre>typedef struct stru_pathloss_data *pathloss_data;</pre>		P ++ LIE_enum.c
30	<pre>pathloss_data *PL_data;</pre>		▷ LTE_enum.h
31	<pre>NETSIM_ID fn_NetSim_LTE_FindNearesteNB(NETSIM_ID nDeviceId);</pre>		++ LTE_Phy.c
32	<pre>int fn_NetSim_LTE_CalculateReceivedPower()</pre>		++ Mac_scheduler.c
33	{		MIMO.c
34	NETSIM_ID i;		MIMO.h
35	<pre>for(i=0;i<network->nDeviceCount;i++)</network-></pre>		** NAS.c
36	{		t+ PDCP.c
37	if(NETWORK->ppstruDeviceList[i]->nDeviceType==eNB		▶ 🕞 PDCP.h
38	<pre>DEVICE_TYPE(i+1)==RELAY)</pre>		b the Relay c
39	(		b the BLC c
40	NEISIM_IU ITIG=get_end_intertace(1+1);		N D PLCK
41	LIC_END_MACT ENDMACT(LIC_END_MACT)DEVICE_MACVAR(1+1,1T1d);		P E REC.n
42	LIC_ASSOCIATEUC_INFO: InTO=ENDMAC->associatedUEINTO;	×	P ** KKU.C
100 % +	4		Solution E Team Expl Class view

Based on whether you are using NetSim 32 bit or 64 bit setup you can configure Visual studio to build 32 bit or 64 bit DII files respectively as shown below:

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- 1. Right click on Solution in Solution Explorer and select rebuild solution
- 2. Upon rebuilding, **libLTE.dll** will get created in the **bin\_x86/ bin\_x64** folder.
- 3. Go to NetSim home page, click on **Open Simulation**, Click on **MODELING\_OBSTACLES\_LTE\_Experiment**.

NetSim Home NetSim S1 Network Simulation/I Version 11.1.11 (32 Bi	tandarc Emulation Plati	d form				www.tetcos.com
		Current workspace: WorkSpace_MOD	ELING_OBSTACLES		C Experiment name	
New Simulation	Ctrl+N	Experiment name	Date modified	Network type		
Open Simulation	Ctrl+O	MODELING_OBSTACLES_LTE_Example	27-03-2019	LTE	View Results	Export 🔟
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Support		Learn		Documentation	Contact	import experiment
Answers/FAQ Contact Technical Su Email - support@tetc	pport :os.com	Learn Videos Experiments Manual		User Manual Technology Libraries Source Code Help	Email - s. Phone -	us ales@tetcos.com +91 767 605 4321

4. After simulation, note down the throughputs available in the metrics window.

Steps to be done in NetSim to configure different path loss exponents:

We have added the following lines of code in LTE\_PHY.c file present inside LTE project as shown below:

LTE_Phy.c* 👳 🗙		▼ Solution Explorer ▼ ₽ >
🕵 LTE		© = 🗗 💿 🔶 📜
*		Search Solution Explorer (Ctrl+;)
<pre>#include "LTE.h" FILE *fp;</pre>		Solution 'NetSim' (1 project)
char data[100]; int UE_count, ue_	en = 0; id, i = 0, flag = 0; contine Tranic Pranic:	P •• References     Finite External Dependencies     ++ CA.c
Struct stru_pathl	enuation, ix_gain, xx_gain; oss_data	▷ CA.h ▷ ++ D2D.c ▷ ++ Emptocell c
double UE_PL; };		► Ferntocell.h ► ++ HARQ.c
pathloss_data *PL NETSIM_ID fn_NetS	ru_pathioss_data *pathioss_data; _data; im_LTE_FindNearesteNB(NETSIM_ID nDeviceId);	<ul> <li>▶ *+ LTE.c</li> <li>▶ ITE.h</li> <li>▶ *+ LTE_enum.c</li> </ul>
NETSIM_ID i;	_raiculatexecelvedpower()	In LTE_enum.h      ++ LTE_Phy.c      h
for (i = 0; i {	<pre><network->nDeviceCount; i++) RK-&gt;ppstruDeviceList[i]-&gt;nDeviceType == eNB   </network-></pre>	
DEVIC	E_TYPE(i + 1) == RELAY)	

To read the file content, we have added the following lines of code in fn\_NetSim\_LTE\_CalculateRxPower() present in LTE\_PHY.c file.

LTE_Phy.c* ♀ ×			<b>-</b>	Solution Explorer	
🕾 LTE	👻 (Global Scope) 👻	In_NetSim_LTE_CalculateRxPower(NET)	TSIM_ID enbld, NET 👻	G O A G - 7 A C	>
<pre>_} _int fn_NetSim_LTE_Cal</pre>	culateRxPower(NETSIM_ID enbId, NETS	IM_ID enbInterface, LTE_ASSOCIATEUE_INF	O* info, unsigned	Search Solution Explorer (Ctrl+;)	
<pre>{     tre_rws_Pvv* enbs     double dTXPower_L     trstpr_Lon LinkII     trs_vr=pvv* webby     double dTXPower_L     double dtArower_L     double dtainTvv=     double dtainTvv=     double dtainTvi     double fall, Haw     double fall, Haw     double fall, dtab, fall     double     double dtab, fall</pre>	<pre>hy = (LTE_ENE_PHY*)OEVICE_PHYVAR(en L = enDPNy-3dTXPOwer; = 0EVICE_PHYVAR(info- L = uEVICE_PHY*)OEVICE_PHYVAR(info- L = uEVPY-3dTXPOwer; 37; // TO GET THE FIXAULUE 6; // TO GET THE FIXAUUTE 6; // TO GET THE FIXAUUTE mone = 1; // TO GET THE FULL TO IS Liength = 0.0; // TO GET THE FULL TO IS Liength = 0.0; // TO GET THE FULL TO IS Liength = 0.0; // TO GET THE FULL TO IS ponent = 2; L, dfXPower_DL; = fn_wetSim_Utilities_CalculateDist 0</pre>	<pre>bid, embinterface); ace,)-&gt;niinktd; &gt;nUEId, info-&gt;nUEInterface); IN TANCE 6TH VALUE ance(DEVICE_POSITION(embid), DEVICE_POS</pre>	ITION(info->PUEId)	ITE         →         ■         References         →         ■         <	
fp = fopen(".	<pre>\\path_loss.txt", "r");</pre>			++ LTE_Phy.c	
<pre>fileOpen++; fscanf(fp, "# PL_data = (pa for (i = 0; i {         PL_data[]         PL_data[]         PL_data[]</pre>	UE_count = %d ", &UE_count); thloss_data *)calloc(UE_count, size . < UE_count; i++) .] = (oathloss_data *)calloc(1, size	of "PL_data);			
fscanf(f PL_data[i PL_data[i PL_data[i PL_data[i PL_data[i	<pre>, "SUE_ID = %d Pathloss_exponent = ' ]-&gt;UE_ID = ue_id; ]-&gt;UE_PL = ue_PL; ]-&gt;ATTENUATION = Attenuation; ]-&gt;TX_GAIN = Tx_gain; ]-&gt;RX_GAIN = Rx_gain;</pre>	%lf Attenuation = %lf Tx_gain = %lf Rx_	gain = %1f", &ue_i	<ul> <li>** PDCP.c</li> <li>PDCP.h</li> <li>** Relay.c</li> <li>** RLC.c</li> <li>N RLC.h</li> </ul>	
3			-	♦ ++ RRC.c	

And then the following lines in fn\_NetSim\_LTE\_CalculateRxPower() present in LTE\_PHY.c file.



Create a path\_loss.txt file and paste it in the install directory of NetSim would look something like "C:\Program Files\NetSim Standard\bin" and the file format should be

#UE\_count = 2

\$UE\_ID = 13 Pathloss = 4.7 Attenuation = 2 Tx\_gain = 2 Rx\_gain = 2

\$UE\_ID = 5 Pathloss = 4.7 Attenuation = 2 Tx\_gain = 2 Rx\_gain = 2

First line represents the number of UEs (whose path loss value needs to be changed). In the above sample, the numbers of UEs are 5. Second line represents UE id and the path loss exponent of particular UE link and so on.

#### Settings to be done to create the network scenario:

• Click and drop 1MME, 1 wired node, 2eNBs and 10UEs as per the below screenshot



- Create applications from wired node to all UEs with packet size 1460Bytes and Inter arrival Time 1168µs.
- Set channel characteristics as Path loss only, Path loss model as LOG DISTANCE and Path loss exponent to 3.5.

# **Results:**

After simulation, note down the throughputs available in the simulation results window and compare with the previous results (Without Obstacles between UEs and eNB). Users can observe the change in throughputs

Application_Metrics_Table													
Application_metrics		✓ Detailed View	V Detailed View										
Application Id	Throughput Plot	Application Name	Source Id	Destination Id	Packet generated	Packet received	Payload generated (bytes)	Payload received					
1	Application throughput plot	App1_CBR					62501140	0					
2	Application_throughput_plot	App2_CBR	2	6	42809	203	62501140	296380					
3	Application_throughput_plot	App3_CBR	2	7	42809	439	62501140	640940					
4	Application_throughput_plot	App4_CBR	2	8	42809	1200	62501140	1752000					
5	Application_throughput_plot	App5_CBR	2	9	42809	555	62501140	810300					
6	Application_throughput_plot	App6_CBR	2	10	42809	1585	62501140	2314100					
7	Application throughput plot	App7_CBR	2	11	42809	1530	62501140	2233800					
8	Application_throughput_plot	App8_CBR	2	12	42809	505	62501140	737300					
9	Application throughput_plot	App9_CBR	2	13	42809	0	62501140	0					
10	Application throughput plot	App10_CBR	2	14	42809	710	62501140	1036600					