

5G Channel Model – Pathloss File Input

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1 Download and project setup

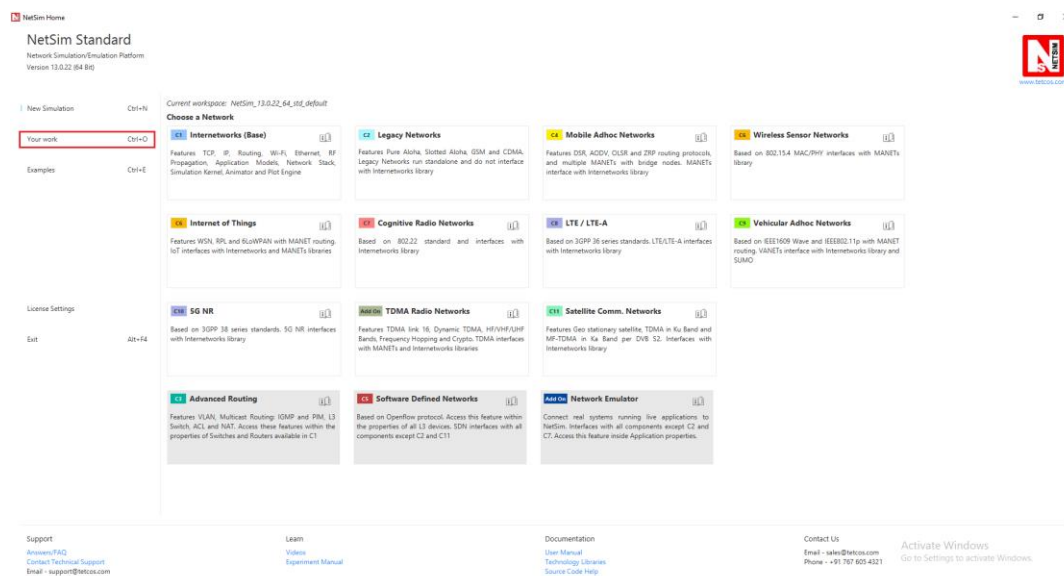
Software Recommended: NetSim Standard v13.0 (32-bit/ 64-bit), Visual Studio 2017/2019

Project Download Link:

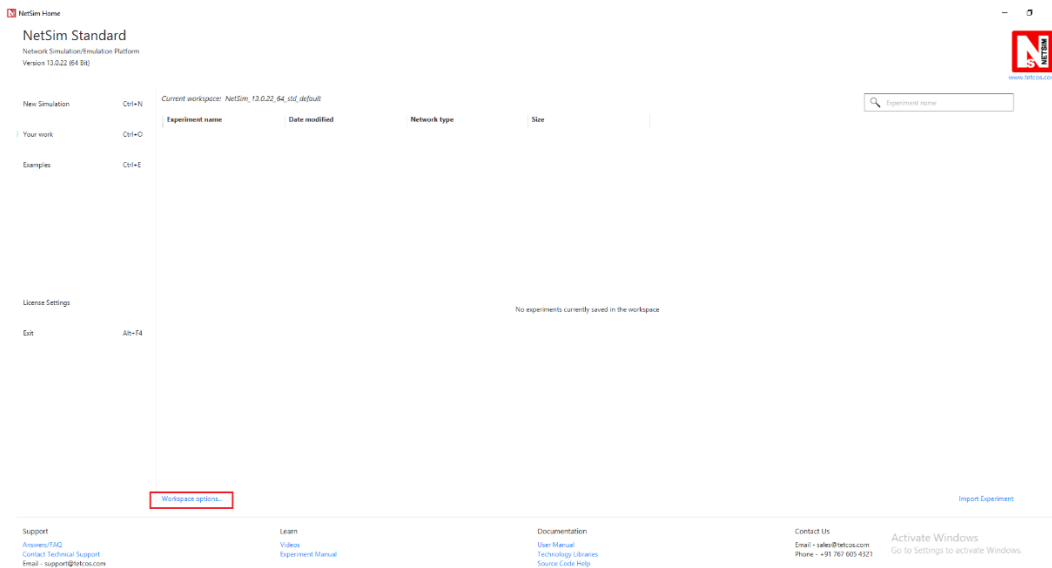
https://github.com/NetSim-TETCOS/5G_LTE_Pathloss_Input_v13.0/archive/refs/heads/main.zip

Procedure:

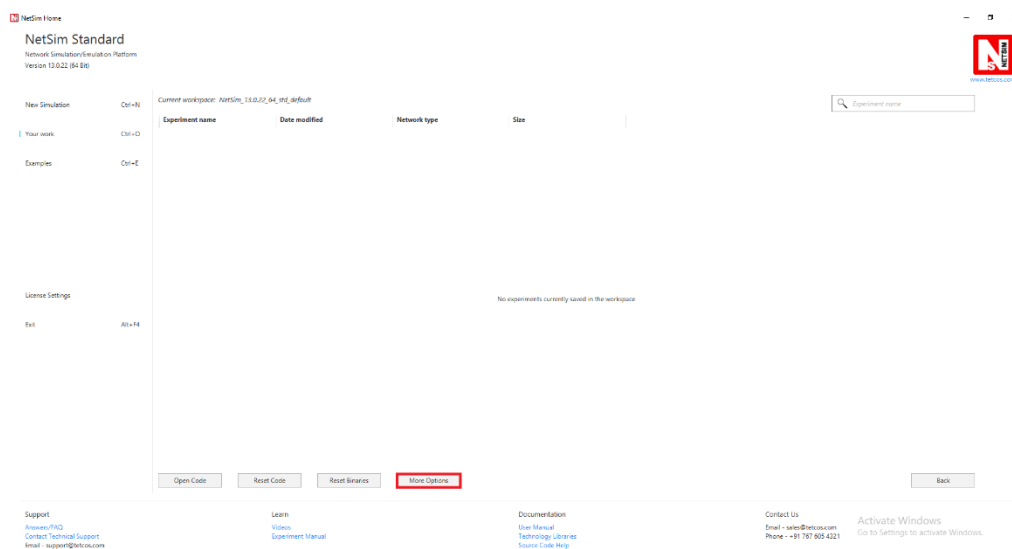
1. After you unzip the downloaded project folder, Open NetSim Home Page click on Your work option,



2. Click on Workspace options

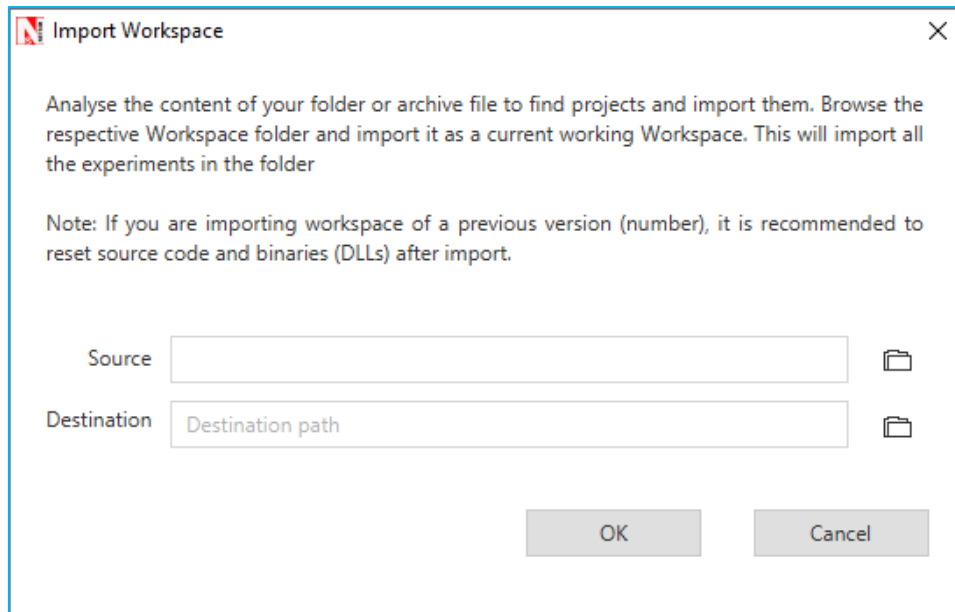


3. Click on More Options,

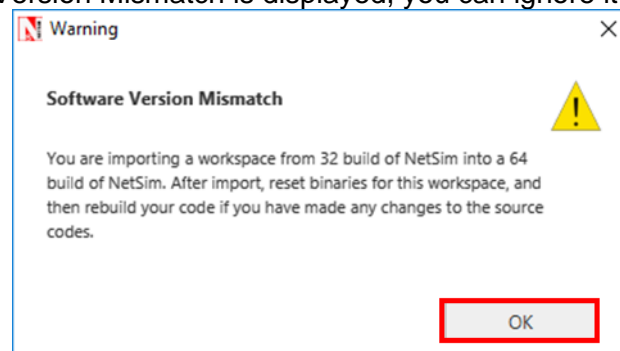


4. This will display a window where users need to give the source file (exported workspace file) and the Destination, the path where the workspace is to be imported to and then click on ok.

Note: Only exported workspaces with “.netsim_wsp” extension can be imported



5. Browse and select the downloaded 5G_Pathloss_File_Input_13_0.netsim_wsp file for the source option and click on Open. Browse and select a location to import for the destination option.
6. After this click on OK button in the Import Workspace window.
7. While importing the workspace, if the following warning message indicating Software Version Mismatch is displayed, you can ignore it and proceed.



8. The Imported workspace will be set as the current workspace automatically.
9. Open the Source codes in Visual Studio by going to Your work-> Workspace Options and Clicking on Open code button as shown below:

2 Features

Using this workspace users can

- vary the 5G channel model in NetSim
- input a pathloss file for each gNB in the network. NetSim would read the pathloss text file for the gNB in the network and use it to identify best server and for signal strength calculations.

3 Code Modifications

In LTE_NR.c file function for reading and opening the input pathloss file has been called

```
static bool isLTENRTraceConfigured = false;
static bool isCalledOnce = false;
//Function prototype
int fn_NetSim_LTE_NR_Init_F();
int fn_NetSim_LTE_NR_Configure_F(void** var);
int fn_NetSim_LTE_NR_Finish_F();
#pragma endregion

#pragma region LTENR_INIT
_declspec(dllexport) int fn_NetSim_LTE_NR_Init()
{
    if (!isCalledOnce)
    {
        FileBasedPathlossWritingFile();
        FileBasedpathlossReadingFile();
        isCalledOnce = true;
    }
    return fn_NetSim_LTE_NR_Init_F();
}
```

In LTENR_Propagation_Model.c the below highlighted edits

```
static double calculate_pathloss_only(ptrLTENR_PROPAGATIONINFO info)
{
    if (pathlossInfo[info->gnbld - 1])
    {
        return fn_netsim_get_pathloss_from_file(info->gnbld, info->ueld);
    }
    double fc = info->frequency_gHz;
    double PL1, PL2, PL3, distance2D, distance3D, distanceBP;
    double pathloss_RMa_LOS = 0, pathloss_RMa_NLOS = 0;
    double pathloss_UMa_LOS = 0, pathloss_UMa_NLOS = 0;
    double pathloss_UMi_LOS = 0, pathloss_UMi_NLOS = 0;
    double pathloss_InH_LOS = 0, pathloss_InH_NLOS = 0;

    double hBS, hUT, W, h;
    double h_effectiveEnv, hBS_effective, hUT_effective;

    distance2D = info->dist2D;
    distance3D = info->dist3D;

    LTENR_LOS_NLOS_STATE state = info->propagationConfig->state;
```

The ReadPathlossInput.c file contains the following functions:

```
LTE_NR.c  LTENR_PropagationModel.c  ReadPathlossInput.c  X
LTE_NR  (Global Scope)
1  #include "main.h"
2  #include "LTE_NR.h"
3  #include "LTENR_PHY.h"
4  #include "NetSim_utility.h"
5
6
7
8
9  /** This function is to free the file pointers */
10 int FileBasedpathlossPointersFree() { ... }
24 /** This function is to open the path where user can place the pathloss file for a GNB */
25 int FileBasedPathlossWritingFile() { ... }
36
37
38 /** This function is to open the file, and identify the pathloss for a receiver */
39 int FileBasedpathlossReadingFile() { ... }
162
163 double fn_netsim_get_pathloss_from_file(int gnbid, int ueid) { ... }
228
```

FileBasedpathlossReadingFile()

Reads the pathloss file given by user and stores the coordinates and pathloss values for each gNB in a separate list.

fn_netsim_get_pathloss_from_file()

Returns the pathloss at a requested receiver coordinate with respect to the transmitter gNB.

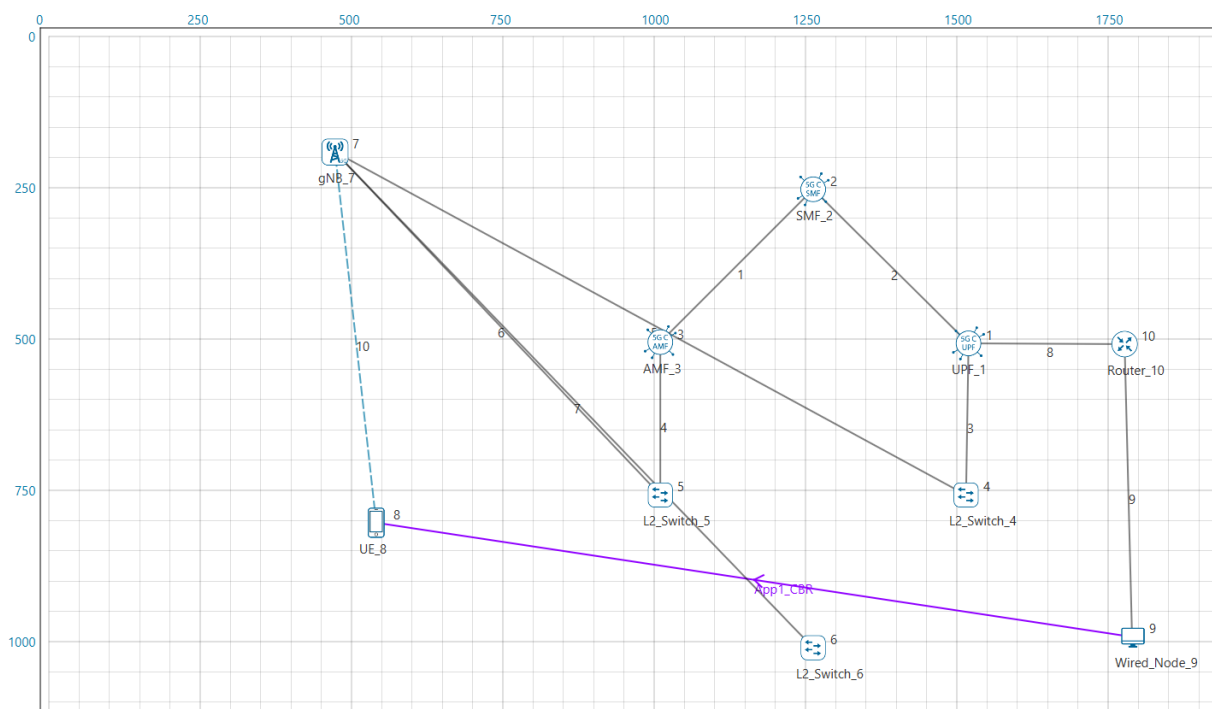
FileBasedPathlossWritingFile()

This function is to open the path where user can place the pathloss file for a GNB.

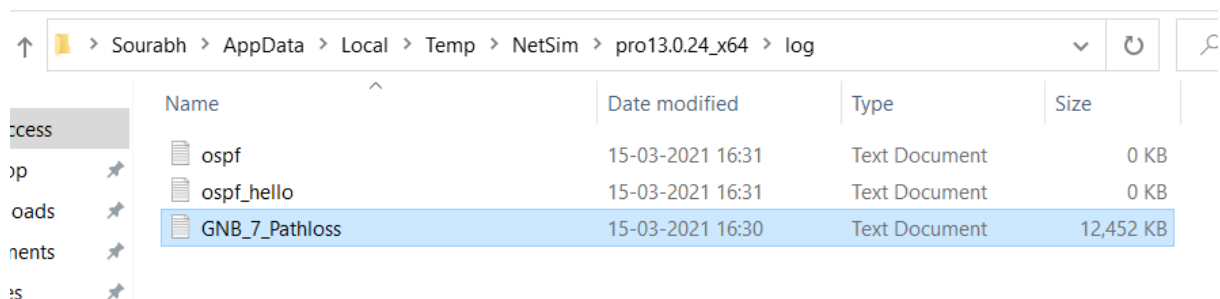
4 Example

The below scenario

- Consists of 1 gNB and 1 UE. An external pathloss file is given as input to the gNB. This will override whatever channel model is set via the GUI.
- Users should pay attention to the gNB's co-ordinates. It is *not* part of the pathloss file, and is set via the GUI (X, Y co-ordinates). Take care that the gNB co-ordinates match (or is suitably transformed) the co-ordinates used for generating the pathloss file
- The network is simulated for 60 s with application generation rate as 23 Mbps.



Upon clicking the RUN button, the log folder path is automatically opened. User should place the files containing the pathloss for eNB/Gnb's in the network here:



The pathloss file should start with the device name followed by “_Pathloss” and be saved as a text file (*.txt).

The pathloss file should be per the given format:

The first two lines must have the below parameters

xmax=1000,ymax=1000,zmax=100

xstep=5,ystep=5,zstep=10

Subsequently, x, y, z coordinates with pathloss value must be given.

x_cordinate (m),y_cordinate (m),z_cordinate (m),pathloss (dB)

An example screen shot is provided below



GNB_7_Pathloss - Notepad

File Edit Format View Help

xmax=1000,ymax=1000,zmax=100

xstep=5,ystep=5,zstep=10

-0,-0,0,137.759027464477

-0,5,0,137.69531485397

-0,10,0,137.632857177762

-0,15,0,137.571685063543

-0,20,0,137.511829025576

-0,25,0,137.45331942446

-0,30,0,137.396186425763

Note that if UE is placed at or moves to a location beyond xmax, ymax then the pathloss will be taken as 500 dB.

If input file is provided for a eNB/gNB then pathloss calculations will happen as per that, else NetSim will use the standard pathloss models to calculate the pathloss.

Once the simulation starts, the cmd window would look as shown below

```
Stack variables initialized
Could Not Find C:\Users\Roman\AppData\Local\Temp\NetSim\pro13.0.24_x64\Plot_*
Metrics variables initialized

5G Channel model workspace is being run. NetSim would now open a folder.
Place the pathloss file(s) for each gNB(s).
If there is no pathloss file for a gNB then the model set in the UI will be considered.
Then close the folder and press any key to continue..
```

Next, close the folder and press any key.

Simulation starts running.

Upon completion of simulation the impact of the pathloss input provided can be understood from the performance metrics parameters such as the application throughput, that are part of the results dashboard

Simulation Results

Network Performance

Link_Metrics

Queue_Metrics

TCP_Metrics

IP_Metrics

IP_Forwarding_Table

UDP Metrics

Switch Mac address table

Application_Metrics

ITERN SNAP

Export Results (.xls/.csv)

Print Results (.html)

Open Packet Trace

Open Event Trace

Log Files

Restore To Original View

Application_Metrics_Table

Application_Metrics

Application Id

Application Name

Packet generated

Packet received

Throughput (Mbps)

Del

1

App1_CBR

45000

5736

7.444053

276

Link_Metrics_Table

Link_Metrics

Link_id

Link_throughput_plot

Packet_transmitted

Packet_errorred

Packet_colliided

Data

Control

Data

Control

Data

Control

All

NA

349204

34

277

0

0

0

0

1

NA

0

0

0

0

0

0

2

NA

36722

16

0

0

0

0

3

NA

73619

2

80

0

0

0

0

4

NA

73722

0

102

0

0

0

0

5

NA

11608

0

0

0

0

0

6

NA

73538

0

95

0

0

0

0

7

NA

36723

16

0

0

0

0

8

NA

43272

0

0

0

0

0

TCP_Metrics_Table

TCP_Metrics

Source

Destination

Segment Sent

Segment Received

Ack Sent

Ack Received

Du

LTE_EPC_1

ANY_DEVICE

0

0

0

0

UE_4

ANY_DEVICE

0

0

0

0

ROUTER_5

ANY_DEVICE

0

0

0

0

WIRED_NODE_6

ANY_DEVICE

0

0

0

0

UE_8

ANY_DEVICE

0

0

0

0

UE_9

ANY_DEVICE

0

0

0

0

UE_10

ANY_DEVICE

0

0

0

0

UE_11

ANY_DEVICE

0

0

0

0

UE_12

ANY_DEVICE

0

0

0

0

UE_13

ANY_DEVICE

0

0

0

0

Queue_Metrics_Table

Queue_Metrics

Device_id

Port_id

Queued_packet

Dequeued_packet

Dropped_packet

1

2

1

1

0

5

1

73621

73621

0