5G Channel Model: Pathloss File Input

**Software:** NetSim Standard v14.0, Visual Studio 2022

**Project Download Link:**

<https://github.com/NetSim-TETCOS/5G-Pathloss-Input-File_v13.3/archive/refs/heads/main.zip>

Follow the instructions specified in the following link to download and setup the Project in NetSim:

[https://support.tetcos.com/en/support/solutions/articles/14000128666-downloading-and-setting-up-netsim-file-exchange-projects](https://support.tetcos.com/support/solutions/articles/14000128666-downloading-and-setting-up-netsim-file-exchange-projects)

**Features**

Using this workspace users can

* Input a pathloss file for each gNB in the network. NetSim would read the pathloss text file for the gNB in the network. This file is used for identifying best server and for calculating signal strength.
* Vary the 5G channel model in NetSim, by modifying the pathloss values in the file.

**Example**

Consider the example 1 Macro-Cell-gNB and 1UE with fixed mobility

* The **5G-Pathloss-Input-File\_v14.0 workspace** comes with a sample configuration that is already saved.To open this example, go to Your Work and click on the **1-Macro-gNB-1UE\_fixed** sample from the list of examples.
* The downloaded directory includes a subfolder named "Pathloss-Log-Sample." Within this subfolder, there is a reference text file containing pathloss values specifically associated with a Macro Cell gnb.
* The scenario consists of 1 gNB and 1 UE. An external pathloss file is given as input to the Macro Cell gNB. This will override whatever channel model is set via the GUI.
* Users should pay attention to the Macro Cell gNB’s co-ordinates. It is not part of the pathloss file, and is set via the GUI (X, Y co-ordinates). Makesure 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 38 Mbps.

A diagram of a network

Description automatically generated

Figure 1: Scenario showing UE downloading data from a server via the 5G Core and the Macro-Cell-gNB

* Upon clicking the RUN button, the log folder path is automatically opened. User should place the files containing the pathloss for gNB in here.

A screenshot of a computer

Description automatically generated

Figure 2: User should place the pathloss file in this log folder

* 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.

**max=<X-axis length(m)>, ymax=<Y-axis length(m)>, zmax=<Z-axis length(m)**

**xstep=<X-axis step length(m)>, ystep=<Y-axis step length(m)>, zstep=<Z-axis step length(m)>**

Here the axis length is the max distance till which points would be given. The number of entries along X for example will be X-Axis-Length divided by X-Axis-Step-Length.

The pathloss does not change between each point; it only changes at the “next” point whose co-ordinates are determined by the step-length.

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

x\_ co-ordinate (m), y\_ co-ordinate (m), z\_ co-ordinate (m), pathloss (dB)

* An example screenshot is provided below.

A screenshot of a computer

Description automatically generated

Figure 3: Pathloss File format

* 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 an Macro-cell 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 command window it will show a Message as “**Close the folder and press any key to continue**”.
* Place your Pathloss input file in the folder opened. Next, close the folder and press any key.
* Simulation starts running.
* Upon completion of simulation the pathloss input provided will have an impact on performance metrics parameters such as the application throughput, that is displayed in the results dashboard.

A screenshot of a computer

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Figure 4: NetSim results dashboard

**Appendix: NetSim source code modifications**

Open the source codes in Visual Studio by going to Your Work -> Workspace Options and clicking on the Open Code button.

**Changes in LTE\_NR.c file function for reading and opening the input pathloss file has been called.**

static bool isLTENRConfigured = false;

static bool isLTENRTraceConfigured = false;

static bool isCalledOnce = false;

static bool isMetricsCalled = 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();

LTENR\_fn\_InterferenceInit();

fn\_NetSim\_LTENR\_HARQ\_Init();

LTENR\_RadioMeasurements\_Init();

fn\_NetSim\_LTE\_MAC\_PRBLOG();

fn\_NetSim\_LTE\_TTTLOG();

isCalledOnce = true;

}

return fn\_NetSim\_LTE\_NR\_Init\_F();

}

**Changes in LTENR\_Propagation\_Model.c**

static double calculate\_pathloss\_only(ptrLTENR\_PROPAGATIONINFO info)

{

if (pathlossInfo[info->gnbId - 1])

{

return fn\_netsim\_get\_pathloss\_from\_file(info->gnbId, info->ueId);

}

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:**

**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.