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**Jomo Kenyatta University of Agriculture and Technology**

**Telecommunication and Information Engineering**

**Unit: Wireless Communication II**

**Code: ETI 2511**

**LAB 3**

**Group 4**

|  | **Name** | **Reg. No.** |
| --- | --- | --- |
| 1 | **Simiyu Patience Simuli** | **ENE221-0110/2018** |
| 2 | **Levin Wasike** | **ENE221-0300/2016** |
| 3 | **Benson Chege** | **ENE221-0283/2016** |
| 4 | **Wicliffe Wasonga** | **ENE221-0122/2017** |

**SIMULATION OF LTE PROPAGATION CHANNELS**

**Introduction**

This lab is meant to demonstrate how to simulate propagation channels. It demonstrates the generation of reference signals specific to a cell, map them onto a resource grid and perform OFDM modulation then pass the results of these processes through a fading channel.

**Procedure:**

**Step 1**

enb.NDLRB = 9;

enb.CyclicPrefix = 'Normal';

enb.PHICHDuration = 'Normal';

enb.CFI = 3;

enb.Ng = 'Sixth';

enb.CellRefP = 1;

enb.NCellID = 10;

enb.NSubframe = 0;

enb.DuplexMode = 'FDD';

antennaPort = 0;

**Step 2: Resource Grid and Transmission Waveform**

Generate a subframe resource grid. To create the resource grid, call the [lteDLResourceGrid](about:blank) function. This function creates an empty resource grid for one subframe.

subframe = lteDLResourceGrid(enb);

Generate cell-specific reference symbols (CellRS) and map them onto the resource elements (REs) of a resource grid using linear indices.

cellRSsymbols = lteCellRS(enb,antennaPort);

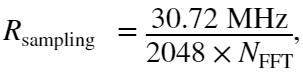
cellRSindices = lteCellRSIndices(enb,antennaPort,{'1based'});

subframe(cellRSindices) = cellRSsymbols;

Perform OFDM modulation of the complex symbols in a subframe, subframe, using cell-wide settings structure enb.

[txWaveform,info] = lteOFDMModulate(enb,subframe);

The first output argument, txWaveform, contains the transmitted OFDM modulated symbols. The second output argument, info, is a structure that contains details about the modulation process. The field info.SamplingRate provides the sampling rate, , of the time domain waveform:



where  is the size of the OFDM inverse Fourier transform (IFT).

**Step 3: Propagation Channel**

Construct the LTE multipath fading channel by first setting up the channel parameters by creating a structure channel.

channel.Seed = 1;

channel.NRxAnts = 1;

channel.DelayProfile = 'EVA';

channel.DopplerFreq = 5;

channel.MIMOCorrelation = 'Low';

channel.SamplingRate = info.SamplingRate;

channel.InitTime = 0;

The sampling rate in the channel model, channel.SamplingRate, must be set to the info field of the SamplingRate returned by the [lteOFDMModulate](about:blank) function.

Pass data through the LTE fading channel by calling the  [lteFadingChannel](about:blank) function. This function generates an LTE multipath fading channel, as specified in TS 36.101 (See reference [1]). The first input argument, txWaveform, is an array of LTE transmitted samples. Each row contains the waveform samples for each of the transmit antennas. These waveforms are filtered with the delay profiles as specified in the parameter structure, channel.

rxWaveform = lteFadingChannel(channel,txWaveform);

**Step 4: Received waveform**

The output argument, rxWaveform, is the channel output signal matrix. Each row corresponds to the waveform at each of the receive antennas. Since you have defined one receive antenna, the number of rows in the rxWaveform matrix is one.

size(rxWaveform)

**Outcome:**



**Step 5: Plot Signal Before and After Fading Channel**

Display a spectrum analyzer with before-channel and after-channel waveforms, using Welch's

spectrum estimation method.

title = 'Waveform Before and After Fading Channel';

saScope = dsp.SpectrumAnalyzer('SampleRate',info.SamplingRate,'ShowLegend',true,...

'SpectralAverages',10,'Title',title,'ChannelNames',{'Before','After'});

saScope([txWaveform,rxWaveform]);

