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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

School of Electronics Engineering (SENSE)

B. Tech – Electronics & Communication Engineering

BECE317P – WIRELESS AND MOBILE COMMUNICATION

LAB RECORD

(lab slot L9+L10)

Submitted By

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Submitted To

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DATE: 5/4/2025

EXPERIMENT 9

AIM: Study how the throughput of LTE network varies as the Channel bandwidth changes in the ENB (Evolved node)

SOFTWARE USED: Net Sim Academia

THEORY:

In an LTE network, the throughput is directly influenced by the channel bandwidth configured at the Evolved Node B (eNB). LTE supports multiple bandwidth options—1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, and 20 MHz—where a higher bandwidth allows more resource blocks (RBs) to be allocated for user data transmission. Since the data rate in LTE is a function of the number of available RBs, modulation scheme, and coding rate, increasing the bandwidth results in a proportional increase in network throughput.

For example, a 20 MHz LTE channel can theoretically provide peak downlink speeds of up to 150 Mbps using 64-QAM modulation and 2x2 MIMO, while a 10 MHz channel would achieve about half that throughput under similar conditions. However, real-world throughput is affected by factors like network congestion, interference, and radio conditions. Thus, while increasing bandwidth generally enhances throughput, optimal performance also depends on adaptive modulation, MIMO configurations, and link quality.

PROCEDURE:

The following set of procedures were done to generate this sample:

Step 1: A network scenario is designed in NetSim GUI comprising of 3 User Equipment's, 1 ENB, 1 MME, 1 Router, and 1 Wired Node in the "LTE/LTE-A" Network Library.

Step 2: TCP Protocol is set to Disable in Wired Node 1.

Step 3: In the Interface LTE > Physical Layer, Carrier Aggregation is set to Inter Band Noncontiguous CA. In the Interface LTE > Physical Layer > CA1 and CA2 Properties of ENB 4, Channel Bandwidth is set to 10 MHz for both the carriers.

Step 4: In the General Properties of all the UE's "Velocity (m/s)" parameter is set to 0.

Step 5: The Wired Link Properties are set as follows:

Link Properties	Wired Link 1	Wired Link 2	Wired Link 3
Uplink Speed (Mbps)	1000	1000	1000
Downlink Speed (Mbps)	1000	1000	1000
Uplink BER	0	0	0
Downlink BER	0	0	0

Step 6: In the Wireless Link Properties, Channel Characteristics is set to NO PATHLOSS.

Step 7: Three CUSTOM Applications are configured as per the table given below:

Application Properties	Application 1	Application 2	Application 3
Application Type	Custom	Custom	Custom
Source ID	Wired Node 1	Wired Node 1	Wired Node 1
Destination ID	UE 5	UE 6	UE 7
Packet Size			
Distribution	Constant	Constant	Constant
Value(Bytes)	1460	1460	1460
Inter Arrival Time			
Distribution	Constant	Constant	Constant
Value(μs)	146	146	146

Step 8: Run the Simulation for 10 Seconds. The following changes in settings are done from the previous sample for the remaining samples:

Sample 2:

Step 1: In the Interface LTE > Physical Layer > CA1 and CA2 Properties of ENB 4, Channel Bandwidth is set to 10 and 5 MHz respectively.

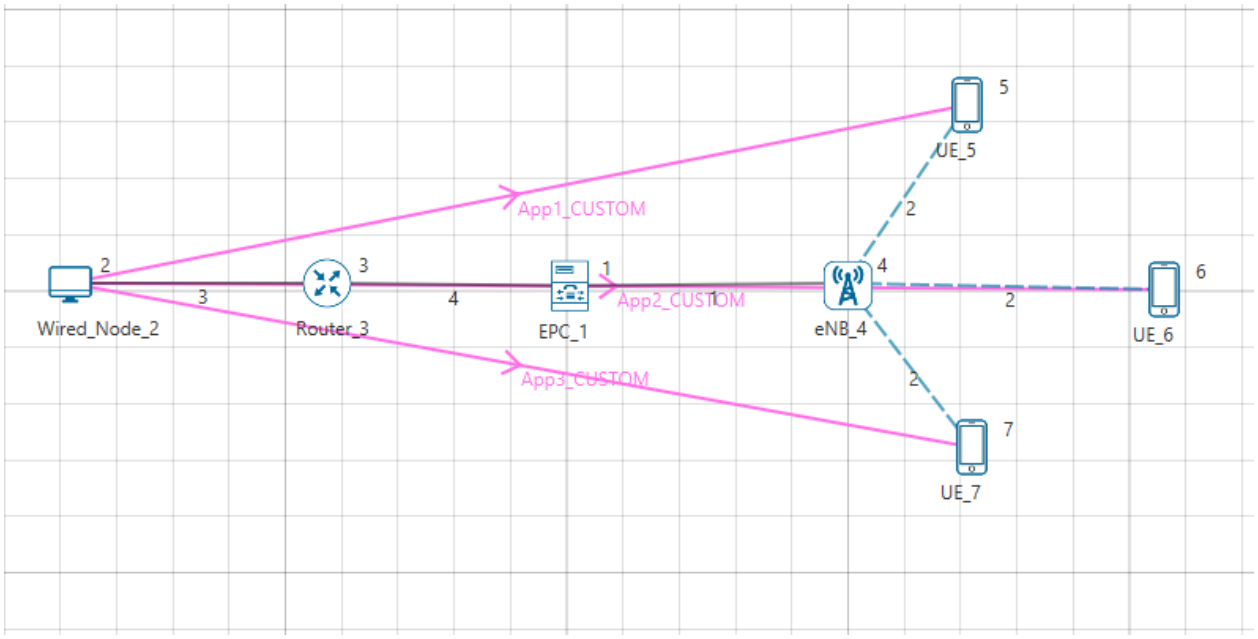
Step 2: Run the Simulation for 10 Seconds.

Sample 3:

Step 1: In the Interface LTE > Physical Layer > CA1 and CA2 Properties of ENB 4, Channel Bandwidth is set to 5 and 5 MHz respectively.

Step 2: Run the Simulation for 10 Seconds.

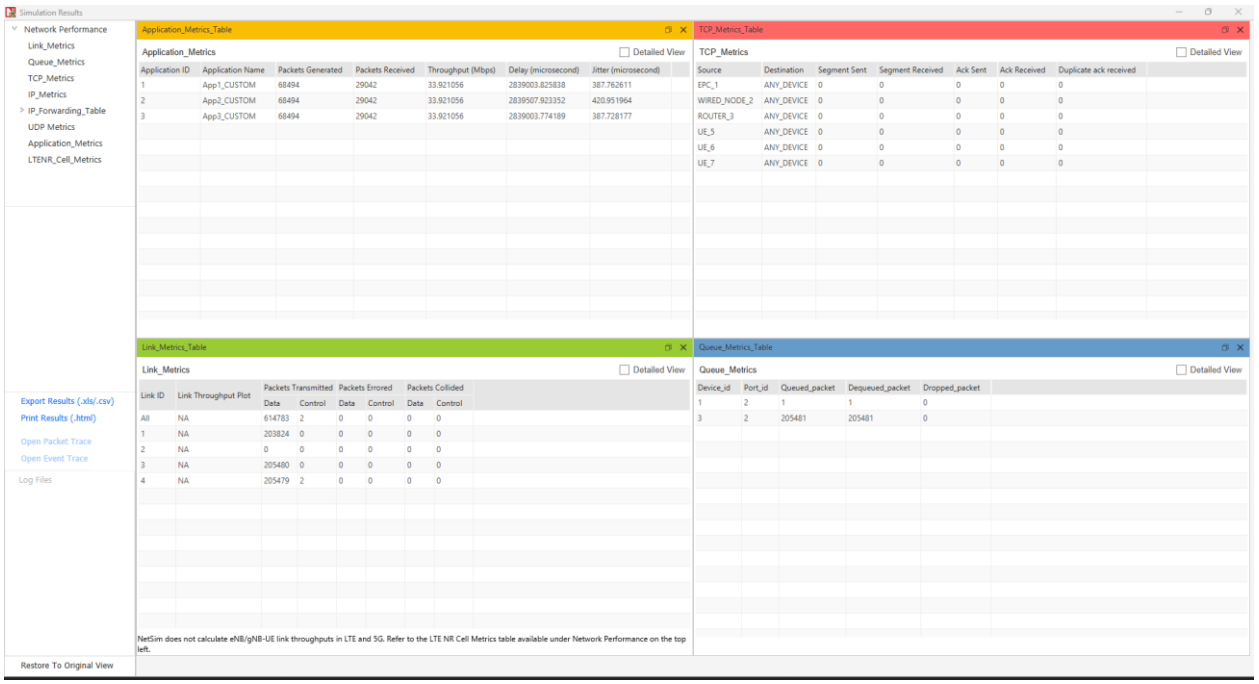
IMPLEMENTATION:



OUTPUT:

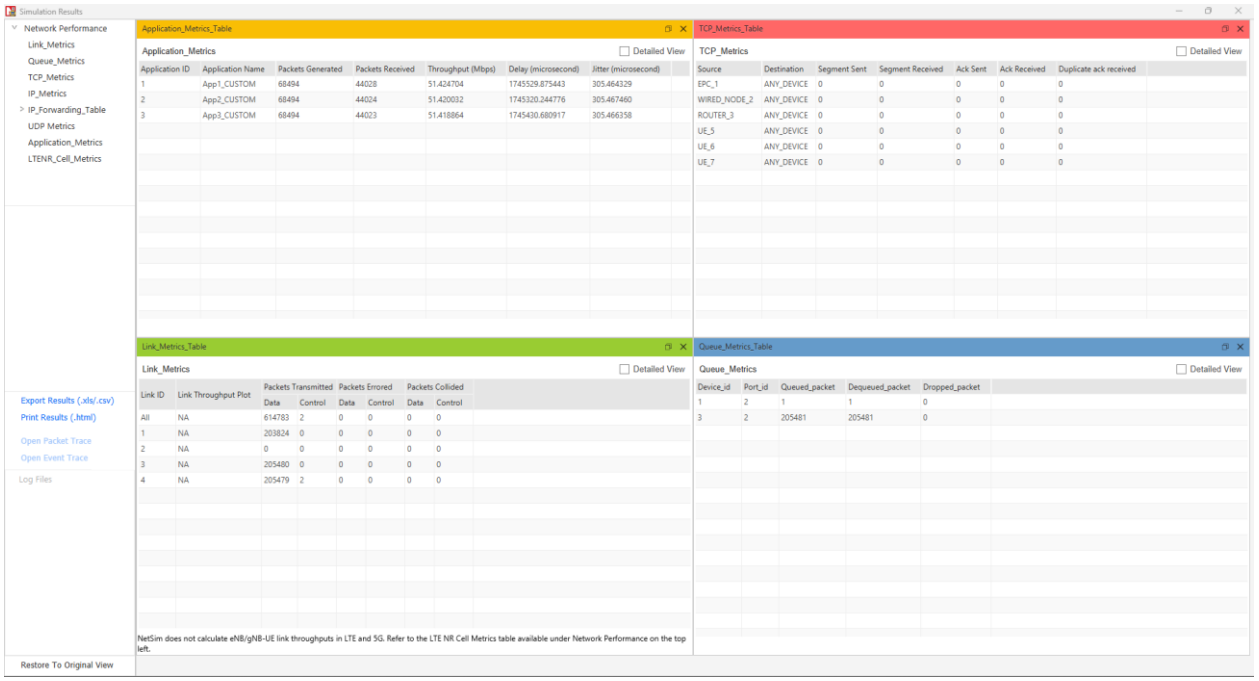
For Channel Bandwidth: 10 MHz

1	33.92106
2	33.92106
3	33.92106
sum	101.7632



For Channel Bandwidth: 15 MHz

1	51.4247
2	51.42003
3	51.41886
sum	154.2636



For Channel Bandwidth: 20 MHz

1	68.92835
2	68.91784
3	68.92018
sum	206.7664

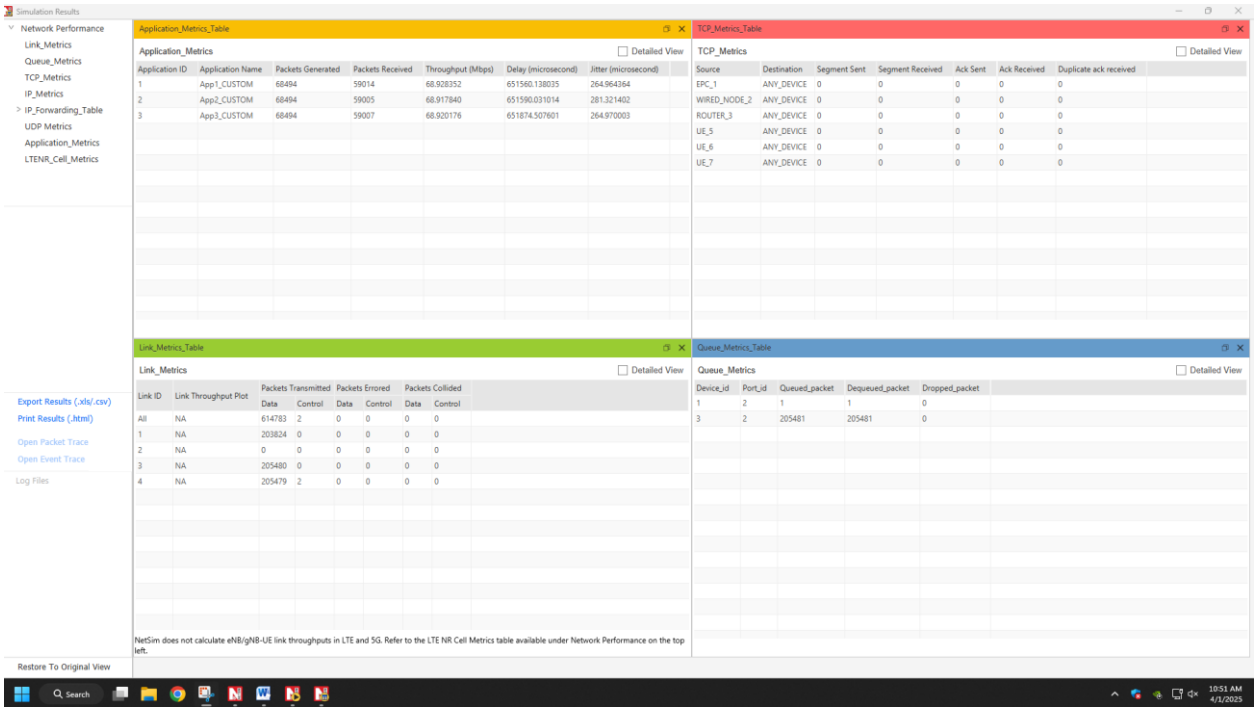
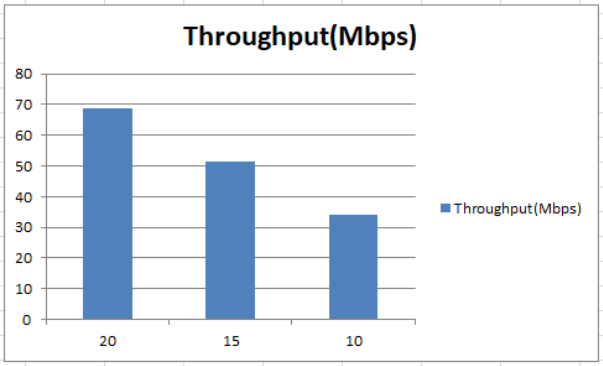


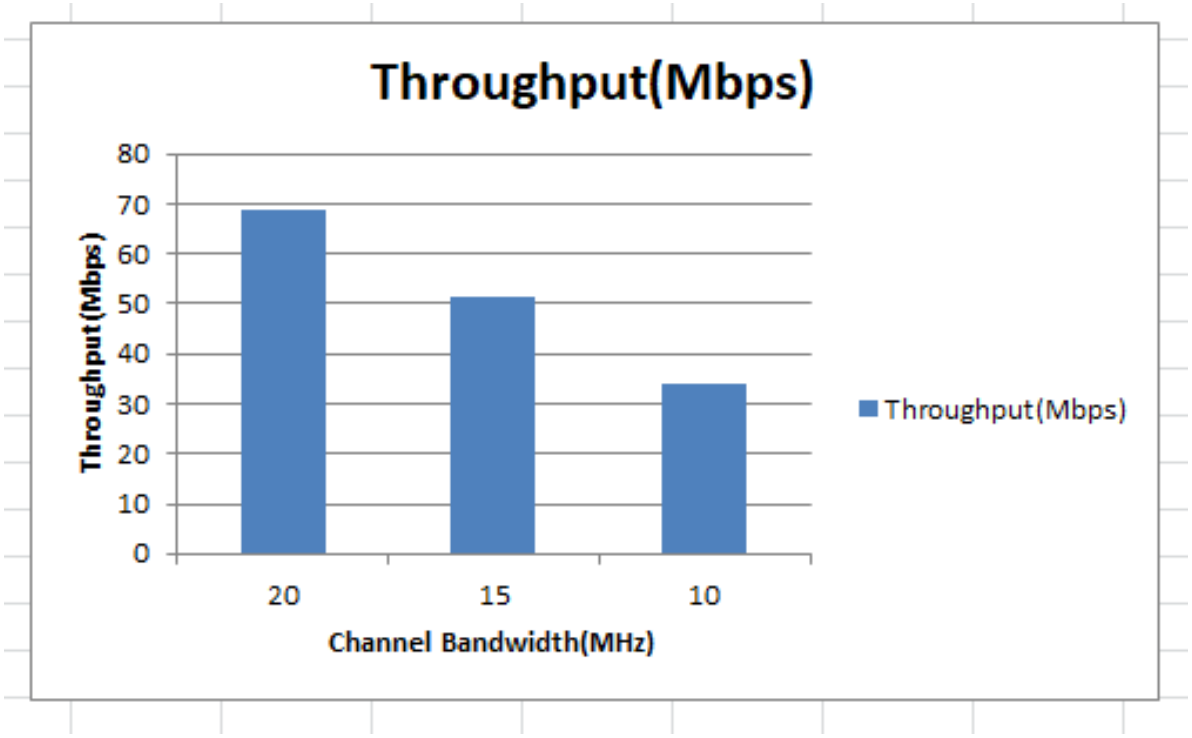
Table: Channel Bandwidth vs Throughput

SAMPLE	CHANNEL BANDWIDTH(MHz)	THROUGHPUT(Mbps)
1	20	68.92
2	15	51.41
3	10	33.92

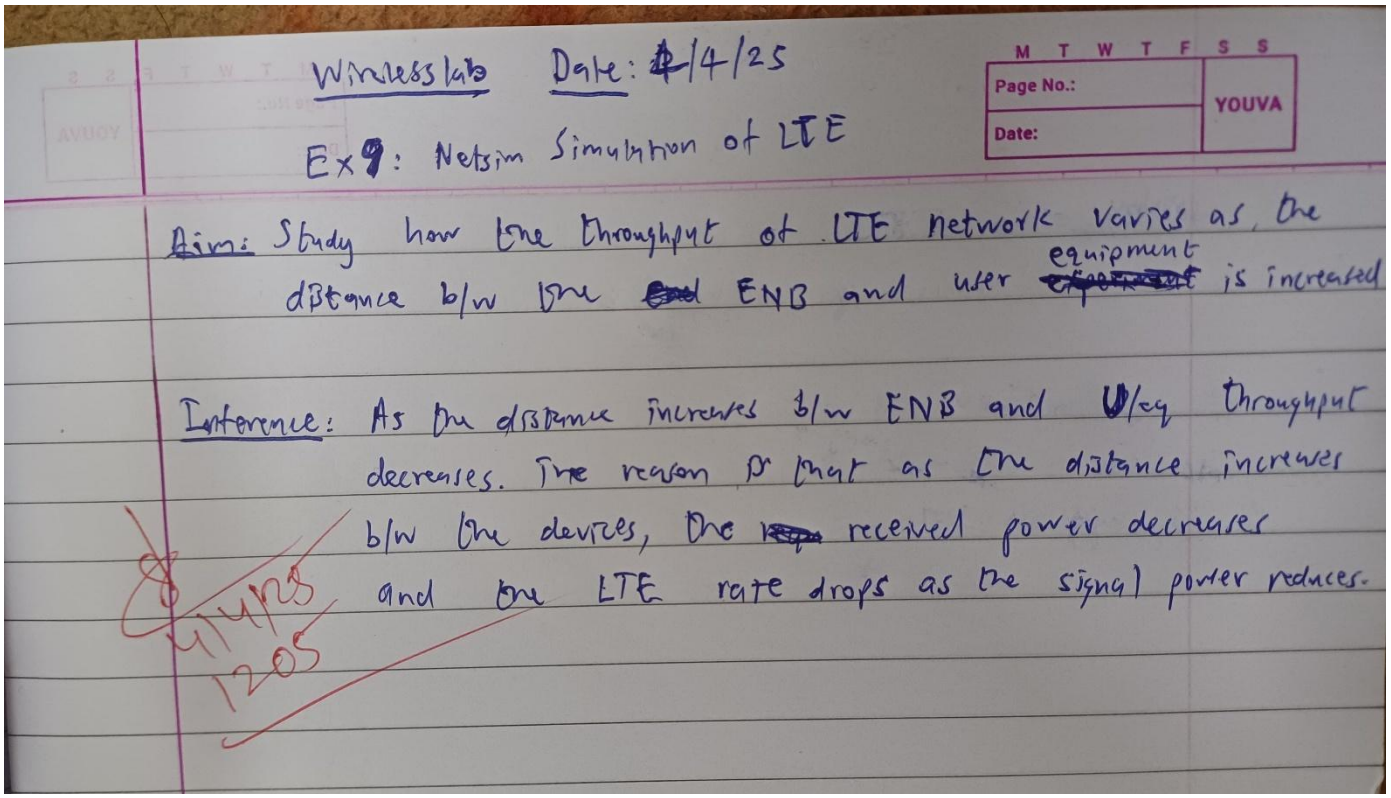
COMPARISON CHART:

CHANNEL BANDWIDTH(MHz)	Throughput(Mbps)
20	68.92
15	51.41
10	33.92





VERIFICATION:


Wireless lab Date: 4/4/25

Ex 9: Netsim Simulation of LTE

M T W T F S S
Page No.: YOUVA
Date:

Aim: Study how the throughput of LTE network varies as the distance b/w the ENB and user equipment is increased

Inference: As the distance increases b/w ENB and U/eq throughput decreases. The reason for that as the distance increases b/w the devices, the received power decreases and the LTE rate drops as the signal power reduces.

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RESULT/INFERENCE:

LTE provides spectrum flexibility with scalable transmission bandwidth between 1.4 MHz and 20 MHz depending on the available spectrum for flexible radio planning. The 20 MHz bandwidth can provide up to 150 Mbps downlink user data rate and 75 Mbps uplink peak data rate with 2×2 MIMO, and 300 Mbps with 4×4 MIMO.

As the channel bandwidth decreases the number of resource blocks also decreases. If more resource blocks are available then a greater number of packets can be transmitted