

Islamic University of Technology (IUT)

A subsidiary organ of the OIC

Department of Electrical and Electronic Engineering

Project

On

Cellular Communication Lab

Submitted By-

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Section : A

Objective:

Build a simulation to cover the whole of Dhaka city with 50 eNodeBs(LTE) according to coverage, capacity, throughput, and signal quality using Forsk Atoll.

Introduction:

To cover the whole city for a cellular communication system, we mainly need to focus on how much area we want to cover, where most of the people live, where the data demand is higher and where signal quality has to be best, and where average signal quality is good enough. Keeping these things in mind we placed eNodeBs and get the estimation of throughput, signal quality, capacity, and coverage.

Procedure:

1. Firstly, we have placed eNodeBs randomly to see the scenario and get the estimation. We have placed 50 eNodeBs to cover the whole area.



Figure 1: Dhaka City coverage with 50 eNodeBs for LTE



		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

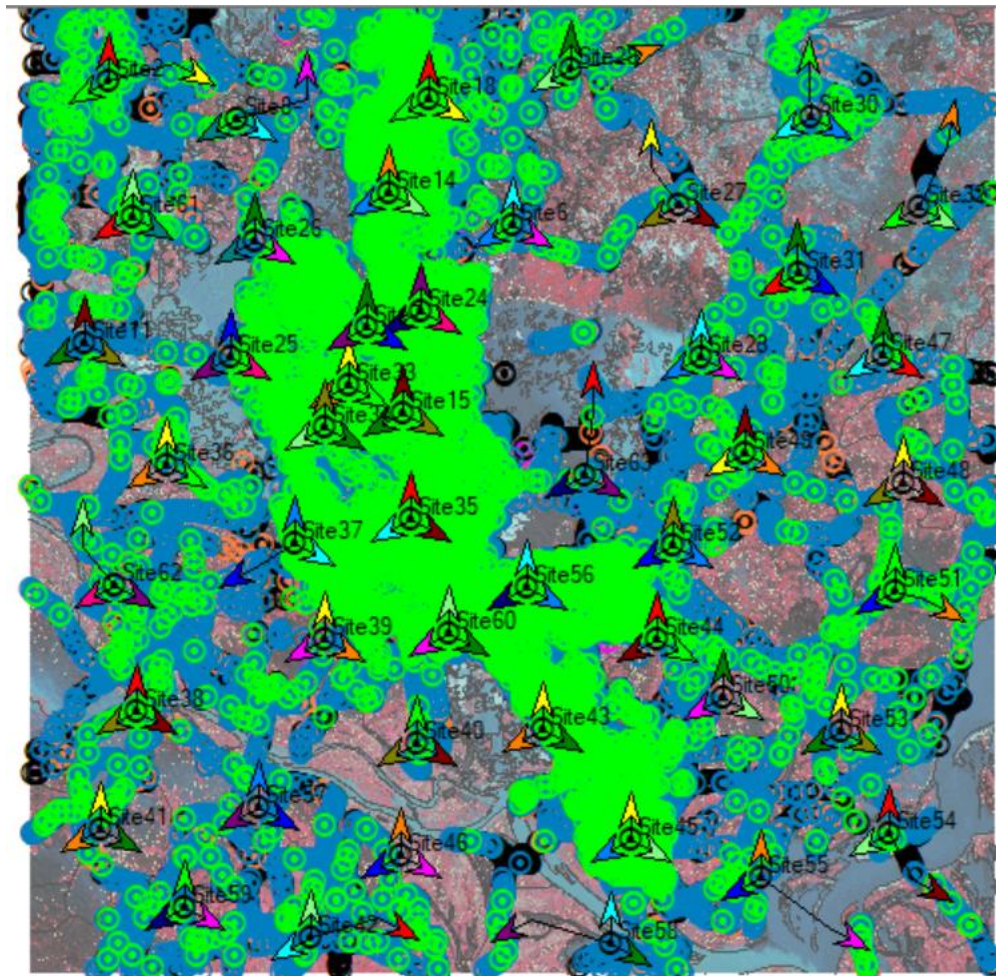
Figure 3: Showing only uplink-connected users.



		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

Figure 4: Showing only downlink-connected users.

3. Second attempt: To make good coverage for a cellular network we have to cover the whole area and from every region the users should get a good amount of signal. So, we moved some eNodeBs to get better coverage. Also, we need to remove those coverage holes and increase the coverage area.



		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

Figure 5: Attempting to reduce the coverage holes.

From this figure, we can say the cover hole reduced also the uplink and downlink connected users increased, only uplink connected users increased and only downlink connected users increased. Also, we can say the coverage area also increased. Because the number of black-colored users is reduced.



		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

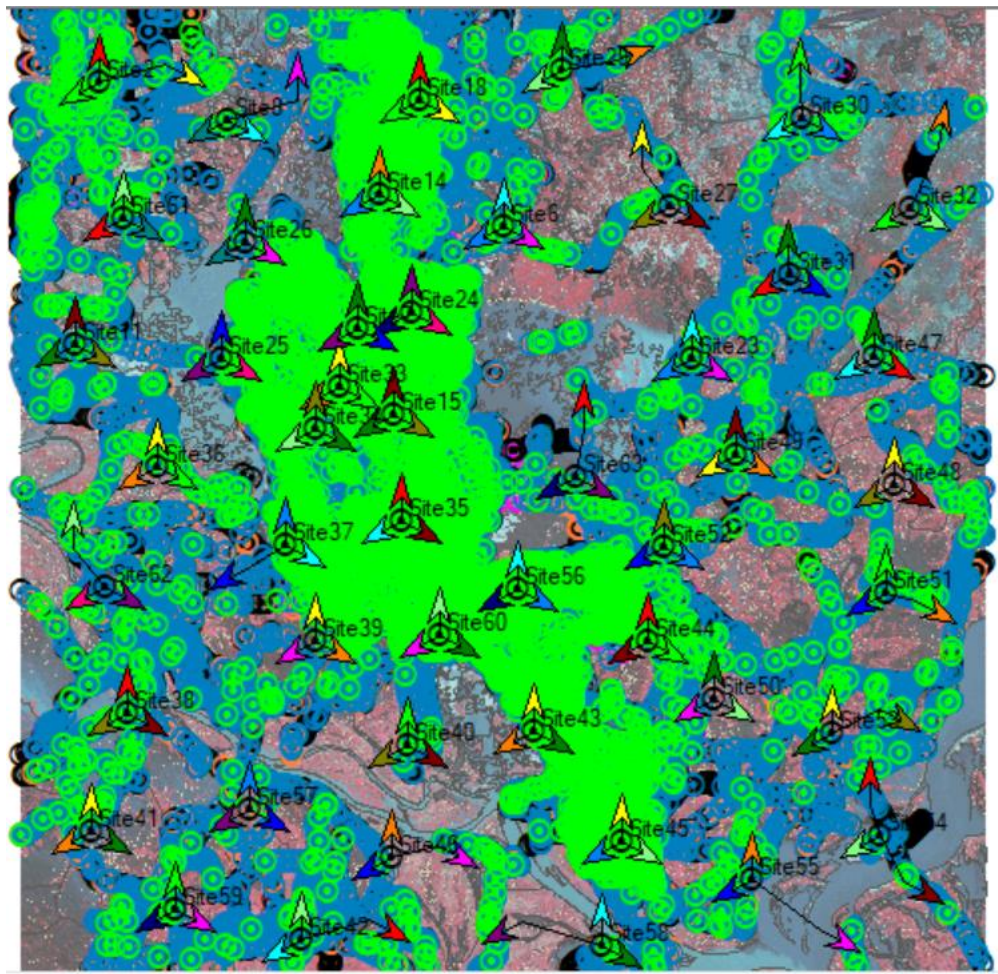
Figure 6: Showing only uplink-connected users.



		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

Figure 7: Showing only uplink-connected users.

4. Third attempt: By doing further improvements we get



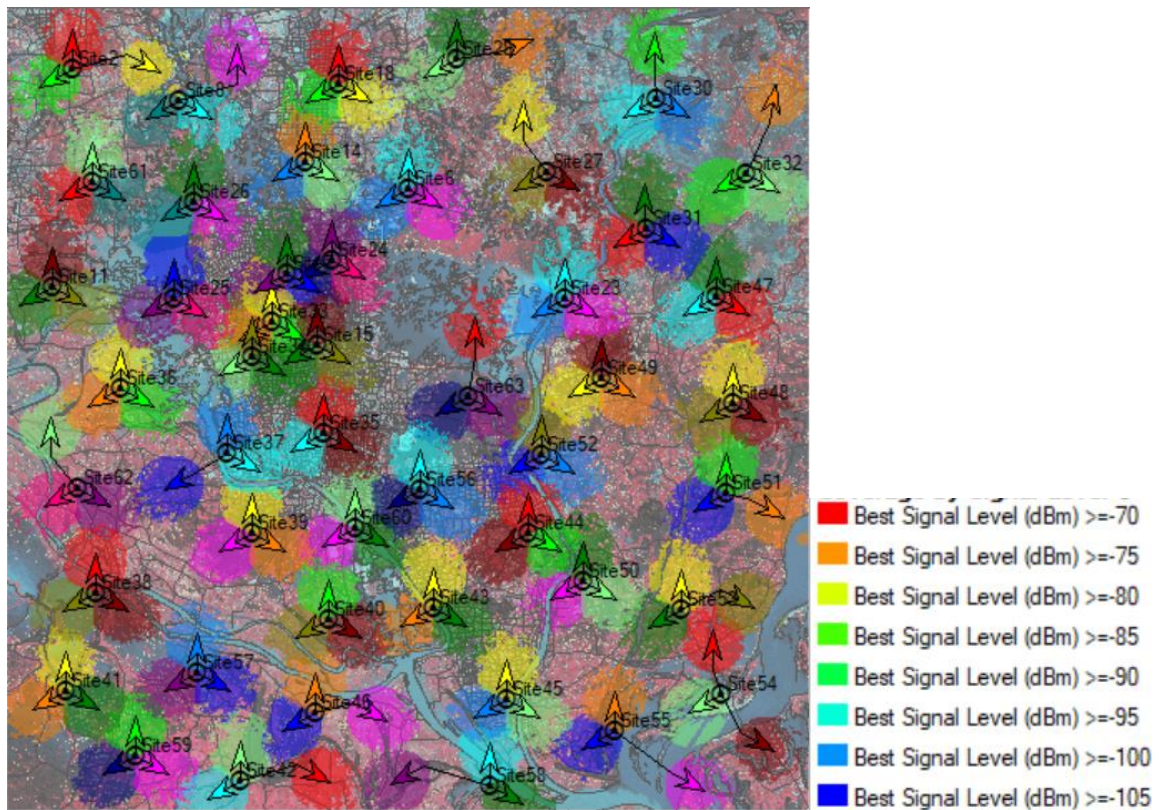
		Value	Legend
1		Connected DL+UL	Connected DL+UL
2		Connected DL	Connected DL
3		Connected UL	Connected UL
4		No Service	No Service

Figure 2: Real-time simulation to see the current signal quality in different areas

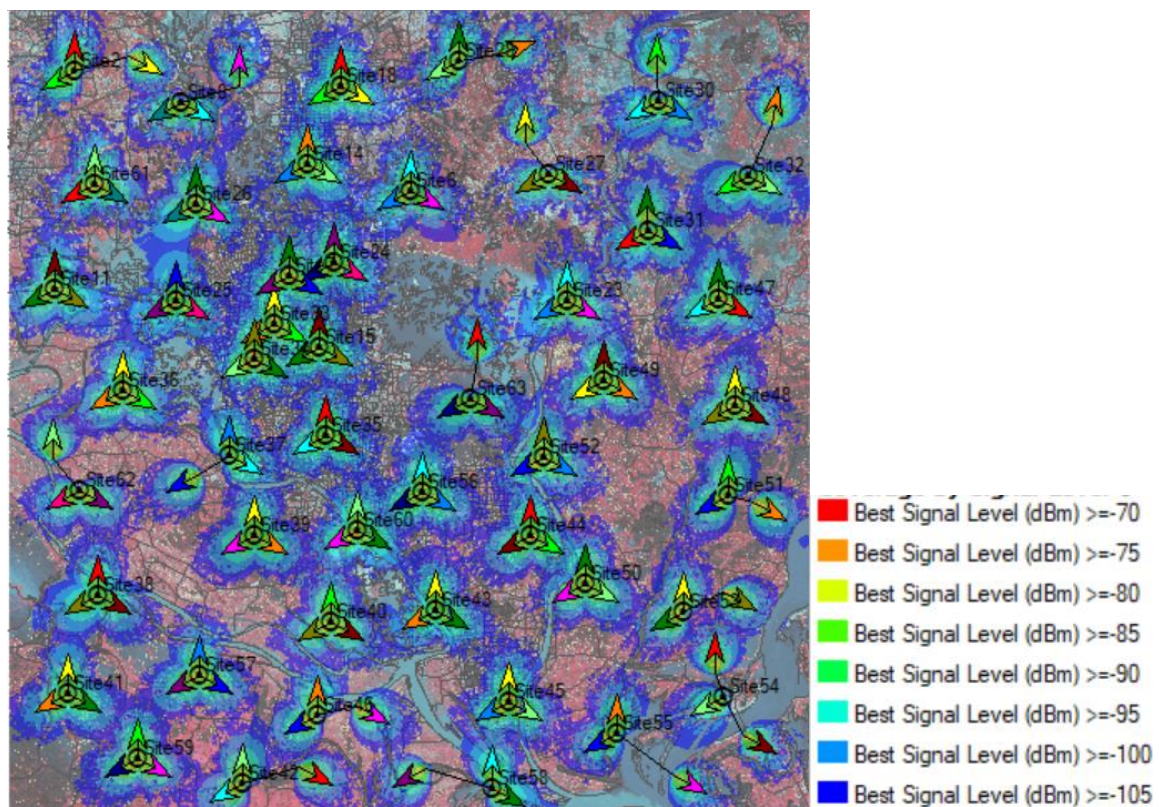
Here we get fewer coverage holes and increased connected users. Also reduced no-service devices. This is our final analysis. Next all the data we took based on this analysis.

5. Observing key parameters based on this current analysis:

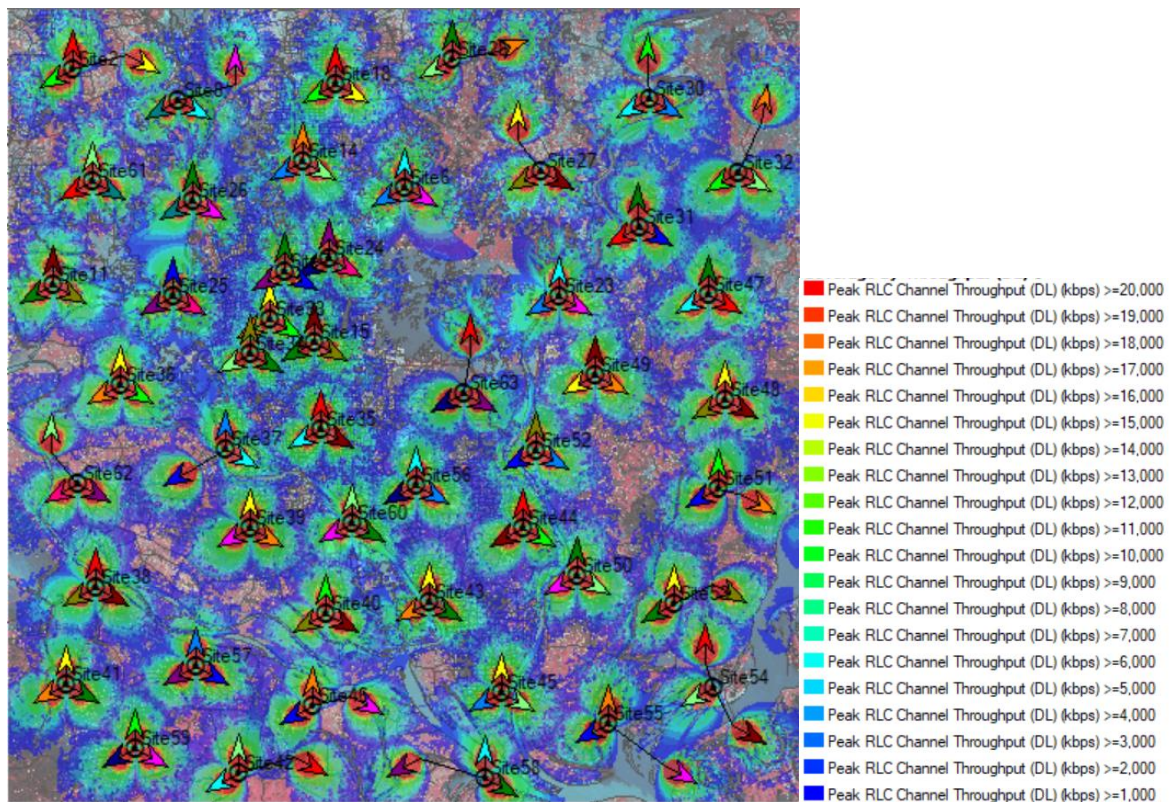
Coverage by transmitter:



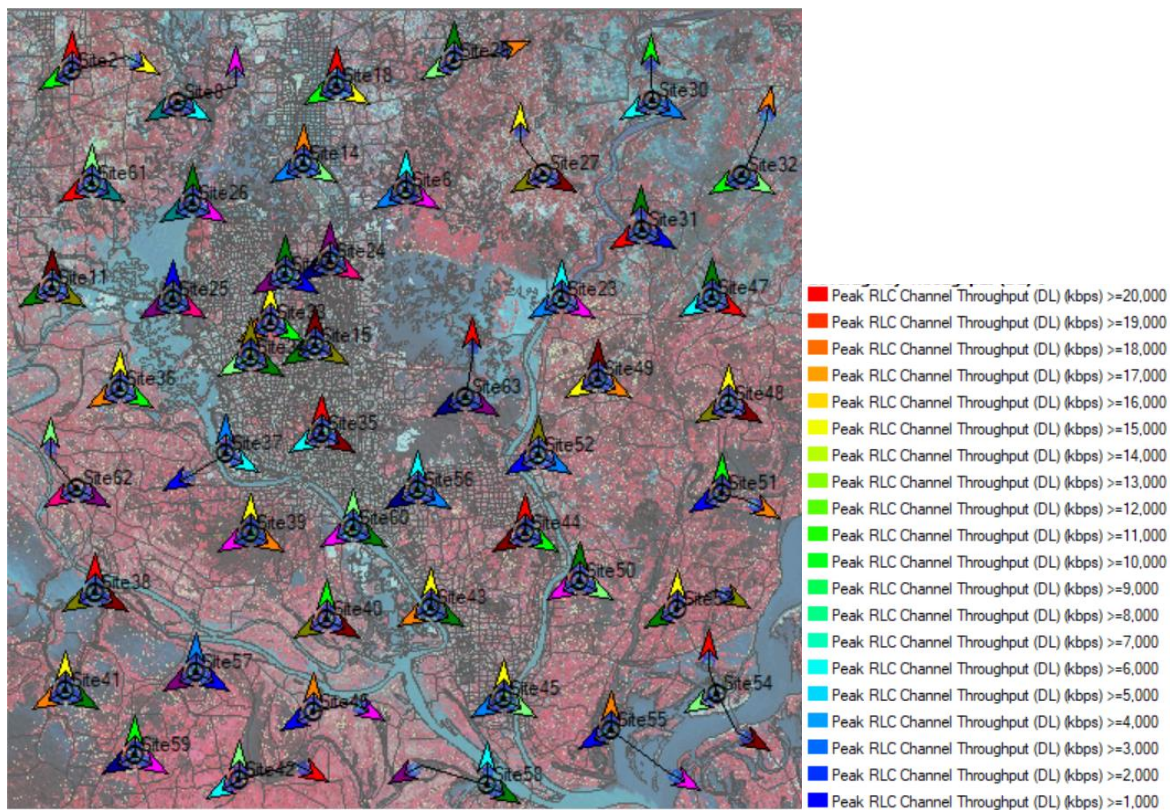
Coverage by signal level:

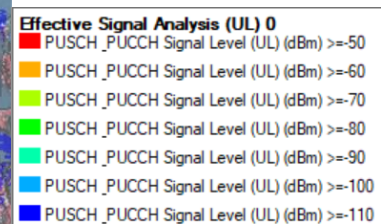
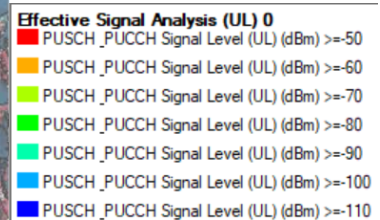


Coverage by throughput (DL):



Coverage by throughput (UL):





Coverage by C/(I+N) Level (DL) 0

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>30

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>29

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>28

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>27

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>26

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>25

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>24

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>23

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>22

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>21

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>20

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>19

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>18

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>17

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>16

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>15

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>14

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>13

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>12

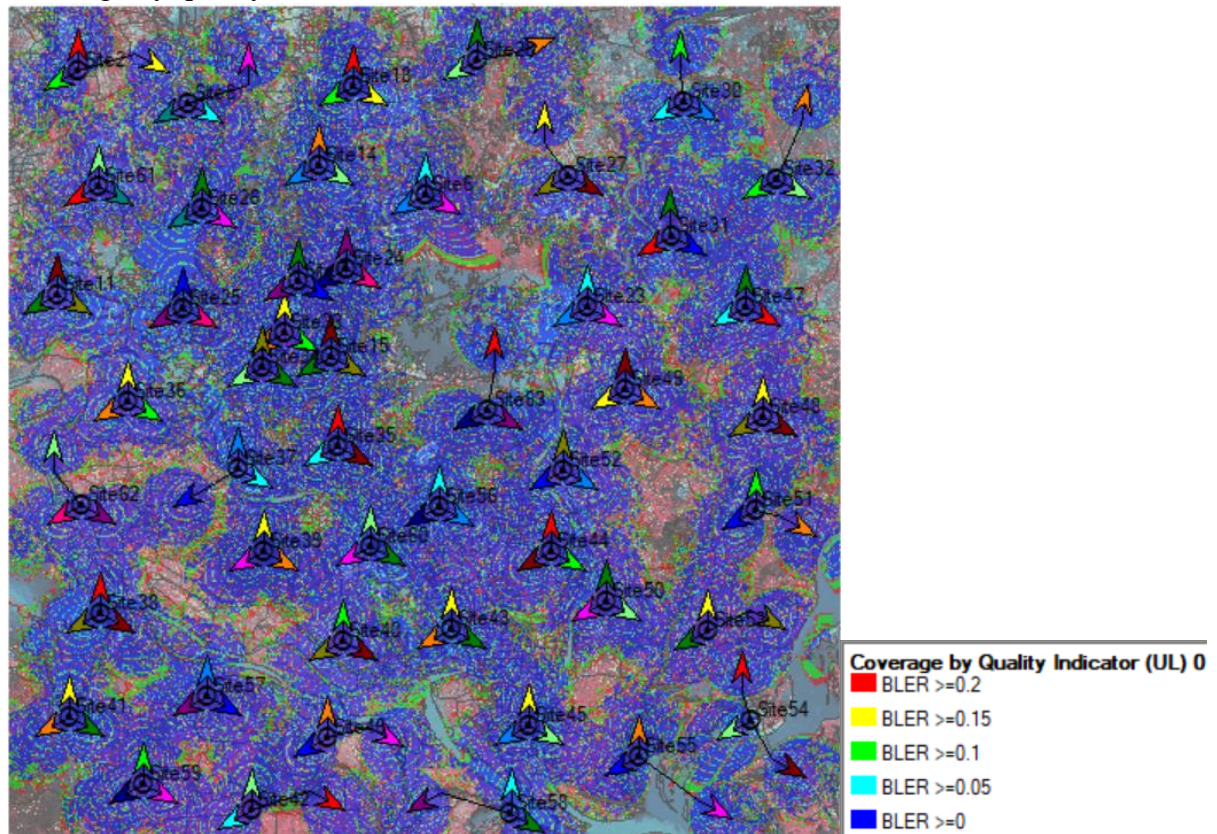
■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>11

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>10

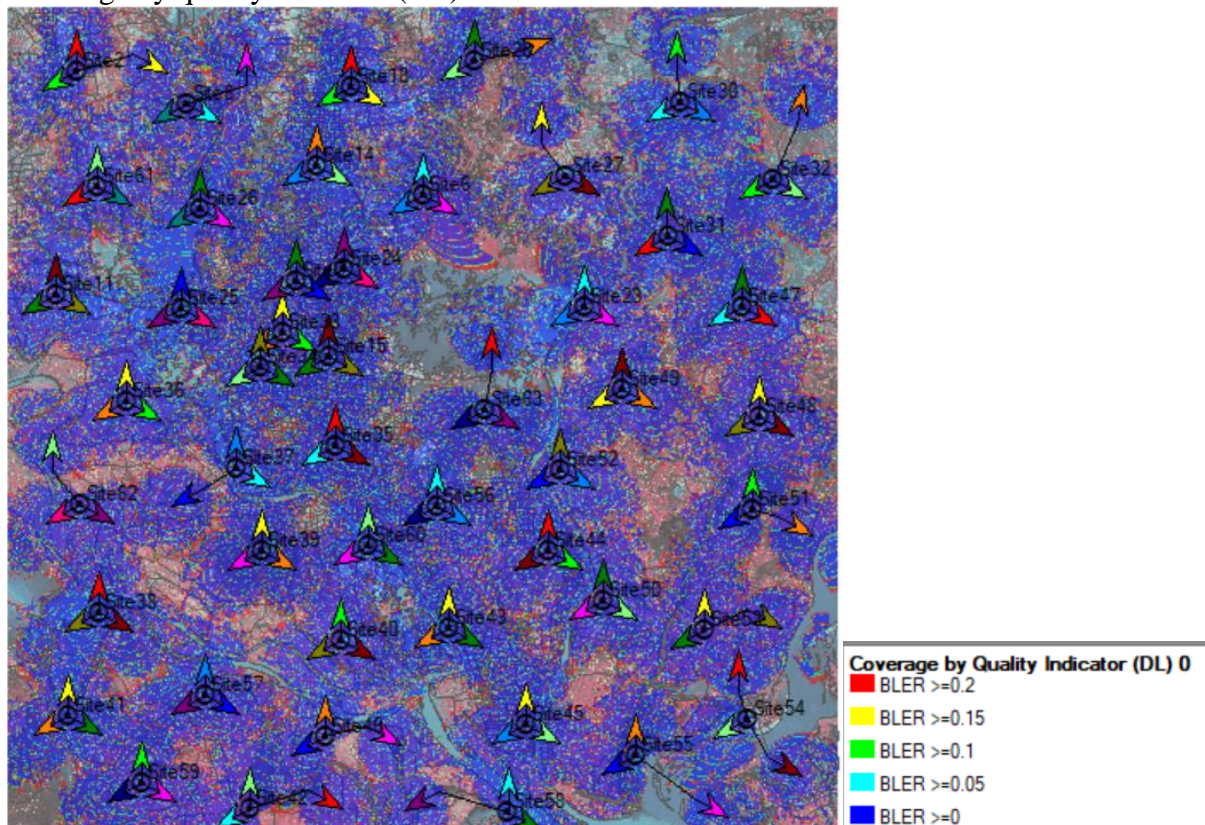
■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>9

■ PDSCH_PDCCH C/(I+N) Level (DL) (dB) =>8

Coverage by quality indicator (UL):



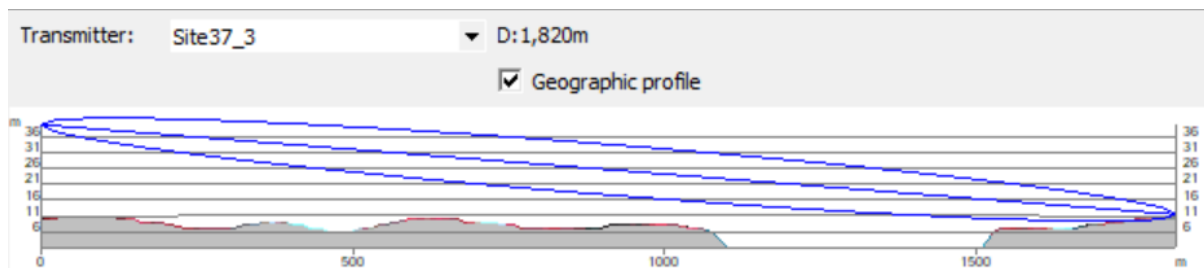
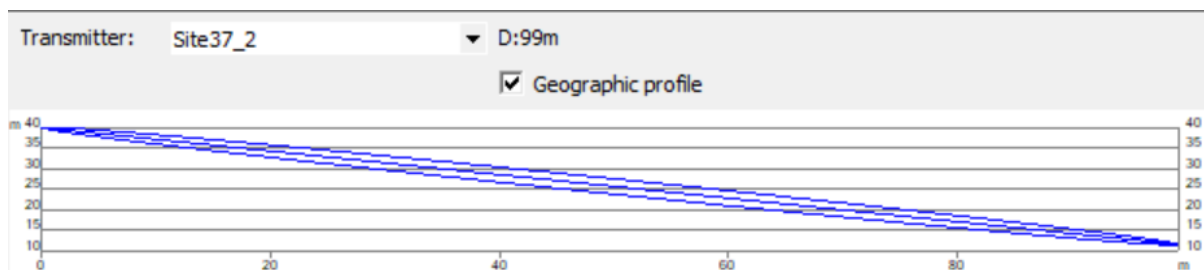
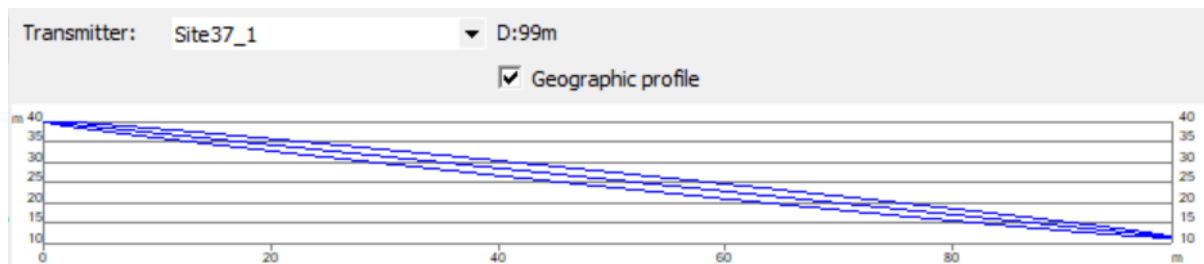
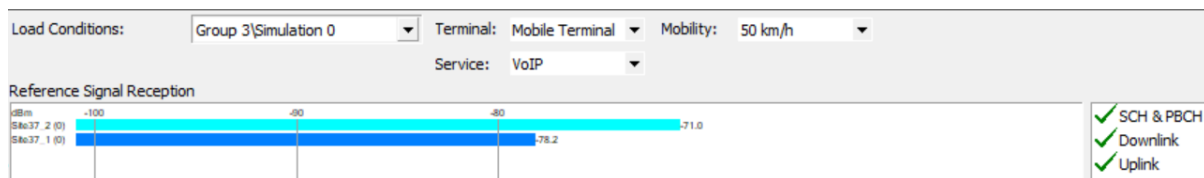
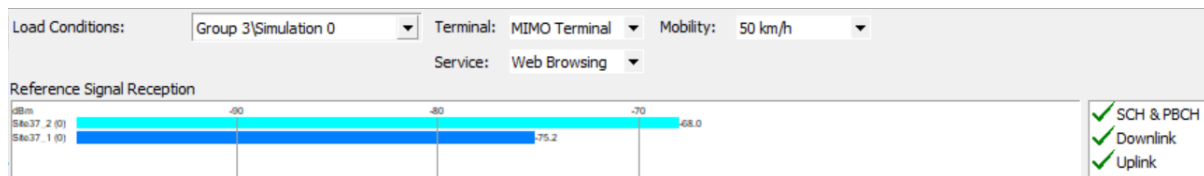
Coverage by quality indicator (DL):



6. Take a site randomly for analyzing the signal:

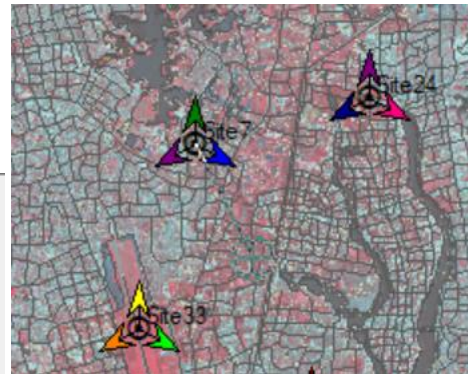
For site 37 by doing a point analysis we get,

Transmitter	C (dBm)	Distance (m)
Site37_2	-67.97	99
Site37_1	-75.16	99
Site37_3	-132.66	1,820

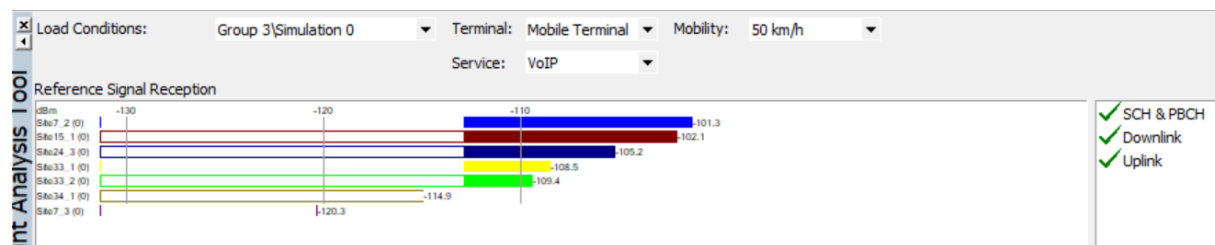
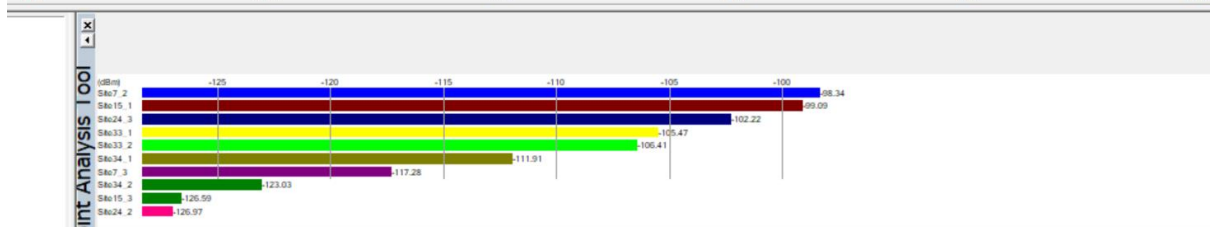
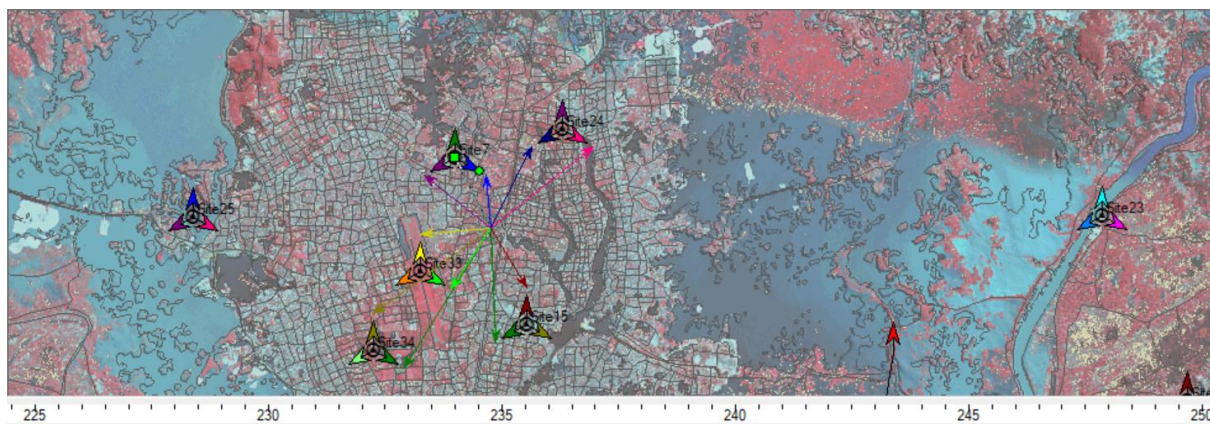


7. Now an analysis of a particular position of a user:

Transmitter	C (dBm)	Distance (m)
Site7_1	-131.34	1,688
Site33_3	-132.72	1,775
Site15_2	-146.09	2,207
Site24_1	-146.41	2,613
Site34_3	-148.41	3,647



A position was taken randomly for analysis. It is in the middle of site 24, site 7, and site 33.



Discussion:

From the above analysis we can see in some places get very good signal levels, throughput, CINR, coverage, and capacity. We can also see some places where we can get the signal from different eNodeBs and their contribution to data rate, coverage, and different parameters, that's why analysis becomes easier by using the point analysis tool. But there were still some coverage holes and there are many places where the signal level is not good enough for communication. We can solve these problems by putting more eNodeBs in those places.