

# Quarterly Report on Mobile Quality of Service (QoS)



འབྲུག་བར་དོན་བརྒྱུད་འབྲེལ་དང་བར་བརྒྱུད་དབང་འཛིན།

**Bhutan InfoComm and Media Authority**

**Royal Government of Bhutan**

**(July - September) 2021**

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## Report on Mobile Quality of Service (QoS)

### 1. Background

The Authority carries out the drive test to monitor the QoS regularly and reports monthly. The report contains the mobile quality of services for both voice and data through the various parameters of key performance indicators (KPI). The test was carried out in various places under Thimphu Thromde in various zones.

### 2. Locations and date of monitoring

Sl. No	Locations	Monitoring date
1	Taba	12 <sup>th</sup> August 2021
2	NPPF colony and Changangkha	12 <sup>th</sup> August 2021
3	Changjiji and Changbangdu	13 <sup>th</sup> August 2021
4	Chamgang	15 <sup>th</sup> September 2021
5	Bjazam	16 <sup>th</sup> September 2021

### 3. Findings

The findings of the drive test of different operators are presented for different places as shown below:

#### Taba

##### *Mobile Voice Services*

#### 3G

Operator	Call Drop Rate (<2%)	Mean Score	Opinion	Call setup time till alerting (Sec)
BTL	0.00	3.3		4.2
TICL	0.00	3.4		3.7

##### *Mobile Data Services*

### Data Completion Rate (%)

Operators	Network	File Transfer Protocol (100%)		HyperText Transfer Protocol (100%)	
		Upload	Download	Upload	Download
BTL	3G	62.50	100	100	100
TICL		14.29	12.5	71.43	71.43
BTL	4G	90.91	100	100	100
TICL		77.78	88.89	100	100

### Data Throughputs (Mbps)

Operators	Network	File Transfer Protocol (Mbps)		Hypertext Transfer Protocol (Mbps)	
		Download	Upload	Download	Upload
BTL	3G	4.9	1.24	4.8	1.2
TICL		2.16	-	2.8	1.22
BTL	4G	26.3	14.9	28.2	13.6
TICL		27.32	10.6	27.9	10.2

### 3G B-Mobile



Figure number 1: RSCP plot 3G B-mobile (Google earth)



Figure number 2: 3G B-mobile (CPICH RSCP (dBm)) plot



### 3G Tashi cell

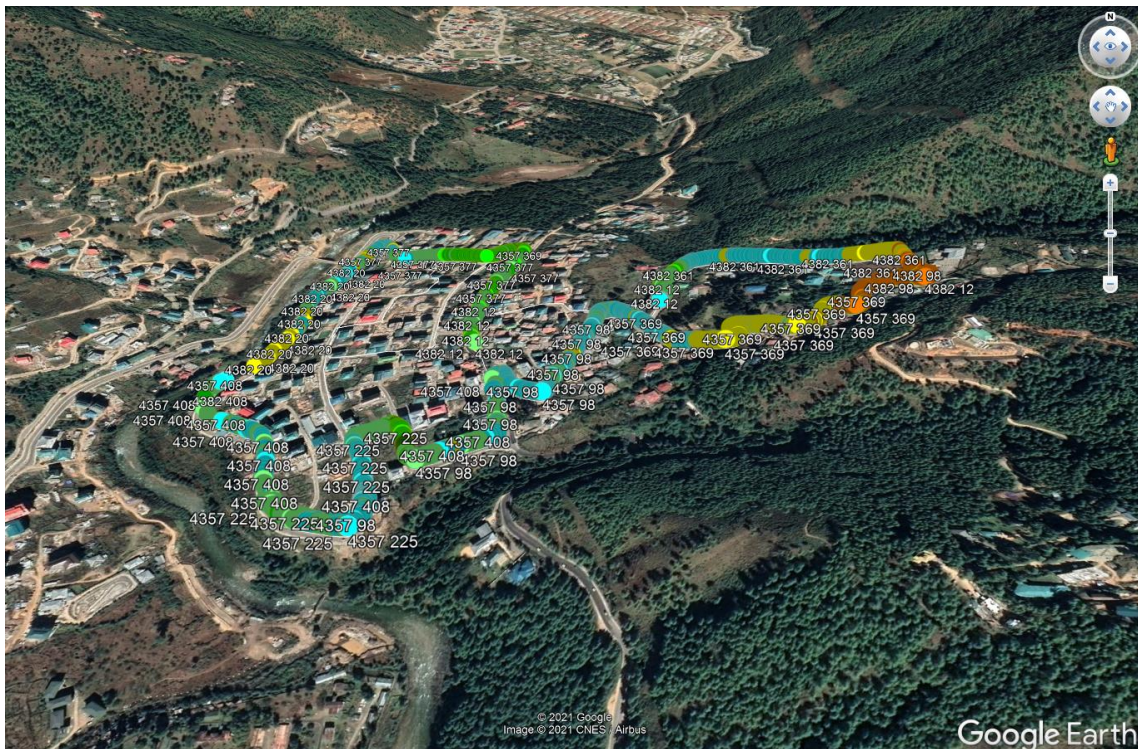


Figure number 3: RSCP plot 3G Tashi cell (Google earth)

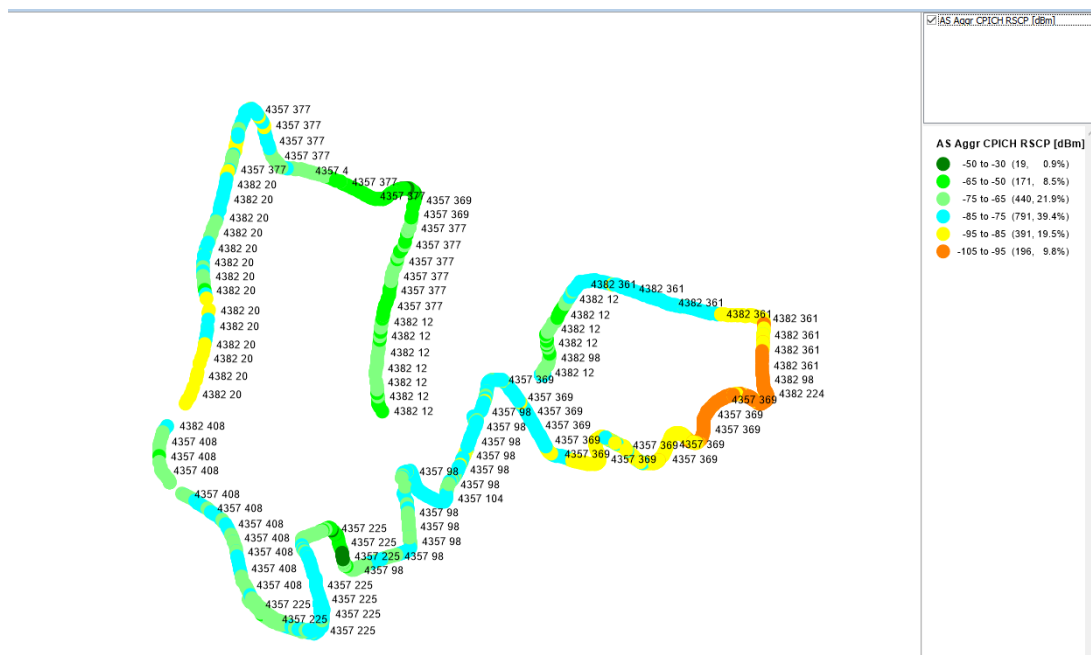


Figure number 4: 3G Tashi cell (CPICH RSCP (dBm) plot)



## 4G B-Mobile

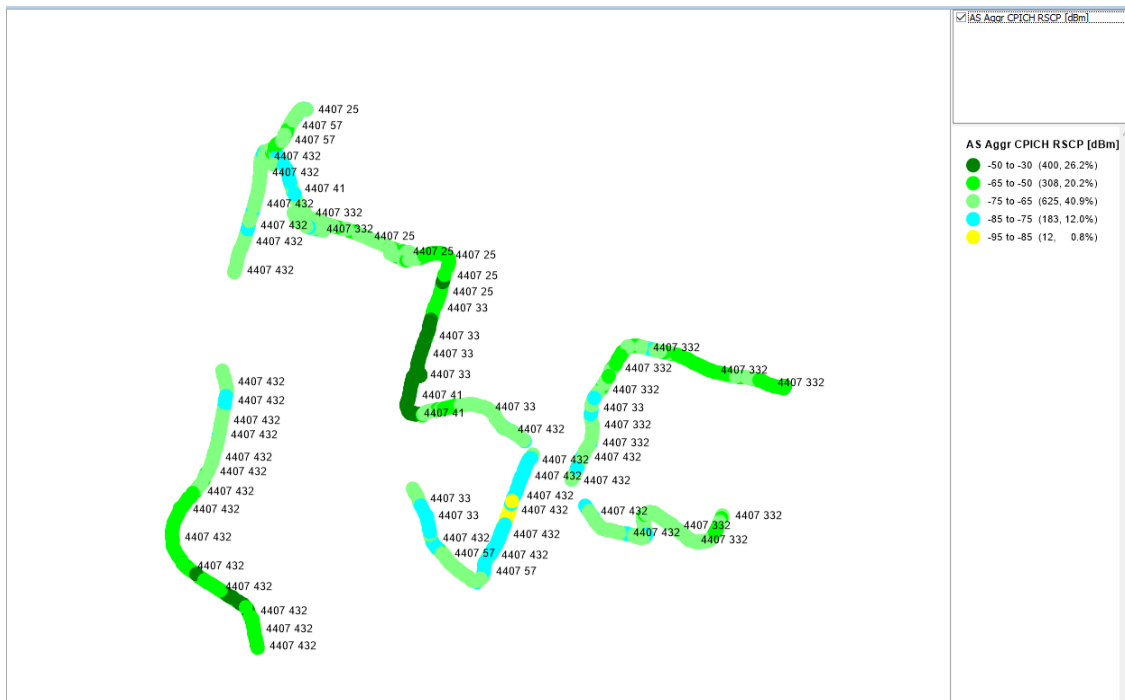


Figure number 5: 4G B-mobile (CPICH RSCP (dBm) plot)

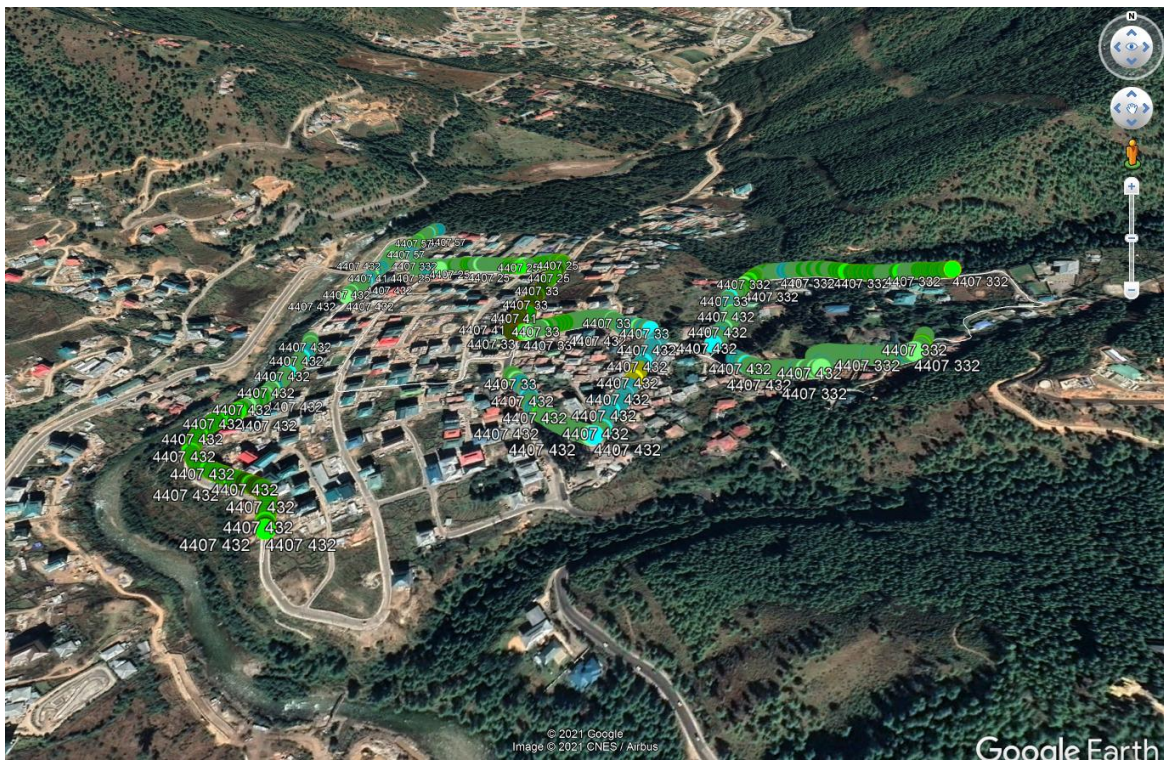


Figure number 6: RSCP plot 4G B-mobile (Google earth)



## 4G Tashi Cell

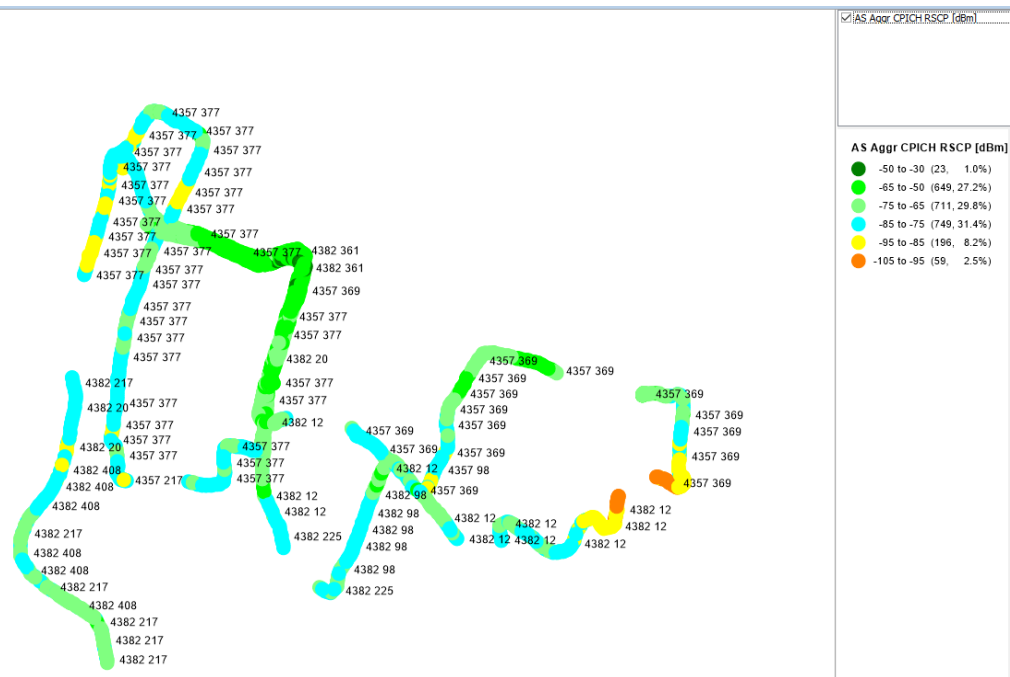


Figure number 7: 4G Tashi cell (CPICH RSCP (dBm) plot)

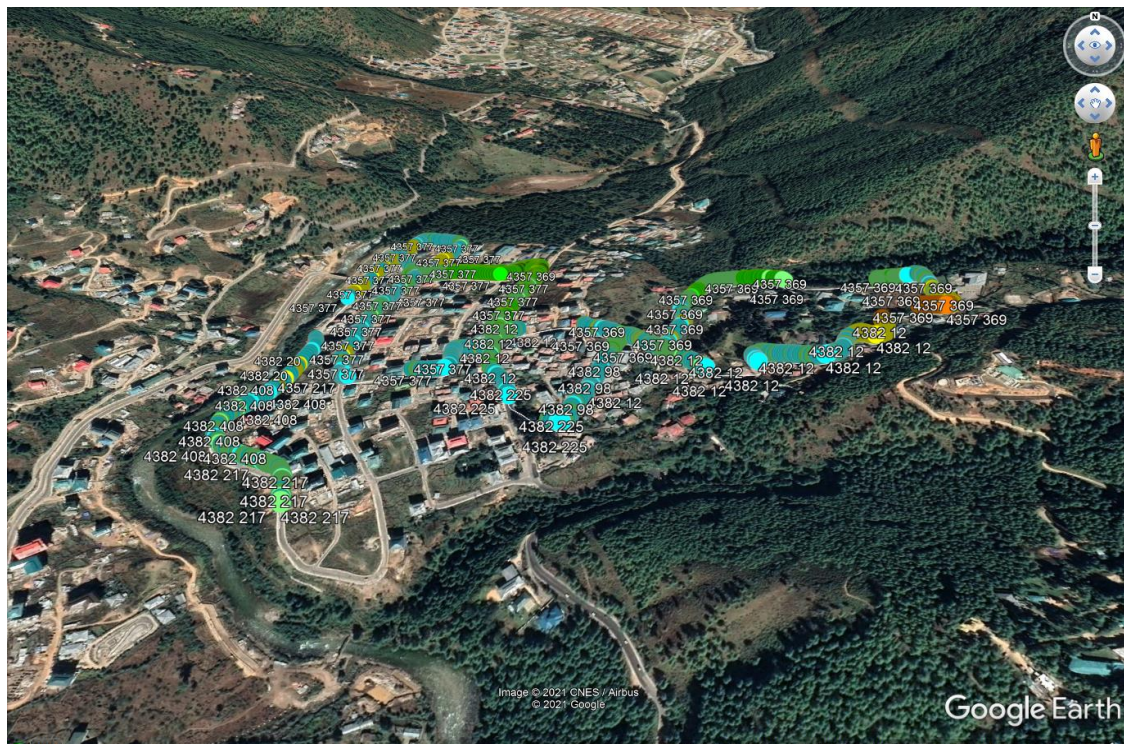


Figure number 8: RSCP plot 4G Tashi cell (Google earth)



**NPPF Colony and Changangkha****Mobile Voice Services****3G**

<b>Operator</b>	<b>Call Drop Rate (&lt;2%)</b>	<b>Mean Score</b>	<b>Opinion</b>	<b>Call setup time till alerting (Sec)</b>
<b>BTL</b>	0.00	3.22		4.7
<b>TICL</b>	0.00	3.34		3.75

**Mobile Data Services****Data Completion Rate (%)**

<b>Operators</b>	<b>Network</b>	<b>File Transfer Protocol (100%)</b>		<b>HyperText Transfer Protocol (100%)</b>	
		<b>Upload</b>	<b>Download</b>	<b>Upload</b>	<b>Download</b>
<b>BTL</b>	<b>3G</b>	100	100	100	100
<b>TICL</b>		66.67	83.33	100	100
<b>BTL</b>	<b>4G</b>	100	100	100	100
<b>TICL</b>		55.56	50	62.50	66.67

**Data Throughputs (Mbps)**

<b>Operators</b>	<b>Network</b>	<b>File Transfer Protocol (Mbps)</b>		<b>Hypertext Transfer Protocol (Mbps)</b>	
		<b>Download</b>	<b>Upload</b>	<b>Download</b>	<b>Upload</b>
<b>BTL</b>	<b>3G</b>	4.06	1.18	3.2	1.2
<b>TICL</b>		3.30	1.2	3.27	1.17
<b>BTL</b>	<b>4G</b>	31.0	12.0	9.7	12.1
<b>TICL</b>		21.6	9.5	16.4	9.2

### 3G B-Mobile

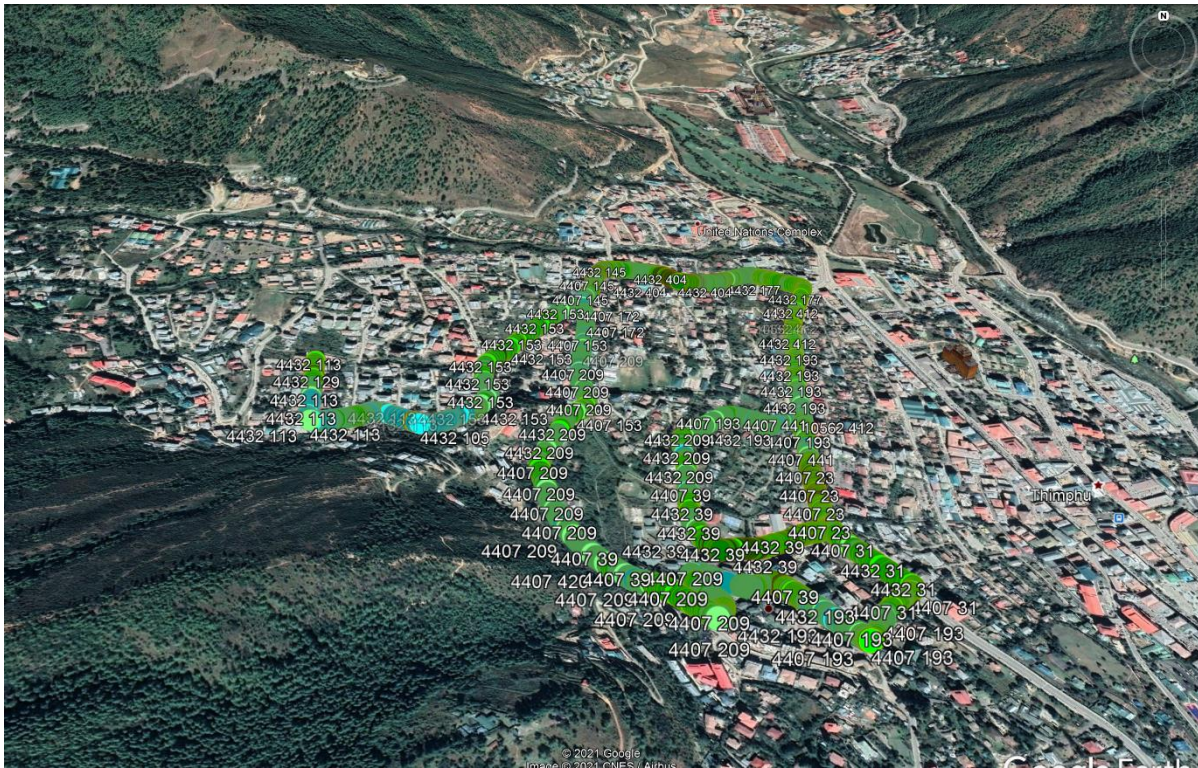


Figure number 9: RSCP plot 3G B-mobile (Google earth)

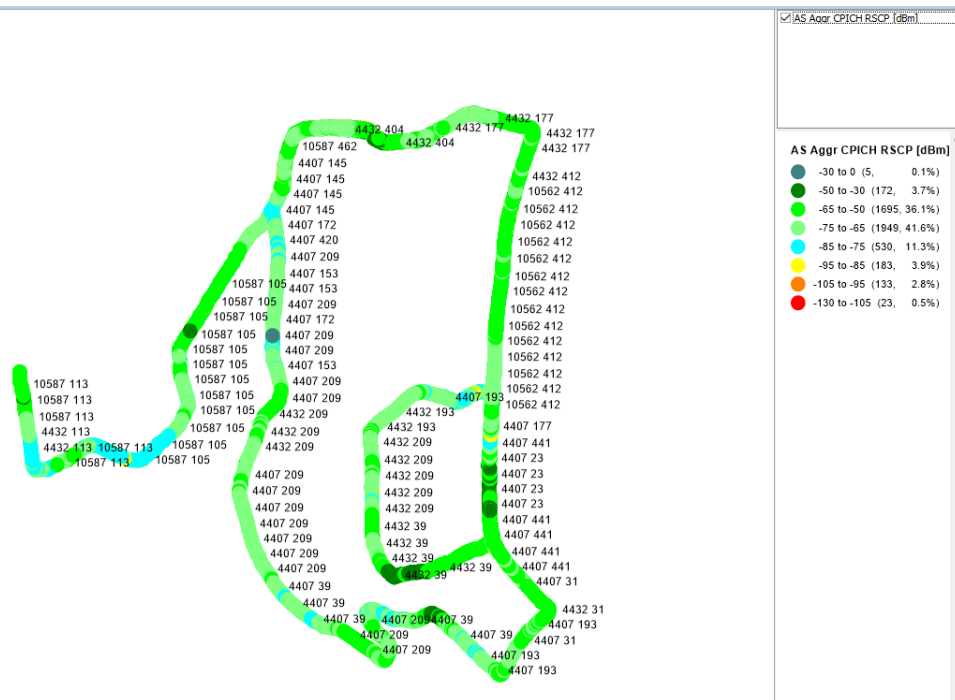


Figure number 10: 3G B-Mobile (CPICH RSCP (dBm) plot)



### 3G Tashi cell



Figure number 11: 3G Tashi cell (CPICH RSCP (dBm) plot)



Figure number 12: RSCP plot 3G Tashi cell (Google earth)



## 4G B-Mobile

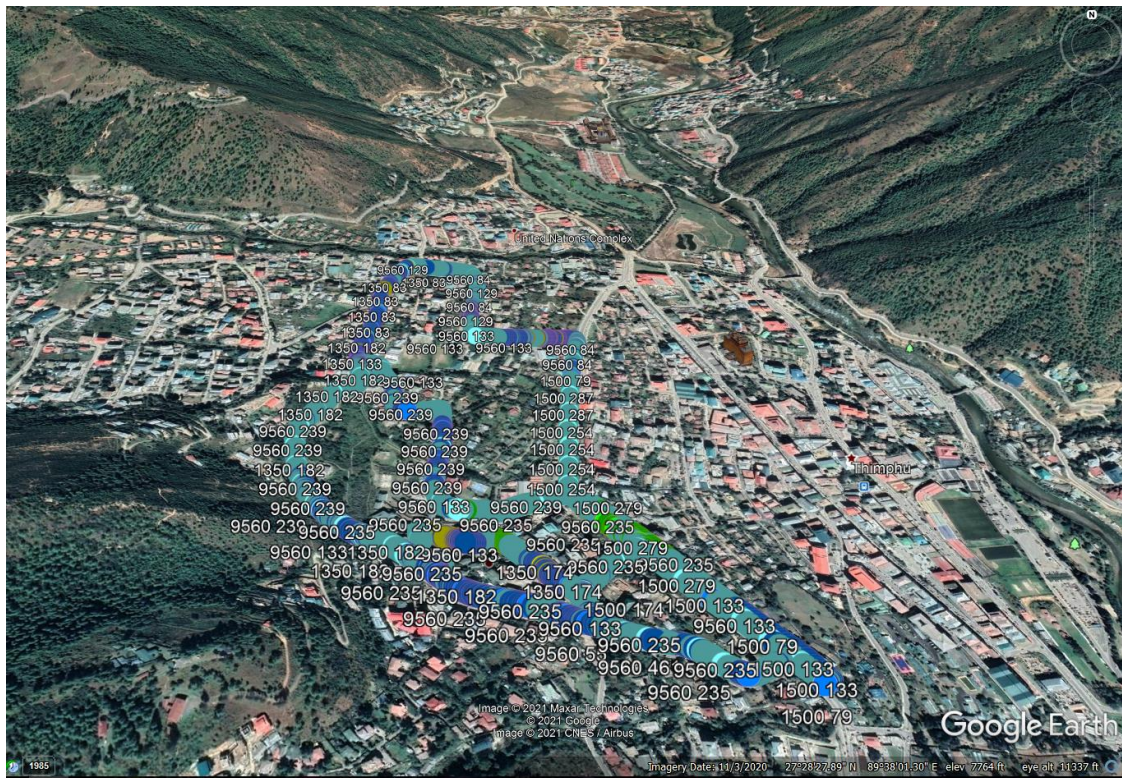


Figure number 13: RSRP plot 4G B-mobile (Google earth)

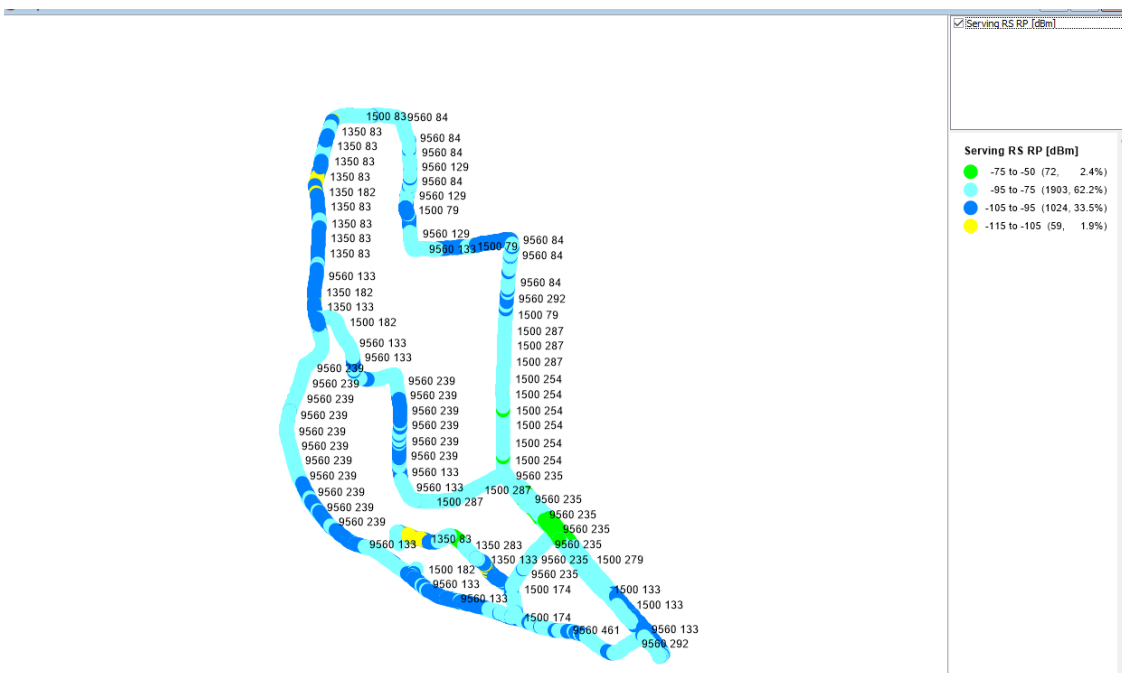


Figure number 14: 4G B-Mobile (Serving RSRP (dBm) plot)



## 4G Tashi Cell

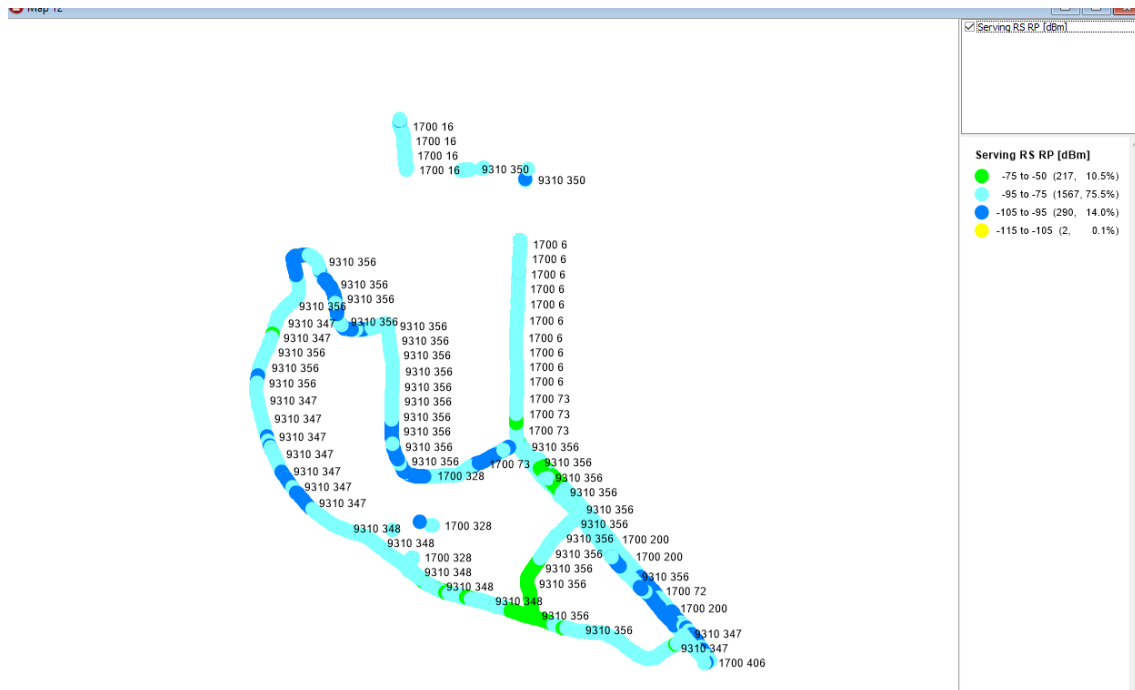


Figure number 15: 4G Tashi cell (Serving RSRP (dBm) plot)



Figure number 16: RSRP plot 4G Tashi cell (Google earth)

## Changijji Colony and Changbangdu

### *Mobile Voice Services*

#### 3G

Operator	Call Drop Rate (<2%)	Mean Score	Opinion	Call setup time till alerting (Sec)
BTL	0.00	3.38		3.4
TICL	0.00	3.55		3.2

### *Mobile Data Services*

#### Data Completion Rate (%)

Operators	Network	File Transfer Protocol (100%)		HyperText Transfer Protocol (100%)	
		Upload	Download	Upload	Download
BTL	3G	12.24	16.33	24.49	26.53
TICL		88.89	88.89	100	100
BTL	4G	86.67	81.25	100	100
TICL		54.55	54.55	45.45	63.64

#### Data Throughputs (Mbps)

Operators	Network	File Transfer Protocol (Mbps)		Hypertext Transfer Protocol (Mbps)	
		Download	Upload	Download	Upload
BTL	3G	3.5	1.17	4.48	1.42
TICL		2.9	1.3	2.8	1.37
BTL	4G	23.2	15.9	20.52	9.7
TICL		23.4	9.14	19.5	17.936



3G B-Mobile



Figure number 17: RSCP plot 3G B-mobile (Google earth)

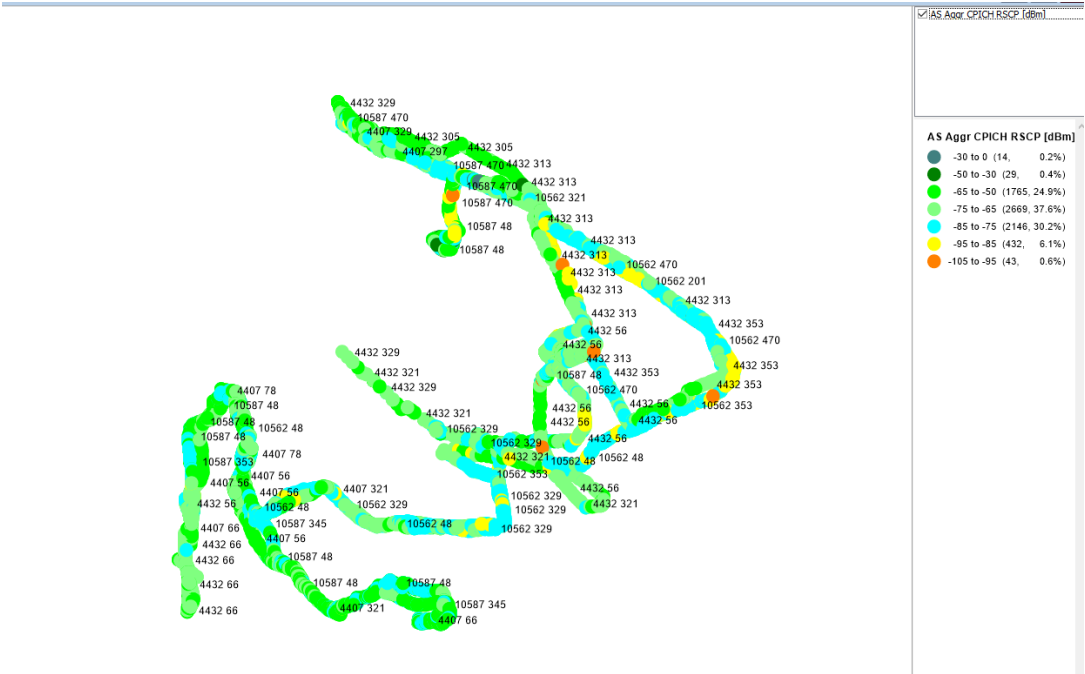


Figure number 18: 3G B-Mobile (CPICH RSCP (dBm) plot)

3G Tashi Cell

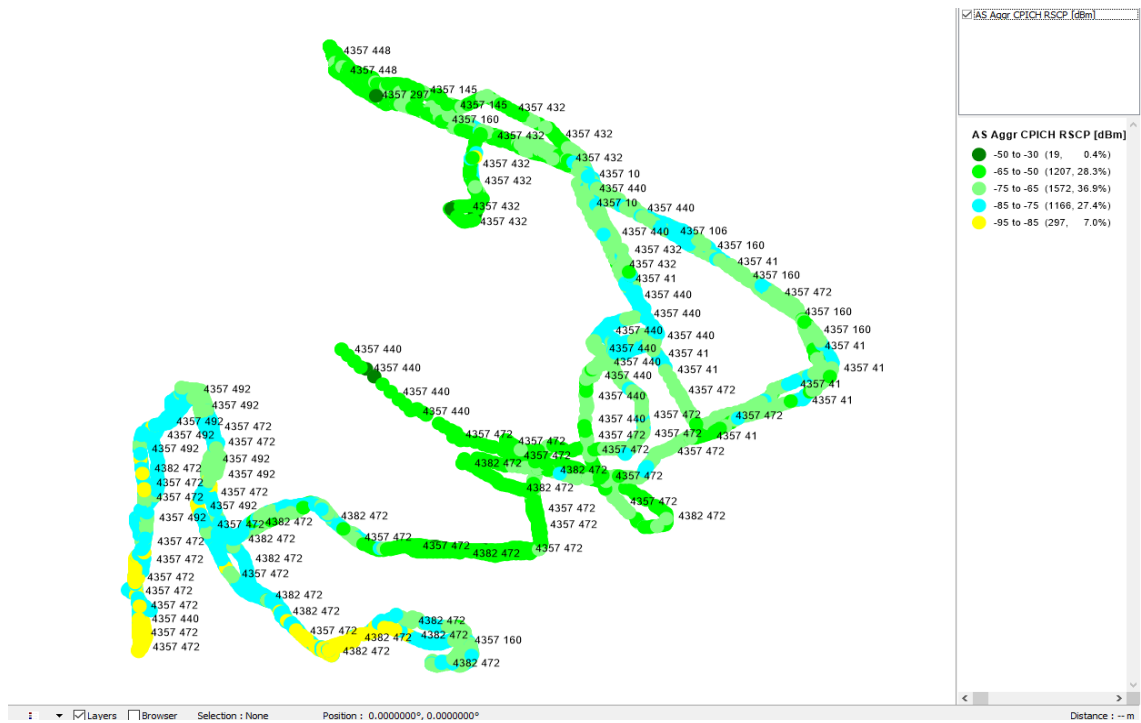


Figure number 19: 3G Tashi cell (CPICH RSCP (dBm) plot)



Figure number 20: RSCP plot 3G Tashi cell (Google earth)



## 4G B-Mobile



Figure number 21: RSRP plot 4G B-mobile (Google earth)

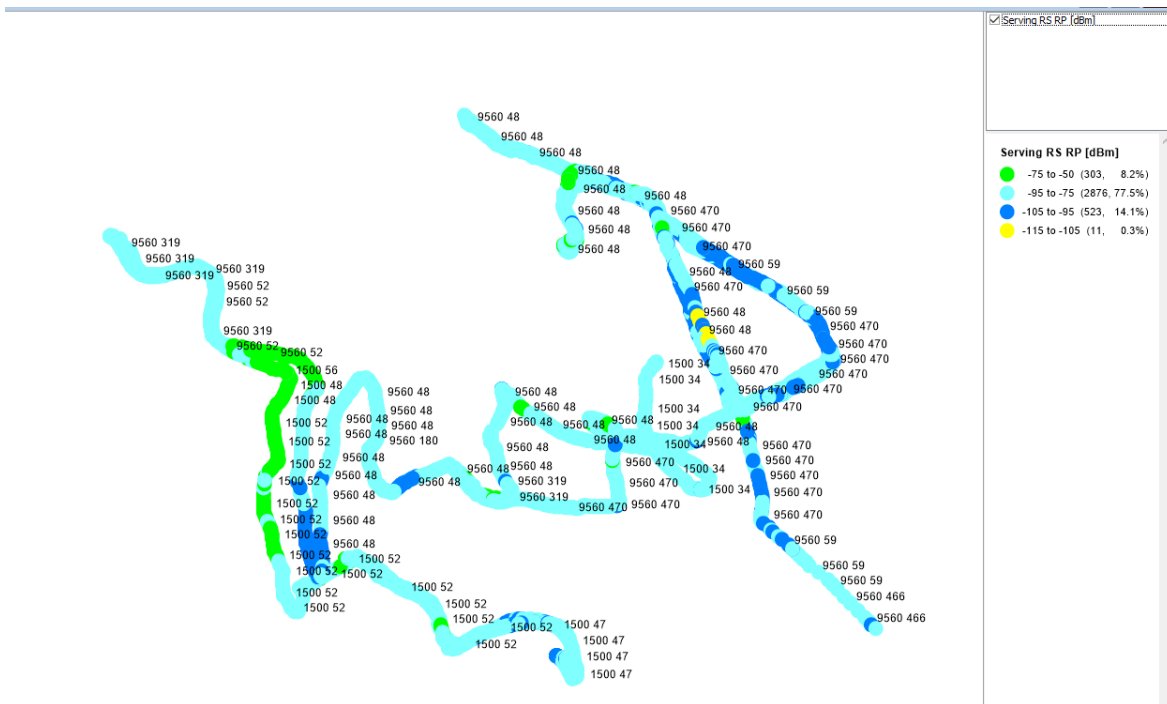


Figure number 22: 4G B-Mobile (Serving RSRP (dBm) plot)



## 4G Tashi Cell

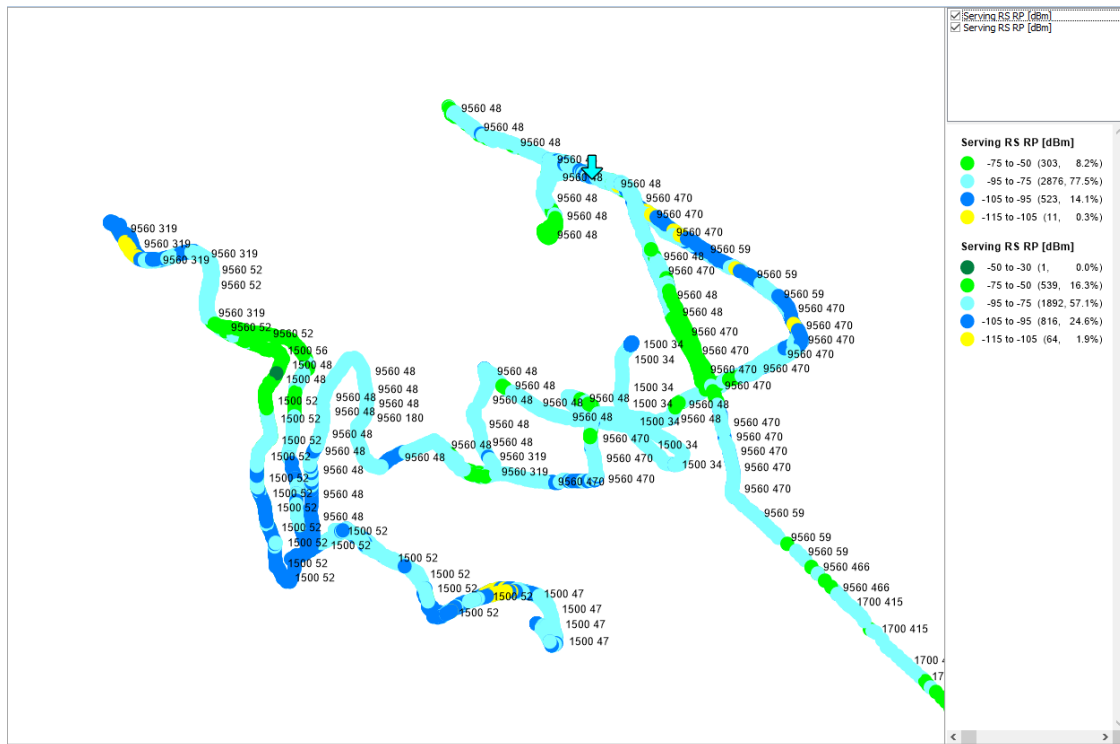


Figure number 23: 4G Tashi cell (Serving RSRP (dBm) plot)



Figure number 24: RSRP plot 4G Tashi cell (Google earth)

## Chamgang

### *Mobile Voice Services*

#### 3G

Operator	Call Drop Rate (<2%)	Mean Score	Opinion	Call setup time till alerting (Sec)
BTL	0.00	3.2		4.4
TICL	0.00	3.4		2.6

#### 4G

Operator	Call Drop Rate (<2%)	Mean Score	Opinion	Call setup time till alerting (Sec)
BTL	0.00	3.2		11.74
TICL	0.00	3.4		7.23

### *Mobile Data Services*

#### Data Throughputs (Mbps)

Operators	Network	File Transfer Protocol (Mbps)		Hypertext Transfer Protocol (Mbps)	
		Download	Upload	Download	Upload
BTL	3G	No 3G network of BTL in Chamgang, it was latched to 2G			
TICL		0.77	1.031	1.57	1.23
BTL	4G	38.43	12.57	40.94	13.03
TICL		10.5	4.17	37.13	11.48

### 3G Tashi cell (Active cell CPICH RSCP (dBm) Plot) - Chamgang

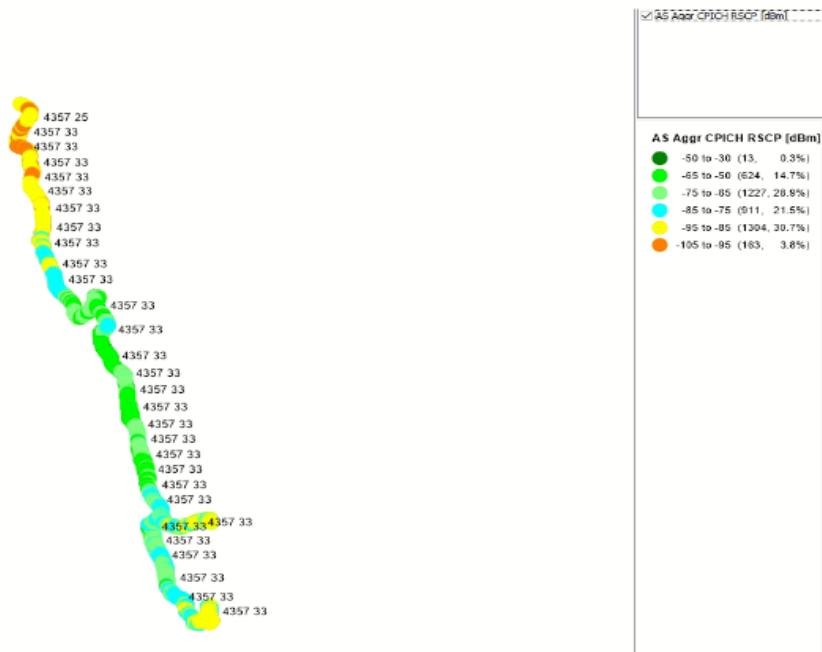


Figure number 25: Tashi cell (Active cell CPICH RSCP (dBm) Plot)



Figure number 26: Tashi cell (Active cell CPICH RSCP (Google Earth))



## 2G B-mobile GSM RxLev Plot - Chamgang

Since B-Mobile does not have 3G coverage, 2G RxLev is being plotted

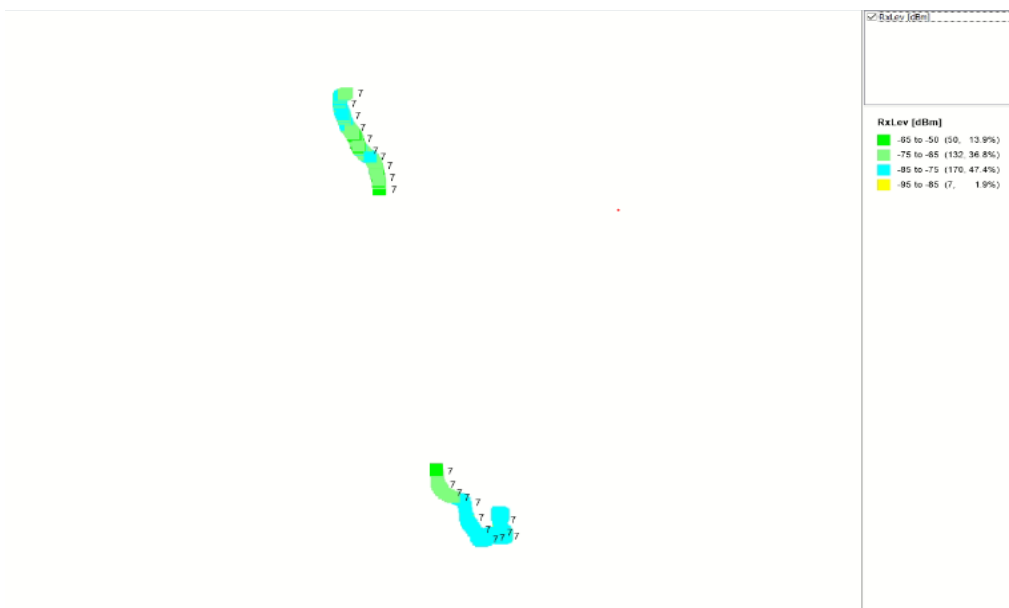


Figure number 27: 2G B-mobile GSM RxLev Plot

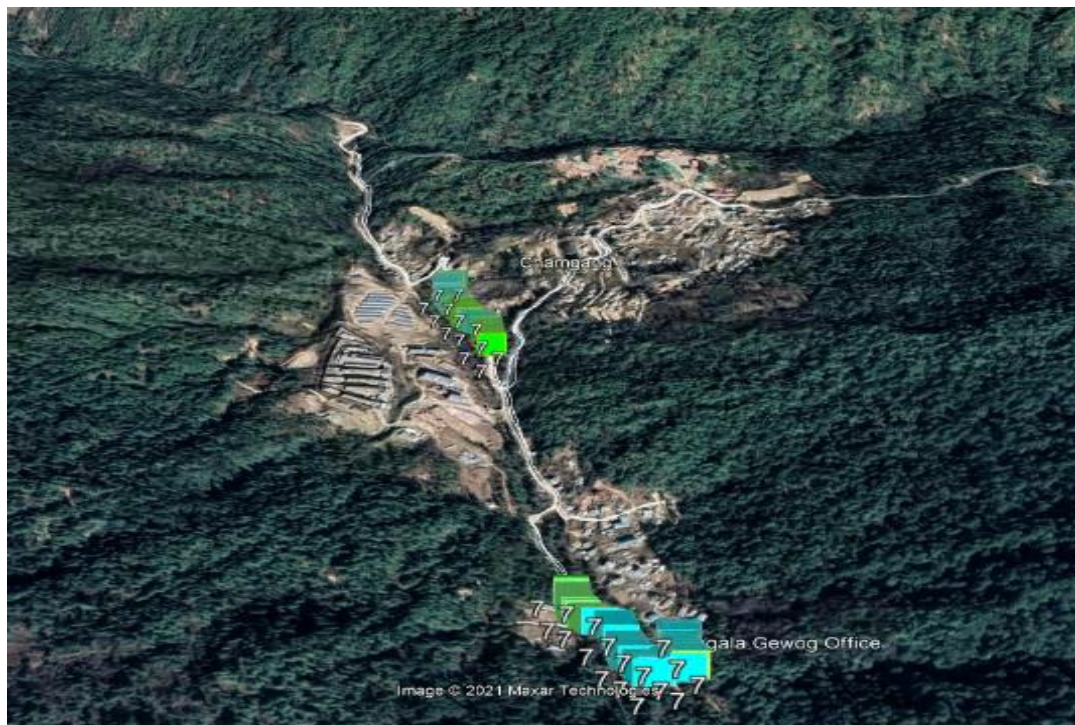


Figure number 28: 2G B-mobile GSM RxLev (Google Earth)

## 4G Tash cell LTE serving cell RSRP Plot -Chamgang

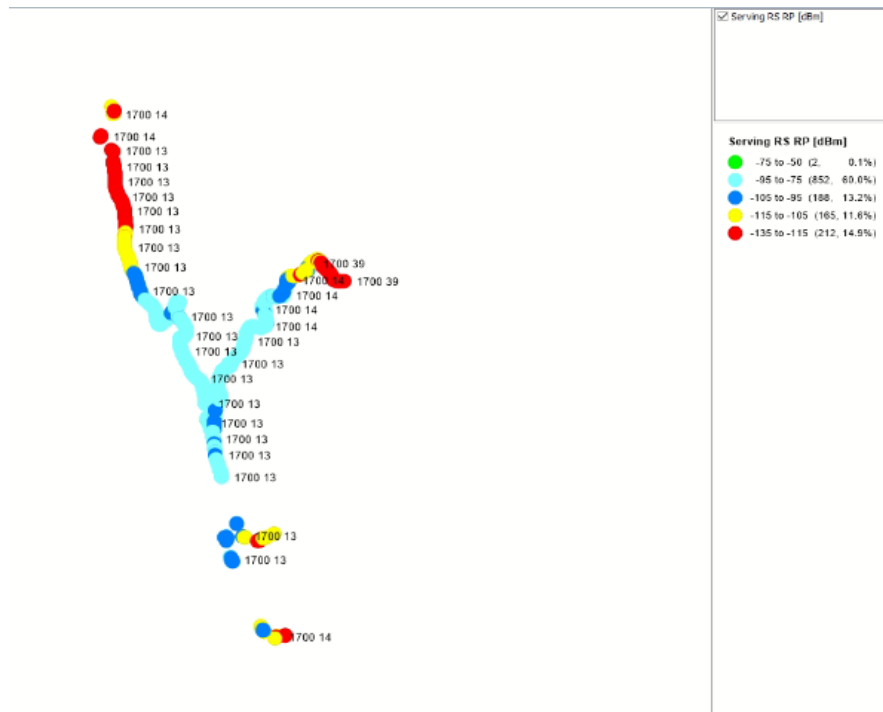


Figure number 29: 4G Tashi cell LTE serving cell RSRP Plot

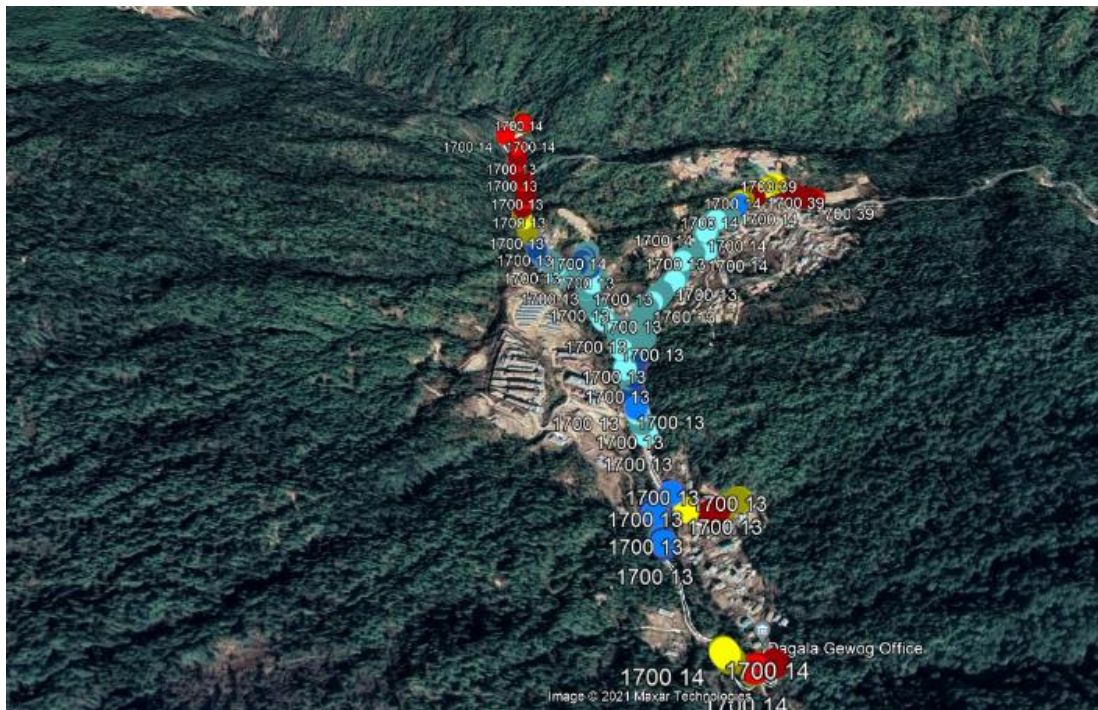


Figure number 30: 4G Tashi cell LTE serving cell RSRP (Google Earth)



## 4G B-mobile LTE serving cell RSRP Plot - Chamgang

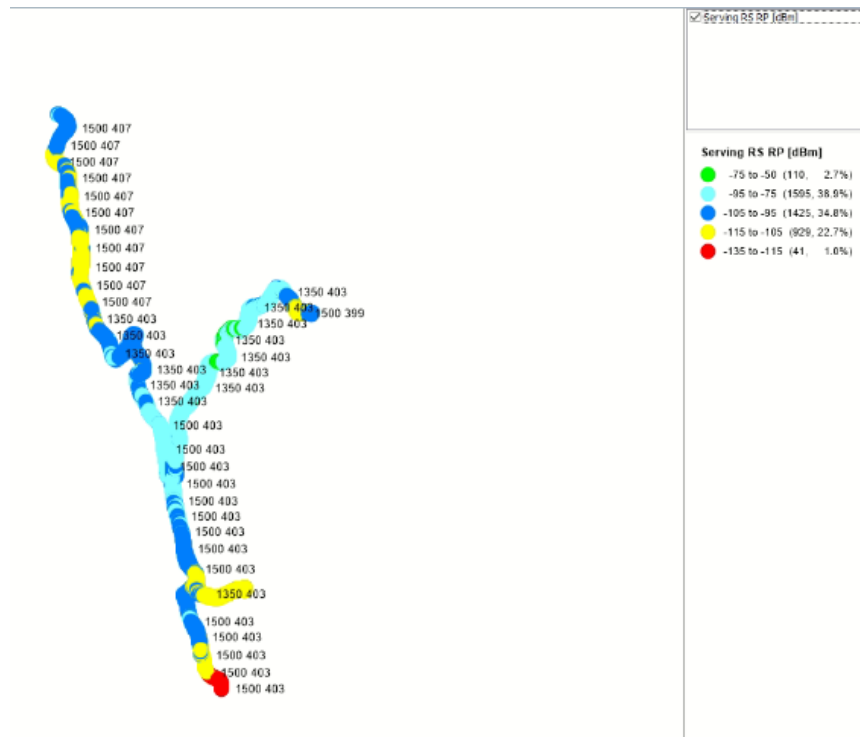


Figure number 31: 4G B-Mobile LTE serving cell RSRP Plot

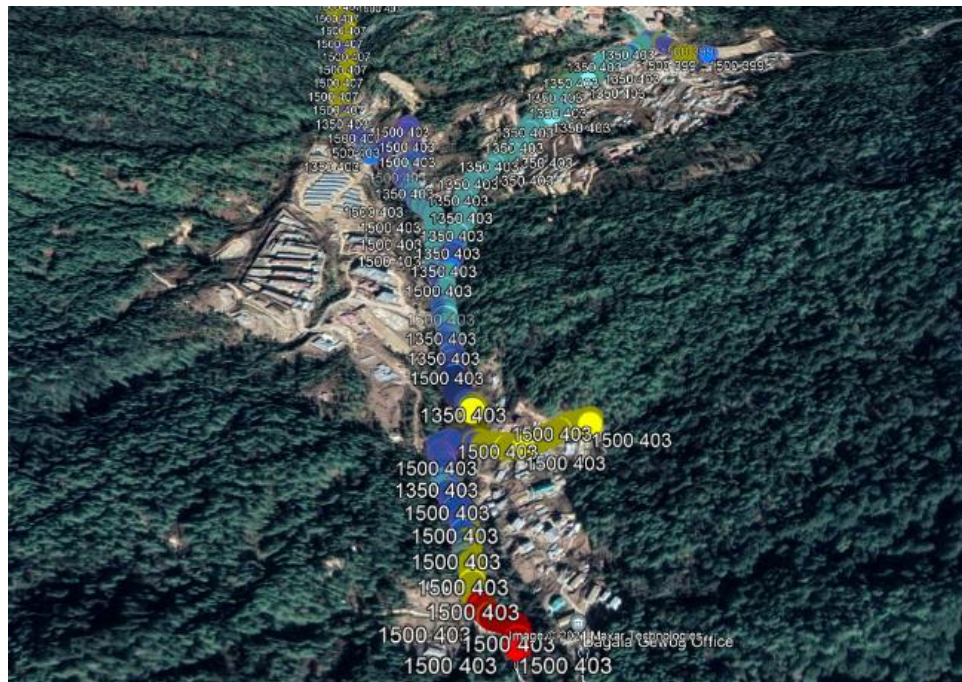


Figure number 32: 4G B-Mobile LTE serving cell RSRP (Google Earth)

## Bjazam

### Mobile Voice Services

#### 4G

Operator	Call Drop Rate (<2%)	Mean Score	Opinion	Call setup time till alerting (Sec)
BTL	0.00	3.3		4.2
TICL	0.00	2.9		4.04

### Mobile Data Services

#### Data Throughputs (Mbps)

Operator	Network	File Transfer Protocol (Mbps)		Hypertext Transfer Protocol (Mbps)	
		Download	Upload	Download	Upload
BTL	4G	6.33	1.21	-	-
TICL		8.33	8.3	16.2	9.5

#### 4G Tashi cell LTE serving cell RSRP Plot - Bjazam (welcome gate)

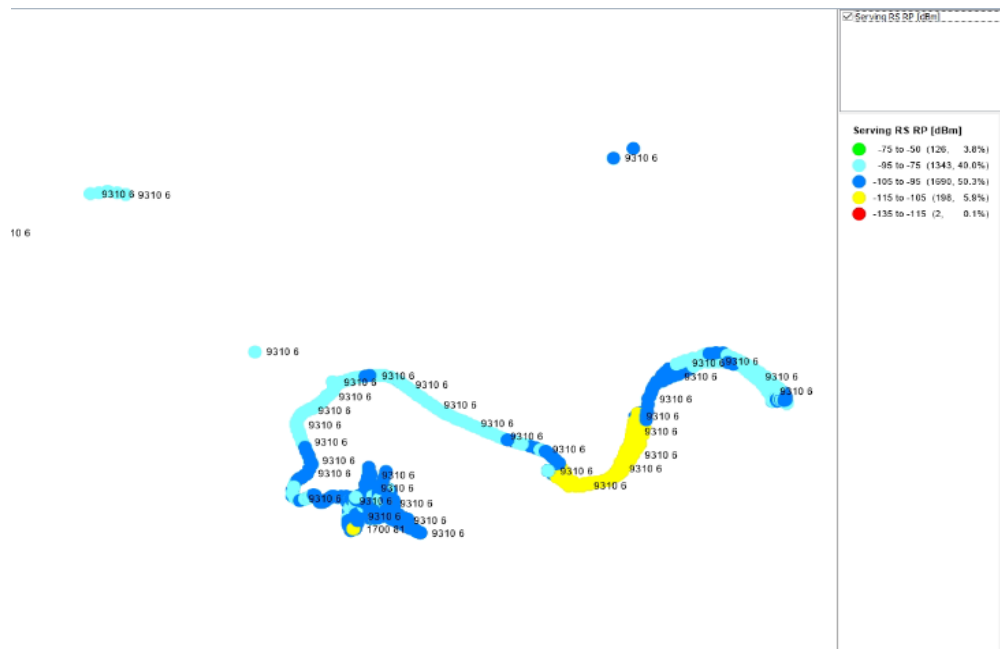


Figure number 33: 4G Tashi cell LTE serving cell RSRP Plot



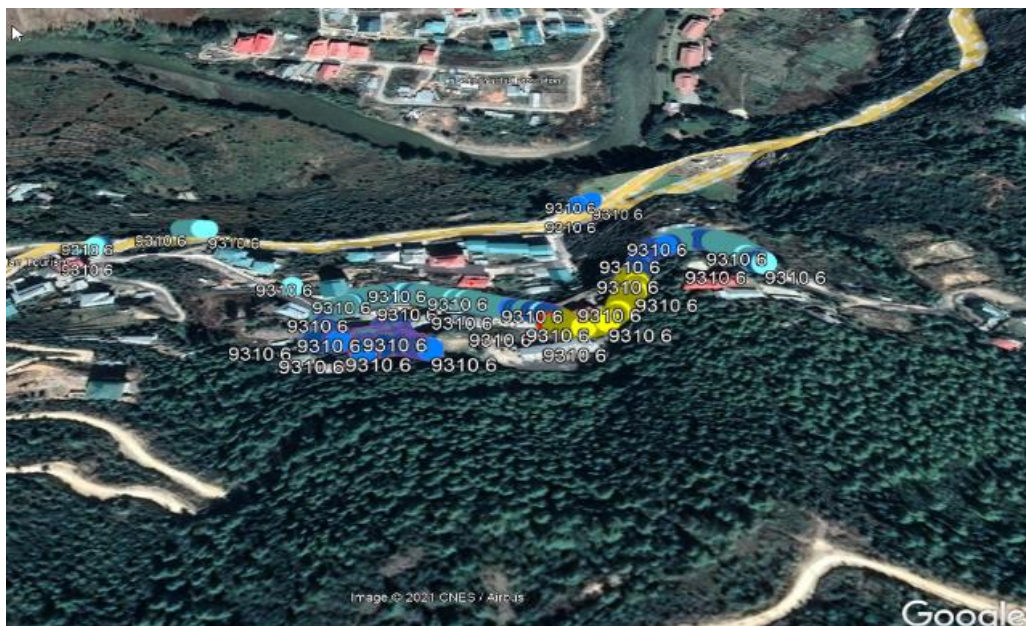


Figure number 34: 4G Tashi cell LTE serving cell RSRP (Google earth)

### 3G

Since Mobile network was latched to 3G due to poor 4G network of B-mobile in the welcome gate area, 3G network was recorded.

### 3G B-mobile (Active cell CPICH RSCP (dBm) Plot) -Bjazam

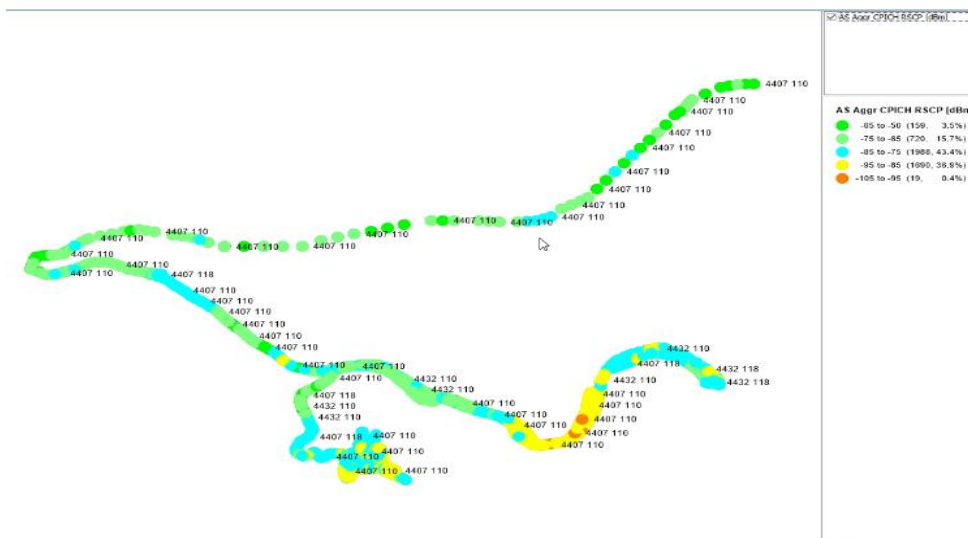


Figure number 35:3G B-mobile (Active cell CPICH RSCP (dBm) Plot)

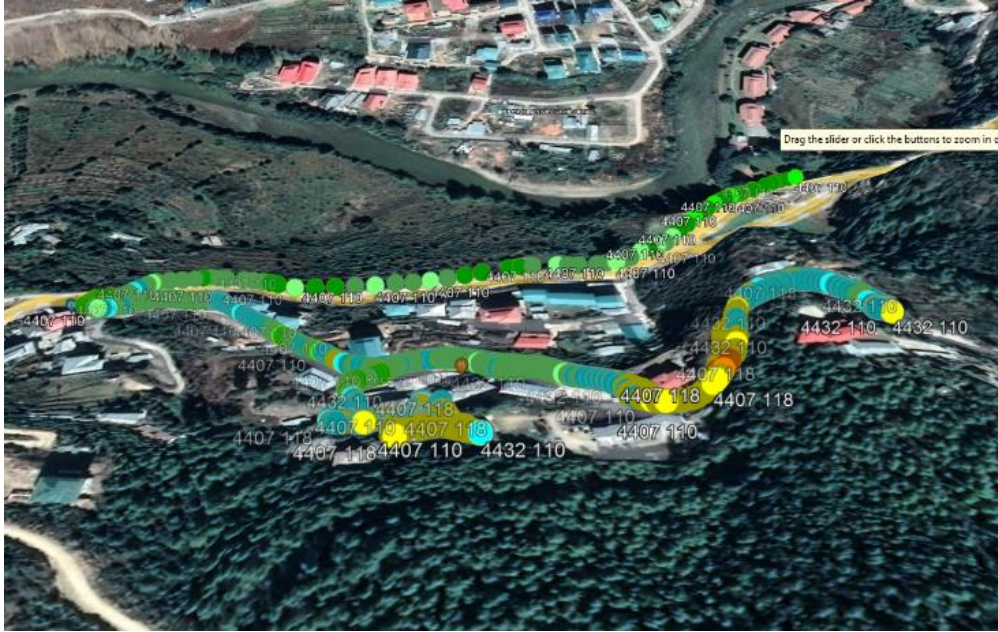


Figure Number 36: 3G B-mobile (Active cell CPICH RSCP (dBm) Google Earth

#### 4. Analysis:

1. There were no issues in voice services in areas like Taba, Changangkha, NPPF colony, Changjiji and Changbangdu for both the operators.
2. The data throughputs for both the 3G and 4G is maintained in all the areas in Taba, Changangkha, NPPF colony, Changjiji and Changbangdu but there are issues regarding the data completion rate for both the operators in these areas.
3. A weak 4G coverage of both B-mobile and Tash cell was observed in the Dagala Gewog office area.
4. There are some issues of 4G network coverage of B-mobile in Bjazam (Welcome gate) where the 4G services get latched to the 3G network.



## 5. Terminologies

1. **Operator:** Refers to the respective mobile service providers
2. **Call Drop Rate:** Refers to the fraction of the telephone calls which, due to technical reasons, were cut off before the speaking parties had finished their conversation and before one of them had hung up (dropped calls).

$$\text{CDR} = (\text{Number of Call drops} / \text{Total number of attempted calls}) \times 100$$

3. **Call Completion Rate:** Refers to the ratio of successfully completed calls to the total number of attempted calls.

$$\text{CCR} = \text{Number of successful calls} / \text{total number of attempted calls}$$

4. **Data Throughput Rate:** Refers to the actual amount of data transmitted or transferred in a period of time. It is used for measuring the speeds of data uploads or downloads.

For 3G, the benchmark is  $\geq 1.5\text{Mbps}$

For 4G, the benchmark is  $\geq 6\text{Mbps}$

5. **File Transfer Protocol (FTP):** Is a standard network protocol used for the transfer of computer files between a client and server on a computer network.
6. **Hypertext Transfer Protocol (HTP):** Is an application protocol for distributed, collaborative, and hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web.
7. **Mean Opinion Score (MOS):** Is a numerical measure of quality of human speech at the destination end of the circuit and will determine the voice quality of user experience (QoE) while talking over the phone.

To measure the quality of experience (QoE). It is expressed as a single number in the range from 1 to 5, where the value of 1 corresponds to the lowest quality experienced by the end-users and 5 as the excellent quality experienced as shown below:

- 5:     Excellent
- 4:     Good
- 3:     Fair
- 2:     Poor
- 1:     Bad

8. **Peak Hours:** Is a time period determined by Service provider where traffic or number of call attempts is the maximum. The peak hours for Bhutan Telecom limited (BTL) is 3 PM to 10 PM while a peak hour for Tashi InfoComm Limited (TICL) is from 6PM to 12 AM.
9. **Off – Peak Hours:** Is a time period determined by Service provided where the traffic or call attempts is moderate. The Off- peak hours of BTL is from 6 AM to 3 PM and Off-peak hours for TICL is from 6 AM to 6 PM.
10. **Latency:** Is a measure of delay. In a network, **latency** measures the time it takes for some data to get to its destination across the network. It is usually measured as a round trip delay - the time taken for information to get to its destination and back again.
11. **Mbps:** stands for “megabits per second.” It is a measure of internet bandwidth. In simple terms, bandwidth is the download rate of your internet connection. It is the maximum speed at which you can download data from the internet onto to your computer or mobile device
12. **RSCP:** received signal code power denotes the power measured by a receiver on a particular physical communication channel.

Range (dBm)	Signal Strength Indication
-60 to 0	Very good
-75 to -60	Good
-75 to -85	Fair
-85 to -95	Poor
-124 to -95	Very Poor

13. **RSRP:** Reference Signal Received Power is a measurement of the received power level in an LTE cell network. The average power is a measurement of the power received from a single reference signal.

RF connectivity	RSRP (dBm)
Excellent	$\geq -80$
Good	-80 to -90
Medium	-90 to -100



