Quarterly Report on Mobile Quality of Service (QoS)

Bhutan InfoComm and Media Authority

Royal Government of Bhutan

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Report on Mobile Quality of Service (QoS)

1. Background

The Bhutan InfoComm and Media Authority (Authority) carries out the Mobile QoS drive test to monitor and report the QoS regularly. The report contains the mobile QoS for both voice and data through the various parameters of Key Performance Indicators (KPI). The test was carried out at Thimphu Thromde and Lhamozingkha core in Dagana Dzongkhag.

2. Locations and date of monitoring

Sl. No	Indoor/Outdoor	Name of the places	Dzongkhag	Monitoring Month
1.	Outdoor	Bebena - Hejo	Thimphu Thromde	August
2.		Pamtsho-Jungzhina		
3.		Langjophaka		
4.		Upper Taba		
5.		Lower Taba		
6.		Zilukha		
7.		RAPA Colony		
10.	Indoor	Zilukha		
14.	Outdoor	Lhamoizingkha core	Dagana	September

3. Results

The findings of the drive test of operators are as shown below:

1. Bebena Hejo

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.83	8.28	No issues
TICL	0	3.885	13.34	Issues with CFbST

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	13.32	12.75	No issues
TICL	21.45	13.21	No issues

Figure number 1.1 : RSRP plot 4G B-mobile (QGIS) [Bebena-Hejo]

Figure number 1.2 : RSRP plot 4G Tashi Cell (QGIS) [Bebena-Hejo]

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2. *Pamtsho Jungshina*

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.74	7.9	No issues
TICL	0	3.8	8.7	No issues

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	9.07	12.55	No issues
TICL	11.98	9.67	No issues

Figure number 2.1 : RSRP plot 4G B-mobile (QGIS) [Pamtsho Jungshina]

Figure number 2.2 : RSRP plot 4G Tashi Cell (QGIS) [Pamtsho Jungshina]

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3. *Langjophaka*

- ***Mobile Voice Service***

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.865	8.6	No issues
TICL	0	3.84	9.092	Issues with CFbST

- ***Data Throughputs (Mbps) (4G)***

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	27.69	17.56	No issues
TICL	8.48	9.30	No issues

Figure number 3.1 : RSRP plot 4G B-mobile (QGIS) [Langjophaka]

Figure number 3.2 : RSRP plot 4G Tashi Cell (QGIS) [Langjophaka]

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4. *Upper Taba*

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.84	9.68	Issues with CFbST
TICL	0	3.88	9.4	Issues with CFbST

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	55.83	15.60	No issues
TICL	24.97	13.5	No issues

Figure number 4.1 : RSRP plot 4G B-mobile (QGIS) [Upper Taba]

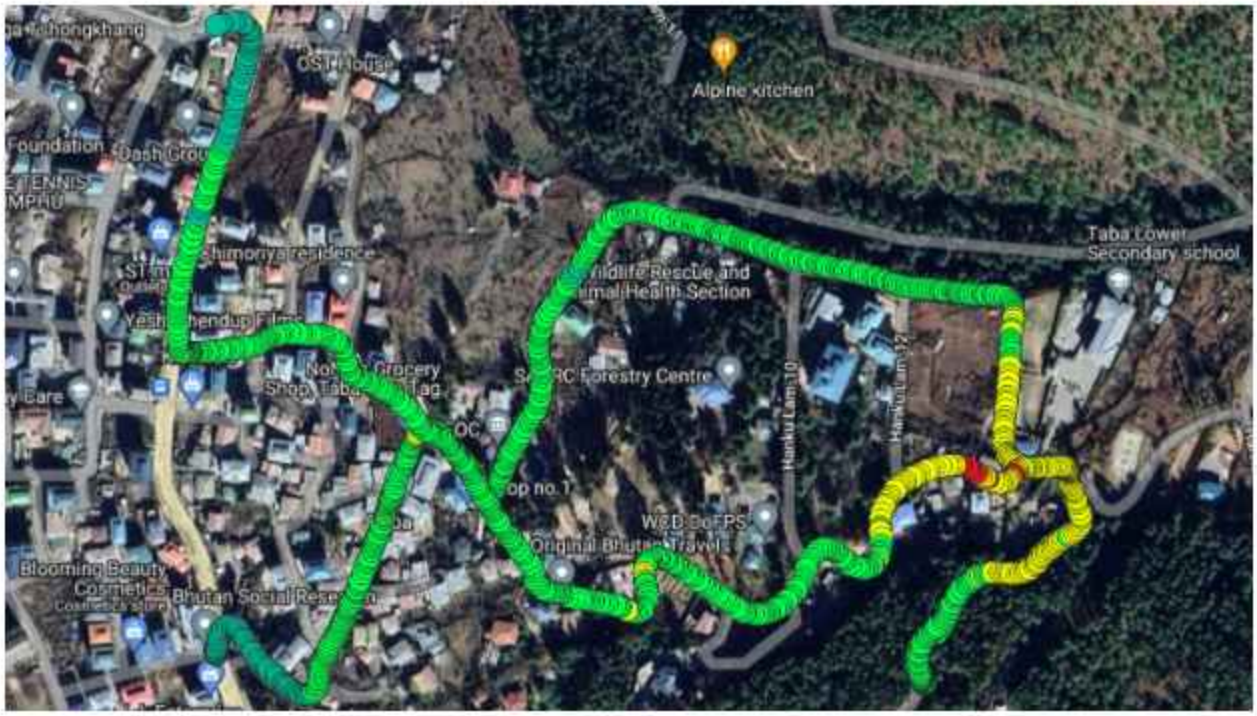

Figure number 4.2 : RSRP plot 4G Tashi Cell (QGIS) [Upper Taba]

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5. *Lower Taba*

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.905	8.41	No issues
TICL	0	3.9	9.06	Issues with CFbST

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	13.10	16.72	No issues
TICL	12.29	10.55	No issues

Figure number 5.1 : RSRP plot 4G B-mobile (QGIS) [Lower Taba]

Figure number 5.2 : RSRP plot 4G Tashi Cell (QGIS) [Lower Taba]

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6. *Zilukha*

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.79	10.37	Issues with CFbST
TICL	0	3.82	9.89	Issues with CFbST

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	19.07	4.40	No issues
TICL	20.01	28.95	No issues

Figure number 6.1 : RSRP plot 4G B-mobile (QGIS) [Zilukha]

Figure number 6.2 : RSRP plot 4G Tashi Cell (QGIS) [Zilukha]

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7. *RAPA Colony*

- ***Mobile Voice Service***

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.71	9.68	Issues with CFbST
TICL	0	3.835	9.39	Issues with CFbST

- ***Data Throughputs (Mbps) (4G)***

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	9.11	13.79	No issues
TICL	11.83	12.69	No issues

Figure number 7.1 : RSRP plot 4G B-mobile (QGIS) [RAPA Colony]

Figure number 7.2 : RSRP plot 4G Tashi Cell (QGIS) [RAPA Colony]

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8. Zilukha Indoor

Geo-Coordinates

Latitude: 27.486596
Longitude: 89.628831

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	17.79	2.96	No issues
TICL	15.37	12.64	No issues

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9. Lhamoizingkha Core Area

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remarks
BTL	0	3.8	8.11	No issues
TICL	0	3.7	9.41	Issues with CFbST

- *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	53.77	8.05	No Issues
TICL	42.35	29.3	No Issues

Figure number 1.1 : RSRP plot 4G B-mobile (QGIS) [Lhamoizingkha]

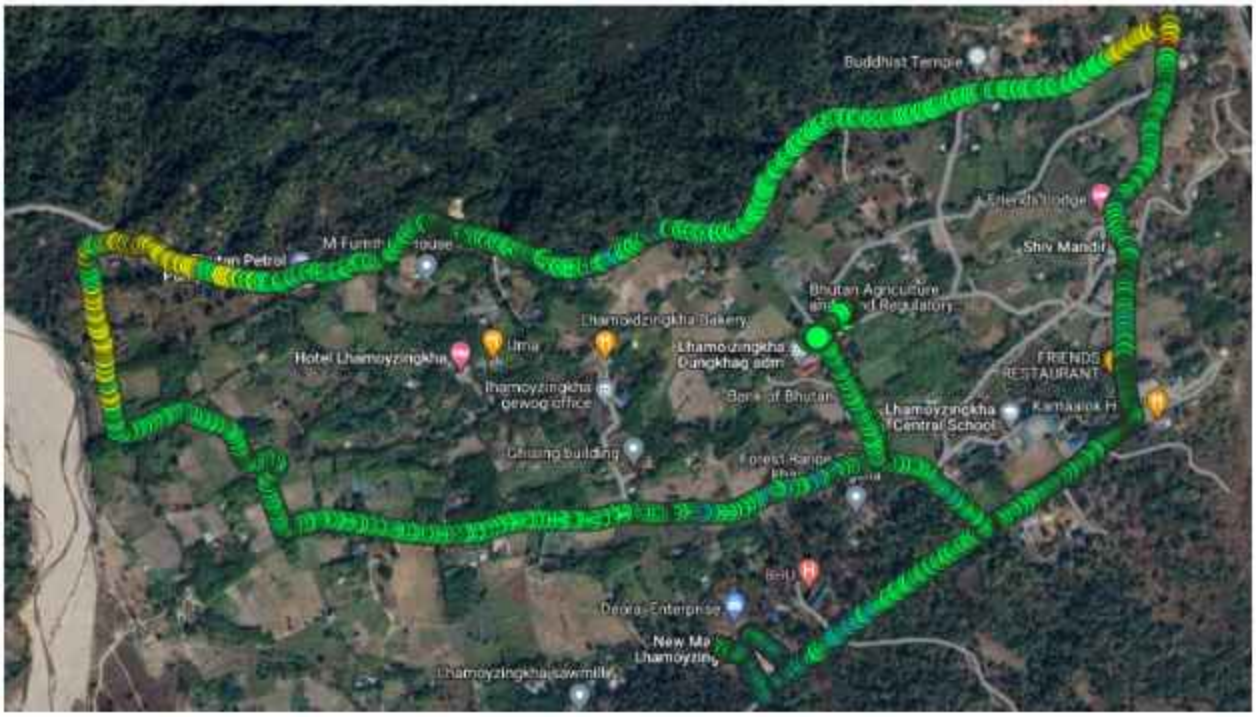

Figure number 1.2 : RSRP plot 4G Tashi Cell (QGIS) [Lhamoizingkha]

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C. Findings

1. It is found that there are no issues with the download and upload throughput of both the operators in all of the monitored areas.

2. For the mobile voice service, it is found that both the operators are meeting the standards as set by the Authority in all parameters except for the following places in terms of the time required to set up calls (Call Fallback Setup Time):

BTL	TICL
1. Upper Taba 2. Zilukha 3. RAPA Colony	1. Bebena-Hejo 2. Langjophaka 3. Upper Taba 4. Lower Taba 5. Zilukha 6. RAPA Colony

3. The Lhamozingkha core areas did not have any issues with average download throughput and upload throughput for both the operators.

4. However, the upload throughputs for TICL in some parts of areas are not meeting the standards when the network speed test was carried out from Ookla speed test application.

5. Both the operators do not have any issues in terms of quality voice service except the TICL's call fallback set up time, which is higher than the prescribed standard.

5. Follow up Actions Taken by the Authority

The general follow up actions and some of the rectifications actions taken by the Authority against the issues addressed above are mentioned below:

- The Authority shared and informed the telecom operators to improve their network coverage and QoS in those areas where the QoS standards are not fulfilled.
- Based on the complaint raised, QoS monitoring (physical drive test) was carried out in the core areas of Lhamo Zingkha to obtain the precise QoS measurement data.
- The Authority has also carried out the complaint validation regarding the QoS issues in the Zilukha area and informed BTL for the immediate rectification.

6. Terminologies

I. **Operator**: Refers to the respective mobile service providers

II. **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).

III. **CDR** = (Number of Call drops/ Total number of attempted calls) x 100

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

V. **CCR** = Number of successful calls / total number of attempted calls

VI. **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.

A. For 3G, the benchmark is: Uplink >= 1Mbps, Downlink >= 1.5 Mbps
B. For 4G, the benchmark is: Uplink >= 2Mbps, Downlink >= 6Mbps

VII. **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.

VIII. **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.

IX. **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:

A. 5: Excellent
B. 4: Good
C. 3: Fair
D. 2: Poor
E. 1: Bad

X. **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.

XI. **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.

XII. **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.

XIII. **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

XIV. **RxLeV:** RxLev represents the received signal strength level measured in dBm units. -105dBm represents the weakest/unusable signal and -80 dBm the strongest.

XV. **RSCP:** received signal code power denotes the power measured by a receiver on a particular physical communication channel.

XVI. **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.

XVII. **Mobile Network Coverage (Signal Strength)**

Sl.No	QoS Parameters	Best dBm	Average dBm	Worst dBm
1	Rxlev (GSM)	>=-80	-80<=-95	<=-105
2	RSCP (UMTS)	>=-80	-80<=-100	<=-110
3	RSRP (LTE)	>=-80	-80<=-105	<=-115