Quarterly Report on Mobile Quality of Service (QoS)

Bhutan InfoComm and Media Authority

Royal Government of Bhutan

(July-September) 2024

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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 Paro,Punakha, Wangdue, Trongsa, Bumthang, Mongar and Lhuentse.

2. Locations and date of monitoring

Sl. No	Indoor/Outdoor	Name of the places	Dzongkhag	Monitoring Month
1.	Outdoor	Wang Site Bongdey	Paro	July
2.		Khangkhu 1		
3.		Khangkhu 2		
4		Town (1,2,3)		
5		Geptey		
6		Taju		
7		Town (1,2,3)		
8		Nyemizampa		
9		Gaupey		
10		Drukgyel Dzong		
11		Drukgyel Town		
12		Lango		
13		Shaba HSS		
14		Shaba Town		

15		Woochu		
16		Isuna		
		Rinchengang	Wangdue	August
		Hospital Area		
		Wangdue Dzong and Army area		
		Bajo Town 1		
		Bajo Town 2		
		Bajo School Area		
		Samthang Area		
		Below Bajo Town Highway road and Police Camp area		
		Lobesa Town Area	Punakha	
		RKPO Resort Area (Near Chimi Lhakhang)		
		Khuruthang Town		
		Hospital Areas		
		Police Camp area		
		Chimilhakhag Homestay area		
		Taktse Town	Trongsa	

		DoST Office and Guest house area		
		Trongsa Town		
		Housing Colony, Trongsa		
		Police Camp area		
		Hospital and BPC Colony Area		
		Trongsa highway area		
		Gaytsa	Bumthang	September
		Chumey Area 1		
		Chumey Area 2		
		Chamkhar Old Town 1		
		Chamkhar Old Town 2		
		Chamkhar Old Town 3		
		Chamkhar New Town		
		Nangkhar		
		Ura		
		Gyelpozhing	Mongar	
		Mongar Hospital		
		Mongar Town		
		Kideykhar		

		Autsho		
		Lhuentse Town 1	Lhuentse	
		Lhuentse Town 2		

3. Results

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

1. ***Wang Site (Bongdey)***

   ● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.86	8.78	No Issue
TICPL	0	4.17	6.64	No Issue

   ● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	14.14	14.10	No Issue
TICPL	16.85	10.19	No Issue

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

Figure number 1.2: RSRP plot 4G Tashi Cell (QGIS) [Wang Site (Bongdey)]

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2. Khangkhu 1

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.63	7.87	No issue
TICPL	0	3.90	6.61	No issue

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	42.07	11.87	No issue
TICPL	8.54	5.48	No issue

Figure number 2.1: RSRP plot 4G B-mobile (QGIS)[Khangkhu 1]

Figure number 2.2: RSRP plot 4G Tashi Cell (QGIS) [Khangkhu 1]

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3. Khangkhu 2

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.88	9.47	Issue with call setup time
TICPL	0	3.6	9.34	Issue with call setup time

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol	Remarks

	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	35.63	15.64	No issue
TICPL	34.85	13.62	No issue

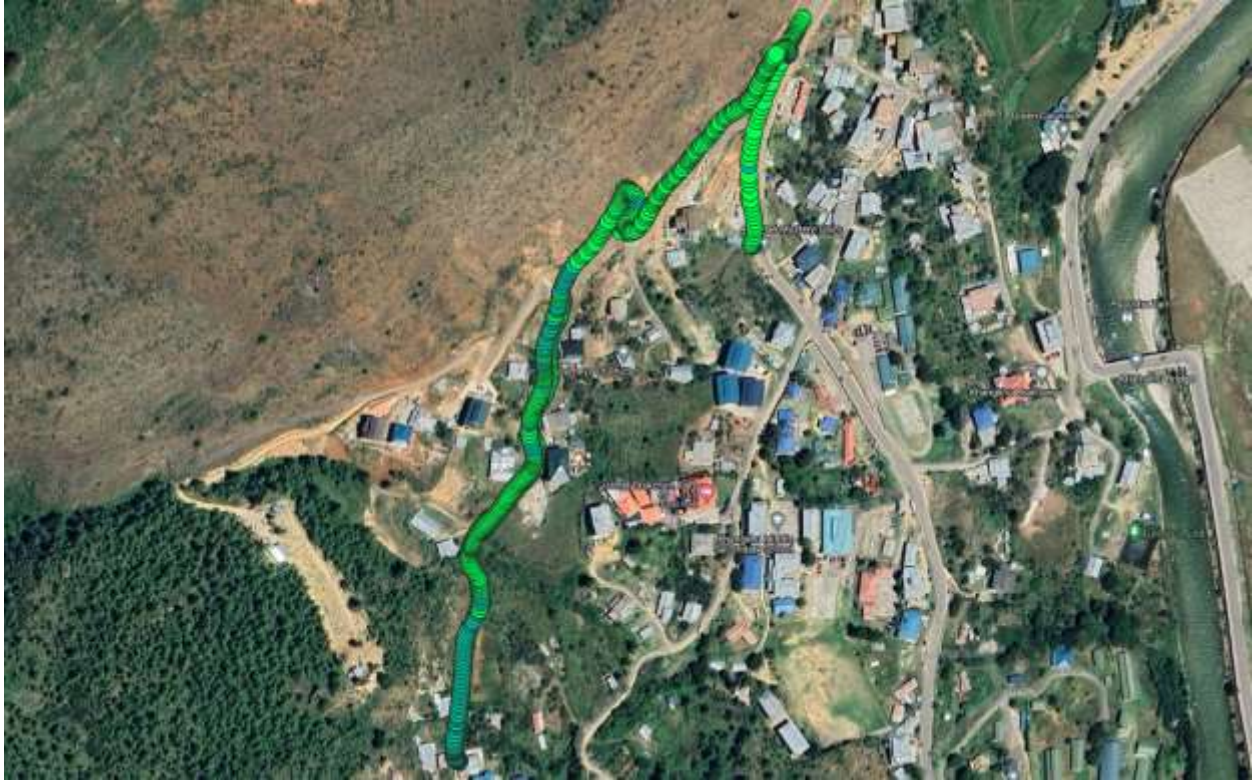*Figure number 3.1: RSRP plot 4G B-mobile (QGIS) [Khangkhu 2]*
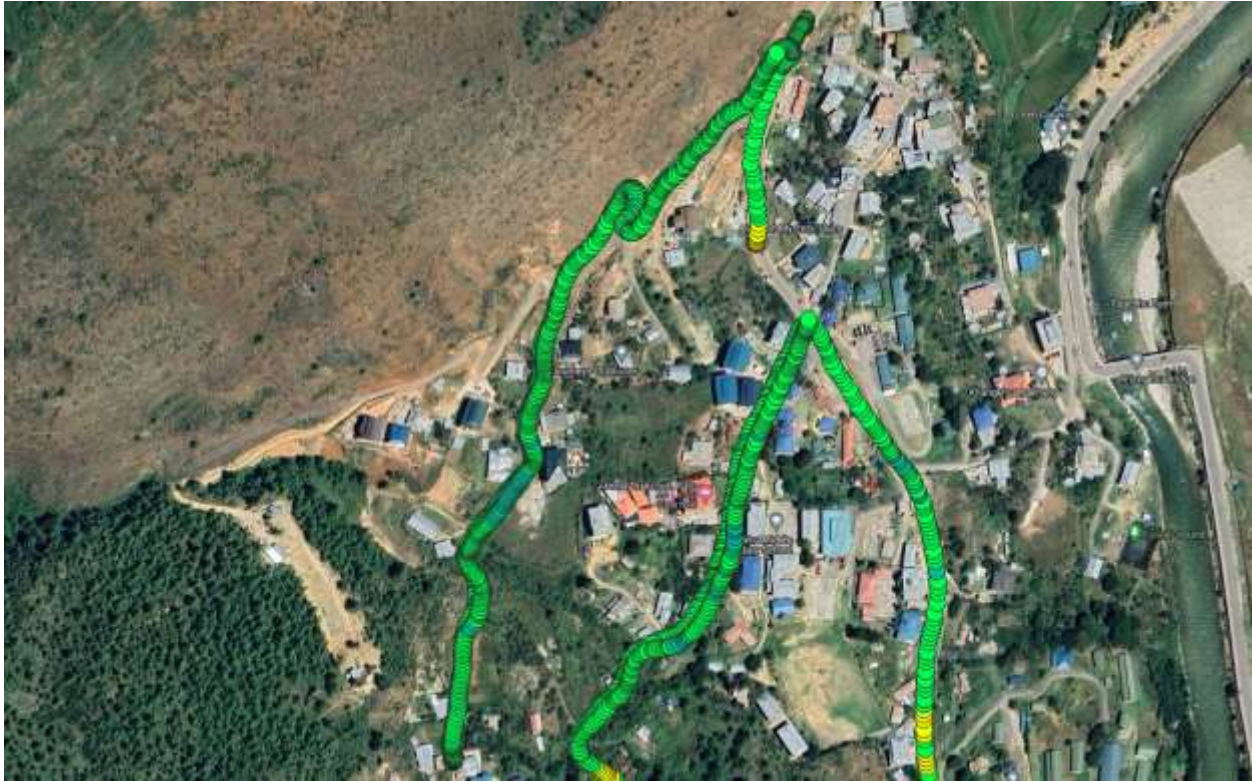
Figure number 3.2: RSRP plot 4G Tashi Cell (QGIS) [Khangkhu 2]

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4. Town 1

● **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.77	8.97	No issue
TICPL	0	3.9	7.13	No issue

● **Data Throughputs (Mbps) (4G)**

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	30.87	19.50	No issue

| TICPL | 27.98 | 15.64 | No issue |

Figure number 4.1: RSRP plot 4G B-mobile (QGIS) [Town - 1]

Figure number 4.2 : RSRP plot 4G Tashi Cell (QGIS) [Town - 1]

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5. Town - 2

● **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.64	7.82	No issue
TICPL	0	3.99	6.98	No issue

● **Data Throughputs (Mbps) (4G)**

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	38.23	11.36	No issue
TICPL	7.96	8.36	No issue

Figure number 5.1: RSRP plot 4G B-mobile (QGIS) [Town - 2]

Figure number 5.2 : RSRP plot 4G Tashi Cell (QGIS) [Town - 2]

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6. *Town - 3*

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.62	8.11	No issue
TICPL	0	4.00	6.52	No issue

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	26.30	21.82	No issue
TICPL	15.48	11.93	No issue

Figure number 6.1: RSRP plot 4G B-mobile (QGIS) [Town - 3]

Figure number 6.2 : RSRP plot 4G Tashi Cell (QGIS) [Town - 3]

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7. Geptey

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.9	8.56	No issue
TICPL	0	4.00	7.16	No issue

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

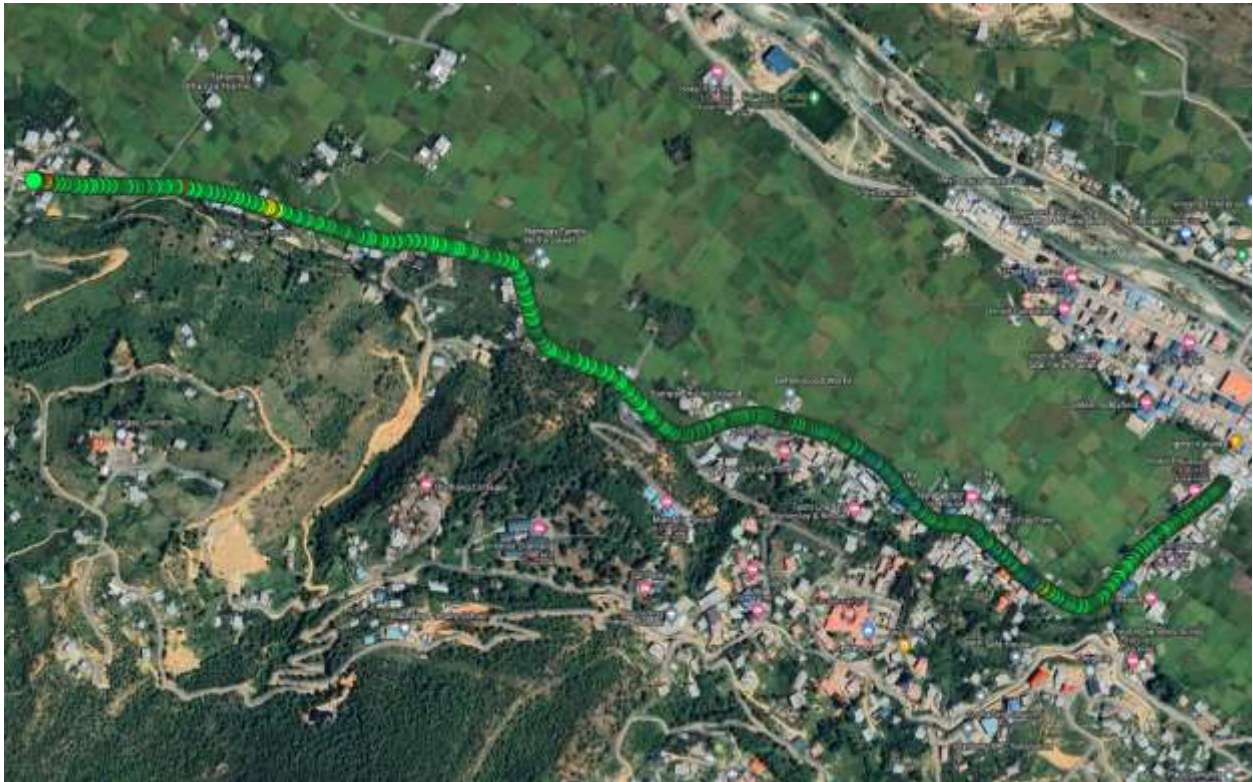| Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	12.87	9.88	No issue
TICPL	11.93	8.49	No issue

Figure number 7.1: RSRP plot 4G B-mobile (QGIS) [Geptey]
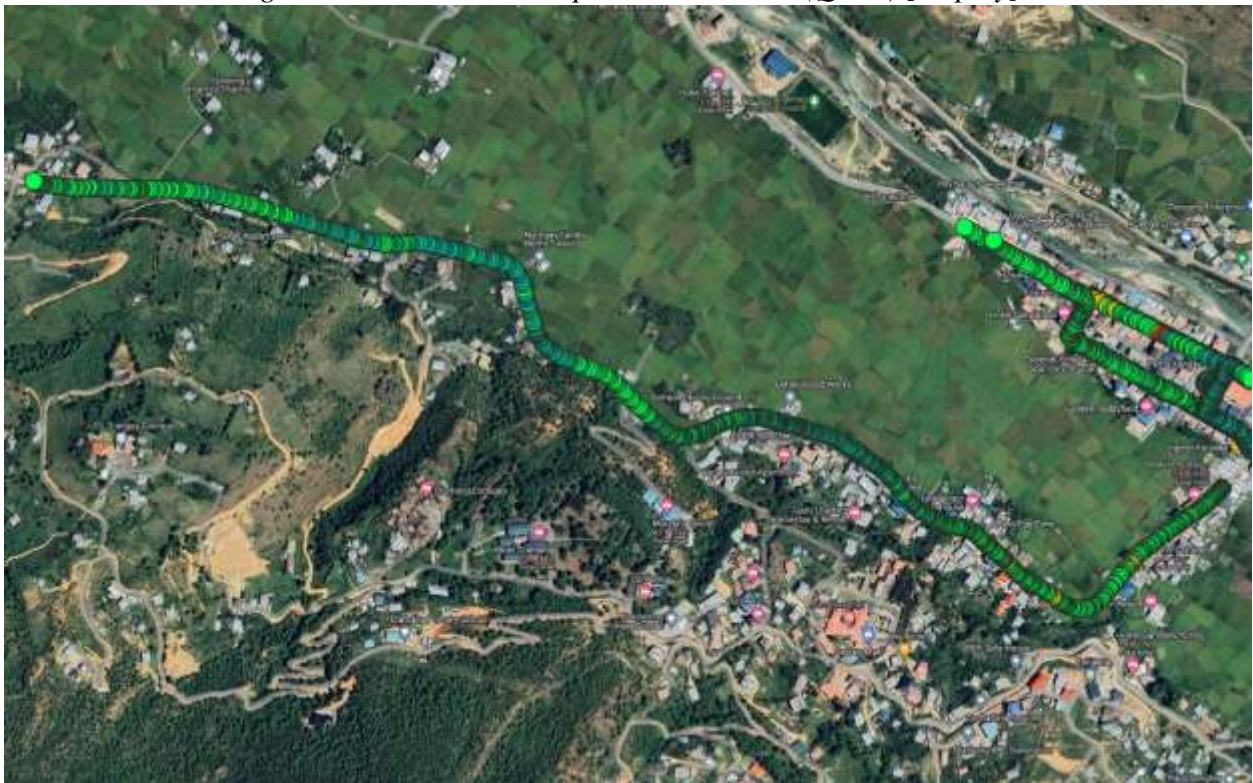
Figure number 7.2 : RSRP plot 4G Tashi Cell (QGIS) [Geptey]

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8. *Taju*

- ● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.9	8.18	No issue
TICPL	0	3.98	7.76	No issue

- ● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	21.20	16.95	No issue
TICPL	4.41	1.79	Issue with UL and DL throughput

Figure number 8.1: RSRP plot 4G B-mobile (QGIS) [Taju]

Figure number 8.2 : RSRP plot 4G Tashi Cell (QGIS) [Taju]

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9. Town - 1 (peak Hour)

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.79	8.06	No issue
TICPL	0	3.48	10.27	Issue with call setup time

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	30.87	19.50	No issue
TICPL	24.43	20.39	No issue

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Figure number 9.1: RSRP plot 4G B-mobile (QGIS) [Town - 1]

Figure number 9.2: RSRP plot 4G Tashi Cell (QGIS) [Town - 1]

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10. Town - 2 (Peak Hours)

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.78	7.67	No issue
TICPL	0	3.22	10.45	Issue with call setup time

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	26.61	12.46	No issue
TICPL	7.49	8.81	No issue

Figure number 10.1: RSRP plot 4G B-mobile (QGIS) [Town - 2]

Figure number 10.2: RSRP plot 4G Tashi Cell (QGIS) [Town - 2]

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11. Town - 3 (Peak Hours)

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.84	7.65	No issue
TICPL	0	3.77	10.17	Issue with call setup time

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	24.36	17.64	No issue
TICPL	12.44	7.42	No issue

Figure number 11.1: RSRP plot 4G B-mobile (QGIS) [Town - 3]

Figure number 11.2: RSRP plot 4G Tashi Cell (QGIS) [Town - 3]

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12. Nyemizampa

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	4.01	7.39	No issue
TICPL	0	4.08	9.08	Issue with call setup time

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	11.64	14.34	No issue
TICPL	14.08	9.37	No issue

Figure number 12.1: RSRP plot 4G B-mobile (QGIS) [Nyemizampa]

Figure number 12.2: RSRP plot 4G Tashi Cell (QGIS) [Nyemizampa]

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13. Gaupey

- **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	4.03	8.43	No issue
TICPL	0	4.06	6.64	No issue

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	2.19	4.87	Issue with DL throughput
TICPL	10.90	2.85	No issue

Figure number 13.1: RSRP plot 4G B-mobile (QGIS) [Gaupey]

Figure number 13.2: RSRP plot 4G Tashi Cell (QGIS) [Gaupey]

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14. Drukgyel Dzong

- **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.81	8.43	No issue
TICPL	0	3.88	11.58	Issue with call setup time

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	23.39	11.17	No issue
TICPL	8.89	4.17	No issue

Figure number 14.1: RSRP plot 4G B-mobile (QGIS) [Drukgyel Dzong]

Figure number 14.2: RSRP plot 4G Tashi Cell (QGIS) [Drukgyel Dzong]

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15. Drukgyel Town

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.88	8.22	No issue
TICPL	0	3.99	6.80	No issue

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	19.11	17.85	No issue
TICPL	15.63	10.59	No issue

Figure number 15.1: RSRP plot 4G B-mobile (QGIS) [Drukgyel Town]

Figure number 15.2: RSRP plot 4G Tashi Cell (QGIS) [Drukgyel Town]

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16. Lango

● *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.74	8.21	No issue
TICPL	0	4.05	6.43	No issue

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	

BTL	56.87	23.33	No issue
TICPL	8.08	7.94	No issue

Figure number 16.1: RSRP plot 4G B-mobile (QGIS) [Lango]

Figure number 16.2: RSRP plot 4G Tashi Cell (QGIS) [Lango]

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17. Shaba HSS

- **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.94	8.95	No issue
TICPL	0	3.95	6.61	No issue

● *Data Throughputs (Mbps) (4G)*

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	13.87	7.48	No issue
TICPL	8.76	3.91	No issue

Figure number 17.1: RSRP plot 4G B-mobile (QGIS) [Shaba HSS]

Figure number 17.2: RSRP plot 4G Tashi Cell (QGIS) [Shaba HSS]

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18. Shaba Town

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	3.82	9.15	Issue with call setup time
TICPL	0	3.93	6.73	No issue

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	21.41	19.46	No issue
TICPL	20.34	9.60	No issue

Figure number 18.1: RSRP plot 4G B-mobile (QGIS) [Shaba Town]

Figure number 18.2: RSRP plot 4G Tashi Cell (QGIS) [Shaba Town]

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19. Woochu

- *Mobile Voice Service*

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	4.07	8.74	No issue
TICPL	0	4.17	6.15	No issue

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	36.36	25.18	No issue
TICPL	52.46	15.87	No issue

Figure number 19.1: RSRP plot 4G B-mobile (QGIS) [Woochu]

Figure number 19.2: RSRP plot 4G Tashi Cell (QGIS) [Woochu]

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20. Isuna

- **Mobile Voice Service**

Operator	Call Drop rate (<2%)	Mean Opinion Score (>= 3.5)	Call Fallback Setup Time (<= 9 Seconds)	Remark
BTL	0	4.14	8.94	No issue
TICPL	0	3.98	8.59	No issue

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

Operators	File Transfer Protocol		Remarks
	Download (≥ 6 Mbps)	Upload (≥ 2 Mbps)	
BTL	5.75	20.94	Issue with DL throughput
TICPL	7.51	2.07	No issue

Figure number 20.2: RSRP plot 4G Tashi Cell (QGIS) [Isuna]

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A. Findings

4. Findings

1. There were not many issues for both the operators in terms of local FTP throughput testing in the Phuentsholing area. However, in terms of HTTP open server testing, in some cycles, the DL throughput is as low as 1.738Mbps to 4.049Mbps, although the average of all cycles is 9Mbps.

2. Average Throughput for both the telecom operators BTL and TICL meets the standard of the Authority in all the monitored places in Sarpang Dzongkhag.

3. There were no call drop issues for BTL but for TICL were found call drop issues in Taraythang Gewog and Singye Gewog.

4. Coverage Maps shown in some parts of Taraythang Gewog and Singye Gewog in Sarpang Dzongkhag were found to have poor network coverage for both the telecom operators in those vicinities.

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.
● The Authority has also initiated the QoS standards and network coverage in Gelephu region (SAR)
● The Authority has also carried out the complaint validation regarding the QoS issues.

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