

Quarterly Report on EMF Monitoring April - June 2023



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Bhutan InfoComm and Media Authority

Royal Government of Bhutan

June 2023

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1. Background

Electromagnetic Field (EMF) Emissions are the electric and magnetic fields that are produced by radios, microwaves, mobile phones and base stations (mobile towers). Telecommunications transmitters generate electromagnetic fields at radio and microwave frequencies. Transmitters have proliferated with siting of wireless communication networks often co-located among other transmitters and the transmitter used in contact with human bodies. If the EMF exposure is prolonged there may be issues of possible health risks although it is scientifically not proven. Such risks must be managed and prevented.

Currently International Commission on Non-Ionizing Radiation Protection (ICNIRP) standards and various other standards are adopted on the assessment and compliance of the exposure levels radiated from different electromagnetic spectrum sources according to the permissible levels in order to protect the people from exposure to higher RF radiations. The most sources of exposure include the cellular network using GSM, WCDMA, LTE and others which occupy the VHF, UHF, L and S band frequencies.

The Bhutan InfoComm and Media Authority have always been monitoring and measuring the EMF radiation level of each Telecommunication Base Transceiver station (towers) in the country based on the EMF emission standards. The Authority also certifies the EMF compliance of the mobile towers in the country mainly in urban areas and satellite towns areas.

The EMF emission standard is derived from the EMF radiation threshold developed by ICNIRP and the Authority has standardized the threshold level of EMF radiation exposure based on the regional threshold.

2. Monitoring

To ensure that Electromagnetic Field (EMF) emission exposure from the Cellular Base Transceiver Station are safe and within the prescribed standard, the Authority has monitored the EMF from April to June, 2023 in following places;

Sl.No	Name of the Monitored Places	Number of tower Monitored
1	Motithang	7
2	Changangkha	5
3	Kalabazaar	3
4	Hospital Area	1
5	Changzamtog	1

The Authority will continue to monitor and measure the mobile towers in the country and will be issued with the certificate of EMF threshold compliance respectively.

3. Objective of the Monitoring

The main objective of the EMF measurement monitoring is:

- To ensure the safe and reliable communication services.
- To test the exposure levels produced by any transmitter or emitter such as telecommunication facilities and mobile telephone base stations for safety purposes and maintain the EMF emission within the standard threshold.
- To ensure that all telecommunication equipment is safe and secure.

4. Details of the Equipment used for EMF Compliance Test

The details of existing EMF monitoring equipment of the Authority are as mentioned below:

Equipment Make/Model: Rohde & Schwarz
Type of the Antenna: Isotropic Antenna/Type (3-Axis)
Spectrum Analyzer: FSH8
Calibration details: Calibrated on 21-12-2022 and valid up to 2 to 3 years

5. Specification of the Equipment/ Instrument

The specification of the above equipment are as mentioned below:

- 3-axis, E-field antenna 30 kHz to 3 GHz
- Spectrum analyzer covering 9 kHz to 8 GHz
- RFEX Software package
- A 1.5 meter cable to separate the antenna from the meter
- Tripod to hold the antenna



Figure 1: Isotropic Antenna/Type (3-Axis)



Figure 2: Spectrum Analyzer FSH8

6. Measurement Parameter

The following quantities are measured while monitoring:

- Electric Field strength E in **V/m**
- Power density in (**$\mu\text{W}/\text{cm}^2$**)

7. Methodology

The following methodology processes are followed while carrying out the monitoring:

- The measurement is done around 10 meters to 20 meters away from the sectoral antenna's BTS towers facing towards the measurement equipment which is based on the ICNIRP standards measurement.
- The measurement result is taken as the average over a time period of 10 to 15 minutes.
- The measurement is done by Frequency selective method. The selected frequency is for 2G, 3G, and 4G for both the operators.
- Measurement values will be recorded and compare the measurement values with the reference level as per the international standard ICNIRP.

8. Reference Standards and Regulation/ICNIRP limits

According to Section 10(1), and 10(2) of the “Standard for the Establishment of Telecommunications Tower”

- 10 (1): *All telecommunication and broadcasting sites shall ensure compliance with the ICNIRP Procedures and Standards for general public exposure and take immediate actions to rectify any non-compliant Sites.*
- 10(2): *Antennas in all sites shall not emit the EMF radiation more than the standards shown in the table below;*

Frequency range	Electric field-strength (V/m)		Equivalent plane wave power-density $S_{eq}(\text{W}/\text{m}^2)$	
	general public	occupational	general public	Occupational
0.1 - 30 Hz	$300/(10^{0.5*f^{0.7}} \text{MHz})$	$600/(10^{0.5*f^{0.7}} \text{MHz})$	NA	NA

>30 – 400 MHz	$27.7/10^{0.5}$	$61/10^{0.5}$	0.2	1
>400 - 2000 MHz	$(1.375f^{0.5}(\text{MHz})/10^{0.5})$	$(3f^{0.5}(\text{MHz}))/10^{0.5}$	(f/2000)	(f/400)
>2 - 300 GHz	19.289	43.323	1	5

9. Findings and Permissible limits of Electric Field and Power Density

The EMF measurement of the BTS tower was carried out in Motithang, Changangkha, Kalabazaar, Hospital Areas and Changzamtog in Thimphu Thromde. It is found that the maximum exposures around all of the base stations are **very low** than prescribed exposure limits. The detailed measurement readings , findings, electric field and Power Density results are attached below in **Annexure I**.

10. Satellite View of the Measurement Location/Telecom site

The satellite view of the measurement location of each telecom site or transmitter is attached in **Annexure 2**.

Annexure 1 (Measurement Results)

The detailed measurement readings of Electric Field and Power Density are attached below;

1. Kalabazaar (Tashi InfoComm Limited)

SL.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Geda lam, Near Druk School	27.4609283	89.6361024	149	1800 MHz	18.44	4.8308788	4.3069	Below the Limits
2	Kalabazaar	27.4589092	89.6349483	1101	850 MHz	12.676	0.3220726	0.0275	Below the Limits
				479	1800 MHz	18.44	1.7495045	0.1490	

2. Kalo Bazer (Bhutan Telecom Limited)

SL.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Near Druk School	27.458843	89.637587	6211	850 MHz	12.676	0.522072612 381878	0.0450	Below the Limit
				4455	1800 MHz	18.00	0.94950455	0.1670	

3. Motithang (Bhutan Telecom Limited)

Sl.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Upper Motithang	27.4722965	89.6215421	83	1800 MHz	18.44	0.0445946211	0.0005	Below the Limits
2	Sersang Primary School, Motithang	27.4761095	89.6203094	160	1800 MHz	18.44	1.6958727427 2052	0.7629	Below the Limits
3	DHI Office/Upper Motithang	27.474949	89.62193714	402	850 MHz	12.676	0.4010207956 23937	0.0427	Below the Limits
				40211	1800 MHz	18.44	0.9451489431 58938	0.2370	
4	BOD, Motithang	27.47778229	89.6253261	334	18800 MHz	18.44	2.0715280263 1581	1.1383	Below the Limits

4. Motithang (Tashi InfoComm Limited)

Sl.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Double Turning Mothitnag	27.4725229	89.6232292292	210	1800 MHz	18.44	0.3210874474	0.0273	Below the Limits
2	BOD, Motithang	27.47755623	89.62474823	10002-1	900 MHz	13.044	0.26751979039	0.0190	Below the Limits
				1101	850 MHz	12.676	0.3220726123	0.0275	
				427	1800 MHz	18.44	0.7495045559	0.1490	

5. Changangkha (BTL)

Sl. No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Changangkha	27.472919	89.6269303	408	1800 MHz	18.44	0.908177003	0.2188	Below the Limits
2	NPPF Colony near Apollo Nurse training	27.4691941	89.6317250	375	1800 MHz	18.44	1.723943493	0.7883	Below the Limits

3	Changangkha FTTC	27.4773047	89.627218	40211	1800 MHz	18.44	0.717110919	0.1364	Below the Limits
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6. Changangkha (TICL)

Sl.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Changangkha	27.47590065	89.62759399	10161-23	900 MHz	13.044	0.418027604016756	0.0464	Below the Limits
				61	850 MHz	12.676	0.346818039836235	0.0319	
				63	1800 MHz	18.44	1.40739756890893	0.5254	
2	Above DGPC Office	27.478556	89.629902	129	1800 MHz	18.44	0.925413071663122	0.2272	Below the Limits

7. Near Hospital area (BTL)

Sl.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Near Mother and Child Hospital	27.4653975	89.6353748	472	1800 MHz	18.44	0.4014952 76799534	0.0248	Below the Limits

8. Changzamtog (TICL)

Sl.No	Site Name	Latitude	Longitude	Cell ID	Frequency Band	Limits V/m	Field Strength V/m	Power Density ($\mu\text{W}/\text{cm}^2$)	Remark
1	Near Fly over bridge	27.4568061	89.6474521	149	1800 MHz	18.44	0.72670470 6304473	0.1401	Below the Limits

Annexure 2 (Satellite View of Location of Monitored Sites)

The following are the satellite view of the measurement location of the each Telecom site transmitter;

27.4609283 89.6361024

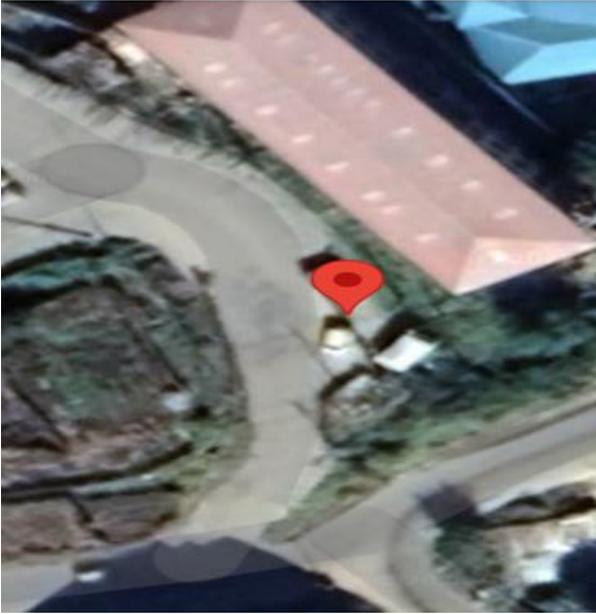


Figure 3: Geda lam, Near Druk School(TICL)

27.4589092, 89.63494...

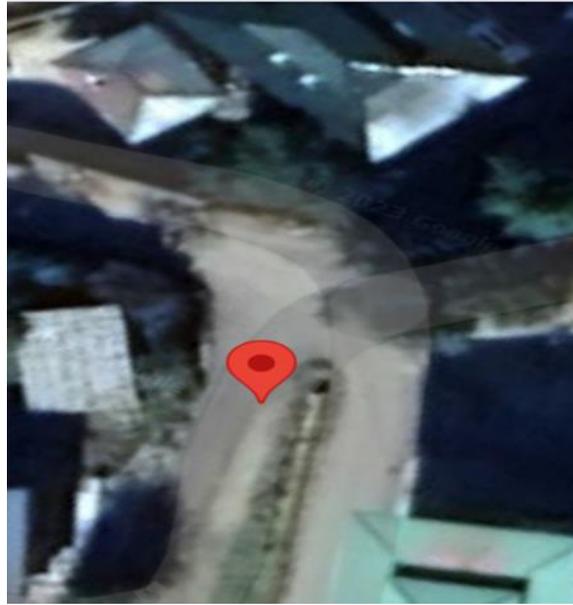


Figure 4: Kalabazaar (TICL)

27.458843 89.637587

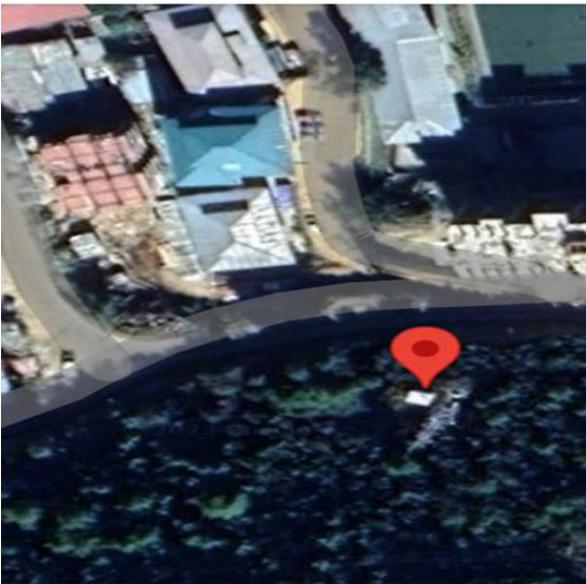


Figure 5: Near Druk School (BTL)

27.4722965 89.6215421

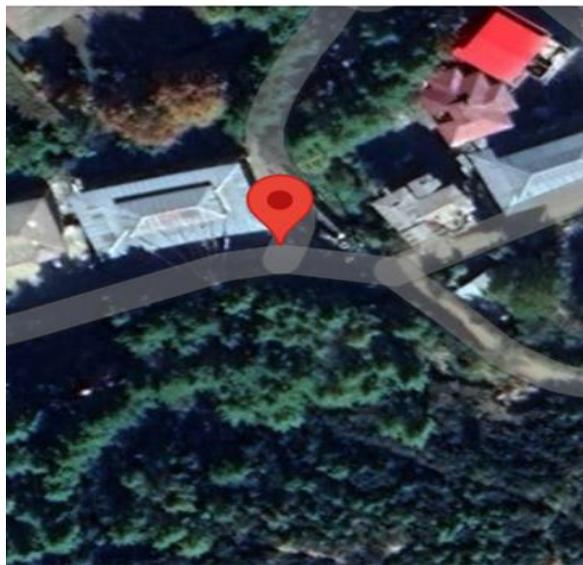


Figure 6: Upper Motithang(BTL)

27.4761095,89.6203094

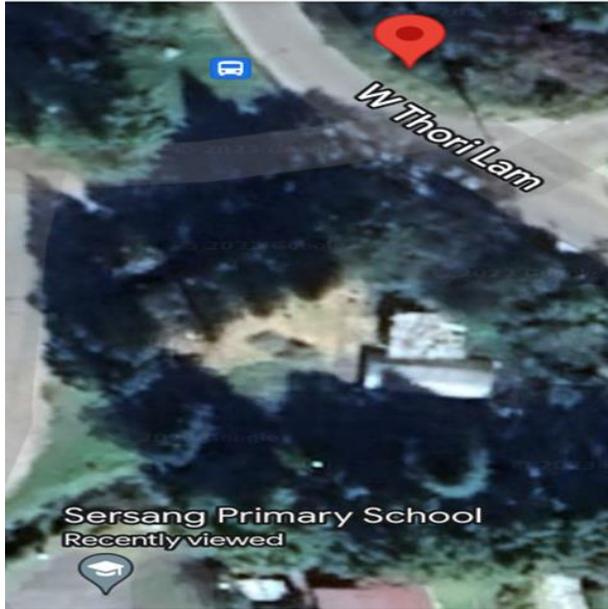


Figure 7: Sersang Primary School, Motithang (BTL)

27.474949, 89.62193714

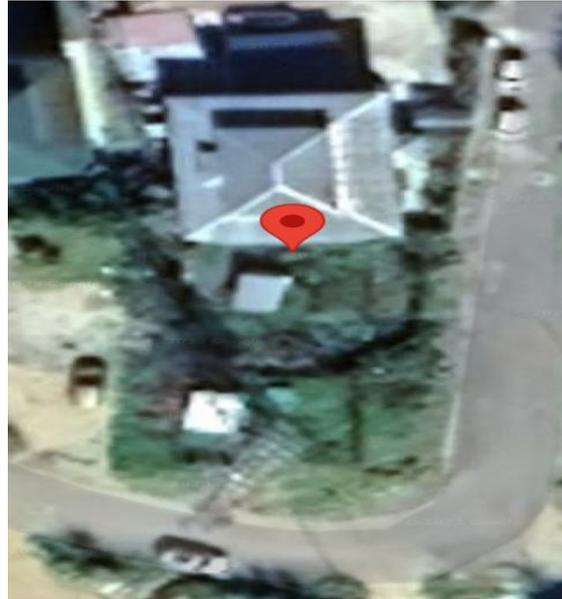


Figure 8: DHI Office/Upper Motithang (BTL)

27.47778229, 89.62532...

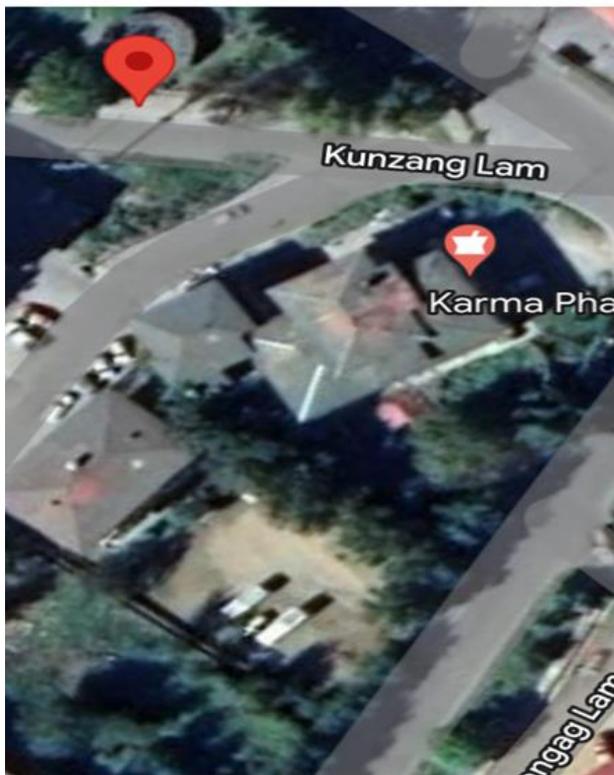


Figure 9: BOD, Motithang (BTL)

27.4725229, 89.623229...

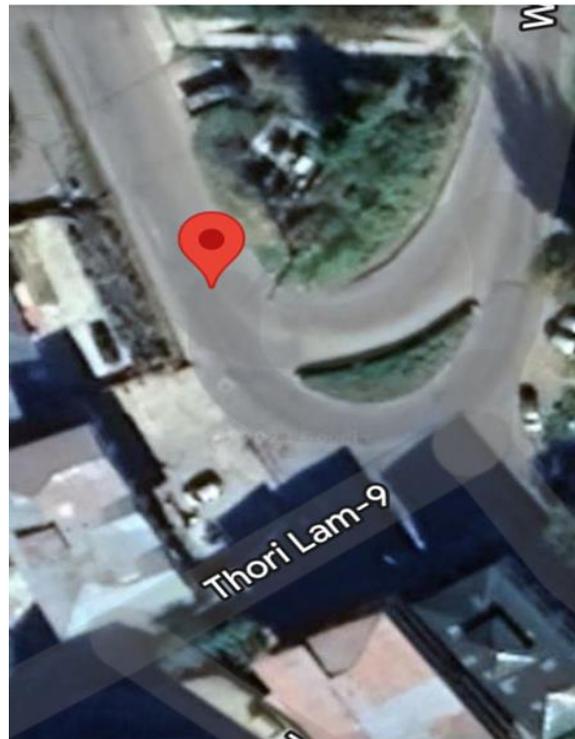


Figure 10: Double Turning Mothitnag (TICL)

27.47755623,89.62474...



Figure 11: BOD, Motithang (TICL)

27.472919 89.6269303

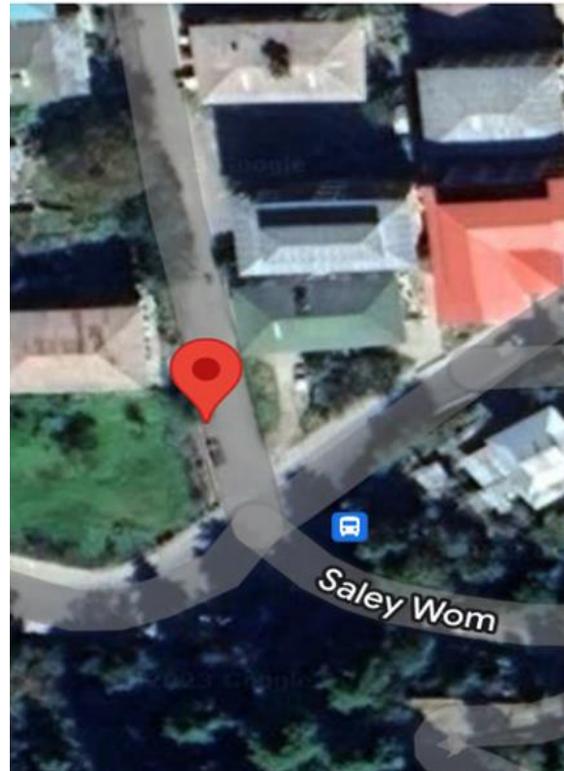


Figure 12: Changangkha (BTL)

27.46933 89.63193

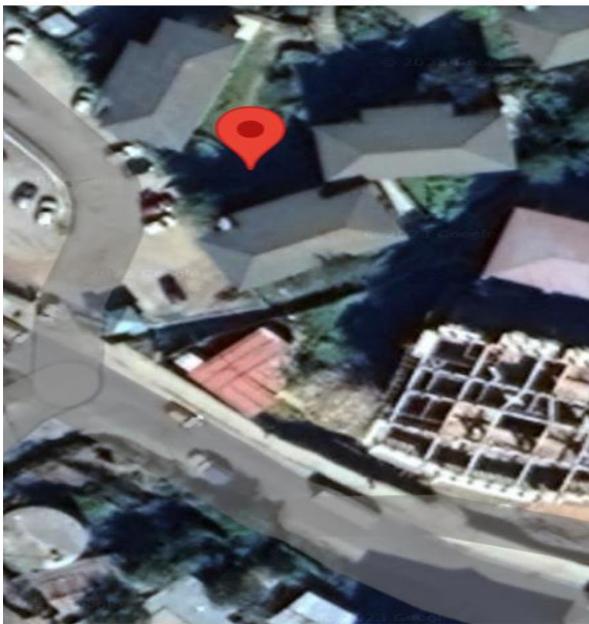


Figure 13: Apollo Nurse training(BTL)

27.4773047 89.627218

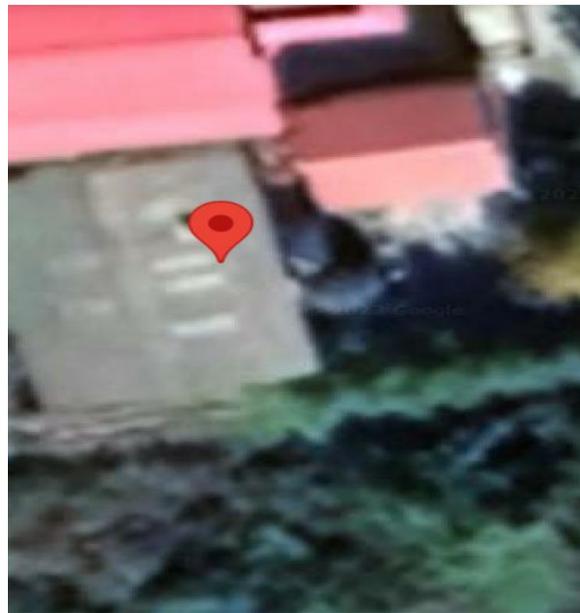


Figure 14: Changangkha FTTC(BTL)

27.478556 89.629902

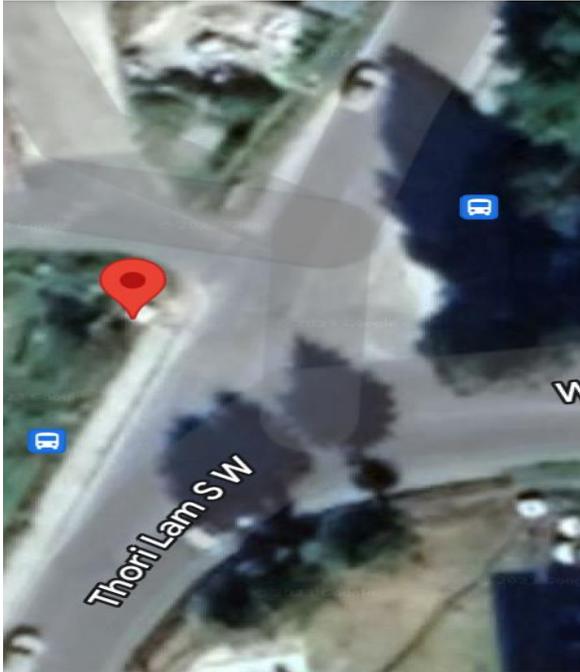


Figure 15: Above DGPC Office (TICL)
(BTL)

27.4653975 89.6353748

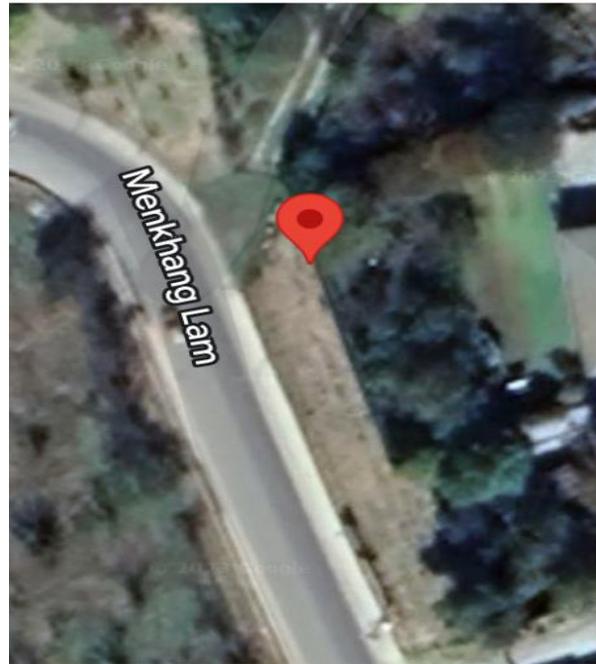


Figure 16: Near Mother and Child Hospital

27.456865,89.647705

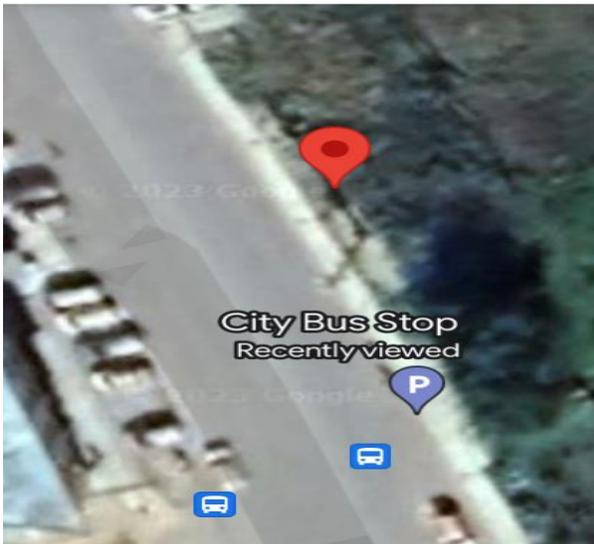


Figure 17: Changzamtog City Bus Stop (TICL)

27.47590065 89.6275...

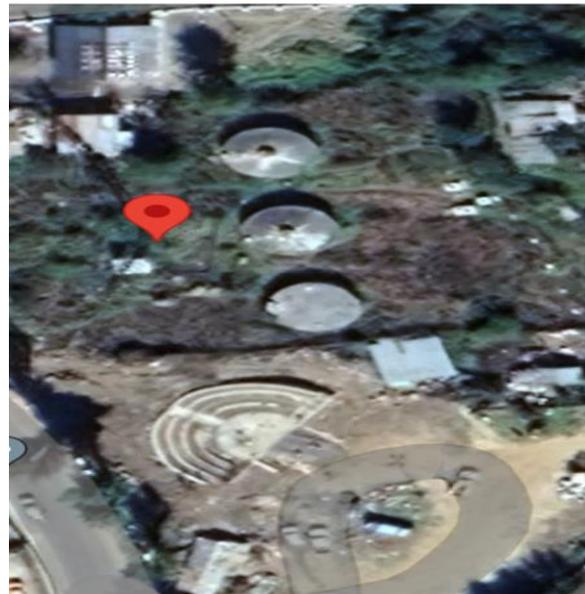


Figure 18: Changangkha, Round Above (TICL)

Annexure 3 (Image of Monitored BTS)

The following are the images of the each Telecom BTS transmitters;



Figure 19: Upper Motithang (BTL)



Figure 20: Sersang Primary school, Motithang (BTL)



Figure 21: DHI/Upper Motithang(BTL)

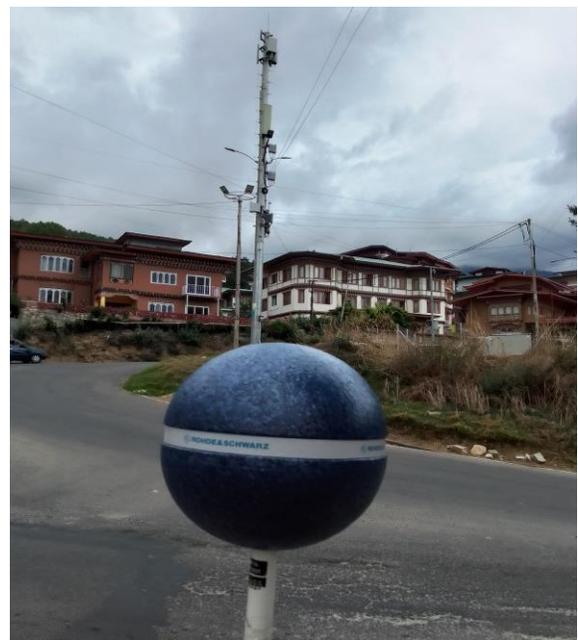


Figure 22: Double Turning, Motithang (TICL)



Figure 23: BOD, Motithang (TICL)



Figure 24: Near BOD, Motithang (BTL)



Figure 25: Above DGPC Office (TICL)



Figure 26: Changangkha FTTC (BTL)



Figure 27: Changangkha (TICL)

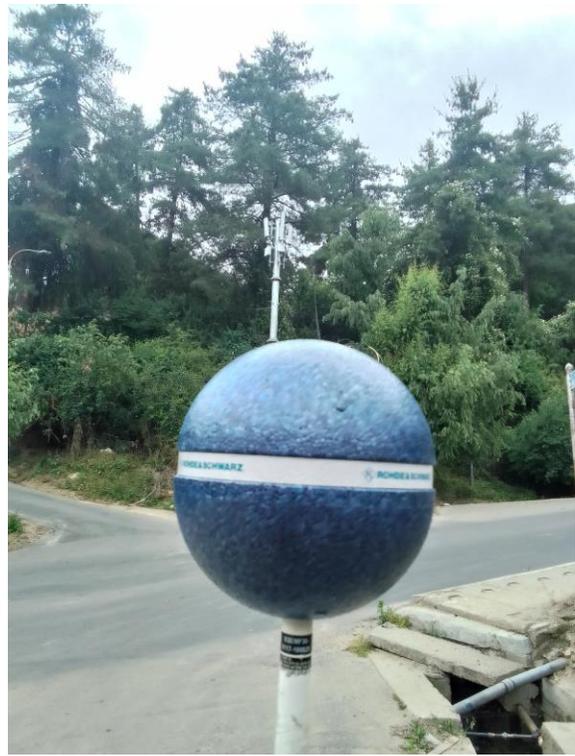


Figure 28: Changangkha (BTL)



Figure 29: NPPF Colony (BTL)



Figure 30: Kalabazaar (BTL)



Figure 31: Near Mother and Child Hospital (BTL)



Figure 32: Near druk School(TICL)



Figure 33: Near Fly over Bridge (TICL)