Quarterly Report on EMF Monitoring

(April - June 2024)

Bhutan InfoComm and Media Authority

Royal Government of Bhutan

June 2024

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Date : 23/07/2024

DIRECTOR

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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. 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

The Authority has monitored the EMF from April to June, 2024 in following places;

Sl.No	Name of the Monitored Places	Number of tower Monitored
1	Thimphu	4
2	Phuentsholing	8
3	Samtse	6

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:	Narda Safety test solution
Type of the Antenna:	Isotropic Antenna/Type (3-Axis), 420 MHz-6GHz
Spectrum Analyzer:	SRM3006 (9kHz-6GHz)
Calibration details:	Calibrated on 7-03-2024 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: 420 MHz to 6 GHz
- Spectrum analyzer SRM 3006: 9 kHz to 6GHz
- RFEX Software package
- A 1.5 meter cable to separate the antenna from the meter
- Tripod to hold the antenna

Figure 1: EMF Monitoring

6. Measurement Parameter

The following quantities are measured while monitoring:

- Electric Field strength E in **V/m**

7. Methodology

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

- The measurement is done around 10 meters to 30 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/Max over a time period of 6 minutes.
- The measurement is done for 2G, 3G, 4G and 5G BTS Tower for both the telecom operators.
- Measurement values will be recorded and compare the measurement values with the reference level as per the international standard ICNIRP.
- Measurement is done through broadband measurement and if the exposure ratio is higher than the exposure ratio limits, the frequency selective measurement is recommended.

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}(W/m^2)**	
	general public	**occupational**	**general public**	**Occupational**
0.1 - 30 Hz	$300/(10^{0.5}*f^{0.7})$ MHz)	$600/(10^{0.5}*f^{0.7}$MHz)	NA	NA

>30 – 400 MHz	$27.7/10^{0.5}$	$61/10^{0.5}$	0.2	1
>400 - 2000 MHz	$(1.375f^{0.5}$(MHz) $)/10^{0.5}$	$(3f^{0.5}$ (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 Exposure Ratio

The EMF measurement of the BTS tower was carried out in Thimphu, Phuentsholing Town and Samtse town Area. It is found that the maximum exposures around all of the base stations are **very low** than exposure limits. The detailed measurement readings , findings, electric field and exposure ratio results are attached below in **Annexure 1** and screenshots of each measurement result are attached in **Annexure 2.**

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 3.**

Annexure 1 (Measurement Results)

The detailed measurement readings of Electric Field and Exposure Ratio are attached below;

1. Phuentsoling Throm (Bhutan Telecom Limited)

Sl.No	Site Name	Latitude	Longitude	Frequency Band	Field Strength Measurement Value (V/m)	BICMA Limits V/m $(1.375f^{0.5}(MHz))/10^{0.5}$	Exposure Ratio SQRT (Measured V/Limit Value)^2	Exposure Ratio Limits	Remark
1	Phuentsholing Exchange	26°51'33.7" N	89°23'13.3" E	GSM 900	0.02608	13.044	0.0019	0.5	Below the Limits
				LTE 1800	0.495	18.44	0.0268		
				LTE700	0.4468	12.0658	0.0370		
				UMTS 850	0.2199	12.678	0.0173		
				TDD2300	0.5235	19.289	0.0271		
				5G 3.5-3.6	0.5072	19.289	0.0262		
				UMTS1900	0.1867	19.289	0.00967		

2.	Phuentsholing Tinkilo	26°51'21.6" N	89°23'38.1" E	LTE 1800	1.049	18.44	0.05688	**0.5**	**Below the Limits**
3	Phuentsholing Chinese Line	26°51'25.7" N	89°23'06.1" E	LTE 1800	2.623	18.44	0.1422	**0.5**	**Below the Limits**
4	Above RRCO	26°51'37.5" N	89°23'00.5" E	GSM 900	0.3766	13.044	0.0288	**0.5**	**Below the Limits**
				LTE 1800	0.5851	18.44	0.0317		
				LTE700	0.2185	12.0658	0.0181		
				UMTS 850	0.8143	12.678	0.0642		
				TDD2300	0.1357	19.289	0.007035		
				5G 3.5-3.6	0.7171	19.289	0.0371		
				UMTS1900	0.5386	19.289	0.0279		
5	Dantak	26°51'50.0" N	89°22'44.0" E	GSM 900	0.1663	13.044	0.0127	**0.5**	**Below the Limits**
				LTE 1800	0.4246	18.44	0.0230		
				LTE700	0.5881	12.0658	0.0487		
				UMTS 850	0.4173	12.678	0.0329		
				TDD2300	0.7654	19.289	0.0500		
				5G 3.5-3.6	0.3923	19.289	0.02033		

				UMTS1900	0.3009	19.289	0.0155		

2. Phuentsholing (Tashi InfoComm Limited)

Sl. No	Site Name	Latitude	Longitude	Frequency Band	Field Strength Measurement Value (V/m)	BICMA Limits V/m ($1.375f^{0.5}$(MHz))/$10^{0.5}$	Exposure Ratio SQRT (Measured V/Limit Value)^2	Exposure Ratio Limits	Remark
1	Above FCB Yard	26°51'57.2" N	89°22'58.9" E	GSM 900	0.240	13.044	0.01839	**0.5**	**Below the Limits**
				LTE 1800	0.727	18.44	0.03942		
				LTE 700	0.074	12.0658	0.00613		
				UMTS850	0.258	12.678	0.02035		
				TDD2300	0.052	19.289	0.00269		
				5G 3.5-3.6	1.17	19.289	0.0606		
2	Toorsa	26°51'59.0" N	89°22'31.4" E	GSM 900	0.4608	13.044	0.0353		**Below the Limits**
				LTE 1800	1.348	18.44	0.0731		
				LTE 700	0.3586	12.0658	0.0297		

				UMTS850	0.7308	12.678	0.05766	**0.5**	
				TDD2300	0.04461	19.289	0.002312		
				5G 3.5-3.6	0.7573	19.289	0.0392		
3	RRCO	26°51'35.7" N	89°22'58.6" E	GSM 900	0.09912	13.044	0.0075	**0.5**	**Below the Limits**
				LTE 1800	0.3037	18.44	0.016		
				LTE 700	0.1884	12.0658	0.0156		
				UMTS850	0.3315	12.678	0.02614		
				TDD2300	0.2593	19.289	0.0134		
				5G 3.5-3.6	0.2211	19.289	0.01146		

3. Samtse Town (Bhutan Telecom Limited)

Sl. No	**Site Name**	**Latitude**	**Longitude**	**Frequency Band**	**Field Strength Measurement Value (V/m)**	**BICMA Limits V/m ($1.375f^{0.5}$(MHz))/$10^{0.5}$**	**Exposure Ratio SQRT (Measured V/Limit Value)^2**	**Exposure Ratio Limits**	**Remark**
1	Samtse Exchange	26°53'58.6" N	89°5'46.8" E	GSM 900	0.2481	13.044	0.0190		
				LTE 1800	1.254	18.44	0.06800		

				LTE700	0.3517	12.0658	0.02914	**0.5**	**Below the Limits**
				UMTS 850	0.2784	12.678	0.0219		
				5G 3.5-3.6	0.524	19.289	0.02716		
				UMTS1900	0.02331	19.289	0.001208		
2.	BPC Samtse	26°53'34.6" N	89°5'50.8" E	LTE 1800	4.973	18.44	0.2696	**0.5**	**Below the Limits**
3	RBP Area Samtse	26°53'55.7" N	89°5'23.0" E	LTE 1800	2.623	18.44	0.142	**0.5**	**Below the Limits**
				5G 3.5-3.6	5.336	19.289	0.2766		
4	Shiva Mandir	26°54'03.1" N	89°5'37.1" E	GSM 900	0.4867	13.044	0.0373	**0.5**	**Below the Limits**
				LTE 1800	1.415	18.44	0.0767		
				LTE700	1.023	12.0658	0.084		
				UMTS 850	0.3905	12.678	0.0308		
				TDD2300	0.04593	19.289	O.0459		
				5G 3.5-3.6	1.176	19.289	0.06096		
				UMTS1900	0.02463	19.289	0.00127		

4. Samtse Town (Tashi InfoComm Limited)

Sl. No	Site Name	Latitude	Longitude	Frequency Band	Field Strength Measurement Value (V/m)	BICMA Limits V/m $(1.375f^{0.5}(MHz))/10^{0.5}$	Exposure Ratio SQRT (Measured V/Limit Value)^2	Exposure Ratio Limits	Remark
1	Sabji Bazar, Samtse	26°54'01.4" N	89°5'46.2" E	GSM 900	0.3939	13.044	0.0301	**0.5**	**Below the Limits**
				LTE 1800	1.014	18.44	0.0549		
				LTE 700	0.1222	12.0658	0.01011		
				TDD2300	0.0451	19.289	0.002		
				5G 3.5-3.6	0.2446	19.289	0.0126		
2	Above BPC Colony	26°53'35.9" N	89°5'54.8" E	GSM 900	0.2847	13.044	0.0218	**0.5**	**Below the Limits**
				LTE 1800	0.2854	18.44	0.01547		

5. Thimphu (Bhutan Telecom Limited)

Sl.No	Site Name	Latitude	Longitude	Frequency Band	Field Strength Measurement Value	BICMA Limits V/m	Exposure Ratio SQRT	Exposure Ratio Limits	Remark

					(V/m)	**$(1.375f^{0.5}(MHz))/10^{0.5}$**	**(Measured V/Limit Value)$^{\wedge 2}$**		
1	Near NPPF Colony	27°28'00.5" N	89°38'01.4 " E	GSM 900	0.1935	13.044	0.0148	**0.5**	**Below the Limits**
				LTE 1800	0.7549	18.44	0.0409		
				LTE700	0.8017	12.0658	0.0664		
				UMTS 850	1.133	12.678	0.0893		
				TDD2300	0.8427	19.289	0.0436		
				5G 3.5-3.6	0.4719	19.289	0.0244		
				UMTS1900	0.3101	19.289	0.0160		
2.	Near DGPC Office	27°28'40.5" N	89°37'54.2 " E	GSM900	0.06188	13.044	0.00447	**0.5**	**Below the Limits**
				LTE 1800	0.7073	18.44	0.0383		
				LTE 700	2.063	12.0658	0.1709		
				UMTS 850	0.09804	12.678	0.0077		
				TDD 2300	2.26	19.289	0.1171		
				5G 3.5-3.6	0.5281	19.289	0.0273		
				UMTS 1900	0.02595	19.289	0.0013		

6. Thimphu (Tashi InfoComm Limited)

Sl.No	Site Name	Latitude	Longitude	Frequency Band	Field Strength Measurement Value (V/m)	BICMA Limits V/m $(1.375f^{0.5}(MHz))/10^{0.5}$	Exposure Ratio SQRT (Measured V/Limit Value)^2	Exposure Ratio Limits	Remark
1	Near BOD	27°28'03.7'' N	89°38'27.1" E	GSM 900	0.7351	13.044	0.0563	0.5	Below the Limits
				LTE 1800	4.726	18.44	0.2562		
				LTE 700	0.3501	12.0658	0.0290		
				UMTS850	0.561	12.678	0.0438		
				TDD2300	0.01133	19.289	0.000587		
				5G 3.5-3.6	1.015	19.289	0.0526		

Annexure 2 (Screenshot of the result)

The following are the screenshot images of measurement result;

Battery:	GPS: 26°51'33.7" N	Ant: 3AX 0.4-6G	SrvTbl: BTL
14.05.24 10:21:42	89°23'13.3" E	Cable: SRM 5 m	Stnd: BGV EXP2

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	446.8 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	219.9 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	26.08 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	495.0 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	186.7 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	523.5 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	507.2 mV/m
	Total			747.1 mV/m

Isotropic

Safety Evaluation

MR:	5 V/m	RBW:	200 kHz	Sweep Time: 1.031 s Noise Suppr.: Off	Progress: No. of Runs: HOLD AVG: 6 min

Figure 1: BTL, Phuentsholing Exchange

Battery:	GPS: 26°51'21.6" N	Ant: 3AX 0.4-6G	SrvTbl: BTL
14.05.24 10:49:27	89°23'38.1" E	Cable: SRM 5 m	Stnd: BGV EXP2

Table View: Detailed

Index	Service	Fmin	Fmax	Max
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	1.049 V/m
	Total			1.049 V/m

Isotropic

Safety Evaluation

MR:	1.8 V/m	RBW:	200 kHz	Sweep Time: 185 ms Noise Suppr.: Off	Progress: No. of Runs: HOLD AVG: 6 min

Figure 2: BTL, Phuentsholing Tinkilo

Battery:		GPS:	26°51'25.7" N	Ant:	3AX 0.4-6G
14.05.24	11:09:35		89°23'06.1" E	Cable:	SRM 5 m

SrvTbl:	BTL
Stnd:	BGV EXP2

Table View: Detailed

Index	Service	Fmin	Fmax	Max
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	2.623 V/m
	Total			2.623 V/m

Isotropic

Safety Evaluation

MR:	5 V/m	RBW:	200 kHz	Sweep Time:	185 ms
				Noise Suppr.:	Off

Progress:	
No. of Runs:	HOLD
AVG:	6 min

Figure 3: BTL, Phuentsholing Chinese Line

Battery:		GPS:	26°51'37.5" N	Ant:	3AX 0.4-6G
14.05.24	11:27:39		89°23'00.5" E	Cable:	SRM 5 m

SrvTbl:	BTL
Stnd:	BGV EXP2

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	218.5 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	814.3 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	376.6 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	585.1 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	538.6 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	135.7 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	717.1 mV/m
	Total			1.060 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	1.033 s
				Noise Suppr.:	Off

Progress:	
No. of Runs:	HOLD
AVG:	6 min

Figure 4: BTL, Above RRCO

Battery:		GPS:	26°51'50.0" N	Ant:	3AX 0.4-6G	SrvTbl:	BTL
14.05.24	11:48:12		89°22'44.0" E	Cable:	SRM 5 m	Stnd:	ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	588.1 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	417.3 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	166.3 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	424.6 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	300.9 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	765.4 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	392.3 mV/m
	Total			947.5 mV/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	1.031 s	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 5: BTL, Dantak

Battery:		GPS:	26°53'58.6" N	Ant:	3AX 0.4-6G	SrvTbl:	BTL
16.05.24	10:55:08		89°5'46.8" E	Cable:	SRM 5 m	Stnd:	ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	351.7 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	278.4 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	248.1 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	1.254 V/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	23.31 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	524.0 mV/m
	Total			1.282 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	913 ms	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 6: BTL, Samtse Exchange

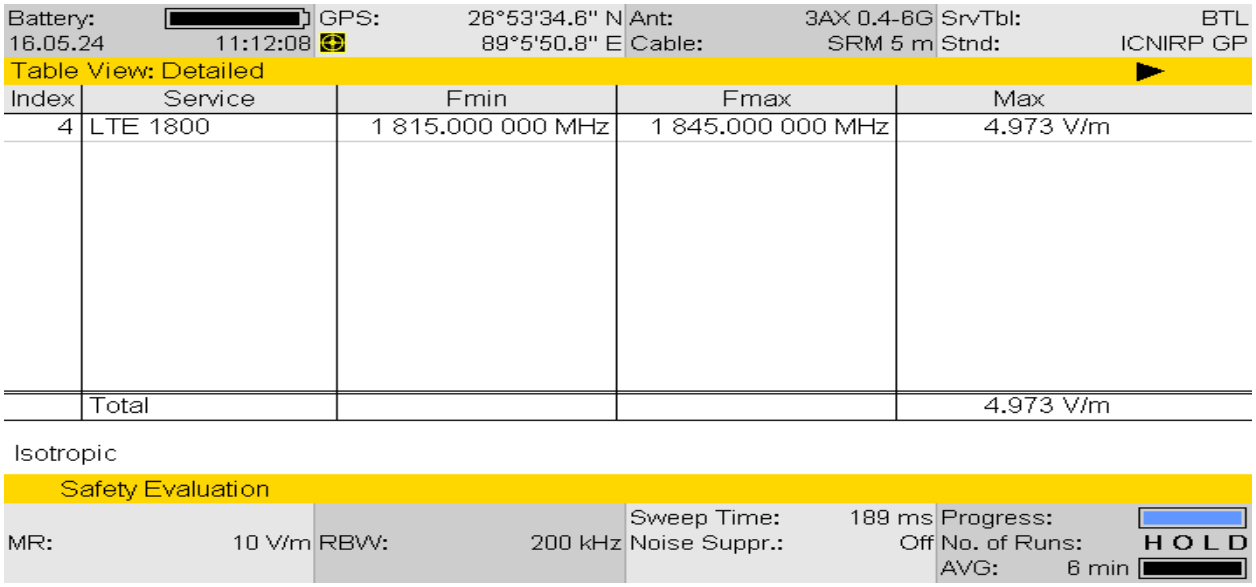

Figure 7: BTL, BPC Samtse

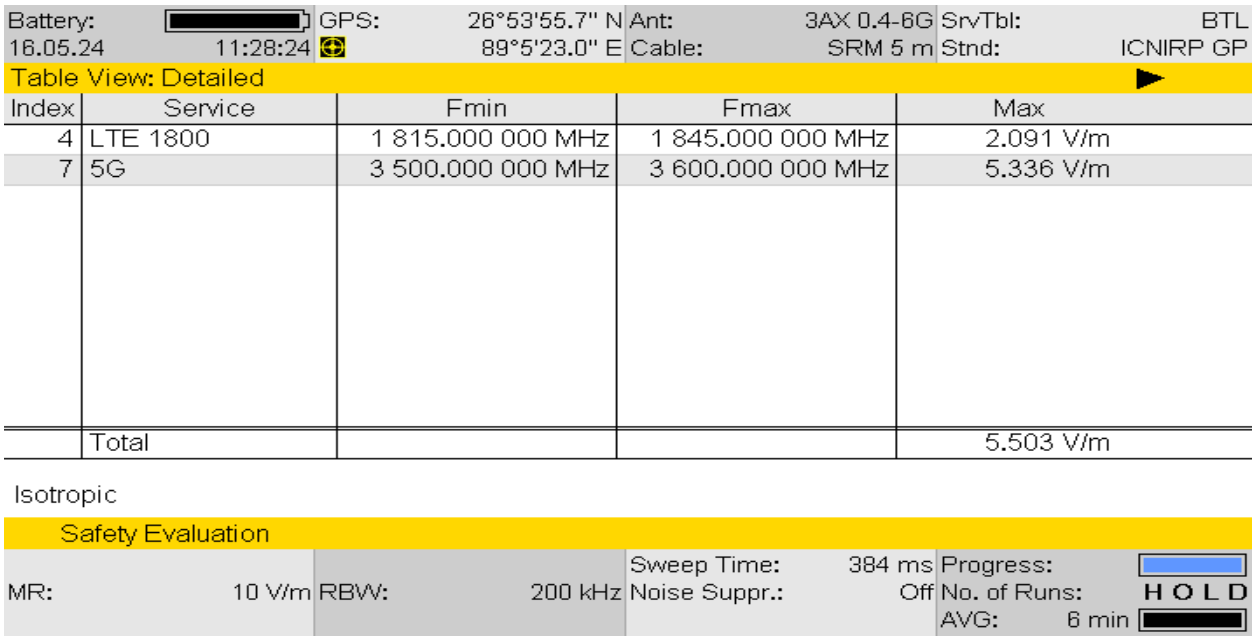

Figure 8: BTL, RBP Area Samtse

Battery:		GPS:	26°54'03.1" N	Ant:	3AX 0.4-6G
16.05.24	11:42:42		89°5'37.1" E	Cable:	SRM 5 m

SrvTbl:	BTL
Stnd:	ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	1.023 V/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	390.5 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	486.7 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	1.415 V/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	24.63 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	45.93 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	1.176 V/m
	Total			1.658 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	1.034 s	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 9: BTL, Shiva Mandir Samtse

Battery:		GPS:	26°51'57.2" N	Ant:	3AX 0.4-6G
14.05.24	15:25:42		89°22'58.9" E	Cable:	SRM 5 m

SrvTbl:	TICPL
Stnd:	ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	758.000 000 MHz	778.000 000 MHz	74.69 mV/m
2	UMTS 850	869.000 000 MHz	879.000 000 MHz	258.8 mV/m
3	GSM 900	945.000 000 MHz	955.000 000 MHz	240.6 mV/m
4	LTE 1800	1 845.000 000 MHz	1 880.000 000 MHz	727.7 mV/m
5	TDD 2300	2 350.000 000 MHz	2 390.000 000 MHz	51.14 mV/m
6	5G	3 400.000 000 MHz	3 500.000 000 MHz	1.177 V/m
	Total			1.248 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	940 ms	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 10: TIPL, Above FCB Yard

Battery:		GPS:	26°51'59.0" N	Ant:	3AX 0.4-6G
14.05.24	15:43:11		89°22'31.4" E	Cable:	SRM 5 m

SrvTbl:	TICPL		
Stnd:	ICNIRP GP		

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	758.000 000 MHz	778.000 000 MHz	303.0 mV/m
2	UMTS 850	869.000 000 MHz	879.000 000 MHz	730.8 mV/m
3	GSM 900	945.000 000 MHz	955.000 000 MHz	460.8 mV/m
4	LTE 1800	1 845.000 000 MHz	1 880.000 000 MHz	1.348 V/m
5	TDD 2300	2 350.000 000 MHz	2 390.000 000 MHz	44.61 mV/m
6	5G	3 400.000 000 MHz	3 500.000 000 MHz	757.3 mV/m
	Total			1.510 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	910 ms
				Noise Suppr.:	Off

Progress:	
No. of Runs:	HOLD
AVG:	6 min

Figure 11: TIPL, Toorsa

Battery:		GPS:	26°51'35.7" N	Ant:	3AX 0.4-6G
14.05.24	16:02:01		89°22'58.6" E	Cable:	SRM 5 m

SrvTbl:	TICPL
Stnd:	ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	758.000 000 MHz	778.000 000 MHz	188.4 mV/m
2	UMTS 850	869.000 000 MHz	879.000 000 MHz	331.5 mV/m
3	GSM 900	945.000 000 MHz	955.000 000 MHz	99.12 mV/m
4	LTE 1800	1 845.000 000 MHz	1 880.000 000 MHz	303.7 mV/m
5	TDD 2300	2 350.000 000 MHz	2 390.000 000 MHz	259.3 mV/m
6	5G	3 400.000 000 MHz	3 500.000 000 MHz	221.1 mV/m
	Total			471.1 mV/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time:	910 ms
				Noise Suppr.:	Off

Progress:	
No. of Runs:	HOLD
AVG:	6 min

Figure 12: TIPL, RRCO

Battery:	GPS: 26°54'01.4" N	Ant: 3AX 0.4-6G	SrvTbl: TICPL
16.05.24 14:45:55	89°5'46.2" E	Cable: SRM 5 m	Stnd: ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	758.000 000 MHz	778.000 000 MHz	122.2 mV/m
3	GSM 900	945.000 000 MHz	955.000 000 MHz	393.9 mV/m
4	LTE 1800	1 845.000 000 MHz	1 880.000 000 MHz	1.014 V/m
5	TDD 2300	2 350.000 000 MHz	2 390.000 000 MHz	45.10 mV/m
6	5G	3 400.000 000 MHz	3 500.000 000 MHz	244.6 mV/m
	Total			1.068 V/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time: 785 ms Noise Suppr.: Off	Progress: No. of Runs: HOLD AVG: 6 min

Figure 13: TIPL, Sabji Bazar Samtse

Battery:	GPS: 26°51'50.0" N	Ant: 3AX 0.4-6G	SrvTbl: BTL
14.05.24 11:48:12	89°22'44.0" E	Cable: SRM 5 m	Stnd: ICNIRP GP

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	588.1 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	417.3 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	166.3 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	424.6 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	300.9 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	765.4 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	392.3 mV/m
	Total			947.5 mV/m

Isotropic

Safety Evaluation

MR:	10 V/m	RBW:	200 kHz	Sweep Time: 1.031 s Noise Suppr.: Off	Progress: No. of Runs: HOLD AVG: 6 min

Figure 14: TIPL, Above BPC Colony

Battery:		GPS:	27°28'00.5" N	Ant:	3AX 0.4-6G	SrvTbl:	BTL
01.05.24	15:25:23		89°38'01.4" E	Cable:	SRM 5 m	Stnd:	ICNIRP20 G

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	801.7 mV/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	1.133 V/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	184.9 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	754.9 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	310.1 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	842.7 mV/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	471.9 mV/m
	Total			1.538 V/m

Isotropic

Safety Evaluation

MR:	1.8 V/m	RBW:	200 kHz	Sweep Time:	1.034 s	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 15: BTL, Near NPPF Colony

Battery:		GPS:	27°28'40.5" N	Ant:	3AX 0.4-6G	SrvTbl:	BTL
01.05.24	15:50:29		89°37'54.2" E	Cable:	SRM 5 m	Stnd:	ICNIRP20 G

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	783.000 000 MHz	803.000 000 MHz	2.063 V/m
2	UMTS 850	879.000 000 MHz	889.000 000 MHz	98.04 mV/m
3	GSM 900	935.000 000 MHz	945.000 000 MHz	61.88 mV/m
4	LTE 1800	1 815.000 000 MHz	1 845.000 000 MHz	707.3 mV/m
5	UMTS 1900	2 110.000 000 MHz	2 120.000 000 MHz	25.95 mV/m
6	TDD 2300	2 310.000 000 MHz	2 350.000 000 MHz	2.260 V/m
7	5G	3 500.000 000 MHz	3 600.000 000 MHz	528.1 mV/m
	Total			2.647 V/m

Isotropic OVERDRIVEN

Safety Evaluation

MR:	1.8 V/m	RBW:	200 kHz	Sweep Time:	1.037 s	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 16: BTL, Near DGPC Office

Battery:		GPS:	27°28'03.7" N	Ant:	3AX 0.4-6G	SrvTbl:	TICPL
01.05.24	14:48:07		89°38'27.1" E	Cable:	SRM 5 m	Stnd:	ICNIRP20 G

Table View: Detailed

Index	Service	Fmin	Fmax	Max
1	LTE 700	758.000 000 MHz	778.000 000 MHz	350.1 mV/m
2	UMTS 850	869.000 000 MHz	879.000 000 MHz	561.0 mV/m
3	GSM 900	945.000 000 MHz	955.000 000 MHz	735.1 mV/m
4	LTE 1800	1 845.000 000 MHz	1 880.000 000 MHz	4.726 V/m
5	TDD 2300	2 350.000 000 MHz	2 390.000 000 MHz	11.33 mV/m
6	5G	3 400.000 000 MHz	3 500.000 000 MHz	1.015 V/m
	Total			4.752 V/m

Isotropic OVERDRIVEN

Safety Evaluation

MR:	2.8 V/m	RBW:	200 kHz	Sweep Time:	912 ms	Progress:	
				Noise Suppr.:	Off	No. of Runs:	HOLD
						AVG:	6 min

Figure 17: TICPL, Near BOD

Annexure 3 (Satellite View of Location of Monitored Sites)

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

26°51'33.7" N 89°23'13.3" E

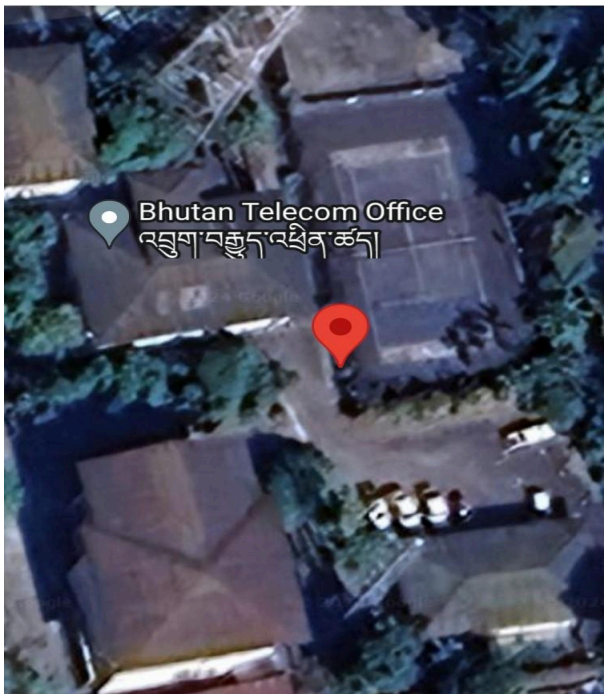

Figure 1:Phuentsholing Exchange(BTL)

26°51'21.6" N 89°23'38.1" E

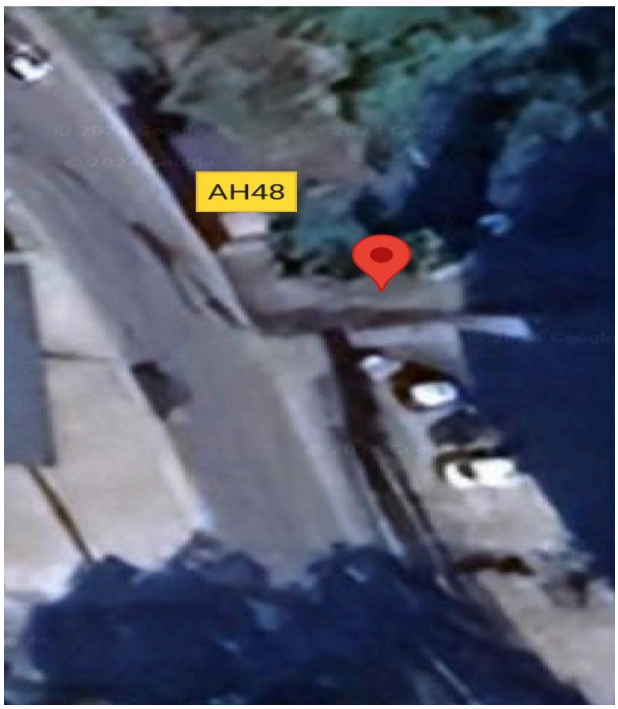

Figure 2: Phuentsholing Tinkilo (BTL)

26°51'25.7" N 89°23'06.1" E

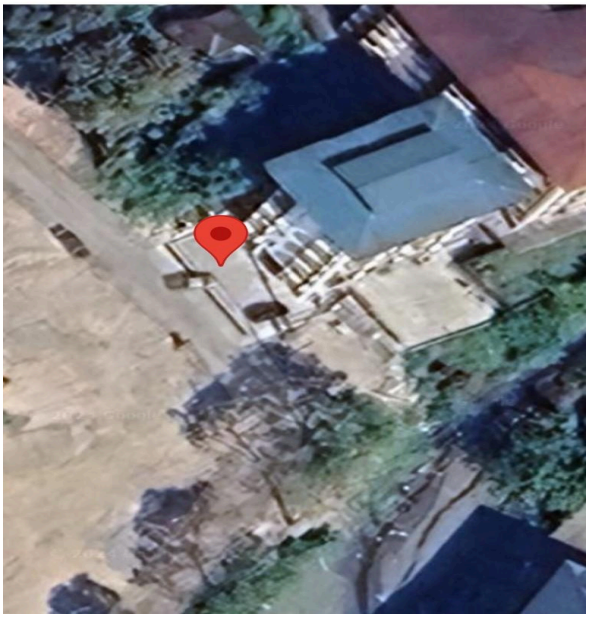

Figure 3: Phuentsholing Chinese Line(BTL)

26°51'37.5" N 89°23'00.5" E

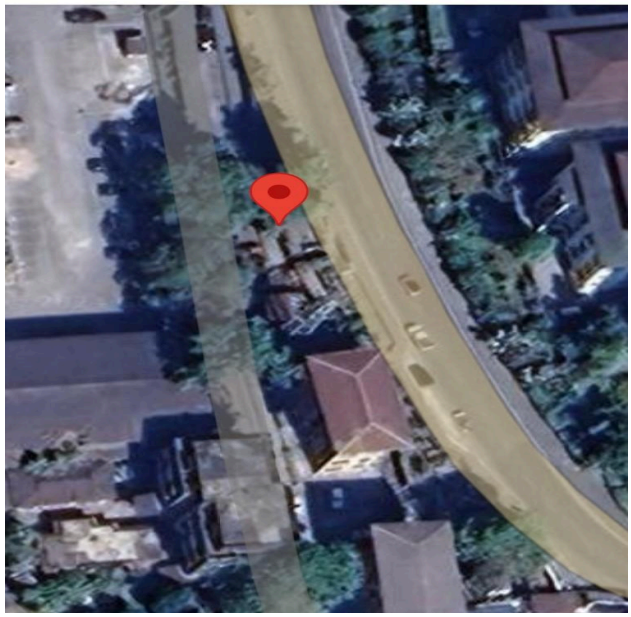

Figure 4: Above RRCO(BTL)

26°51'50.0" N 89°22'44.0" E

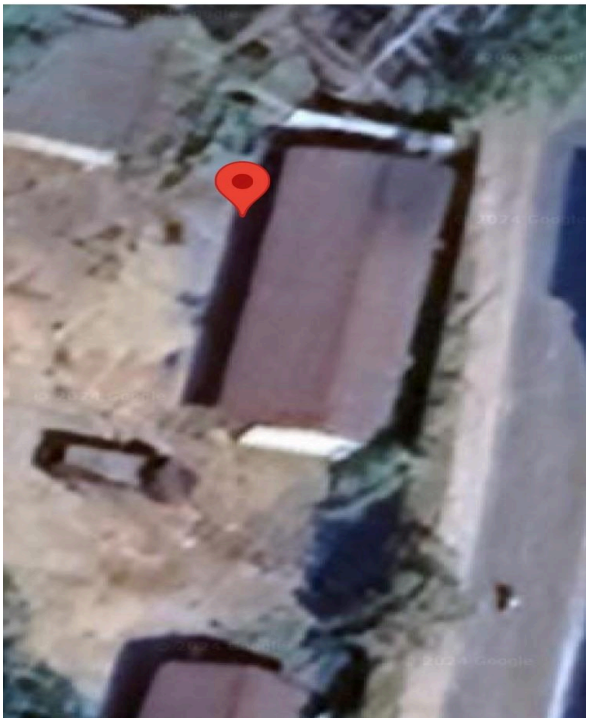

Figure 5: Dantak(BTL)

26°51'57.2" N 89°22'58.9"E

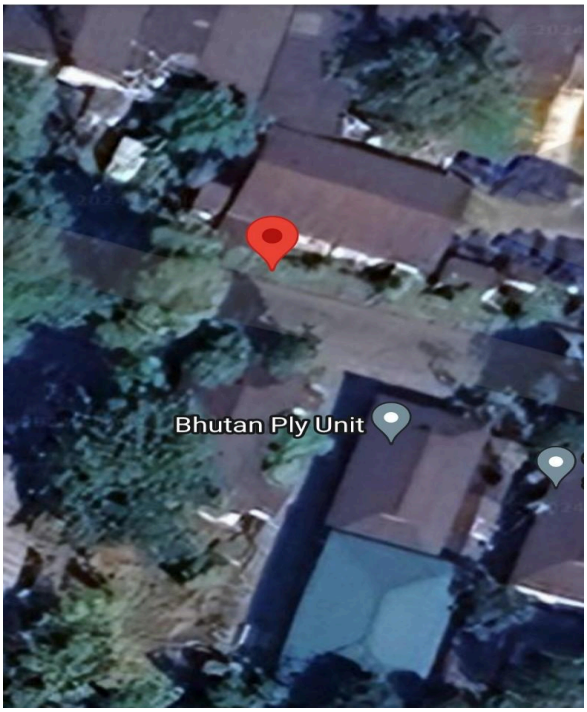

Figure 6: Above FCB Yard(TIPL)

26°51'59.0" N 89°22'31.4"E

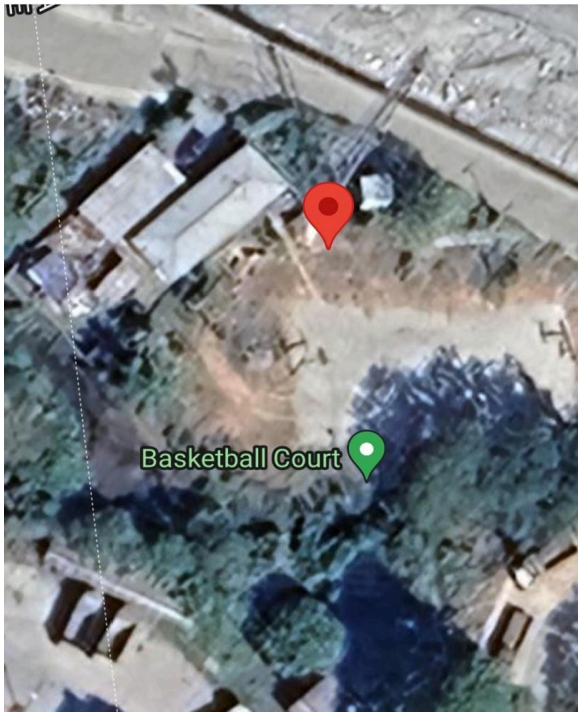

Figure 7: Toorsa(TICPL)

26°51'35.7" N 89°22'58.6"E

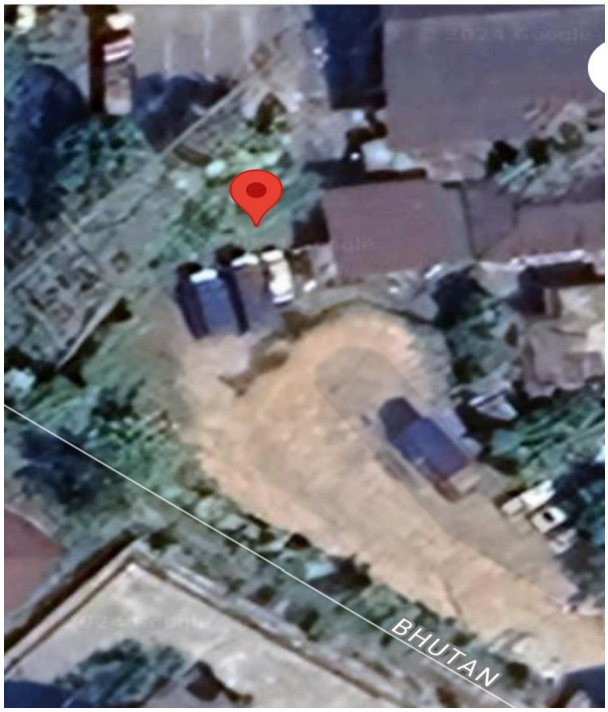

Figure 10: RRCO(TICPL)

26°53'58.6"N 89°5'46.8" E

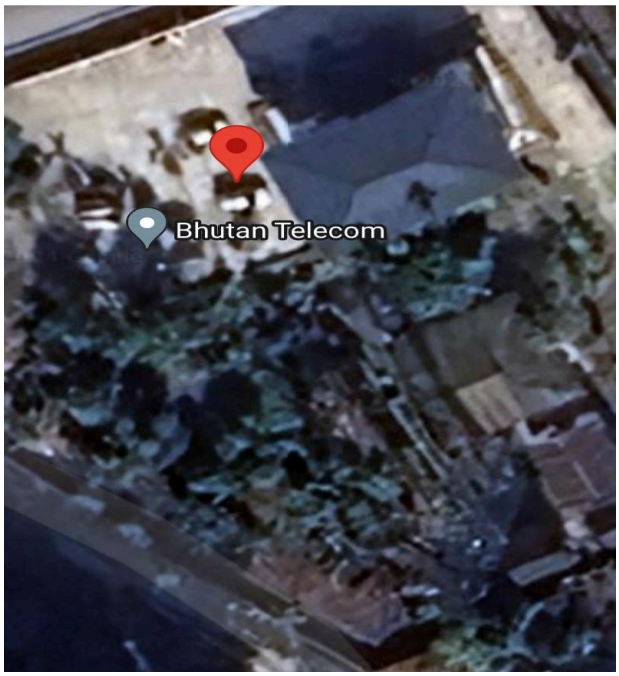

Figure 11: Samtse Exchange(BTL)

26°53'34.6"N 89°5'50.8" E

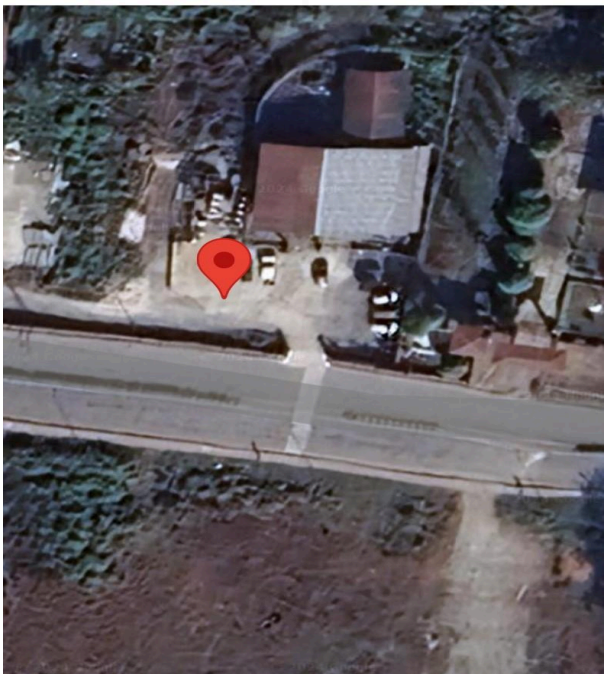

Figure 12: BPC Samtse (BTL)

26°53'55.7"N 89°5'23.0" E

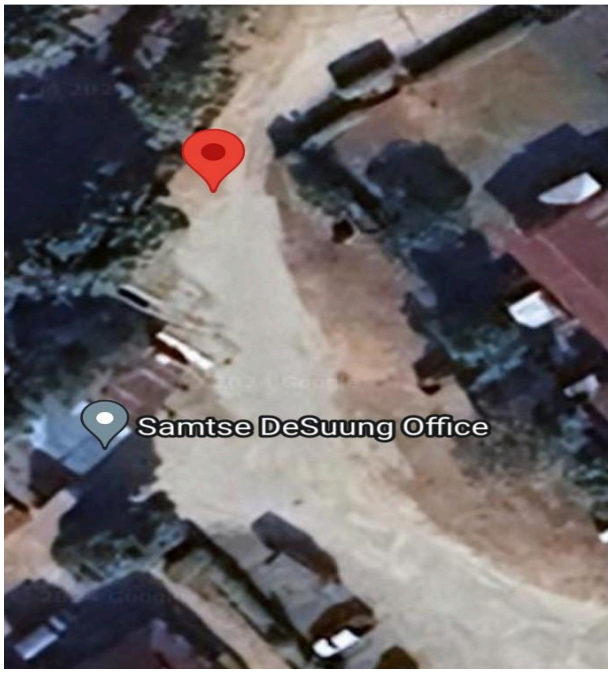

Figure 11: RBP Area Samtse(BTL)

26°53'03.1"N 89°5'37.1" E

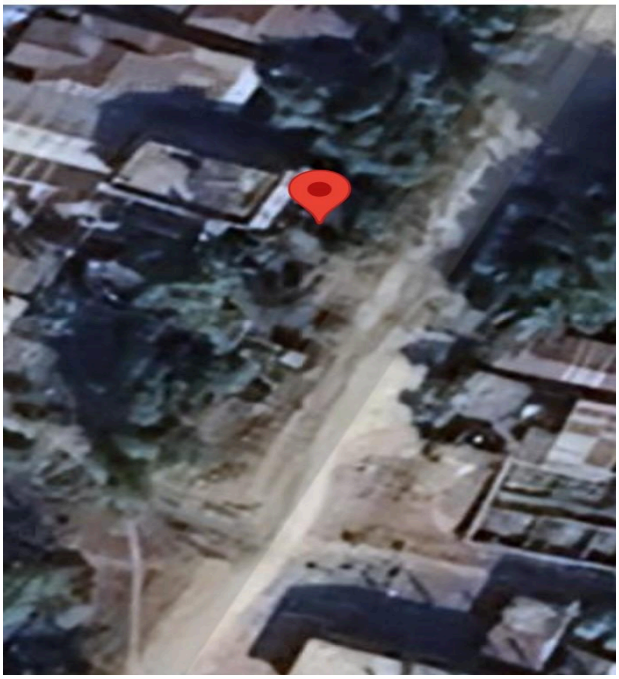

Figure 12: Shiva Mandir(BTL)

26°54'01.4" N 89°5'46.2 E

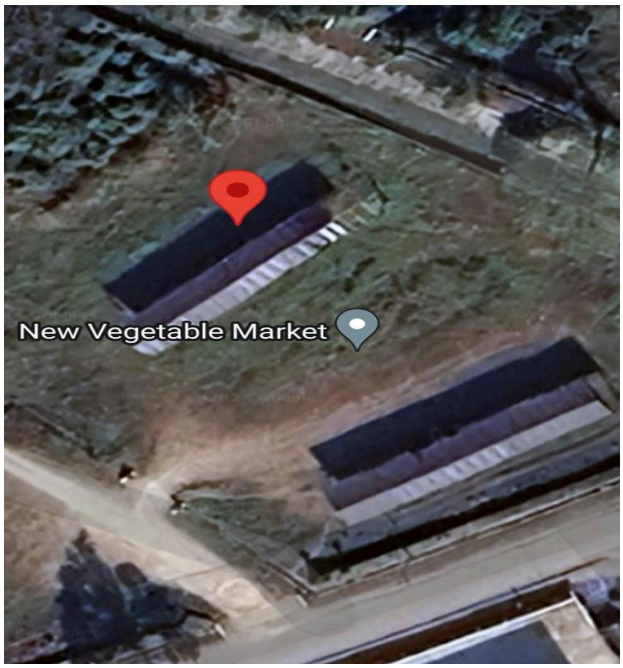

Figure 13: Sabji Bazar, Samtse(TIPL)

26°53'35.9" N 89°5'54.8 E

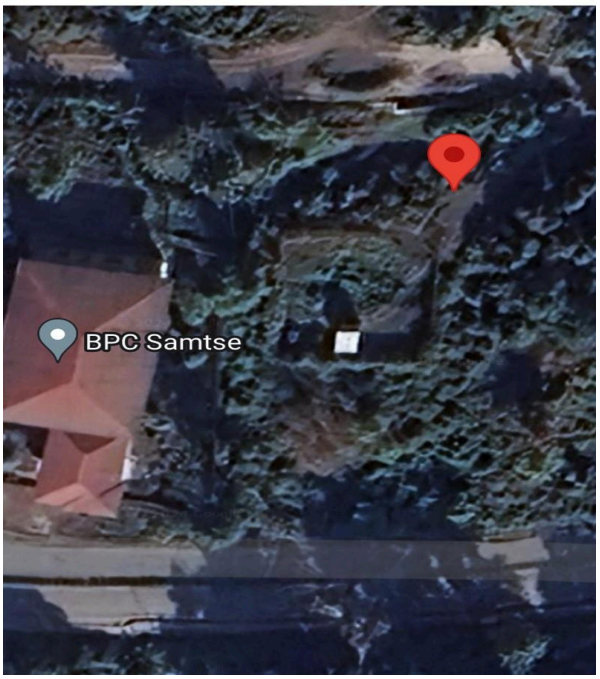

Figure 14: Above BPC Colony(TIPL)

27°28'00.5" N 89°38'01.4 E

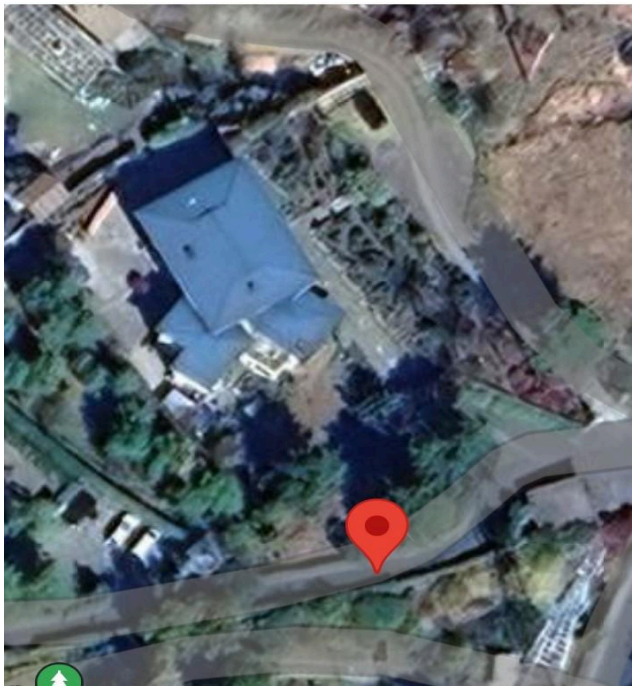

Figure 15: Near NPPF Colony(BTL)

27°28'03.7" N 89°38'27.1 E

Figure 16: Near BOD(TIPL)

Annexure 4 (Image of Monitored BTS)

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

Figure 1: Phuentsholing Exchange(BTL)

Figure 2: Phuentsholing Chinese Line (BTL)

Figure 3: Phuentsholing Tinkilo (BTL) (BTL)

Figure 4: Above RRCO

Figure 5: Above FCB Yard(TIPL)

Figure 6: Toorsa(TIPL)

Figure 7: Near RRCO*(TIPL)*

Figure 8: Samtse Exchange(BTL)

Figure 9: BPC Samtse (BTL)

Figure 10: RBP Area Samtse (BTL)

Figure 11: Shiva Mandir (BTL)

Figure 12: Sabji Bazar, Samtse (TIPL)

Figure 13: Near BOD (TICL)

Figure 14: Near NPPF (TICL)

Figure 15: Near DGPC (BTL)