

Quarterly Report on EMF Monitoring

(January - March 2024)



Bhutan InfoComm and Media Authority
Royal Government of Bhutan

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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 January to March, 2024 in following places;

| Sl.No | Name of the Monitored Places | Number of tower Monitored |
|-------|------------------------------|---------------------------|
| 1 | Tsirang Town | 4 |
| 2 | Chubachu, Thimphu | 4 |
| 3 | Thimphu Town Area | 1 |
| 4 | Babesa, Thimphu | 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 (**μW/cm²**)

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} (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 | $(1.375f^{0.5}(\text{MHz})/10^{0.5})$ | $(3f^{0.5}(\text{MHz}))/10^{0.5}$ | $(f/2000)$ | $(f/400)$ |
| >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 Tsirang Town, Babesa, Chubachu (Thimphu) and Thimphu 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 Power Density results are attached below in **Annexure 1**.

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. Tsirang (Bhutan Telecom Limited)

| SL. No | Site Name | Location | Latitude | Longitude | Cell ID | Frequency Band (MHz) | Limits V/m | Field Strength V/m | Power Density ($\mu\text{W}/\text{cm}^2$) | Remark |
|--------|----------------|----------|--------------|-------------|---------|----------------------|------------|--------------------|---|-------------------------|
| 1 | Daphu Exchange | Tsirang | 27.00215 | 90.12424167 | 4472 | 900 | 13.044 | 0.4196 | 0.4670 | <i>Below the Limits</i> |
| | | | | | 120 | 700 | 11.5043 | 0.3733 | 0.37 | |
| | | | | | 124 | 1800 | 18.00 | 0.381 | 0.379 | |
| 2 | Daphu Town | Tsirang | 27.009338899 | 90.12428611 | 4222 | 900 | 13.044 | 0.5453 | 0.789 | <i>Below the Limits</i> |
| | | | | | 325 | 700 | 11.5043 | 0.3994 | 0.423 | |
| | | | | | 321 | 1800 | 18.44 | 0.7835 | 0.1628 | |
| 3 | Daphu D-Site | Tsirang | 27.00641111 | 90.12475278 | 133 | 1800 | 18.44 | 1.416 | 0.4547 | <i>Below the Limits</i> |

2. Tsirang (Tashi InfoComm Private Limited)

| SL.No | Site Name | Location | Latitude | Longitude | Cell ID | Frequency Band(MHz) | Limits V/m | Field Strength V/m | Power Density ($\mu\text{W}/\text{cm}^2$) | Remark |
|-------|------------|----------|-------------|-------------|---------|---------------------|------------|--------------------|---|------------------------|
| 1 | Dampu Town | Tsirang | 27.00511111 | 90.10711111 | 2 | 850 MHz | 12.676 | 0.1534 | 0.0062 | <i>Below the Limit</i> |
| | | | | | 22 | 1800 MHz | 18.00 | 0.2679 | 0.019 | |

3. Thimphu Thromde, Thimphu (Bhutan Telecom Limited)

| Sl.No | Site Name | Location | Latitude | Longitude | Cell ID | Frequency Band (MHz) | Limits V/m | Field Strength V/m | Power Density ($\mu\text{W}/\text{cm}^2$) | Remark |
|-------|------------------------------|----------|------------|------------|---------|----------------------|------------|--------------------|---|------------------------|
| 1 | Near BPC Substation Chubachu | Thimphu | 27.4787339 | 89.6383255 | 323 | 1800 MHz | 18.44 | 1.1065 | 0.3248 | <i>Below the Limit</i> |
| 2 | Hong Kong Market | Thimphu | 27.4720130 | 89.6384944 | 366 | 1800 MHz | 18.44 | 4.6694 | 5.7834 | <i>Below the Limit</i> |
| 3 | Babesa | Thimphu | 27.4393450 | 89.6593619 | 218 | 1800 | 18.44 | 1.6079 | 0.5478 | <i>Below the Limit</i> |
| | | | | | 35 | 1800 | 18.44 | 1.5606 | 0.5261 | |

4. Thimphu Thromde, Thimphu(Tashi InfoComm Private Limited)

| Sl.No | Site Name | Location | Latitude | Longitude | Cell ID | Frequency Band(MHz) | Limits V/m | Field Strength V/m | Power Density ($\mu\text{W}/\text{cm}^2$) | Remark |
|-------|------------------------------------|----------|------------|------------|---------|---------------------|------------|--------------------|---|-------------------------|
| 1 | Near T-Bank TICL | Thimphu | 27.4764287 | 89.6367444 | 140 | 1800 MHz | 18.44 | 1.1462 | 0.3485 | <i>Below the Limits</i> |
| 2 | Chubachu Dorji Element Hotel | Thimphu | 27.4785520 | 89.6383074 | 316 | 1800 MHz | 18.44 | 2.0318 | 1.0950 | <i>Below the Limits</i> |
| 3 | Below JamYang Hotel | Thimphu | 27.4742118 | 89.6434733 | 142 | 1800 MHz | 18.44 | 1.0810 | 0.3099 | <i>Below the Limits</i> |

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;

27.00641111 90.12475278



Figure 3: Damphu D-Site(BTL)

27.009338899 90.12428611

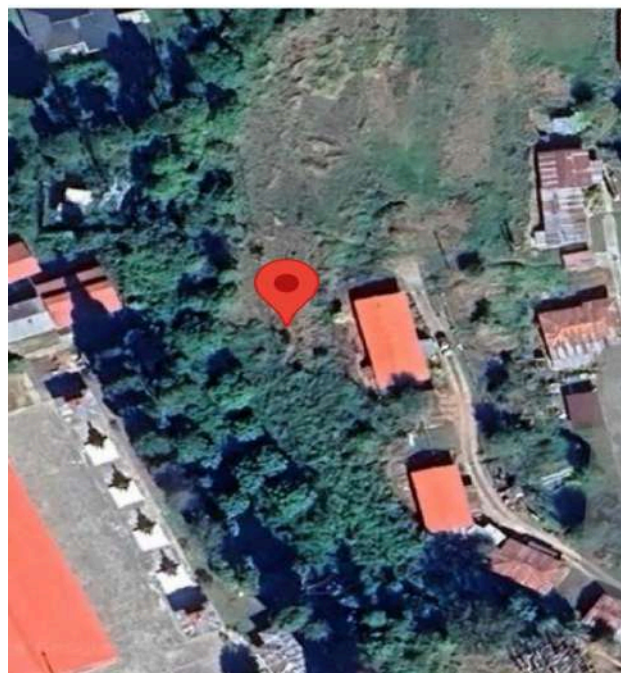


Figure 4: Damphu Town (BTL)

27.00215 90.12424167



Figure 5: Damphu Exchange(BTL)

27.00511111 90.10711111



Figure 6: Damphu Town(TICPL)

27.4787339 89.6383255



Figure 7: BPC Substation Chubachu(BTL)

27.4720130 89.6384944



Figure 8: Hong Kong Market(BTL)

27.4764287 89.6367444



Figure 9: Near T-Ban(TICPL)

27.4785520 89.6383074



Figure 10: Dorji Element Hotel (TICPL)

27.4742118 89.6434733

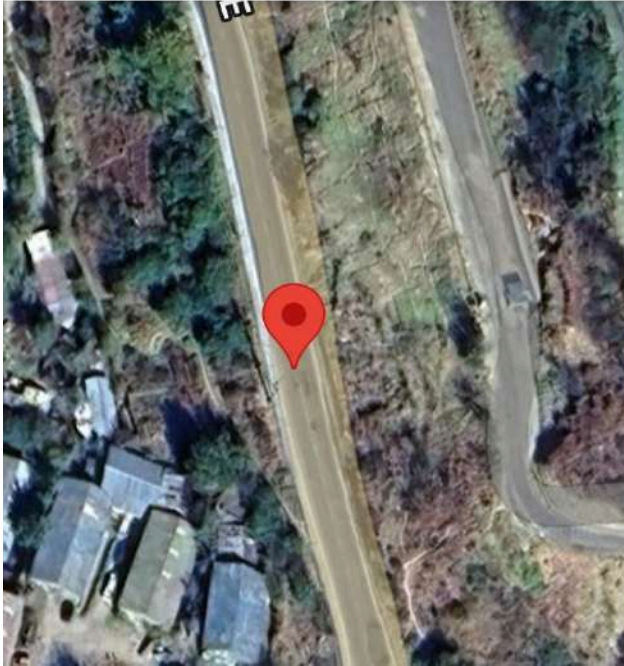


Figure 11: Below JamYang Hotel(TICPL)

27.4393450 89.6593619

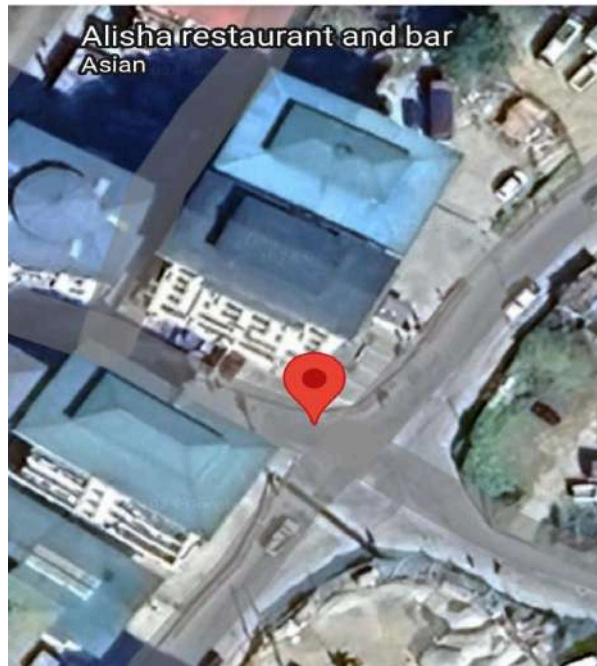


Figure 12: Babesa (BTL)

Annexure 3 (Image of Monitored BTS)

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



*Figure 13: Hong Kong Market (BTL)
(TICPL)*



Figure 14: Below Jamyang Resort



Figure 15: BPC Substation (BTL)



Figure 16: Near T-Bank(TICPL)



Figure 17: Chubachu Dorji Element Hotel (TICPL)



Figure 18: Damphu(TICPL) near Hospital



Figure 19: BTL Damphu Town Damphu



Figure 20: BTL near Police Station, Damphu



Figure 21: BTL main Exchange, Damphu



Figure 22: Babesa, Thimphu (BTL)