

# RF Exposure evaluation

FCC ID: 2AYCQ-TE-304B-A12

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

## 1. Reference

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

## 2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

| Frequency Range(MHz)                        | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minute) |
|---------------------------------------------|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure |                              |                              |                                     |                         |
| 0.3 – 3.0                                   | 614                          | 1.63                         | (100) *                             | 6                       |
| 3.0 – 30                                    | 1842/f                       | 4.89/f                       | (900/f <sup>2</sup> )*              | 6                       |
| 30 – 300                                    | 61.4                         | 0.163                        | 1.0                                 | 6                       |
| 300 – 1500                                  | /                            | /                            | f/300                               | 6                       |
| 1500 – 100,000                              | /                            | /                            | 5                                   | 6                       |

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

| Frequency Range(MHz)                        | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minute) |
|---------------------------------------------|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure |                              |                              |                                     |                         |
| 0.3 – 3.0                                   | 614                          | 1.63                         | (100) *                             | 30                      |
| 3.0 – 30                                    | 824/f                        | 2.19/f                       | (180/f <sup>2</sup> )*              | 30                      |
| 30 – 300                                    | 27.5                         | 0.073                        | 0.2                                 | 30                      |
| 300 – 1500                                  | /                            | /                            | f/1500                              | 30                      |
| 1500 – 100,000                              | /                            | /                            | 1.0                                 | 30                      |

F=frequency in MHz

\*=Plane-wave equivalent power density

### 3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

### 4. Antenna Information

TE-304B-A12 can only use antennas certificated as follows provided by manufacturer;

| Antenna No. | Model No. of antenna: | Type of antenna: | Gain of the antenna (Max.)          | Frequency range: |
|-------------|-----------------------|------------------|-------------------------------------|------------------|
| Bluetooth   | /                     | FPC Antenna      | 0.0dBi for 2402-2480MHz;            |                  |
| WCDMA&LTE   | /                     | FPC Antenna      | 3.0dBi for WCDMA Band II;           |                  |
|             |                       |                  | 2.0dBi for WCDMA Band IV;           |                  |
|             |                       |                  | 1.0dBi for WCDMA Band V;            |                  |
|             |                       |                  | 1.0 dBi for LTE Band 5/12/13/14/71; |                  |
|             |                       |                  | 2.0 dBi for LTE Band 4/66;          |                  |
|             |                       |                  | 3.0 dBi for LTE Band 2;             |                  |

### 5. Manufacturing Tolerance

< WCDMA >

| Band | Mode            | The Tune-up Maximum Power (Customer Declared)(dBm) |
|------|-----------------|----------------------------------------------------|
| W-B2 | AMR 12.2kbps    | 23.0±1                                             |
|      | RMC 12.2Kbps    | 23.0±1                                             |
|      | HSDPA Subtest-1 | 22.0±1                                             |
|      | HSDPA Subtest-2 | 21.0±1                                             |
|      | HSDPA Subtest-3 | 21.0±1                                             |
|      | HSDPA Subtest-4 | 20.0±1                                             |
|      | HSUPA Subtest-1 | 22.0±1                                             |
|      | HSUPA Subtest-2 | 21.0±1                                             |
|      | HSUPA Subtest-3 | 21.0±1                                             |
|      | HSUPA Subtest-4 | 20.0±1                                             |
|      | HSUPA Subtest-5 | 20.0±1                                             |
|      | HSUPA+          | 21.0±1                                             |
|      | AMR 12.2kbps    | 23.0±1                                             |
|      | RMC 12.2Kbps    | 23.0±1                                             |

|      |                 |        |
|------|-----------------|--------|
| W-B4 | HSDPA Subtest-1 | 22.0±1 |
|      | HSDPA Subtest-2 | 21.0±1 |
|      | HSDPA Subtest-3 | 21.0±1 |
|      | HSDPA Subtest-4 | 20.0±1 |
|      | HSUPA Subtest-1 | 22.0±1 |
|      | HSUPA Subtest-2 | 21.0±1 |
|      | HSUPA Subtest-3 | 21.0±1 |
|      | HSUPA Subtest-4 | 20.0±1 |
|      | HSUPA Subtest-5 | 20.0±1 |
|      | HSUPA+          | 21.0±1 |
| W-B5 | AMR 12.2kbps    | 23.0±1 |
|      | RMC 12.2Kbps    | 23.0±1 |
|      | HSDPA Subtest-1 | 22.0±1 |
|      | HSDPA Subtest-2 | 21.0±1 |
|      | HSDPA Subtest-3 | 21.0±1 |
|      | HSDPA Subtest-4 | 20.0±1 |
|      | HSUPA Subtest-1 | 22.0±1 |
|      | HSUPA Subtest-2 | 21.0±1 |
|      | HSUPA Subtest-3 | 21.0±1 |
|      | HSUPA Subtest-4 | 20.0±1 |
|      | HSUPA Subtest-5 | 20.0±1 |
|      | HSUPA+          | 21.0±1 |

< LTE >

| Mode        | Target Power |          |          |
|-------------|--------------|----------|----------|
|             | 1RB          | 50%RB    | 100%RB   |
| LTE BAND 2  | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 4  | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 5  | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 12 | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 13 | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 14 | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 66 | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |
| LTE BAND 71 | 22.0±2.0     | 22.0±2.0 | 22.0±2.0 |

| Mode        | Target Power |          |          |
|-------------|--------------|----------|----------|
| 16QAM       | 1RB          | 50%RB    | 100%RB   |
| LTE BAND 2  | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 4  | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 5  | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 12 | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 13 | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 14 | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 66 | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |
| LTE BAND 71 | 21.0±2.0     | 21.0±2.0 | 21.0±2.0 |

<BT>

| GFSK (Peak)1Mbps |            |            |            |
|------------------|------------|------------|------------|
| Channel          | Channel 00 | Channel 19 | Channel 39 |
| Target (dBm)     | 0.0        | 0.0        | 0.0        |
| Tolerance ±(dB)  | 1.0        | 1.0        | 1.0        |
| GFSK (Peak)2Mbps |            |            |            |
| Channel          | Channel 00 | Channel 19 | Channel 39 |
| Target (dBm)     | 0.0        | 0.0        | 0.0        |
| Tolerance ±(dB)  | 1.0        | 1.0        | 1.0        |

## 6. Standalone MPE Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance,  $r=20\text{cm}$ , as well as the gain of WIFI antenna is 0dBi, the gain of BT antenna is 0dBi.the RF power density can be obtained.

[BT]

| Modulation Type | Output power |        | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm <sup>2</sup> ) | MPE Limits (mW/cm <sup>2</sup> ) |
|-----------------|--------------|--------|--------------------|-----------------------|---------------------------|----------------------------------|
|                 | dBm          | mW     |                    |                       |                           |                                  |
| BLE 1Mbps       | 1.0          | 1.2589 | 0.00               | 1.000                 | 0.0003                    | 1.0000                           |
| BLE 2Mbps       | 1.0          | 1.2589 | 0.00               | 1.000                 | 0.0003                    | 1.0000                           |

[WCDMA&LTE]

| Modulation Type | Output power |          | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm <sup>2</sup> ) | MPE Limits (mW/cm <sup>2</sup> ) |
|-----------------|--------------|----------|--------------------|-----------------------|---------------------------|----------------------------------|
|                 | dBm          | mW       |                    |                       |                           |                                  |
| WCDMA B2        | 24.0         | 251.1886 | 3.00               | 1.9953                | 0.0998                    | 1.0000                           |
| WCDMA B4        | 24.0         | 251.1886 | 2.00               | 1.5849                | 0.0792                    | 1.0000                           |
| WCDMA B5        | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.5493                           |
| LTE B2          | 24.0         | 251.1886 | 3.00               | 1.9953                | 0.0998                    | 1.0000                           |
| LTE B4          | 24.0         | 251.1886 | 2.00               | 1.5849                | 0.0792                    | 1.0000                           |
| LTE B5          | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.5493                           |
| LTE B12         | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.4660                           |
| LTE B13         | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.5180                           |
| LTE B14         | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.5253                           |
| LTE B66         | 24.0         | 251.1886 | 2.00               | 1.5849                | 0.0792                    | 1.0000                           |
| LTE B71         | 24.0         | 251.1886 | 1.00               | 1.2589                | 0.0629                    | 0.4420                           |

Remark:

1. Output power (Peak) including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

## 7. Summary simultaneous transmission results

The sample supports 2 antennas for BT and WCDMA&LTE. The antenna 0 and antenna 1 can transmit simultaneous.

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\Sigma$  of MPE ratios  $\leq 1.0$

Antenna 0 for BT and Antenna 1 for WCDMA&LTE

| Modulation Type | MPE <sub>ant0</sub> (mW/cm <sup>2</sup> ) | MPE <sub>ant1</sub> (mW/cm <sup>2</sup> ) | $\Sigma$ MPE ratios | Limit | Results |
|-----------------|-------------------------------------------|-------------------------------------------|---------------------|-------|---------|
| BT&WCDMA&LTE    | 0.0003                                    | 0.0998                                    | 0.1001              | 1.0   | PASS    |

## 8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----THE END OF REPORT-----