

# RF Exposure evaluation

Exposure category: General population/uncontrolled environment EUT

Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06 FCC

Part 2 §2.1091

FCC ID: 2A9LU-A1000

## 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.

KDB 447498 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 givendistance

Equation from page 18 of OET Bulletin 65, Edition97-01

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

Where: S=powerdensity

P=power input toantenna

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

R=distance to the center of radiation of theantenna

### 4. Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, atleast20 cm from any body part of the user or nearby persons; from the maximum EUT

RFoutputpower, the minimum separation distance, r =20cm, as well as the gain of the used BT antenna is 4dBi, the RF power density can beobtained.

| EDR            |                          |                                         |                              |                                       |                      |                                           |                       |        |
|----------------|--------------------------|-----------------------------------------|------------------------------|---------------------------------------|----------------------|-------------------------------------------|-----------------------|--------|
| Freq.<br>(MHz) | Output<br>Power<br>(dBm) | Target<br>powerW/<br>tolerance<br>(dBm) | Max tuneup<br>power<br>(dBm) | Output<br>power to<br>antenna<br>(mW) | Ant<br>Gain<br>(dBi) | Power<br>Density at<br>R=20cm<br>(mW/cm2) | Limit<br>(mW/c<br>m2) | Result |
| GFSK           |                          |                                         |                              |                                       |                      |                                           |                       |        |
| 2402           | -4.249                   | -4±1.0                                  | -3                           | 0.501                                 | 4                    | 0.00025                                   | 1                     | Pass   |
| 2441           | -2.910                   | -2±1.0                                  | -1                           | 0.794                                 | 4                    | 0.00040                                   | 1                     | Pass   |
| 2480           | 0.878                    | 0±1.0                                   | 1                            | 1.259                                 | 4                    | 0.00063                                   | 1                     | Pass   |
| π/4DQPSK       |                          |                                         |                              |                                       |                      |                                           |                       |        |
| 2402           | -1.857                   | -1±1.0                                  | 0                            | 1.000                                 | 4                    | 0.00050                                   | 1                     | Pass   |
| 2441           | -0.487                   | 0±1.0                                   | 1                            | 1.259                                 | 4                    | 0.00063                                   | 1                     | Pass   |
| 2480           | 3.216                    | 3±1.0                                   | 4                            | 2.512                                 | 4                    | 0.00126                                   | 1                     | Pass   |
| 8DPSK          |                          |                                         |                              |                                       |                      |                                           |                       |        |
| 2402           | -1.236                   | -1±1.0                                  | 0                            | 1.000                                 | 4                    | 0.00050                                   | 1                     | Pass   |
| 2441           | 0.169                    | 0±1.0                                   | 1                            | 1.259                                 | 4                    | 0.00063                                   | 1                     | Pass   |
| 2480           | 3.897                    | 3±1.0                                   | 4                            | 2.512                                 | 4                    | 0.00126                                   | 1                     | Pass   |

| BLE            |                          |                                         |                              |                                       |                      |                                           |                       |        |
|----------------|--------------------------|-----------------------------------------|------------------------------|---------------------------------------|----------------------|-------------------------------------------|-----------------------|--------|
| Freq.<br>(MHz) | Output<br>Power<br>(dBm) | Target<br>powerW/<br>tolerance<br>(dBm) | Max tuneup<br>power<br>(dBm) | Output<br>power to<br>antenna<br>(mW) | Ant<br>Gain<br>(dBi) | Power<br>Density at<br>R=20cm<br>(mW/cm2) | Limit<br>(mW/c<br>m2) | Result |
| GFSK           |                          |                                         |                              |                                       |                      |                                           |                       |        |
| 2402           | -4.275                   | -4±1.0                                  | -3                           | 0.501                                 | 4                    | 0.00025                                   | 1                     | Pass   |
| 2440           | -2.920                   | -2±1.0                                  | -1                           | 0.794                                 | 4                    | 0.00040                                   | 1                     | Pass   |
| 2480           | 0.730                    | 0±1.0                                   | 1                            | 1.259                                 | 4                    | 0.00063                                   | 1                     | Pass   |

Note: The estimation distance is 20cm

## 5. Conclusion

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