

## RF Exposure Compliance Requirement

### Model no.: ZPAD3.4

#### 1. Standard requirement

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

#### (a) Limits for Occupational / Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S)(mW/cm <sup>2</sup> ) | Averaging Times  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|----------------------------------------|--------------------------------------------------------------------|
| 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                                                                  |
| 1500-100000           | --                                | --                                | 5                                      | 6                                                                  |

#### (b) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S)(mW/cm <sup>2</sup> ) | Averaging Times  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|----------------------------------------|--------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                 | 30                                                                 |
| 1.34-30               | 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                                                                 |
| 1500-100000           | --                                | --                                | 1.0                                    | 30                                                                 |

Note: f=frequency in MHz; \*Plane-wave equivalent power density

## 2. MPE Calculation Method

$$E (V/m) = (30 * P * G)^{0.5} / d \quad \text{Power Density: } Pd(W/m^2) = E^2 / 377$$

E=Electric Field (V/m)

P=Peak RF output Power (W)

G=EUT Antenna numeric gain (numeric)

d= Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = (30 * P * G) / (377 * d^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

## 3. Calculated Result and Limit

Z-wave:

E=93.5dBμV@3m(max. value provided by client)

| Frequency (MHz) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|-----------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 908.4-916       | -1.7                    | 0.68                   | 0.00013                                 | 0.6                                              | Complies    |

MPE ratio:

$$0.00013(mW/cm^2) / 0.6(mW/cm^2) = 0.000217$$

FSC-BT691 Bluetooth:

Peak Output Power = -1.108dBm(max.value declared by client), antenna gain = 2dBi

| Frequency (MHz) | Antenna Gain (Numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|-----------------|------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 2402-2480       | 1.58                   | -1.108                  | 0.77                   | 0.00024                                 | 1                                                | Complies    |

MPE ratio:

$$0.00024 (mW/cm^2) / 1(mW/cm^2) = 0.00024$$

E104-BT5032A:

Peak Output Power = -35.23dBm(max.value declared by client), antenna gain = 1dBi

| Frequency (MHz) | Antenna Gain (Numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|-----------------|------------------------|-------------------------|------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 2402-2480       | 1.26                   | -35.23                  | 0.0003                 | 0.00000075                              | 1                                                | Complies    |

MPE ratio:

$$0.00000075 \text{ (mW/cm}^2\text{)}/1\text{(mW/cm}^2\text{)} = 0.00000075$$

Sum of the MPE ratio for all simultaneously transmitting antennas:

$$0.000217+0.00024+0.00000075 = 0.00045775 < 1$$

According to MPE test Exclusion condition in KDB 447498 (D01) General RF Exposure Guidance D01 v06, the MPE report is not required.

Test Location:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

All tests were performed at:

Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China