

## RF Exposure Evaluation

According to KDB447498D01 General RF Exposure Guidance v06 4.3.1. Standalone SAR test exclusion considerations Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

### Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

**TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

| Frequency range<br>(MHz)                                       | Electric field<br>strength<br>(V/m) | Magnetic field<br>strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|----------------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|-----------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                                     |                                     |                                        |                             |
| 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                           |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                                     |                                     |                                        |                             |
| 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                          |
| 1500–100,000 .....                                             | .....                               | .....                               | 1.0                                    | 30                          |

F= Frequency in MHz Friis Formula

Friis transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$  Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi$  = 3.1416

R = distance between observation point and center of the radiator in cm

$P_d$  is the limit of MPE . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Result of RF Exposure Evaluation

Antenna gain: 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance: 20cm

Measurement Data

The Max Conducted Peak Output Power data refer to report Report No.:ZKT-230321L1889

## 1.1 EUT RF EXPOSURE

| Operational Mode: FSK--ANT1                                    |                                              |                                           |                        |                       |         |                                        |       |
|----------------------------------------------------------------|----------------------------------------------|-------------------------------------------|------------------------|-----------------------|---------|----------------------------------------|-------|
| Channel (MHz)                                                  | Maximum Peak Conducted Output Power (dBuV/m) | Maximum Peak Conducted Output Power (dBm) | Tune up tolerance (dB) | Maximum tune-up Power |         | Calculated value (mW/cm <sup>2</sup> ) | Limit |
|                                                                |                                              |                                           |                        | (dBm)                 | (mW)    |                                        |       |
| 2403                                                           | 110.98                                       | 20.98                                     | 20±1                   | 21                    | 125.893 | 0.0397                                 | 1.0   |
| Conclusion: the calculated value $\leq 1.0$ , SAR is exempted. |                                              |                                           |                        |                       |         |                                        |       |

1)  $P_d = (P_{out} * G) / (4 * \pi * R^2) = (125.893 * 1.585) / (4 * 3.14159 * 20^2) = 0.0397$ ,  $G = 10 \log_{10} = 1.585$

2)  $dBm = dBuV - 90 - 10 \log(Z); Z=3$

| Operational Mode: FSK--ANT2                                    |                                              |                                           |                        |                       |         |                                        |       |
|----------------------------------------------------------------|----------------------------------------------|-------------------------------------------|------------------------|-----------------------|---------|----------------------------------------|-------|
| Channel (MHz)                                                  | Maximum Peak Conducted Output Power (dBuV/m) | Maximum Peak Conducted Output Power (dBm) | Tune up tolerance (dB) | Maximum tune-up Power |         | Calculated value (mW/cm <sup>2</sup> ) | Limit |
|                                                                |                                              |                                           |                        | (dBm)                 | (mW)    |                                        |       |
| 2432                                                           | 110.57                                       | 20.57                                     | 20±1                   | 21                    | 125.893 | 0.0397                                 | 1.0   |
| Conclusion: the calculated value $\leq 1.0$ , SAR is exempted. |                                              |                                           |                        |                       |         |                                        |       |

3)  $P_d = (P_{out} * G) / (4 * \pi * R^2) = (125.893 * 1.585) / (4 * 3.14159 * 20^2) = 0.0397$ ,  $G = 10 \log_{10} = 1.585$

4)  $dBm = dBuV - 90 - 10 \log(Z); Z=3$

EUT RF Exposure Evaluation simultaneous transmission operations

According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

| Simultaneous transmission mode                               | The sum of the ratios | SUM    | Limit |
|--------------------------------------------------------------|-----------------------|--------|-------|
| ANT1+ANT2                                                    | 0.0397 +0.0397        | 0.0794 | 1.0   |
| conclusion : $0.0794 < 1.0$ , So there is no sar requirement |                       |        |       |