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## **RF Exposure and Transmitter Power Considerations for co-location of FCC ID:OG3-RADIOMO1-2G4 and FCC ID:OG3-CIM2X0-3G-4G Modules**

For mobile product operation the FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The modules utilize 2.4GHz 802.15.4 and 3G/ 4G cellular technologies.

The modules have been certified for the following operating bands:

802.15.4: 2405 – 2480MHz

CDMA850/ LTE B5: 824-849MHz

CDMA1900/ LTE B2: 1850-1910MHz

LTE B4: 1710 – 1755MHz

LTE B17: 704 – 716MHz

LTE B12: 698 - 716MHz

LTE B13: 777 – 787MHz

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

KDB447498 D01 v06

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

## MPE CALCULATIONS

The MPE calculation used to calculate the safe operating distance for the user is:

$$S = \text{EIRP} / 4 \pi R^2$$

### Where

S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

### Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure  
of

FCC §1.1310 (e) for  $f > 1500\text{MHz}$ ,  $S_{\text{req1}} = 1.0 \text{ mW/cm}^2$

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of  
FCC §1.1310 (e) for  $f < 1500\text{MHz}$ ,  $S = f/1500 \text{ mW/cm}^2$

(f = operating frequency)

## VALUES

Conducted power values and antenna gains are taken from RF exposure analysis of module grants FCC ID:OG3-RADIOMO1-2G4 and FCC ID:OG3-CIM2X0-3G-4G (R17LE910NAV2)

| Frequency Range (MHz) | Operating Band   | TX Conducted Power Average (dBm) | Antenna Gain (dBi) | EIRP (mW) | Calculated Distance R @ $S_{\text{req}}$ (cm) | Power Density $S \text{ mW/cm}^2$ |                                |                      |
|-----------------------|------------------|----------------------------------|--------------------|-----------|-----------------------------------------------|-----------------------------------|--------------------------------|----------------------|
|                       |                  |                                  |                    |           |                                               | Limit $S_{\text{req}}$            | Calculated $S_n @ 20\text{cm}$ | $S_n/S_{\text{req}}$ |
| 2405 - 2480           | 802.15.4         | 1.75                             | +2.0               | 2.37      | 0.43                                          | 1.0                               | 0.0005                         | 0.0005               |
| 824 - 849             | CDMA V<br>LTE 5  | 24.5                             | +6.63              | 1297      | 13.45                                         | 0.57                              | 0.26                           | 0.46                 |
| 1850 - 1910           | CDMA II<br>LTE 2 | 24.5                             | +8.51              | 1995      | 12.6                                          | 1.0                               | 0.4                            | 0.4                  |
| 1710 - 1755           | LTE4             | 24.0                             | +6.0               | 1000      | 8.92                                          | 1.0                               | 0.2                            | 0.2                  |
| 704 - 716             | LTE 17           | 24.0                             | +6.63              | 1156      | 13.99                                         | 0.47                              | 0.23                           | 0.49                 |
| 699 - 716             | LTE 12           | 24.0                             | +6.63              | 1156      | 13.99                                         | 0.47                              | 0.23                           | 0.49                 |
| 777 - 787             | LTE 13           | 24.0                             | +6.63              | 1156      | 13.0                                          | 0.52                              | 0.23                           | 0.44                 |

## **KDB447498 D01 v05 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS**

Worst case summation of calculated MPE ratios.

WCDMA and 802.15.4 operation:

$$\text{ie: } \Sigma \text{MPE}_{\text{ratios}} = (S_1 / S_{\text{req1}}) + (S_2 / S_{\text{req2}})$$

$$= 0.0005 + 0.46$$

$$= \mathbf{0.46}$$

LTE and 802.15.4 operation:

$$\text{ie: } \Sigma \text{MPE}_{\text{ratios}} = (S_1 / S_{\text{req1}}) + (S_6 / S_{\text{req6}})$$

$$= 0.0005 + 0.49$$

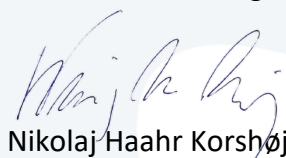
$$= \mathbf{0.49}$$

$\Sigma$  of MPE ratios < 1.0, so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies for the 802.15.4 + CDMA and 802.15.4 + LTE transmitters.

### **Conclusion**

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for co-location of the modules using antennas having a maximum gain of 2.0dBi for 2.4GHz, 6.63 dBi for 700 MHz & 850 MHz; 6.00 dBi for 1700 MHz; 8.51 dBi for 1900 MHz operation

Yours sincerely,  
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