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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:

$$S = EIRP/4\,\pi\,R^2$$

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 >1500MHz , S_{req1} = 1.0 mW/cm²**

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC §1.1310 (e) **for f <1500MHz, S = f/1500 mW/cm²**

(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 (RI7LE910NAV2)

Frequency Range (MHz)	Operating Band	TX Conducted Power Average (dBm)	Antenna Gain (dBi)	EIRP (mW)	Calculated Distance R @ S_{req} (cm)	Power Density S mw/ cm²		
						Limit S_{req}	Calculated S_n @ 20cm	S_n/S_{req}
2405 - 2480	802.15.4	1.75	+2.0	2.37	0.43	1.0	0.0005	0.0005
824 - 849	CDMA V LTE 5	24.5	+6.63	1297	13.45	0.57	0.26	0.46
1850 - 1910	CDMA II 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:

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

= 0.0005 + 0.46

= 0.46

LTE and 802.15.4 operation:

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

= 0.0005 + 0.49

= 0.49

Σ 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,
GRUNDFOS Holding A/S

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