

RF Exposure and Transmitter Power Considerations for the Eurotech Integrated radio module RECELL 10-32

Contains FCC ID: UKMRC1032 and FCC ID: XMR201903EG25G

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 transmitter operation for the Integrated radio module ReliaCELL 10-32 utilises a certified BT / 2.4 GHz WLAN / 5GHz WLAN module (FCC ID: UKMRC1032), together with a certified LTE radio module Manufacturer: Quectel, Model: EG25-G (FCC ID: XMR201903EG25G).

These modules have been certified for the following operating bands:

BT BR EDR / BT LE: 2402 to 2480 MHz

2.4 GHz WLAN: 2412 to 2462 MHz

5 GHz WLAN: 5180 to 5240 MHz, 5260 to 5320 MHz, 5500 to 5700 MHz, 5745 to 5825 MHz

GSM850 / WCDMA850 B5 / LTE B5: 824 to 849 MHz

GSM1900 / WCDMA B2 / LTE B2: 1850 to 1910 MHz

WCDMA B4 / LTE B4: 1710 to 1755 MHz

LTE B7: 2500 to 2570 MHz

LTE B12: 699 to 716 MHz

LTE B13: 777 to 787 MHz

LTE B25: 1850 to 1915 MHz

LTE B26: 814 to 849 MHz

LTE B38: 2570 to 2620 MHz

LTE B41: 2496 to 2690 MHz

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

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 >1500MHz** , **S_{req} = 1.0 mW/cm²**

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

(f = operating frequency)

VALUES

Powers are from the BT BR / EDR, BT LE, 2.4 GHz WLAN and 5 GHz WLAN FCC Grant listings and the cellular module FCC Grant RF Exposure Evaluation report.

Refer to antenna document '*RECELL-10-32 antennas_FCC.pdf*' for antenna gain values.

Frequency Range (MHz)	Operating Band	Max. Conducted Average Output Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Calculated Distance R @ S _{req} (cm)	Power Density S mw/ cm ²		
						Limit S _{req}	Calculated S _n @ 20cm	S _n /S _{req}
2402 - 2480	BT BR/EDR	5.56	4.71	10.6	0.92	1.0	0.0021	0.0021
2402 - 2480	BT LE	-2.22	4.71	1.8	0.38	1.0	0.0004	0.0004
2412 - 2462	2.4 GHz WLAN	18.24	4.71	197.2	3.96	1.0	0.0392	0.0392
5180 - 5825	5 GHz WLAN	16.40	4.41	120.5	3.10	1.0	0.0240	0.0240
5260-5320	5 GHz WLAN	15.65	4.47	102.8	2.86	1.0	0.0205	0.0205
5500-5700	5 GHz WLAN	16.86	4.28	130.0	3.22	1.0	0.0259	0.0259
5745-5825	5 GHz WLAN	16.81	4.33	130.0	3.22	1.0	0.0259	0.0259
824 - 849	GSM850	25.81	1.50	538.3	8.83	0.55	0.1071	0.1949
824 - 849	WCDMA B5 LTE B5	25.00	1.50	446.7	8.04	0.55	0.0889	0.1618
1850 - 1910	GSM1900	22.81	2.62	349.1	5.27	1.0	0.0695	0.0695
1850 - 1910	WCDMA B2 LTE B2	25.0	2.62	578.1	6.78	1.0	0.1150	0.1150
1710 - 1755	WCDMA B4 LTE B4	25.0	2.20	524.8	6.46	1.0	0.1044	0.1044
2500 - 2570	LTE B7	25.0	1.43	439.5	5.91	1.0	0.0874	0.0874
699 - 716	LTE B12	25.0	1.60	457.1	8.83	0.47	0.0909	0.1951
777 - 787	LTE B13	25.0	0.63	365.6	7.49	0.52	0.0727	0.1404
1850 - 1915	LTE B25	25.0	2.62	578.1	6.78	1.0	0.1150	0.1150
814 - 849	LTE B26	25.0	1.50	446.7	8.09	0.54	0.0889	0.1638
2570 - 2620	LTE B38	25.0	2.00	501.2	6.32	1.0	0.0997	0.0997
2496 - 2690	LTE B41	25.0	1.43	439.5	5.91	1.0	0.0874	0.0874

KDB447498 D01 v06 Section 7.2 SIMULTANEOUS TRANSMISSION CONSIDERATIONS

Considering the three cases of simultaneous transmission:

- 1) Bluetooth and Cellular
- 2) 2.4 GHz WLAN and Cellular
- 3) 5 GHz WLAN and Cellular

Worst case summation of calculated MPE ratios S_n/S_{req} .

- 1) Bluetooth and Cellular (LTE B12) operation

$$\begin{aligned}\text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_3 / S_{\text{req3}}) \\ &= 0.0021 + 0.1951 \\ &= \mathbf{0.1973}\end{aligned}$$

- 2) 2.4 GHz WLAN + Cellular

$$\begin{aligned}\text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_3 / S_{\text{req3}}) \\ &= 0.0392 + 0.1951 \\ &= \mathbf{0.2344}\end{aligned}$$

- 3) 5 GHz WLAN + Cellular

$$\begin{aligned}\text{ie: } \sum \text{MPE}_{\text{ratios}} &= (S_1 / S_{\text{req1}}) + (S_3 / S_{\text{req3}}) \\ &= 0.0259 + 0.1951 \\ &= \mathbf{0.2210}\end{aligned}$$

$\sum$ of MPE ratios < 1.0 , so in accordance with KDB447498 Section 7.2, simultaneous transmission test exclusion applies.

Conclusion

The required 20 cm RF exposure limits for General Population / Uncontrolled Exposure will not be exceeded for the Eurotech Integrated radio module RECELL-10-32 using the listed antenna.