

The Device is a carrier grade gateway designed for IoT applications. The Kona micro gateway is designed to be used as indoor equipment for home or small office.

The device has 1 antenna port, which must be used with antenna respecting the requirement specified in the technical documentation.

Kona micro indoor gateway is evaluated for RF radiation exposure according to the provisions of FCC §2.1091, MPE guidelines identified in FCC §1.1310 and FCC KDB 447498:2015.

Limits for General Population/Uncontrolled Exposure: 47 CFR 1.1310 Table 1 (B)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30
Where <i>f</i> is in MHz		*Plane-wave equivalent power density		

Using the highest transmitted power at a distance of 20 cm in the equation below:

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

Where: S, power density in 'mW/cm²'

EIRP, Effective Isotropic Radiated Power in 'mW'

R, distance to the center of the radiation of the antenna in 'cm'

The power density calculations for the EG21-G, EG21-G MINIPCIE at an exposure minimum separation distance of 0.2m are shown in the table below for each mode of operation. The worst case value is highlighted below.

LTE Module Pre- Certified ¹ .								
Operating Band	Freq. (MHz)	Max. Cond. AV Output Power (dBm)	Actual Antenna Gain (dBi)	Avg EIRP (dBm)	Avg EIRP (mW)	[Pd] Power density (mW/cm ²) @ 20cm	[Limit] FCC MPE Limit (mW/cm ²)	Ratio Pd/limit
GSM850	824.2	25.81	2.29	28.10	645.6542	0.1284	0.5495	0.234
GSM1900	1850.2	22.81	1.59	24.4	275.4229	0.0548	1.000	0.0548
WCDMA B2	1852.4	25.00	1.59	26.59	456.0369	0.0907	1.000	0.0907
WCDMA B4	1712.4	25.00	2.00	27	501.1872	0.0997	1.000	0.0997
WCDMA B5	826.4	25.00	2.29	27.29	535.7967	0.1066	0.5509	0.193
LTE B2	1850.7	25.00	1.59	26.59	456.0369	0.0907	1.000	0.0907
LTE B4	1710.7	25.00	2.00	27.00	501.1872	0.0997	1.000	0.0997
LTE B5	824.70	25.00	2.29	27.29	535.7967	0.1066	0.5498	0.194
LTE B7	2502.50	25.00	3.00	28.00	630.9573	0.1255	1.000	0.1255
LTE B12	699.70	25.00	3.26	28.26	669.8846	0.1333	0.4665	0.286
LTE B13	779.50	25.00	4.45	29.45	881.0489	0.1753	0.5197	0.337
LTE B25	1850.7	25.00	1.59	26.59	456.0369	0.0907	1.000	0.0907
LTE B26 (814-824)	814.7	25.00	2.53	27.53	566.2393	0.1126	0.5431	0.207
LTE B26 (824-849)	824.7	25.00	2.53	27.53	566.2393	0.1126	0.5498	0.205
LTE B38	2572.5	25.00	2.06	27.06	508.1594	0.1011	1.000	0.1011
LTE B41	2498.5	25.00	3.00	28.00	630.9573	0.1255	1.000	0.1255

¹ RF Exposure Evaluation Report# HR/2019/10016E-0102 for EG21-G, EG21-G MINIPCIE Radio Module, issue date May 07, 2019.

LoRa and BLE RF conducted power measurement and antenna gain as per ETC test reports t29e22a141-DTS_FCC and t29e22a141-DSS_FCC section 2.3.5 are reported below. The maximum duty cycle of the radio is stated in the Operation Description exhibit to be 33%. The worst-case value is in bold below

TX	Frequency (MHz)	Conducted RF Output 100% Duty Cycle (dBm)	Max. antenna gain (dBi)	EIRP 100% duty Cycle (mW)	EIRP 33% duty Cycle (mW)	[Pd] 33 % Power density (mW/cm ²) @ 20cm	[Limit] FCC MPE Limit (mW/cm ²)	Ratio Pd / limit
LoRa 500 KHz DTS	903	25.78	0.4	415	136.95	0.0273	0.602	0.0454
	914.2	26.02	0.4	438.5	144.71	0.0288	0.609	0.0473
	927.5	25.63	0.4	401	132.33	0.0263	0.618	0.0426
LoRa 125 KHz DSS	902.3	19.49	0.4	97.5	32.175	0.00640	0.601	0.0106
	914.9	19.98	0.4	109.14	36.02	0.00717	0.609	0.0118
	927.7	19.24	0.4	92.05	30.4	0.00605	0.618	0.0098
Using a worst case scenario after tuning procedure								
Tx Power		27.5	0.4	617	203.61	0.04051	0.601	0.0674

Conclusion

Both LTE Pre Certified Module and LoRa can transmit simultaneously.

The formula to calculate the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots < 1$$

Where, CPD: Calculated Power Density

LPD: Limit of Power Density

$$GSM / Limit + LoRa / Limit = 0.337 + 0.0674 = 0.4044$$

The RF exposure from the radio is less than the limit specified as shown below and meets the exemption criteria.

Rounded up **0.405** <<< **1**

The manufacturer manual specified a minimum safe distance of **20 cm**.