

1 Test Sample Description:

Product Name: Kona micro gateway

Functional Description: 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.

Category: Mobile (A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the RF source's radiating structure(s) and the body of the user or nearby persons.)

Power supply: (100 – 240) AC/DC Adaptor (12VDC@1A) / POE

LoRa: Radio	500 KHz	125 KHz
Frequency Range:	903 – 927.5 MHz	902.3 – 927.7 MHz
Mode of operation:	DTS	DSS
Antenna Description:	SUZHOU WUTONG COMMUNICATION CO.,LTD 860M Antenna, Omn directional, Gain 0.4 dBi	

LTE: Pre-Certified Module

FCC ID: RI7LE910CXWWX
Equipment Class: PCS Licensed Transmitter
Modular Type: Single Modular
Model#: LE910C4-WWX
Manufacture: Telit Communications S.p.A
Antenna Description: PCB antenna CU9013-ANT1

Prepared for: Tektelic Communication Inc.
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2 RF Exposure Limits:

KONA Micro Gateway 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.

TABLE 1 TO §1.1310(E)(1)—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)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1.500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
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 f = frequency in MHz. * = Plane-wave equivalent power density.

Using the lowest transmitter frequency of all possible on-board radio (module radio LE910C4-WWX) for worst case calculation: 699.7 MHz (LE910C4-WWX module, LTE band 12) is used.

S = f/1500 mW/cm², for General Population/Uncontrolled Exposure

S = 699.7/1500 mW/cm², for General Population/Uncontrolled Exposure

S = 0.4665 mW/cm², for General Population/Uncontrolled Exposure

2.1 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by the transmitter used in this product was initially measured by a spectrum analyzer and the powers were recorded. Through use of the Friis transmission formula and knowledge of the maximum antenna gain to be used, the power density level is calculated at a distance of 20cm.

Friis Transmission Formula

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

Where,

P_d = Power Density (mW/cm²) π = 3.1416

EIRP = [Output power to antenna + antenna Gain (dBi)] mW

r = distance between observation point and center of the radiator (cm)

3 Pre-certified LTE Module EIRP:

As per Telit Communications S.p.A Pre-certified Module MPE Evaluation for LE910C4-WWX Radio Module Report dated January 6, 2021. The average EIRP calculations are shown in the table below for each mode of operation. The worst case value is highlighted below.

Band/Mode	Frequency [MHz]	Max average powers [dBm]	Maximum Antenna Gain [dBi]	MPE@20cm (mW/cm ²)	FCC Limit (mW/cm ²)	Ratio (MPE@20cm / Limit)
GSM/GPRS Cell	824.2 – 848.8	27.5	1.531	0.159	0.549	0.290
EDGE Cell	824.2 – 848.9	22	1.531	0.045	0.549	0.082
GSM/GPRS PCS	1850.2 – 1909.8	24.5	1.684	0.083	1.000	0.083
EDGE PCS	1850.2 – 1909.8	21	1.684	0.037	1.000	0.037
WCDMA Cell	826.4 – 846.6	24.5	1.531	0.080	0.551	0.145
WCDMA AWS	1712.4 – 1752.6	24.5	2.258	0.094	1.000	0.094
WCDMA PCS	1852.4 – 1907.6	24.5	1.684	0.083	1.000	0.083
LTE BAND25/2	1850.7 – 1914.3	24	1.684	0.074	1.000	0.074
LTE BAND4	1710.7 – 1754.3	24	2.258	0.084	1.000	0.084
LTE BAND26/5	824.7 – 848.3	24	1.531	0.071	0.550	0.129
LTE BAND7	2502.5 – 2667.5	24	1.818	0.076	1.000	0.076
LTE BAND8	898.2 – 899.8	24	0.070	0.051	0.599	0.085
LTE BAND12	699.7 – 715.3	24	0.412	0.055	0.466	0.118
LTE BAND13	779.5 – 784.5	24	0.864	0.061	0.520	0.117
LTE BAND14	790.5 – 795.5	24	0.864	0.061	0.527	0.116
LTE Band26(Part.90)	814.7 – 823.3	24	1.531	0.071	0.543	0.131

4 LoRa Radio EIRP:

EIRP calculated using associated antenna gain with LoRa Radio for Kona micro gateway. The table below shows the EIRP value for LoRa radio for both DTS and DSS transmission mode. The maximum duty cycle of the radio is stated to be 33%. The worst case value is highlighted below.

Mode	Frequency (MHz)	Conducted RF Output 100% DC (dBm)	Max. antenna gain (dBi)	EIRP 100% DC (mW)	EIRP 33% DC (mW)	33 % PD (mW/cm ²) @ 20cm	[Limit] FCC MPE (mW/cm ²)	Ratio Pd / limit
500 KHz DTS	903.0	25.87	0.4	423.6	140	0.028	0.602	0.0465
	914.2	26.49	0.4	488.65	161.3	0.0321	0.609	0.053
	927.5	25.71	0.4	408.32	135	0.027	0.618	0.044
125 KHz DSS	902.3	19.63	0.4	100.7	33.23	0.007	0.601	0.012
	914.9	20.21	0.4	115.1	38	0.0076	0.610	0.01245
	927.7	19.47	0.4	97.051	32.03	0.0064	0.618	0.01036

PD = Power density

5 Co-located Simultaneous Transmission Calculations:

When both radios transmitting simultaneously:

Maximum LTE Pre-certified Radio module MPE Ratio	Maximum LoRa Radio MPE Ratio
0.290	0.053
Σ(All MPE Ratios)	
0.343	
Limit	
≤ 1	

5 Conclusion:

The sum of the simultaneous transmission results has not over Limit, which is in compliance and exempt from SAR evaluation.

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