

1 Test Sample Description:

Product Name: KONA Mega Gen3 Gateway

Functional Description: The KONA Mega Gen3 Gateway module is a LoRaWAN gateway designed for IoT applications. Its intended purpose is to provide a carrier grade Gateway solution for LoRa networks. Several configuration options of the KONA Mega will be available to meet the requirements of the customer. The product is designed to operate in the North American Industrial, Scientific and Medical (ISM) Band.

Category: Fix (Fixed RF source is one that is physically secured at one location, even temporarily, and is not able to be easily moved to another location while radiating)

Power supply: 48VDC / POE

LoRa: Radio 500 KHz

Frequency Range: 923 – 928 MHz

Mode of operation: DTS

Highest Gain Antenna Description: MODLE : WTTX-OMNI920-8-NJ, Polarization: Vertical, Gain 8.0 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: MODLE : WTTX-OMNILTE-2-NJ-TEC, Polarization: Vertical, Gain 2.0 dBi

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.

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

The antenna gain used with the Kona Mega Gen3 Gateway with LTE module is model#: WTTX-OMNILTE-2-NJ-TEC, Frequency range 698-960 / 1710-2690MHz with Gain of 2.0 dBi as provided by the tektelic to ETC. Re-calculating the MPE by using 2dBi antenna gain for all bands.

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	2.0	0.177	0.549	0.323
EDGE Cell	824.2 – 848.9	22	2.0	0.050	0.549	0.091
GSM/GPRS PCS	1850.2 – 1909.8	24.5	2.0	0.089	1.000	0.089
EDGE PCS	1850.2 – 1909.8	21	2.0	0.040	1.000	0.040
WCDMA Cell	826.4 – 846.6	24.5	2.0	0.089	0.551	0.161
WCDMA AWS	1712.4 – 1752.6	24.5	2.0	0.089	1.000	0.089
WCDMA PCS	1852.4 – 1907.6	24.5	2.0	0.089	1.000	0.089
LTE BAND25/2	1850.7 – 1914.3	24	2.0	0.079	1.000	0.079
LTE BAND4	1710.7 – 1754.3	24	2.0	0.079	1.000	0.079
LTE BAND26/5	824.7 – 848.3	24	2.0	0.079	0.550	0.144
LTE BAND7	2502.5 – 2667.5	24	2.0	0.079	1.000	0.079
LTE BAND8	898.2 – 899.8	24	2.0	0.079	0.599	0.132
LTE BAND12	699.7 – 715.3	24	2.0	0.079	0.466	0.170
LTE BAND13	779.5 – 784.5	24	2.0	0.079	0.520	0.152
LTE BAND14	790.5 – 795.5	24	2.0	0.079	0.527	0.150
LTE Band26(Part.90)	814.7 – 823.3	24	2.0	0.079	0.543	0.146

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	923.3	26.73	8.0	2972.0	981	0.1952	0.615	0.320
	925.1	27.47	8.0	3524.0	1163	0.2314	0.617	0.375
	927.5	27.68	8.0	3698.0	1220	0.2430	0.618	0.393
Max Power Tx Power		28.0	8.0	3981.1	1314	0.2614	0.615	0.4251

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
0.323	0.4251
Σ(All MPE Ratios)	
0.7481 (0.750)	
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 80 cm in user manual.