

1. Radio Frequency Exposure

RESULT:

Pass

Test standard : FCC Part 2: Section 2.1091
KDB 447498 D01 General RF Exposure Guidance v06
RSS-102 Issue 6, December 2023

1.1 Product Technical Information

The EUT is a Mesh Lite which supports 2.4GHz Wi-Fi, Lora and LTE functions.

For details refer to the User Manual, Technical Description and Circuit Diagram.

General Information of EUT	Description
Kind of Equipment:	Mesh Lite
Type Designation:	GBP-2005
FCC ID:	2AXA8-MGD-5146
IC:	27299-MGD5146
HMN:	GBP-2005
Input Voltage:	DC 12V via AC/DC Adapter or DC 37 ~ 57V via POE adapter
Testing Voltage:	AC 120V, 60Hz or DC 48V
AC/DC Adapter information:	Model #1: AD-0241200200US-1 Model #2: PSY1202000US Model #3: PSYC1202000 Rating for all models: Input: AC 100-240V, 50/60Hz, 0.6A Max Output: DC 12.0V, 2A 24.0W Note: Model #2 is identical with model # 3 except the type of plug.
Remark: This product assemblies multi-transmitter modules: - LTE Module (FCC ID: XMR201807EG95NA, IC ID: 10224A-2018EG95NA) - Wi-Fi Module (FCC ID: 2AXA8-MBD-0634, IC ID: 27299-MBD0634) - Lora Module (FCC ID: 2AXA8-MGD-5146, IC ID: 27299-MGD5146) The LTE module, Wi-Fi module and Lora module are combination in a new host, the EMF is arrange re-assessment (CIIPC and C4PC for FCC ID: 2AXA8-MGD-5146, IC: 27299-MGD5146).	
Technical Specification of LTE Module	
Characteristic	Description
Operating Frequency	WCDMA Band: II, IV, V LTE Band: 2, 4, 5, 12, 13
Type of Modulation	QPSK, 16QAM
Power Class	4
Antenna Number:	2
Antenna Gain:	4.4dBi for Ant 0 2.9dBi@780MHz,3.5dBi@2300MHz for Ant1
Technical Specification of Wi-Fi Module	
Characteristic	Description
Operating Frequency	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate:	1/2/5.5/11 Mbps for 802.11b

	6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 for 802.11n
Channel Number:	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Antenna Number:	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Antenna Gain:	5.4dBi for Ant0 5.0dBi for Ant1
Technical Specification of Lora DTS	
Characteristic	Description
Operating Frequency:	923.3 - 927.5MHz
Type of Modulation:	Lora
Data Rate:	SF7 – SF12 / DR8 – DR13
Channel Number:	8 channels
Channel Separation:	600 kHz
Occupied Bandwidth:	500 kHz
Number of Antenna:	1
Antenna Gain:	2.3dBi (Dipole Antenna)
Technical Specification of Lora Hybrid	
Characteristic	Description
Operating Frequency:	903.9MHz - 905.3MHz
Type of Modulation:	Lora
Data Rate:	SF7 – SF12 / DR8 – DR13
Channel Number:	8 channels
Channel Separation:	200 kHz
Occupied Bandwidth:	125 kHz
Number of Antenna:	1
Antenna Gain:	2.3dBi (Dipole Antenna)
Information of LTE Module	
Product Name	LTE Module
Model Number	EG95-NA
FCC ID	XMR201807EG95NA
IC ID	10224A-2018EG95NA
Information of Wi-Fi Module	
Product Name	Wi-Fi Module
Model Number	MBD-0634
FCC ID	2AXA8-MBD-0634
IC ID	27299-MBD0634
Information of Lora Module	
Product Name	WisLink LPWAN Concentrator
Model Number	MGD-5146
FCC ID	2AXA8-MGD-5146
IC ID	27299-MGD5146

1.2 Product Classification

This device 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 40 cm is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

1.3 Radio Frequency Exposure Limit

For FCC:

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Average Time (minutes)
(A) 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	--	--	1.0	<6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-3.0	614	1.63	*100	<30
3.0-30	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

f = frequency in MHz. * = Plane-wave equivalent power density.

For IC:

Frequency range (MHz)	Electric field (V _{RMS} /m)	Magnetic field (A _{RMS} /m)	Power density (W/m ²)	Reference period (minutes)
10-20	27.46	0.0728	2	6
20-48	58.07 / f ^{0.25}	0.1540 / f ^{0.25}	8.944 / f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 × 10 ⁻⁴ f ^{0.5}	6.67 × 10 ⁻⁵ f	616000/f ^{1.2}

Note: f is frequency in MHz.

1.4 Radio Frequency Exposure Calculation Formula

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

or:

$$S = \frac{EIRP}{4\pi R^2}$$

where: EIRP = equivalent (or effective) isotropically radiated power

1.5 Calculation Result

1.5.1 Stand-alone transmission MPE

Mode	Band	PG (dBm)	PG (W)	Power Density (mW/cm ²)	FCC Limit (mW/cm ²)
Lora (RAK5146)	902-928MHz	30.49	1.11944	0.070	0.601
WIFI	2.4GHz	31.74	0.77983	0.094	1.0
WCDMA	II	29.0	0.79433	0.040	1.0
	VI	29.0	0.79433	0.040	1.0
	V	29.0	0.79433	0.040	0.55
LTE	2	29.0	0.79433	0.040	1.0
	4	29.0	0.79433	0.040	1.0
	5	29.0	0.79433	0.040	0.55
	12	29.0	0.79433	0.040	0.47
	13	29.0	0.79433	0.040	0.52

Mode	Band	PG (dBm)	PG (W)	Power Density (W/m ²)	IC Limit (W/m ²)
Lora (RAK5146)	902-928MHz	30.49	1.11944	0.701	2.74
WIFI	2.4GHz	31.74	0.77983	0.935	5.35
WCDMA	II	28.0	0.63096	0.314	4.48
	VI	28.0	0.63096	0.314	4.24
	V	28.0	0.63096	0.314	2.58
LTE	2	28.5	0.70795	0.352	4.48
	4	28.5	0.70795	0.352	4.24
	5	28.5	0.70795	0.352	2.58
	12	28.5	0.70795	0.352	2.30
	13	28.5	0.70795	0.352	2.47

1.5.2 Simultaneous transmission MPE

FCC						
Operating Mode	Lora RAK5146	WIFI	WCDMA/LTE	Sum Ratio	Limit	Verdict
Lora + WIFI + WCDMA/LTE	0.12	0.094	0.085	0.299	<1	Pass
IC						
Operating Mode	Lora RAK5146	WIFI	WCDMA/LTE	Sum Ratio	Limit	Verdict
Lora + WIFI + WCDMA/LTE	0.256	0.175	0.153	0.584	<1	Pass

Note:

1. WCDMA/LTE modes cannot transmit simultaneous.
2. R = 0.4m