

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 WisGate Edge Prime which supports GNSS, Lora, 2.4GHz Wi-Fi and WCDMA/LTE wireless technologies.

Contains FCC ID: 2AF6B-RAK634, 2AF6B-RAK5146, XMR201807EG95NA.

Contains IC: 25908-RAK634, 25908-RAK5146, 10224A-2018EG95NA.

Remark:

- 1) This product assembles a Lora Module (M/N: RAK5146) without change than it was approved except add an alternative LoRa fiberglass antenna (M/N: RAKARG12) with lower antenna gain
- 2) This product assembles a 2.4GHz Wi-Fi module (M/N: RAK634) without change than it was approved except disable one transmitter antenna via software by RAK
- 3) This product assembles a LTE module (MN: EG95-NA) without change than it was approved except a new LTE fiberglass antenna (M/N: RAKARL01) with lower antenna gain

RAK7240CV2 has two configurations, other aspects are identical:

- 1) With DC input connector
- 2) Without DC input connector

This report is for FCC CIIPC and ISED C4PC as changed transmit antennas and will be installed into HOST WisGate Edge Prime (M/N: RAK7240CV2), radiated spurious emissions for WCDMA/LTE and co-location were re-performed.

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

General Information of EUT	Description
Kind of Equipment:	WisGate Edge Prime
Type Designation:	RAK7240CV2
HMN:	RAK7240CV2
Operating Voltage:	DC 9-24V or DC 48V via POE adapter
Testing Voltage:	AC 120V, 60Hz (Power supply to POE adapter)
Operating Temperature Range:	-30 °C ~ +55 °C (Use DC connector supply only) -10 °C ~ +40 °C (Use PoE adapter supply only)
POE adapter information:	Model: R012-4800500 Input: AC 100-240V, 50/60Hz, 0.6A Output: DC 48V, 0.3A, 24W Factory: Risunic Technology (ShenZhen) Co., Ltd.
Remark: This product assembles multi-transmitter modules: - LTE Module (FCC ID: XMR201807EG95NA, IC: 10224A-2018EG95NA) - Wi-Fi Module (FCC ID: 2AF6B-RAK634, IC: 25908-RAK634) - LoRa Concentrator Module (FCC ID: 2AF6B-RAK5146, IC: 25908-RAK5146)	
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 (1 for MAIN, 1 for DIV)
Antenna Gain:	3dBi (declared by client)
Model of contained LTE module:	EG95-NA
FCC ID	XMR201807EG95NA
IC ID	10224A-2018EG95NA
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:	1
Antenna Gain:	2.0dBi (declared by client)
Model of contained Wi-Fi Module:	RAK634
FCC ID	2AF6B-RAK634
IC ID	25908-RAK634
Technical Specification of WisLink LPWAN Concentrator	
Characteristic	Description
Operating Frequency	923.3 - 927.5MHz for DTS LoRa 903.9 - 905.3MHz for Hybrid LoRa
Type of Modulation	FSK/Lora
Data Rate:	Lora: SF7 – SF12 / DR8 – DR13, SF7 – SF10 / DR0 –DR3
Antenna Number:	1
Antenna Gain:	Fiberglass Antenna (M/N: RAKARG12) with 3dBi, or Fiberglass Antenna (M/N: RAKARG19) with 5.1dBi, or Fiberglass Antenna (M/N: RAKARG14) with 5.8dBi, or Fiberglass Antenna (M/N: RAKARG15) with 8dBi (declared by client)
Model of contained Lora Module:	RAK2287X
FCC ID	2AF6B-RAK5146
IC ID	25908-RAK5146

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 30 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	902-928MHz	30.49	1.12	0.099	0.601
WIFI	2.4GHz	26.52	0.45	0.040	1.0
WCDMA	II	28.00	0.631	0.056	1.0
	VI	28.00	0.631	0.056	1.0
	V	28.00	0.631	0.056	0.55
LTE	2	28.00	0.631	0.056	1.0
	4	28.00	0.631	0.056	1.0
	5	28.00	0.631	0.056	0.55
	12	28.00	0.631	0.056	0.47
	13	28.00	0.631	0.056	0.52

Mode	Band	PG (dBm)	PG (W)	Power Density (W/m ²)	IC Limit (W/m ²)
Lora	902-928MHz	30.49	1.12	0.990	2.74
WIFI	2.4GHz	26.52	0.45	0.397	5.35
WCDMA	II	27.00	0.501	0.443	4.48
	VI	27.00	0.501	0.443	4.24
	V	27.00	0.501	0.443	2.58
LTE	2	27.50	0.562	0.497	4.48
	4	27.50	0.562	0.497	4.24
	5	27.50	0.562	0.497	2.58
	12	27.50	0.562	0.497	2.30
	13	27.50	0.562	0.497	2.47

Note:

- Output power for Lora, refer to test report CN21AUGI 001 (issued by TÜV Rheinland (Shenzhen) Co., Ltd.) with FCC ID: 2AF6B-RAK5146, IC: 25908-RAK5146
- Output power for Wi-Fi, refer to test report CN21NDUV 001 (issued by TÜV Rheinland (Shenzhen) Co., Ltd.) with FCC ID: 2AF6B-RAK634, IC: 25908-RAK634
- Output power for LTE:
 - refer to test reports R1805A0249-R1, R1805A0249-R2, R1805A0249-R3, R1805A0249-M1V1 (issued by TA Technology (Shanghai) Co., Ltd.) with FCC ID: XMR201807EG95NA
 - refer to test reports R1805A0249-R4V1, R1805A0249-R5V1, R1805A0249-R6V1, R1805A0249-M2V1 (issued by TA Technology (Shanghai) Co., Ltd.) with IC: 10224A-2018EG95NA

1.5.2 Simultaneous transmission MPE

FCC						
Operating Mode	Lora	WIFI	WCDMA/LTE	Sum Ratio	Limit	Verdict
Lora + WIFI + WCDMA/LTE	0.165	0.004	0.119	0.288	<1	Pass
IC						
Operating Mode	Lora	WIFI	WCDMA/LTE	Sum Ratio	Limit	Verdict
Lora + WIFI + WCDMA/LTE	0.361	0.074	0.216	0.651	<1	Pass

Note:

- WCDMA/LTE modes cannot transmit simultaneously.
- R = 0.3m.