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 which supports Lora, 2.4GHz Wi-Fi wireless technologies.

Contains FCC ID: 2AF6B-RAK634, 2AF6B-RAK2287X.
Contains IC: 25908-RAK634, 25908-RAK2287X.

The model RAK7268 is identical with model RAK7268V2 except non-radio related Flash chip U2 (on the wifi module): 16MB and 32MB, and this two Flash chip are pin to pin only the storage space is different.

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

General Information of EUT	**Description**
Kind of Equipment:	WisGate
Type Designation:	RAK7268, RAK7268V2
HMN:	RAK7268, RAK7268V2
Operating Voltage:	DC 12V via AC/DC Adapter or DC 37 ~ 57V via POE adapter
Testing Voltage:	AC 120V, 60Hz (Power supply to AC/DC Adapter or POE adapter)
Operating Temperature Range:	-30 °C ~ +45 °C
Remark: This product assemblies multi-transmitter modules: - Wi-Fi Module (FCC ID: 2AF6B-RAK634, IC ID: 25908-RAK634) - LoRa Concentrator Module (FCC ID: 2AF6B-RAK2287X, IC ID: 25908-RAK2287X)	
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:	3.0dBi for Ant0 (declared by client) PIFA Antenna 3.0dBi for Ant1 (declared by client) PIFA Antenna
Model of contained Wi-Fi Module:	RAK634
FCC ID	2AF6B-RAK634
IC ID	25908-RAK634
Technical Specification of LoRa Concentrator Module	
Characteristic	**Description**
Operating Frequency	904.6MHz, 923.3 - 927.5MHz for DTS LoRa 903.9MHz - 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:	2.3dBi (declared by client) for Dipole Antenna
Model of contained LoRa Module:	RAK2287X
FCC ID	2AF6B-RAK2287X
IC ID	25908-RAK2287X

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/cm²)	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/f²)	<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/f²)	<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/m²)**	**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	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

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/cm^2)
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/cm²)	FCC Limit (mW/cm²)
Lora	902-928MHz	30.26	1.062	0.094	0.601
WIFI	2.4GHz	31.74	0.77983	0.132	1.0

Mode	Band	PG (dBm)	PG (W)	Power Density (W/m²)	IC Limit (W/m²)
Lora	902-928MHz	30.26	1.062	0.939	2.74
WIFI	2.4GHz	31.74	0.77983	1.321	5.35

1.5.2 Simultaneous transmission MPE

FCC					
Operating Mode	Lora	WIFI	Sum Ratio	Limit	Verdict
Lora + WIFI	0.16	0.13	0.29	<1	Pass
IC					
Operating Mode	Lora	WIFI	Sum Ratio	Limit	Verdict
Lora + WIFI	0.34	0.25	0.59	<1	Pass

Note:
1. R = 0.3m