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 Soho Pro which supports Lora, 2.4GHz Wi-Fi and LTE technology.

Contains FCC ID: 2AF6B-RAK634, XMR2023EG915QNA.

Contains IC: 25908-RAK634, 10224A-023EG915QNA.

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

<table>
<tr><th>General Information of EUT</th><th>Value</th></tr>
<tr><td>Kind of Equipment</td><td>WisGate Soho Pro</td></tr>
<tr><td>Type Designation</td><td>RAK7267</td></tr>
<tr><td>Trademark</td><td>RAK</td></tr>
<tr><td>FCC ID</td><td>2AF6B-RAK7267</td></tr>
<tr><td>IC</td><td>25908-RAK7267</td></tr>
<tr><td>HVIN</td><td>RAK7267</td></tr>
<tr><td>Operating Voltage</td><td>DC 9-36V via Solar Battery Kits</td></tr>
<tr><td colspan="2">Technical Specification of Lora DTS</td></tr>
<tr><td>Operating Frequency</td><td>923.3 - 927.5MHz</td></tr>
<tr><td>Type of Modulation</td><td>Lora</td></tr>
<tr><td>Data Rate</td><td>SF7 – SF12
<table>
<tr><th>Data Rate</th><th>Configuration</th><th>Indicative physical bit rate [bit/sec]</th></tr>
<tr><td>0</td><td>LoRa Modulation: SF10 / Bandwidth 125 kHz</td><td>980</td></tr>
<tr><td>1</td><td>LoRa Modulation: SF9 / Bandwidth 125 kHz</td><td>1760</td></tr>
<tr><td>2</td><td>LoRa Modulation: SF8 / Bandwidth 125 kHz</td><td>3125</td></tr>
<tr><td>3</td><td>LoRa Modulation: SF7 / Bandwidth 125 kHz</td><td>5470</td></tr>
<tr><td>4</td><td>LoRa Modulation: SF8 / Bandwidth 500 kHz</td><td>12500</td></tr>
<tr><td>8</td><td>LoRa Modulation: SF12 / Bandwidth 500 kHz</td><td>980</td></tr>
<tr><td>9</td><td>LoRa Modulation: SF11 / Bandwidth 500 kHz</td><td>1760</td></tr>
<tr><td>10</td><td>LoRa Modulation: SF10 / Bandwidth 500 kHz</td><td>3900</td></tr>
<tr><td>11</td><td>LoRa Modulation: SF9 / Bandwidth 500 kHz</td><td>7000</td></tr>
<tr><td>12</td><td>LoRa Modulation: SF8 / Bandwidth 500 kHz</td><td>12500</td></tr>
<tr><td>13</td><td>LoRa Modulation: SF7 / Bandwidth 500 kHz</td><td>21900</td></tr>
</table></td></tr>
<tr><td>Channel Number</td><td>8 channels</td></tr>
<tr><td>Channel Separation</td><td>600 KHz</td></tr>
<tr><td>Occupied Bandwidth</td><td>500 KHz</td></tr>
<tr><td>Antenna Number:</td><td>1</td></tr>
<tr><td>Antenna Gain and Type:</td><td>Integral PCB ANT with 2.5dBi</td></tr>
<tr><td colspan="2">Technical Specification of Lora Hybrid</td></tr>
<tr><td>Frequency Range</td><td>903.9MHz - 905.3MHz</td></tr>
<tr><td>Type of Modulation</td><td>Lora</td></tr>
<tr><td>Data Rate</td><td>SF7 – SF10
<table>
<tr><th>Data Rate</th><th>Configuration</th><th>Indicative physical bit rate</th></tr>
</table></td></tr>
</table>

			[bit/sec]
	0	LoRa Modulation: SF10 / Bandwidth 125 kHz	980
	1	LoRa Modulation: SF9 / Bandwidth 125 kHz	1760
	2	LoRa Modulation: SF8 / Bandwidth 125 kHz	3125
	3	LoRa Modulation: SF7 / Bandwidth 125 kHz	5470
	4	LoRa Modulation: SF8 / Bandwidth 500 kHz	12500
	8	LoRa Modulation: SF12 / Bandwidth 500 kHz	980
	9	LoRa Modulation: SF11 / Bandwidth 500 kHz	1760
	10	LoRa Modulation: SF10 / Bandwidth 500 kHz	3900
	11	LoRa Modulation: SF9 / Bandwidth 500 kHz	7000
	12	LoRa Modulation: SF8 / Bandwidth 500 kHz	12500
	13	LoRa Modulation: SF7 / Bandwidth 500 kHz	21900
Channel Number	8 channels (DSS & DTS)		
Channel Separation	200 KHz		
Occupied Bandwidth	125 KHz		
Antenna Number:	1		
Antenna Gain and Type:	Integral PCB ANT with 2.5dBi		
Technical Specification of Contained LTE Module			
Characteristic	**Description**		
Operating Frequency	LTE Band: 2, 4, 5, 12, 13, 14, 66, 71 (LTE Band 14, 71 is not support for Canada)		
Type of Modulation	QPSK, 16QAM		
Antenna Gain:	3dBi@700MHz~960MHz, 1710~21700MHz (declared by client)		
Model of contained LTE module:	EG915Q-NA		
FCC ID	XMR2023EG915QNA		
IC ID	10224A-023EG915QNA		
Technical Specification of Contained 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:	2.0dBi for Ant0 (declared by client) 2.0dBi for Ant1 (declared by client)		
Model of contained Wi-Fi Module:	RAK634		
FCC ID	2AF6B-RAK634		
IC ID	25908-RAK634		

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	26.16	413.05	0.037	0.601
WIFI	2.4GHz	25.52	356.45	0.032	1.0
LTE	2	25.00	316.23	0.028	1.0
	4	25.00	316.23	0.028	1.0
	5	25.00	316.23	0.028	0.55
	12	25.00	316.23	0.028	0.47
	13	25.00	316.23	0.028	0.52
	14	25.00	316.23	0.028	0.53
	66	25.00	316.23	0.028	1.0
	71	25.00	316.23	0.028	0.44

Mode	Band	PG (dBm)	PG (W)	Power Density (W/m²)	IC Limit (W/m²)
Lora	902-928MHz	26.16	413.05	0.365	2.74
WIFI	2.4GHz	25.52	356.45	0.315	5.35
LTE	2	25.00	316.23	0.280	4.48
	4	25.00	316.23	0.280	4.24
	5	25.00	316.23	0.280	2.58
	12	25.00	316.23	0.280	2.30
	13	25.00	316.23	0.280	2.47
	66	25.00	316.23	0.280	4.24

1.5.2 Simultaneous transmission MPE

FCC						
Operating Mode	**Lora**	**WIFI**	**LTE**	**Sum Ratio**	**Limit**	**Verdict**
Lora + WIFI + WCDMA/LTE	0.062	0.032	0.064	0.158	<1	Pass
IC						
Operating Mode	**Lora**	**WIFI**	**LTE**	**Sum Ratio**	**Limit**	**Verdict**
Lora + WIFI + WCDMA/LTE	0.133	0.059	0.066	0.258	<1	Pass

Note: R = 0.3m