

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 IEEE 802.11 b/g/n 2.4GHz 2T2R Wi-Fi Module.

This report is for FCC CIIPC and ISED C4PC as changed transmit antennas and will be installed into HOST WisGate Soho Pro (MN: RAK7267), radiated spurious emissions for 2.4G WIFI and co-location were re-performed.

HOST WisGate Soho Pro (MN: RAK7267) has Lora, 2.4G WIFI (contains FCC ID: 2AF6B-RAK634, IC: 25908-RAK634) and LTE (contains FCC ID: XMR2023EG915QNA, IC: 10224A-023EG915QNA) functions.

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

| General Information of EUT | | Description |
|----------------------------|--|---------------------------------|
| Kind of Equipment: | | Wi-Fi Module |
| Type Designation: | | RAK634 |
| HMN: | | RAK7267 |
| Operating Voltage: | | DC 9-36V via Solar Battery Kits |

| 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: | 5 MHz |
| Antenna Gain: | 2 |

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 | PG (W) | Power | FCC Limit |
|------|------|----|--------|-------|-----------|
| | | | | | |

| | | (dBm) | | Density (mW/cm ²) | (mW/cm ²) |
|------|--------|-------|--------|-------------------------------|-----------------------|
| WIFI | 2.4GHz | 25.52 | 356.45 | 0.032 | 1.0 |

| Mode | Band | PG (dBm) | PG (W) | Power Density (W/m ²) | IC Limit (W/m ²) |
|------|--------|----------|--------|-----------------------------------|------------------------------|
| WIFI | 2.4GHz | 25.52 | 356.45 | 0.315 | 5.35 |

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:

1. R = 0.3m