

RF Exposure evaluation

| | |
|----------------------|---|
| FCC ID | 2AIT9-PG-500 |
| Product Name | Alarm Host |
| Model/Type reference | PG-500 |
| Exposure category | General population/uncontrolled environment |
| EUT Type | Production Unit |
| Device Type | Mobile Device |

1. Reference

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radio frequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radio frequency radiation exposure evaluation: mobile devices

2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| 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 – 1500 | / | / | f/300 | 6 |
| 1500 – 100,000 | / | / | 5 | 6 |

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled 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 – 1500 | / | / | f/1500 | 30 |
| 1500 – 100,000 | / | / | 1.0 | 30 |

F=frequency in MHz

*=Plane-wave equivalent power density

3. MPE Calculation Method

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S=PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

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

4. Antenna Information

FLW8189FSA7-A WiFi module can only use antennas certificated as follows provided by manufacturer;

| Antenna No. | Type of antenna: | Gain of the antenna (Max.) | Frequency range: |
|-------------|------------------|----------------------------|------------------|
| 2.4GWIFI | Metal antenna | 3.1dBi | 2400-2500MHz |
| 433M | Metal antenna | -2.9dBi | |

5. Conducted Peak Output Power

| Mode | Channel | Peak Output Power (dBm) |
|-----------|---------|-------------------------|
| 11b | 1 | 17.42 |
| | 6 | 16.71 |
| | 11 | 17.84 |
| 11g | 1 | 18.97 |
| | 6 | 18.42 |
| | 11 | 19.80 |
| 11n(HT20) | 1 | 18.83 |
| | 6 | 18.21 |
| | 11 | 19.67 |
| 11n(HT40) | 3 | 17.88 |
| | 6 | 17.81 |
| | 9 | 18.03 |

TX frequency range: 433.92MHz

Device category: Portable device (Distance: 20cm) Max. Field Strength: 60.60dBuV/m @3m

EIRP=E-104.8+20logD=53.63-104.8+20log3=-41.63dBm

Maximum Conducted Output Power: -41.63dBm

Tune-up: -41 ± 1

6. Manufacturing Tolerance

2.4GWIFI

| Mode | 11b | | |
|----------------------|-----------|-----------|------------|
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 17 | 16 | 17 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| Mode | 11g | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 18 | 18 | 19 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| Mode | 11n(HT20) | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 18 | 18 | 19 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| Mode | 11n(HT40) | | |
| Channel | Channel 3 | Channel 6 | Channel 9 |
| Target (dBm) | 17 | 17 | 18 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

7. Standalone MPE Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna is 3.1dBi, the RF power density can be obtained.

| Mode | Output power | | Antenna Gain (dBi) | Antenna Gain(linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------|--------------|--------|--------------------|----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| 11b | 18 | 63.10 | 1.37 | 1.37 | 0.01721 | 1.0000 |
| 11g | 20 | 100.00 | 1.37 | 1.37 | 0.02727 | 1.0000 |
| 11n(HT20) | 20 | 100.00 | 1.37 | 1.37 | 0.02727 | 1.0000 |
| 11n(HT40) | 19 | 79.43 | 1.37 | 1.37 | 0.02166 | 1.0000 |

Remark:

1. Output power (Peak) including turn-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

| Band/Mode | f (GHz) | RF output power | | Antenna Gain (dBi) | Antenna Gain(linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------|------------|-----------------|--------|--------------------------|-------------------------|------------------------------|--|
| | | dBm | mW | | | | |
| ASK | 0.433 | -40 | 0.0001 | -2.90 | 0.51 | 0.000005 | 0.2893 |

8. Simultaneous Transmission MPE Evaluation

The EUT equipped with one 2.4GWIFI antenna and one 433MHz antenna. so need consider simultaneous transmission;

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\Sigma \Sigma$ of MPE ratios ≤ 1.0

| Ant0: 2.4GWIFI MPE ratios | Ant1: 433M MPE ratios | Σ MPE ratios | Limit | Results |
|---------------------------------|-----------------------------|---------------------|-------|---------|
| 0.02727 | 0.000019 | 0.027289 | 1.0 | Pass |

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----End of the report-----