

RF Exposure Report

Standard Applicable

For The radiation source included into the device the output power is taken from a corresponding RF test report. If needed the output power is converted to source based, time – average out power. Finally the output power is compared to FCC and IC low power SAR evaluation exemption level.

According to §2.1093

FCC SAR test exclusion:

According to KDB 447498 D01 General RF Exposure Guidance v06, Appendix A requirement, “The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.”

4.3.1. Standalone SAR test exclusion considerations

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.²³ The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.²⁴

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}^{25} \text{ where}$$

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation²⁶
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Tune-Up Power:

| | |
|----------------------|--|
| Frequency Range: | 2402 – 2480MHz |
| Tune-Up Power: | 2.69dBm +/- 1.0 dBm |
| Antenna Designation: | Fixed PCB Ant , 0.5dBi Iplex type detachable PIFA Antenna , 2.0 +/- 0.5 dBi Iplex type detachable PCB Antenna , 2.0 +/- 0.5 dBi Iplex type detachable Dipole Antenna , 4.5 +/- 0.5 dBi The antennas above comply with FCC 15.203 requirements. |

Conducted Power

| | | | |
|------------------------|-------------------------|-------------------|-------------------|
| Operation Mode: | Normal Operation | Test Date: | 2019/06/17 |
|------------------------|-------------------------|-------------------|-------------------|

| Frequency (MHz) | Peak Reading Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|--------------------------|------------------|-----------|
| Low | 2.66 | 0.00185 | 1 |
| Mid | 2.69 | 0.00186 | 1 |
| High | 2.64 | 0.00184 | 1 |

2 Mbps

| Frequency (MHz) | Peak Reading Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|--------------------------|------------------|-----------|
| Low | 2.32 | 0.00171 | 1 |
| Mid | 2.38 | 0.00173 | 1 |
| High | 2.29 | 0.00169 | 1 |

offset:0.5

SAR test exclusion Evaluation Result:

FCC(The worst case):

| Frequency (MHz) | Max power (dBm) | Antenna Gain(dBi) | EIRP Power (dBm) | tune-up tolerance(dB) | Max power (mW) | Min Distance (mm) | Result | Limit (3.0 @ 1g SAR) |
|-----------------|-----------------|-------------------|------------------|-----------------------|----------------|-------------------|--------|----------------------|
| 2402 | 2.66 | 5.00 | 7.66 | 1 | 7.345139 | 5.00 | 2.277 | 3.0 |
| 2442 | 2.69 | 5.00 | 7.69 | 1 | 7.396053 | 5.00 | 2.312 | 3.0 |
| 2480 | 2.64 | 5.00 | 7.64 | 1 | 7.311391 | 5.00 | 2.303 | 3.0 |

$$\text{Max Power(mW)} = 10^{((\text{Max Power(dBm)} + \text{Tune-up tolerance(dB)})/10)}$$

$$\text{Result} = \text{Max Power (mW)} / \text{min. distance(mm)} * \sqrt{f(\text{GHz})}$$

Maximum Permissible Exposure (MPE)

Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|----------------------------------|----------------------------------|--|----------------------------|
| Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *(180/f ²) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | / | / | F/1500 | 30 |
| 1500-15000 | / | / | 1.0 | 30 |

F = frequency in MHz

* = Plane-wave equipment power density

Maximum Permissible Exposure (MPE) Evaluation

| | | |
|---|-------------|-----------------------|
| Maximum output power at antenna input terminal: | 2.69 | (dBm) |
| Maximum output power at antenna input terminal: | 1.857804455 | (mW) |
| Tune-Up power Tolerance: | 1 | dB |
| Duty cycle: | 100 | (%) |
| Maximum Pav : | 2.338837239 | (mW) |
| Antenna gain (typical): | 5 | (dBi) |
| Maximum antenna gain: | 3.16227766 | (numeric) |
| Prediction distance: | 20 | (cm) |
| | | |
| MPE limit for uncontrolled exposure at prediction | 1 | (mW/cm ²) |
| Power density at predication frequency at 20 (cm) | 0.0014721 | (mW/cm ²) |

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

Measurement Result:

The predicted power density level at 20 cm is 0.0014721 mW/cm².. This is below the uncontrolled exposure limit of 1 mW/cm².

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