

5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

5.1 §15.247 (i) and §2.1093/ RSS-102[2.5.2] – RF Exposure

Standard Requirement:

According to §15.247 (i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

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:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}^{16} \text{ where}$$

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation¹⁷
- The result is rounded to one decimal place for comparison

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 is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

Two antennas are available for the EUT (WIFI antenna, GPS antenna). The minimum separation distances is 10 mm.

The maximum average output power (turn-up power) in low channel of WIFI is -4.796 dBm = 0.33 mW

The calculation results = $0.33 / 10 * \sqrt{2.402} = 0.051 < 3$

The maximum average output power (turn-up power) in middle channel of WIFI is -5.391 dBm = 0.29 mW

The calculation results = $0.29 / 10 * \sqrt{2.44} = 0.045 < 3$

The maximum average output power (turn-up power) in high channel of WIFI is -6.544 dBm = 0.22 mW

The calculation results = $0.22 / 10 * \sqrt{2.48} = 0.035 < 3$

According to KDB 447498, no stand-alone required for WIFI antenna, and no simultaneous SAR measurement is required.

According to RSS-102 [2.5] Exemption from Routine Evaluation Limits.

All transmitters are exempt from routine SAR and RF exposure evaluations provided that output power complies with the power levels of sections 2.5.1 or 2.5.2. If the equipment under test (EUT) meets the requirements of sections 2.5.1 or 2.5.2, applicants are only required to submit a properly signed declaration of compliance (see Annex C). The information contained in the RF exposure technical brief may be limited to information that demonstrates how the output power of the transmitter was derived.

If the EUT does not meet the appropriate exemption limit, a complete SAR or RF exposure evaluation shall be performed.

It must be emphasized that the above exemption from routine evaluation is not an exemption from compliance.

2.5.1 Exemption from Routine Evaluation Limits – SAR Evaluation

SAR evaluation is required if the separation distance between the user and the radiating element of the device is less than or equal to 20 cm, except when the device operates as follows:

- from 3 kHz up to 1 GHz inclusively, and with output power (i.e. the higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 200 mW for general public use and 1000 mW for controlled use;
- above 1 GHz and up to 2.2 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 100 mW for general public use and 500 mW for controlled use;
- above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use and 100 mW for controlled use;
- above 3 GHz and up to 6 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 10 mW for general public use and 50 mW for controlled use.

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the output power of the device was derived.

The maximum e.i.r.p. of BLE is $-2.796 \text{ dBm} = 0.53 \text{ mW} < 20 \text{ mW}$.

Note: The maximum e.i.r.p. = the maximum output power (turn-up power) + the antenna gain (2dBi).

Test Result: Pass