



RF Exposure Analysis – Routine Evaluation Exemption

Applicant: ABB S.p.A.
FCC ID: 2AW2L-TSENSEBUS
Model number/name: T-Sense Busbars

The above device operates in the 2402-2483.5 MHz frequency band (BLE).

The following FCC Rule Parts are applicable:

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

Part 1.1307(b)(3)(i)(A) – 1 mW Blanket Exemption (i)

Part 1.1307(b)(3)(i)(C) – MPE-based Exemption (ii)

Part 1.1307(b)(3)(i)(B) – SAR-based Exemption (iii)

For the above device:

Transmitter frequency range = 2402 MHz to 2483.5 MHz

Maximum Conducted Power = 5.07 dBm (including tune-up tolerance)

Antenna gain: 2.7 dBi

Duty Cycle: 100 %

EIRP = 5.07 dBm + 2.7 dBi = 7.77 dBm

ERP = EIRP - 2.15 dBm = 5.62 dBm (3.65 mW)

Minimum separation distance (R) to be considered: **0.2 m**

Evaluation:

RF exemption applies if the maximum time-averaged transmitted power is less than the maximum of the following three criteria:

- i) Less than 1 mw Blanket exemption. $P_{TH} = 0.001 \text{ W}$ – §1.1307(b)(3)(i)(A) – not met
- ii) determination of exemption under the MPE-based §1.1307(b)(3)(i)(C), if i) not met
- iii) determination of exemption under the SAR-based §1.1307(b)(3)(i)(B) if both i) and ii) are not met;

Determination of exemption under the MPE-based §1.1307(b)(3)(i)(C):

This is only applicable at a separation distance greater than $\lambda/2\pi$ and at frequencies from 0.3 MHz to 100 GHz.

For 2.4 GHz operation: $\lambda/2\pi = \underline{0.02 \text{ m}}$

It follows that this clause is applicable since the separation distance (R) equals **0.2 m** which is greater than **0.02 m**.

Threshold ERP P_{TH} (watts) for the frequency range of 1.5-100 GHz: $19.2 * R^2$

$R = 0.2 \text{ m}$

$P_{TH} = (19.2 * 0.2^2) \text{ W} = \underline{0.768 \text{ W}}$ (**768 mW**)

Determination of exemption under the SAR-based §1.1307(b)(3)(i)(B):

This method shall only be used at separation distances from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz.

$$P_{th} (mW) = \begin{cases} ERP_{20cm} * (d/20 \text{ cm})^x & d \leq 20cm \\ ERP_{20cm} & 20cm < d \leq 40cm \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm} * \sqrt{f}} \right) \quad \text{and } f \text{ is in GHz}$$

and

$$ERP_{20cm} (mW) = \begin{cases} 2040 * f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

For a minimum separation distance of 0.2 m, the threshold for operation at 2.4 GHz is 3060 mw

Conclusion:

The maximum ERP of **3.65 mW** is below the applicable **768 mW** threshold for operation at 2.4GHz, and therefore the above device is exempt from evaluation in accordance with §1.1307(b)(3)(i)(C).

Certification Body

UL International (UK) Ltd