Calculation:
RF-Exposure for 2.4 GHz Bluetooth Low Energy transmitter

Type identification: ILB BT ADIO MUX
FCC ID: YG3ADIOMUX

Subject of Investigation

According the 47CFR §2.1091 the ILB BT ADIO MUX from PHOENIX CONTACT Electronics GmbH (FCC ID: YG3ADIOMUX) has been defined as a mobile device, used in such a way that a separation distance of at least 20 cm is normally maintained between the device and the user. The human exposure to RF emissions from such devices could be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and / or power density. The limits for Occupational / Controlled Exposure are given in Table 1, the limits for General Population / Uncontrolled Exposure are given in Table 2.

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm²]	Averaging Time $\|E\|^2$,$\|H\|^2$ or S [min]
0.3 – 3.0	614	1.63	(100)*	6
3.0 – 30	1842/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500			f/300	
1500 – 100,000			5	

Table 1: Limits for Occupational / Controlled Exposure.

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm²]	Averaging Time $\|E\|^2$,$\|H\|^2$ or S [min]
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500			f/1500	30
1500 – 100,000			1.0	

Table 2: Limits for General Population / Uncontrolled Exposure.

Note: f = frequency in MHz; * Plane – wave equivalent power density

MPE evaluation

In accordance to the **CFR Part 47, §2.1091**

S: Limit for power density according to CFR Part 47, §1.1310:

1 mW/cm^2

P: 3.16 mW (rated output power)

G: 9 dBi = 7.9

D: Duty cycle: 100 % = 1

R: Distance in what the limit of S has to be reached: 0.2 m

$$S = \frac{P \cdot G \cdot D}{4 \cdot \pi \cdot R^2} \Rightarrow \underline{\underline{S}} = \frac{3.16mW \cdot 7.9 \cdot 1}{4 \cdot \pi \cdot (20cm)^2} = \underline{\underline{0.00496 \frac{mW}{cm^2}}}$$

The value for the “General population / Uncontrolled Exposure” of the power density is below the limit of CFR Part 47, §1.1310.

Limits and calculated results

The results for ILB BT ADIO MUX are given in Table 3 and based on the rated output power shown in the user manual of the device.

Band	CH	f [MHz]	d [cm]	EIRP [dBm]	EIRP [mW]	Power Density [mW/cm²]	Limit of Power Density [mW/cm²]	Evaluation Result
2.4 GHz	0	2402	20	14	25	0.00496	1.0	Complies

Table 3: Calculated results for the ILB BT ADIO MUX compared to the limit for uncontrolled exposure.

The ILB BT ADIO MUX from PHOENIX CONTACT Electronics GmbH (FCC ID: YG3ADIOMUX) is in compliance with the maximum permissible exposure (MPE) limits for the Power Density given by the FCC 47CFR §1.1310 (4)(e) Table 1.