

RF EXPOSURE

FCC ID : 2BO3L-TMCDD15

1. FCC Regulation

According to §15.247(i) 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 levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissible Exposure: RF exposure is calculated.

Frequency Range	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 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	1	30

f=frequency in MHz, *= plane-wave equivalent power density

MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm²]

P = Power input to antenna [mW]

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 [cm]

2. RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

MPE Calculations : Bluetooth LE (Front)

- Frequency Range : 2402 MHz ~ 2480 MHz
- Measured RF Maximum Output Power : 7.81 dBm
- Target Power & Tolerance 10.00 dBm & $\pm$ 3.00 dB
(Maximum : 13.00 dBm & Minimum : 7.00 dBm)
- Maximum Peak Antenna Gain : -1.18 dBi
- Maximum Output Power for the Calculation : 13.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

- EIRP = P + G = <u>13.00</u> dBm + <u>-1.18</u> dBi = <u>11.82</u> dBm = <u>15.21</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = <u>15.21</u> / (4 X 20² X π) = <u>0.003 025</u> mW/cm² (Limit : 1.00)	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : Thread (Rear)

- Frequency Range : 2405 MHz ~ 2480 MHz
- Measured RF Maximum Output Power : 9.44 dBm
- Target Power & Tolerance 10.00 dBm & $\pm$ 3.00 dB
(Maximum : 13.00 dBm & Minimum : 7.00 dBm)
- Maximum Peak Antenna Gain : 0.45 dBi
- Maximum Output Power for the Calculation : 13.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

- EIRP = P + G = <u>13.00</u> dBm + <u>0.45</u> dBi = <u>13.45</u> dBm = <u>22.13</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = <u>22.13</u> / (4 X 20² X π) = <u>0.004 403</u> mW/cm² (Limit : 1.00)	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : Bluetooth LE (Rear)

- Frequency Range : 2402 MHz ~ 2480 MHz
- Measured RF Maximum Output Power : 8.17 dBm
- Target Power & Tolerance 10.00 dBm & $\pm$ 3.00 dB
(Maximum : 13.00 dBm & Minimum : 7.00 dBm)
- Maximum Peak Antenna Gain : 0.45 dBi
- Maximum Output Power for the Calculation : 13.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

- EIRP = P + G = <u>13.00</u> dBm + <u>0.45</u> dBi = <u>13.45</u> dBm = <u>22.13</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R ² π) = <u>22.13</u> / (4 X 20 ² X π) = <u>0.004 403</u> mW/cm ² (Limit : 1.00)	- NOTE S : Maximum Power Density (mW/cm ²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : NFC

- Frequency Range :	<u>13.56</u>	MHz		
- Fundamental Peak Power :	62.1	dBuV/m	- EIRP	-33.13 dBm
- EIRP			0.000 486 407	mW
- Prediction frequency			20	cm
- Power density at prediction frequency			0.000 000 097	mW/cm ²
- MPE limit for uncontrolled exposure at prediction frequency			0.978 933 354	mW/cm ²

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

- EIRP = EIRP(dBm) = <u>Field Strength(dBuV/m) -95.23</u>	- NOTE
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Power Density at the specific separation

- S = $EIRP / (4 \times R^2 \pi)$	- NOTE S : Maximum Power Density (mW/cm ²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : BLE(Front) + Thread + UWB + NFC

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

simultaneous MPE

Bluetooth LE (Front) + Thread + UWB + NFC

- Total (%) = $ \begin{aligned} & [\text{Bluetooth LE Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{Thread Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{UWB Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{NFC Result(mW/cm2)} / \text{Limit(mW/cm2)}] * 100 \\ & = [\underline{0.003\ 025} / 1] + \\ & \quad [\underline{0.004\ 403} / 1] + \\ & [\underline{0.000\ 000\ 099} / 1] + \\ & [\underline{0.000\ 000\ 097} / 0.978\ 933\ 354] * 100 \\ & = \underline{0.743} \% \end{aligned} $	- NOTE BLE(Front) + Thread + UWB + NFC BLE(Front) = <u>0.003 025</u> mW/cm2 Thread = <u>0.004 403</u> mW/cm2 UWB = <u>0.000 000 099</u> mW/cm2 Note1 NFC = <u>0.000 000 097</u> mW/cm2 Distance to the center of the radiation of the antenna (<u>20</u> cm) Limit : ≤ 100 %
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Note 1: EIRP value of the certified module report was used
Report No. : HCT-RF-2608-FI001-R1

MPE Calculations : BLE(Front) + BLE(Rear) + UWB + NFC

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE Calculations for this exposure is shown below.

simultaneous MPE

Bluetooth LE (Front) + Bluetooth LE (Rear) + UWB + NFC

- Total (%) = $ \begin{aligned} & [\text{BLE(Front) Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{BLE(Rear) Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{UWB Result(mW/cm2)} / \text{Limit(mW/cm2)}] + \\ & [\text{NFC Result(mW/cm2)} / \text{Limit(mW/cm2)}] * 100 \\ & = [\underline{0.003\ 025} / 1] + \\ & \quad [\underline{0.004\ 403} / 1] + \\ & [\underline{0.000\ 000\ 099} / 1] + \\ & [\underline{0.000\ 000\ 097} / 0.978\ 933\ 354] * 100 \\ & = \underline{0.743} \% \end{aligned} $	- NOTE BLE(Front) + Thread + UWB + NFC BLE(Front) = <u>0.003 025</u> mW/cm2 BLE(Rear) = <u>0.004 403</u> mW/cm2 UWB = <u>0.000 000 099</u> mW/cm2 Note1 NFC = <u>0.000 000 097</u> mW/cm2 Distance to the center of the radiation of the antenna (<u>20</u> cm) Limit : ≤ 100 %
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Note 1: EIRP value of the certified module report was used
Report No. : HCT-RF-2607-FC004