

RF Exposure Analysis for the Belimo Automation AG ZIP-BT-NFC

FCC ID: 2ALENZIP-BT-NFC

The product (FCC ID: 2ALENZIP-BT-NFC) is a 13.56MHz RF ID device that also contains a FCC certified BT LE module (FCC ID: QOQBGM113).

Analysis for FCC mobile use of the 13.56MHz RF ID

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The following equation applies:

$$S = \text{EIRP}/4 \pi R^2$$

Where: S = Power density

EIRP = Effective Isotropic Radiated Power ($\text{EIRP} = P \times G$)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

Power Density Requirement

From FCC Rule Part 1.1310 Table 1 - Limits for General Population/
Uncontrolled Exposure, $S=0.98 \text{ mW/cm}^2$ at 13.56MHz

$S = 180 / f^2$ (f is frequency in MHz)

At 13.56MHz, $S = 180 / (13.56)^2$

$S = 0.98 \text{ mW/cm}^2$

$\text{EIRP} = -25 \text{ dBm}$ ($3.2 \mu\text{W}$ or 0.0032 mW)

Calculation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 0.0032 / (12.56 \times 20^2)$$

$$S = 0.0032 / (5024)$$

$$S = 6.4 \times 10^{-7} \text{ mW/cm}^2$$

Conclusion

This demonstrates the ZIP-BT-NFC meets the requirement of $S = 0.98 \text{ mW/cm}^2$ for $>20\text{cm}$ module usage, and equates to a safe operating distance of **0.02cm**.

The FCC requires that when a module is integrated in to a host device that the integrated module remains compliant within the host device.

Analysis for FCC mobile use of the BT module

The FCC requires that the calculated MPE be equal to or less than a given limit dependent on frequency at a distance of 20 cm from a device to the body of a user.

The following equation applies:

$$S = \text{EIRP} / 4 \pi R^2$$

Where: S = Power density

EIRP = Effective Isotropic Radiated Power ($\text{EIRP} = P \times G$)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (safe operating distance)

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Power Density Requirement

From FCC Rule Part 1.1310 Table 1 - Limits for General Population/
Uncontrolled Exposure, $S=1.0 \text{ mW/cm}^2$ for 2.4GHz

$$S = 1.0 \text{ mW/cm}^2$$

$$P_{\max} = +4.5 \text{ dBm (2.8mW)}$$

$$G = +0.5 \text{ dBi max (as stated in BT LE module test report)}$$

$$\text{EIRP} = 5.0 \text{ dBm (3.2mW)}$$

Calculation:

$$S = \text{EIRP} / 4 \pi R^2$$

$$S = 3.2 / (12.56 \times 20^2)$$

$$S = 3.2 / (5024)$$

$$S = 6.3 \times 10^{-4} \text{ mW/cm}^2$$

Conclusion

This demonstrates the ZIP-BT-NFC meets the requirement of $S = 1.0 \text{ mW/cm}^2$ for $>20\text{cm}$ module usage, and equates to a safe operating distance of **0.50cm**.

Signature:  Date: 16.06.2017