RF Exposure Evaluation for SoClean 3.0/EzClean

FCC ID: 2AVU3-SC1400

BLE RF exposure evaluation

The following information provides the minimum separation distance for the antenna as part of the design for the SoClean 3.0 and EzClean as calculated from the FCC OET Bulletin 65, Appendix A, Table (B) Limits for General Population/Uncontrolled Exposure. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering a 1.0mW/cm^2 uncontrolled exposure limit for the frequency range of 1500MHz – 100,000MHz. The power density formula used was:

$$S = \frac{P * G}{4\pi R^2}$$

Measured Conducted Power = 5.09 dBm

Manufacturer Output Power Rating = 4 dBm
Maximum Rated output Power = 6 dBm
Max Antenna gain is 0 dBi
R = 20.0cm

EIRP = 6 dBm
Converting 6 dBm to mW = 3.98 mW

$$S = \frac{3.98mW}{4\pi 20^2} = 0.00079 \frac{mW}{cm^2}$$

In the frequency range of 1500 – 100,000 MHz, the MPE limit is 1.0 mWcm^{-2} for general population and uncontrolled exposure. As the measured conducted power density is below this limit at a distance of 20cm^2, SAR testing is not required for this device.

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RFID RF exposure evaluation

The following information provides the minimum separation distance for the antenna as part of the design for the SoClean 3.0 and EzClean as calculated from the FCC OET Bulletin 65, Appendix A, Table (B) Limits for General Population/Uncontrolled Exposure. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering a $(180/f^2)$ mW/cm^2 uncontrolled exposure limit for the frequency range of 3MHz – 30MHz. The power density formula used was:

$$S = \frac{P * G}{4\pi R^2}$$

13.56 MHz RFID module:
Frequency range for RFID: 13.553 MHz to 13.567 MHz
Measured Field Strength is 62.59 dBuV/m
Assumed Field Strength tolerance = ±3dB
Antenna gain is 0dBi

The maximum allowed field strength with tolerance is 65.59 dBuV/m at 3m in frequency 13.56 MHz

The EIRP = [(FS*D)^2*1000 / 30] = 0.0011mW

The power density at 20cm = 0.0011mW * 1.00/(4πR^2) = 0.00000022 mWcm^{-2}

$(180/f^2) = (180/13.56^2) = 0.979$ mWcm^{-2}

In the frequency range of 1.34 MHz – 30 MHz, the MPE limit is $(180/f^2)$ mW/cm^2 for general population and uncontrolled exposure. As the measured conducted power density is below this limit at 20cm^2, SAR testing is not required for this device.

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Combined RF Exposure Evaluation

Using the calculated power densities for the BLE transmitter and RFID transmitter above, this section calculates and evaluates the simultaneous transmission exposure.

$$Combined\ Exposure = \frac{S_{BLE}}{1.0\ \frac{mW}{cm^2}} + \frac{S_{RFID}}{\frac{180}{f^2}\frac{mW}{cm^2}} = 0.00079$$

The 0.079% simultaneous exposure falls underneath the 100% exposure limit for simultaneous transmission. Thus, SAR testing is not required for this device.