

47 C.F.R. Part 1, Subpart I, Section 1.1310

47 C.F.R. Part 2, Subpart J, Section 2.1091

47 C.F.R. Part 2, Subpart J, Section 2.1093

447498 D04 Interim General RF Exposure Guidance v01

Maximum Permissible Exposure Calculations

For: Pura Scents

FCC ID: 2BA2Z-PURAPLUSV1

EUT Device Category = General Population/Uncontrolled Exposure

EUT consists of the following:

Bluetooth LE transceiver operating from 2402 MHz to 2480 MHz (Certified Module)

2 RFID/NFC transmitters operating at 13.56 MHz

The distance used for separation in all cases is 20 mm even though in real use the separation should be much greater. If compliant at the worst possible case of 20 mm, the device is assumed to comply at greater separation distances.

MPE Summary:

According subpart 1.1307 (b)(1) and 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure						
Frequency (MHz)	Range	Electric Strength (V/m)	Field Magnetic Strength (A/m)	Field	Power Density (mW/cm²)	Averaging Time (Minutes)
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
300-1500	/		/		f/1500	30
1500-100,000	/		/		1.0	30

f = frequency in MHz;

* = Plane-wave equivalent power density

Calculated Formulary:

Predication of MPE limit at a given distance:

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

PG = EIRP

MPE and Limit are calculated as follows:

BLE Module, Highest Power Channel

2.402 GHz to 2.48 GHz Frequency Band							
BLE Transceiver							
Freq	Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (dBm)	Max EIRP (mW)	Power Density at 20 cm (mW/cm ²)	Limit (mW/cm ²)	Margin (mW)
2480	7.0	3.4	10.4	10.96	0.218	1.000	0.782

Result: The device meets FCC MPE limit at 20 cm for General Population/Uncontrolled Exposure as specified in 47 CFR §1.1310 and §2.1091

NFC Radio, Since the 2 radios cannot simultaneously transmit, only the highest of the two was calculated.

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions.

NFC Maximum EIRP = 0.000000137 W (at frequency = 13.56MHz) < 1mW

Result: Exempt RF Device

Multiple Transmitter Ratio Test:

FCC Rule Part 1.1307(b)(3)(ii):(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source(separation is not required).(B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Freq (MHz)	Distance	EIRP (dBm)	ERP (dBm)	ERP (mW)	Limit (mW)	Ratio
2480	20 cm	10.4	8.25	6.7	768	0.00872
13.56	20 cm	-38.63	-40.78	0.00014	1.0	0.00014

BLE Ratio + NFC Ratio = 0.00886 < 1, therefore **PASS**