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IC: 2309A-CXA

EN2242 / EN2244
HVIN: 00104-02

EN2242/EN2244 EchoStream® Pendant Series Transceiver Calculation of SAR Test Exclusion Threshold

Operating Conditions:

The product has three radio transmission states: STANDBY, SINGLE ALARM, and REPEATED ALARM. Table 1 shows the worst-case on-time for each transmitter in the different states.

Product State	Worst Case Transmitter On-Time in 360 seconds	
	EchoStream® 902.4 - 927.6 MHz (sec)	Bluetooth Low Energy (BLE) 2402, 2426, and 2480 MHz (sec)
STANDBY (CHECK-IN)	0.198	0.003
SINGLE ALARM	0.726	0.660
REPEATED ALARM	$0.726 \times 360 / 5.2 = 50.3$	$0.660 \times 360 / 5.2 = 46.6$

Table 1: Worst Case Transmitter On-Time for Each Transmitter in a 6 Minute Period.

SBTA factor calculation

The REPEATED ALARM state is the worst-case transmitter on-time over a 360 second period. The worst-case duty cycle is fixed by design and complies with source based time-averaging pursuant to 47 CFR § 2.1093 for exposure derating. Product hardware design prevents simultaneous transmissions in both bands and the SAR Text Exclusion threshold is calculated for each band separately.

Worst Case SBTA Factor for 2400-2483 MHz = $46.6 \text{ sec} / 360 \text{ sec} \times 100\% = 12.9\%$

Worst Case SBTA Factor for 902.4-927.6 MHz = $50.3 \text{ sec} / 360 \text{ sec} \times 100\% = 14.0\%$

Antenna Separation

The worst-case separation between the BLE transmitter antenna and operator of 1.73 mm is maintained by the transmitter enclosure as shown in Figure 2 below. The worst-case separation between the EchoStream® transmitter antenna and operator of 1.6 mm is maintained by the transmitter enclosure as shown in Figure 3 below.

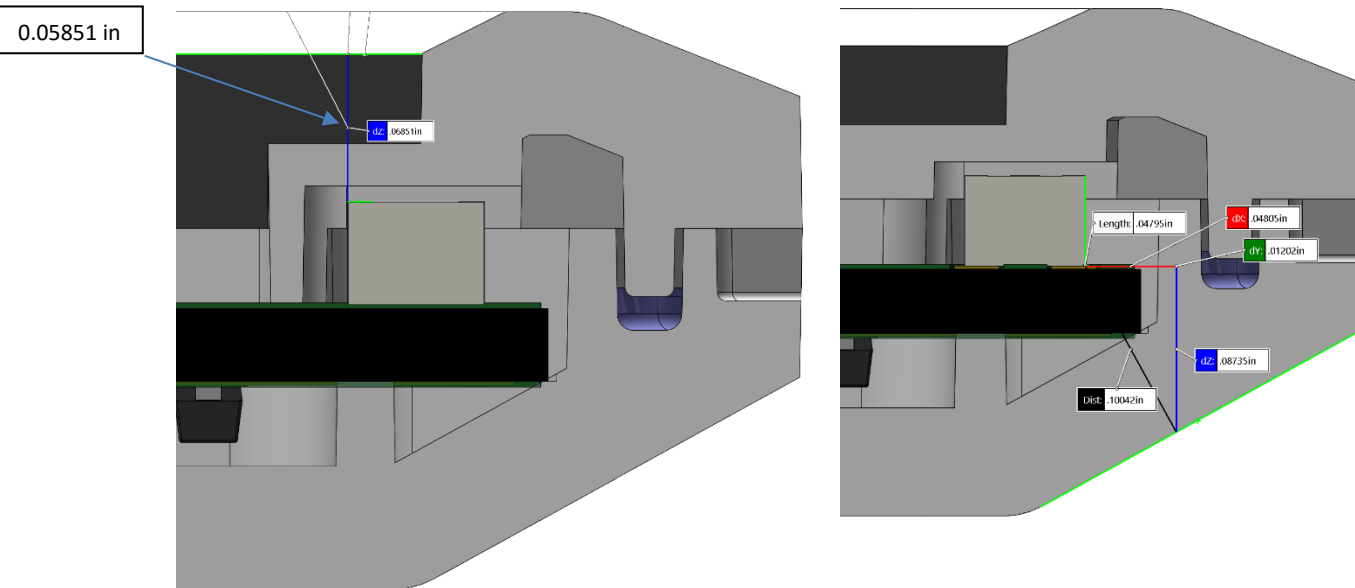


Figure 2: Cross section of product through the antennas showing the minimum distance between the operator extremities and body. 2402-2480 MHz antenna separation is 0.068" and 0.10" between operator fingers and body, respectively closest point from top and bottom. The minimum distance is then 1.73mm.

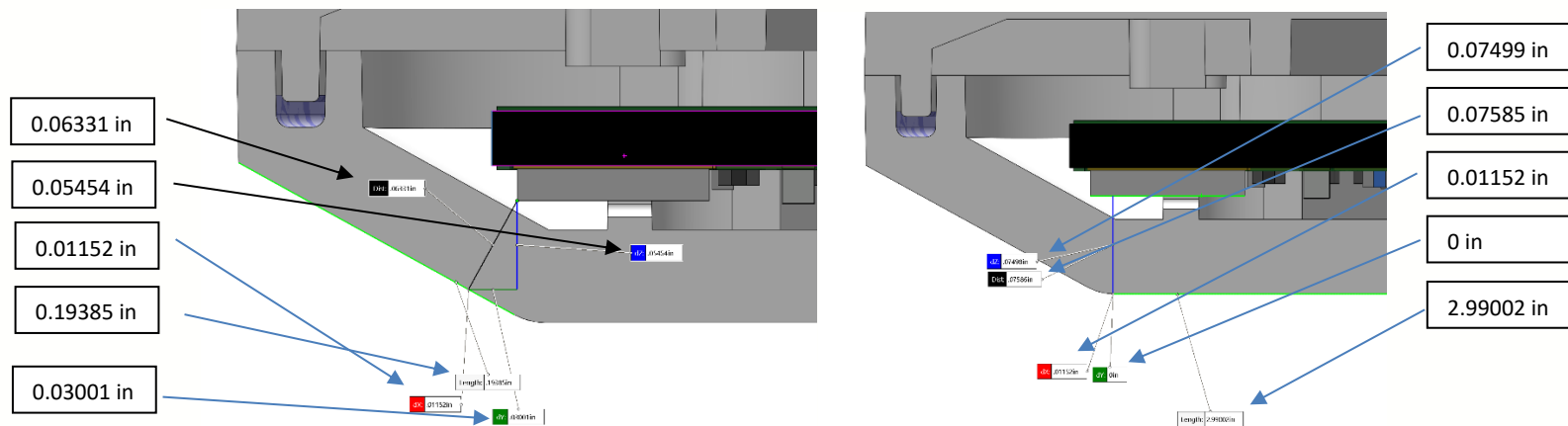


Figure 3: Cross section of product through the antennas showing the minimum distance between the operator extremities and body (dimensions are in inches). 902.4-927.6 MHz antenna separation is 0.063" or 0.075" between operator fingers or body depending on angle. The minimum distance is then 1.6mm.



SAR Exclusion Threshold Calculation:

The product could be worn as a neck pendant, on the belt clip, placed in a pocket or mounted for fixed position signaling; the following analysis shows the SBTA SAR power threshold. Inovonics elects to use KDB 447498 D01v06 to demonstrate exemption from SAR testing for this application. Power is calculated not through a per channel duty factor, rather is a total time on vs off time.

Product SBTA Power Calculation³

For the 2400.0-2483.5 MHz transmitter,

Maximum RF Power²: = 2.5 mW

SBTA Power (w +10% tuneup) = 0.129 x 2.5 mW x 1.1 = 0.355 mW

For the 902.4-927.8 MHz transmitter,

Maximum RF Power⁴: = 27.4mW

SBTA Power (w +10% tuneup) = 0. 14 x 27.4 mW x 1.1 = 4.22 mW

SAR Exemption Calculation

Referencing FCC SAR Exemption equation for 1-g SAR:

$$\left[\frac{(\text{max power of channel, including tuneup tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot \left[\sqrt{f(\text{GHz})} \right] \leq 3 \text{ for 1-g SAR.}$$

Using the formula above:

For the 2400.0-2483.5 MHz transmitter:

$$0.355 \text{ mW} / 1.73 \text{ mm} * \sqrt{2.480} = 0.323 < 3.0$$

For the 902.4-927.8 MHz transmitter

$$4.22 \text{ mW} / 1.6 \text{ mm} * \sqrt{0.9276} = 2.54 < 3.0$$

Conclusion:

SAR evaluation is not required for this product.

¹447498 D01 General RF Exposure Guidance v06, footnote 30

²See NCEE Report R20250912-70-E2 DTS, page 9

³See 47 CFR § 2.1091(d)(2)

⁴See NCEE Report R20250912-70-E1 DSS, page 9