phone: 303.939.9336 | website: www.inovonics.com
11000 Westmoor Circle, Building 10, Westminster, CO 80021

EN2222S-60/EN2221S-60 EchoStream® Mobile Duress Pendant Series Transceiver
Calculation of SAR Test Exclusion Threshold

Operation Condition*:*
The product has three radio transmission states: STANDBY, SINGLE ALARM, and REPEATED ALARM. Table 1 shows the worse-case on-time for each transmitter is the different states (see Operational Description for on-time calculations).

Table 1: Worse-Case Transmitter On-Time for Each Transmitter in Various 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	0.108	0.0034
SINGLE ALARM	0.756	4.061
REPEATED ALARM	27.216	4.061

The REPEATED ALARM state is the worse-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 = 4.061 sec/360 sec x 100% = 1.13%
Worst Case SBTA Factor for 902.4-927.6 MHz = 27.216 sec/360 sec x 100% = 7.56%

The worst-case separation between the transmitter antenna and operator of 5.1 mm is maintained by the transmitter enclosure as shown in Figure 2 of the Operational Description.

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. The gain of the antennas was included when measuring EIRP. The rules allow calculation of conducted power for small devices with permanently attached antennas from radiated emissions data (See KDB 558074D01v05r02 at § 3 and ANSI C63.10(2013) at Clause 11.3).

For example, the 915 MHz magnetic loop antenna (H2U64U1H2C0200), the gain is +0.8 dBi. Therefore, the conducted power for 915 MHz is: (EIRP) – (Peak gain). EIRP & RF Conducted measurement taken from NCEE DSS and DTS Test Report.

For the 2400.0-2483.5 MHz Transmitter:
Referencing Section 4.0 of the NCEE DTS Report, worst case RF Conducted power[2] = 4.954 dBm which converts to 3.12 mW. RF Conducted will be used as worst case at 3 mW.

For the 902.4-927.8 MHz Transmitter:
Referencing Section 4.0 of the NCEE DSS report, worst case RF Conducted power[4] = 15.641 dBm which converts to 36.65 mW. RF Conducted will be used as worst case at 37 mW.

Note: Power is calculated not through a per channel duty factor, rather is a total time on vs off time.

Product SBTA Power Calculation[3]

For the 2400.0-2483.5 MHz transmitter,

Maximum RF Power[2]: = 3 mW

SBTA Power (w +10% tuneup) = 0.0113 x 3 mW x 1.1 = 0.037 mW

For the 902.4-927.8 MHz transmitter,

Maximum RF Power[4]: = 37 mW

SBTA Power (w +10% tuneup) = 0. 0756 x 37 mW x 1.1 = 3.07 mW

SAR Exemption Calculation

Referencing FCC SAR Exemption equation for 1-g SAR:

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

Using the formula above:
For the 2400.0-2483.5 MHz transmitter:
$0.037\ {}^{mW}/_{5\ mm} * \sqrt{2.402}$ = **0.0114 < 3.0**

For the 902.4-927.8 MHz transmitter
$3.07\ {}^{mW}/_{5\ mm} * \sqrt{0.9024}$ = **0.583 < 3.0**

Conclusion:

SAR evaluation not required for this product.

[1]447498 D01 General RF Exposure Guidance v06, footnote 30
[2]See NCEE Report R20210831-20-E2 DTS, page 9.
[3]See 47 CFR § 2.1091(d)(2)
[4]See NCEE Report R20210831-20-E1 DSS, page 10.