

FCC RF Exposure Information Per KDB 447498

Operational Description

The BI LOC8 Tracker is an ankle-worn tracking device. The unit utilizes GPS data and other location monitoring technologies to accurately track an offender moving within local communities. The maximum transmission rate is once per minute with duration of 3 seconds but only occurs when the offender is in violation.

Justification for 5% Maximum Duty Cycle (Information provided by BI):

In this application, the cell module is used to communicate location data from the tracking device to a host computer. The location data points can be acquired at variable rates, the maximum rate being 4 points per minute and the typical rate being 1 point per minute. The maximum call rate occurs when the client is in an exclusion zone, and the location information is communicated to the host once each minute. Under normal conditions, location information is acquired once each minute, and the data is communicated to the host at longer intervals, say, 15 minutes or 1 hour. The highest duty cycle will occur when only 4 location points are called in once each minute, since message overhead remains relatively fixed, regardless of the number of location points per communication session. All location point acquisition rates and call-in frequency are determined by the firmware that controls the tracker operation.

The maximum duty cycle occurs when the unit is calling in 4 location points at the minimum reporting time of 1 minute. The time for this communication with the host is 3 seconds maximum, resulting in a maximum connect time duty cycle of 5 percent.

This duty cycle was derived by measuring multiple message connection times at the host for the 4-location points-per-minute being called in to the host once each minute. This maximum measured connection time was 3 seconds. In contrast, the connection time for a message containing 29 location points, called in after 29 minutes of gathering this data, was 8 seconds (0.46% duty cycle), thus verifying the highest duty cycle occurs at a 1-minute call-in window.

RF Exposure Conditions

The BI locator ankle-worn tracking device is intended for operation in the general population / uncontrolled RF exposure environment. Two radios are incorporated into this device - a CDMA cellular transmitter and a Part 15.231 periodic transmitter (Shield Detect Transmitter) for detecting attempts to shield the device.

Antenna Separation Distances

~8.39 mm to Ankle (cellular)

~5 mm to Ankle (shield detect)

Transmission Mode

The tracker utilizes an internal CDMA cellular transmitter (FCCID: R5Q-LISAC200A) and Part 15.231 periodic transmitter for detecting attempts to shield the device.





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Duty Cycle

The device has a **maximum** transmission rate of once per minute. The on-air transmission time is 3 seconds. This leads to a worst case on-air duty cycle of 5%.

Information regarding the worst case duty cycle was provided by the host manufacture BI.

Worst Case Duty Cycle

Duty Cycle = Transmission Time / TOTAL Time = 3s/60s = 0.05

Duty Cycle = 5%

SAR Exclusion Threshold for Low Duty Factor Device

The maximum power used for calculations below is based on the maximum power stated by UBlox for the cellular module which includes tune-up tolerance.

CDMA Mode – Cellular 850 Band

Maximum Measured Conducted Output Power = 289mW

Worst Case Duty Cycle – 5.0 %

Worst Case Source Based Time Averaged Output Power = 289mW x 0.05 = 14.45mW

Exclusion Threshold Calculation from KDB 447498 - $[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot \sqrt{f(\text{GHz})} \leq 7.5$ (10-g extremity exclusion threshold)

Calculation for Worst Case Duty Cycle = $(14/8) \cdot \sqrt{(0.849)} = 1.6$

CDMA Mode – PCS 1900 Band

Maximum Measured Conducted Output Power = 234mW

Worst Case Duty Cycle – 5.0 %

Worst Case Source Based Time Averaged Output Power = 234mW x 0.05 = 11.7mW

Exclusion Threshold Calculation from KDB 447498 - $[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot \sqrt{f(\text{GHz})} \leq 7.5$ (10-g extremity exclusion threshold)

Calculation for Worst Case Duty Cycle = $(12/8) \cdot \sqrt{(1.91)} = 2.1$

Shield Detect Transmitter – 433.92 MHz ISM Band

Maximum Designed Output Power (to comply with 15.231 requirements) = 3.63 mW

Transmission On Time = 10mS

Worst Case Interval = 30 seconds

Duty Cycle = $(0.01\text{S} / 30\text{S}) \times 100 = 0.033\%$

Source Based Time Averaged Output Power = 3.63mW x 0.00033 = 0.00119mW

Exclusion Threshold Calculation - $[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot \sqrt{f(\text{GHz})} \leq 7.5$ (10-g extremity exclusion threshold)

Exclusion Threshold Calculation = $(0.001/5) \cdot \sqrt{(0.43392)} = 0.0001$





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Simultaneous Transmission Consideration

The shield detect and cellular radio do not transmit simultaneously. The cellular transmitter cannot transmit in CDMA Cell and CDMA PCS bands simultaneously.

