| From: | oetech@fccsun27w.fcc.gov |
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| Sent: | Tuesday, July 24, 2012 2:29 PM |
| To: | Nicholas Abbondante  Intertek |
| Subject: | Response to Inquiry to FCC (Tracking Number 218217) |

**Inquiry on 06/08/2012 :**

**Inquiry:**

Per the FCC guidance on the March 2012 TCB conference call, the FCC has requested that for portable devices subject to routine RF exposure evaluation under 2.1093 for which no SAR report will be provided, including those which meet the 60/f exemption due to duty cycle averaging, a PBA inquiry must be submitted to address RF exposure compliance. In compliance with this requirement, this PBA requests approval of the following RF exposure exemption based on low duty cycle.

The client, Ingersoll Rand (IR) is integrating a pre-approved 2.4 GHz Zigbee radio module, FCC ID: W7Z-FSTARPRO, manufactured by California Eastern Laboratories (CEL), into a handheld portable tool.  The grant of authorization for FCC ID: W7Z-FSTARPRO is modular, restricted to Mobile applications, and lists an output power of 116 mW (20.66 dBm from the test report) conducted into a -1.03 dB gain PCB inverted F antenna, yielding an EIRP of 19.63 dBm or 91.8 mW peak.  The intention is for California Eastern Laboratories to perform a permissive change on their grant of authorization to add the specific portable configuration referenced in this PBA.

Zigbee radios operated under 47CFR FCC Part 15 Subpart C 15.247 are subject to routine RF exposure evaluation and the peak EIRP of 91.8 mW exceeds the 60/f exemption threshold of 25 mW, average.  The usage type for this device would be ?General Population/Uncontrolled? therefore the averaging time allowed for RF exposure is 6 minutes.

Ingersoll Rand has provided a detailed analysis of the worst case duty cycle, uploaded as part of this PBA inquiry as a supporting exhibit, as well as a photo of the device form factor.  The duty cycle is calculated to be 2.896%, based on a worst case pulse train consisting of four 3.62 ms pulses with a period of 500ms.  The 500 ms average is taken to be the same as the 6 minute average due to the repetitive nature of the signal.  Please see the included attestation from Ingersoll Rand for more details.

Given a duty cycle of 2.896%, the 6 minute average EIRP for RF exposure purposes would be 2.66 mW or 4.25 dBm EIRP.  This is well below the 25 mW exemption threshold, therefore it is expected that the FCC ID: W7Z-FSTARPRO module complies with the RF exposure requirements in this portable configuration.

**FCC response on 06/21/2012**

Could you provide an operational description or other documentation explaining the purpose of this device and its operating characteristics?  What are the typical use conditions and can the end user modify transmissions?

**---Reply from Customer on 06/22/2012---**

Included below is a client response clarifying the operation of the product and typical use scenarios.  The end user cannot modify transmissions.

**Operational description and typical usage:**

*The product system which contains the RF device is used for transmitting process data from the tool to the Process Communication Module (PCM) for recording process data and quality assurance type monitoring. The tool is a cordless*

*screwdriver which is to be used in an assembly line environment to tighten screws / fasteners to user defined angle or torque values. After each fastening cycle, the end-of-run data (EOR) will be transmitted wirelessly to the PCM. In the event which the EOR is not successfully sent to the PCM due to loss of communication, the tool will store the EORs until the communication link between the tool and the PCM is restored. Once the communication link is restored, the tool will transmit the EOR backlog to the PCM at the rate of two EORs/second. The tool is capable of storing a backlog of up to 1200 EORs.*

*The worst case scenario which we mentioned in the report was when the communication is restored (after a loss of communication) and the tool is transmitting a backlog of 1200 EORs to the PCM at the rate of two EORs/second.*

*The typical cycle rate of the tool varies from application to application, however we can use 18 cycles/minute as a cycle rate on the high side of most applications.*

**FCC response on 06/29/2012**

We do believe that this device can qualify for low duty factor SAR exclusion and that a Class 2 Permissive Change filing to the module to add a specific host would be appropriate. We need to clear up a couple of items before this can be taken to a TCB.

Please confirm that the UART setup is an accurate approximation of the Zigbee transmission characteristics. Is the maximum number of EOR retries in a 500 ms period limited to 3? Also, the 6 minute average reference in the duty factor analysis can be removed as it is unnecessary since the 500 ms period is repetitive. For SAR exclusion analysis, the duty factor will need to be applied to the conducted power of the module.

Respond back to this KDB with an attachment explaining why this device has been excluded from SAR testing by showing that the conducted output is less than 60/f. The attachment will serve as the RF exposure exhibit in the FCC Form 731 application in lieu of a SAR report. Upon approval of the attachment, the FCC Laboratory will provide any appropriate grant conditions. This information can then be taken to the TCB for filing without further FCC comment or the need for a PBA.

---**Reply from Customer on 07/18/2012**---

As part of this correspondence, an RF exposure compliance report using the conducted power has been included as requested. This document would be uploaded to the TCB along with the Ingersoll Rand Duty cycle Attestation already provided in this PBA as the two exhibits addressing RF exposure compliance in the TCB filing.

The client has confirmed that the UART is an accurate approximation of the Zigbee transmission characteristics, with the following statement:

*There is a maximum of 4 EOR Zigbee transmissions (1 original transmission + 3 retries) in 500 ms.*

*The UART setup is an accurate approximation of the Zigbee transmission characteristics because:*

*For our duty factor attestation, the measured transmission period was that of a Zigbee transmission (not an UART transmission).*

*The radio module will transmit EOR packet wirelessly only if (and after) it receives the EOR packet from the daughterboard through the UART interface. There is a 12 ms delay between UART receipt and Zigbee transmission, however the length of the delay is the same for each 500 ms interval. Therefore a 500 ms UART transmission interval also represents a 500 ms Zigbee transmission interval.*

**FCC response on 07/24/2012**

Because of the operating conditions for this device, as communicated through this KDB inquiry, it has been determined that SAR testing can be excluded. Take this KDB inquiry to the TCB for certification. The TCB is not required to submit a separate PBA for FCC review. In lieu of a SAR report, provide the Intertek duty factor analysis submitted to this inquiry as the RF exposure exhibit of the FCC Form 731 application. Please include the *Ingersoll Rand Duty Cycle Attestation* as a separate attestation statement exhibit. The number of this KDB inquiry (218217) should also be included in the duty factor analysis. The following grant condition applies: <u>Maximum duty factor of 2.9 % as identified in the filing.</u>

**Attachment Details:**