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125kHz RFID SAR exclusion calculations

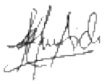
Compliance Testing of:

X3 SEMS + BT

Prepared For:

Tyco/Scott Health and Safety
Attn: Ann Carver
4320 Goldmine Road
Monroe, NC 28110

This Test Report is issued under the Authority of:
Khairul A. Zainal, Sr. EMC Engineer

Signature:  Date: 9/22/15

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LSR, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industrie Canada Industry Canada

Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

1.0 Conformance Summary

The EUT was found to MEET the requirements for SAR test exclusion per FCC §2.1091 and RSS102 using methods of FCC KDB 447498 D01 General RF Exposure Guidance v05r02 as a standalone device.

2.0 SAR Test Exclusion Threshold

SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 20 cm

1-g SAR test exclusion threshold equation:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≤ 3.0

10-g SAR test exclusion threshold equation:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≤ 7.5

SAR test exclusion threshold calculation for below 100 MHz is listed in KDB 447498 D01 General RF Exposure Guidance section 4.3.1(3)

3.0 Separation distance used for calculations.

A conservative separation distance of 50mm was used in all calculations. Please refer to section 7 for separation distance justification.

4.0 Client Information

Manufacturer Name:	Tyco/Scott Health and Safety
Address:	4320 Goldmine Road
Contact Person:	Ann Carver

4.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	X3 SEMS + BT
Model Number:	201122-31, 201122-32 and 201122-33
Serial Number:	Test
FCC ID	T5E201122A

4.2 Product Description

Scott Emergency Management System (SEMS II) with Blue Tooth is a telemetry system for firefighter, comprises mainly of two devices a (1) Control Module which house the piezos for the Personnel Alarm Safety System (PASS) and (2) an Console unit which houses the telemetry radio being capable of bidirectional communications with a base station (gateway) comprised of a USB or PCMCIA card. The system operates on a radio frequency of 2.4 GHz, where by the console unit is capable of transmitting and receiving information to and from the base station. The transmission range is 450ft in a typical indoor environment and 2000ft line of sight (LOS). The Console also contains a blue tooth radio with ability to pair and transmit data every 60 seconds to an external APX Motorola radio which then forwards the data over a Motorola network.

4.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test

4.4 Deviations & Exclusions from Test Specifications

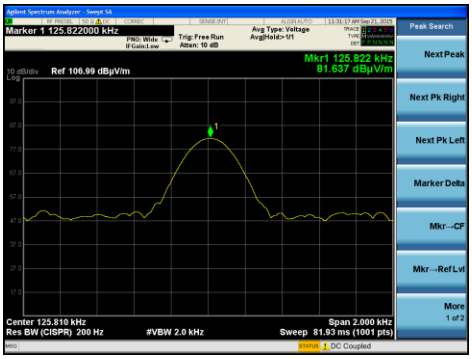
None noted at time of test

4.5 Additional Information

The single channel 2405 MHz was programmed using an Ember tool.

5.0 RF Conducted Measurement Data

Plot
RFID:



6.0 SAR Test Exclusion Calculation

Comparison to SAR threshold

A. RFID

Frequency = 125kHz
Field Strength at 3m = 81.6dBµV/m
Output Power = 81.6 - 95.2 = -13.6 dBm
Output Power = 0.043mW
Minimum separation distance = 50mm

SAR Exclusion threshold:
KDB 447498 Section 4.3.1
Step 1:
Power allowed = 3*(50mm)/(√0.1GHz) = 474.3mW

Step 2:
Power threshold = 474.3mW + 0 = 474.3mW

Step 3:
Power threshold = [474.3mW * (1+log(100/0.125))]= **1851.2mW**

Output power = 0.043mW < 1851.2mW

B. Simultaneous transmitting (RFID + ZIGBEE + Bluetooth)

Standalone SAR estimation KDB 447498 section 4.3.2 2):

1. Zigbee (2405MHz)
   SAR estimation = (0.141mw/50mm) * (√2.405/7.5)
   = 0.00282 * 0.207
   = 0.000583 W/kg

2. Bluetooth (2402 MHz)
   SAR estimation = (1.31mw/50mm) * (√2.402/7.5)
   = 0.00262 * 0.207
   = 0.000541 W/kg

3. RFID (125kHz)
   SAR estimation = (0.043mw/50mm) * (√0.000125/7.5)
   = 0.00086 * 0.0015
   = 0.00000128 W/kg

Per section 4.3.2 of KDB 447498, if the sum of the 1-g SAR of all simultaneously transmitting antenna in operating mode and exposure condition is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of standalone SAR = (0.000583 + 0.000541+ 0.00000128) = **0.001125 W/kg**

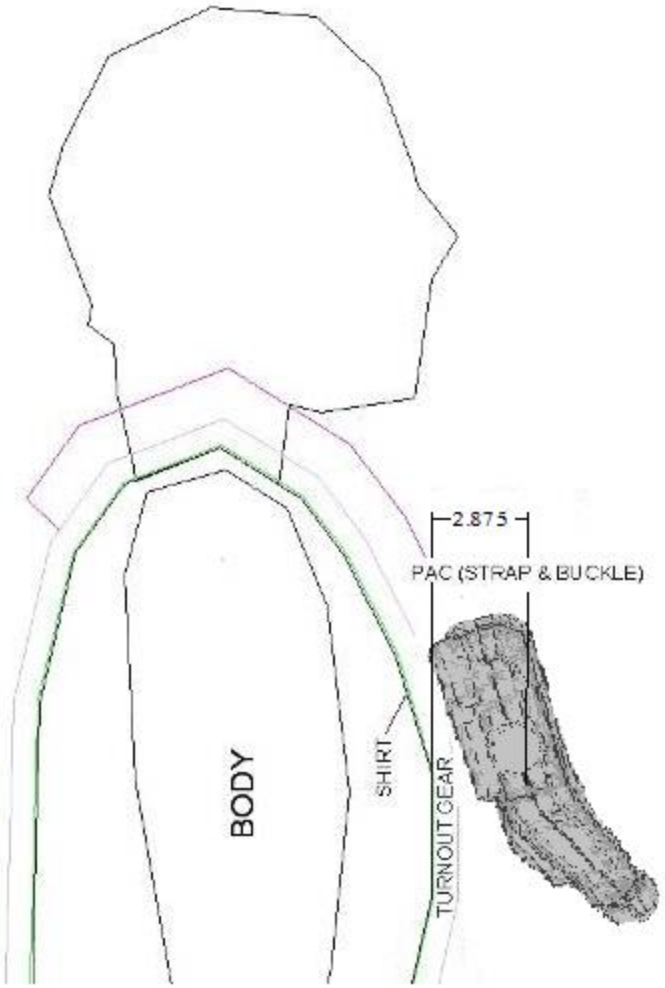
Limit for general population/uncontrolled environment (CFR 47 part 2.1093 (d) (2)) = **0.08 W/kg**

Since,

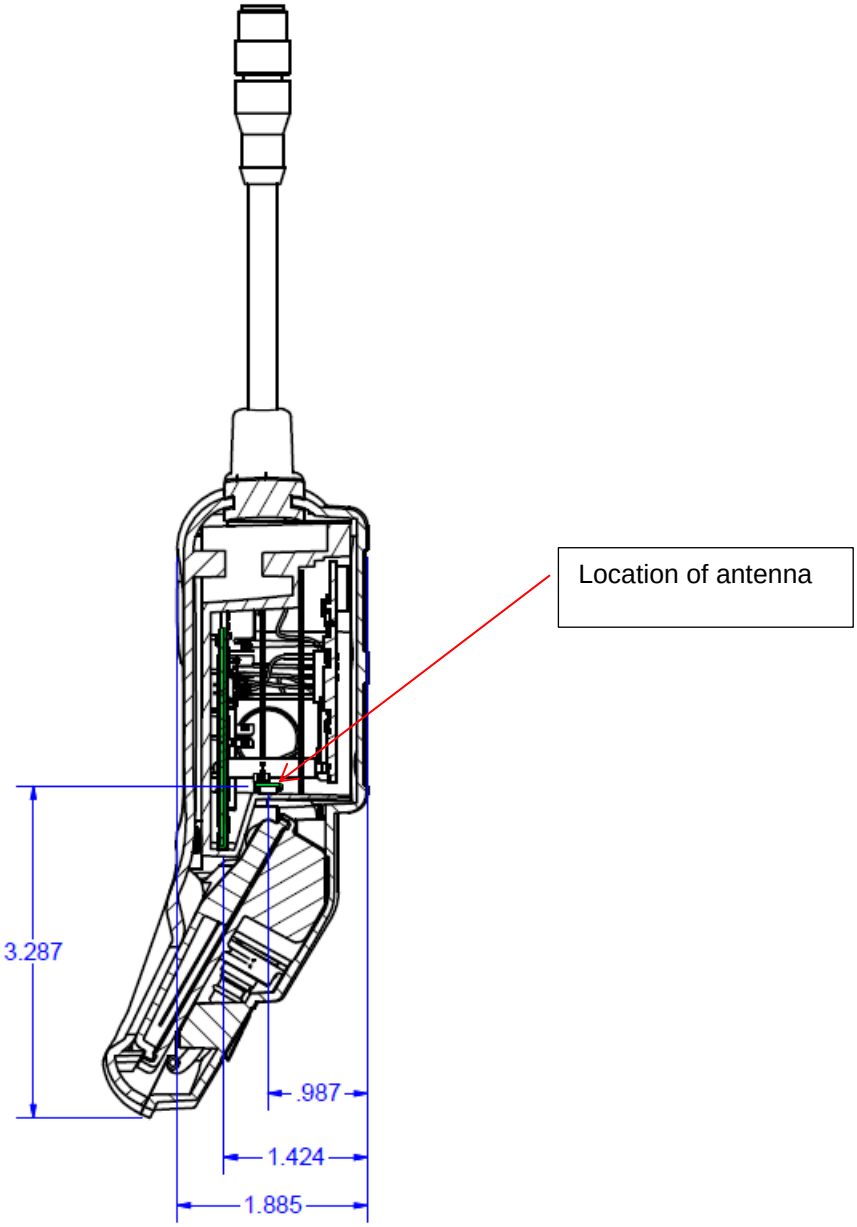
0.001125 W/kg < 0.08 W/kg

SAR test exclusion applies.

7.0 Separation Distance Exhibit



Sketch 1- Side view of Firefighter showing layering of clothing, turnout gear, and X3 SCBA with BT / SEMS® II Console **(distance shown in inches)**


Location of antenna
3.287
.987
1.424
1.885

Location of antenna is approximately 2.5” to the Coat, which is 63.5mm. For calculation of SAR exclusion, a distance of 50mm was used.