Test Report # 317206 D

Equipment Under Test:	Spot-r Clip
Test Date(s):	8/6/18
Prepared for:	Triax Technologies Attn: Justin Morgenthau 330 Roberts Street Suite 205 East Hartford, CT 06108, USA

Report Issued by: Shane Dock, EMC Engineer

Signature:

Date: 8/14/2018

Report Reviewed by: Adam Alger, Quality Manager

Signature:

Date: 08/14/2018

Report Constructed by: Shane Dock, EMC Engineer

Signature:

Date: 8/14/2018

CONTENTS

Laird Technologies Test Services in Review

The Laird Technologies, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope
A2LA Certificate Number: 1255.01
Scope of accreditation includes all test methods listed herein, unless otherwise noted.

Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492

Government of Canada

Innovation, Science and Economic Development Canada

ISED Site listing of two 3 meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4
File Number: IC 3088A-2
File Number: IC 3088A-3

1 Test Report Summary

On **7/11/18** the Equipment Under Test (EUT), **Spot-r Clip**, as provided by **Triax Technologies** was tested to the following requirements:

Requirement	Description	Specification	Method	Result
FCC Part 1.1307, 2.1091, 2.1093	RF Exposure and equipment authorization requirements	Reported	FCC KDB 447498	Reported
ISED Canada RSS-102	Radiofrequency Radiation Exposure Evaluation: Portable	Reported	RSS-102 Section 2.5.2	Reported

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	Triax Technologies
Contact Person	Justin Morgenthau
Address	330 Roberts Street Suite 205 East Hartford, CT 06108, USA

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Spot-r Clip
Model Number	CL-2
Serial Number	CSM0202-00003043 (Conducted RF) CSM0202-00003040, -00003145 (Radiated Emissions)
FCC / IC ID	FCC ID: 2AGHICSM1 IC: 21358-CSM1

2.2 Product Description

The Spot-r Clip, our flagship wearable device, automatically connects to the Spot-r network when workers arrive on site, automating time and attendance and providing real-time workforce location by floor and zone. The device detects falls at the jobsite and sends immediate email, dashboard, or text notifications to designated supervisors, including who, where, and distance of fall, improving injury response time by up to 91%. By pushing the button at the bottom of the Clip, workers can report a hazard or other injury to designated supervisors from anywhere on site. And in situations that require evacuation, authorized personnel can trigger 80 decibel alarms emitted by each worker's device.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Unit Information

The unit in question is a worn device that has a BLE and 900 MHz proprietary radio. The proprietary radio has both FHSS and DSSS Modes. The device is battery powered (3.3 VDC).

2.6 BLE Information

Unit tested on 3 channels at one set power. Unit tested in Vertical, Horizontal and Flat Orientations. Unit programmed with a serial connection (via a terminal connection program like PuTTY).

Low – 2402 MHz

Mid – 2440 MHz

High – 2480 MHz

2.7 FHSS Information

Unit tested on Channels 1, 32, and 64 (902.5 MHz, 914.9 MHz, 927.7 MHz). Unit programmed via serial connection with a terminal access program like PuTTY. Power setting of 15 used. The FHSS radio can transmit at the same time as the BLE radio, but not the DSSS radio.

2.8 DSSS Information

Unit tested on Channels 1, 32, and 63 (902.5 MHz, 914.9 MHz, 927.3 MHz). Unit programmed via serial connection with a terminal access program like PuTTY. Power setting of 15 used. The DSSS radio can transmit at the same time as the BLE radio, but not the FHSS radio.

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15	-	2018
ANSI C63.10	-	2013
RSS-247	2	2017
RSS GEN	4	2014
RSS-102	5	2015
CFR 47 Part 1 and 2	-	2017
FCC KDB 447498	6	2015

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Fundamental Emission – BLE

Operator	Shane Dock
Test Date	10/12/17
Location	Conducted RF Measurement Area
Temp. / R.H.	70 degrees Fahrenheit / 59% RH
Requirement	FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)
Method	FCC KDB 558074 D01 DTS Meas Guidance V04, section 9.1.1

Limits:

Maximum Conducted Output Power (watts)	Maximum Conducted Output Power (dBm)
1	30

Test Parameters

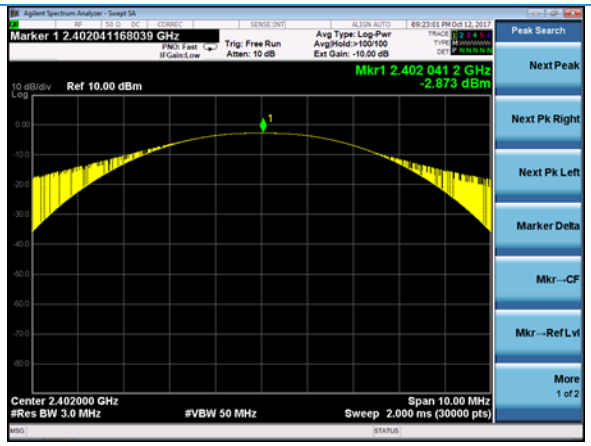
Frequency	2402, 2440, 2480 MHz
RBW	3 MHz

Table

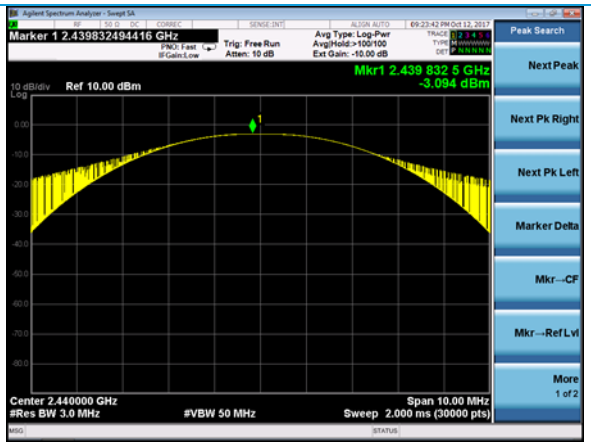
Channel	Low	Mid	High
Pout Conducted (dBm)	-2.873	-3.094	-3.935

Worst Case Margin = 30.000 dBm – (-2.873 dBm) = 32.873 dB

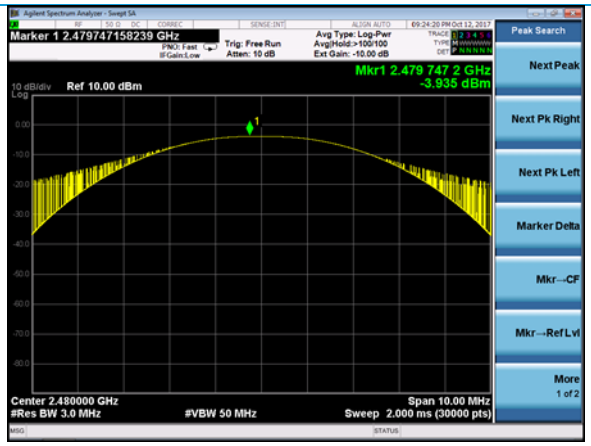
Plots



Low Channel Pout



Mid Channel Pout



High Channel Pout

5.2 Fundamental Emission – FHSS

Operator	Shane Dock
Test Date	10/18/17
Location	Conducted RF Area
Temp. / R.H.	71 degrees F/ 57%
Requirement	FCC: 15.247 (b)(1) IC: RSS-247 5.4 (b)
Method	ANSI C63.10 Section 7.8.5

Limits:

Maximum Conducted Output Power (watts)	Maximum Conducted Output Power (dBm)
1	30

Test Parameters

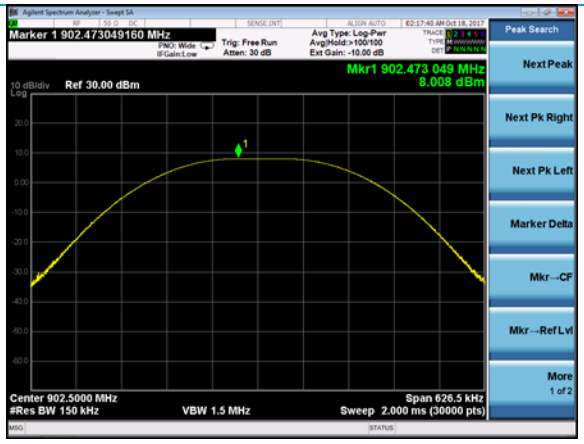
Channels	Low, Mid, High

Table

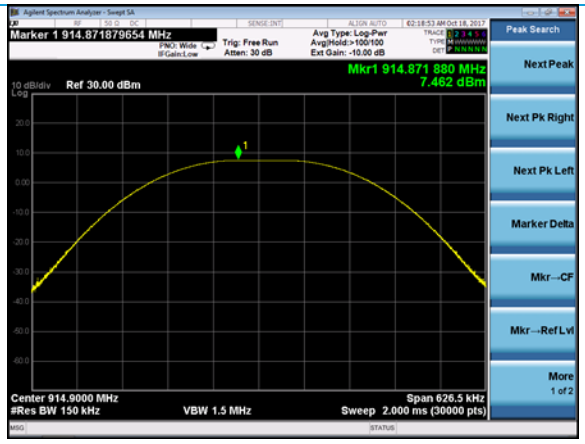
Channel	Low	Mid	High
Pout Conducted (dBm)	8.008	7.462	6.948

Worst Case Margin = 30.000 dBm – (8.008 dBm) = 21.992 dB

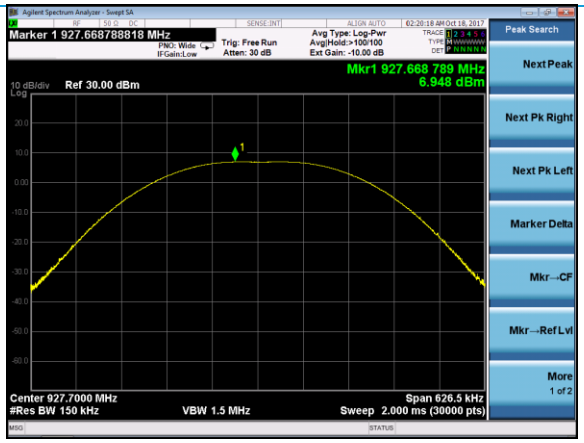
Plots



Low



Mid



High

5.3 Fundamental Emission – DSSS

Operator	Shane Dock
Test Date	10/17/17
Location	Conducted RF Measurement Area
Temp. / R.H.	71 degrees Fahrenheit / 57%
Requirement	FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)
Method	FCC KDB 558074 D01 DTS Meas Guidance V04, section 9.1.1

Limits:

Maximum Conducted Output Power (watts)	Maximum Conducted Output Power (dBm)
1	30

Test Parameters

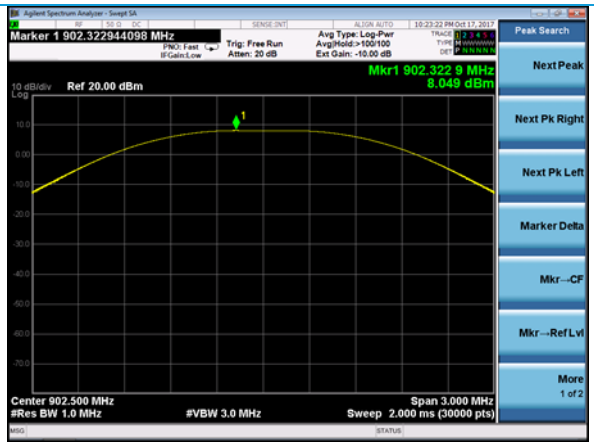
Frequency	902.5 MHz, 914.9 MHz, 927.3 MHz
RBW	1 MHz

Table

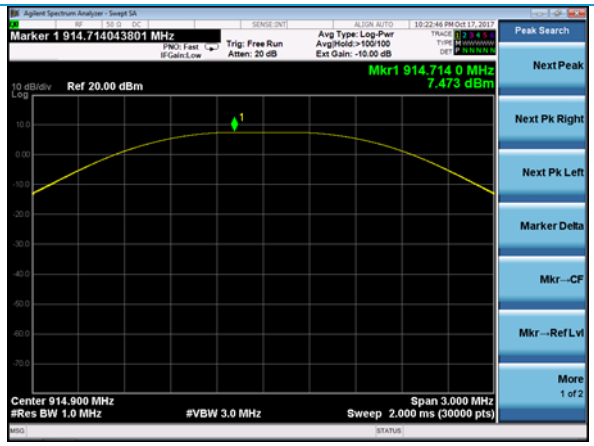
Channel	Low	Mid	High
Pout Conducted (dBm)	8.049	7.473	6.987

Worst Case Margin = 30.000 dBm – (8.049 dBm) = 21.951 dB

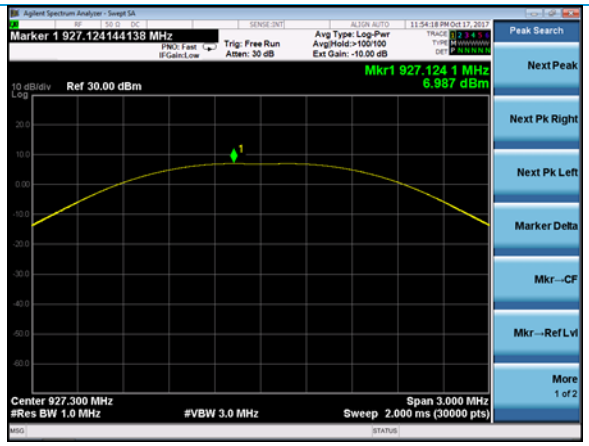
Plots



Low Channel Pout



Mid Channel Pout



High Channel Pout

6 EXCLUSION CALCULATION

6.1 FCC

Output Power (dBm) = Measured Value (dBm) + Antenna Gain (dBi) + Tune-up Tolerance (dB)

BLE Output Power = -2.87 dBm + 1.6 dBi + 4 dB = 2.7 dBm = 1.9 mW

Per FCC KDB 447498 Section 4.3.1 a):

Maximum Output power (mW) * sqrt(f(GHz)) / Min separation distance (mm) <=3.0

= 1.9 mW * sqrt(2.402) / (5 mm)

= 0.6

Therefore, the EUT is exempt from SAR testing for all separation distances 5 mm or less.

FHSS Output Power = 8.01 dBm + 2.3 dBi + 0.9 dB = 11.2 dBm = 13.2 mW

Per FCC KDB 447498 Section 4.3.1 a):

Maximum Output power (mW) * sqrt(f(GHz)) / Min separation distance (mm) <=3.0

= 13.2 mW * sqrt(.9025) / (5 mm)

= 2.5

Therefore, the EUT is exempt from SAR testing for all separation distances 5 mm or less.

DSSS Output Power = 8.05 dBm + 2.3 dBi + 0.9 dB = 11.3 dBm = 13.5mW

Per FCC KDB 447498 Section 4.3.1 a):

Maximum Output power (mW) * sqrt(f(GHz)) / Min separation distance (mm) <=3.0

= 13.5 mW * sqrt(.9025) / (5 mm)

= 2.6

Therefore, the EUT is exempt from SAR testing for all separation distances 5 mm or less.

6.2 ISED Canada

Compliance determined with RSS-102 Section 2.5.1 Table 1. Values Interpolated to actual channel frequency

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

BLE

For 2402 MHz, the exemption limit is 4.3 mW at 5 mm or less.

Since 1.9 mW < 4.3 mW, the EUT is exempt from routine SAR evaluation at 5 mm or less.

FHSS

For 902.5 MHz, the exemption limit is 16.4 mW at 5 mm or less.

Since 13.2 mW < 16.4 mW, the EUT is exempt from routine SAR evaluation at 5 mm or less.

DSSS

For 902.5 MHz, the exemption limit is 16.4 mW at 5 mm or less.

Since 13.5 mW < 16.4 mW, the EUT is exempt from routine SAR evaluation at 5 mm or less.

6.3 Simultaneous Transmission

Per KDB 447498, Section 4.3.2:

[Max power (mW)/test separation distance (mm)]* sqrt[f(GHz)]/x = SAR Estimate in W/kg, where x = 7.5 or 18.75 for 1-g and 10-g, respectively.

BLE

(1.9 mw/5 mm) *(sqrt(2.402)/x) = .0785 W/kg for 1-g and .0314 W/kg for 10-g SAR

FHSS

(13.2 mw/5 mm) *(sqrt(.9025)/x) = .3344 W/kg for 1-g and .1338 W/kg for 10-g SAR

DSSS

(13.5 mw/5 mm) *(sqrt(.9025)/x) = .3420 W/kg for 1-g and .1368 W/kg for 10-g SAR

Worst Case: DSSS + BLE
=.0785 + .3420 = .4205 W/kg, which is less than 1.6 W/kg.

Therefore, the simultaneous transmission is excluded from SAR evaluation.

7 REVISION HISTORY

Version	Date	Notes	Person
V0	8/6/18	First Draft	Shane Dock
V1	8/9/18	Updated Draft	Shane Dock
V2	8/13/18	Further Updates	Shane Dock
V3	8/14/18	Final Draft	Shane Dock

END OF REPORT