Test Report # 317204 C

Equipment Under Test:	Spot-r Cloud Pod
Test Date(s):	1/18/18 – 6/5/18
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: 12/11/2018

Report Reviewed by: Adam Alger, Quality Manager

Signature:

Date: 08/14/2018

Report Constructed by: Shane Dock, EMC Engineer

Signature:

Date: 8/14/2018

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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 **8/8/18** the Equipment Under Test (EUT), **Spot-r Cloud Pod**, 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 Cloud Pod
Model Number	CP-2
Serial Number	CCP0204-00003940
FCC / IC ID	FCC: 2AGHICP01 IC: 21358-CP01

2.2 Product Description

The Spot-r Cloud Pod is a key component of the Spot-r network. It allows for the communication of all Spot-r device data to our cloud platform for viewing, storage and analysis via a cellular connection. It is mounted in a fixed location on a job site, though it can be easily moved over time as construction progresses and the site is developed.

2.3 Modifications Incorporated for Compliance

Cable implemented to separate module from host board units.

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 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.

2.6 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.

2.7 Licensed Cellular Radio Information

Unit may contain one of the 3 cellular units listed below. Power values taken from original filing exposure evaluations. Each radio is to be used with a Zhengi SRFC015 antenna (.5 dBi gain used for <1 GHz, and 4 dBi for >1 GHz).

Nimbelink NW-SW-LTE-GELS3

FCC ID: QIPELS31-V

IC ID: 7830A-ELS31V

Digi XBC-V1-UT-001

FCC ID: RI7LE866SV1

IC ID: 5131A-LE866SV1

Nimbelink NL-SW-LTE-TSVG-B (This module used for measurements to assume worst case).

FCC ID: RI7LE910SV

IC ID: 5131A-LE910SV

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15	-	2017
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 - DSSS

Operator	Shane Dock
Test Date	2/1/18
Location	Conducted RF Measurement Area
Temp. / R.H.	72 degrees F/36% 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

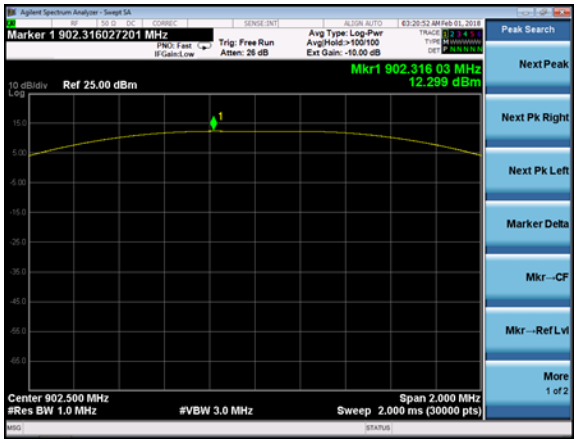
Frequency	902.5 MHz, 914.9 MHz, 927.3 MHz
RBW	1 MHz

Table

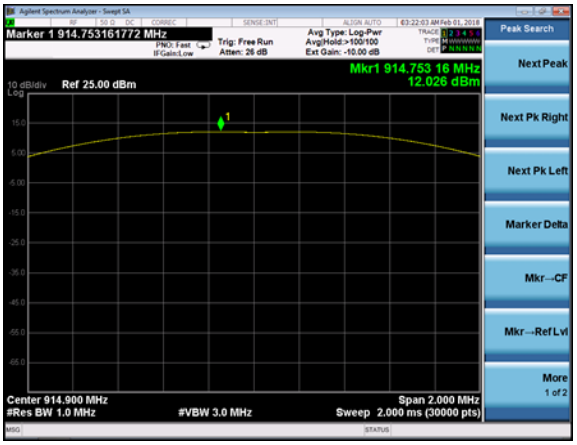
Channel	Low	Mid	High
Pout Conducted (dBm)	12.299	12.026	11.791

Worst Case Margin = 30.000 dBm – (12.299 dBm) = 17.701 dB

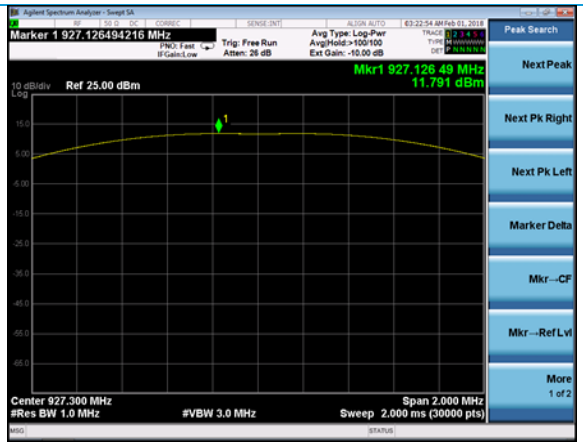
Plots



Low Channel Pout



Mid Channel Pout



High Channel Pout

5.2 Fundamental Emission – FHSS

Operator	Shane Dock
Test Date	5/23/18
Location	Conducted RF Area
Temp. / R.H.	72 degrees F/36% RH
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

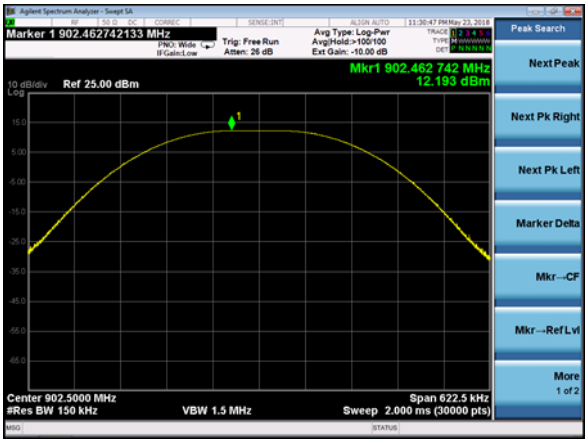
Channels	Low, Mid, High

Table

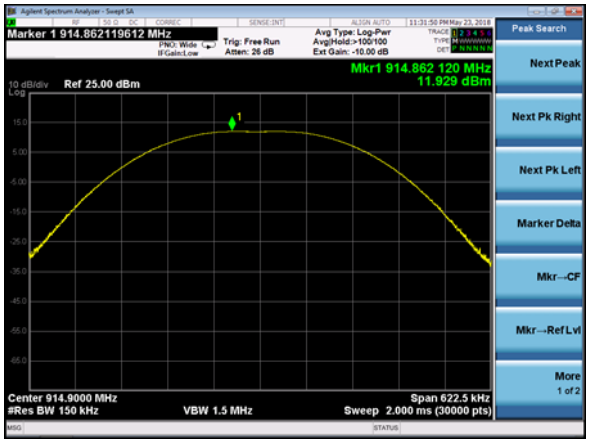
Channel	Low	Mid	High
Pout Conducted (dBm)	12.193	11.929	11.695

Worst Case Margin = 30.000 dBm – (12.193 dBm) = 17.807 dB

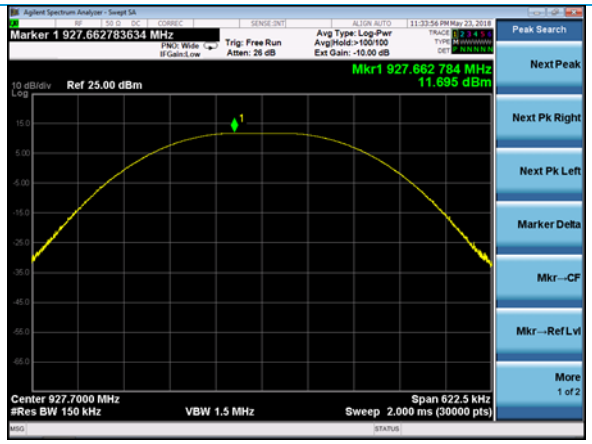
Plots



Low



Mid



High

6 EXCLUSION CALCULATION

6.1 FCC

Compliance to 2.1091 is to be demonstrated via MPE calculations.

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

DSSS Output Power = 12.3dBm + 3.0 dBi + .9 dB = 16.2 dBm = 41.7 mW

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.30	(dBm)
Maximum peak output power at antenna input terminal:	16.982	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	902.5	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.60	(*f* / 1500) (mW/cm²)
Power density at prediction frequency:	0.01	(mW/cm²)

FHSS Output Power = 12.2 dBm + 3.0 dBi + 0.9 dB = 16.1 dBm = 40.7 mW

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.20	(dBm)
Maximum peak output power at antenna input terminal:	16.596	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	902.5	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.60	(*f* / 1500) (mW/cm²)
Power density at prediction frequency:	0.01	(mW/cm²)

6.2 ISED Canada

Per RSS-102 Section 2.52:

- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

DSSS

For 902.5 MHz, the Exemption Limit is .0131* f(MHz)^.6834 = 1.37 W

Since 41.7 mW < 1.37 W, the EUT is exempt from routine SAR evaluation

FHSS

For 902.5 MHz, the Exemption Limit .0131* f(MHz)^.6834 = 1.37 W

Since 40.7 mW < 1.37 W, the EUT is exempt from routine SAR evaluation

6.3 Simultaneous Transmission (with Cellular Device)

Worst Case is Cellular Bands with DSSS radio (41.7 mW at 902.5 MHz)

Maximum Output power = 25.00 dBm

Channels used to evaluate: 784.5 MHz (Band 13) and 1752.5 MHz (Band 4)

Antenna Gain: 0.5 dBi (Band 13), 4.0 dBi (Band 4)

Maximum Output Power (including Antenna Gain) = 354.8 mW (Band 13), 794.3 mW (Band 4)

Evaluation per KDB 447498 Section 7.2.a.:

a) The [∑ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [∑ of MPE ratios] is ≤ 1.0.

Band 13 MPE:

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	25.00	(dBm)
Maximum peak output power at antenna input terminal:	316.228	(mW)
Antenna gain(typical):	0.5	(dBi)
Maximum antenna gain:	1.122	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	784.5	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.52	(*f* / 1500) (mW/cm²)
Power density at prediction frequency:	0.07	(mW/cm²)

Band 4 MPE:

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	25.00	(dBm)
Maximum peak output power at antenna input terminal:	316.228	(mW)
Antenna gain(peak):	4	(dBi)
Maximum antenna gain:	2.512	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	1752.5	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)

Power density at prediction frequency:	0.158027	(mW/cm^2)
Maximum allowable antenna gain:	12.0	(dBi)
Margin of Compliance at 20 cm =	8.0	dB

To be exempt from routine SAR Testing, at their respective frequencies:

[Power Density (DSSS)/ MPE Limit (DSSS)] + [Power Density (Band 4)/ MPE Limit (Band 4)] < 1

and,

[Power Density (DSSS)/ MPE Limit (DSSS)] + [Power Density (Band 13)/ MPE Limit (Band 13)] < 1.

Band 4: 0.01/0.6 + 0.158/1 = 0.175

Band 13: 0.01/0.6 + 0.07/0.52 = 0.151

As both of these values are less than 1, the unit is exempt from routine evaluation for simultaneous transmission.

7 REVISION HISTORY

Version	Date	Notes	Person
V0	8/8/18	First Draft	Shane Dock
V1	8/14/18	Final Draft	Shane Dock
V2	11/27/18	Cell Information added	Shane Dock
V3	12/11/18	Final version	Shane Dock

END OF REPORT