

# Test Report # 317206 C

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**Equipment Under Test:** Spot-r Clip

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**Test Date(s):** 10/2/17 – 6/20/18

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**Prepared for:** Triax Technologies  
Attn: Justin Morgenthau  
330 Roberts Street  
Suite 205  
East Hartford, CT 06108, USA

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**Report Issued by: Shane Dock, EMC Engineer**


Signature:



Date: 8/14/2018

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**Report Reviewed by: Adam Alger, Quality Manager**

Signature: 

Date: 08/14/2018

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**Report Constructed by: Shane Dock, EMC Engineer**

Signature:



Date: 8/14/2018

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Company: Triax Technologies	Page 1 of 28	Name: Spot-r Clip
Report: 317206 C		Model: CL-2
Job: C-2757		Serial: CSM0202-0000

## CONTENTS

Contents.....	2
Laird Technologies Test Services in Review.....	3
1    Test Report Summary.....	4
2    Client Information.....	5
2.1    Equipment Under Test (EUT) Information.....	5
2.2    Product Description.....	5
2.3    Modifications Incorporated for Compliance.....	5
2.4    Deviations and Exclusions from Test Specifications.....	5
2.5    Additional Information.....	6
3    References.....	7
4    Uncertainty Summary.....	8
5    Test Data.....	9
5.1    Antenna Port Conducted Emissions.....	9
5.2    Radiated Emissions.....	22
6    Revision History.....	28

## 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*

Company: <a href="#">Triax Technologies</a>	Page 3 of 28	Name: <a href="#">Spot-r Clip</a>
Report: <a href="#">317206C</a>		Model: <a href="#">CL-2</a>
Job: <a href="#">C-2757</a>		Serial: <a href="#">See Section 2.1</a>

## 1 TEST REPORT SUMMARY

During **10/2/17 – 6/20/17** 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: 15.247 (a)(1) IC: RSS-247 5.1	Channel Separation, Number of Hopping frequencies, Time of Occupancy	FHS	ANSI C63.10	Pass
FCC: 2.1049 IC: RSS-GEN 6.6	Occupied Bandwidth	Reported	ANSI C63.10	Pass
FCC: 15.247 (b)(1) IC: RSS-247 5.4 (b)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	20 dBc	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Pass
FCC: 15.207 IC: RSS-GEN 8.8	AC Power Line Conducted Emissions	0.150-30 MHz	ANSI C63.10	N/A

### 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

<b>Company Name</b>	Triax Technologies
<b>Contact Person</b>	Justin Morgenthau
<b>Address</b>	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*

<b>Product Name</b>	Spot-r Clip
<b>Model Number</b>	CL-2
<b>Serial Number</b>	CSM0202-00003043 (Conducted RF) CSM0202-00003040, -00003145 (Radiated Emissions)
<b>FCC/IC #</b>	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 Additional 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.

Company: Triax Technologies	Page 6 of 28	Name: Spot-r Clip
Report: 317206 C		Model: CL-2
Job: C-2757		Serial: See Section 2.1

### 3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15	-	2017
ANSI C63.10	-	2013
RSS-247	2	2017
RSS GEN	4	2014

## 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 $\pm$
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. $\pm$	U.C. $\pm$
Radio Frequency, from F0	$1 \times 10^{-7}$	$0.55 \times 10^{-7}$
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 %

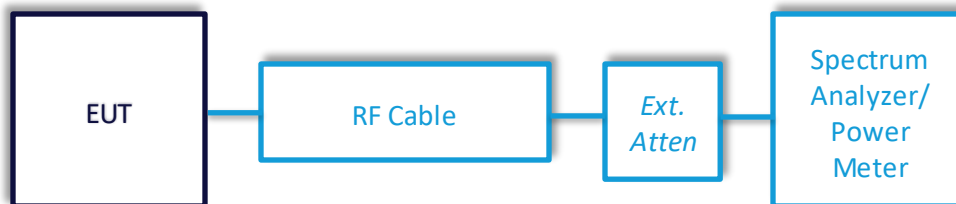


## 5 TEST DATA

### 5.1 Antenna Port Conducted Emissions

<b>Description of Measurement</b>	<p>The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
<b>Example Calculations</b>	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

#### Block Diagram



### 5.1.1 Antenna Port Conducted Emissions – Hopping Parameters

<b>Operator</b>	Shane Dock
<b>Test Date</b>	10/18/17 – 6/20/18
<b>Location</b>	Conducted RF Area
<b>Temp. / R.H.</b>	71 degrees F/ 57%
<b>Requirement</b>	FCC: 15.247 (a)(1) IC: RSS-247 5.1
<b>Method</b>	ANSI C63.10 Sections 7.8.2, 7.8.3, 7.8.4

#### Limits:

Frequency Separation	Number of Hopping Channels	Maximum Occupancy Time
>25 kHz or 20 dB Bandwidth	>50	0.4 seconds per 20 sec. Period

#### Test Parameters

<b>Frequency</b>	902-928 MHz
<b>Settings</b>	Low, Mid, and High Checked
<b>EUT</b>	Hopping mode Utilized on EUT

#### Instrumentation



Date : 18-Jul-2017      Test : Conducted RF Testing      Job # : C-2757  
 PE: Shane Dock      Customer : Triax Technologies      Quote # : 317206

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Spectrum Analyzer	Agilent	N9010A	MY53400296	12/22/2016	12/22/2017	Active Calibration
2	AA 960143	Phaseflex	Gore	BKD01D01048.0	5546519	6/29/2016	12/31/2017	Active Calibration

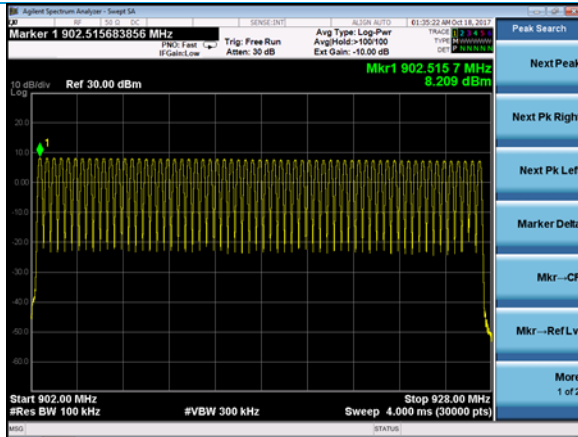
#### June Testing

1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/25/2018	4/25/2019	Active Calibration
2	AA 960143	Cable	Gore	BKD01D01048.0	5546519	11/15/2017	11/15/2018	Active Verification

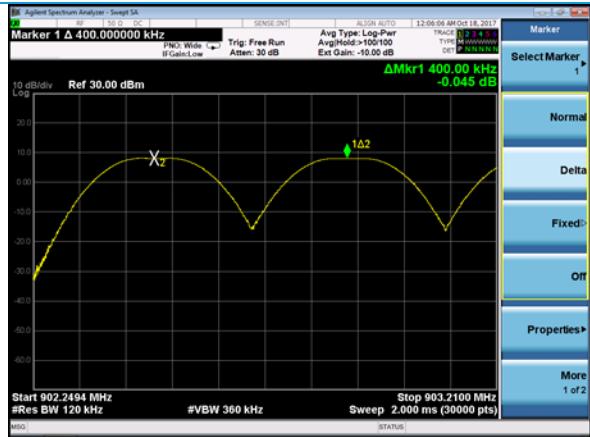
Table

Channel	Occupancy Time (ms)	Number of Transmissions	Occupancy time per 20s (ms)
Low	199.9	2	399.8
Mid	199.9	2	399.8
High	199.9	2	399.8

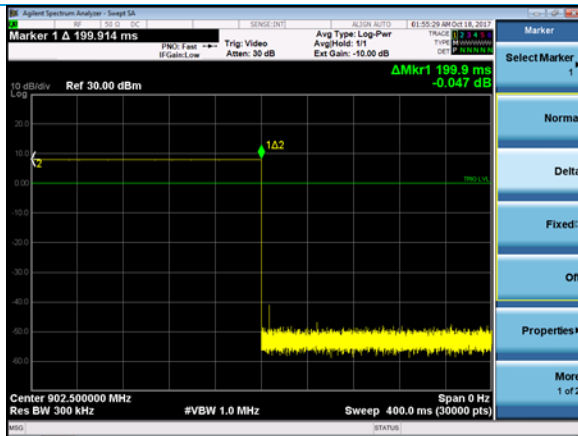
### Plots



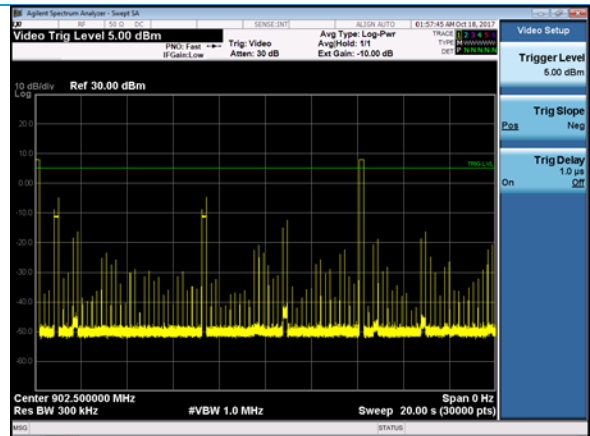
Number of Hopping Frequencies = 64



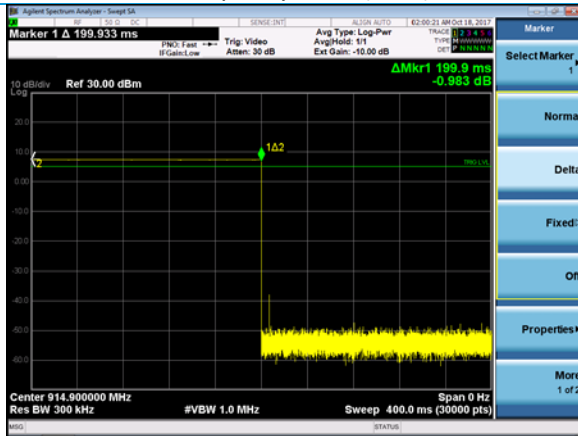
Carrier Frequency Separation = 400kHz



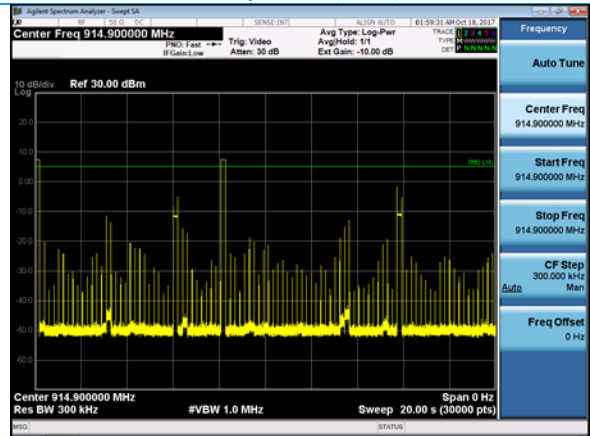
Occupancy Time (Low)



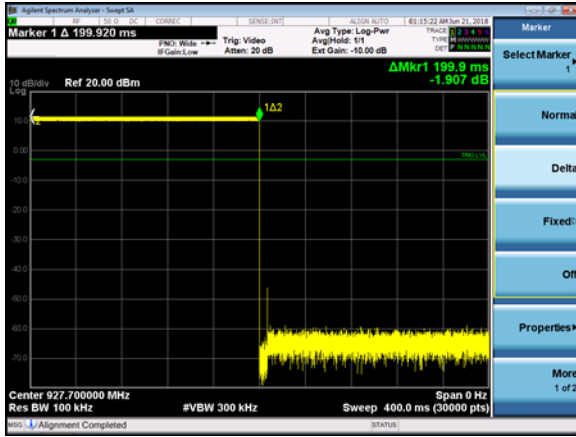
20s period (Low)



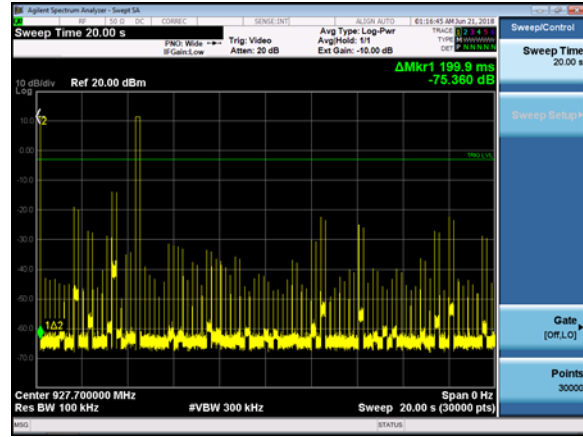
Occupancy Time (Mid)



20s period (Mid)



Occupancy Time (High)



20s period (High)

### 5.1.2 Antenna Port Conducted Emissions – Occupied Bandwidth

<b>Operator</b>	Shane Dock
<b>Test Date</b>	10/18/17
<b>Location</b>	Conducted RF Area
<b>Temp. / R.H.</b>	71 degrees F/ 57%
<b>Requirement</b>	FCC: 2.1049 IC: RSS-GEN 6.6
<b>Method</b>	ANSI C63.10 Section 7.8.7

**Limits:**

<b>20 dB BW (MHz)</b>
< 500

**Test Parameters**

<b>Channels</b>	Low, Mid, High Channels Checked
<b>Settings</b>	99% and 20 dB BW recorded

**Table**

Channel	Low	Mid	High
20 dB BW (kHz)	124.9	123.7	123.8
99% BW (kHz)	114.96	112.99	111.97

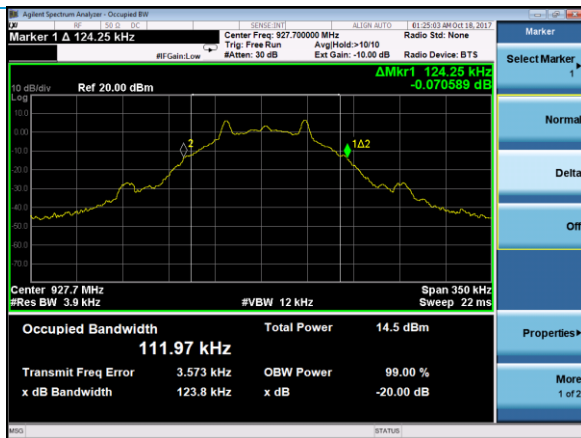
## Plots



Low



Mid



High

### 5.1.3 Antenna Port Conducted Emissions – Maximum Conducted Output Power

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

**Limits:**

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

**Test Parameters**

<b>Channels</b>	Low, Mid, High
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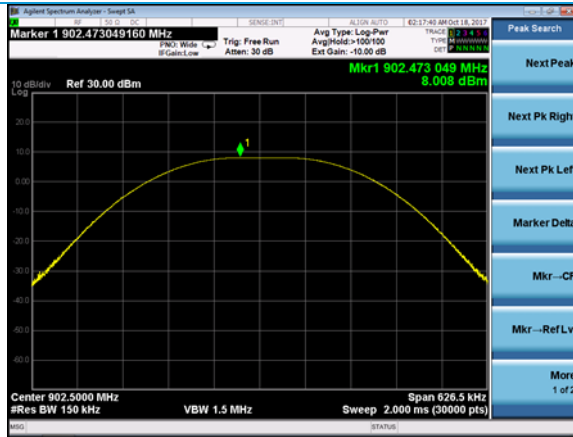
**Table**

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

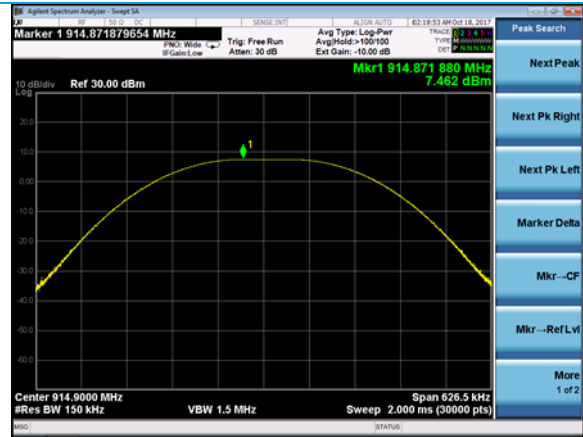
**Worst Case Margin = 30.000 dBm – (8.008 dBm) = 21.992 dB**



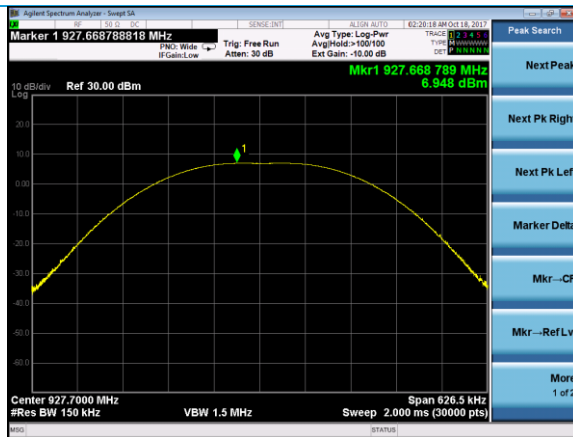
# Plots



Low



Mid



High

Company: Triax Technologies	Page 17 of 28	Name: Spot-r Clip
Report: 317206C		Model: CL-2
Job: C-2757		Serial: See Section 2.1

### 5.1.4 Antenna Port Conducted Emissions – RF Spurious Emissions

<b>Operator</b>	Shane Dock
<b>Test Date</b>	10/18/17
<b>Location</b>	Conducted RF Area
<b>Temp. / R.H.</b>	71 degrees F/ 57%
<b>Requirement</b>	FCC: 15.247 (d) IC: RSS-247 5.5
<b>Method</b>	ANSI C63.10 Sections 7.8.6 and 7.8.8

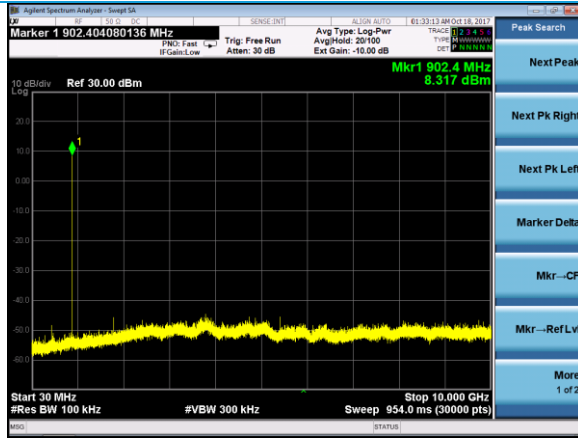
**Limits:**

<b>RF Spurious Limit</b>
20 dBc

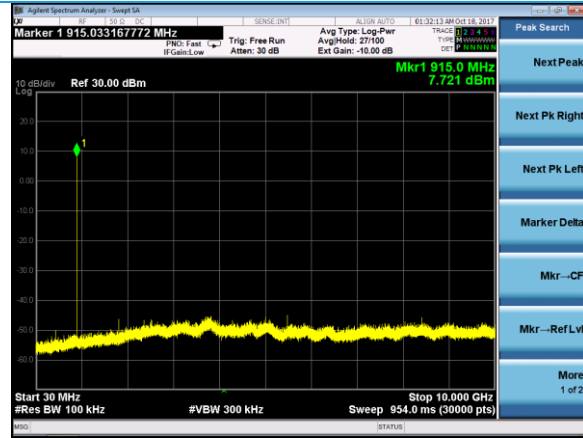
**Test Parameters**

<b>Frequency</b>	30-10000 MHz
<b>Channels</b>	Low, Mid, High
<b>Notes</b>	No emissions observed within 20dB of limit.

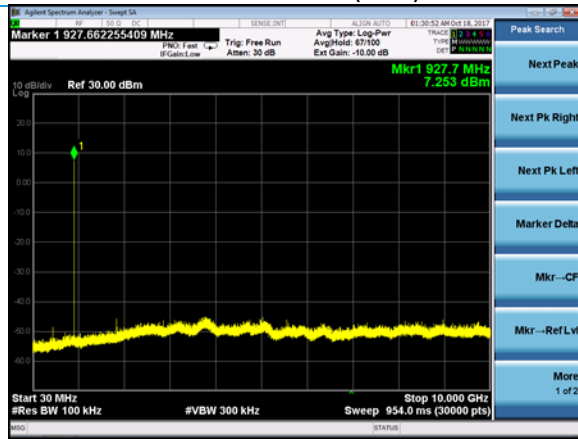
### Plots



30-10000 MHz (Low)

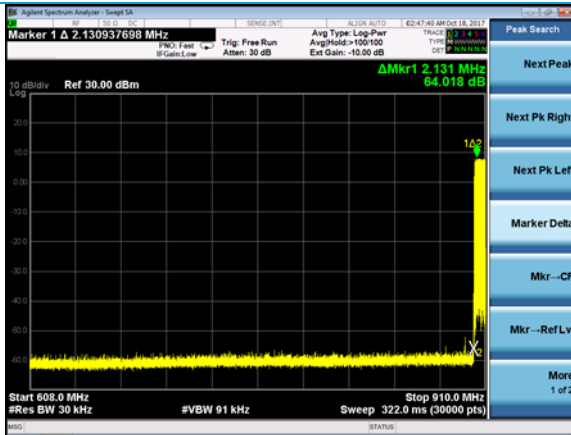


30-10000 MHz (Mid)

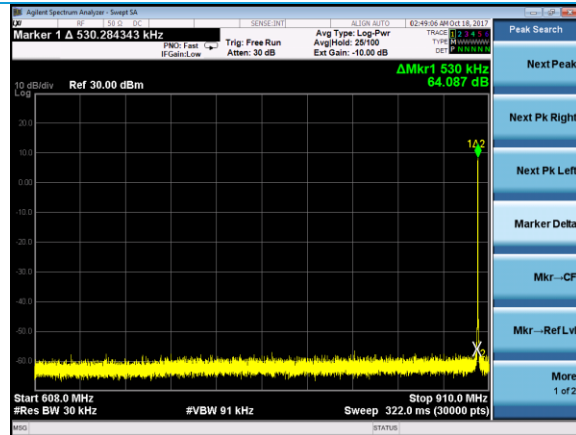


30-10000 MHz (High)

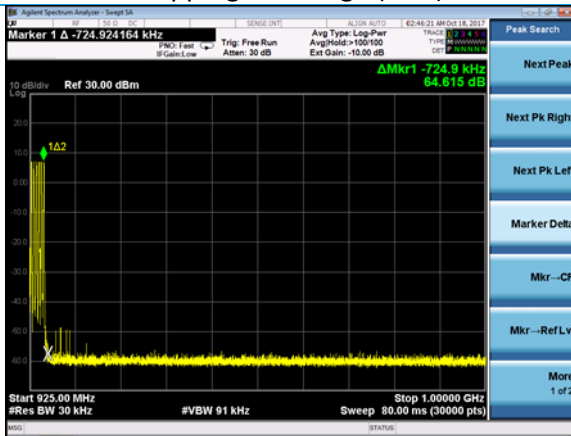
### Band Edges



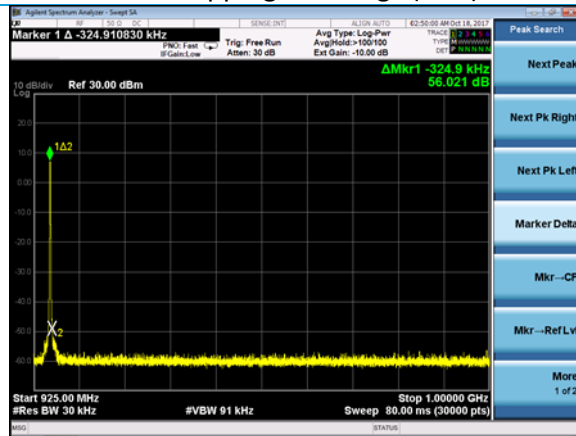
Hopping Band Edge (Low)



Non-Hopping Band Edge (Low)



Hopping Band Edge (High)



Non-Hopping Band Edge (High)

### 5.1.5 Antenna Port Conducted Emissions – Frequency Stability

<b>Operator</b>	Shane Dock
<b>Test Date</b>	10/18/17
<b>Location</b>	Conducted RF Area
<b>Temp. / R.H.</b>	71 degrees F/ 57%
<b>Requirement</b>	FCC: 2.1055 (d) IC: RSS-GEN 6.11
<b>Method</b>	ANSI C63.10 Section 6.8

#### Test Parameters

<b>Channels</b>	Low, Mid, High
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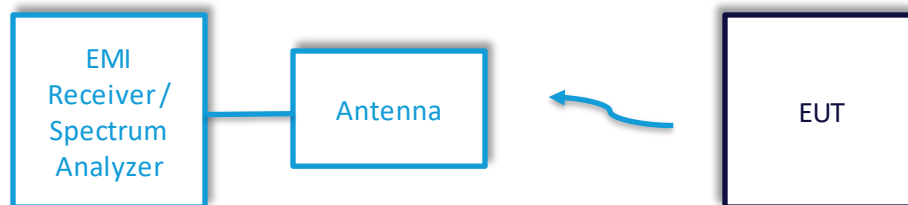
**Table (Values below listed in Hz at the given voltages)**

	3.15 VDC	3.70 VDC	4.20 VDC	Deviation
Low Channel	902500808	902501575	902499692	1883
Mid Channel	914901792	914899142	914899292	2650
High Channel	927703375	927701858	927702008	1517

## 5.2 Radiated Emissions

<p><b>Description of Measurement</b></p>	<p>The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna.</p> <p>The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values.</p> <p>The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.</p>
<p><b>Example Calculations</b></p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>Example at 4000 MHz:            Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m            Average Limit = 20 log (500) = 54 dBμV/m            Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB</p>

### Block Diagram



### 5.2.1 Radiated Emissions

<b>Operator</b>	Shane Dock
<b>Test Date</b>	10/2/17 – 10/5/17
<b>Location</b>	Chamber 3, Chamber 5
<b>Temp. / R.H.</b>	71/55%
<b>Requirement</b>	FCC: 15.247 (d)
<b>Method</b>	IC: RSS-GEN 8.10

#### Limits:

	30-88 MHz	88-216 MHz	216 – 960 MHz	960+ MHz
Field Strength (µV/m)	100	150	200	500
Field Strength (dBµV/m)	40.0	43.5	46.0	54.0

#### Test Parameters

<b>Frequency</b>	30-25000
<b>Distance</b>	3M
<b>Settings</b>	Unit tested at Low, Mid, High Channels
<b>Settings</b>	RBW = 120kHz, VBW 1.2 MHz (<1 GHz) RBW = 1 MHz, VBW = 3 MHz (>1 GHz) VBW = 10 Hz for Average Measurements above 1 GHz
<b>Notes</b>	Measurements taken in restricted bands. For measurements above 1 GHz, antenna used with a tilt gear to keep EUT within the cone of radiation. Absorbers were also added to the floor of the chamber while measuring emissions above 1 GHz. Emissions below 200 MHz are not a function of the EUT. For Band Edges, both hopping and non hopping modes were investigated.
<b>Example Calculation</b>	Limit (dBµV) = 20* Log[ Limit (µV) ] 40 = 20* log (100) Raw Data + Antenna Factor + Cable Factor = Reported Data 19.77 dBµV + 12.50 dB/m + 0.93 dB = 38.80 dBµV/m

## Instrumentation



Date : 18-Jul-2017

Test : RE - 900 MHz

Job # : C-2757

PE : Shane Dock

Customer : Triax Technologies

Quote # : 317206

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960128	Biconical Antenna	ETS Lindgren	3110B	00062899	4/13/2017	4/13/2018	Active Calibration
2	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	4/17/2017	4/17/2018	Active Calibration
3	EE 960088	EM Receiver	Agilent	N9038A	MY51210138	3/2/2017	3/2/2018	Active Calibration
4	EE 960085	EM Receiver	Agilent	N9038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	8/30/2017	8/30/2018	Active Calibration
6	AA 960171	Cable - low loss 6m	A.H. Systems, Inc.	SAC-26G-6	386	3/31/2016	12/11/2017	Active Verification
7	AA 960156	High Pass Filter 900 MHz	KWM	HFF-L-14185	none	8/29/2017	8/29/2018	Active Calibration

## Table

Measurements below 200 MHz are noise floor measurements.

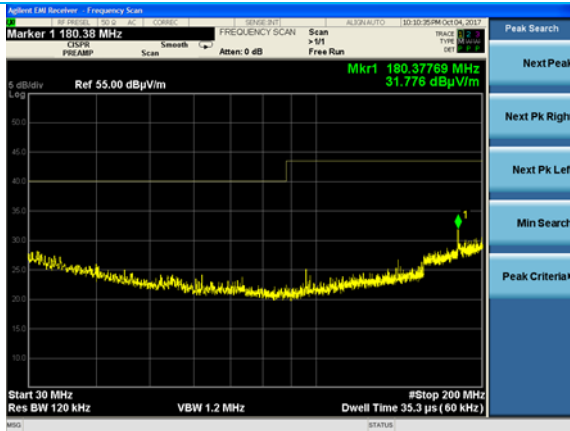
Frequency (MHz)	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dB $\mu$ V/m)	Quasi-Peak Limit (dB $\mu$ V/m)	Quasi-Peak Margin (dB)	Antenna Polarity	EUT orientation	Channel
198.68	100.00	0.0	24.4	43.5	19.1	H	V	Low
180.38	100.00	0.0	23.2	43.5	20.3	V	V	Low

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Avg Reading (dB $\mu$ V/m)	Avg Limit (dB $\mu$ V/m)	Avg Margin (dB)	Antenna Polarity	EUT orientation	Channel
2707.5	127.57	139.00	51.3	50.0	54.0	4.0	Vertical	Horizontal	1
3610.0	100.00	214.25	42.4	39.4	54.0	14.6	Vertical	Horizontal	1
2719.9	109.61	134.50	49.6	48.1	54.0	5.9	Vertical	Horizontal	32
2732.9	178.76	135.25	48.6	46.9	54.0	7.1	Vertical	Horizontal	64

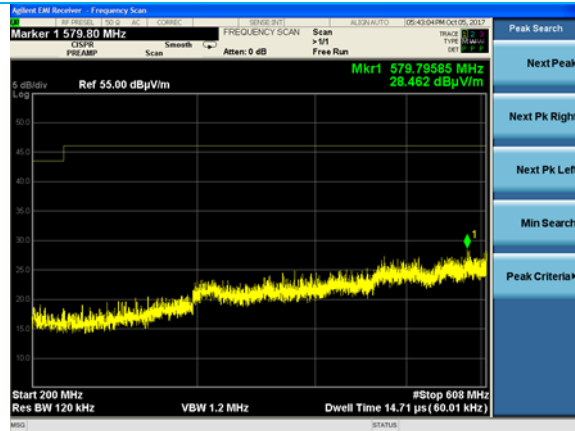


Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Avg Reading (dBμV/m)	Avg Limit (dBμV/m)	Margin (dB)	Antenna Polarity	EUT orientation	Channel
4512.4	281.00	39.5	46.4	43.1	54.0	10.9	Horizontal	Horizontal	1
9024.8	248.38	160.75	47.5	39.3	54.0	14.7	Horizontal	Horizontal	1
5415.0	167.76	265.5	42.3	33.7	54.0	20.3	Horizontal	Horizontal	1
4512.6	115.33	72.5	44.6	40.1	54.0	13.9	Vertical	Horizontal	1
9024.8	100.04	136.25	46.2	36.9	54.0	17.1	Vertical	Horizontal	1
9025.4	150.14	167.75	46.8	39.5	54.0	14.5	Vertical	Vertical	1
4512.6	243.57	323.5	43.1	37.1	54.0	16.9	Vertical	Vertical	1
4512.4	100.19	113.75	42.6	37.1	54.0	16.9	Horizontal	Vertical	1
9024.7	150.04	163.25	46.6	37.4	54.0	16.6	Horizontal	Vertical	1
4512.6	108.66	353.5	44.6	40.5	54.0	13.5	Horizontal	Flat	1
4512.5	108.52	78.75	42.7	37.5	54.0	16.5	Vertical	Flat	1
9024.8	106.42	189.75	45.3	35.4	54.0	18.6	Vertical	Flat	1
4574.6	105.28	353.5	44.0	38.8	54.0	15.2	Horizontal	Flat	32
9149.3	100.04	290	45.2	35.8	54.0	18.2	Vertical	Vertical	32
4638.6	127.42	357.5	43.5	38.1	54.0	15.9	Horizontal	Flat	64

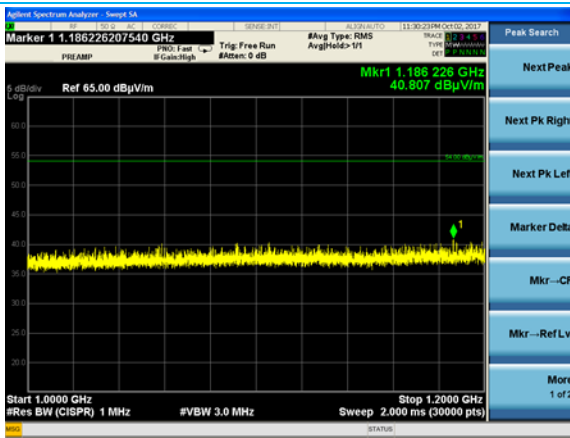
## Plots – Spurious Emissions



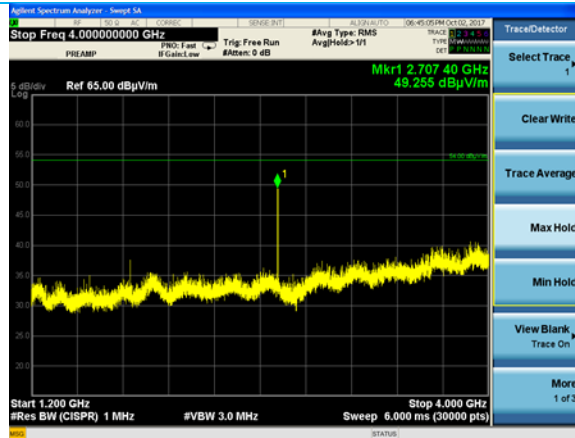
30-200 MHz



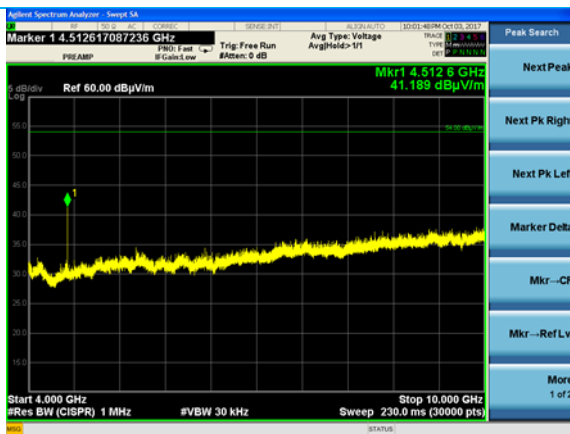
200-608 MHz



1000-1200 MHz



1200-4000 MHz (Reduced BW)

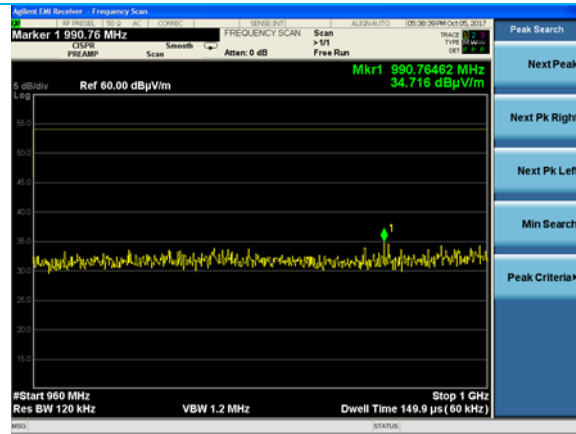


4-10 GHz (Reduced BW)

### Plots – Band Edges (Worst Case Shown)



LBE



UBE

## 6 REVISION HISTORY

Version	Date	Notes	Person
V0	11/14/17	First Draft	Shane Dock
V1	6/6/18	Update Draft	Shane Dock
V2	8/13/18	Updated Customer Info	Shane Dock
V3	8/14/18	Final	Shane Dock

**END OF REPORT**