



# LS RESEARCH LLC

Wireless Product Development

W66 N220 Commerce Court • Cedarburg, WI 53012 USA • Phone: 262.375.4400 • Fax: 262.375.4248 • www.lsr.com

## ENGINEERING TEST REPORT # 314006 LSR Job #: C-1883

### Compliance Testing of:

Proximity Locator

### Test Date(s):

March 18, 19, 20, 24, 25, 26 2014

### Prepared For:

Matrix

Attn: Tony Amos

3299 Tower Drive

Newburgh, IN 47630

### **This Test Report is issued under the Authority of:**

Adam Alger, EMC Engineer

Signature: Date: 5-20-14

### **Test Report Reviewed by:**

Ryan Urness, Manager

Signature: Date: 4-14-14

### **Report by:**

Adam Alger, EMC Engineer

Signature: Date: 4-7-14

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Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Table of Contents

i.	Title Page .....	1
ii.	Table of Contents .....	2
iii.	LS Research, LLC.....	3
1.0	Summary of Test Report.....	4
2.0	Test Facilities .....	4
3.0	Client Information.....	5
3.1	Equipment Under Test (EUT) Information.....	5
3.2	Product Description .....	5
3.3	Modifications Incorporated In the EUT for Compliance Purposes .....	5
3.4	Deviations & Exclusions from Test Specifications .....	5
3.5	Additional Information .....	5
4.0	Conditions of Test.....	6
5.0	Test Equipment .....	6
6.0	Conformance Summary .....	6
	Appendix A – Test Equipment .....	7
	Appendix B – Test Data.....	8
B.1	– RF Conducted Emissions .....	8
B.2	– Radiated Emissions .....	28
B.3	– AC Mains Conducted Emissions .....	46
B.4	– Radiated Emissions (Charging Mode) .....	49
	Appendix C - Uncertainty Summary .....	51
	Appendix D - References.....	52

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## LS Research, LLC in Review

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

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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

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Federal Communications Commission (FCC) – USA

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

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Industrie Canada      Industry 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

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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

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Report: 314066	Model: 10000615
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## 1.0 Summary of Test Report

In Date the EUT Proximity Locator was tested and MEETS the following requirements:

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
FCC:15.247 (a)(2) IC: RSS 210 A8.2 (a)	6 dB Bandwidth of a Digital Modulation System	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC:15.247 (d) IC: RSS 210 A8.2 (b)	Power Spectral Density of a Digital Modulation System	Yes
FCC :15.247(d) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.109 IC : ICES-003	Digital Device / ITE Radiated Emissions	Yes

## 2.0 Test Facilities

All testing was performed at:

LS Research, LLC  
W66 N220 Commerce Court  
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted.

Prepared For: Matrix	Name: Proximity Locator
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### **3.0 Client Information**

<b>Manufacturer Name:</b>	Matrix
<b>Address:</b>	3299 Tower Drive Newburgh, IN 47630
<b>Contact Person:</b>	Tony Amos

#### **3.1 Equipment Under Test (EUT) Information**

*The following information has been supplied by the applicant.*

<b>Product Name:</b>	Proximity Locator
<b>Model Number:</b>	10000615
<b>Serial Number:</b>	Radiated (001A57-000D7D); RF Conducted (001A57-000D8B)
<b>FCC ID</b>	USK-10000615
<b>IC Number</b>	11898A-10000615

#### **3.2 Product Description**

The locator is a portable device worn by a coal miner in an underground and topside environment. It is used to detect an individual's proximity to operating coal extraction equipment.

If an operator gets too close to the equipment, it will either shut the equipment down or put it into a safe mode of operation via a controller that is mounted on the equipment.

Device utilizes a PCB mounted antenna. Taoglass PN SWLP.2450.12.4.B.02

#### **3.3 Modifications Incorporated In the EUT for Compliance Purposes**

Power reduction for radiated band-edge in restricted bands on outer channels. Data tables indicate final power settings. Channel 15 not utilized.

Fair-Rite # 0431164281 with two passes on power cable near cradle for unintentional emissions.

#### **3.4 Deviations & Exclusions from Test Specifications**

None noted at time of test

#### **3.5 Additional Information**

EUT programmed for continuous transmit modulation or receive mode via serial port connection to a modified cradle with USB. Hyper-terminal (or similar) used to type commands into EUT.

EUT fitted with a temporary connector for RF conducted measurements (serial # 002A57-000D8B).

Radiated sample serial # 001A57-000D7D

Power supply with EUT cradle: V-INFINITY P/N: EPSA150160U-PSP-SZ, Model: 3A-242WU15

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## **4.0 Conditions of Test**

Environmental:

Temperature: 20-25° C  
Relative Humidity: 30-60%  
Atmospheric Pressure: 86-106 kPa

Mains Voltage: 120VAC 60Hz

## **5.0 Test Equipment**

All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

<b>Frequency Range</b>	<b>Resolution Bandwidth</b>
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

## **6.0 Conformance Summary**

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, 15.207, 15.109, 15.107, Industry Canada RSS-210, Issue 8 (2010), Annex 8, RSS-GEN Issue 3 (2010), and ICES-003 Issue 5.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Appendix A – Test Equipment



Date : 18-Mar-2014

Type Test: Radiated Emissions

Job #: C-1883

Prepared By: Adam A

Customer: Matrix

Quote #: 314006

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	11/19/2013	11/19/2014	Active Calibration
2	AA 960005	Biconical Antenna	EMCO	93110B	9601-2280	7/25/2013	7/25/2014	Active Calibration
3	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/23/2013	9/23/2014	Active Calibration
4	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
5	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	8/7/2013	8/7/2014	Active Calibration
6	AA 960158	Double Ridge Horn Antenna	EMCO	3117	109300	3/29/2013	3/28/2014	Active Calibration
7	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213X-S+	740411007	3/28/2013	3/28/2014	Active Calibration
8	AA 960153	2.4GHz High Pass Filter	KW/M	HPF-L-14186	7272-04	4/1/2013	4/1/2014	Active Calibration
9	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	VLA622-4 / 3160-09	123001	9/24/2013	9/24/2014	Active Calibration

Project Engineer: Adam O'Byrne

Quality Assurance: J. H. H.



Date : 25-Mar-2014

Type Test: AC Line Conducted Emissions

Job #: C-1883

Prepared By: Adam A

Customer: Matrix

Quote #: 314006

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	11/19/2013	11/19/2014	Active Calibration
2	EE 960089	LISN-15A	COM-POWER	LI-215A	191943	2/26/2014	2/26/2015	Active Calibration

Project Engineer: Adam O'Byrne

Quality Assurance: J. H. H.



Date : 18-Mar-2014

Type Test: RF Conducted

Job #: C-1883

Prepared By: Adam A

Customer: Matrix

Quote #: 314006

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	8/7/2013	8/7/2014	Active Calibration

Project Engineer: Adam O'Byrne

Quality Assurance: J. H. H.

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## **Appendix B – Test Data**

### **B.1 – RF Conducted Emissions**

Manufacturer	Matrix
Test Location	LS Research, LLC
Rule Part	FCC Part 15.247 / RSS-210 Annex 8
General Measurement Procedure	FCC KDB 558074 D01 DTS Meas Guidance v03r01 ANSI C63.10-2009 Section 6.7
General Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings thereby allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

### B.1.1 – RF Conducted – Fundamental Bandwidth

Manufacturer	Matrix
Date	3-26-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	FCC Part 15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 8.0 DTS bandwidth ANSI C63.10-2009 Section 6.9 RSS-GEN Section 4.6
Additional Description of Measurement	Peak detector used
Additional Notes	Continuous transmit modulated used for this test.

**Table**

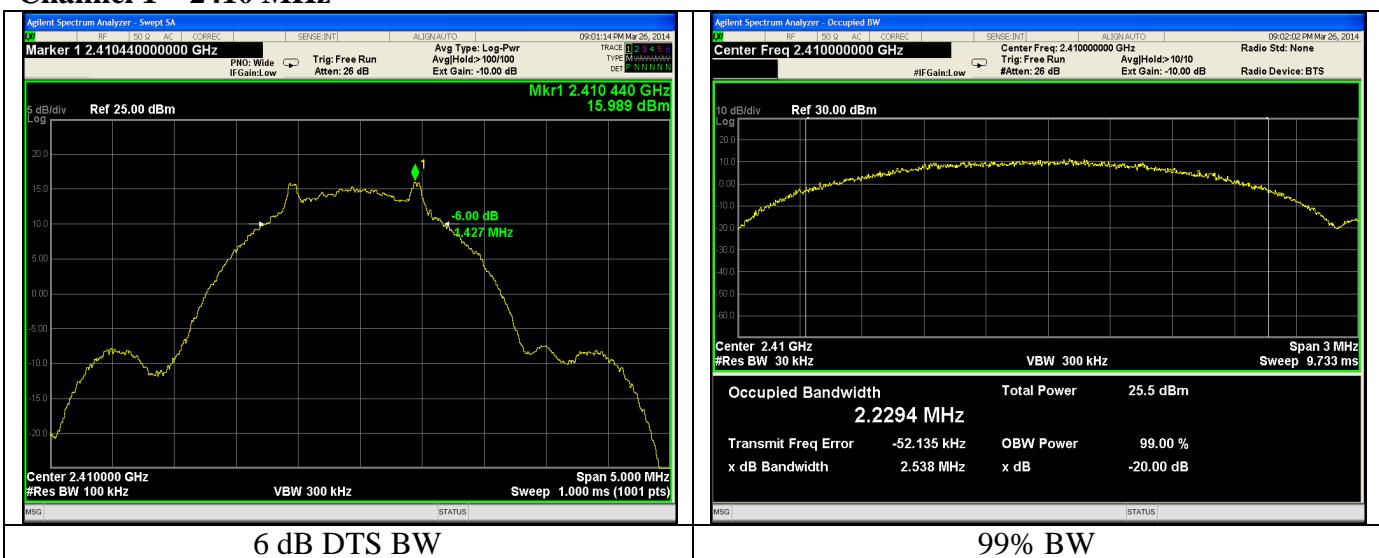
Frequency (MHz)	Channel	Power Level	DTS BW (6dB) MHz	99 % BW MHz
2405	0	14	1.45	2.22
2410	1	13	1.43	2.23
2415	2	12	1.41	2.22
2420	3	11	1.46	2.22
2440	7	11	1.43	2.23
2465	12	11	1.42	2.23
2470	13	12	1.41	2.23
2475	14	14	1.43	2.24

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## Channel 0 – 2405 MHz

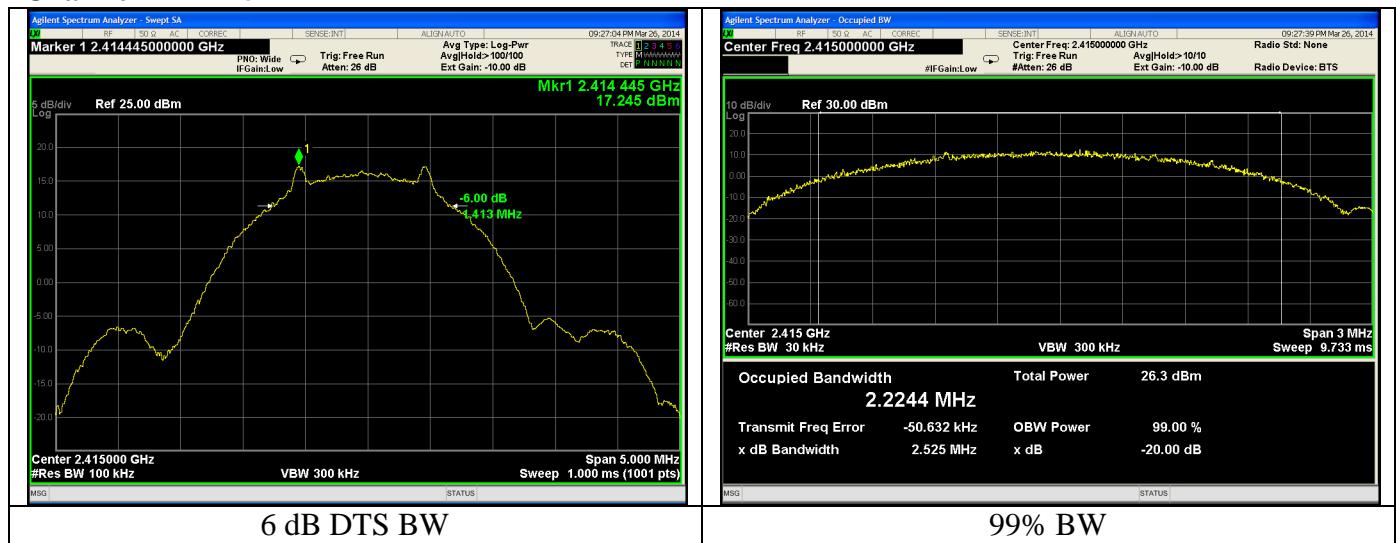


## Channel 1 – 2410 MHz



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 2 – 2415 MHz

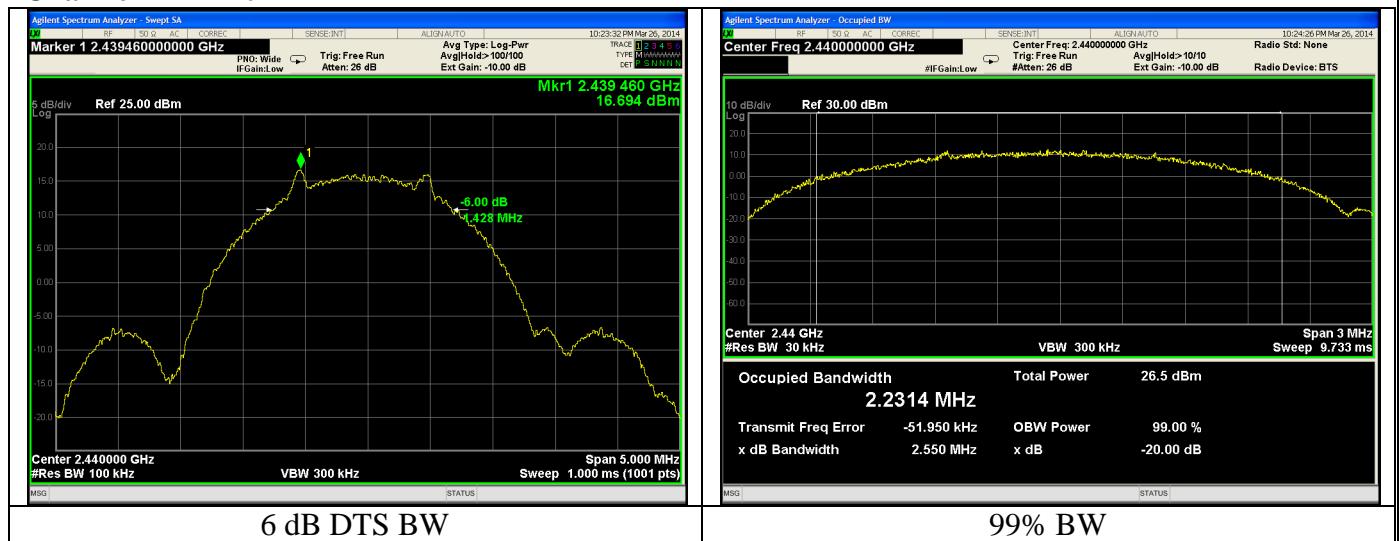


## Channel 3 – 2420 MHz

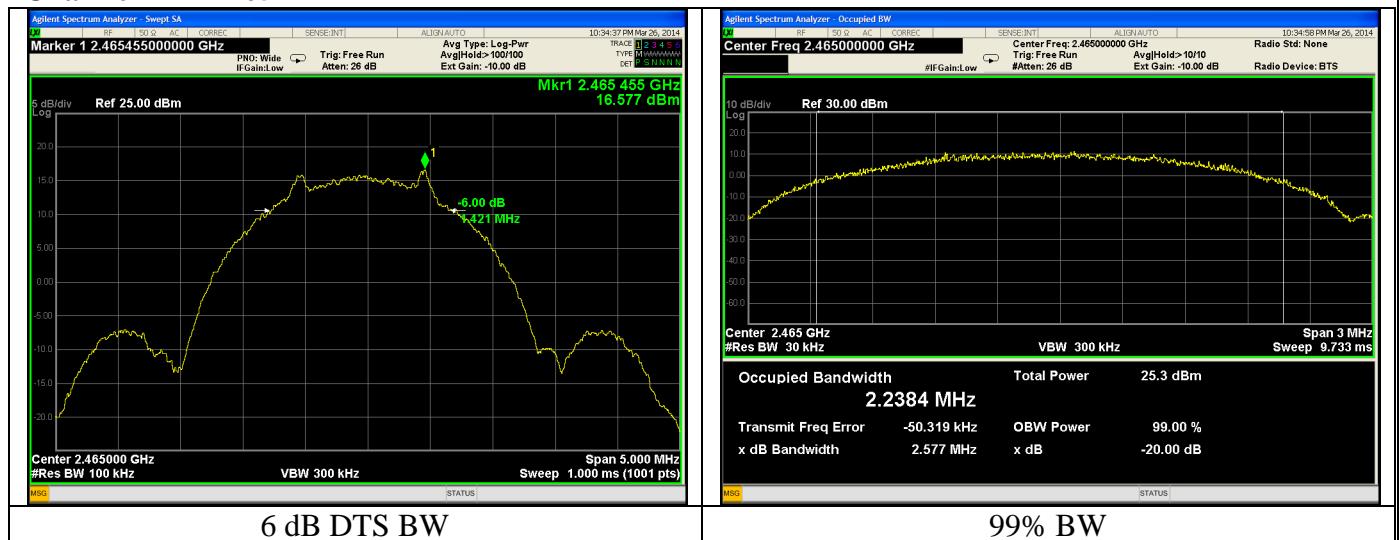


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 7 – 2440 MHz

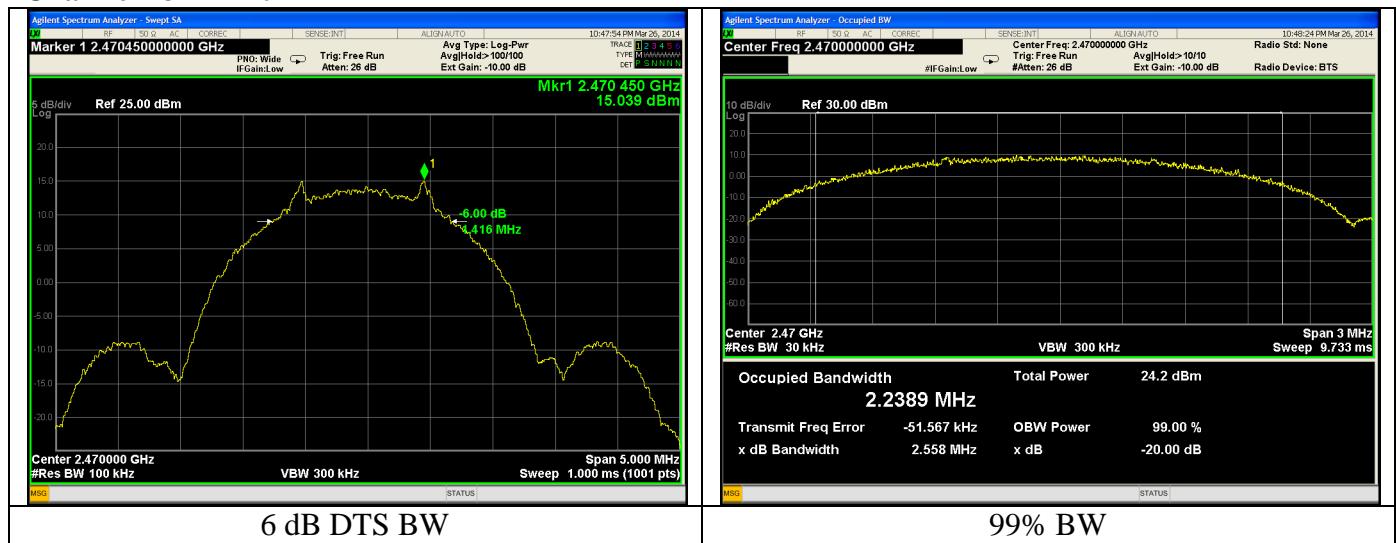


## Channel 12 – 2465 MHz



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 13 – 2470 MHz



## Channel 14 – 2470 MHz



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

### B.1.2 – RF Conducted – Fundamental Power and Spectral Density

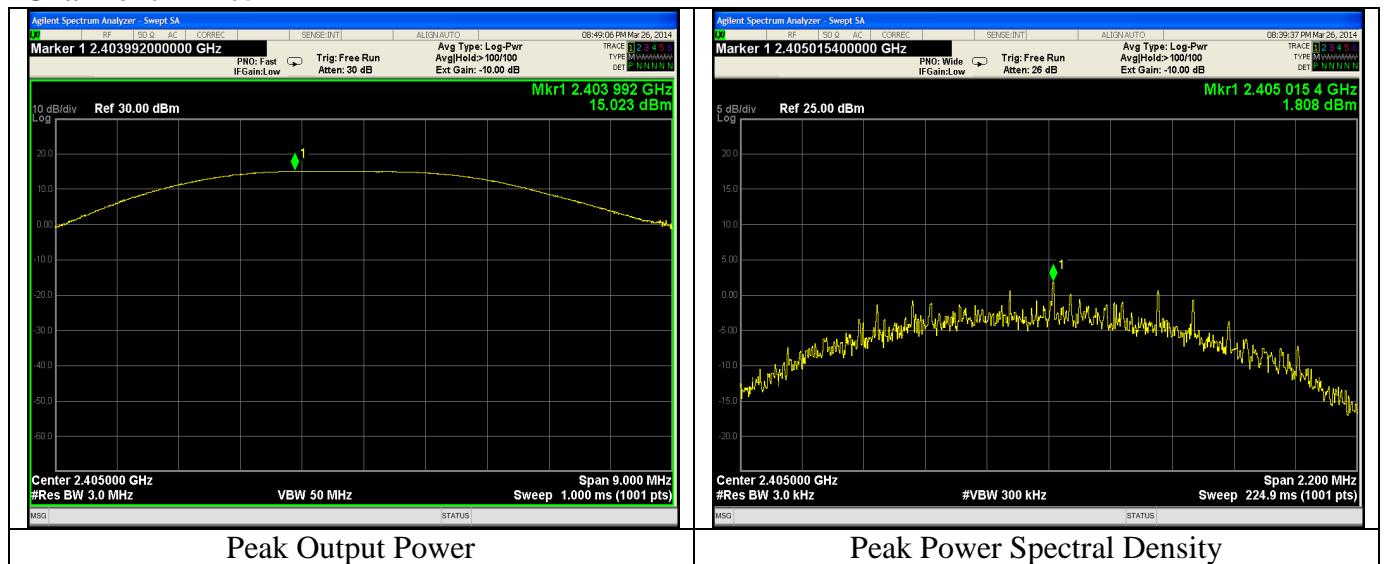
Manufacturer	Matrix
Date	3-26-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 9.1.1 – Maximum peak conducted output power FCC KDB 558074 Section 10.2 – Peak PSD
Additional Description of Measurement	3 kHz resolution bandwidth used for Peak Power Spectral Density measurement
Additional Notes	Sample Calculation: Margin (dB) = Limit – Measured level  Continuous transmit modulated used for this test.

**Table**

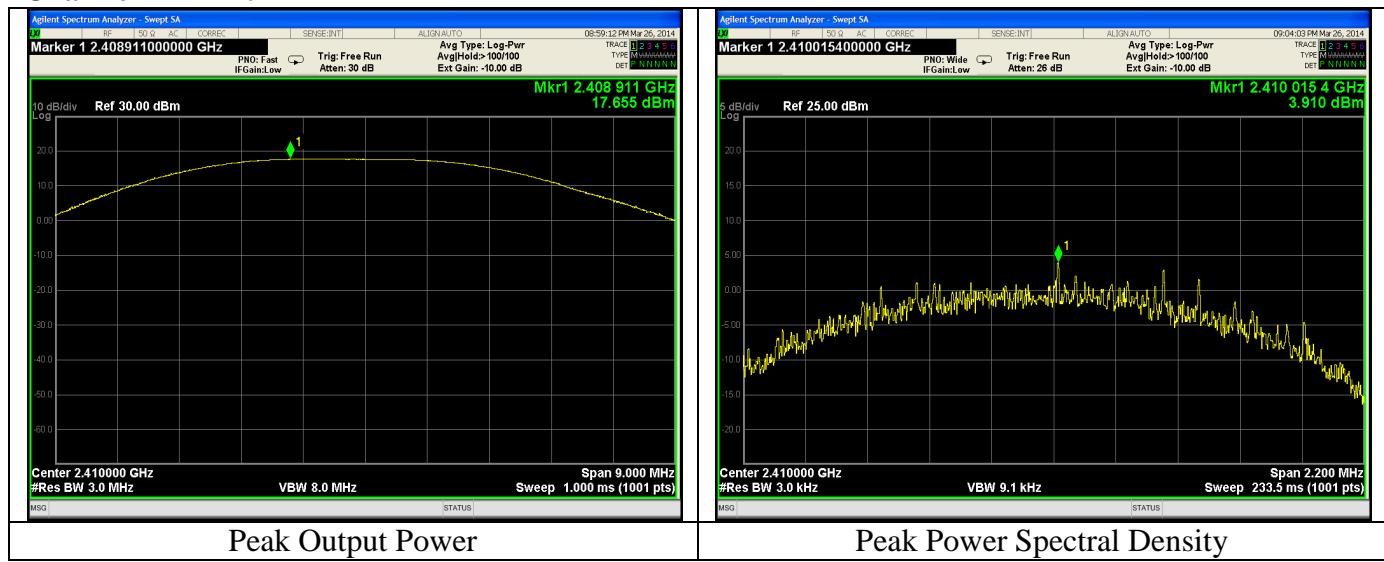
Frequency (MHz)	Channel	Power Level	DTS BW (6dB) MHz	99 % BW MHz	Output Power (dBm)	PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
2405	0	14	1.45	2.22	15.02	1.81	8	6.2
2410	1	13	1.43	2.23	17.65	3.91	8	4.1
2415	2	12	1.41	2.22	18.56	5.00	8	3.0
2420	3	11	1.46	2.22	19.09	5.32	8	2.7
2440	7	11	1.43	2.23	18.51	4.86	8	3.1
2465	12	11	1.42	2.23	18.02	4.52	8	3.5
2470	13	12	1.41	2.23	16.43	3.06	8	4.9
2475	14	14	1.43	2.24	10.59	-2.73	8	10.7

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 0 – 2405 MHz

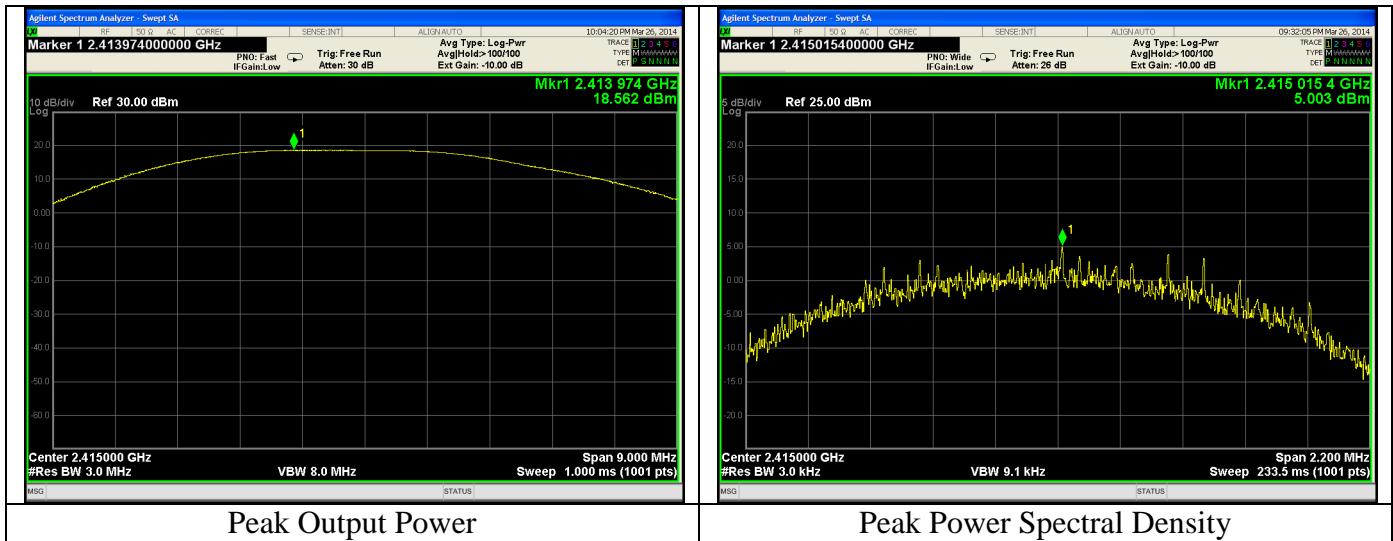


## Channel 1 – 2410 MHz

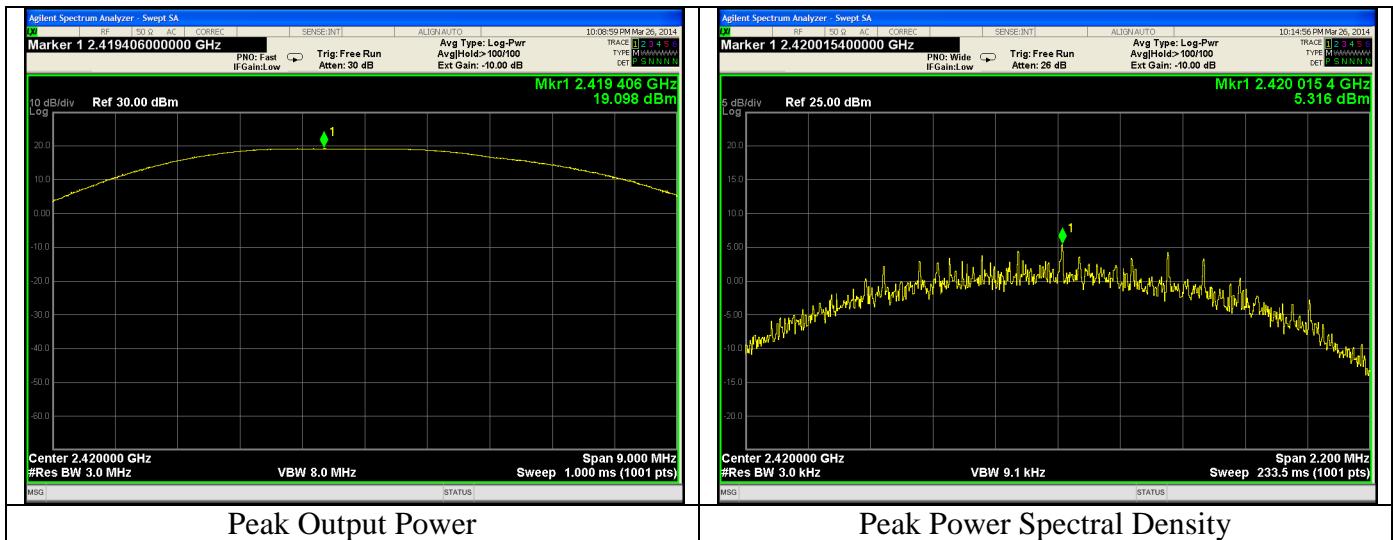


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 2 – 2415 MHz



## Channel 3 – 2420MHz

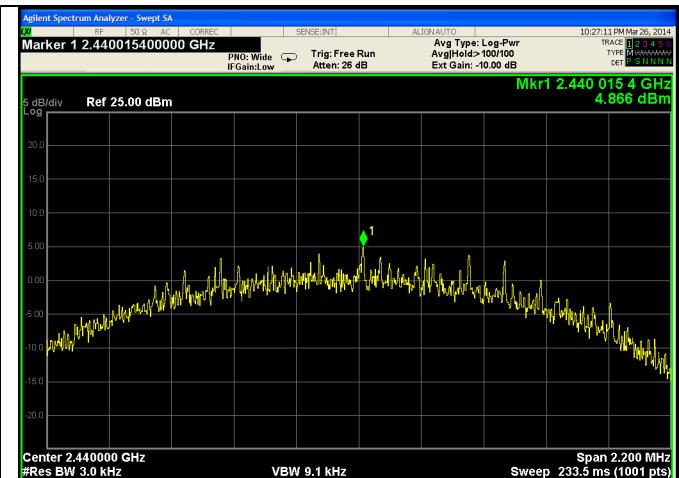


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 7 – 2440 MHz

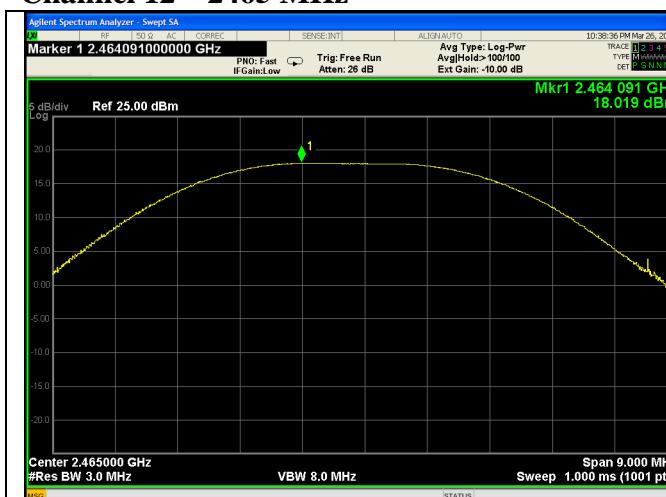


Peak Output Power

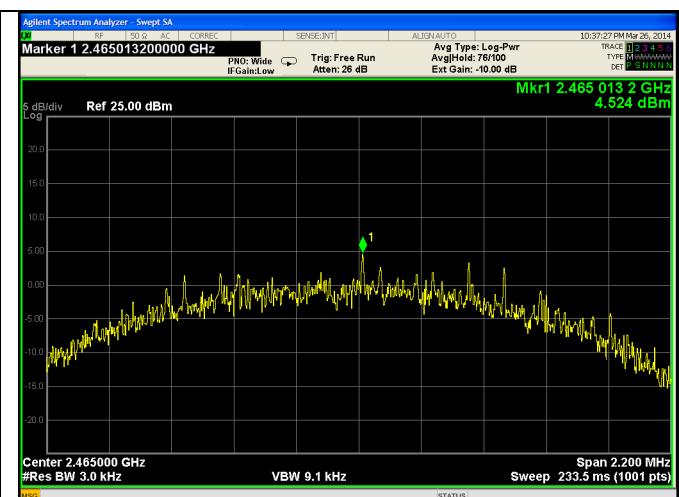


Peak Power Spectral Density

## Channel 12 – 2465 MHz



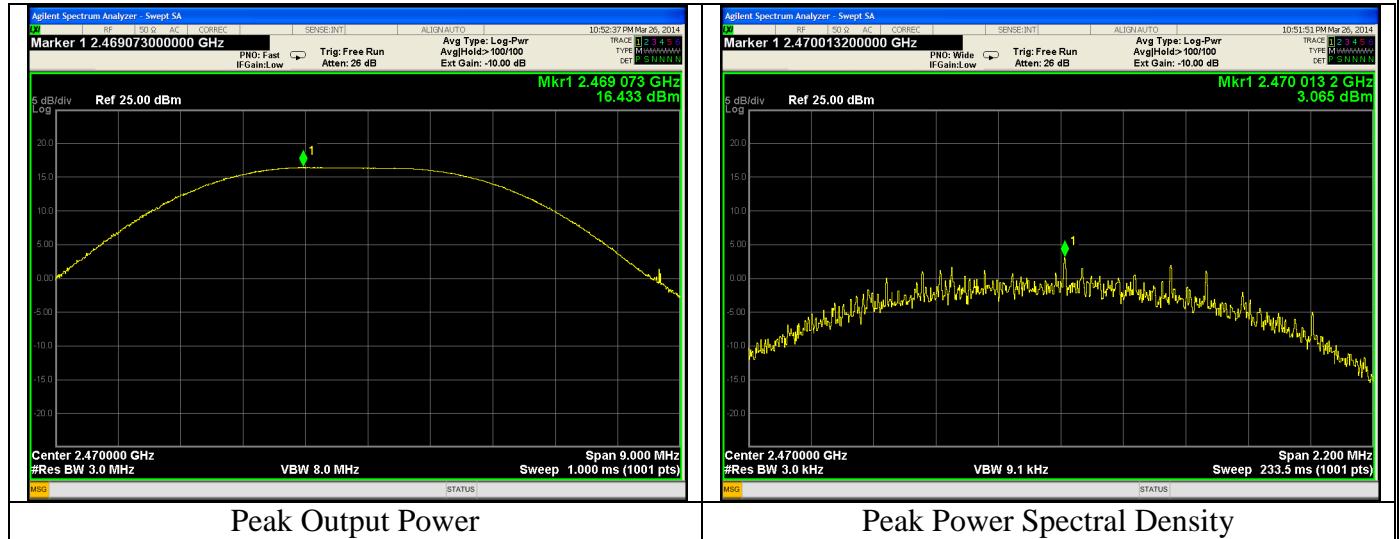
Peak Output Power



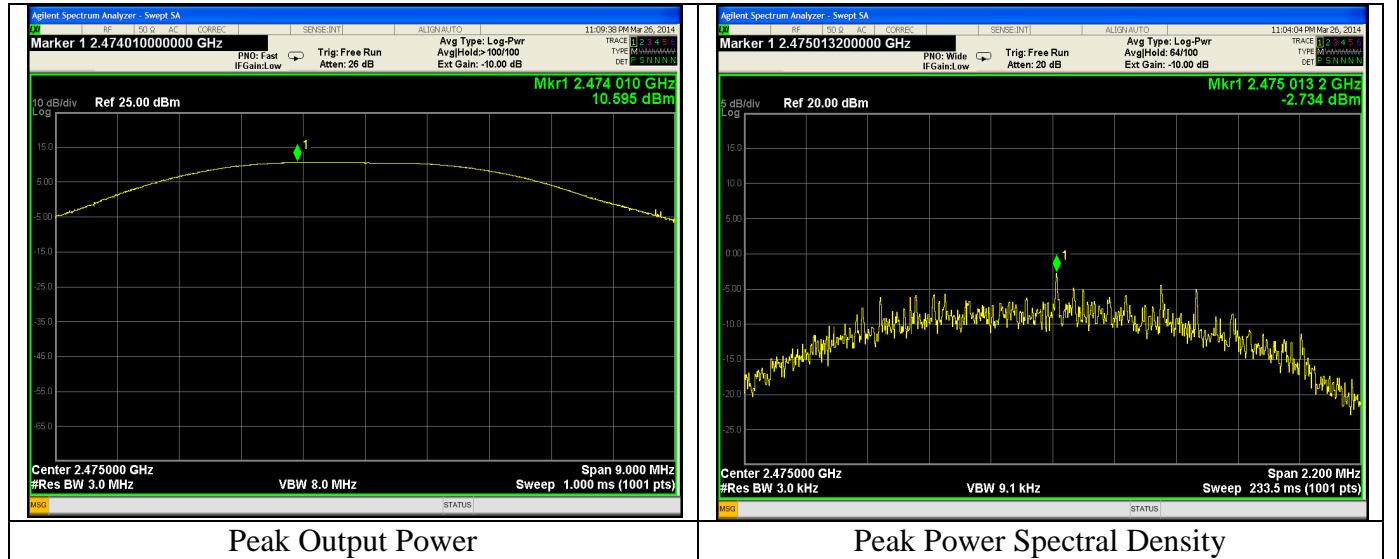
Peak Power Spectral Density

Prepared For: Matrix	Name: Proximity Locator
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## Channel 13 – 2470 MHz



## Channel 14 – 2470 MHz



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
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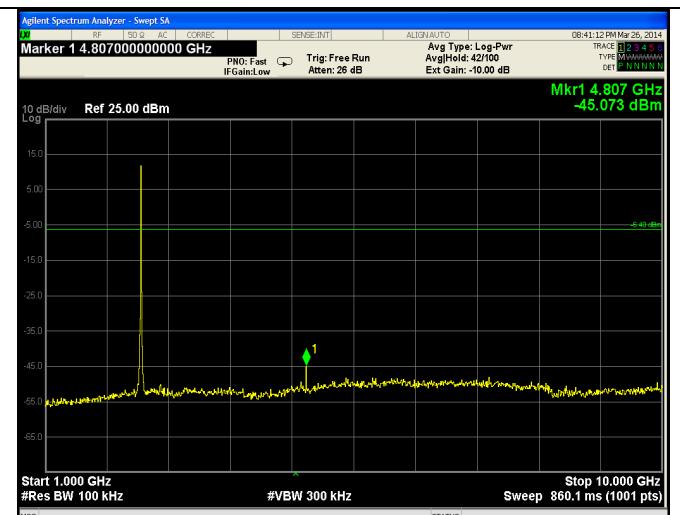
### B.1.3 – RF Conducted – Fundamental Spurious

Manufacturer	Matrix
Date	3-26-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247 / RSS-210 A8
Specific Measurement Procedure	FCC KDB 558074 Section 11.0 – Emissions in non-restricted frequency bands
Additional Description of Measurement	RF Conducted Measurement
Additional Notes	No Emissions found to be within 20 dB of limit Continuous transmit modulated used for this test.

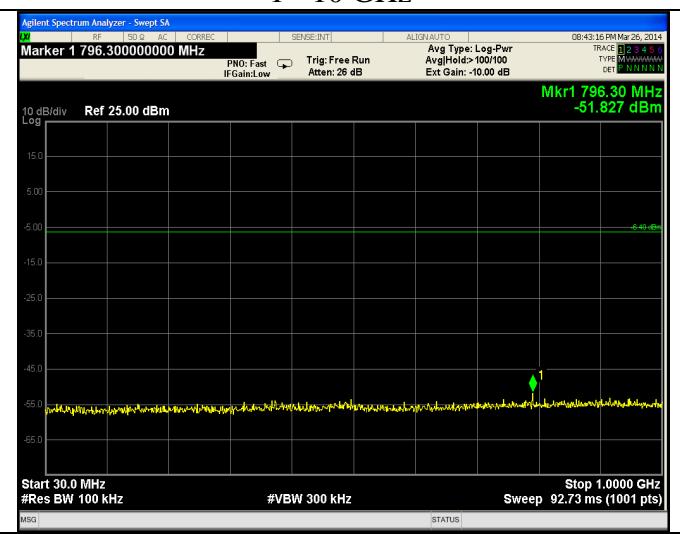
**Plots start next page**

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 0 – 2405 MHz



## 100 kHz Reference



## 10-25 GHz

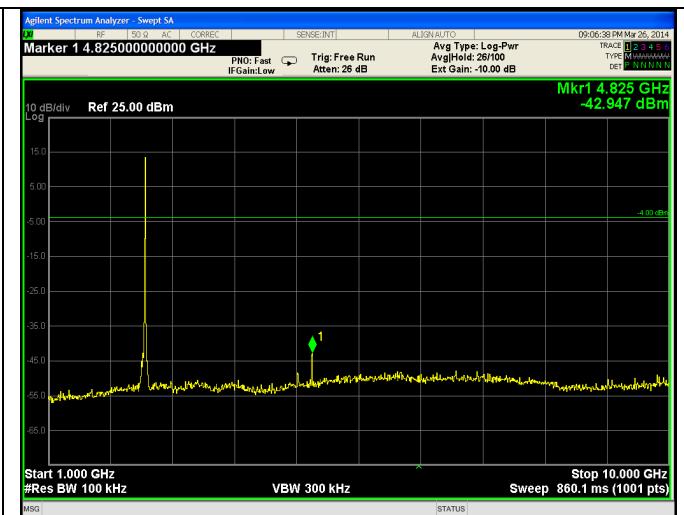
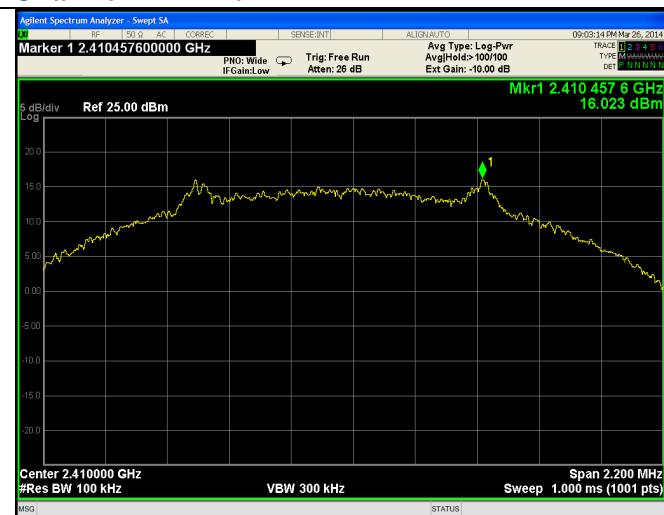


## 30-1000 MHz

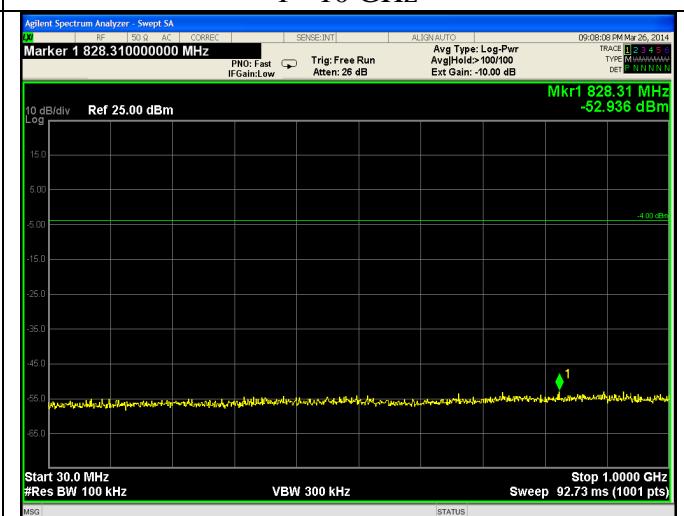
## Band-Edge

Prepared For: Matrix	Name: Proximity Locator
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## Channel 1 – 2410 MHz

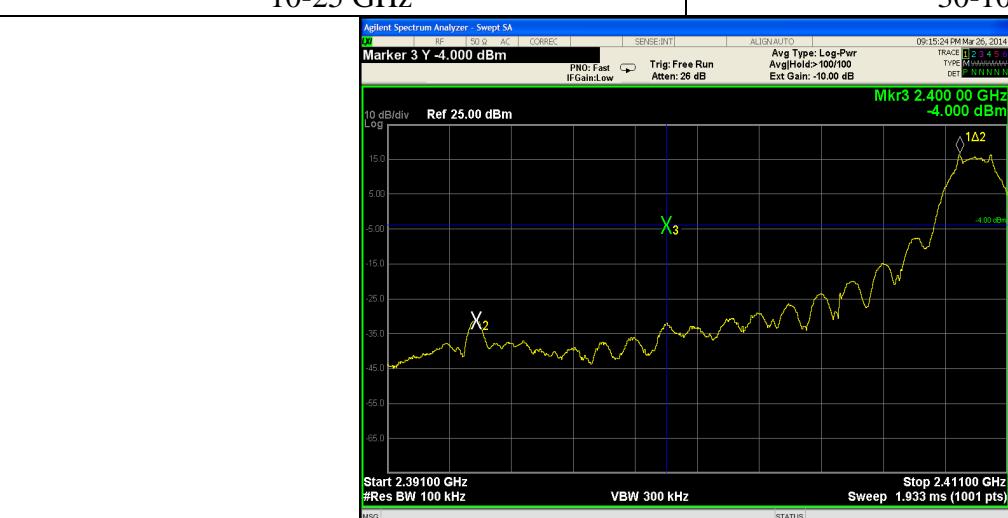


100 kHz Reference



10-25 GHz

30-1000 MHz



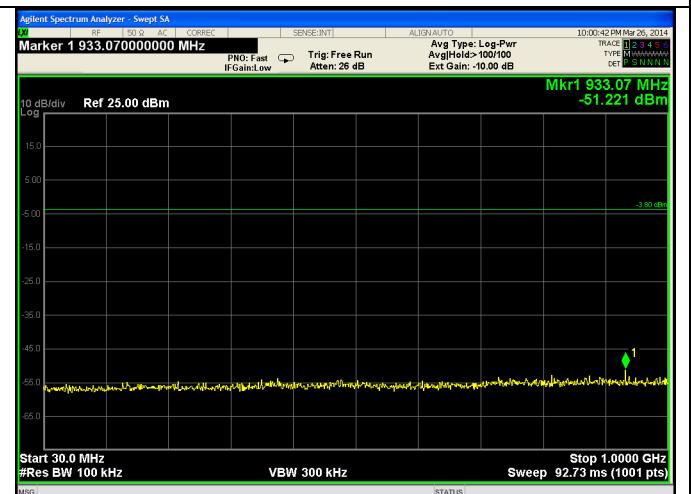
Band-Edge

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## Channel 2 – 2415 MHz



100 kHz Reference



10-25 GHz

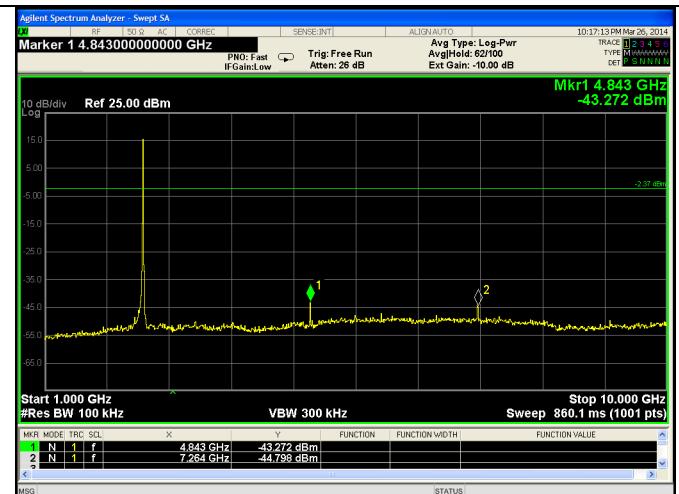
30-1000 MHz



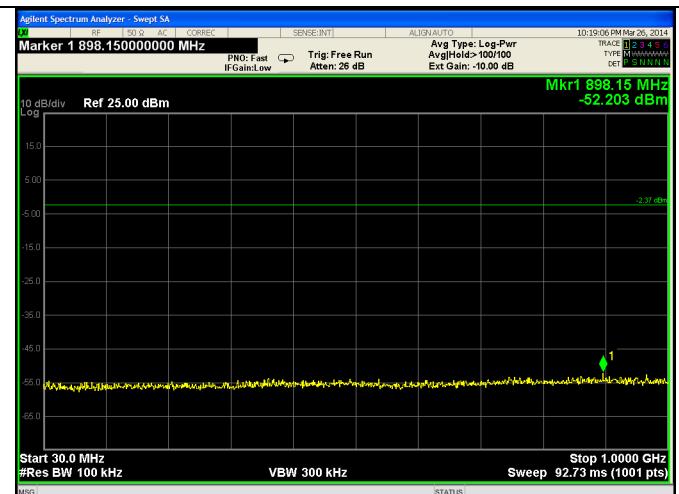
Band-Edge

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## Channel 3 – 2420 MHz



100 kHz Reference



10-25 GHz

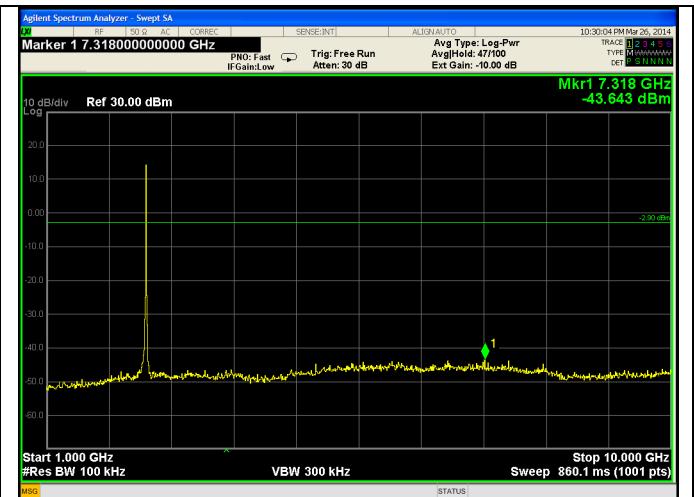
30-1000 MHz



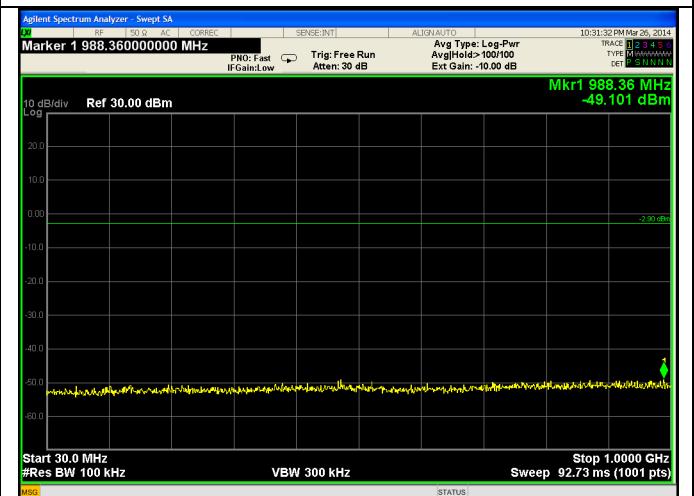
Band-Edge

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 7 – 2440 MHz



100 kHz Reference

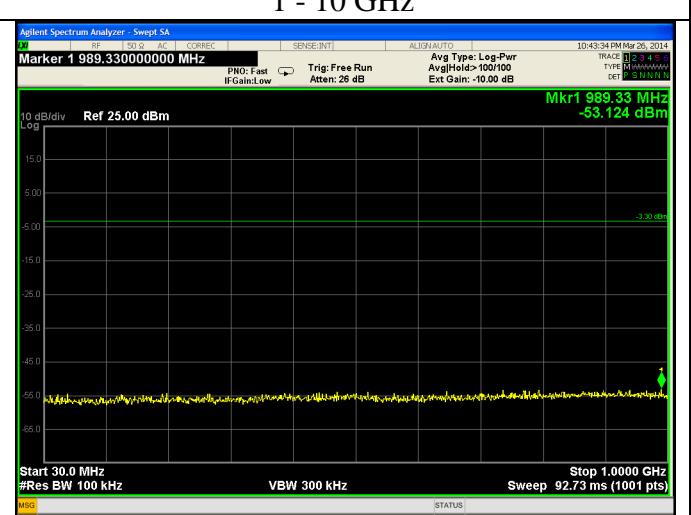
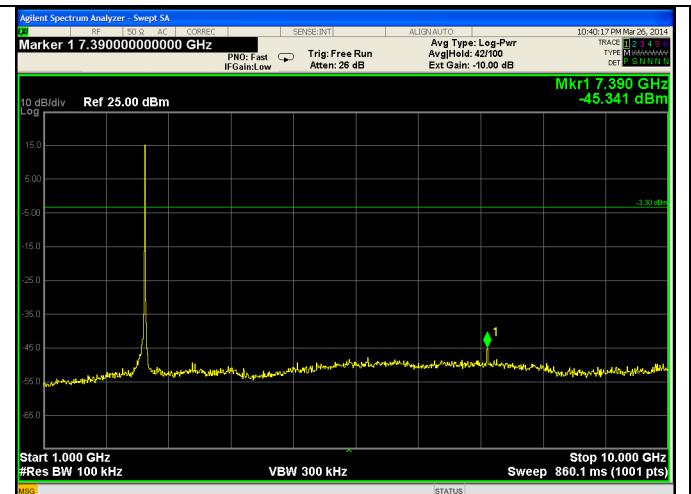


10-25 GHz

30-1000 MHz

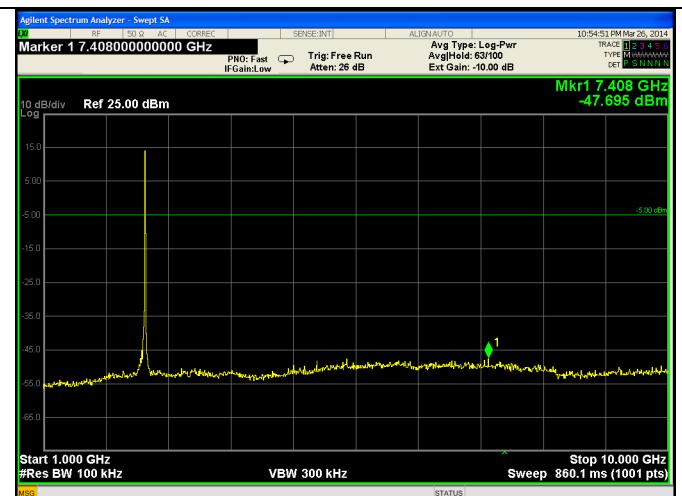
Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 12 – 2465 MHz

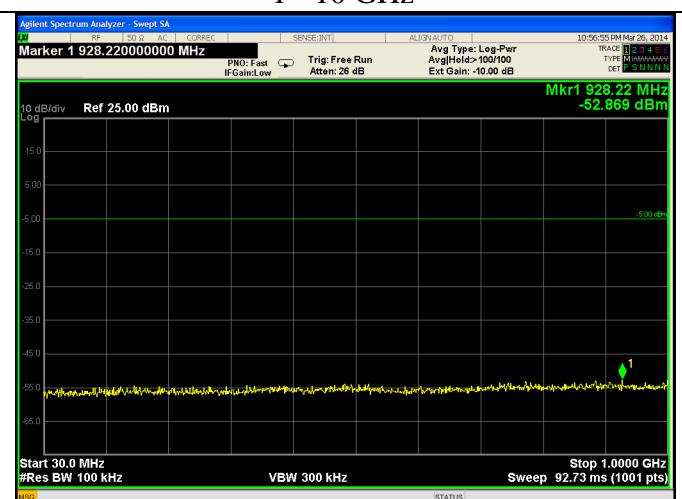


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-0000D7D) RF Conducted (001A57-0000D8B)

## Channel 13 – 2470 MHz



100 kHz Reference



10-25 GHz

30-1000 MHz



Band-Edge

Prepared For: Matrix

Report: 314066

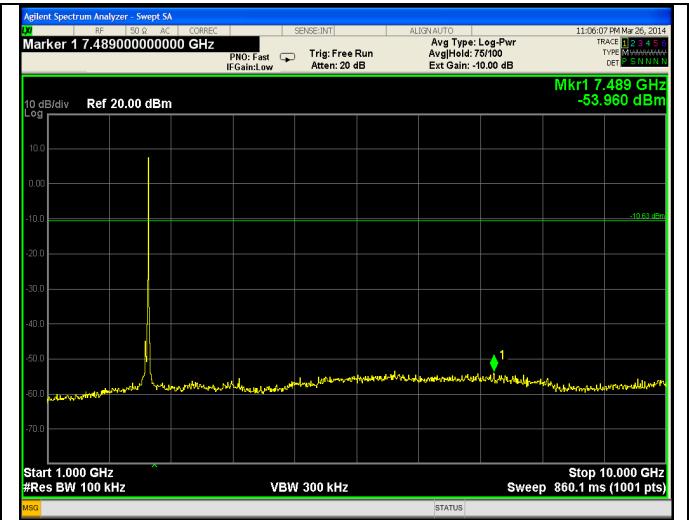
LSR: C-1883

Name: Proximity Locator

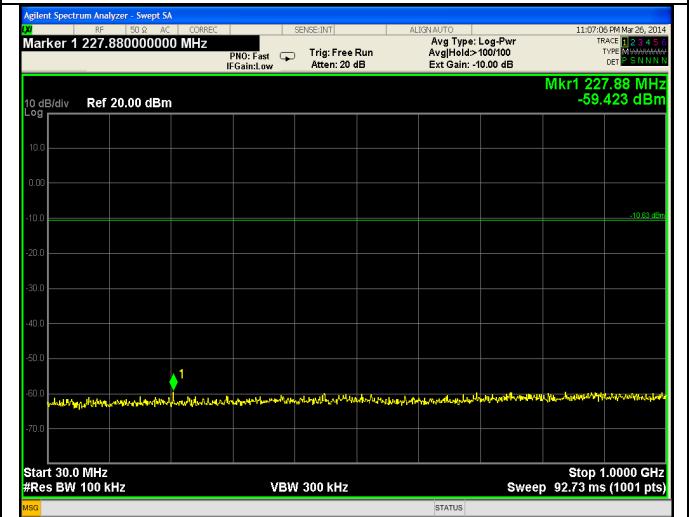
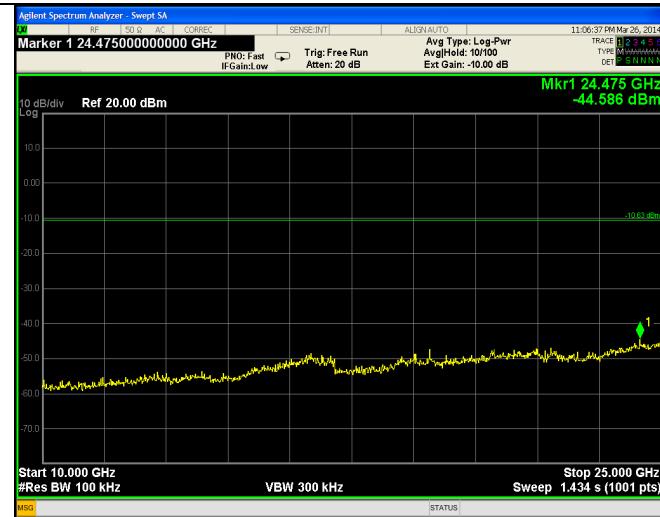
Model: 10000615

Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

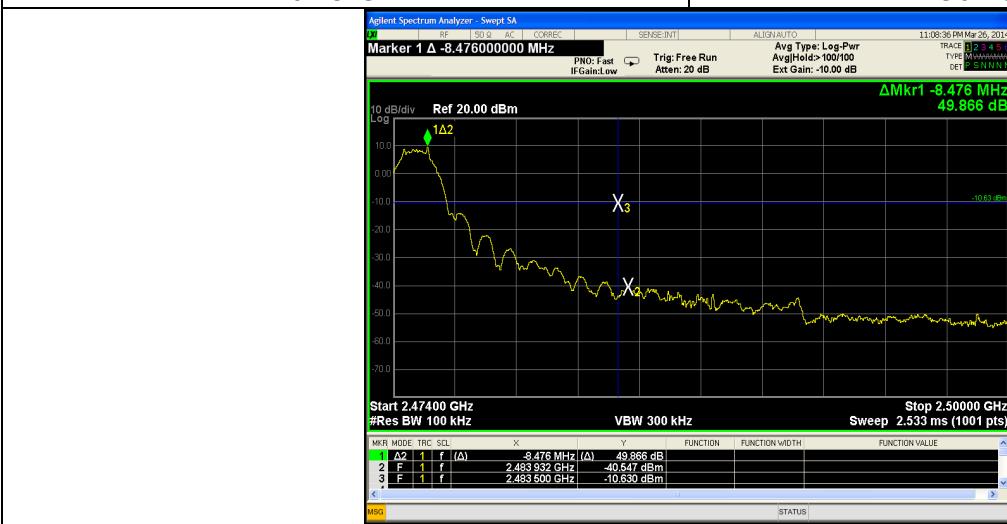
**Channel 14 – 2470 MHz**



## 100 kHz Reference



10-25 GHz



Band-Edge

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## B.2 – Radiated Emissions

Rule Part(s)	FCC: 15.247 / 15.205 / 15.209 IC: RSS-210 A8 / RSS-210 Section 2.2					
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 – 2009 FCC KDB 558074 D01 DTS Meas Guidance v03r01					
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber					
Test Distance	See data section					
EUT Placement	80 cm height non-conductive table above reference ground plane					
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-26GHz		
Measurement Detectors	30-1000MHz RBW: 120 kHz VBW: At least 300 kHz		1 - 40 GHz: RBW : 1MHz VBW: At least 3 (MHz) Peak 10 Hz Average			
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values.  2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT  3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.					
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)					

## FCC Part 15.209 / IC RSS-210 Section 2.7 Limits:

Frequency (MHz)	3 m Limit ( $\mu\text{V/m}$ )	3 m Limit ( $\text{dB}\mu\text{V/m}$ )	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

### B.2.1 – Radiated Band-Edge Restricted Bands

Manufacturer	Matrix
Date	3-18 and 3-19 2014
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009 FCC KDB 558074
Test Distance	3 meter (1-3.6 GHz)
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1MHz VBW 3 MHz (10Hz VBW for average measurements)
Additional Notes	<ul style="list-style-type: none"> <li>1) Tested in the worst case of continuous transmit modulated mode. Outer channels require power reduction to meet restricted band limits.</li> <li>2) EUT maximized in azimuth and antenna height with maximum results reported.</li> </ul>

#### Example Calculation:

FCC 15.209 Peak Limit @ 3 meter (dB $\mu$ V/m) – Peak Reading (dB $\mu$ V/m) = Peak Margin

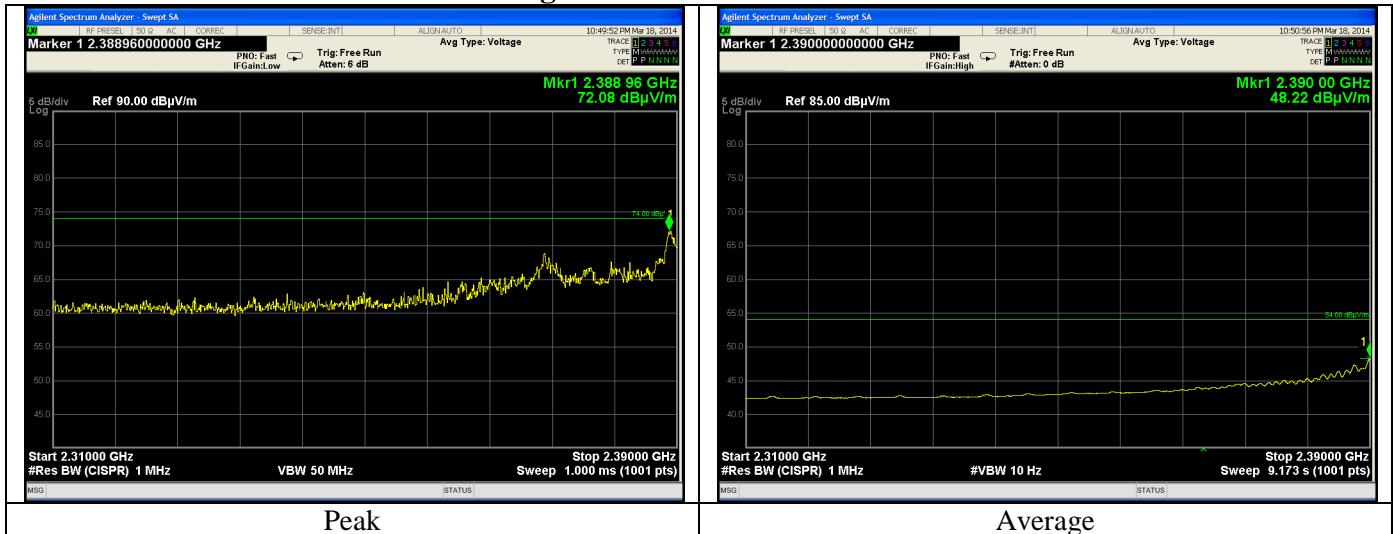
FCC 15.209 Average Limit @ 3 meter (dB $\mu$ V/m) – Average Reading (dB $\mu$ V/m) = Average Margin

#### Data Table

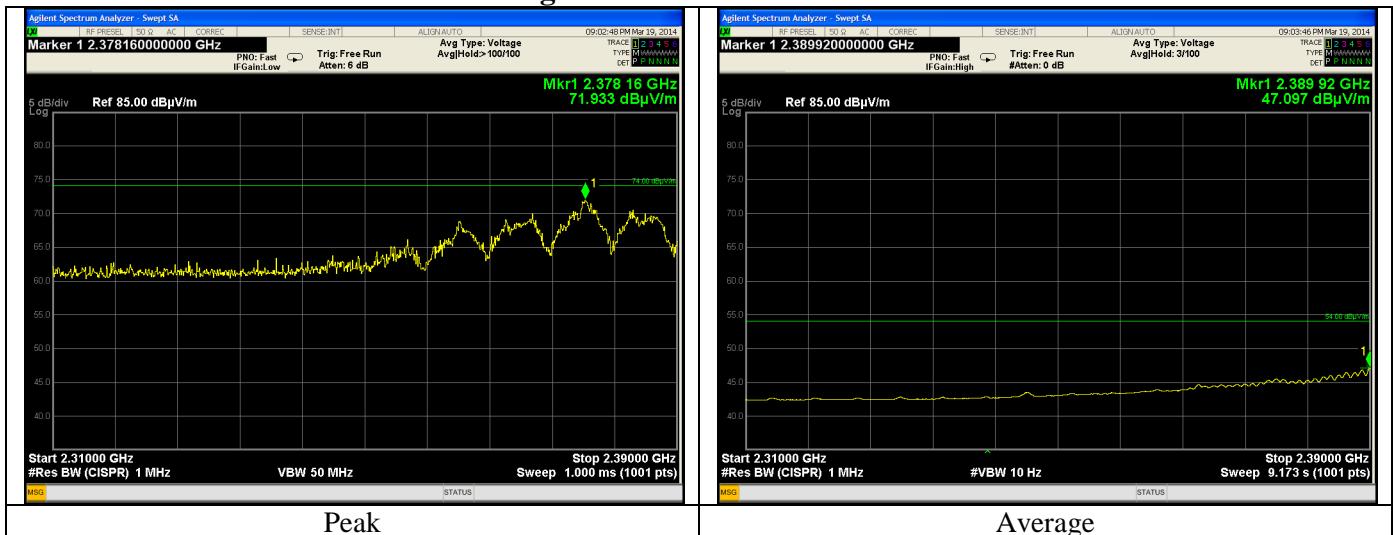
Frequency (MHz)	Channel	Power Level	Peak Level (dB $\mu$ V/m)	Average Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Peak Margin (dB)	Average Margin (dB)
2405	0	14	72.08	48.22	74	54	1.9	5.8
2410	1	13	71.93	47.09	74	54	2.1	6.9
2415	2	12	72.34	46.40	74	54	1.7	7.6
2420	3	11	72.37	46.60	74	54	1.6	7.4
2465	12	11	68.18	46.57	74	54	5.8	7.4
2470	13	12	71.80	48.75	74	54	2.2	5.3
2475	14	14	68.34	49.55	74	54	5.7	4.5

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Plots - Lower Restricted Band-edge Channel 0 – 2405 MHz – Power Setting 14

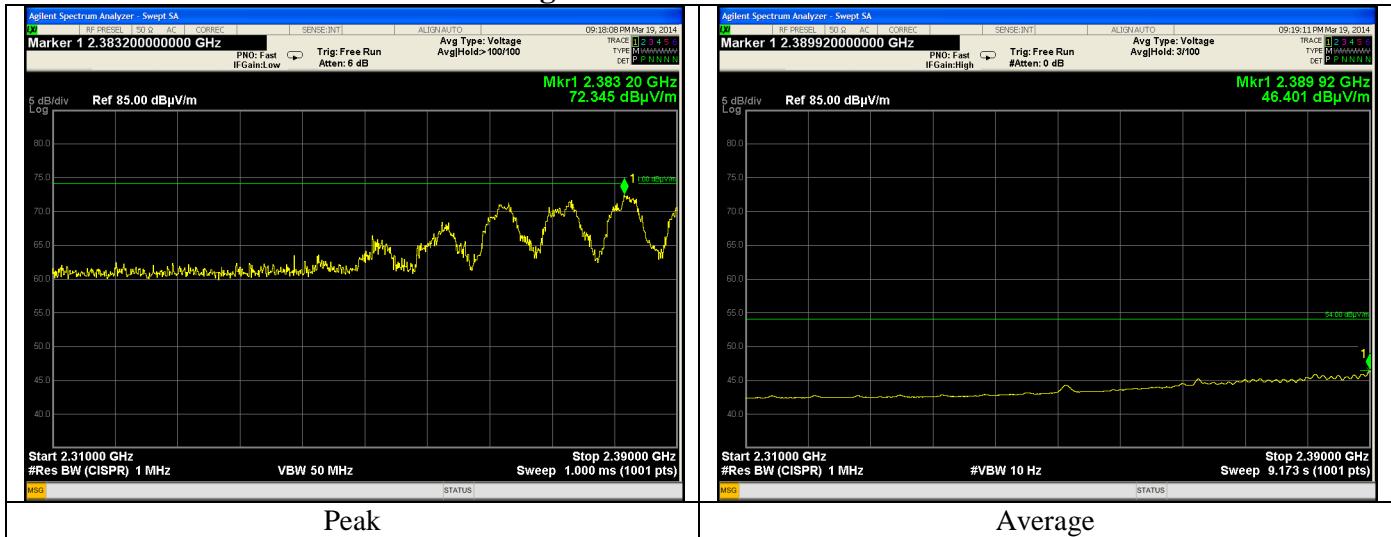


## Channel 1 – 2410 MHz – Power Setting 13

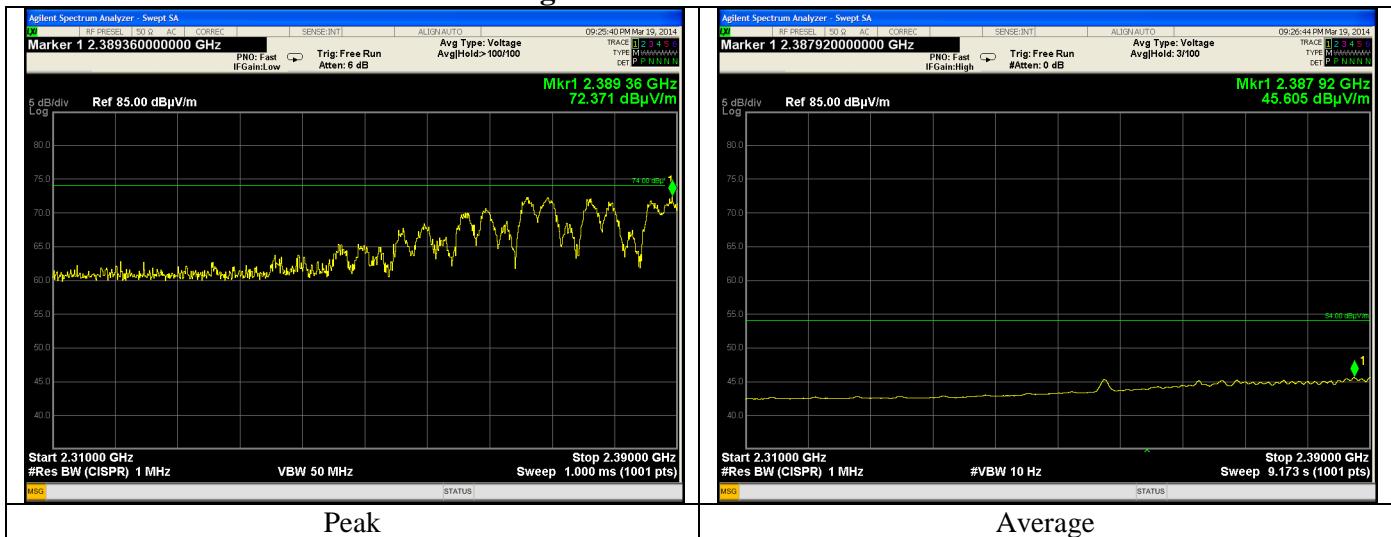


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 2 – 2415 MHz – Power Setting 12

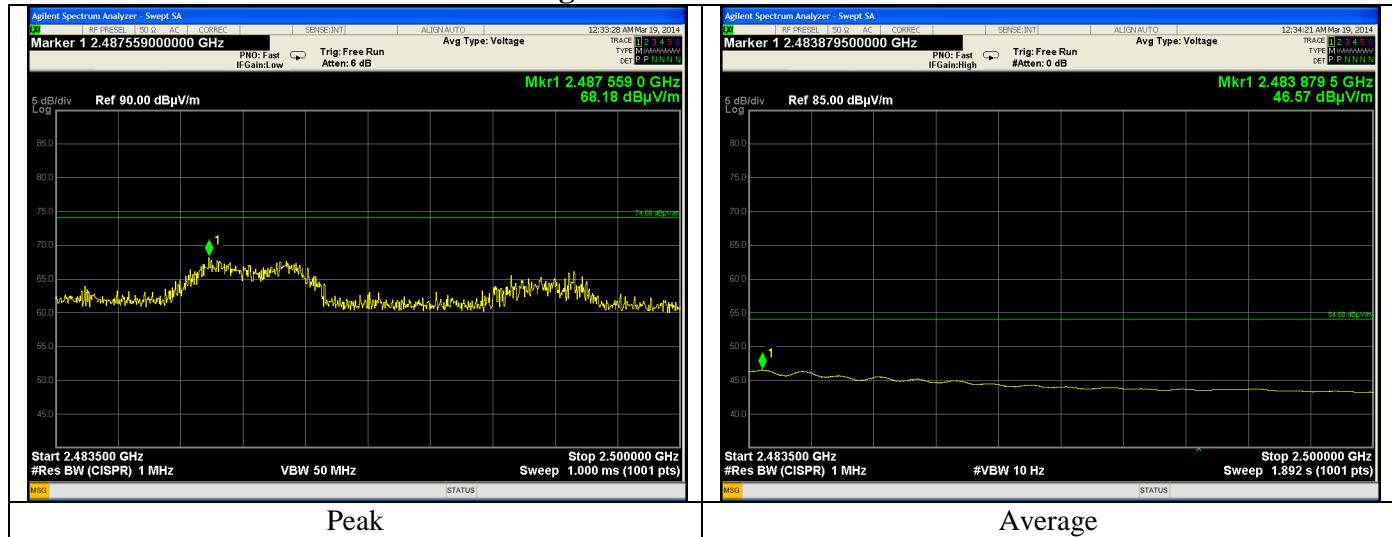


## Channel 3 – 2420 MHz – Power Setting 11

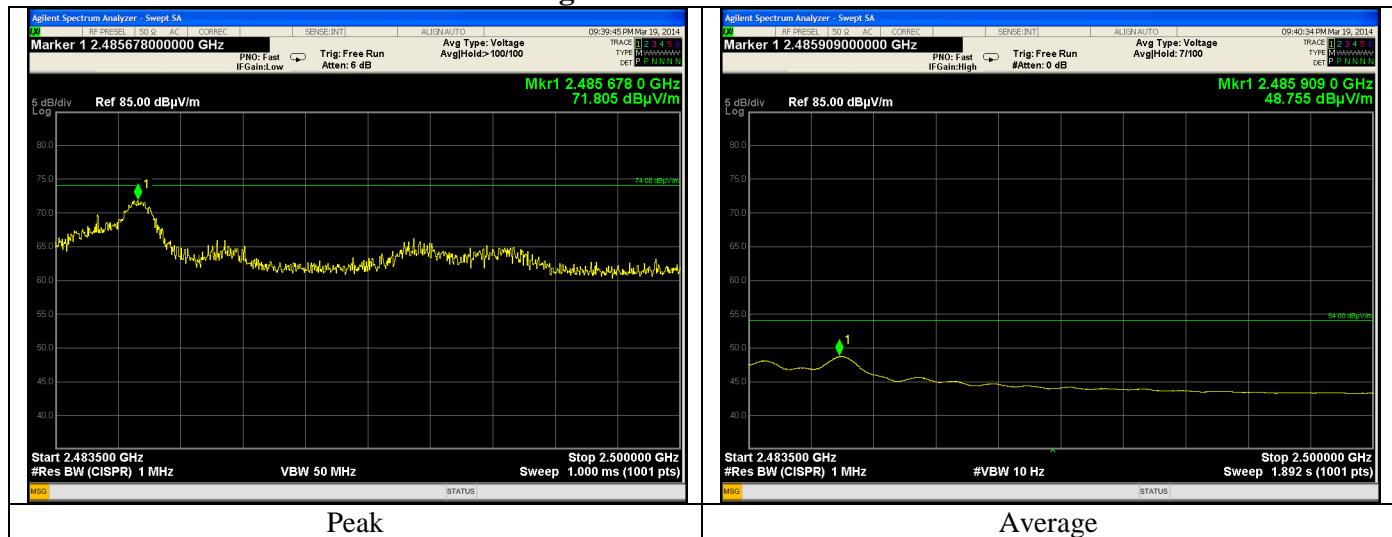


Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 12 – 2465 MHz – Power Setting 11

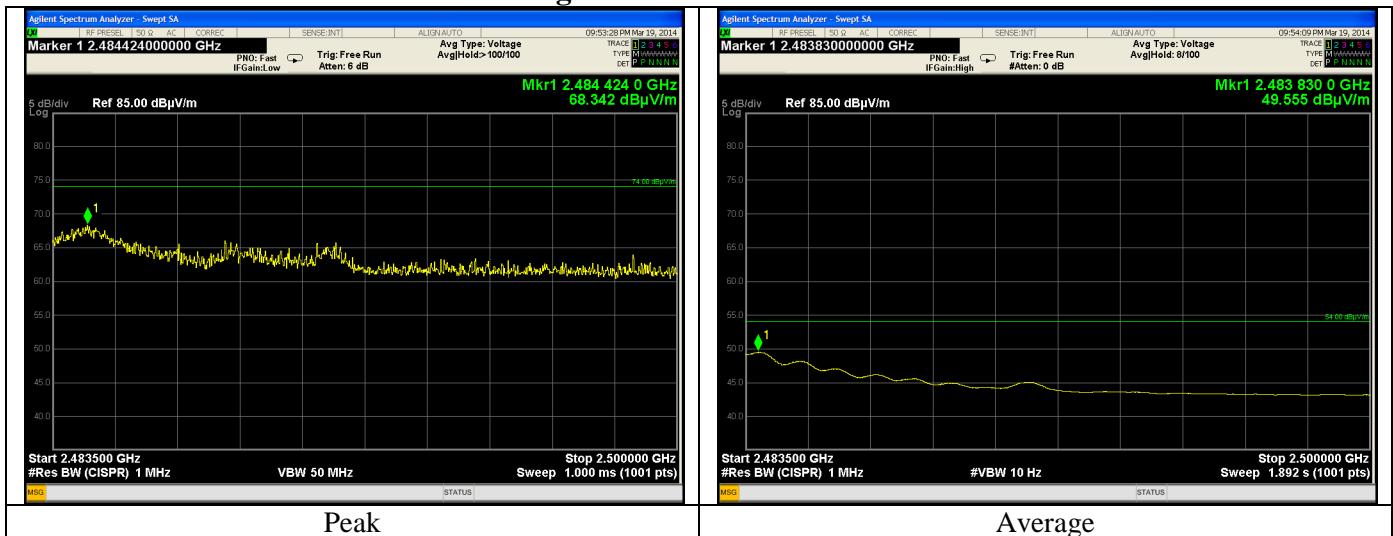


## Channel 13 – 2470 MHz – Power Setting 12



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 14 – 2475 MHz – Power Setting 14



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## B.2.2 – Radiated Harmonics in Restricted Bands

Manufacturer	Matrix
Date	3-24-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	1 meter 3.6-25 GHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1 MHz Average VBW (10Hz)
Additional Notes	<ul style="list-style-type: none"> <li>1) Tested in continuous transmit modulated mode with EUT in three orientations stand alone and while in charging cradle at maximum power setting 11.</li> <li>2) Maximum results reported.</li> <li>3) Tested at 1 meter test distance so a distance correction factor of 9.5 added to 3 meter limit</li> </ul>

### Example Calculation:

FCC 15.209 Average Limit @ 1 meter (dB $\mu$ V/m) – Peak Reading (dB $\mu$ V/m) = Margin

### Data Table

#### Channel 0 – 2402 MHz – Power Setting 11

Frequency (MHz)	EUT orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Avg Reading (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Avg Limit (dB $\mu$ V/m)	Avg Margin (dB)
4810	Vertical	Vertical	100	207	62.06	50.15	83.5	21.4	63.5	13.4
		Horizontal	113	316	68.27	55.86		15.2		7.6
	Horizontal	Vertical	100	342	67.36	54.88		16.1		8.6
		Horizontal	100	136	61.01	49.37		22.5		14.1
	Flat	Vertical	100	206	62.95	51.21		20.6		12.3
		Horizontal	129	187	61.41	49.45		22.1		14.1
	Cradle	Vertical	100	127	61.05	49.09		22.5		14.4
		Horizontal	115	244	65.21	52.85		18.3		10.7
12025	Vertical	Vertical	100	0	53.44	43.38	83.5	30.1	63.5	20.1
		Horizontal	103	321	56.29	44.41		27.2		19.1
	Horizontal	Vertical	101	326	57.00	45.37		26.5		18.1
		Horizontal	100	310	58.46	45.95		25.0		17.6
	Flat	Vertical	100	118	59.25	46.38		24.3		17.1
		Horizontal	100	287	55.82	44.14		27.7		19.4
	Cradle	Vertical	100	347	55.99	45.79		27.5		17.7
		Horizontal	102	323	58.76	46.75		24.7		16.8

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 7 – 2440 MHz – Power Setting 11

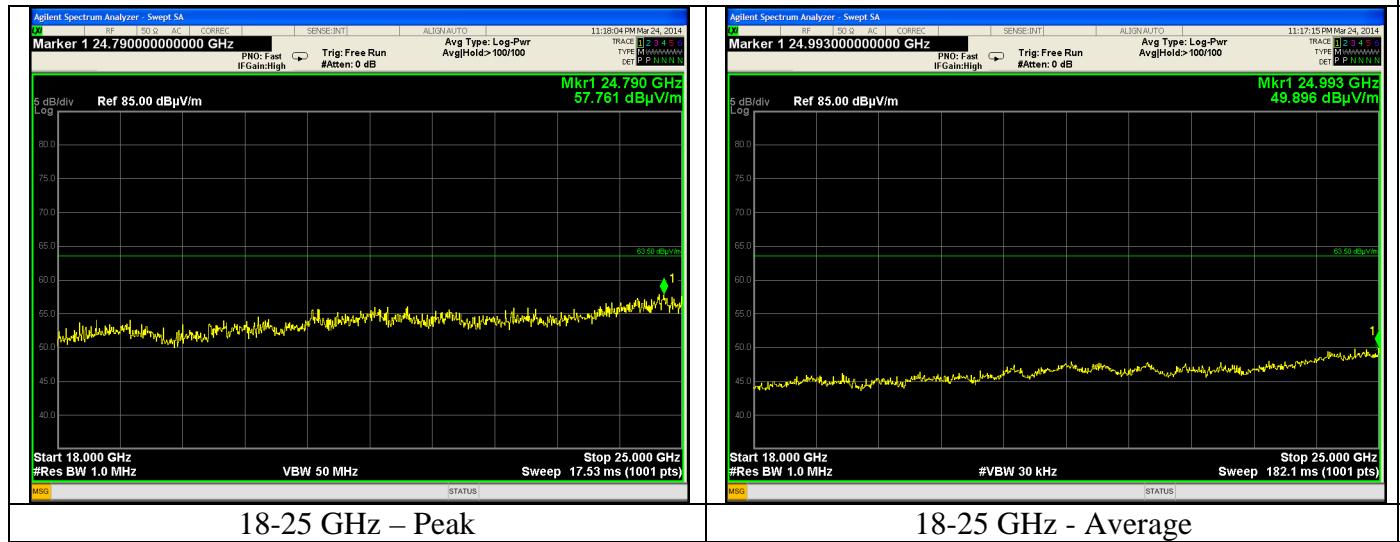
Frequency (MHz)	EUT orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Avg Reading (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Avg Limit (dB $\mu$ V/m)	Avg Margin (dB)
4880	Vertical	Vertical	115	202	66.37	54.29	83.5	17.1	63.5	9.2
		Horizontal	119	318	74.21	61.52		9.3		2.0
	Horizontal	Vertical	107	345	73.87	61.05		9.6		2.5
		Horizontal	100	130	67.35	55.19		16.2		8.3
	Flat	Vertical	110	225	69.94	57.27		13.6		6.2
		Horizontal	125	193	67.30	55.05		16.2		8.5
	Cradle	Vertical	100	123	65.09	52.56		18.4		10.9
		Horizontal	106	330	72.31	59.39		11.2		4.1
7320	Vertical	Vertical	100	0	62.89	50.03	83.5	20.6	63.5	13.5
		Horizontal	100	189	62.69	50.45		20.8		13.1
	Horizontal	Vertical	104	222	66.26	53.14		17.2		10.4
		Horizontal	100	144	66.56	53.28		16.9		10.2
	Flat	Vertical	106	284	67.00	53.77		16.5		9.7
		Horizontal	100	250	60.53	48.41		23.0		15.1
	Cradle	Vertical	104	355	63.28	50.56		20.2		12.9
		Horizontal	100	19	63.56	50.86		19.9		12.6
12200	Vertical	Vertical	100	0	58.99	47.31	83.5	24.5	63.5	16.2
		Horizontal	100	317	63.14	51.07		20.4		12.4
	Horizontal	Vertical	100	174	63.82	51.66		19.7		11.8
		Horizontal	100	0	59.91	48.43		23.6		15.1
	Flat	Vertical	100	118	64.57	52.54		18.9		11.0
		Horizontal	100	0	59.34	47.74		24.2		15.8
	Cradle	Vertical	102	170	62.75	50.31		20.8		13.2
		Horizontal	105	323	65.00	52.98		18.5		10.5

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Channel 14 – 2470 MHz – Power Setting 11

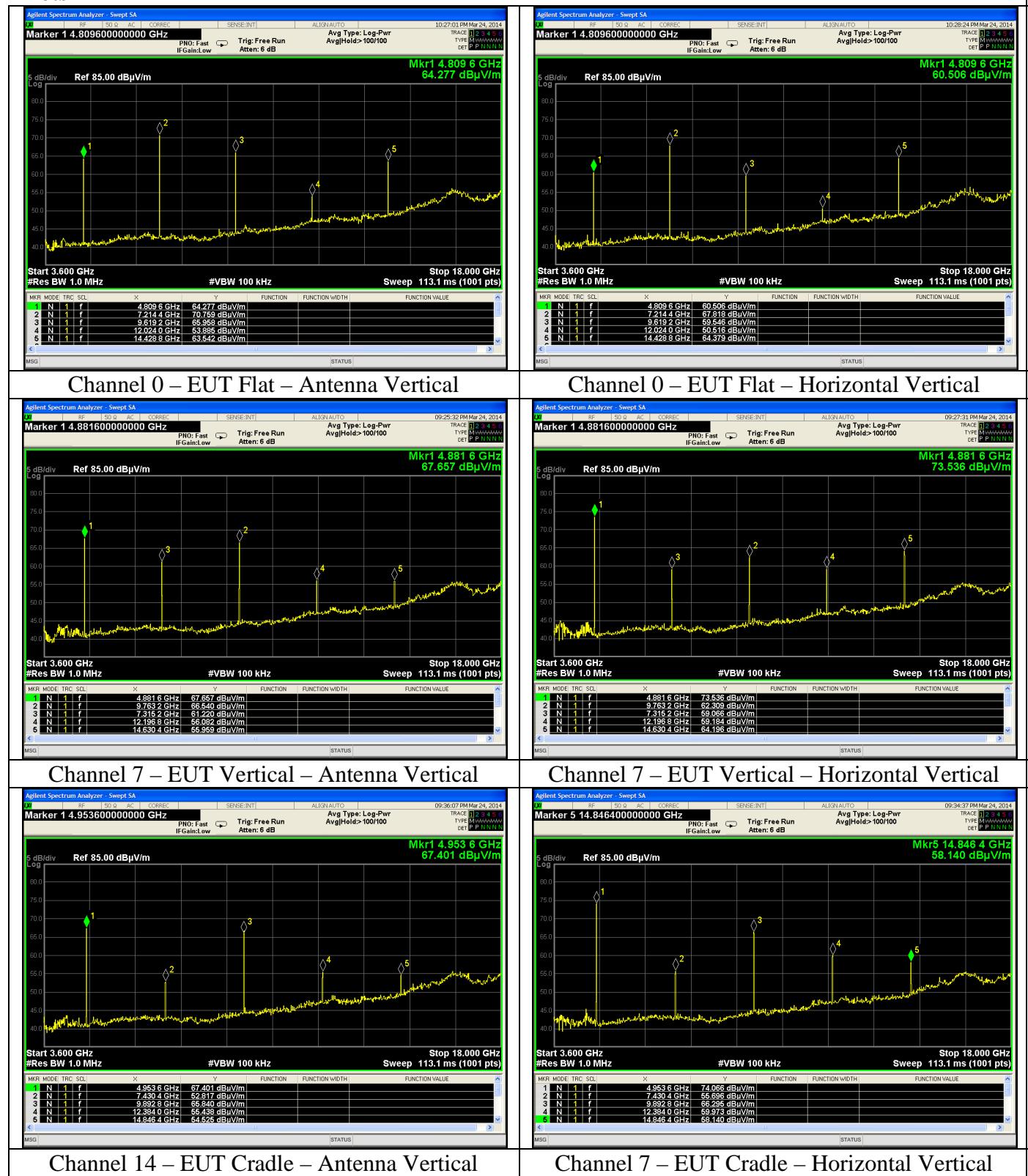
Frequency (MHz)	EUT orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Avg Reading (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Avg Limit (dB $\mu$ V/m)	Avg Margin (dB)
4950	Vertical	Vertical	103	204	67.27	55.28	83.5	16.2	63.5	8.2
		Horizontal	102	315	71.56	58.69		11.9		4.8
	Horizontal	Vertical	104	341	71.90	59.46		11.6		4.0
		Horizontal	100	302	69.44	57.21		14.1		6.3
	Flat	Vertical	114	218	69.84	57.58		13.7		5.9
		Horizontal	109	197	65.15	53.22		18.4		10.3
	Cradle	Vertical	100	178	68.14	55.78		15.4		7.7
		Horizontal	123	192	72.50	59.60		11.0		3.9
7425	Vertical	Vertical	103	0	53.83	41.80	83.5	29.7	63.5	21.7
		Horizontal	100	190	55.39	43.31		28.1		20.2
	Horizontal	Vertical	100	127	58.47	46.19		25.0		17.3
		Horizontal	100	173	58.70	45.86		24.8		17.6
	Flat	Vertical	108	285	59.87	47.11		23.6		16.4
		Horizontal	100	247	54.22	42.35		29.3		21.2
	Cradle	Vertical	100	349	57.10	44.68		26.4		18.8
		Horizontal	100	45	58.42	46.19		25.1		17.3
12375	Vertical	Vertical	100	0	58.38	47.17	83.5	25.1	63.5	16.3
		Horizontal	100	11	60.43	48.95		23.1		14.6
	Horizontal	Vertical	100	14	61.85	50.19		21.7		13.3
		Horizontal	100	355	60.15	48.52		23.4		15.0
	Flat	Vertical	100	121	60.98	49.31		22.5		14.2
		Horizontal	100	346	59.55	47.88		24.0		15.6
	Cradle	Vertical	103	173	60.62	48.81		22.9		14.7
		Horizontal	100	327	62.81	51.11		20.7		12.4

## Plots



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-0000D7D) RF Conducted (001A57-0000D8B)

## Plots



Prepared For: Matrix

Report: 314066

LSR: C-1883

Name: Proximity Locator

Model: 10000615

Serial: Radiated (001A57-0000D7D) RF Conducted (001A57-0000D8B)

### B.2.3 – Radiated Emissions Transmit Mode

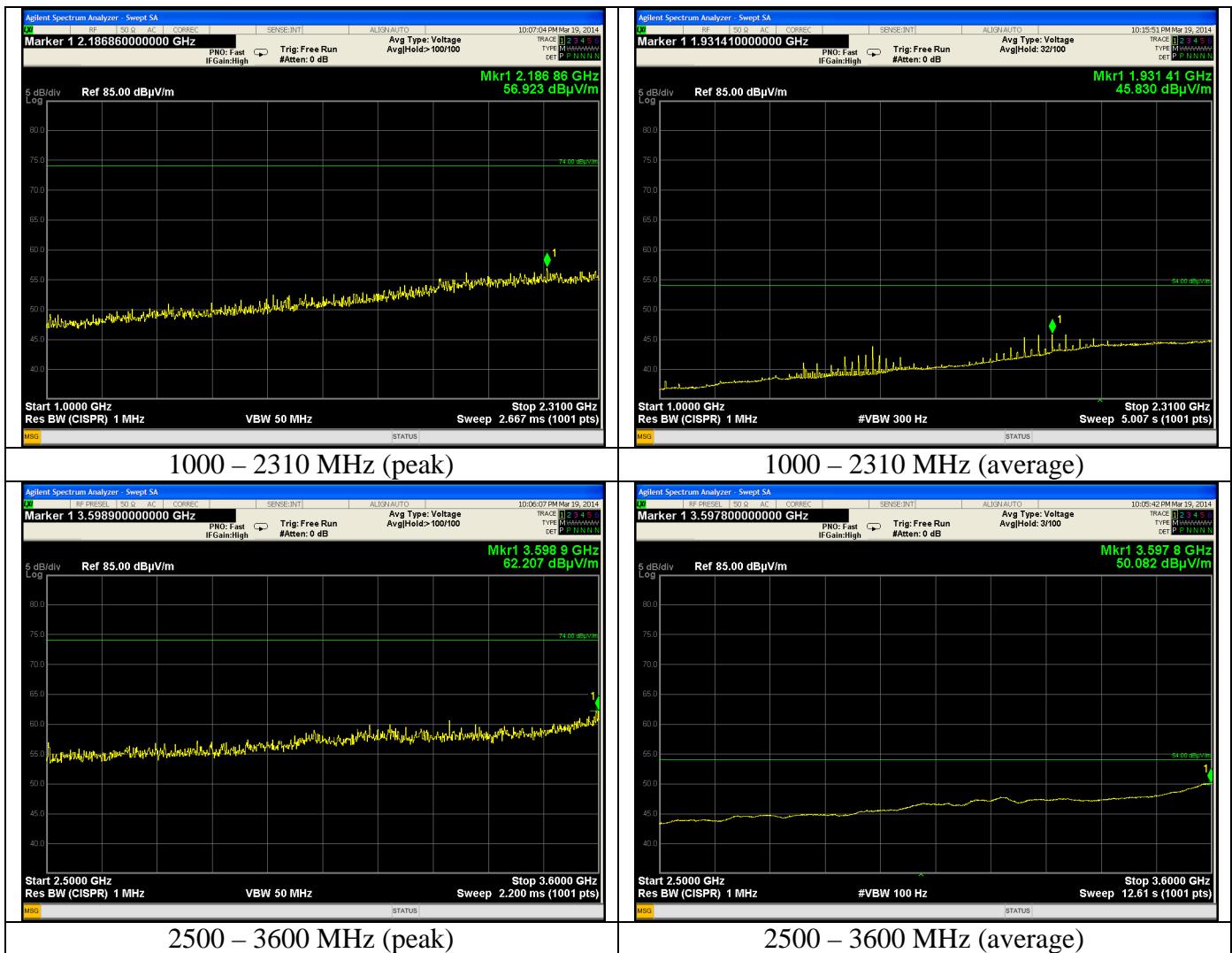
Manufacturer	Matrix
Date	3-19-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter 30-3600 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1 MHz
Additional Notes	<ul style="list-style-type: none"> <li>4) Tested in continuous transmit modulated mode with EUT in three orientations stand alone and while in charging cradle at maximum power setting 11.</li> <li>1) Peak detector with max hold in vertical and horizontal antenna polarizations</li> <li>2) No emissions found associated with EUT</li> </ul>

#### Example Calculation:

Limit (dB $\mu$ V/m) – Reading (dB $\mu$ V/m) = Margin

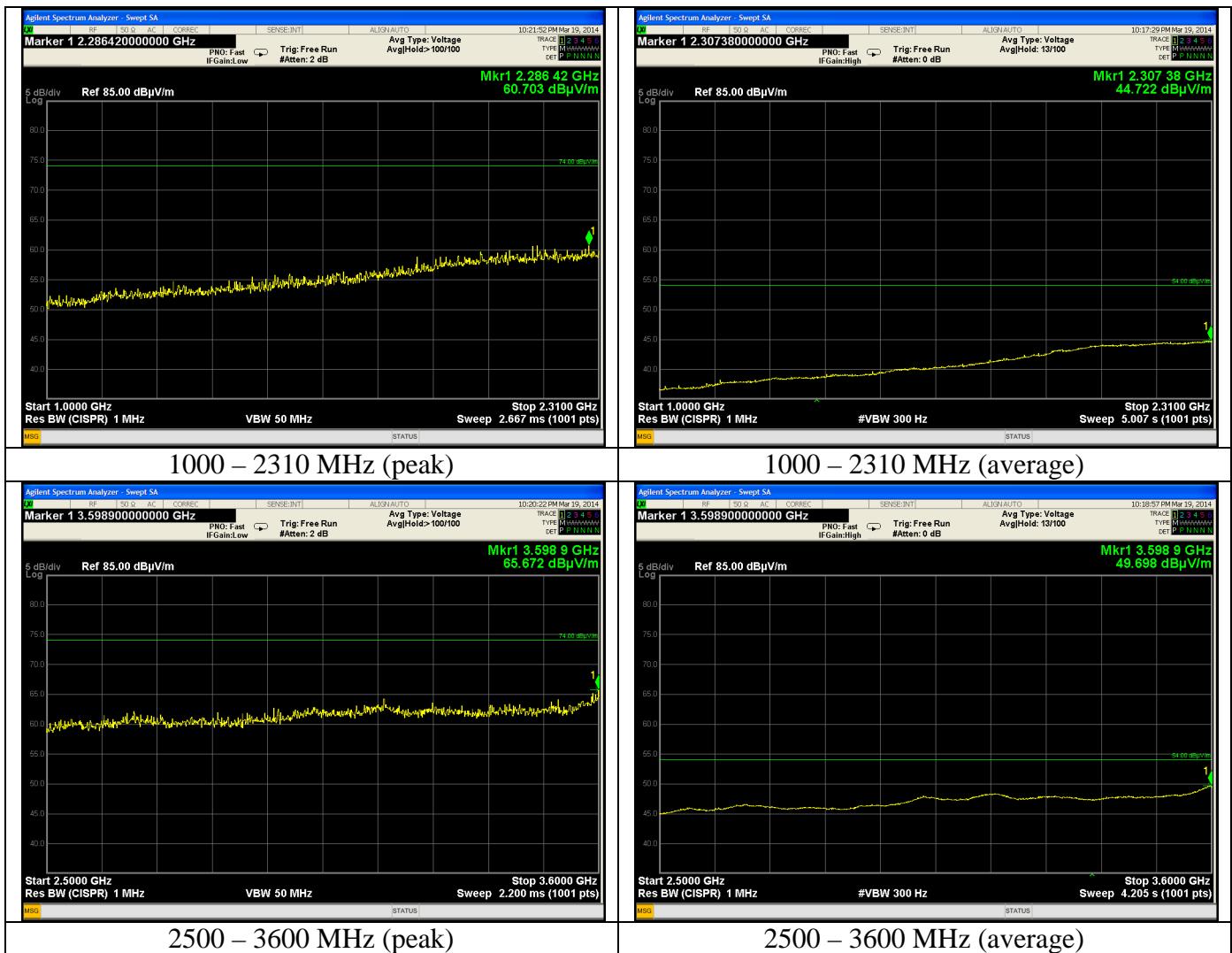
Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Horizontal Antenna



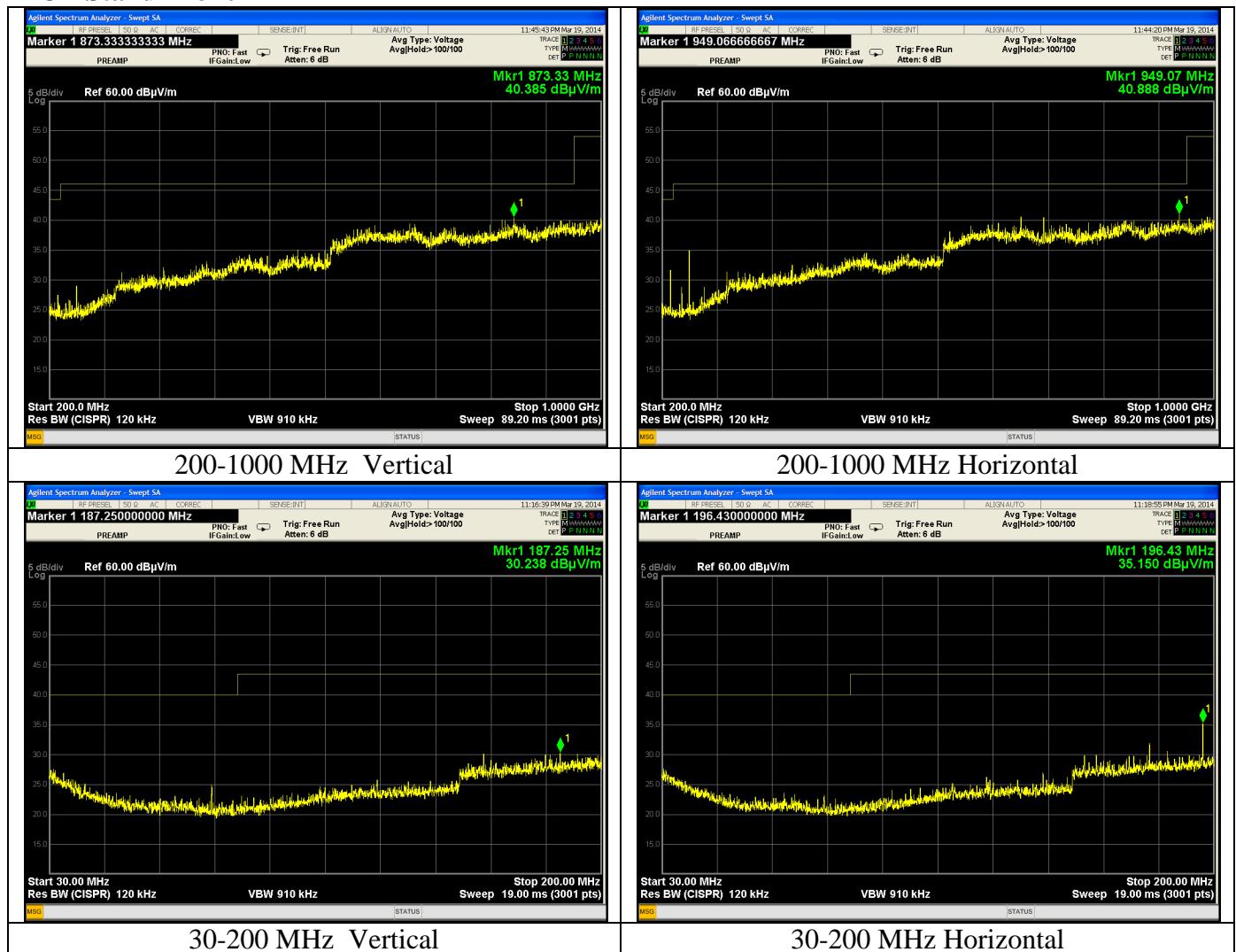
Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Vertical Antenna



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## EUT Stand-Alone



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

#### B.2.4 – Radiated Emissions Receive Mode

Manufacturer	Matrix
Date	3-19,24,25 2014
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter 30-3600 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak; RBW 1 MHz
Additional Notes	1) Tested in continuous transmit modulated mode with EUT in three orientations stand alone and while in charging cradle at maximum power setting 11. 2) Maximum results reported

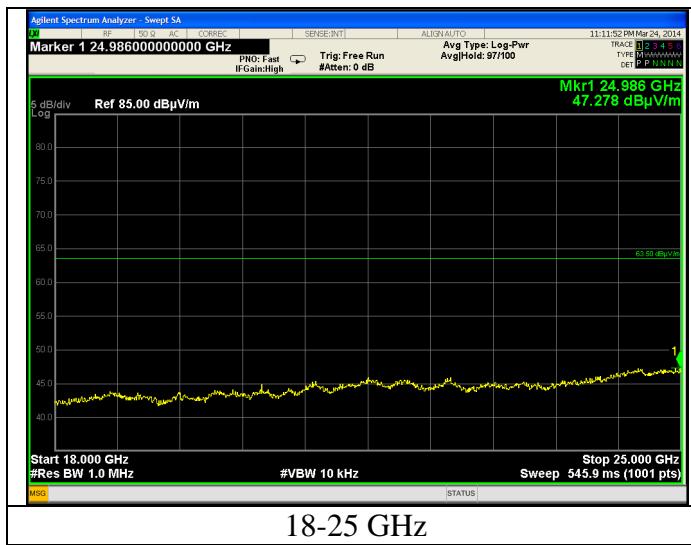
**Example Calculation:**

Limit (dB $\mu$ V/m) – Reading (dB $\mu$ V/m) = Margin

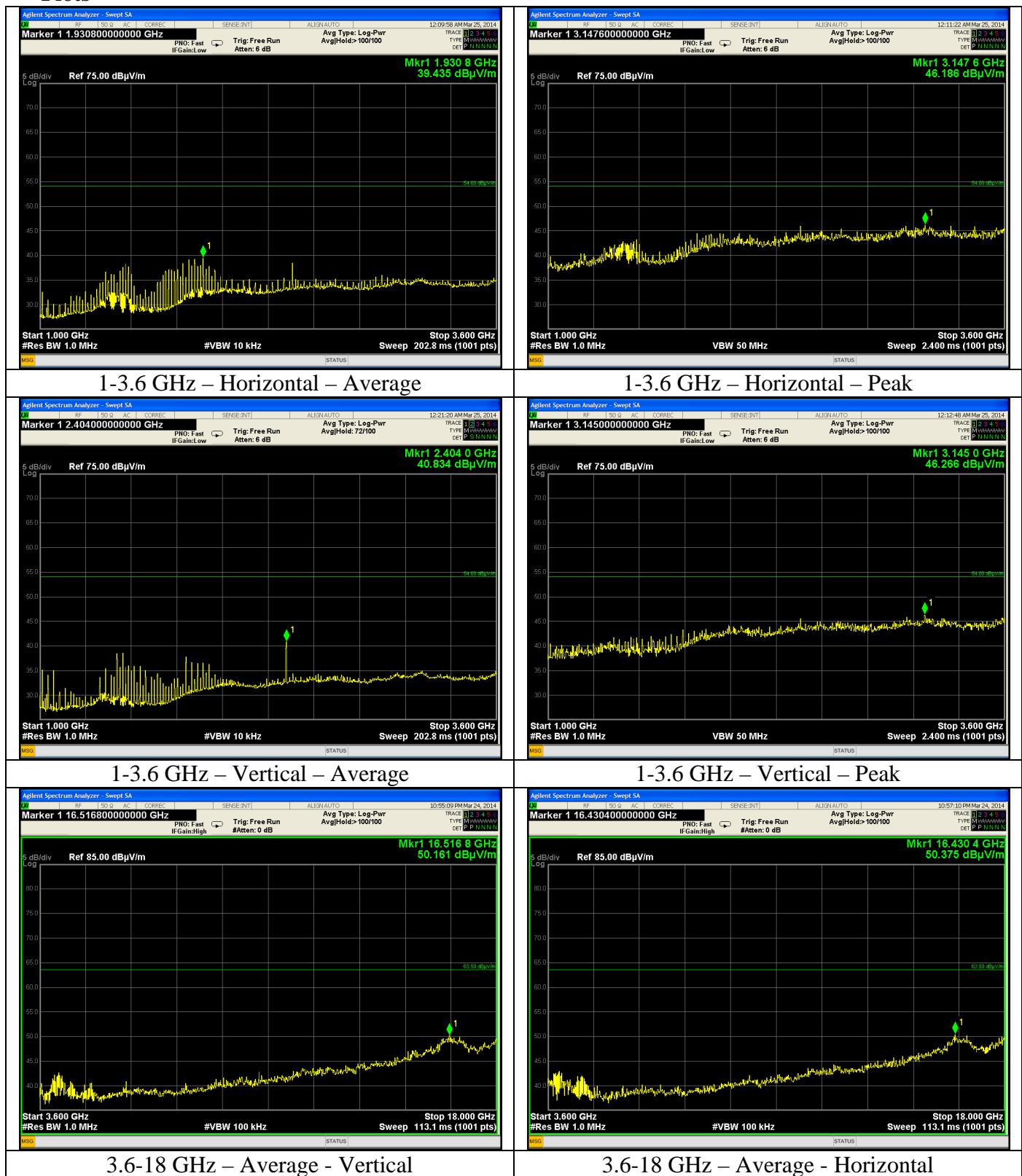
Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

**Table**

Frequency (MHz)	EUT orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dB $\mu$ V/m)	Avg Reading (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Avg Limit (dB $\mu$ V/m)	Avg Margin (dB)
2403	Vertical	Vertical	100	297	47.61	41.04	74	26.4	54	13.0
		Horizontal	105	0	46.85	39.70		27.2		14.3
	Horizontal	Vertical	100	229	47.87	42.16		26.1		11.8
		Horizontal	107	184	47.64	41.69		26.4		12.3
	Flat	Vertical	103	241	47.92	41.85		26.1		12.2
		Horizontal	107	167	48.82	43.88		25.2		10.1
	Cradle	Vertical	116	276	46.53	38.26		27.5		15.7
		Horizontal	104	37	47.33	40.24		26.7		13.8
2438	Vertical	Vertical	120	287	46.89	39.48	74	27.1	54	14.5
		Horizontal	105	0	46.02	37.45		28.0		16.6
	Horizontal	Vertical	100	222	47.43	40.74		26.6		13.3
		Horizontal	103	34	46.94	39.41		27.1		14.6
	Flat	Vertical	129	247	46.87	39.25		27.1		14.8
		Horizontal	105	281	48.37	42.43		25.6		11.6
	Cradle	Vertical	115	281	47.31	40.36		26.7		13.6
		Horizontal	103	46	46.42	39.48		27.6		14.5
2473	Vertical	Vertical	115	208	47.50	40.59	74	26.5	54	13.4
		Horizontal	112	302	46.11	35.60		27.9		18.4
	Horizontal	Vertical	119	231	48.30	42.35		25.7		11.7
		Horizontal	100	54	45.73	36.48		28.3		17.5
	Flat	Vertical	103	237	47.23	37.97		26.8		16.0
		Horizontal	103	278	48.33	43.09		25.7		10.9
	Cradle	Vertical	119	93	45.68	37.03		28.3		17.0
		Horizontal	110	301	45.48	36.32		28.5		17.7



## Plots



Prepared For: Matrix

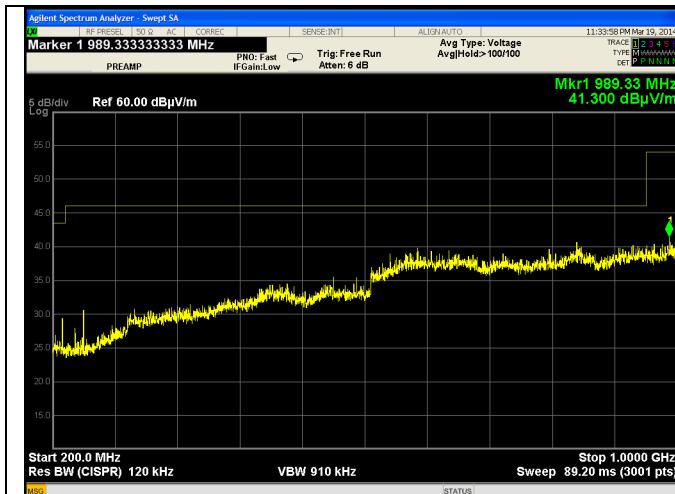
Report: 314066

LSR: C-1883

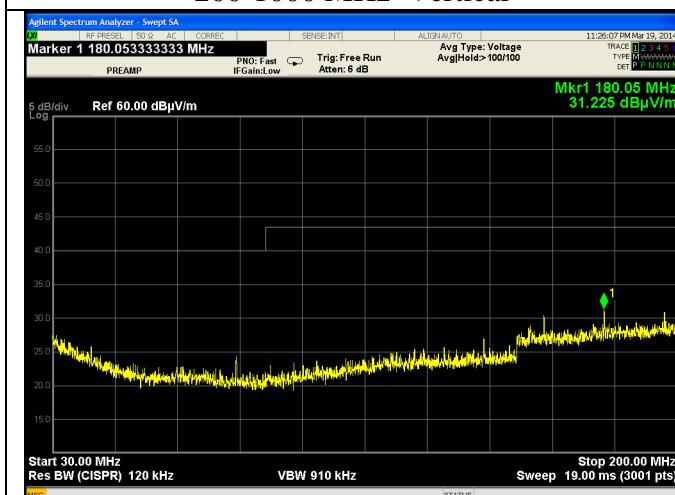
Name: Proximity Locator

Model: 10000615

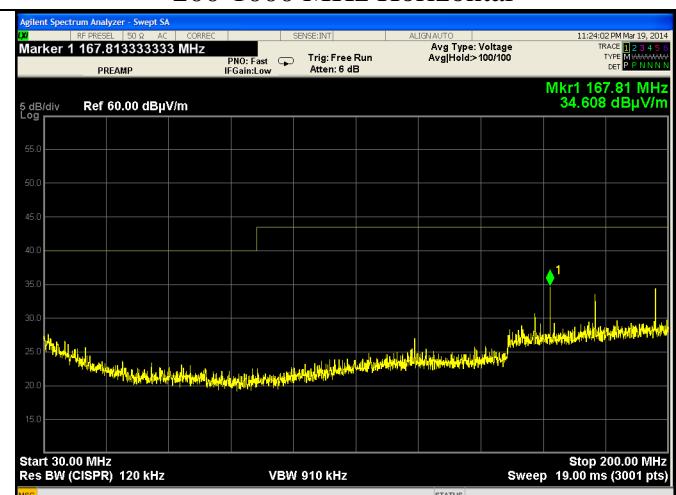
Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)



### 200-1000 MHz Vertical



### 200-1000 MHz Horizontal



### 30-200 MHz Vertical

### 30-200 MHz Horizontal

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-0000D7D) RF Conducted (001A57-0000D8B)

## B.3 – AC Mains Conducted Emissions

### Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the EMI Receiver. The LISN used has the ability to terminate the unused port with a  $50\Omega$  (ohm) load when switched to either L1 (line) or L2 (neutral).

### Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements was as specified for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

#### Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dB $\mu$ V)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz
0.5 – 5.0	56	46	
5.0 – 30	60	50	

\* The limit decreases linearly with the logarithm of the frequency in this range.

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

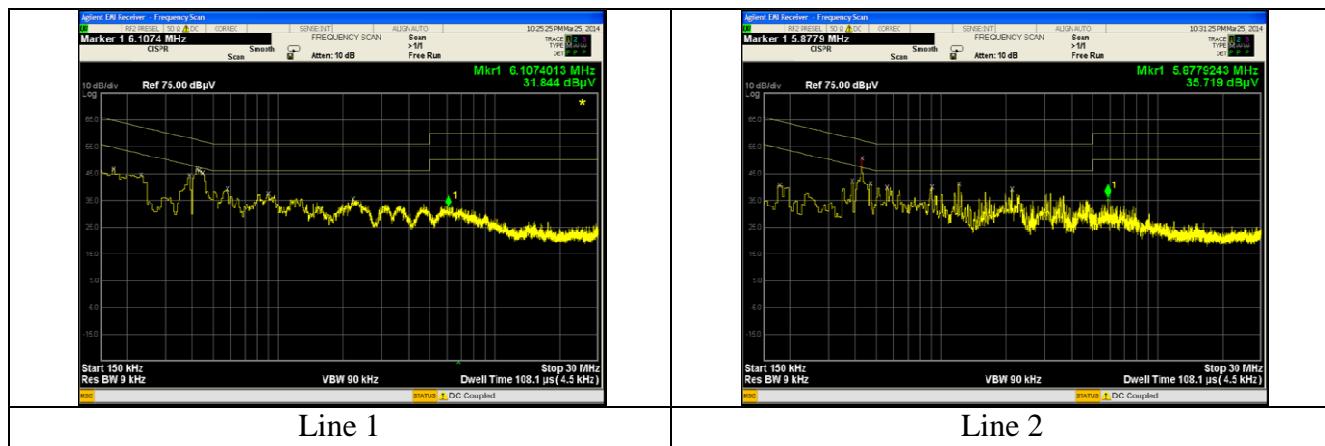
## Test Data

Manufacturer:	Matrix			
Date(s) of Test:	3-25-14			
Test Engineer:	Adam A			
Voltage:	120 VAC 60Hz			
Operation Mode:	Continuous transmit modulated used for this test but no difference seen in receive mode.			
Environmental Conditions in the Lab:	Temperature: 71°F Relative Humidity: 40%			
Test Location:	X	AC Mains Test area		Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane		10cm Spacers
	X	80cm above Ground Plane		Other:
Measurements:		Pre-Compliance	Preliminary	X Final
Detectors Used:	X	Peak	Quasi-Peak	Average

### Sample Calculation:

$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V)} - \text{Reading (dB}\mu\text{V)}$$

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).



Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Line 1

### Signal List

Sig	Trc	Freq	PEAK Amptd	QPD Amptd	EAVG Amptd	PEAK LL4 Delta	QPD LL1 Delta	EAVG LL2 Delta
1	1	172.51 kHz	46.838 dBuV	41.434 dBuV	32.113 dBuV	---	-23.404 dB	-22.726 dB
2	1	230.99 kHz	46.091 dBuV	39.465 dBuV	29.812 dBuV	---	-22.949 dB	-22.602 dB
3	1	386.52 kHz	43.921 dBuV	39.453 dBuV	23.666 dBuV	---	-18.685 dB	-24.472 dB
4	1	419.97 kHz	46.896 dBuV	43.613 dBuV	30.053 dBuV	---	-13.836 dB	-17.395 dB
5	1	433.47 kHz	46.773 dBuV	42.755 dBuV	28.706 dBuV	---	-14.431 dB	-18.480 dB
6	1	446.97 kHz	45.726 dBuV	41.125 dBuV	25.963 dBuV	---	-15.806 dB	-20.969 dB
7	1	581.96 kHz	40.190 dBuV	34.480 dBuV	21.901 dBuV	---	-21.520 dB	-24.099 dB
8	1	896.92 kHz	38.384 dBuV	33.166 dBuV	21.059 dBuV	---	-22.834 dB	-24.941 dB
9	1	2.2063 MHz	34.812 dBuV	30.239 dBuV	19.847 dBuV	---	-25.761 dB	-26.153 dB
10	1	6.1029 MHz	32.636 dBuV	27.482 dBuV	17.561 dBuV	---	-32.518 dB	-32.439 dB

## Line 2

### Signal List

Sig	Trc	Freq	PEAK Amptd	QPD Amptd	EAVG Amptd	PEAK LL4 Delta	QPD LL1 Delta	EAVG LL2 Delta
1	1	178.88 kHz	40.995 dBuV	35.472 dBuV	24.830 dBuV	---	-29.065 dB	-29.707 dB
2	1	385.90 kHz	46.696 dBuV	36.902 dBuV	22.151 dBuV	---	-21.250 dB	-26.001 dB
3	1	428.97 kHz	50.261 dBuV	41.199 dBuV	26.565 dBuV	---	-16.074 dB	-20.707 dB
4	1	469.47 kHz	42.365 dBuV	31.634 dBuV	19.988 dBuV	---	-24.889 dB	-26.535 dB
5	1	559.46 kHz	41.248 dBuV	31.994 dBuV	19.325 dBuV	---	-24.006 dB	-26.675 dB
6	1	901.42 kHz	41.668 dBuV	31.056 dBuV	18.395 dBuV	---	-24.944 dB	-27.605 dB
7	1	1.2029 MHz	40.466 dBuV	28.967 dBuV	17.298 dBuV	---	-27.033 dB	-28.702 dB
8	1	2.1118 MHz	38.327 dBuV	28.895 dBuV	17.074 dBuV	---	-27.105 dB	-28.926 dB
9	1	5.8779 MHz	35.708 dBuV	26.837 dBuV	16.646 dBuV	---	-33.163 dB	-33.354 dB

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## B.4 – Radiated Emissions (Charging Mode)

Manufacturer	Matrix
Date	3-20-14
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.247/ 15.205 / 15.209 ICES-003
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter 30-1000 MHz
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak, Quasi-Peak
Additional Notes	1) Emissions found no difference in transmit, receive, or stand-by mode.

### Example Calculation:

$$\text{Limit (dB}\mu\text{V/m)} - \text{Reading (dB}\mu\text{V/m)} = \text{Margin}$$

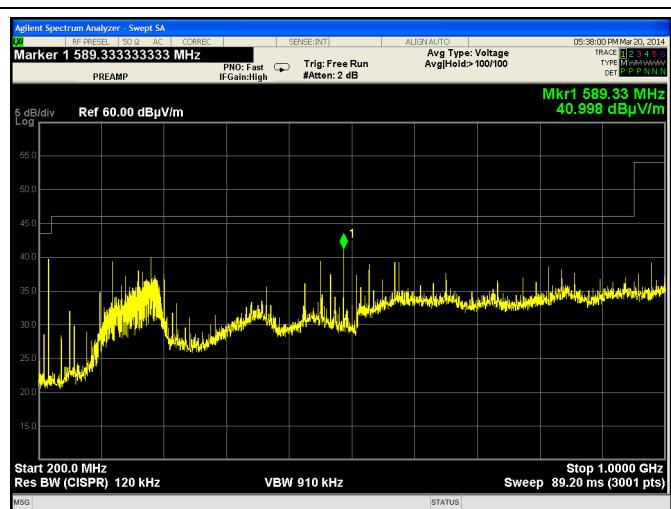
FCC

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dB $\mu$ V/m)	Quasi-Peak Limit (dB $\mu$ V/m)	Quasi-Peak Margin (dB)
212.8	Vertical	100	156	39.22	43.5	4.28
589.3	Vertical	100	279	40.99	46.0	5.01
294.6	Horizontal	172	85	40.00	46.0	6.00
196.4	Horizontal	153	331	33.68	43.5	9.82
80.1	Vertical	100	165	34.57	40.0	5.43

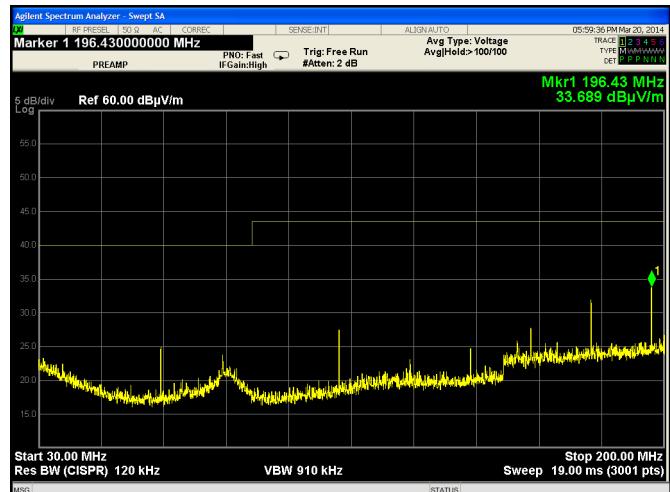
ICES-003

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dB $\mu$ V/m)	Quasi-Peak Limit (dB $\mu$ V/m)	Quasi-Peak Margin (dB)
212.8	Vertical	100	156	39.22	40.5	1.28
589.3	Vertical	100	279	40.99	47.5	6.51
294.6	Horizontal	172	85	40.00	47.5	7.50
196.4	Horizontal	153	331	33.68	40.5	6.82
80.1	Vertical	100	165	34.57	40.5	5.93

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)



### 200-1000 MHz – Horizontal



### 200-1000 MHz – Vertical



### 30-200 MHz – Horizontal

### 30-200 MHz – Vertical

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Appendix C - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

*Table of Expanded Uncertainty Values, (K=2) for Specified Measurements*

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.32 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.63 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64° / 2.88 %RH

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## Appendix D - References

Publication	Year	Title
FCC CFR Parts 0-15	2013	Code of Federal Regulations – Telecommunications
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-210 Annex 8	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment
RSS-GEN Issue 3	2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01 DTS Meas Guidance v03r01	2013	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
ICES-003	2012	Information Technology Equipment – Limits and methods of measurement (Issue 5)

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

## **END OF REPORT**

Date	Version	Comments	Person
4-4-14	V0	Initial Draft Release	Adam A
5-20-14	V1	Final	Adam A

Prepared For: Matrix	Name: Proximity Locator
Report: 314066	Model: 10000615
LSR: C-1883	Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)