Impinj Inc.

TEST REPORT FOR

Speedway Revolution
Model: IPJ-R420

Tested To The Following Standards:

FCC Part 15 Subpart C Sections 15.207, 15.247
and
RSS 210 Issue 8

Report No.: 94448-4

Date of issue: May 16, 2013

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Impinj Inc.
701 N. 34th Street
Seattle, WA 98103

Representative: Mike Thomas
Customer Reference Number: 112623-1

REPORT PREPARED BY:

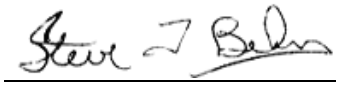
Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 94448

DATE OF EQUIPMENT RECEIPT: May 9, 2013
DATE(S) OF TESTING: May 9-10, 2013

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Bothell, WA 98021-4413

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.00.14
Immunity	5.00.07

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Bothell	US0081	SL2-IN-E-1145R	3082C-1	318736	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C 15.207, 15.247 and RSS 210 Issue 8

Description	Test Procedure/Method	Results
Conducted Emissions	FCC Part 15 Subpart C Section 15.207 / ANSI C63.4 (2003) / DA 00-705	Pass
RF Power Output	FCC Part 15 Subpart C Section 15.247 (b)(2) / DA 00-705	Pass
-20dBc Occupied Bandwidth	FCC Part 15 Subpart C Section 15.247 / DA 00-705	Pass
Bandedge	FCC Part 15 Subpart C / DA 00-705	Pass
Conducted Spurious Emissions	FCC Part 15 Subpart C Section 15.249(d) / RSS 210 Issue 8 / DA 00-705	Pass
Radiated Spurious Emissions	FCC Part 15 Subpart C Section 15.249(d) / DA 00-705	Pass

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

Speedway Revolution
Manuf: Impinj Inc.
Model: IPJ-R420
Serial: 37012340460

POE
Manuf: Netgear
Model: FS726TP
Serial: 1DA5895Y0031B

Antenna 6dBi Composite Gain with Integrated 8 Foot Pigtail to RP-TNC Male Connector
Manuf: Laird Technologies
Model: S9028PCLJ
Serial: NA

Mini-Guardrail Antenna with SMA Female Connector -15dBi gain
Manuf: Impinj Inc.
Model: IPJ-A0303-000
Serial: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Firewall Router
Manuf: Linksys
Model: BEFSX41
Serial: CB900E900020

Laptop
Manuf: Dell
Model: Latitude D-610
Serial: NA

POE
Manuf: Netgear
Model: FS726TP
Serial: 1DA5895Y0031B

Coaxial Cable
Manuf: Generic
Model: RG-58 (2.62meters, 1.5dB Loss)
Serial: NA

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR 15C requirements for Unlicensed Radio Frequency Devices, Subpart C - Intentional Radiators.

15.207 AC Conducted Emissions

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Conducted Emissions** Time: 10:51:33
Equipment: **Speedway Revolution** Sequence#: 1
Manufacturer: Impinj Inc. Tested By: Steven Pittsford
Model: IPJ-R420 120V 60Hz
S/N: 37012340460

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05435	Attenuator	PE7015-10	10/5/2012	10/5/2014
T2	ANP05965	Cable	Various	8/26/2011	8/26/2013
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013
T3	AN01311	5uH LISN-Line	3816/2	12/9/2011	12/9/2013
	AN01311	5uH LISN-Neutral	3816/2	12/9/2011	12/9/2013
T4	AN03227	Cable	32026-29080-29080-84	3/29/2013	3/29/2015

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Speedway Revolution*	Impinj Inc.	IPJ-R420	37012340460
POE	Netgear	FS726TP	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is in normal operation.
The EUT is powered by a Netgear POE Model FS726TP.
The EUT is transmitting into a 50 Ohm Load.

Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

Measured Power= 29.42dBm, 29.53dBm, 29.57dBm

Frequency range of measurement = 150k-30MHz
CISPR Bandwidths used

Test method in accordance with FCC document: DA 00-705.

Temperature: 23°C
Pressure: 102.8kPa
Humidity: 38%

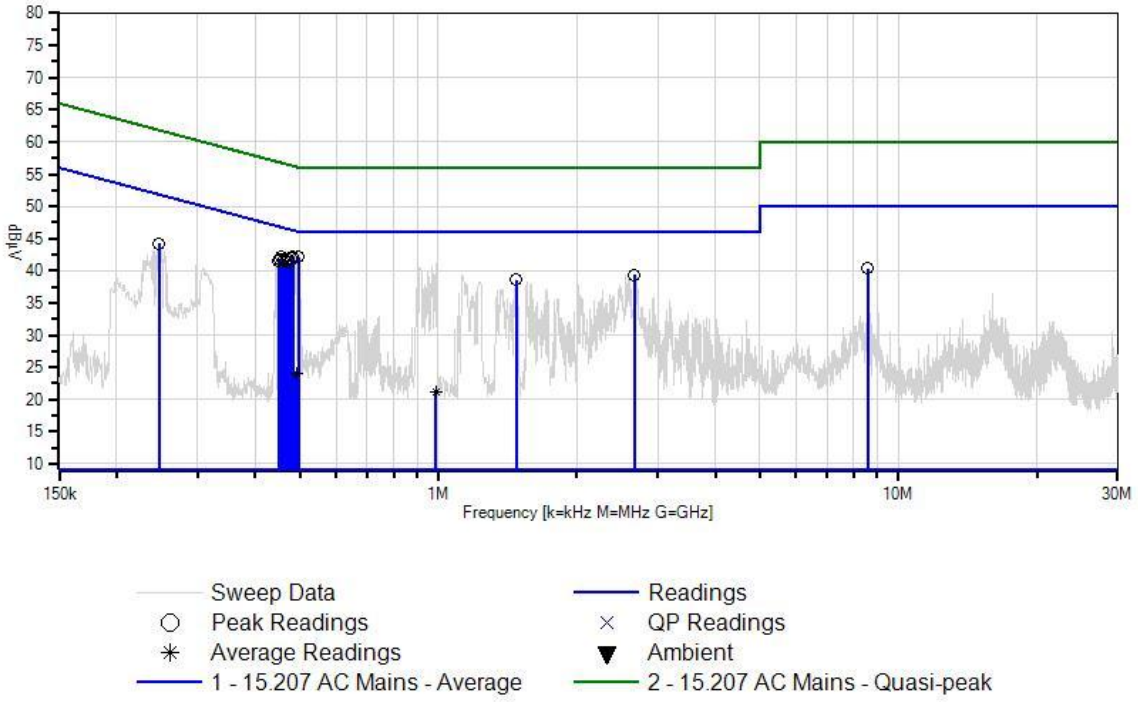
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	496.877k	33.0	+9.0	+0.0	+0.1	+0.0	+0.0	42.1	46.1	-4.0	Line
2	482.333k	33.1	+9.0	+0.0	+0.1	+0.0	+0.0	42.2	46.3	-4.1	Line
3	479.424k	32.9	+9.0	+0.0	+0.1	+0.0	+0.0	42.0	46.3	-4.3	Line
4	456.154k	33.0	+9.0	+0.0	+0.1	+0.0	+0.0	42.1	46.8	-4.7	Line
5	471.425k	32.6	+9.0	+0.0	+0.1	+0.0	+0.0	41.7	46.5	-4.8	Line
6	461.971k	32.6	+9.0	+0.0	+0.1	+0.0	+0.0	41.7	46.7	-5.0	Line
7	452.518k	32.7	+9.0	+0.0	+0.1	+0.0	+0.0	41.8	46.8	-5.0	Line
8	465.607k	32.4	+9.0	+0.0	+0.1	+0.0	+0.0	41.5	46.6	-5.1	Line
9	475.061k	32.1	+9.0	+0.0	+0.1	+0.0	+0.0	41.2	46.4	-5.2	Line
10	450.336k	32.5	+9.0	+0.0	+0.1	+0.0	+0.0	41.6	46.9	-5.3	Line
11	2.671M	30.2	+9.0	+0.0	+0.1	+0.1	+0.0	39.4	46.0	-6.6	Line
12	1.479M	29.4	+9.0	+0.0	+0.1	+0.1	+0.0	38.6	46.0	-7.4	Line
13	247.200k	35.1	+9.0	+0.0	+0.1	+0.0	+0.0	44.2	51.9	-7.7	Line
14	8.580M	30.9	+9.0	+0.1	+0.3	+0.1	+0.0	40.4	50.0	-9.6	Line

15 Ave	491.787k	14.9	+9.0	+0.0	+0.1	+0.0	+0.0	24.0	46.1	-22.1	Line
^	491.787k	33.8	+9.0	+0.0	+0.1	+0.0	+0.0	42.9	46.1	-3.2	Line
^	490.332k	33.7	+9.0	+0.0	+0.1	+0.0	+0.0	42.8	46.2	-3.4	Line
^	494.696k	33.2	+9.0	+0.0	+0.1	+0.0	+0.0	42.3	46.1	-3.8	Line
^	493.241k	32.6	+9.0	+0.0	+0.1	+0.0	+0.0	41.7	46.1	-4.4	Line
20 Ave	987.776k	12.0	+9.0	+0.0	+0.1	+0.0	+0.0	21.1	46.0	-24.9	Line
^	987.776k	32.0	+9.0	+0.0	+0.1	+0.0	+0.0	41.1	46.0	-4.9	Line

CKC Laboratories, Inc. Date: 5/9/2013 Time: 10:51:33 Impinj Inc. WO#: 94448
Test Lead: Line 120V 60Hz Sequence#: 1 Line
Impinj Inc. Speedway Revolution P/N: IPJ-R420



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Conducted Emissions** Time: 11:06:19
Equipment: **Speedway Revolution** Sequence#: 2
Manufacturer: Impinj Inc. Tested By: Steven Pittsford
Model: IPJ-R420 120V 60Hz
S/N: 37012340460

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05435	Attenuator	PE7015-10	10/5/2012	10/5/2014
T2	ANP05965	Cable	Various	8/26/2011	8/26/2013
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013
	AN01311	5uH LISN-Line	3816/2	12/9/2011	12/9/2013
T3	AN01311	5uH LISN-Neutral	3816/2	12/9/2011	12/9/2013
T4	AN03227	Cable	32026-29080-29080-84	3/29/2013	3/29/2015

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Speedway Revolution*	Impinj Inc.	IPJ-R420	37012340460
POE	Netgear	FS726TP	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is in normal operation.
The EUT is powered by a Netgear POE Model FS726TP.
The EUT is transmitting into a 50 Ohm Load.

Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

Measured Power= 29.42dBm, 29.53dBm, 29.57dBm

Frequency range of measurement = 150k-30MHz
CISPR Bandwidths used

Test method in accordance with FCC document: DA 00-705

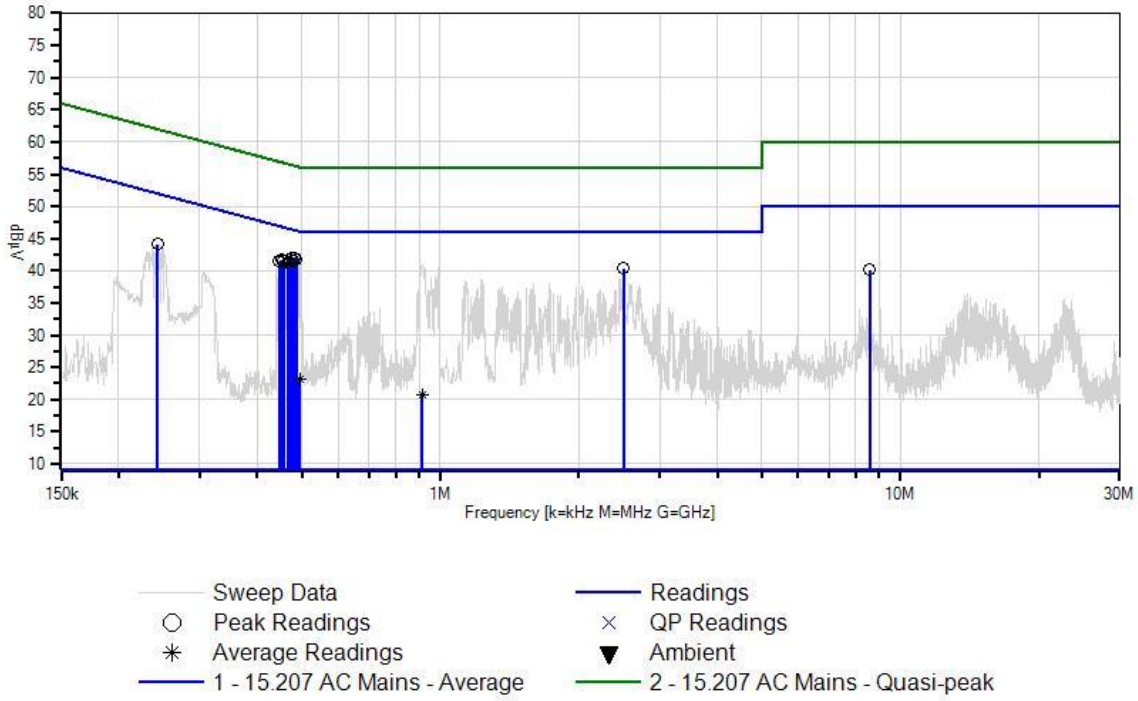
Temperature: 23°C
Pressure: 102.8kPa
Humidity: 38%

Ext Attn: 0 dB

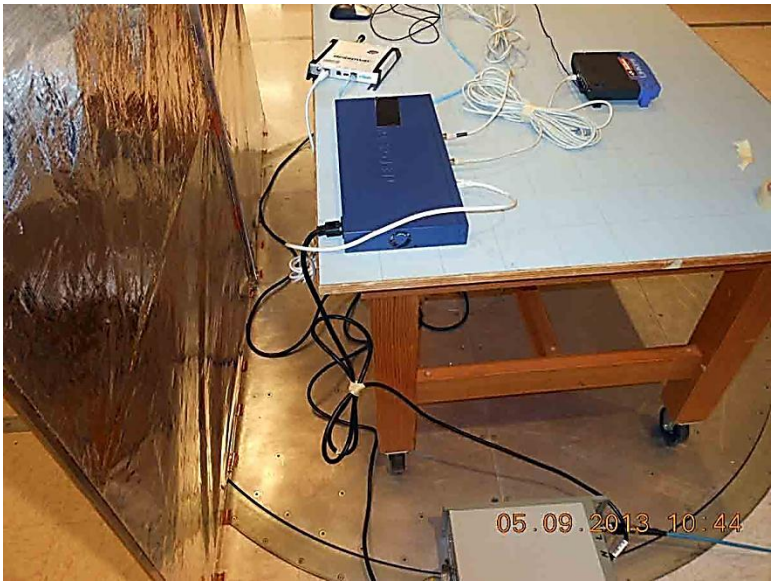
Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	483.059k	32.9	+9.0	+0.0	+0.1	+0.0	+0.0	42.0	46.3	-4.3	Neutr
2	474.333k	32.9	+9.0	+0.0	+0.1	+0.0	+0.0	42.0	46.4	-4.4	Neutr
3	485.968k	32.7	+9.0	+0.0	+0.1	+0.0	+0.0	41.8	46.2	-4.4	Neutr
4	477.242k	32.5	+9.0	+0.0	+0.1	+0.0	+0.0	41.6	46.4	-4.8	Neutr
5	479.423k	32.4	+9.0	+0.0	+0.1	+0.0	+0.0	41.5	46.3	-4.8	Neutr
6	451.062k	32.6	+9.0	+0.0	+0.1	+0.0	+0.0	41.7	46.9	-5.2	Neutr
7	456.880k	32.4	+9.0	+0.0	+0.1	+0.0	+0.0	41.5	46.7	-5.2	Neutr
8	465.606k	32.2	+9.0	+0.0	+0.1	+0.0	+0.0	41.3	46.6	-5.3	Neutr
9	469.242k	32.1	+9.0	+0.0	+0.1	+0.0	+0.0	41.2	46.5	-5.3	Neutr
10	445.972k	32.4	+9.0	+0.0	+0.1	+0.0	+0.0	41.5	46.9	-5.4	Neutr
11	2.500M	31.2	+9.0	+0.0	+0.1	+0.1	+0.0	40.4	46.0	-5.6	Neutr
12	242.900k	35.0	+9.0	+0.0	+0.1	+0.0	+0.0	44.1	52.0	-7.9	Neutr
13	8.580M	30.6	+9.0	+0.1	+0.3	+0.1	+0.0	40.1	50.0	-9.9	Neutr
14	494.695k Ave	14.1	+9.0	+0.0	+0.1	+0.0	+0.0	23.2	46.1	-22.9	Neutr
^	494.695k	33.9	+9.0	+0.0	+0.1	+0.0	+0.0	43.0	46.1	-3.1	Neutr
^	493.240k	33.2	+9.0	+0.0	+0.1	+0.0	+0.0	42.3	46.1	-3.8	Neutr
^	496.876k	33.1	+9.0	+0.0	+0.1	+0.0	+0.0	42.2	46.1	-3.9	Neutr
^	499.058k	32.3	+9.0	+0.0	+0.1	+0.0	+0.0	41.4	46.0	-4.6	Neutr
19	915.480k Ave	11.7	+9.0	+0.0	+0.1	+0.0	+0.0	20.8	46.0	-25.2	Neutr
^	915.480k	31.8	+9.0	+0.0	+0.1	+0.0	+0.0	40.9	46.0	-5.1	Neutr

CKC Laboratories, Inc. Date: 5/9/2013 Time: 11:06:19 Impinj Inc. WO#: 94448
Test Lead: Neutral 120V 60Hz Sequence#: 2 Neutral
Impinj Inc. Speedway Revolution P/N: IPJ-R420



Test Setup Photos



15.247(b)(2) RF Power Output

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **15.247(b)(2) RF Output power**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Conducted Emissions** Time: 09:02:21
Tested by: **Steven Pittsford**

EUT Information:
Manufacturer: Impinj Inc. Model #: IPJ-R420
Equipment: Speedway Revolution Serial #: 37012340460
Operating voltage/frequency: Number of channels:
Design Phase: Production Model Installation: Mobile

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN05759	Attenuator-Facto	PE7010-20	2/6/2012	2/6/2014
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013

Customer Support Equipment:

Equipment	Manufacturer	Model Number	Serial Number
POE	NetGear	FS726TP	1DA5895Y0031B
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is set in constant transmit mode.
The EUT is powered by a NetGear POE Model FS726TP.
The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB.

Frequency: 902-928MHz

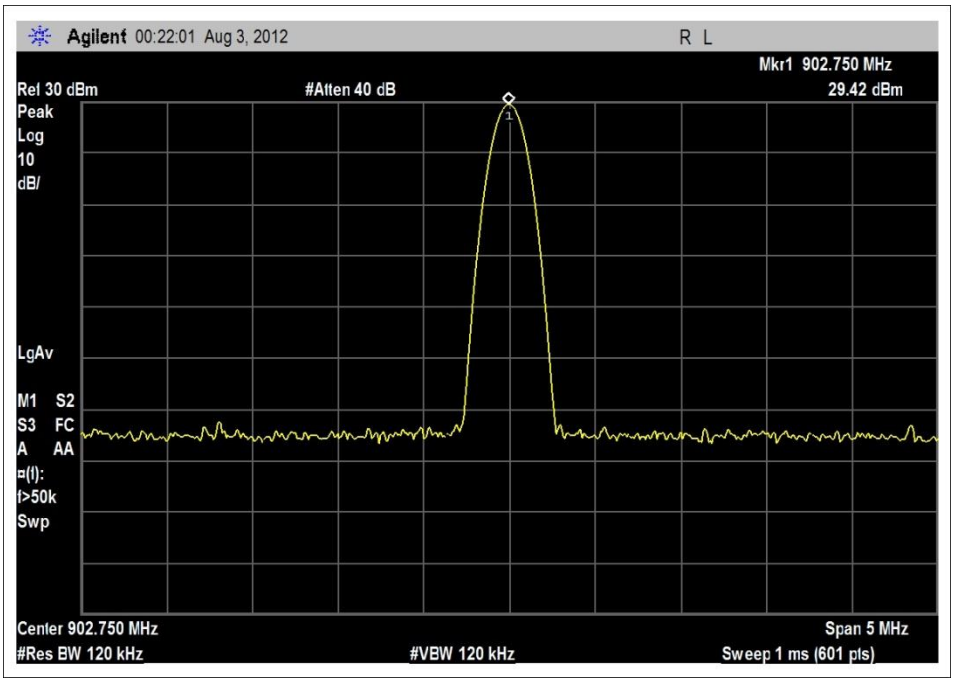
Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

Attenuator insertion loss applied for in the Spectrum Analyzer screen capture.
Measured Power= 29.42dBm, 29.53dBm, 29.57dBm
30MHz-1000 MHz; RBW=120 kHz, VBW=120kHz

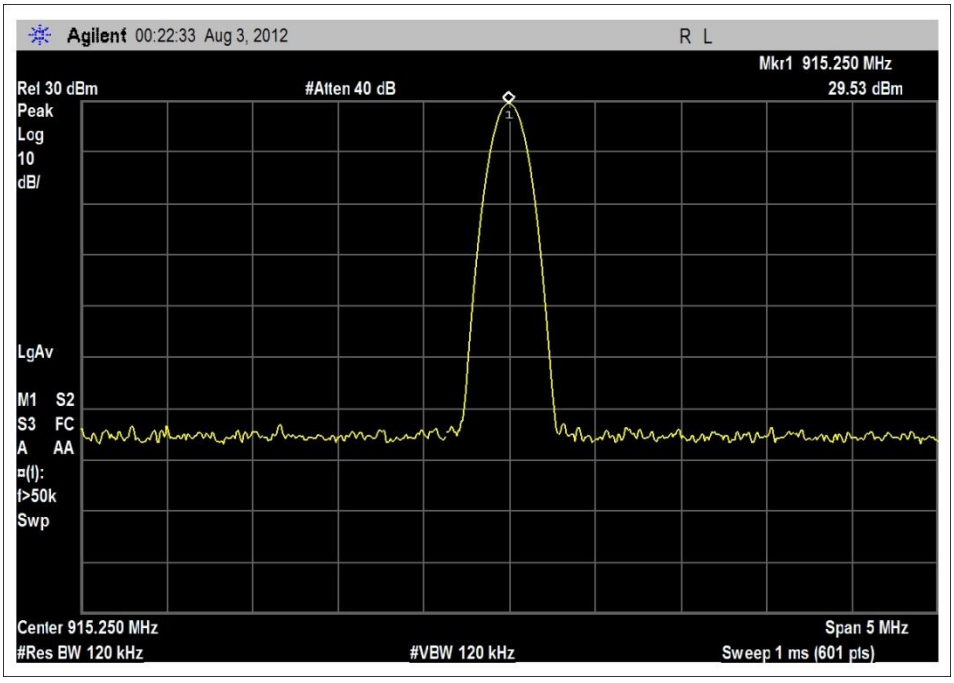
Test method in accordance with FCC document: DA 00-705

Temperature: 22°C
Pressure: 102.8kPa
Humidity: 38%

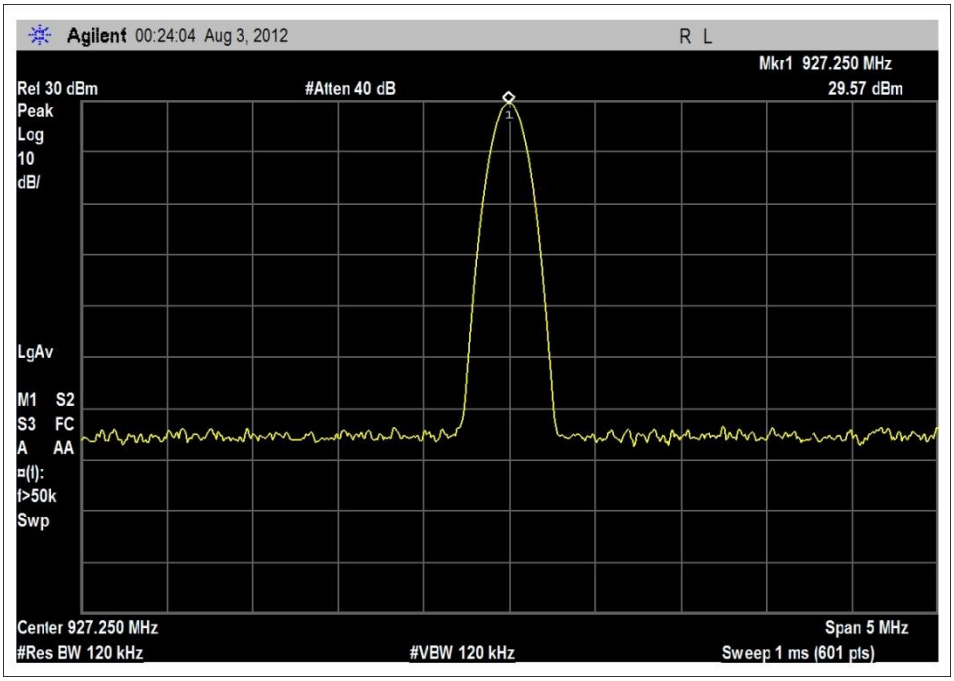
Test Data



Low Channel



Mid Channel



High Channel

Test Setup Photo

-20dBc Occupied Bandwidth

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **FCC15.247 -20dB Bandwidth**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Conducted Emissions** Time: 09:02:21
Tested By: **Steven Pittsford**

EUT Information:

Manufacturer: Impinj Inc. Model #: IPJ-R420
Equipment: Speedway Revolution Serial #: 37012340460
Operating voltage/frequency: Number of channels:
Design Phase: Production Model Installation: Mobile

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN05759	Attenuator-Facto	PE7010-20	2/6/2012	2/6/2014
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013

Customer Support Equipment:

Equipment	Manufacturer	Model Number	Serial Number
POE	NetGear	FS726TP	1DA5895Y0031B
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

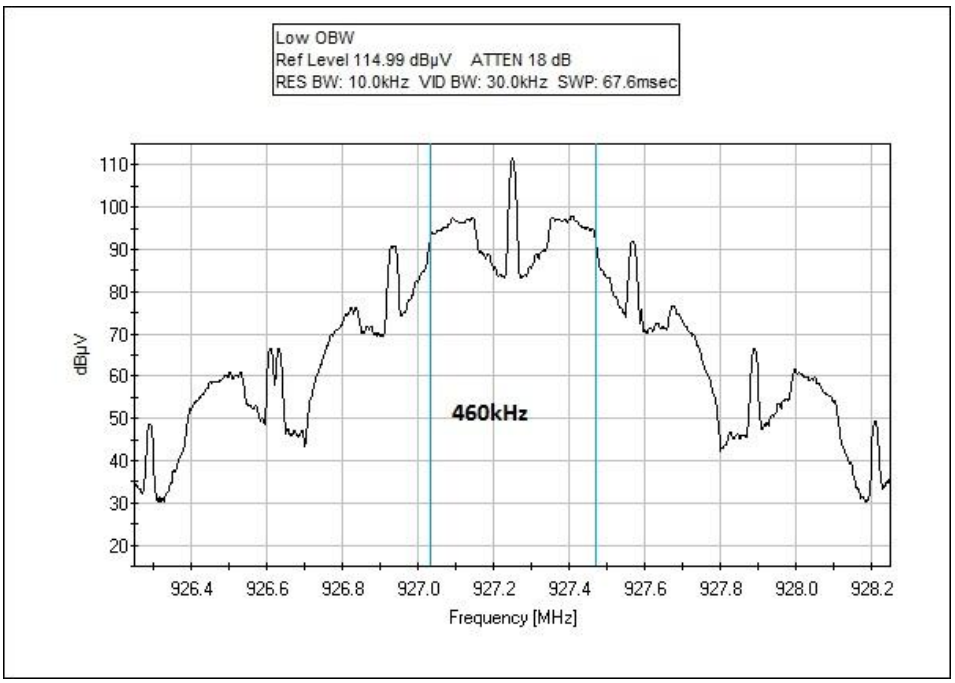
A laptop sends test command to the EUT via an Ethernet cable. The EUT is powered by a NetGear POE Model FS726TP. The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB.
Frequency: 902-928MHz
Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm
Attenuator insertion loss applied for in the Spectrum Analyzer screen capture.
Measured Power= 29.42dBm, 29.53dBm, 29.57dBm
30MHz-1000 MHz; RBW=120 kHz, VBW=120kHz

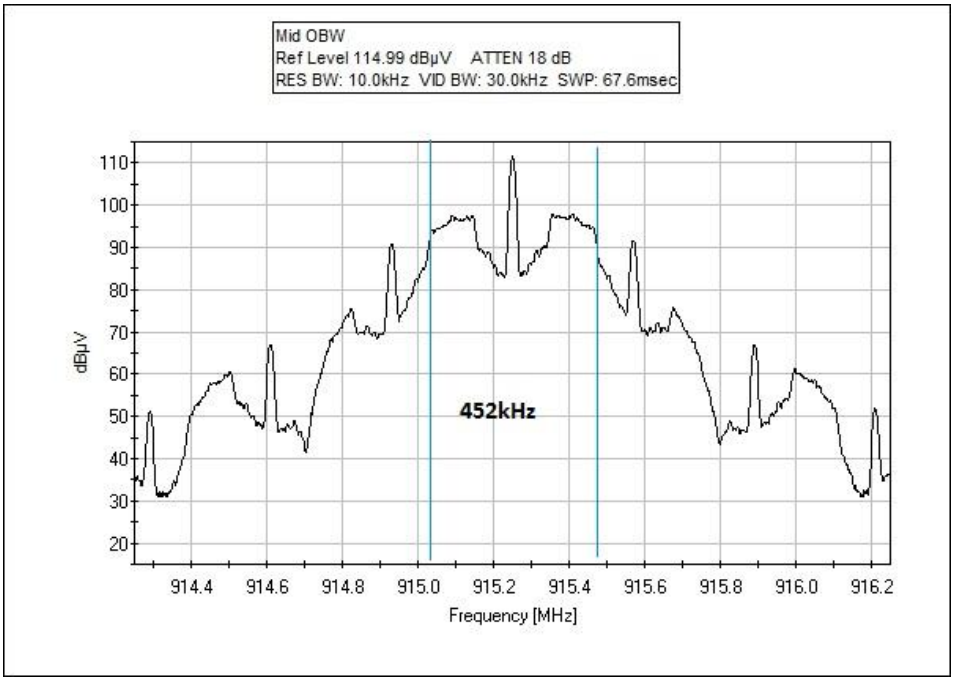
Test method in accordance with FCC document: DA 00-705.

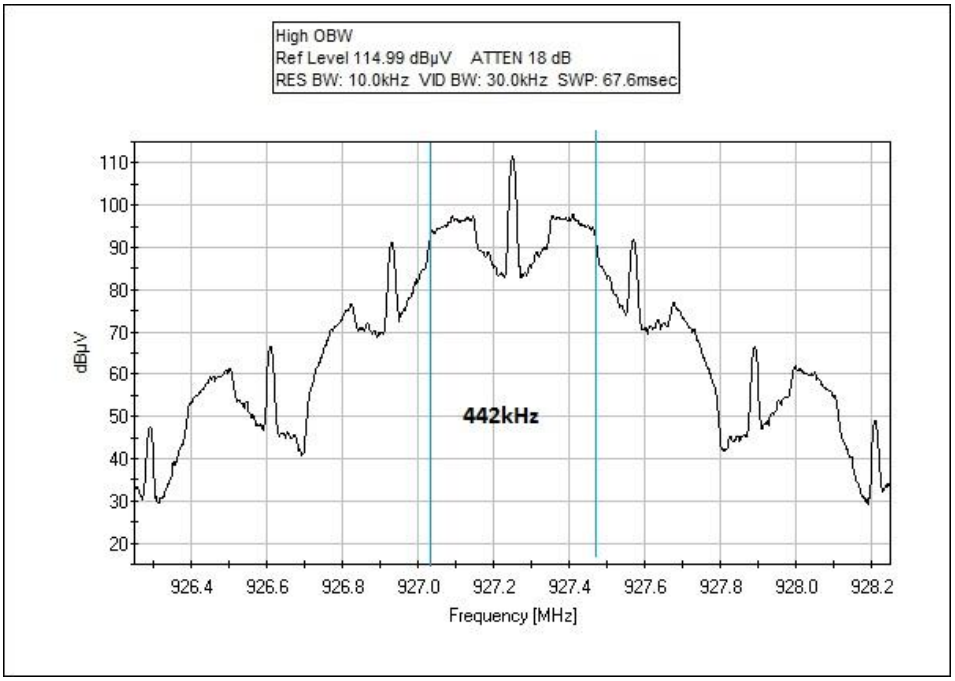
Temperature: 22°C
Pressure: 102.8kPa
Humidity: 38%

-20dB OBW	**Low Channel**	**Mid Channel**	**High Channel**
	460 kHz	452 kHz	442kHz

Test Plots


Low OBW
Ref Level 114.99 dBµV ATTEN 18 dB
RES BW: 10.0kHz VID BW: 30.0kHz SWP: 67.6msec
dBµV
110
100
90
80
70
60
50
40
30
20
460kHz
926.4
926.6
926.8
927.0
927.2
927.4
927.6
927.8
928.0
928.2
Frequency [MHz]


Mid OBW
Ref Level 114.99 dBµV ATTEN 18 dB
RES BW: 10.0kHz VID BW: 30.0kHz SWP: 67.6msec
dBµV
110
100
90
80
70
60
50
40
30
20
452kHz
914.4
914.6
914.8
915.0
915.2
915.4
915.6
915.8
916.0
916.2
Frequency [MHz]



Test Setup Photos

Bandedge

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **Band Edge Compliance FCC Part 15.247 & RSS-210**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Radiated Scan** Time: 11:08:26
Tested By: **Steven Pittsford**

EUT Information:
Manufacturer: Impinj Inc. Model #: IPJ-R420
Equipment: Speedway Revolution Serial #: 37012340460
Operating voltage/frequency: Number of channels:
Design Phase: Production Model Installation: Mobile

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN03227	Cable	32026-29080-29080-84	3/29/2013	3/29/2015
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013
	ANP05360	Cable	RG214	12/3/2012	12/3/2014
	ANP05366	Cable	RG-214	10/14/2011	10/14/2013
	AN02308	Preamp	8447D	4/3/2012	4/3/2014
	AN01996	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014

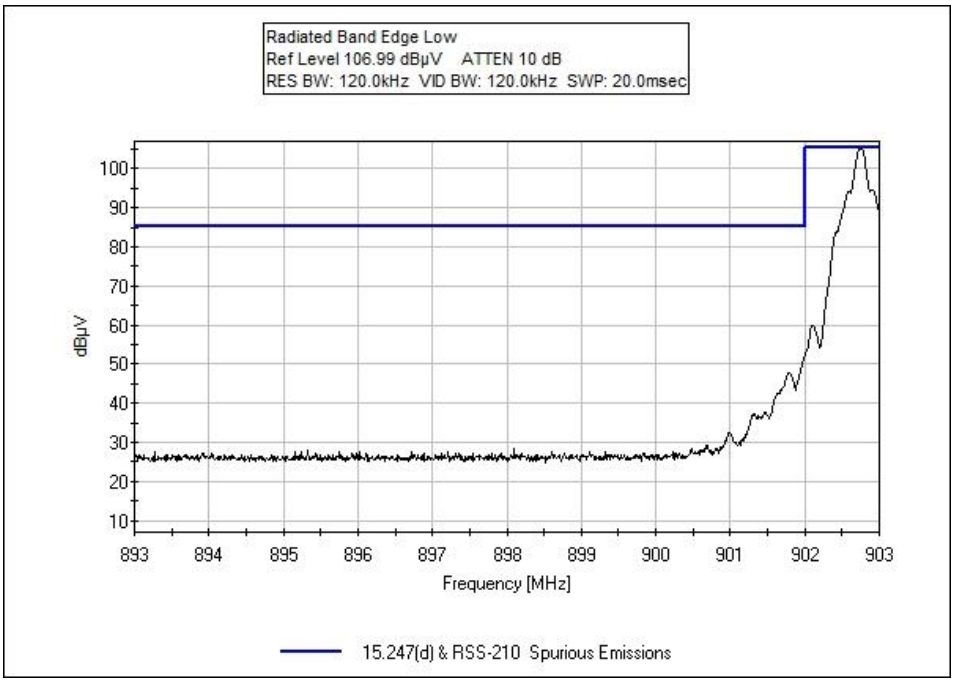
Customer Support Equipment:

Equipment	**Manufacturer**	**Model Number**	**Serial Number**
POE	NetGear	FS726TP	1DA5895Y0031B
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA
Antennas Tested			
Antenna 6dBi composite gain with integrated 8 foot pigtail to RP-TNC male connector	Laird Technologies	S9028PCLJ	NA
Mini-Guardrail Antenna with SMA Female Connector -15dBi gain	Impinj Inc.	IPJ-A0303-000	NA

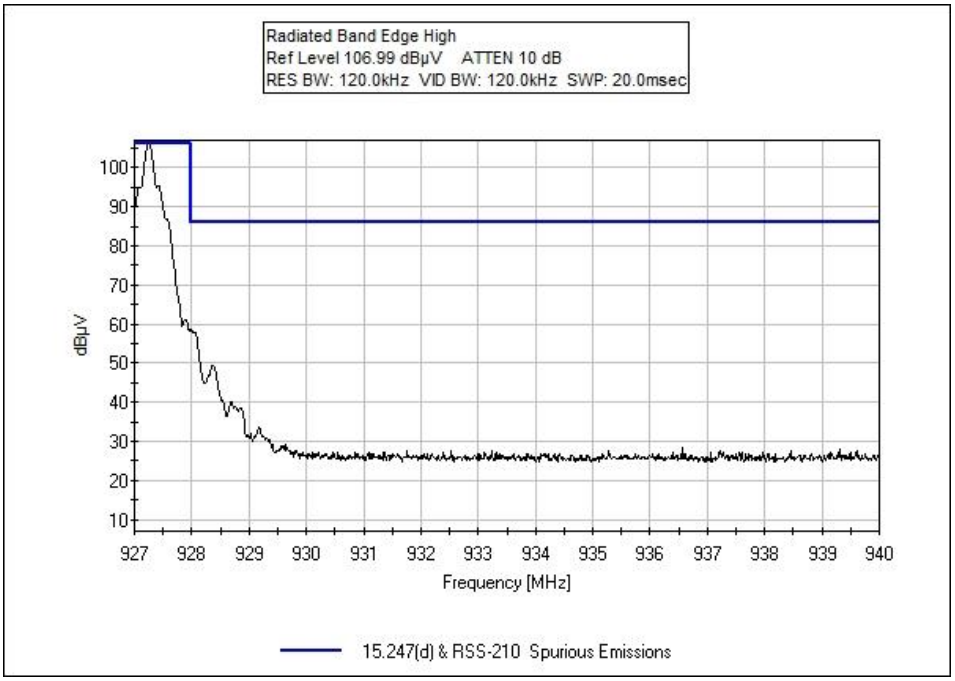
Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is powered by a NetGear POE Model FS726TP. The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB into the Laird Technologies 6dBi Antenna & Impinj Mini-Guardrail Antenna. EUT is placed in the center of the turntable on a Styrofoam table 80cm above the ground plane. Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm. Measured Power= 29.42dBm, 29.53dBm, 29.57dBm
CISPR Bandwidths used. Test method in accordance with FCC document: DA 00-705.
Temperature: 23°C, Pressure: 102.8kPa, Humidity: 38%

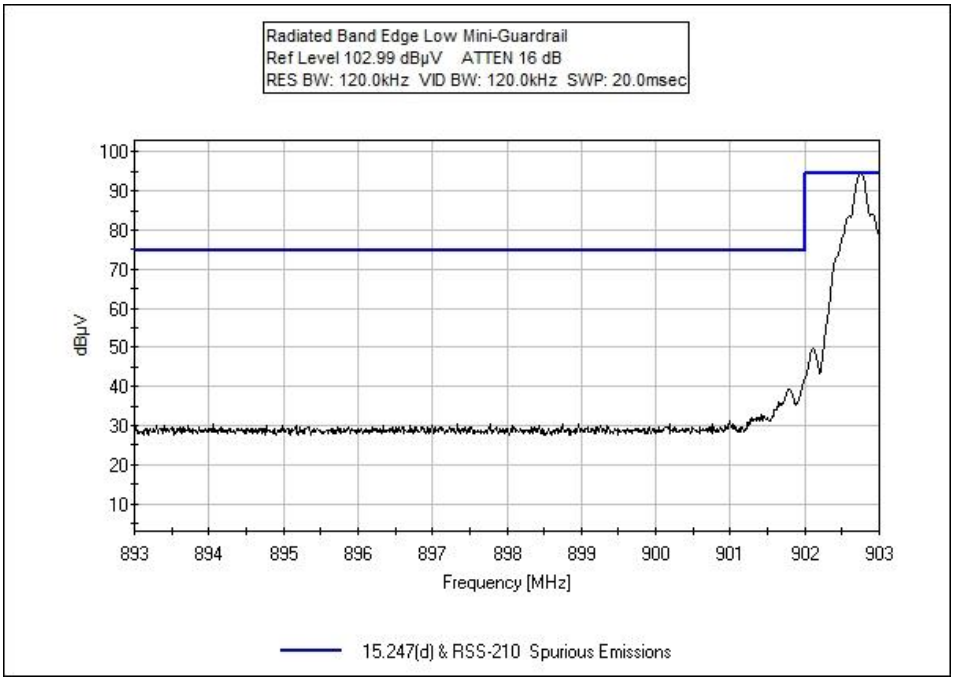
Test Data



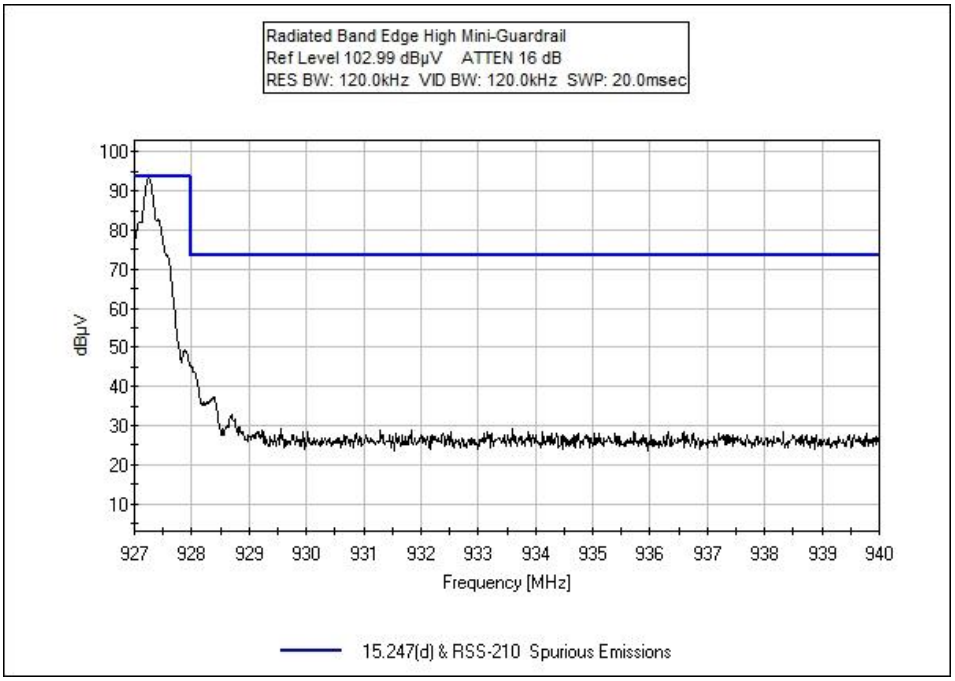
Laird Technologies 6dBi Antenna



Laird Technologies 6dBi Antenna

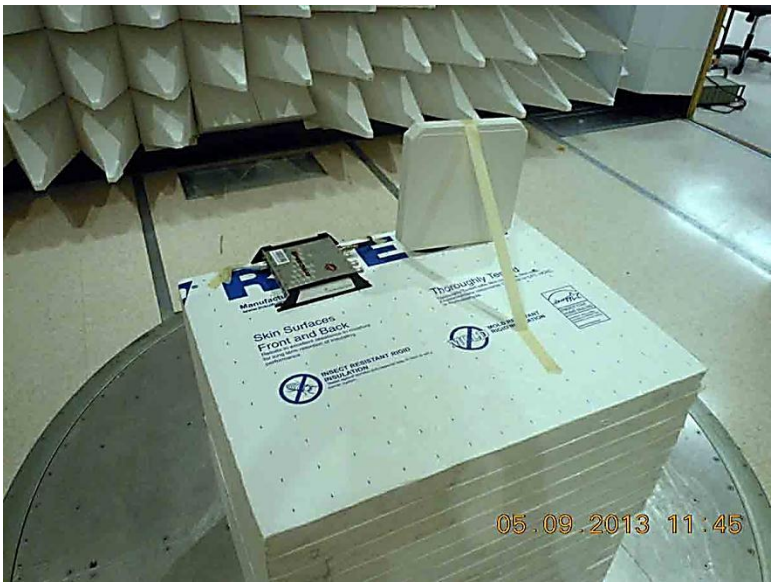


Mini-Guardrail Antenna



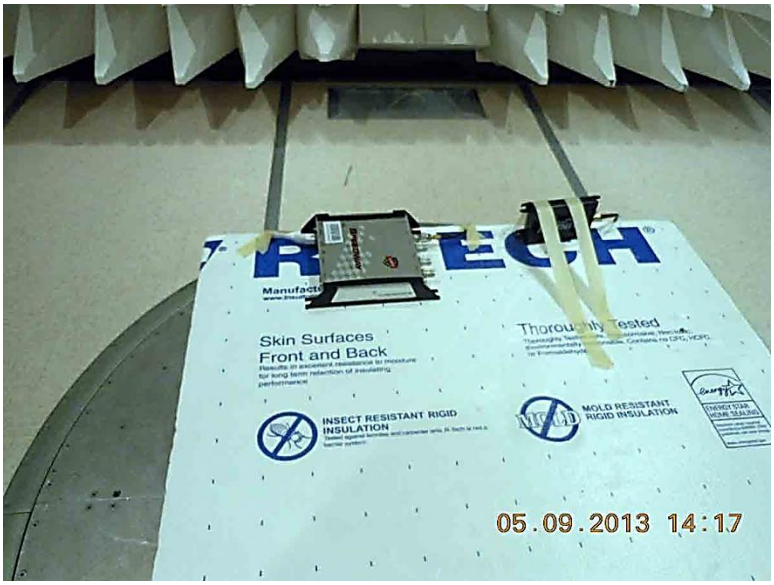
Mini-Guardrail Antenna

Test Setup Photos



Laird Technologies 6dBi Antenna, View #1

Laird Technologies 6dBi Antenna, View #2



Mini-Guardrail Antenna, View #1

Mini-Guardrail Antenna, View #2

15.247(d) Conducted Spurious Emissions / RSS 210

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **FCC Part 15.247(d) & RSS-210 Conducted Spurious emission.**
Work Order #: **94448** Date: 5/9/2013
Test Type: **Conducted Emissions**
Tested By: **Steven Pittsford**

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN01706	Attenuator-Facto	8495B	1/11/2012	1/11/2014
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013

Customer Support Equipment:

Equipment	Manufacturer	Model Number	Serial Number
POE	NetGear	FS726TP	1DA5895Y0031B
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is set in constant transmit mode.
The EUT is powered by a NetGear POE Model FS726TP.
The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB.

Frequency: 902-928MHz

Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

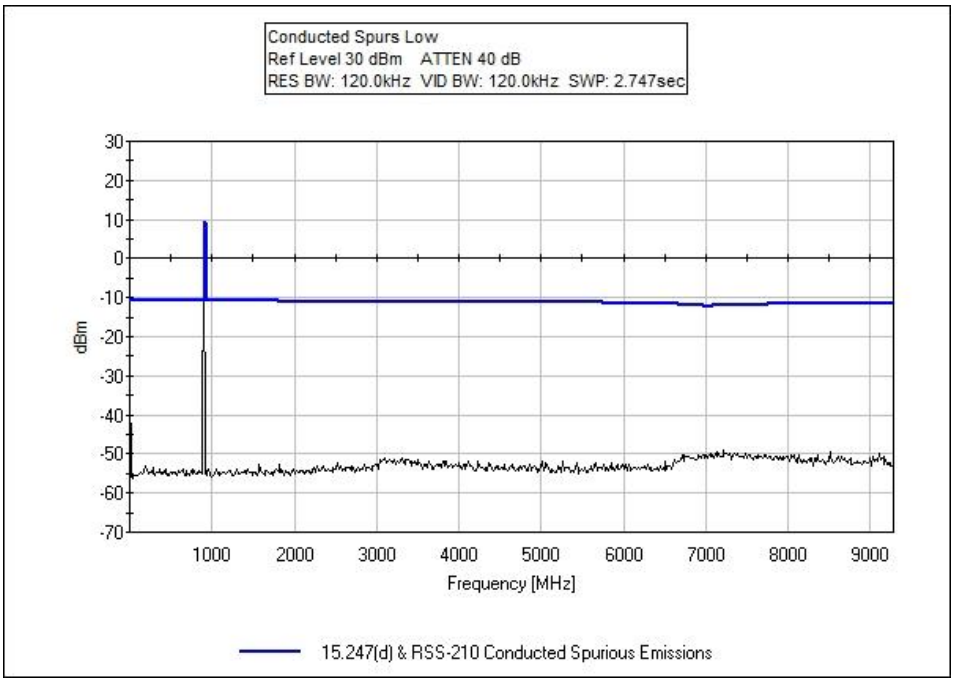
Measured Power= 29.42dBm, 29.53dBm, 29.57dBm

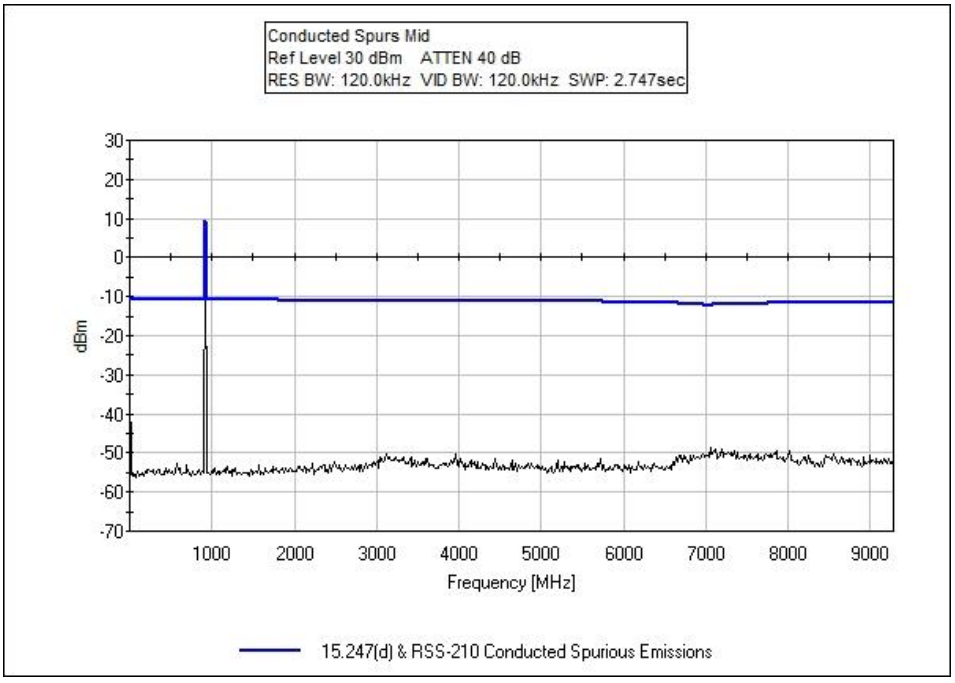
Frequency range of measurement = 9 kHz- 10GHz.
9 kHz-10GHz; RBW=120 kHz, VBW=120 kHz. No emission was detected with slightly larger RBW.
Limit line set at -20dBc.

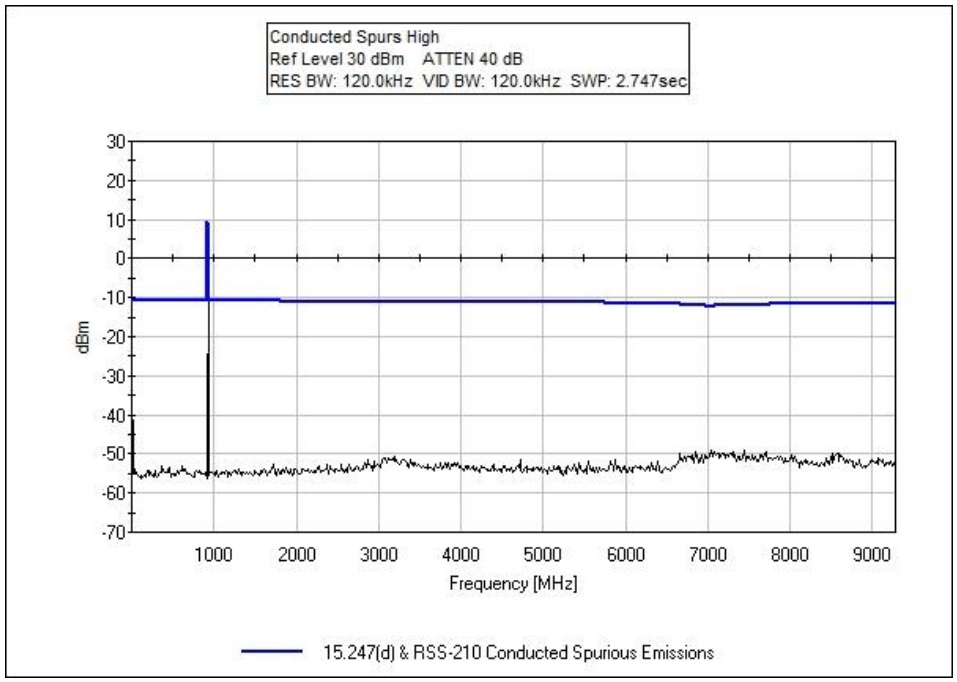
Test method in accordance with FCC document: DA 00-705

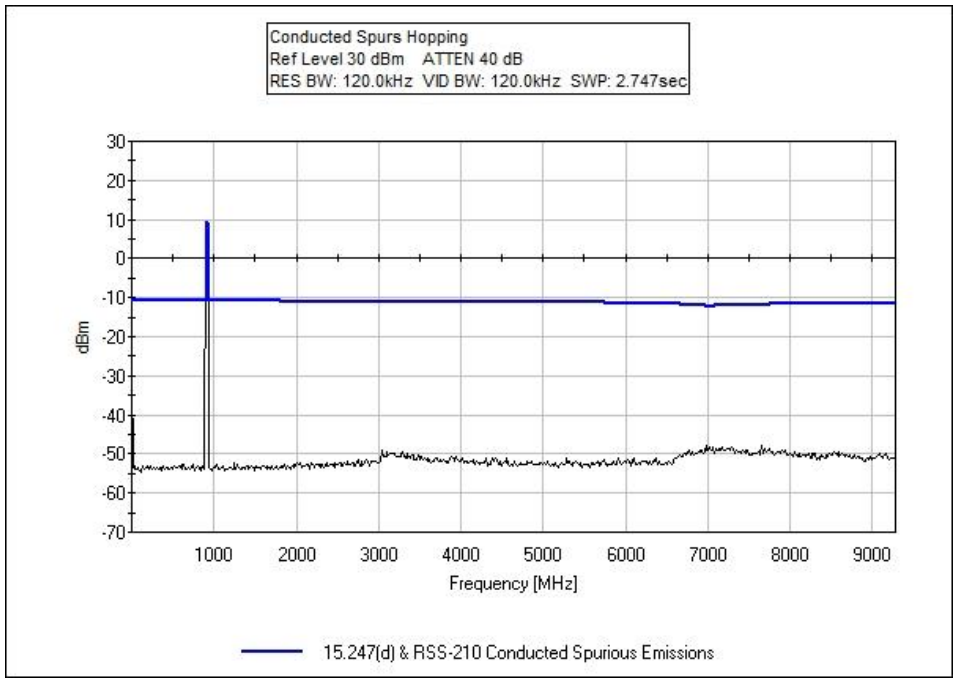
Temperature: 22°C
Pressure: 102.8kPa
Humidity: 38%

Test Data

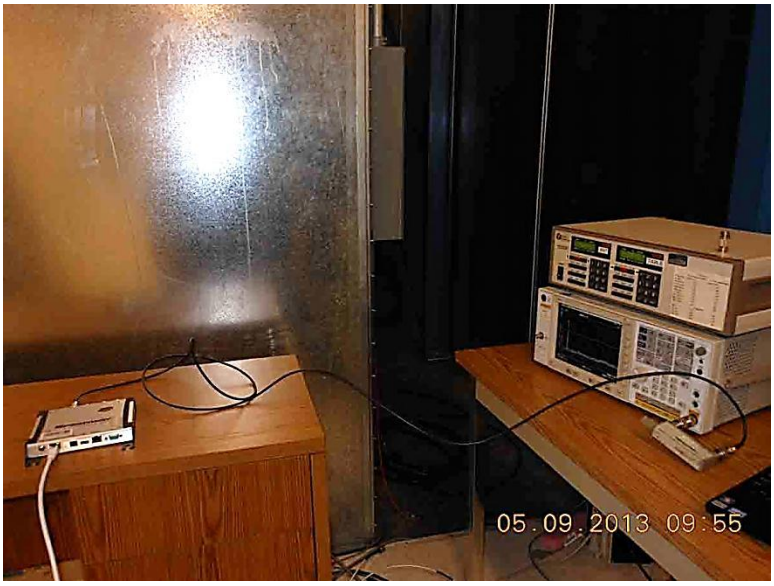

Conducted Spurs Low
Ref Level 30 dBm ATTEN 40 dB
RES BW: 120.0kHz VID BW: 120.0kHz SWP: 2.747sec
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
dBm
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) & RSS-210 Conducted Spurious Emissions


Conducted Spurs Mid
Ref Level 30 dBm ATTEN 40 dB
RES BW: 120.0kHz VID BW: 120.0kHz SWP: 2.747sec
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
dBm
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) & RSS-210 Conducted Spurious Emissions


Conducted Spurs High
Ref Level 30 dBm ATTEN 40 dB
RES BW: 120.0kHz VID BW: 120.0kHz SWP: 2.747sec
dBm
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) & RSS-210 Conducted Spurious Emissions


Conducted Spurs Hopping
Ref Level 30 dBm ATTEN 40 dB
RES BW: 120.0kHz VID BW: 120.0kHz SWP: 2.747sec
dBm
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) & RSS-210 Conducted Spurious Emissions

Test Setup Photo



15.247(d) Radiated Spurious Emissions

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **94448** Date: 5/10/2013
Test Type: **Maximized Emissions** Time: 10:32:56
Equipment: **Speedway Revolution** Sequence#: 3
Manufacturer: Impinj Inc. Tested By: Steven Pittsford
Model: IPJ-R420
S/N: 37012340460

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03227	Cable	32026-29080-29080-84	3/29/2013	3/29/2015
T2	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013
T3	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T4	ANP05366	Cable	RG-214	10/14/2011	10/14/2013
T5	AN02308	Preamp	8447D	4/3/2012	4/3/2014
T6	AN01996	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014
	AN00052	Loop Antenna	6502	5/16/2012	5/16/2014
T7	ANP05965	Cable	Various	8/26/2011	8/26/2013
T8	AN01271	Preamp	83017A	8/18/2011	8/18/2013
T9	AN03123	Cable	32026-2-29801-12	10/14/2011	10/14/2013
T10	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	10/19/2011	10/19/2013
T11	AN03181	Attenuator	PE7015-20	1/4/2012	1/4/2014
T12	AN03170	High Pass Filter	HM1155-11SS	9/6/2011	9/6/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Speedway Revolution*	Impinj Inc.	IPJ-R420	37012340460
Antenna 6dBi composite gain with integrated 8 foot pigtail to RP-TNC male connector	Laird Technologies	S9028PCLJ	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
POE	Netgear	FS726TP	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is set to Low mid and High Channels. The EUT is powered by a Netgear POE Model FS726TP. The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB into the Laird Technologies Antenna 6dBi composite gain with integrated 8 foot pigtail to RP-TNC male connector.

Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

Measured Power= 29.42dBm, 29.53dBm, 29.57dBm

Frequency range of measurement = 9k-10GHz
CISPR Bandwidths used

Test method in accordance with FCC document: DA 00-705

Temperature: 23°C
Pressure: 102.8kPa
Humidity: 38%

No Emissions observed 9k-30MHz

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

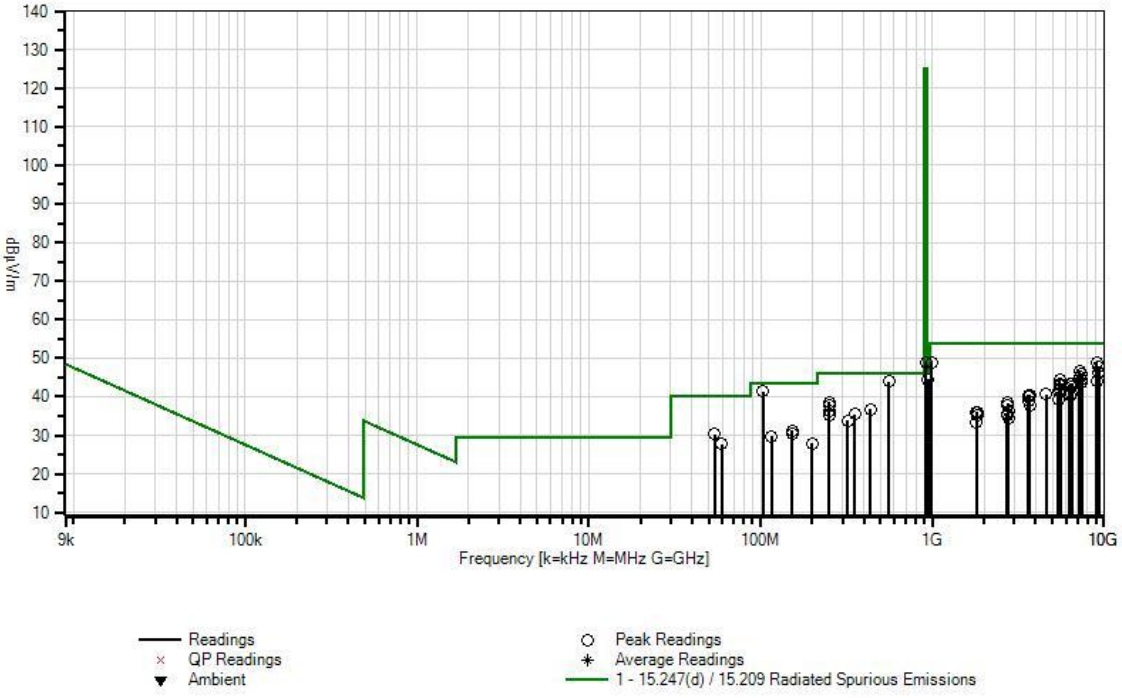
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	940.100M	23.5	+1.1 -27.3 +0.0	+0.0 +23.2 +0.0	+2.1 +0.0 +19.7	+2.3 +0.0 +0.0	+0.0	44.6	46.0 Low	-1.4	Horiz 129
2	556.300M	29.3	+0.8 -28.3 +0.0	+0.0 +19.2 +0.0	+1.6 +0.0 +19.7	+1.7 +0.0 +0.0	+0.0 360	44.0	46.0 Mid	-2.0	Horiz 138
3	103.700M	38.2	+0.3 -27.9 +0.0	+0.0 +10.1 +0.0	+0.6 +0.0 +19.6	+0.5 +0.0 +0.0	+0.0 43	41.4	43.5 Mid	-2.1	Vert 100
4	986.370M	26.5	+1.1 -27.2 +0.0	+0.0 +24.1 +0.0	+2.2 +0.0 +19.7	+2.5 +0.0 +0.0	+0.0 360	48.9	54.0 High	-5.1	Vert 101
5	9027.466M	37.8	+3.4 +0.0 +0.8	+0.0 +0.0 +37.0	+0.0 +3.9 +0.0	+0.0 -34.2 +0.2	+0.0 152	48.9	54.0 Low	-5.1	Vert 119
6	9027.453M	37.7	+3.4 +0.0 +0.8	+0.0 +0.0 +37.0	+0.0 +3.9 +0.0	+0.0 -34.2 +0.2	+0.0 162	48.8	54.0 Low	-5.2	Horiz 104
7	9272.530M	37.6	+3.5 +0.0 +0.8	+0.0 +0.0 +35.8	+0.0 +4.0 +0.0	+0.0 -34.1 +0.2	+0.0 175	47.8	54.0 High	-6.2	Vert 126
8	7221.965M	37.9	+3.0 +0.0 +0.6	+0.0 +0.0 +35.7	+0.0 +3.6 +0.0	+0.0 -34.4 +0.3	+0.0 247	46.7	54.0 Low	-7.3	Horiz 110

9	250.000M	31.1	+0.5 -27.1 +0.0	+0.0 +12.5 +0.0	+1.0 +0.0 +19.7	+1.0 +0.0 +0.0	+0.0	38.7	46.0 High	-7.3	Vert 101
10	9272.473M	35.9	+3.5 +0.0 +0.8	+0.0 +0.0 +35.8	+0.0 +4.0 +0.0	+0.0 -34.1 +0.2	+0.0 287	46.1	54.0 High	-7.9	Horiz 107
11	7418.016M	36.9	+3.2 +0.0 +0.6	+0.0 +0.0 +36.0	+0.0 +3.6 +0.0	+0.0 -34.5 +0.2	+0.0 248	46.0	54.0 High	-8.0	Vert 121
12	7418.016M	36.9	+3.2 +0.0 +0.6	+0.0 +0.0 +36.0	+0.0 +3.6 +0.0	+0.0 -34.5 +0.2	+0.0 258	46.0	54.0 High	-8.0	Horiz 99
13	249.980M	30.0	+0.5 -27.1 +0.0	+0.0 +12.5 +0.0	+1.0 +0.0 +19.7	+1.0 +0.0 +0.0	+0.0	37.6	46.0 Mid	-8.4	Horiz 138
14	7222.002M	36.2	+3.0 +0.0 +0.6	+0.0 +0.0 +35.7	+0.0 +3.6 +0.0	+0.0 -34.4 +0.3	+0.0 245	45.0	54.0 Low	-9.0	Vert 99
15	435.500M	24.7	+0.7 -28.0 +0.0	+0.0 +16.9 +0.0	+1.4 +0.0 +19.7	+1.4 +0.0 +0.0	+0.0	36.8	46.0 Mid	-9.2	Vert 100
16	5491.498M	38.2	+3.0 +0.0 +0.4	+0.0 +0.0 +33.3	+0.0 +2.9 +0.0	+0.0 -33.5 +0.3	+0.0 159	44.6	54.0 Mid	-9.4	Horiz 99
17	250.200M	28.7	+0.5 -27.1 +0.0	+0.0 +12.5 +0.0	+1.0 +0.0 +19.7	+1.0 +0.0 +0.0	+0.0	36.3	46.0 Low	-9.7	Horiz 129
18	7322.003M	35.6	+3.1 +0.0 +0.5	+0.0 +0.0 +35.9	+0.0 +3.6 +0.0	+0.0 -34.6 +0.2	+0.0 266	44.3	54.0 Mid	-9.7	Horiz 107
19	53.900M	30.8	+0.2 -28.0 +0.0	+0.0 +6.9 +0.0	+0.4 +0.0 +19.7	+0.3 +0.0 +0.0	+0.0 -16	30.3	40.0 High	-9.7	Vert 99
20	9152.503M	33.5	+3.4 +0.0 +0.8	+0.0 +0.0 +36.4	+0.0 +3.9 +0.0	+0.0 -34.1 +0.2	+0.0 232	44.1	54.0 Mid	-9.9	Horiz 122
21	7322.003M	34.9	+3.1 +0.0 +0.5	+0.0 +0.0 +35.9	+0.0 +3.6 +0.0	+0.0 -34.6 +0.2	+0.0 229	43.6	54.0 Mid	-10.4	Vert 115
22	6490.781M	35.9	+3.0 +0.0 +0.5	+0.0 +0.0 +34.4	+0.0 +3.4 +0.0	+0.0 -34.0 +0.3	+0.0 53	43.5	54.0 High	-10.5	Vert 113
23	6406.733M	35.9	+3.0 +0.0 +0.5	+0.0 +0.0 +34.4	+0.0 +3.3 +0.0	+0.0 -34.0 +0.4	+0.0 3	43.5	54.0 Mid	-10.5	Vert 99
24	352.000M	25.3	+0.6 -27.4 +0.0	+0.0 +14.8 +0.0	+1.2 +0.0 +19.7	+1.2 +0.0 +0.0	+0.0 360	35.4	46.0 Mid	-10.6	Horiz 138
25	250.200M	27.7	+0.5 -27.1 +0.0	+0.0 +12.5 +0.0	+1.0 +0.0 +19.7	+1.0 +0.0 +0.0	+0.0 360	35.3	46.0 Mid	-10.7	Horiz 138

26	5491.514M	36.8	+3.0	+0.0	+0.0	+0.0	+0.0	43.2	54.0	-10.8	Vert
			+0.0	+0.0	+2.9	-33.5	270		Mid		110
			+0.4	+33.3	+0.0	+0.3					
27	6319.250M	35.5	+3.0	+0.0	+0.0	+0.0	+0.0	43.2	54.0	-10.8	Horiz
			+0.0	+0.0	+3.3	-33.9	310		Low		121
			+0.5	+34.5	+0.0	+0.3					
28	5563.509M	36.4	+3.0	+0.0	+0.0	+0.0	+0.0	42.9	54.0	-11.1	Horiz
			+0.0	+0.0	+2.9	-33.6	246		High		99
			+0.4	+33.5	+0.0	+0.3					
29	6490.751M	35.1	+3.0	+0.0	+0.0	+0.0	+0.0	42.7	54.0	-11.3	Horiz
			+0.0	+0.0	+3.4	-34.0	225		High		107
			+0.5	+34.4	+0.0	+0.3					
30	322.000M	24.6	+0.6	+0.0	+1.1	+1.2	+0.0	33.9	46.0	-12.1	Horiz
			-27.2	+13.9	+0.0	+0.0			Low		129
			+0.0	+0.0	+19.7	+0.0					
31	5563.509M	35.4	+3.0	+0.0	+0.0	+0.0	+0.0	41.9	54.0	-12.1	Vert
			+0.0	+0.0	+2.9	-33.6			High		105
			+0.4	+33.5	+0.0	+0.3					
32	152.200M	26.5	+0.4	+0.0	+0.8	+0.7	+0.0	31.3	43.5	-12.2	Vert
			-27.6	+10.8	+0.0	+0.0			Mid		100
			+0.0	+0.0	+19.7	+0.0					
33	59.600M	29.5	+0.3	+0.0	+0.5	+0.4	+0.0	27.8	40.0	-12.2	Vert
			-28.0	+5.4	+0.0	+0.0	-16		High		99
			+0.0	+0.0	+19.7	+0.0					
34	5416.502M	34.9	+3.1	+0.0	+0.0	+0.0	+0.0	41.4	54.0	-12.6	Vert
			+0.0	+0.0	+2.9	-33.5	271		Low		106
			+0.5	+33.2	+0.0	+0.3					
35	6406.748M	33.3	+3.0	+0.0	+0.0	+0.0	+0.0	40.9	54.0	-13.1	Horiz
			+0.0	+0.0	+3.3	-34.0	360		Mid		138
			+0.5	+34.4	+0.0	+0.4					
36	152.200M	25.5	+0.4	+0.0	+0.8	+0.7	+0.0	30.3	43.5	-13.2	Vert
			-27.6	+10.8	+0.0	+0.0	360		Low		100
			+0.0	+0.0	+19.7	+0.0					
37	4576.299M	37.0	+2.8	+0.0	+0.0	+0.0	+0.0	40.7	54.0	-13.3	Horiz
			+0.0	+0.0	+2.6	-33.5	239		Mid		107
			+0.1	+31.4	+0.0	+0.3					
38	6319.252M	32.7	+3.0	+0.0	+0.0	+0.0	+0.0	40.4	54.0	-13.6	Vert
			+0.0	+0.0	+3.3	-33.9	208		Low		104
			+0.5	+34.5	+0.0	+0.3					
39	3709.009M	39.0	+2.4	+0.0	+0.0	+0.0	+0.0	40.3	54.0	-13.7	Vert
			+0.0	+0.0	+2.1	-33.6	61		High		107
			+0.4	+29.6	+0.0	+0.4					
40	3660.957M	39.3	+2.4	+0.0	+0.0	+0.0	+0.0	40.3	54.0	-13.7	Vert
			+0.0	+0.0	+2.1	-33.6	245		Mid		108
			+0.4	+29.4	+0.0	+0.3					
41	115.400M	25.1	+0.4	+0.0	+0.7	+0.6	+0.0	29.8	43.5	-13.7	Horiz
			-27.8	+11.2	+0.0	+0.0	360		Mid		138
			+0.0	+0.0	+19.6	+0.0					
42	3661.028M	39.3	+2.4	+0.0	+0.0	+0.0	+0.0	40.3	54.0	-13.7	Horiz
			+0.0	+0.0	+2.1	-33.6	360		Mid		108
			+0.4	+29.4	+0.0	+0.3					

43	3610.973M	39.2	+2.3	+0.0	+0.0	+0.0	+0.0	40.1	54.0	-13.9	Horiz
			+0.0	+0.0	+2.2	-33.6			Low		107
			+0.4	+29.3	+0.0	+0.3					
44	5416.502M	32.8	+3.1	+0.0	+0.0	+0.0	+0.0	39.3	54.0	-14.7	Horiz
			+0.0	+0.0	+2.9	-33.5	190		Low		99
			+0.5	+33.2	+0.0	+0.3					
45	3611.001M	38.1	+2.3	+0.0	+0.0	+0.0	+0.0	39.0	54.0	-15.0	Vert
			+0.0	+0.0	+2.2	-33.6	219		Low		120
			+0.4	+29.3	+0.0	+0.3					
46	198.800M	24.3	+0.5	+0.0	+0.9	+0.9	+0.0	28.0	43.5	-15.5	Vert
			-27.3	+9.0	+0.0	+0.0	360		Low		100
			+0.0	+0.0	+19.7	+0.0					
47	2745.721M	40.2	+1.9	+0.0	+0.0	+0.0	+0.0	38.4	54.0	-15.6	Horiz
			+0.0	+0.0	+2.1	-33.9	360		Mid		103
			+0.5	+27.3	+0.0	+0.3					
48	3709.000M	36.5	+2.4	+0.0	+0.0	+0.0	+0.0	37.8	54.0	-16.2	Horiz
			+0.0	+0.0	+2.1	-33.6	8		High		107
			+0.4	+29.6	+0.0	+0.4					
49	2745.748M	39.4	+1.9	+0.0	+0.0	+0.0	+0.0	37.6	54.0	-16.4	Vert
			+0.0	+0.0	+2.1	-33.9			Mid		116
			+0.5	+27.3	+0.0	+0.3					
50	2781.750M	38.1	+1.9	+0.0	+0.0	+0.0	+0.0	36.4	54.0	-17.6	Horiz
			+0.0	+0.0	+2.1	-33.9	329		High		99
			+0.5	+27.4	+0.0	+0.3					
51	1830.531M	42.0	+1.5	+0.0	+0.0	+0.0	+0.0	36.1	54.0	-17.9	Vert
			+0.0	+0.0	+1.6	-34.6	320		Mid		135
			+0.3	+24.9	+0.0	+0.4					
52	1805.501M	42.1	+1.4	+0.0	+0.0	+0.0	+0.0	36.0	54.0	-18.0	Horiz
			+0.0	+0.0	+1.6	-34.6	33		Low		123
			+0.3	+24.7	+0.0	+0.5					
53	2708.251M	37.6	+1.9	+0.0	+0.0	+0.0	+0.0	35.6	54.0	-18.4	Horiz
			+0.0	+0.0	+2.1	-33.9	297		Low		103
			+0.5	+27.1	+0.0	+0.3					
54	1830.499M	41.1	+1.5	+0.0	+0.0	+0.0	+0.0	35.2	54.0	-18.8	Horiz
			+0.0	+0.0	+1.6	-34.6			Mid		101
			+0.3	+24.9	+0.0	+0.4					
55	2708.251M	37.1	+1.9	+0.0	+0.0	+0.0	+0.0	35.1	54.0	-18.9	Vert
			+0.0	+0.0	+2.1	-33.9	360		Low		129
			+0.5	+27.1	+0.0	+0.3					
56	2781.750M	36.2	+1.9	+0.0	+0.0	+0.0	+0.0	34.5	54.0	-19.5	Vert
			+0.0	+0.0	+2.1	-33.9	360		High		115
			+0.5	+27.4	+0.0	+0.3					
57	1805.501M	39.6	+1.4	+0.0	+0.0	+0.0	+0.0	33.5	54.0	-20.5	Vert
			+0.0	+0.0	+1.6	-34.6	317		Low		99
			+0.3	+24.7	+0.0	+0.5					
58	916.500M	28.6	+1.0	+0.0	+2.1	+2.3	+0.0	49.0	125.2	-76.2	Vert
			-27.4	+22.7	+0.0	+0.0	360		High		101
			+0.0	+0.0	+19.7	+0.0					

CKC Laboratories, Inc. Date: 5/10/2013 Time: 10:32:56 Impinj Inc. WO#: 94448
Test Distance: 3 Meters Sequence#: 3 Vert
Impinj Inc. Speedway Revolution P/N: IPJ-R420



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **94448** Date: 5/10/2013
Test Type: **Maximized Emissions** Time: 09:15:21
Equipment: **Speedway Revolution** Sequence#: 4
Manufacturer: Impinj Inc. Tested By: Steven Pittsford
Model: IPJ-R420
S/N: 37012340460

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03227	Cable	32026-29080-29080-84	3/29/2013	3/29/2015
	AN02872	Spectrum Analyzer	E4440A	7/23/2011	7/23/2013
T2	ANP05360	Cable	RG214	12/3/2012	12/3/2014
T3	ANP05366	Cable	RG-214	10/14/2011	10/14/2013
T4	AN02308	Preamp	8447D	4/3/2012	4/3/2014
T5	AN01996	Biconilog Antenna	CBL6111C	3/2/2012	3/2/2014
	AN00052	Loop Antenna	6502	5/16/2012	5/16/2014
T6	ANP05965	Cable	Various	8/26/2011	8/26/2013
T7	AN01271	Preamp	83017A	8/18/2011	8/18/2013
T8	AN03123	Cable	32026-2-29801-12	10/14/2011	10/14/2013
T9	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	10/19/2011	10/19/2013
T10	AN03170	High Pass Filter	HM1155-11SS	9/6/2011	9/6/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Speedway Revolution*	Impinj Inc.	IPJ-R420	37012340460
Mini-Guardrail Antenna with SMA Female Connector -15dBi gain	Impinj Inc.	IPJ-A0303-000	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Firewall Router	Linksys	BEFSX41	CB900E900020
Laptop	Dell	Latitude D-610	NA
POE	Netgear	FS726TP	NA
Coaxial Cable	Generic	RG-58 (2.62meters, 1.5dB Loss)	NA

Test Conditions / Notes:

A laptop sends test command to the EUT via an Ethernet cable. The EUT is set to Low mid and High Channels
The EUT is powered by a Netgear POE Model FS726TP. The EUT is transmitting through a 2.62meter long RG-58 antenna cable with a stated loss of 1.5dB into the Impinj Mini-Guardrail Antenna with SMA Female Connector - 15dBi gain

Freq: 902.75MHz, 915.25MHz, 927.25MHz
Firmware setting = 31.5dBm, 31.5dBm, 31.5dBm

Measured Power= 29.42dBm, 29.53dBm, 29.57dBm

Frequency range of measurement = 9k-10GHz
CISPR Bandwidths used

Test method in accordance with FCC document: DA 00-705

Temperature: 23°C
Pressure: 102.8kPa
Humidity: 38%

No Emissions observed 9k-30MHz

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	31.900M	45.8	+0.2 +17.5 +0.0	+0.3 +0.0 +0.0	+0.2 +0.0	-28.0 +0.0	+0.0	36.0	40.0 Mid	-4.0	Vert 100
2	31.900M	45.4	+0.2 +17.5 +0.0	+0.3 +0.0 +0.0	+0.2 +0.0	-28.0 +0.0	+0.0 360	35.6	40.0 Low	-4.4	Vert 100
3	9272.480M	31.2	+3.5 +0.0 +35.8	+0.0 +4.0 +0.2	+0.0 -34.1	+0.0 +0.8	+0.0 190	41.4	54.0 High	-12.6	Horiz 121
4	250.200M	44.0	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0	+0.0 360	31.9	46.0 High	-14.1	Vert 99
5	31.900M	35.7	+0.2 +17.5 +0.0	+0.3 +0.0 +0.0	+0.2 +0.0	-28.0 +0.0	+0.0	25.9	40.0 High	-14.1	Horiz 99
6	9152.521M	29.2	+3.4 +0.0 +36.4	+0.0 +3.9 +0.2	+0.0 -34.1	+0.0 +0.8	+0.0	39.8	54.0 Mid	-14.2	Vert 99
7	250.200M	43.7	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0	+0.0	31.6	46.0 High	-14.4	Horiz 99
8	335.600M	41.5	+0.6 +14.3 +0.0	+1.1 +0.0 +0.0	+1.2 +0.0	-27.3 +0.0	+0.0	31.4	46.0 High	-14.6	Horiz 99

9	250.200M	43.5	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0 360	+0.0	31.4	46.0 Low	-14.6	Vert 100
10	858.400M	31.1	+1.0 +22.2 +0.0	+2.0 +0.0 +0.0	+2.2 +0.0	-27.6 +0.0 360	+0.0	30.9	46.0 Mid	-15.1	Horiz 194
11	31.900M	34.6	+0.2 +17.5 +0.0	+0.3 +0.0 +0.0	+0.2 +0.0	-28.0 +0.0 360	+0.0	24.8	40.0 Mid	-15.2	Horiz 194
12	31.900M	34.4	+0.2 +17.5 +0.0	+0.3 +0.0 +0.0	+0.2 +0.0	-28.0 +0.0	+0.0	24.6	40.0 Low	-15.4	Horiz 200
13	9152.514M	28.0	+3.4 +0.0 +36.4	+0.0 +3.9 +0.2	+0.0 -34.1	+0.0 +0.8 312	+0.0	38.6	54.0 Mid	-15.4	Horiz 132
14	9272.506M	28.1	+3.5 +0.0 +35.8	+0.0 +4.0 +0.2	+0.0 -34.1	+0.0 +0.8 281	+0.0	38.3	54.0 High	-15.7	Vert 119
15	250.200M	42.3	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0	+0.0	30.2	46.0 Mid	-15.8	Vert 100
16	714.800M	32.5	+0.9 +20.9 +0.0	+1.8 +0.0 +0.0	+2.0 +0.0	-28.1 +0.0 360	+0.0	30.0	46.0 High	-16.0	Vert 99
17	7418.002M	28.8	+3.2 +0.0 +36.0	+0.0 +3.6 +0.2	+0.0 -34.5	+0.0 +0.6 244	+0.0	37.9	54.0 High	-16.1	Vert 106
18	250.200M	41.9	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0	+0.0	29.8	46.0 Low	-16.2	Horiz 200
19	5563.479M	31.3	+3.0 +0.0 +33.5	+0.0 +2.9 +0.3	+0.0 -33.6	+0.0 +0.4 217	+0.0	37.8	54.0 High	-16.2	Vert 109
20	7221.960M	28.6	+3.0 +0.0 +35.7	+0.0 +3.6 +0.3	+0.0 -34.4	+0.0 +0.6 280	+0.0	37.4	54.0 Low	-16.6	Horiz 99
21	7417.968M	28.2	+3.2 +0.0 +36.0	+0.0 +3.6 +0.2	+0.0 -34.5	+0.0 +0.6 200	+0.0	37.3	54.0 High	-16.7	Horiz 115
22	786.600M	30.4	+0.9 +21.8 +0.0	+1.9 +0.0 +0.0	+2.1 +0.0	-27.9 +0.0	+0.0	29.2	46.0 Low	-16.8	Horiz 200
23	335.600M	39.3	+0.6 +14.3 +0.0	+1.1 +0.0 +0.0	+1.2 +0.0	-27.3 +0.0	+0.0	29.2	46.0 Low	-16.8	Horiz 200
24	304.500M	39.9	+0.6 +13.3 +0.0	+1.1 +0.0 +0.0	+1.2 +0.0	-27.1 +0.0	+0.0	29.0	46.0 High	-17.0	Horiz 99
25	465.500M	36.2	+0.7 +17.4 +0.0	+1.4 +0.0 +0.0	+1.5 +0.0	-28.2 +0.0	+0.0	29.0	46.0 Low	-17.0	Horiz 200

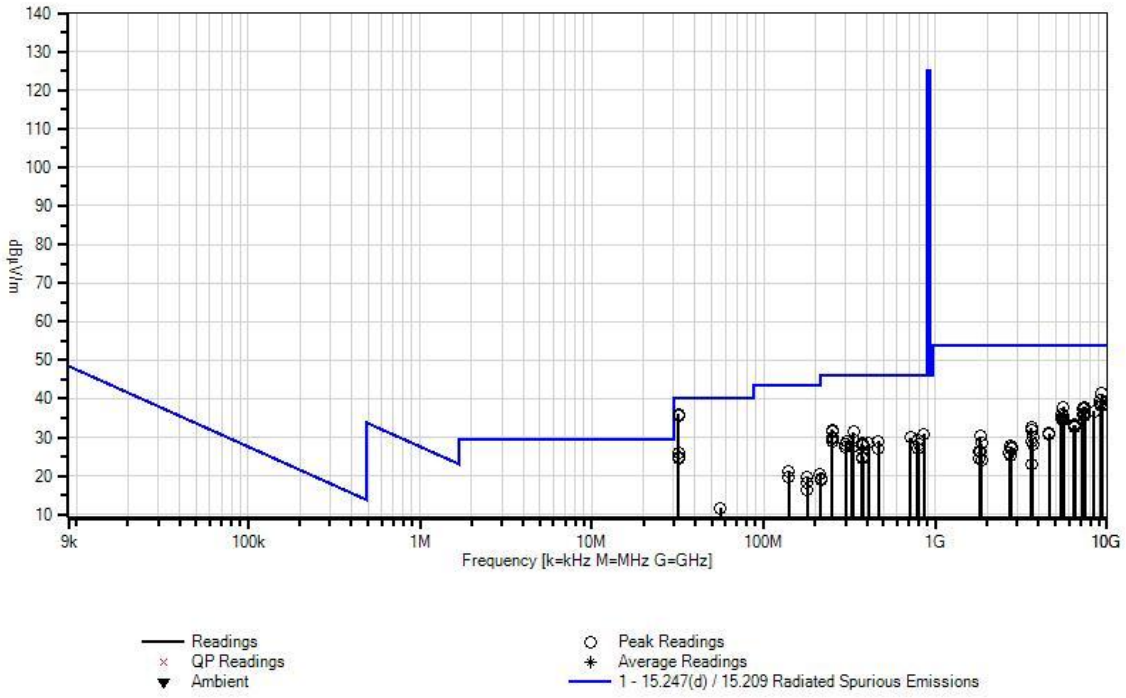
26	250.200M	41.1	+0.5 +12.5 +0.0	+1.0 +0.0 +0.0	+1.0 +0.0	-27.1 +0.0	+0.0 360	29.0	46.0 Mid	-17.0	Horiz 194
27	8345.252M	26.6	+3.4 +0.0 +36.4	+0.0 +3.8 +0.2	+0.0 -34.5	+0.0 +0.9	+0.0	36.8	54.0 High	-17.2	Vert 99
28	375.300M	37.4	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0 360	28.5	46.0 High	-17.5	Vert 99
29	407.300M	36.6	+0.7 +16.3 +0.0	+1.3 +0.0 +0.0	+1.4 +0.0	-27.9 +0.0	+0.0 360	28.4	46.0 Low	-17.6	Vert 100
30	7322.005M	27.7	+3.1 +0.0 +35.9	+0.0 +3.6 +0.2	+0.0 -34.6	+0.0 +0.5	+0.0 180	36.4	54.0 Mid	-17.6	Horiz 99
31	373.400M	37.2	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0 360	28.3	46.0 Mid	-17.7	Horiz 194
32	802.100M	29.3	+0.9 +22.0 +0.0	+1.9 +0.0 +0.0	+2.1 +0.0	-27.9 +0.0	+0.0	28.3	46.0 High	-17.7	Horiz 99
33	374.400M	37.2	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0	28.3	46.0 High	-17.7	Horiz 99
34	299.700M	39.4	+0.6 +13.1 +0.0	+1.1 +0.0 +0.0	+1.1 +0.0	-27.1 +0.0	+0.0	28.2	46.0 Low	-17.8	Horiz 200
35	375.300M	36.9	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0	28.0	46.0 Low	-18.0	Horiz 200
36	5416.522M	29.4	+3.1 +0.0 +33.2	+0.0 +2.9 +0.3	+0.0 -33.5	+0.0 +0.5	+0.0 280	35.9	54.0 Low	-18.1	Vert 109
37	7222.004M	27.0	+3.0 +0.0 +35.7	+0.0 +3.6 +0.3	+0.0 -34.4	+0.0 +0.6	+0.0 270	35.8	54.0 Low	-18.2	Vert 99
38	328.800M	37.8	+0.6 +14.1 +0.0	+1.1 +0.0 +0.0	+1.2 +0.0	-27.2 +0.0	+0.0 360	27.6	46.0 Mid	-18.4	Horiz 194
39	300.600M	38.8	+0.6 +13.1 +0.0	+1.1 +0.0 +0.0	+1.1 +0.0	-27.1 +0.0	+0.0 360	27.6	46.0 Mid	-18.4	Horiz 194
40	5563.501M	29.1	+3.0 +0.0 +33.5	+0.0 +2.9 +0.3	+0.0 -33.6	+0.0 +0.4	+0.0 312	35.6	54.0 High	-18.4	Horiz 99
41	7322.005M	26.8	+3.1 +0.0 +35.9	+0.0 +3.6 +0.2	+0.0 -34.6	+0.0 +0.5	+0.0 322	35.5	54.0 Mid	-18.5	Horiz 118
42	465.500M	34.4	+0.7 +17.4 +0.0	+1.4 +0.0 +0.0	+1.5 +0.0	-28.2 +0.0	+0.0 360	27.2	46.0 High	-18.8	Vert 99

43	797.300M	28.2	+0.9 +22.0 +0.0	+1.9 +0.0 +0.0	+2.1 +0.0	-27.9 +0.0	+0.0 360	27.2	46.0 Mid	-18.8	Horiz 194
44	5491.502M	28.6	+3.0 +0.0 +33.3	+0.0 +2.9 +0.3	+0.0 -33.5	+0.0 +0.4	+0.0 188	35.0	54.0 Mid	-19.0	Vert 104
45	5416.512M	28.5	+3.1 +0.0 +33.2	+0.0 +2.9 +0.3	+0.0 -33.5	+0.0 +0.5	+0.0 264	35.0	54.0 Low	-19.0	Horiz 99
46	5491.482M	28.2	+3.0 +0.0 +33.3	+0.0 +2.9 +0.3	+0.0 -33.5	+0.0 +0.4	+0.0 305	34.6	54.0 Mid	-19.4	Horiz 99
47	6490.702M	25.6	+3.0 +0.0 +34.4	+0.0 +3.4 +0.3	+0.0 -34.0	+0.0 +0.5	+0.0 226	33.2	54.0 High	-20.8	Horiz 134
48	6406.729M	25.5	+3.0 +0.0 +34.4	+0.0 +3.3 +0.4	+0.0 -34.0	+0.0 +0.5	+0.0 254	33.1	54.0 Mid	-20.9	Vert 99
49	376.300M	33.8	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0	24.9	46.0 Mid	-21.1	Vert 100
50	6490.736M	25.0	+3.0 +0.0 +34.4	+0.0 +3.4 +0.3	+0.0 -34.0	+0.0 +0.5	+0.0	32.6	54.0 High	-21.4	Vert 99
51	3610.965M	31.6	+2.3 +0.0 +29.3	+0.0 +2.2 +0.3	+0.0 -33.6	+0.0 +0.4	+0.0 183	32.5	54.0 Low	-21.5	Horiz 115
52	373.400M	33.3	+0.7 +15.5 +0.0	+1.2 +0.0 +0.0	+1.3 +0.0	-27.6 +0.0	+0.0 360	24.4	46.0 Low	-21.6	Vert 100
53	3610.971M	31.1	+2.3 +0.0 +29.3	+0.0 +2.2 +0.3	+0.0 -33.6	+0.0 +0.4	+0.0 185	32.0	54.0 Low	-22.0	Vert 125
54	139.600M	35.4	+0.4 +11.6 +0.0	+0.7 +0.0 +0.0	+0.7 +0.0	-27.7 +0.0	+0.0 360	21.1	43.5 High	-22.4	Vert 99
55	4576.253M	27.3	+2.8 +0.0 +31.4	+0.0 +2.6 +0.3	+0.0 -33.5	+0.0 +0.1	+0.0 254	31.0	54.0 Mid	-23.0	Vert 100
56	214.300M	35.2	+0.5 +10.1 +0.0	+0.9 +0.0 +0.0	+0.9 +0.0	-27.2 +0.0	+0.0	20.4	43.5 High	-23.1	Horiz 99
57	4576.253M	26.9	+2.8 +0.0 +31.4	+0.0 +2.6 +0.3	+0.0 -33.5	+0.0 +0.1	+0.0 237	30.6	54.0 Mid	-23.4	Horiz 111
58	1830.526M	36.2	+1.5 +0.0 +24.9	+0.0 +1.6 +0.4	+0.0 -34.6	+0.0 +0.3	+0.0 360	30.3	54.0 Mid	-23.7	Vert 99
59	179.400M	36.2	+0.4 +8.9 +0.0	+0.8 +0.0 +0.0	+0.8 +0.0	-27.4 +0.0	+0.0 360	19.7	43.5 High	-23.8	Vert 99

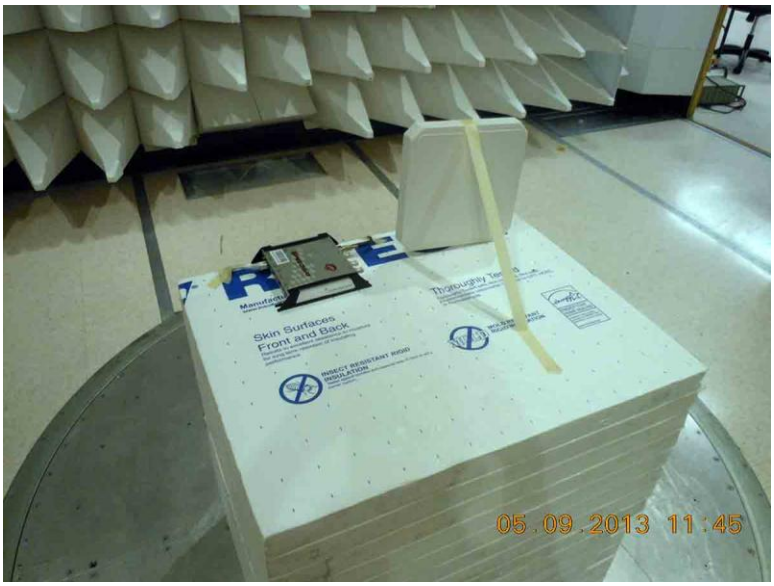
60	139.600M	33.9	+0.4 +11.6 +0.0	+0.7 +0.0 +0.0	+0.7 +0.0	-27.7 +0.0	+0.0 360	19.6	43.5 Low	-23.9	Vert 100
61	215.300M	34.1	+0.5 +10.2 +0.0	+0.9 +0.0 +0.0	+0.9 +0.0	-27.2 +0.0	+0.0 360	19.4	43.5 Mid	-24.1	Horiz 194
62	3709.002M	28.6	+2.4 +0.0 +29.6	+0.0 +2.1 +0.4	+0.0 -33.6	+0.0 +0.4	+0.0 360	29.9	54.0 High	-24.1	Vert 103
63	215.300M	33.6	+0.5 +10.2 +0.0	+0.9 +0.0 +0.0	+0.9 +0.0	-27.2 +0.0	+0.0	18.9	43.5 Low	-24.6	Horiz 200
64	3661.002M	28.0	+2.4 +0.0 +29.4	+0.0 +2.1 +0.3	+0.0 -33.6	+0.0 +0.4	+0.0	29.0	54.0 Mid	-25.0	Horiz 112
65	179.400M	34.8	+0.4 +8.9 +0.0	+0.8 +0.0 +0.0	+0.8 +0.0	-27.4 +0.0	+0.0	18.3	43.5 High	-25.2	Horiz 99
66	1854.534M	34.0	+1.5 +0.0 +25.2	+0.0 +1.6 +0.4	+0.0 -34.5	+0.0 +0.3	+0.0 360	28.5	54.0 High	-25.5	Vert 100
67	3709.002M	27.0	+2.4 +0.0 +29.6	+0.0 +2.1 +0.4	+0.0 -33.6	+0.0 +0.4	+0.0 42	28.3	54.0 High	-25.7	Horiz 118
68	2745.773M	29.6	+1.9 +0.0 +27.3	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0 360	27.8	54.0 Mid	-26.2	Horiz 99
69	2745.754M	29.5	+1.9 +0.0 +27.3	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0	27.7	54.0 Mid	-26.3	Vert 125
70	2781.784M	29.3	+1.9 +0.0 +27.4	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0 360	27.6	54.0 High	-26.4	Horiz 99
71	2781.752M	28.9	+1.9 +0.0 +27.4	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0	27.2	54.0 High	-26.8	Vert 110
72	180.400M	33.0	+0.4 +8.9 +0.0	+0.8 +0.0 +0.0	+0.8 +0.0	-27.4 +0.0	+0.0 360	16.5	43.5 Mid	-27.0	Horiz 194
73	1830.498M	32.3	+1.5 +0.0 +24.9	+0.0 +1.6 +0.4	+0.0 -34.6	+0.0 +0.3	+0.0 136	26.4	54.0 Mid	-27.6	Horiz 136
74	1805.476M	32.4	+1.4 +0.0 +24.7	+0.0 +1.6 +0.5	+0.0 -34.6	+0.0 +0.3	+0.0 183	26.3	54.0 Low	-27.7	Vert 115
75	2708.215M	27.9	+1.9 +0.0 +27.1	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0 183	25.9	54.0 Low	-28.1	Vert 115
76	56.200M	32.5	+0.2 +6.3 +0.0	+0.4 +0.0 +0.0	+0.3 +0.0	-28.0 +0.0	+0.0	11.7	40.0 High	-28.3	Horiz 99

77	2708.250M	27.3	+1.9 +0.0 +27.1	+0.0 +2.1 +0.3	+0.0 -33.9	+0.0 +0.5	+0.0 256	25.3	54.0 Low	-28.7	Horiz 106
78	1805.501M	30.5	+1.4 +0.0 +24.7	+0.0 +1.6 +0.5	+0.0 -34.6	+0.0 +0.3	+0.0 256	24.4	54.0 Low	-29.6	Horiz 106
79	1854.534M	29.8	+1.5 +0.0 +25.2	+0.0 +1.6 +0.4	+0.0 -34.5	+0.0 +0.3	+0.0	24.3	54.0 High	-29.7	Horiz 114
80	3661.003M	21.9	+2.4 +0.0 +29.4	+0.0 +2.1 +0.3	+0.0 -33.6	+0.0 +0.4	+0.0 360	22.9	54.0 Mid	-31.1	Vert 99

CKC Laboratories, Inc. Date: 5/10/2013 Time: 09:15:21 Impinj Inc. WO#: 94448
Test Distance: 3 Meters Sequence#: 4 Vert
Impinj Inc. Speedway Revolution P/N: IPJ-R420

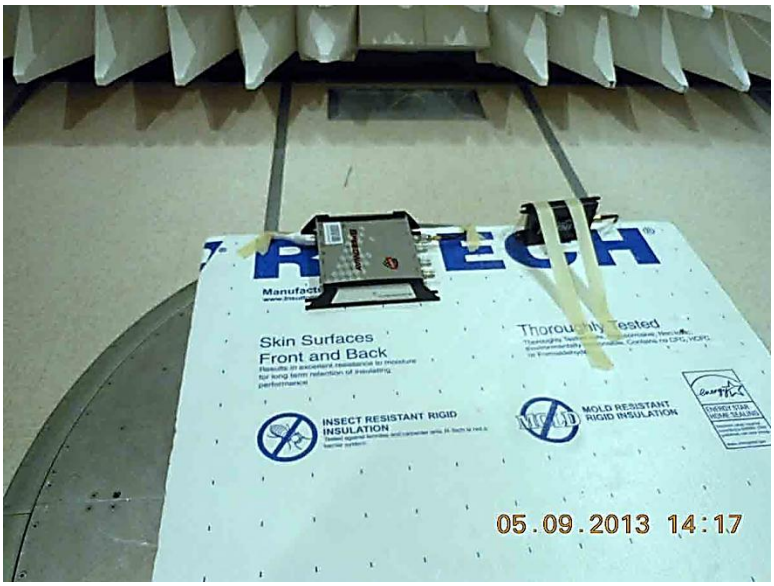


Test Setup Photos



Laird Technologies 6dBi Antenna, View #1

Laird Technologies 6dBi Antenna, View #2



Mini-Guardrail Antenna, View #1

Mini-Guardrail Antenna, View #2

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.