

Impinj Inc.

TEST REPORT FOR

**Impinj R705 Portal Gateway Reader
Model: IPJ-R705-FGX**

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

**15.207 & 15.247
(FHSS 902-928 MHz)**

Report No.: 109462-2

Date of issue: February 27, 2024



Test Certificate # 803.01

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 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.

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Administrative Information

Test Report Information

REPORT PREPARED FOR:

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Seattle, WA 98109

Representative: Greg Robinson
Customer Reference Number: P038106

REPORT PREPARED BY:

Viviana Prado
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Mariposa, CA 95338

Project Number: 109462

DATE OF EQUIPMENT RECEIPT:

January 24, 2024

DATE(S) OF TESTING:

January 24, 25, and 26, 2024

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, 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.

A handwritten signature in black ink that reads "Steve Behm".

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 SE, Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

Summary of Results

Standard / Specification: FCC Part 15 Subpart C - 15.247 (FHSS 902-928MHz)

Test Procedure	Description	Modifications	Results
15.247(a)(1)(i)	Occupied Bandwidth	NA	NP
15.247(a)(1)	Carrier Separation	NA	NP
15.247(a)(1)(i)	Number of Hopping Channels	NA	NP
15.247(a)(1)(i)	Average Time of Occupancy	NA	NP
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	NP
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

NP = CKC Laboratories was not contracted to perform test.

ISO/IEC 17025 Decision Rule

The equipment sample utilized for testing is selected by the manufacturer. The declaration of pass or fail herein is a binary statement for simple acceptance rule (ILAC G8) based upon assessment to the specification(s) listed above, without consideration of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions

No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions

None

Equipment Under Test (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Impinj R705 Portal Gateway Reader	Impinj, Inc.	IPJ-R705-FGX	37023101032

Support Equipment:

Device	Manufacturer	Model #	S/N
POE Injector/Hub	Phihong	POE29U-1AT(PL)	NA
Router	Belkin	F5D7230-4	NA
Router PSU	DVE	DV-91A	NA
Laptop	HP	EliteBook 840 G2	NA
Laptop PSU	HP	HSTNN-DA40	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Operating Frequencies Tested:	902.75, 915.25, 927.25MHz
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Maximum Duty Cycle:	Tested 100% as worst case
Modulation Type(s):	ASK
Number of TX Chains:	1
Beamforming Type:	NA
Antenna Type(s) and Gain:	Patch Antenna Array, 7.1 to 7.4dBi tested for this configuration
Antenna Connection Type:	External Connector (antenna is attached to the unit)
Nominal Input Voltage:	120VAC applied to PoE injector
Firmware / Software Version(s):	ItemTest V2.0.0-Preview-790
Firmware / Software Description:	Manufacturer supplied control software
Firmware / Software Setting(s):	30.75 power setting to match power settings within 0.5dB of previous data for this PCII testing.
Tune-up or Adjustment(s):	NA
Receiver Bandwidth and Synchronization:	The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter.
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT and Accessory Photo(s)



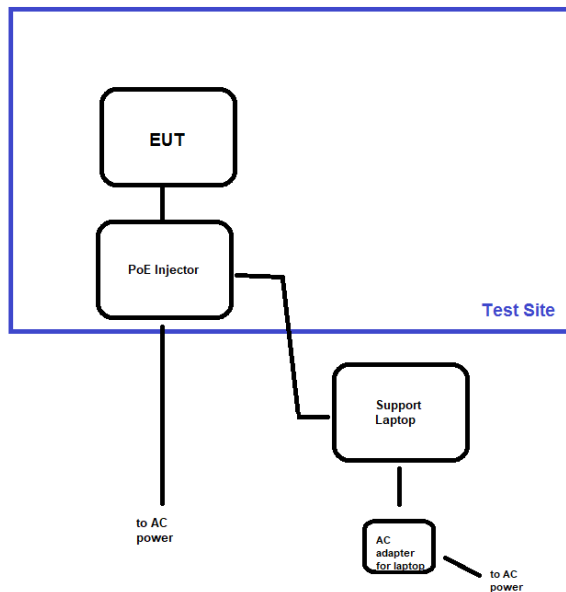
Support Equipment Photo(s)



Block Diagram of Test Setup(s)

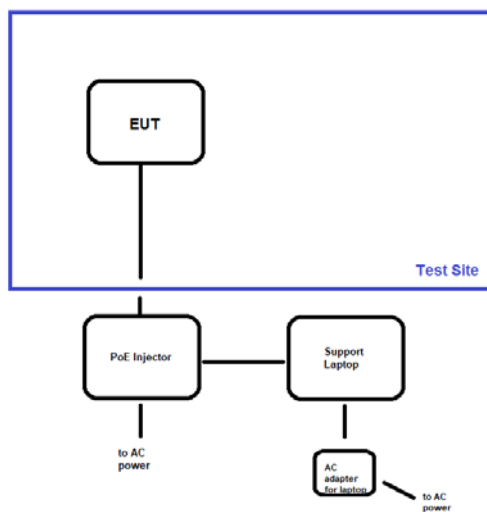
Config#	Description of Block Diagram
1	EUT was setup in a tabletop configuration and was tested in 3 orthogonal orientations. It is connected to a remote POE injector and Laptop via Ethernet cable. The additional transmit and IO ports were terminated with a cable or terminator and bundled off the back of the table.

Test Setup Block Diagram



AC Conducted

Test Setup Block Diagram



Radiated

FCC Part 15 Subpart C

15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2020)	Test Date(s):	1/24/2024
Configuration:	1		
Test Setup:	Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting. Test Setup: EUT is transmitting through the antenna port connector and is attached to the spectrum analyzer with appropriate cables/attenuation. The customer has a declared cable loss of 2.5dB which is accounted as a factor in the datasheet, and already factored into the RF Conducted Measurement. Voltage variations not contracted for this permissive change testing per the manufacturer. Tested with nominal 120VAC to the PoE injector.		

Environmental Conditions			
Temperature (°C)	20	Relative Humidity (%):	47

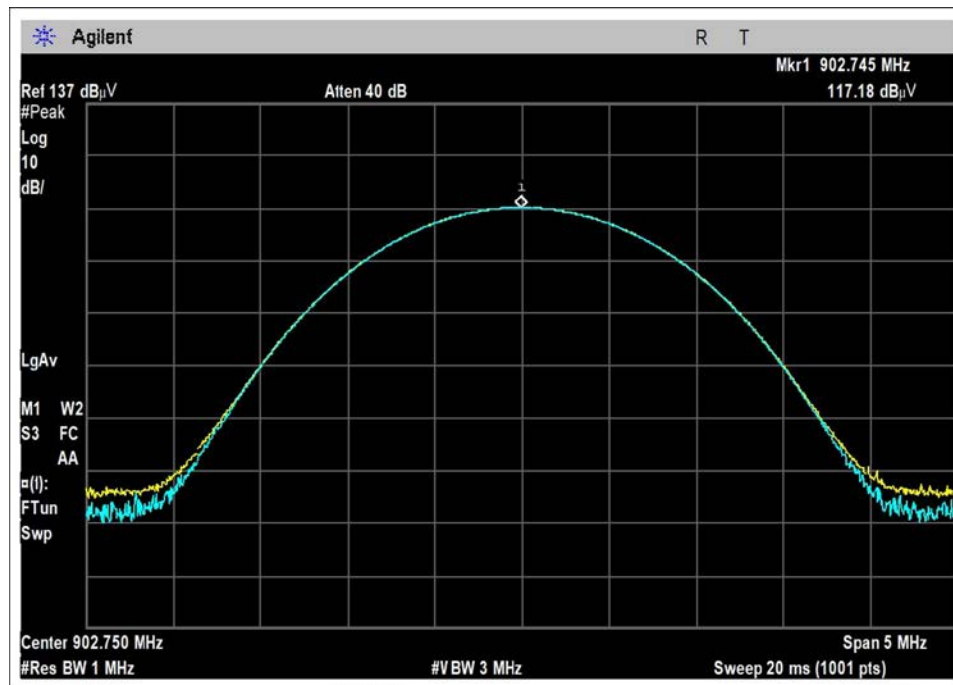
Test Data Summary - RF Conducted Measurement							
$Limit = \begin{cases} 30dBm \text{ Conducted} / 36dBm \text{ EIRP} & \geq 50 \text{ Channels} \\ 24dBm \text{ Conducted} / 30dBm \text{ EIRP} & < 50 \text{ Channels (min 25)} \end{cases}$							
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	RF Conducted (dBm)		EIRP (dBm)		Results
			Measured	Limit	Calculated	Limit	
902.75	ASK	Patch/7.1dBi	28.1	≤30	35.2	≤36	Pass
915.25	ASK	Patch/7.4dBi	28.3	≤30	35.7	≤36	Pass
927.25	ASK	Patch/7.1dBi	28.7	≤30	35.8	≤36	Pass

EIRP is calculated as RF conducted power (dBm) + antenna gain (dBi)

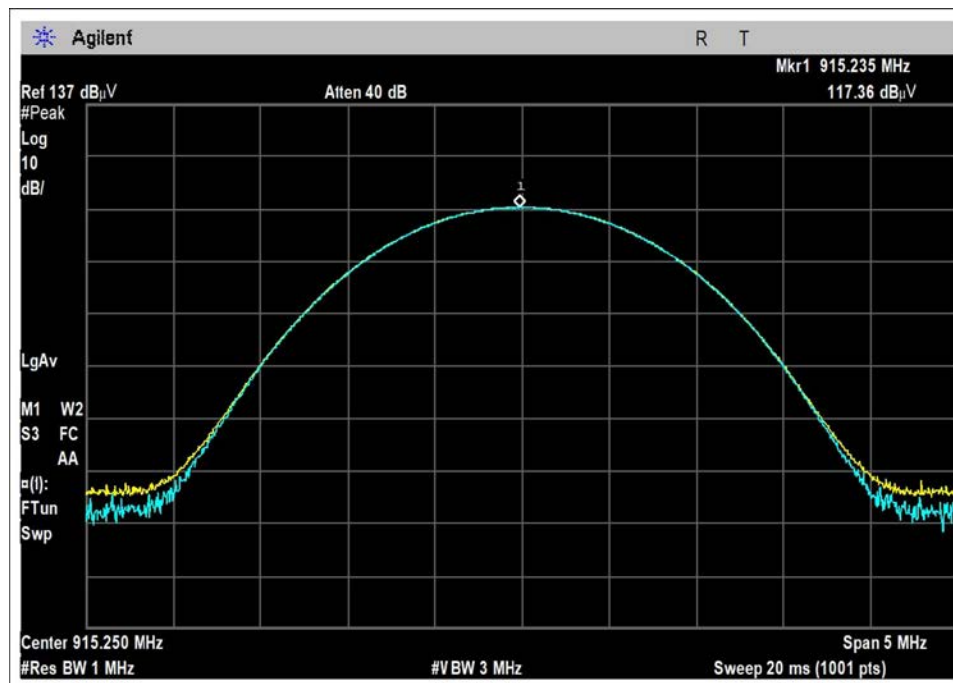
The RF conducted power limit is calculated according to the maximum allowed RF conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b):

$$Limit = 30 \text{ (or 24)} - Roundup(G - 6)$$

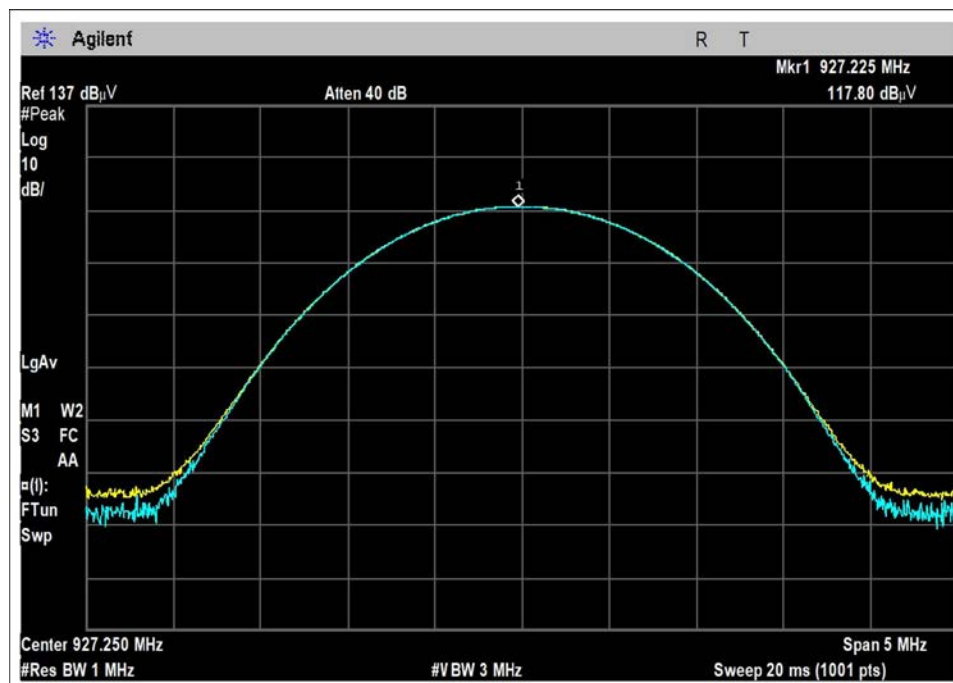
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(b) Power Output (902-928 MHz FHSS >50 Channels)**
 Work Order #: **104294** Date: 1/24/2024
 Test Type: **Conducted Emissions** Time: 17:03:47
 Tested By: Michael Atkinson Sequence#: 1
 Software: EMITest 5.03.20 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions:
 Temperature: 20°C
 Humidity: 47%
 Pressure: 100.4kPa

 Frequency Range: Fundamental

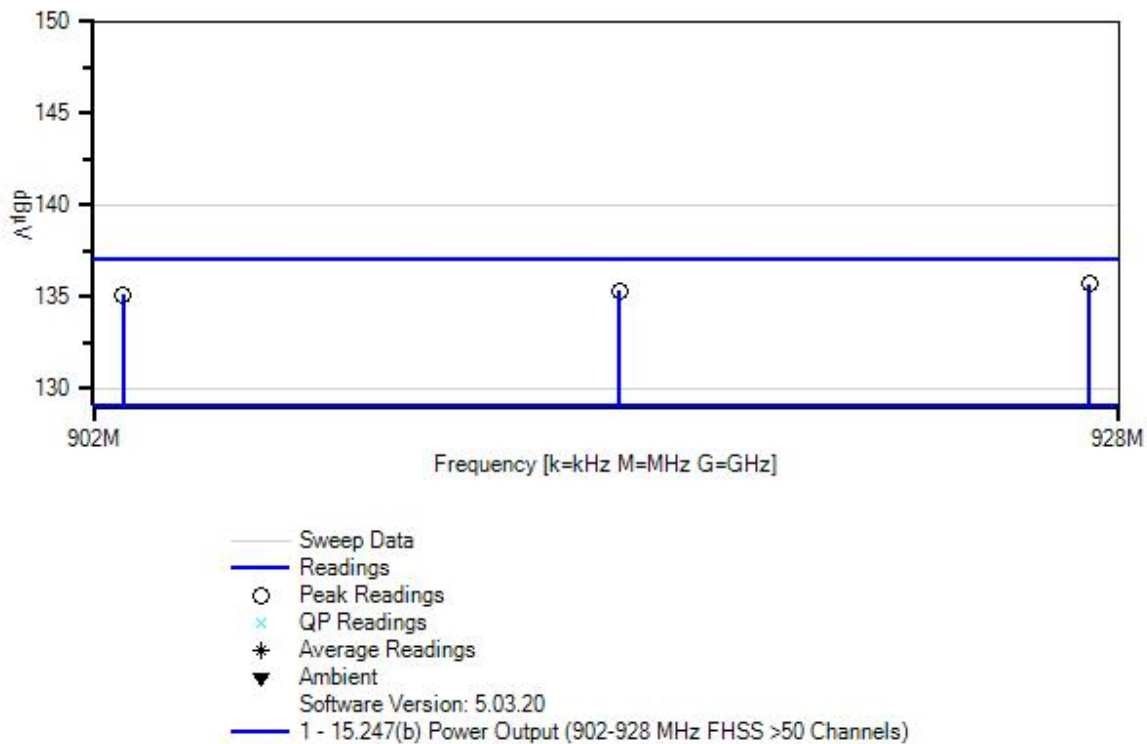
 Frequencies Tested: 902.75, 915.25, 927.25

 Test Method: ANSI C63.10 (2013)

 Test Mode: Constantly transmitting a modulated signal.

 Setup: EUT setup for conducted measurements. It is connected to a POE hub and a PC via Ethernet cable. The antenna port is connected to the analyzer via cable and attenuator.

Impinj Inc. W/O#: 104294 Sequence#: 1 Date: 1/24/2024
15.247(b) Power Output (902-928 MHz FHSS >50 Channels) Test Lead: 120V 60Hz Antenna Port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02871	Spectrum Analyzer	E4440A	10/12/2023	10/12/2025
T1	ANP05961	Cable	Heliac	11/13/2023	11/13/2025
T2	ANP07638	Attenuator	47-20-34	5/3/2022	5/3/2024
T3	AN	Cable	Multiple	No Cal Required	No Cal Required

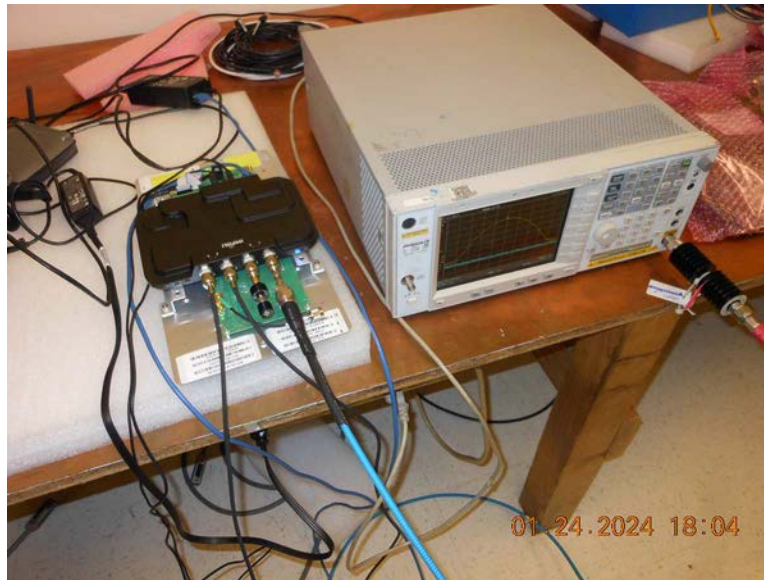
Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	927.225M	117.8	+0.7	+19.7	+2.5		+0.0	135.7	137.0	-1.3	Anten
2	915.235M	117.4	+0.7	+19.7	+2.5		+0.0	135.3	137.0	-1.7	Anten
3	902.745M	117.2	+0.7	+19.7	+2.5		+0.0	135.1	137.0	-1.9	Anten

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **109462** Date: 1/26/2024
 Test Type: **Maximized Emissions** Time: 22:08:12
 Tested By: Michael Atkinson Sequence#: 52
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

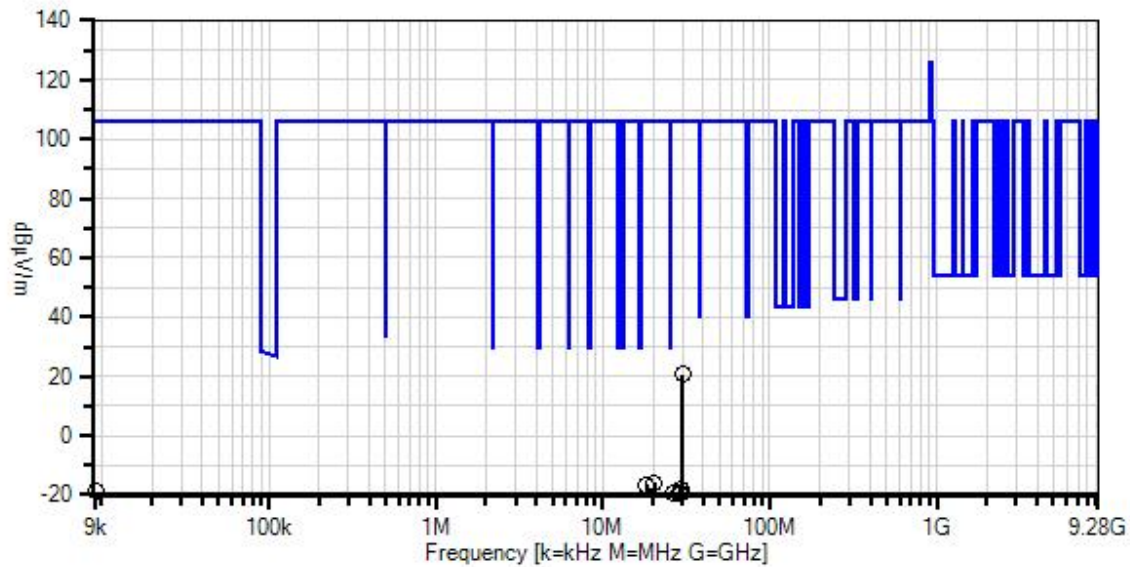
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 21°C Humidity: 40% Pressure: 101kPa Frequency Range: 9kHz-30MHz Frequencies Tested: 902.75, 915.25, 927.25 Test Method: ANSI C63.10 (2013) Test Mode: Constantly transmitting a modulated signal. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable. Low, Mid, and High channels, 3 x orthogonal measurement antenna axes investigated, worst case reported.
--

Impinj Inc. W/O#: 109462 Sequence#: 52 Date: 1/26/2024
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Various



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.20
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T1	ANP06011	Cable	Heliacx	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliacx	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	30.000M	16.2	+0.0	+0.3	+0.4	+3.6	+0.0	20.5	105.9	-85.4	Para
2	20.240M	17.4	+0.0	+0.2	+0.3	+6.3	-40.0	-15.8	105.9	-121.7	Perp
3	18.260M	15.8	+0.0	+0.2	+0.3	+7.0	-40.0	-16.7	105.9	-122.6	Groun
4	29.230M	17.5	+0.0	+0.3	+0.4	+3.9	-40.0	-17.9	105.9	-123.8	Para
5	9.300k	44.7	+0.0	+0.0	+0.1	+16.5	-80.0	-18.7	105.9	-124.6	Para
6	28.700M	15.9	+0.0	+0.3	+0.4	+4.2	-40.0	-19.2	105.9	-125.1	Para
7	29.230M	16.0	+0.0	+0.3	+0.4	+3.9	-40.0	-19.4	105.9	-125.3	Perp
8	26.620M	14.6	+0.0	+0.3	+0.4	+5.2	-40.0	-19.5	105.9	-125.4	Para

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **109462** Date: 1/26/2024
 Test Type: **Maximized Emissions** Time: 22:14:57
 Tested By: Michael Atkinson Sequence#: 51
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

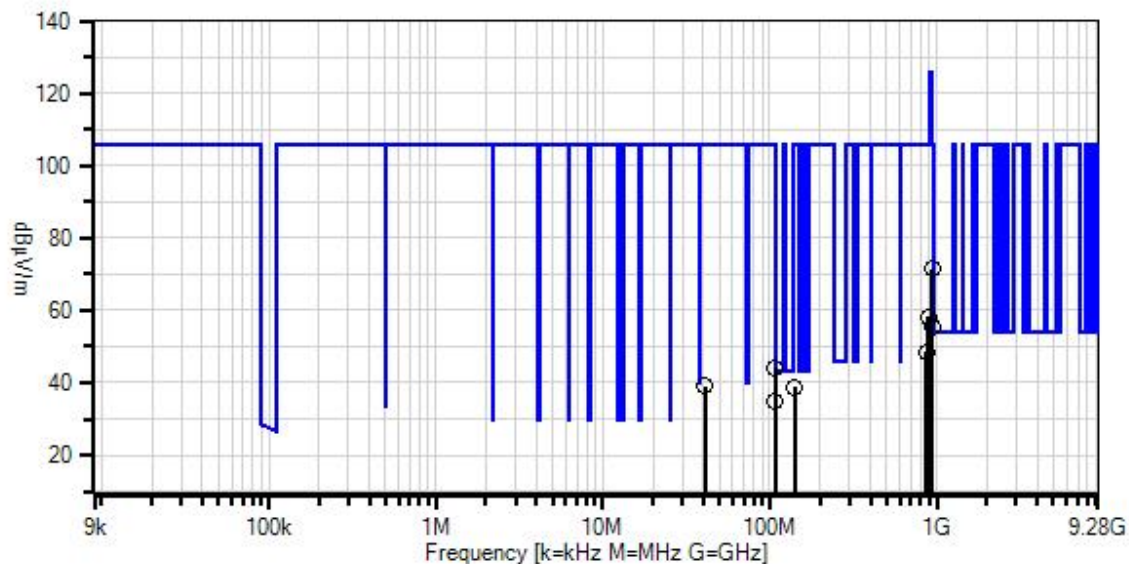
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 21°C Humidity: 40% Pressure: 101kPa Frequency Range: 30-1000MHz Frequencies Tested: 902.75, 915.25, 927.25 Test Method: ANSI C63.10 (2013) Test Mode: Constantly transmitting a modulated signal. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable. Low, Mid, and High channels, Horizontal and Vertical polarities investigated, worst case reported.
--

Impinj Inc. W/O#: 109462 Sequence#: 51 Date: 1/26/2024
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.20
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	940.000M	35.2	+0.4	+1.5	+2.6	+31.7	+0.0	71.4	105.9	-34.5	Vert
2	890.000M	24.9	+0.4	+1.5	+2.5	+28.9	+0.0	58.2	105.9	-47.7	Vert
3	940.800M	19.4	+0.4	+1.5	+2.6	+31.7	+0.0	55.6	105.9	-50.3	Vert
4	869.200M	15.0	+0.4	+1.5	+2.5	+29.0	+0.0	48.4	105.9	-57.5	Horiz
5	107.600M	28.9	+0.1	+0.5	+0.7	+14.0	+0.0	44.2	105.9	-61.7	Vert
6	41.000M	22.6	+0.0	+0.3	+0.4	+15.7	+0.0	39.0	105.9	-66.9	Vert
7	141.200M	23.4	+0.1	+0.5	+0.8	+13.9	+0.0	38.7	105.9	-67.2	Vert
8	107.600M	19.7	+0.1	+0.5	+0.7	+14.0	+0.0	35.0	105.9	-70.9	Horiz

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **109462** Date: 1/24/2024
 Test Type: **Maximized Emissions** Time: 21:42:52
 Tested By: Michael Atkinson Sequence#: 50
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

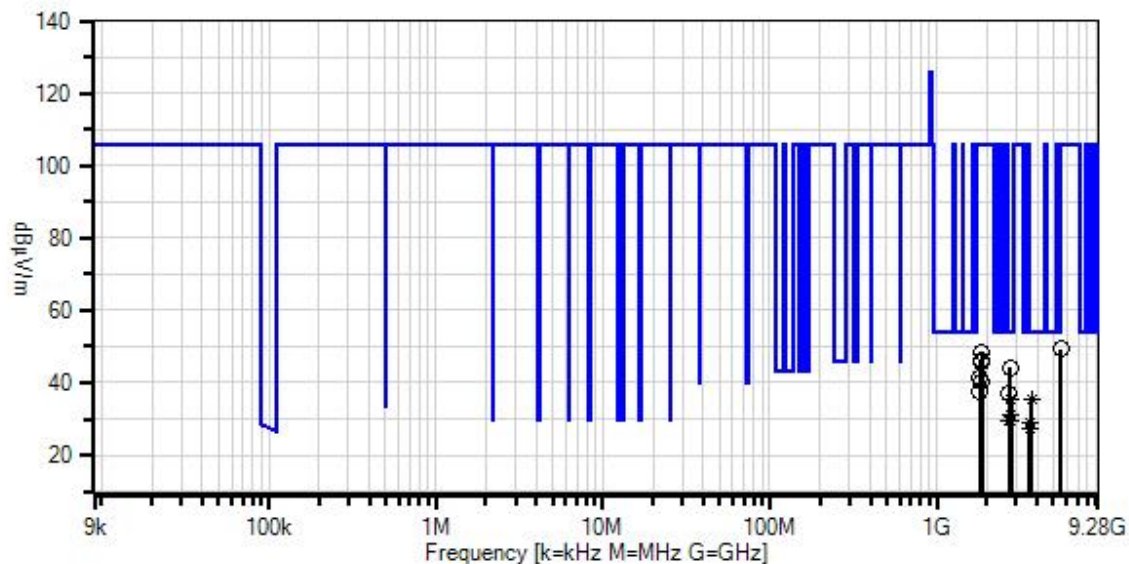
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 21°C Humidity: 40% Pressure: 101kPa Frequency Range: 1-9.28GHz Frequencies Tested: 902.75, 915.25, 927.25 Test Method: ANSI C63.10 (2013) Test Mode: Constantly transmitting a modulated signal. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable. Low, Mid, and High channels. Horizontal and Vertical polarities investigated, worst case reported. Test Equipment Note: 6dB pad only used for high channel, saturation check okay on low and mid channels.

Impinj Inc. W/O#: 109462 Sequence#: 50 Date: 1/24/2024
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.20

1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T2	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T3	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T4	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/27/2023	9/27/2025
T8	ANP07746	Attenuator	PE7004-6	2/16/2023	2/16/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 T8 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2745.620M	44.7	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	44.1	54.0	-9.9	Horiz
2	2708.260M	37.9	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	37.3	54.0	-16.7	Vert
3	2781.760M Ave	30.2	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +5.9	+0.0	35.5	54.0	-18.5	Horiz
^	2781.760M	40.2	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +5.9	+0.0	45.5	54.0	-8.5	Horiz
5	3709.010M Ave	26.1	+0.0 +0.8	+0.9 +31.6	+3.6 +0.3	-33.9 +5.9	+0.0	35.3	54.0	-18.7	Horiz
^	3709.010M	36.7	+0.0 +0.8	+0.9 +31.6	+3.6 +0.3	-33.9 +5.9	+0.0	45.9	54.0	-8.1	Horiz
7	2781.760M Ave	25.7	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +5.9	+0.0	31.0	54.0	-23.0	Vert
^	2781.760M	38.8	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +5.9	+0.0	44.1	54.0	-9.9	Vert
9	2708.220M Ave	30.3	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	29.7	54.0	-24.3	Horiz
^	2708.220M	40.6	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	40.0	54.0	-14.0	Horiz
11	2745.735M Ave	30.0	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	29.4	54.0	-24.6	Vert
^	2745.735M	41.4	+0.0 +0.5	+0.8 +29.3	+3.0 +0.3	-34.5 +0.0	+0.0	40.8	54.0	-13.2	Vert
13	3660.870M Ave	25.6	+0.0 +0.9	+0.9 +31.4	+3.7 +0.3	-34.0 +0.0	+0.0	28.8	54.0	-25.2	Horiz
^	3660.870M	38.0	+0.0 +0.9	+0.9 +31.4	+3.7 +0.3	-34.0 +0.0	+0.0	41.2	54.0	-12.8	Horiz
15	3610.970M Ave	23.9	+0.0 +1.0	+0.9 +31.3	+3.7 +0.4	-34.0 +0.0	+0.0	27.2	54.0	-26.8	Horiz
^	3610.970M	36.9	+0.0 +1.0	+0.9 +31.3	+3.7 +0.4	-34.0 +0.0	+0.0	40.2	54.0	-13.8	Horiz
17	5563.510M	34.7	+0.0 +1.3	+1.2 +34.4	+5.2 +0.4	-33.8 +5.8	+0.0	49.2	105.9	-56.7	Horiz
18	1854.510M	46.2	+0.0 +0.4	+0.6 +27.8	+2.3 +0.4	-35.0 +5.9	+0.0	48.6	105.9	-57.3	Vert
19	1830.525M	50.0	+0.0 +0.4	+0.6 +27.6	+2.3 +0.4	-35.1 +0.0	+0.0	46.2	105.9	-59.7	Vert
20	1854.510M	43.3	+0.0 +0.4	+0.6 +27.8	+2.3 +0.4	-35.0 +5.9	+0.0	45.7	105.9	-60.2	Horiz
21	1805.450M	45.3	+0.0 +0.4	+0.6 +27.3	+2.2 +0.5	-35.1 +0.0	+0.0	41.2	105.9	-64.7	Vert
22	1830.625M	43.9	+0.0 +0.4	+0.6 +27.6	+2.3 +0.4	-35.1 +0.0	+0.0	40.1	105.9	-65.8	Horiz
23	1805.500M	41.5	+0.0 +0.4	+0.6 +27.3	+2.2 +0.5	-35.1 +0.0	+0.0	37.4	105.9	-68.5	Horiz

Band Edge

Band Edge Summary – Single Channel Mode

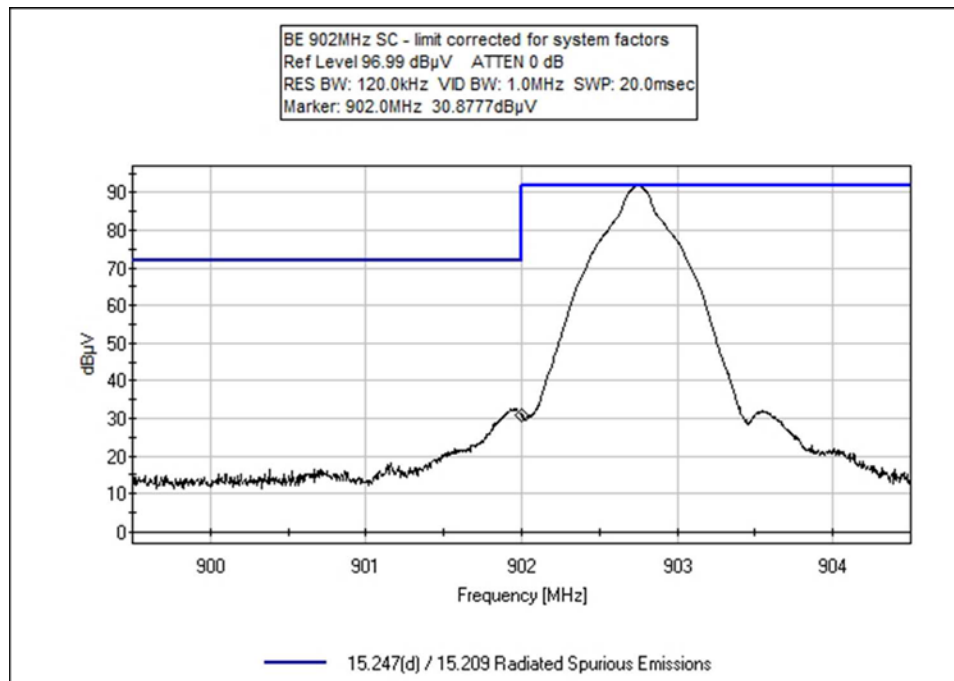
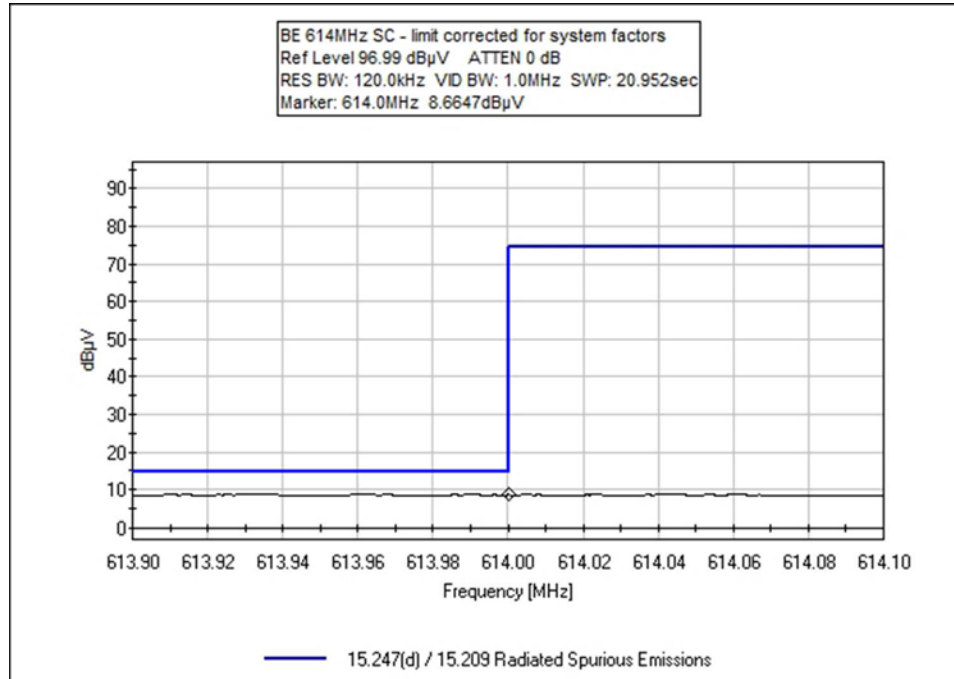
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614 (QP)	ASK	Patch Array	39.9	<46	Pass
902			64.8	<105.9	Pass
928			66.9	< 105.9	Pass
960			48.8	<54	Pass
960 (QP)			44.4	<54	Pass

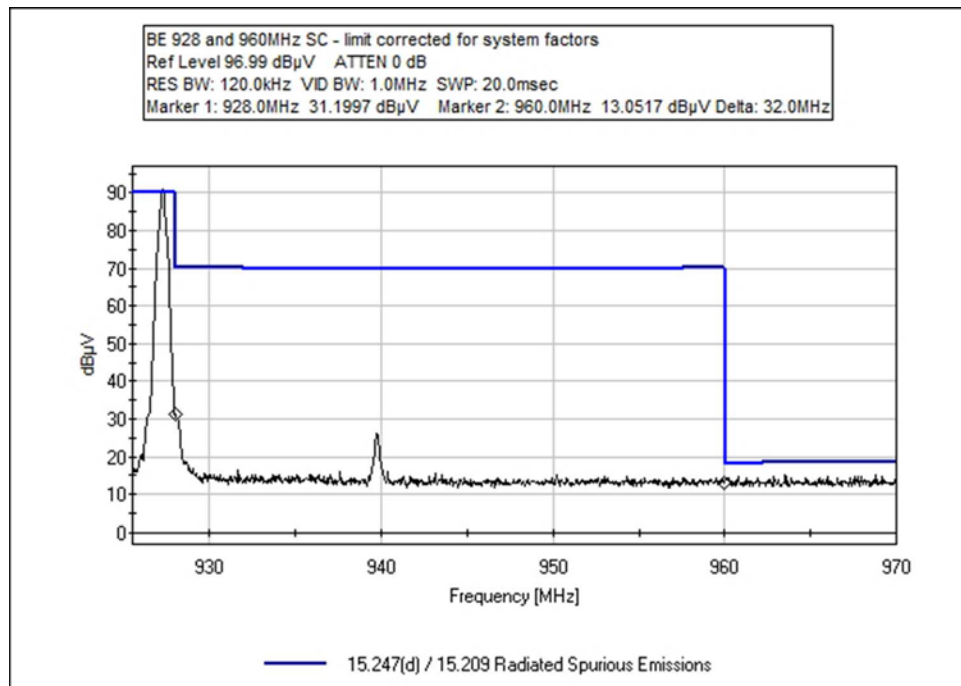
Band Edge Summary – Hopping Mode

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614 (QP)	ASK	Patch Array	39.8	<46	Pass
902			66.6	<105.9	Pass
928			67.8	< 105.9	Pass
960			51.2	<54	Pass
960 (QP)			44.3	<54	Pass

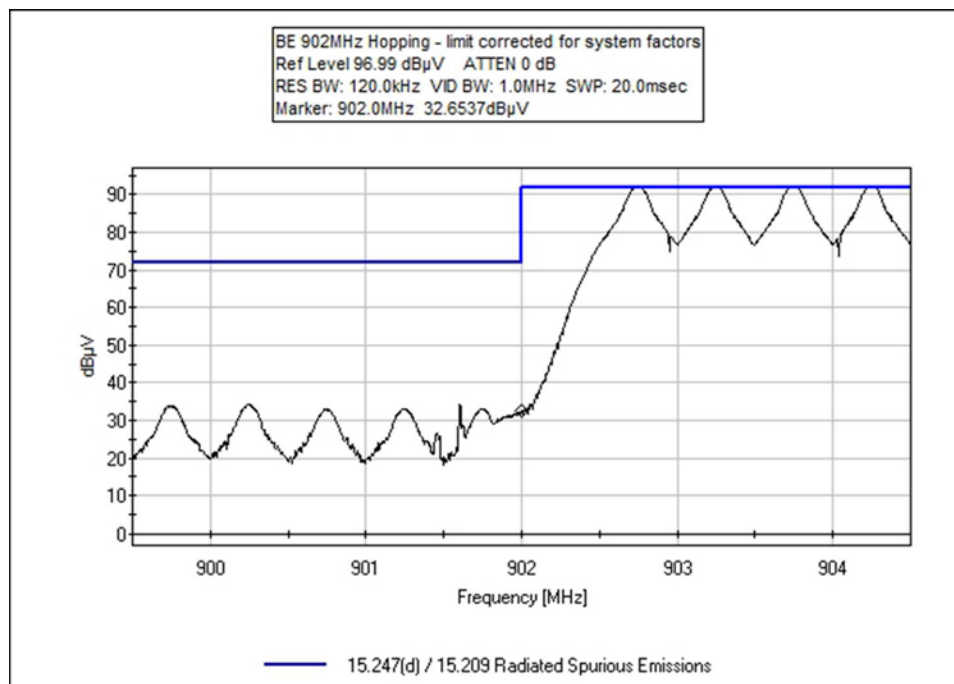
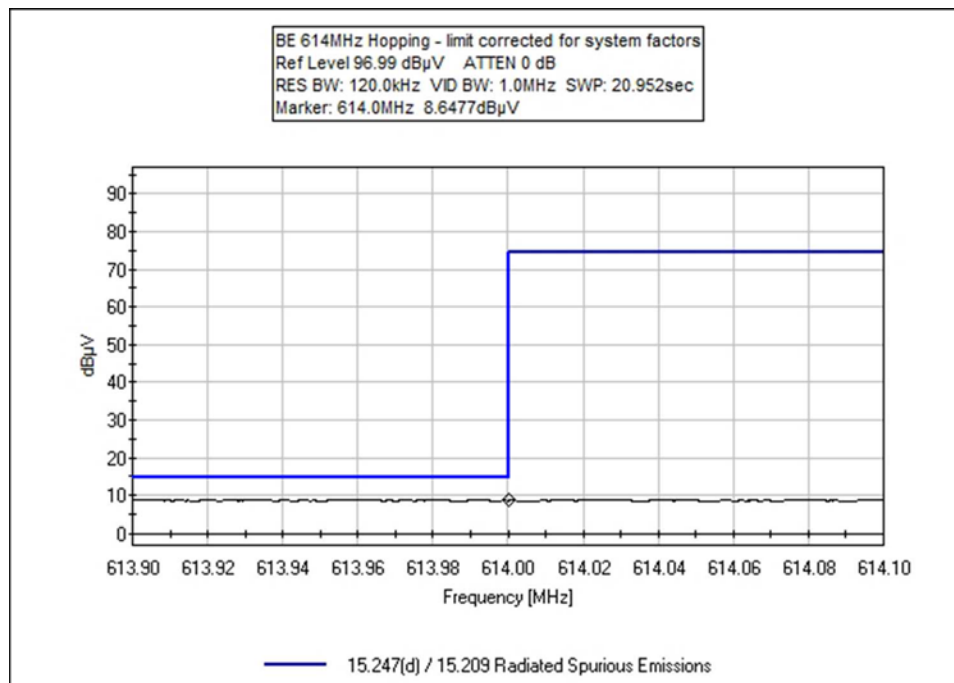
Band Edge Plots

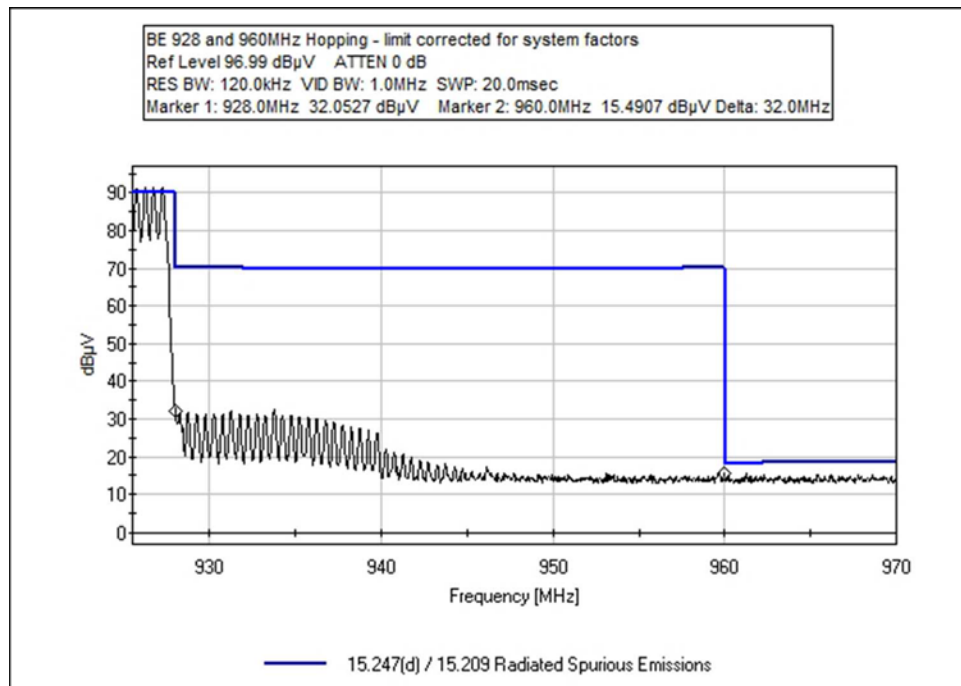
Single Channel





Hopping





Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **109462** Date: 1/26/2024
 Test Type: **Maximized Emissions** Time: 22:26:22
 Tested By: Michael Atkinson Sequence#: 52
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 20.6°C Humidity: 44% Pressure: 101.5kPa Frequency Range: Band Edge Frequencies Tested: 902.75, 927.25 Test Method: ANSI C63.10 (2013) Test Mode: Constantly transmitting a modulated signal, single channel Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable. Horizontal and Vertical polarities investigated, worst case reported.
--

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	614.000M QP	8.7	+0.3	+1.2	+2.3	+27.4	+0.0	39.9	46.0	-6.1	Vert
2	960.000M QP	8.7	+0.4	+1.6	+2.6	+31.1	+0.0	44.4	54.0	-9.6	Vert
^	960.000M	13.1	+0.4	+1.6	+2.6	+31.1	+0.0	48.8	54.0	-5.2	Vert
4	928.000M	31.2	+0.4	+1.5	+2.6	+31.2	+0.0	66.9	105.9	-39.0	Vert
5	902.000M	30.9	+0.4	+1.5	+2.5	+29.5	+0.0	64.8	105.9	-41.1	Vert

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **109462** Date: 1/26/2024
 Test Type: **Maximized Emissions** Time: 22:49:32
 Tested By: Michael Atkinson Sequence#: 53
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 20.6°C Humidity: 44% Pressure: 101.5kPa Frequency Range: Band Edge Frequencies Tested: 902.75, 927.25 Test Method: ANSI C63.10 (2013) Test Mode: Constantly transmitting a modulated signal, hopping mode. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable. Horizontal and Vertical polarities investigated, worst case reported.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	614.000M QP	8.6	+0.3	+1.2	+2.3	+27.4	+0.0	39.8	46.0	-6.2	Vert
2	960.000M QP	8.6	+0.4	+1.6	+2.6	+31.1	+0.0	44.3	54.0	-9.7	Vert
^	960.000M	15.5	+0.4	+1.6	+2.6	+31.1	+0.0	51.2	54.0	-2.8	Vert
4	928.000M	32.1	+0.4	+1.5	+2.6	+31.2	+0.0	67.8	105.9	-38.1	Vert
5	902.000M	32.7	+0.4	+1.5	+2.5	+29.5	+0.0	66.6	105.9	-39.3	Vert

Test Setup Photo(s)



Below 1GHz, 0.8m



Above 1GHz, 1.5m

15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717
 Customer: **Impinj Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **109462** Date: 1/25/2024
 Test Type: **Conducted Emissions** Time: 11:20:18
 Tested By: Cassandra Plumadore Sequence#: 6
 Software: EMITest 5.03.20 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

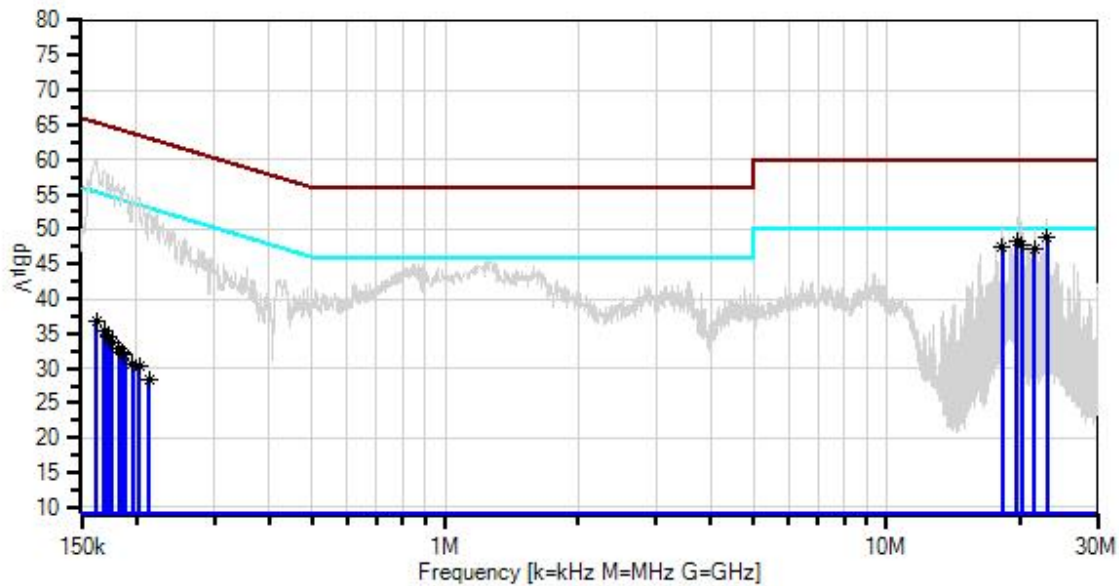
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 21°C Humidity: 42.5% Pressure: 101.3 kPa Frequency Range: 0.15-30MHz Test Method: ANSI C63.10 (2013) Test Mode: EUT is reading tags, this is representative of worst case between standby and continuous Tx mode. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable.
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Impinj Inc. WO#: 109462 Sequence#: 6 Date: 1/25/2024
15.207 AC Mains - Average Test Lead: 115V 60Hz Line



— Sweep Data
× QP Readings
Software Version: 5.03.20
— Readings
* Average Readings
○ Peak Readings
▼ Ambient
— 1 - 15.207 AC Mains - Average
— 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T2	AN02611	High Pass Filter	HE9615-150K-50-720B	11/27/2023	11/27/2025
T3	ANP06219	Attenuator	768-10	3/23/2022	3/23/2024
T4	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T5	AN01311	50uH LISN-Line1 (L)	3816/2	2/23/2022	2/23/2024
	AN01311	50uH LISN-Line2 (N)	3816/2	2/23/2022	2/23/2024

Measurement Data:

Reading listed by margin.

Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	23.128M	39.3	+0.0	+0.1	+9.1	+0.3	+0.0	48.8	50.0	-1.2	Line
	Ave		+0.0								
^	23.128M	41.9	+0.0	+0.1	+9.1	+0.3	+0.0	51.4	50.0	+1.4	Line
			+0.0								
3	19.708M	38.8	+0.0	+0.1	+9.1	+0.2	+0.0	48.3	50.0	-1.7	Line
	Ave		+0.1								
^	19.708M	42.7	+0.0	+0.1	+9.1	+0.2	+0.0	52.2	50.0	+2.2	Line
			+0.1								
5	20.258M	38.4	+0.0	+0.1	+9.1	+0.2	+0.0	47.9	50.0	-2.1	Line
	Ave		+0.1								
^	20.258M	41.8	+0.0	+0.1	+9.1	+0.2	+0.0	51.3	50.0	+1.3	Line
			+0.1								
7	18.243M	37.9	+0.0	+0.1	+9.1	+0.2	+0.0	47.4	50.0	-2.6	Line
	Ave		+0.1								
^	18.243M	41.7	+0.0	+0.1	+9.1	+0.2	+0.0	51.2	50.0	+1.2	Line
			+0.1								
9	21.663M	37.6	+0.0	+0.1	+9.1	+0.2	+0.0	47.1	50.0	-2.9	Line
	Ave		+0.1								
^	21.663M	40.9	+0.0	+0.1	+9.1	+0.2	+0.0	50.4	50.0	+0.4	Line
			+0.1								
^	21.661M	40.5	+0.0	+0.1	+9.1	+0.2	+0.0	50.0	50.0	+0.0	Line
			+0.1								
12	162.363k	27.1	+0.0	+0.6	+9.1	+0.0	+0.0	36.9	55.3	-18.4	Line
	Ave		+0.1								
^	162.362k	50.3	+0.0	+0.6	+9.1	+0.0	+0.0	60.1	55.3	+4.8	Line
			+0.1								
14	168.907k	25.9	+0.0	+0.4	+9.1	+0.0	+0.0	35.5	55.0	-19.5	Line
	Ave		+0.1								
15	172.543k	25.1	+0.0	+0.4	+9.1	+0.0	+0.0	34.7	54.8	-20.1	Line
	Ave		+0.1								
^	168.907k	48.8	+0.0	+0.4	+9.1	+0.0	+0.0	58.4	55.0	+3.4	Line
			+0.1								
17	176.179k	24.3	+0.0	+0.3	+9.1	+0.0	+0.0	33.8	54.7	-20.9	Line
	Ave		+0.1								
^	172.543k	48.4	+0.0	+0.4	+9.1	+0.0	+0.0	58.0	54.8	+3.2	Line
			+0.1								
^	176.179k	48.0	+0.0	+0.3	+9.1	+0.0	+0.0	57.5	54.7	+2.8	Line
			+0.1								
20	182.724k	23.2	+0.0	+0.3	+9.1	+0.0	+0.0	32.7	54.4	-21.7	Line
	Ave		+0.1								
21	184.906k	22.9	+0.0	+0.3	+9.1	+0.0	+0.0	32.4	54.3	-21.9	Line
	Ave		+0.1								
^	182.724k	47.2	+0.0	+0.3	+9.1	+0.0	+0.0	56.7	54.4	+2.3	Line
			+0.1								

23	187.815k	22.6	+0.0	+0.2	+9.1	+0.0	+0.0	32.0	54.1	-22.1	Line
	Ave		+0.1								
^	187.814k	46.8	+0.0	+0.2	+9.1	+0.0	+0.0	56.2	54.1	+2.1	Line
			+0.1								
^	184.905k	46.5	+0.0	+0.3	+9.1	+0.0	+0.0	56.0	54.3	+1.7	Line
			+0.1								
26	203.086k	21.1	+0.0	+0.1	+9.1	+0.0	+0.0	30.4	53.5	-23.1	Line
	Ave		+0.1								
^	203.086k	45.2	+0.0	+0.1	+9.1	+0.0	+0.0	54.5	53.5	+1.0	Line
			+0.1								
28	195.814k	21.3	+0.0	+0.1	+9.1	+0.0	+0.0	30.6	53.8	-23.2	Line
	Ave		+0.1								
^	195.813k	45.5	+0.0	+0.1	+9.1	+0.0	+0.0	54.8	53.8	+1.0	Line
			+0.1								
30	213.994k	19.0	+0.0	+0.1	+9.1	+0.0	+0.0	28.3	53.0	-24.7	Line
	Ave		+0.1								
^	213.994k	43.9	+0.0	+0.1	+9.1	+0.0	+0.0	53.2	53.0	+0.2	Line
			+0.1								

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717
 Customer: **Impinj Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **109462** Date: 1/25/2024
 Test Type: **Conducted Emissions** Time: 11:36:10
 Tested By: Cassandra Plumadore Sequence#: 7
 Software: EMITest 5.03.20 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

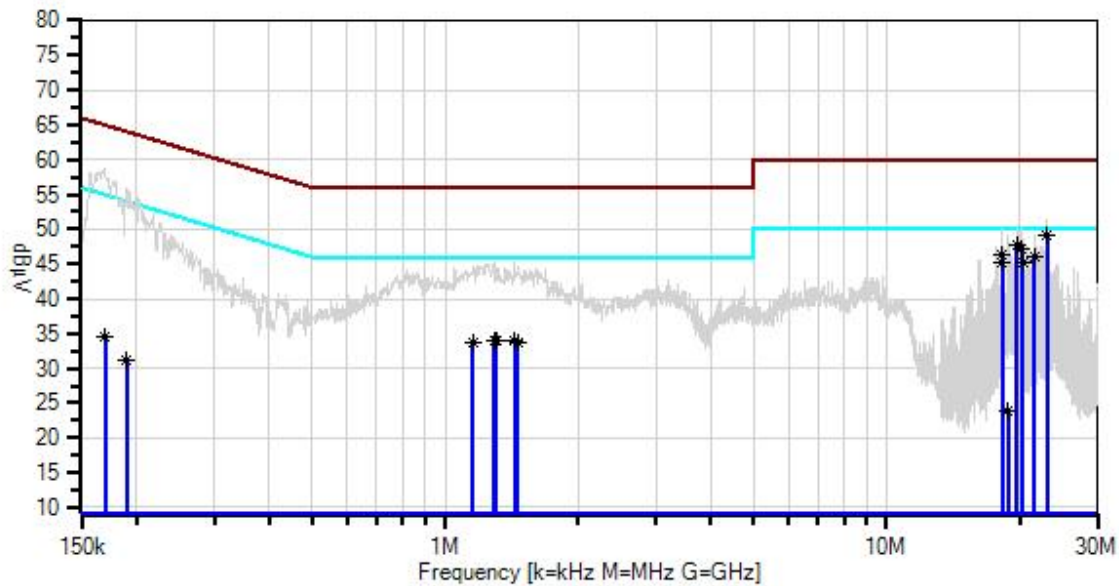
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 21°C Humidity: 42.5% Pressure: 101.3kPa Frequency Range: 0.15-30MHz Test Method: ANSI C63.10 (2013) Test Mode: EUT is reading tags, this is representative of worst case between standby and continuous Tx mode. Setup: EUT is on foam test table. It is connected to a remote POE hub and a remote PC via Ethernet cable.
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Impinj Inc. W/O#: 109462 Sequence#: 7 Date: 1/25/2024
15.207 AC Mains - Average Test Lead: 115V 60Hz Neutral



— Sweep Data
× QP Readings
Software Version: 5.03.20
— Readings
* Average Readings
○ Peak Readings
▼ Ambient
— 1 - 15.207 AC Mains - Average
— 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T2	AN02611	High Pass Filter	HE9615-150K-50-720B	11/27/2023	11/27/2025
T3	ANP06219	Attenuator	768-10	3/23/2022	3/23/2024
T4	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
	AN01311	50uH LISN-Line1 (L)	3816/2	2/23/2022	2/23/2024
T5	AN01311	50uH LISN-Line2 (N)	3816/2	2/23/2022	2/23/2024

Measurement Data:

Reading listed by margin.

Test Lead: Neutral

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	23.128M	39.4	+0.0	+0.1	+9.1	+0.3	+0.0	49.0	50.0	-1.0	Neutr
	Ave		+0.1								
^	23.128M	42.1	+0.0	+0.1	+9.1	+0.3	+0.0	51.7	50.0	+1.7	Neutr
			+0.1								
3	19.709M	38.3	+0.0	+0.1	+9.1	+0.2	+0.0	47.7	50.0	-2.3	Neutr
	Ave		+0.0								
^	19.709M	42.1	+0.0	+0.1	+9.1	+0.2	+0.0	51.5	50.0	+1.5	Neutr
			+0.0								
5	20.259M	37.8	+0.0	+0.1	+9.1	+0.2	+0.0	47.2	50.0	-2.8	Neutr
	Ave		+0.0								
^	20.259M	41.2	+0.0	+0.1	+9.1	+0.2	+0.0	50.6	50.0	+0.6	Neutr
			+0.0								
7	18.244M	37.0	+0.0	+0.1	+9.1	+0.2	+0.0	46.4	50.0	-3.6	Neutr
	Ave		+0.0								
^	18.244M	41.1	+0.0	+0.1	+9.1	+0.2	+0.0	50.5	50.0	+0.5	Neutr
			+0.0								
9	21.661M	36.4	+0.0	+0.1	+9.1	+0.2	+0.0	46.0	50.0	-4.0	Neutr
	Ave		+0.2								
^	21.661M	39.4	+0.0	+0.1	+9.1	+0.2	+0.0	49.0	50.0	-1.0	Neutr
			+0.2								
11	18.304M	35.8	+0.0	+0.1	+9.1	+0.2	+0.0	45.2	50.0	-4.8	Neutr
	Ave		+0.0								
^	18.304M	39.9	+0.0	+0.1	+9.1	+0.2	+0.0	49.3	50.0	-0.7	Neutr
			+0.0								
13	20.319M	35.7	+0.0	+0.1	+9.1	+0.2	+0.0	45.1	50.0	-4.9	Neutr
	Ave		+0.0								
^	20.319M	39.3	+0.0	+0.1	+9.1	+0.2	+0.0	48.7	50.0	-1.3	Neutr
			+0.0								
15	1.290M	24.6	+0.0	+0.1	+9.1	+0.1	+0.0	34.0	46.0	-12.0	Neutr
	Ave		+0.1								
^	1.290M	35.9	+0.0	+0.1	+9.1	+0.1	+0.0	45.3	46.0	-0.7	Neutr
			+0.1								
17	1.434M	24.5	+0.0	+0.1	+9.1	+0.1	+0.0	33.9	46.0	-12.1	Neutr
	Ave		+0.1								
^	1.434M	35.8	+0.0	+0.1	+9.1	+0.1	+0.0	45.2	46.0	-0.8	Neutr
			+0.1								
19	1.302M	24.5	+0.0	+0.1	+9.1	+0.1	+0.0	33.9	46.0	-12.1	Neutr
	Ave		+0.1								
^	1.302M	35.2	+0.0	+0.1	+9.1	+0.1	+0.0	44.6	46.0	-1.4	Neutr
			+0.1								
21	1.460M	24.4	+0.0	+0.1	+9.1	+0.1	+0.0	33.8	46.0	-12.2	Neutr
	Ave		+0.1								
^	1.460M	35.4	+0.0	+0.1	+9.1	+0.1	+0.0	44.8	46.0	-1.2	Neutr
			+0.1								

23	1.158M	24.3	+0.0	+0.1	+9.1	+0.1	+0.0	33.7	46.0	-12.3	Neutr
	Ave		+0.1								
^	1.158M	35.2	+0.0	+0.1	+9.1	+0.1	+0.0	44.6	46.0	-1.4	Neutr
			+0.1								
25	169.634k	25.0	+0.0	+0.4	+9.1	+0.0	+0.0	34.6	55.0	-20.4	Neutr
	Ave		+0.1								
^	169.633k	49.2	+0.0	+0.4	+9.1	+0.0	+0.0	58.8	55.0	+3.8	Neutr
			+0.1								
27	189.995k	21.7	+0.0	+0.2	+9.1	+0.0	+0.0	31.1	54.0	-22.9	Neutr
	Ave		+0.1								
^	189.995k	46.6	+0.0	+0.2	+9.1	+0.0	+0.0	56.0	54.0	+2.0	Neutr
			+0.1								
29	18.869M	14.4	+0.0	+0.1	+9.1	+0.2	+0.0	23.8	50.0	-26.2	Neutr
	Ave		+0.0								
^	18.869M	39.8	+0.0	+0.1	+9.1	+0.2	+0.0	49.2	50.0	-0.8	Neutr
			+0.0								

Test Setup Photo(s)



Supplemental Information

Measurement Uncertainty

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

Uncertainties reported are worst case for all CKC Laboratories' sites and 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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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 caret ("^") 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.