

Impinj Inc.

REVISED TEST REPORT TO 104294-6

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.: 104294-6A

Date of issue: September 29, 2020



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:

Impinj Inc.
400 Fairview Ave N, Suite 1200
Seattle, WA 98109

Representative: Greg Robinson
Customer Reference Number: 702937

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104294

August 18, 2020

August 18-19, 2020

Revision History

Original: Testing of the Impinj R705 Portal Gateway Reader, Model: IPJ-R705-FGX, to FCC Part 15 Subpart C Section(s) 15.207 & 15.247 (FHSS 902-928 MHz).

Revision A: To correct the limit (dBm) for Section 15.247(b)(2) Output Power.

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.



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
Canyon Park, Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	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	Pass
15.247(a)(1)	Carrier Separation	NA	Pass
15.247(a)(1)(i)	Number of Hopping Channels	NA	Pass
15.247(a)(1)(i)	Average Time of Occupancy	NA	Pass
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment 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	37020250803

CKC Laboratories tested the referenced model as IPJ-R705-FCC. The manufacturer declares the model name given at the time of testing was in error and should have been referenced as IPJ-R705-FGX.

Support Equipment:

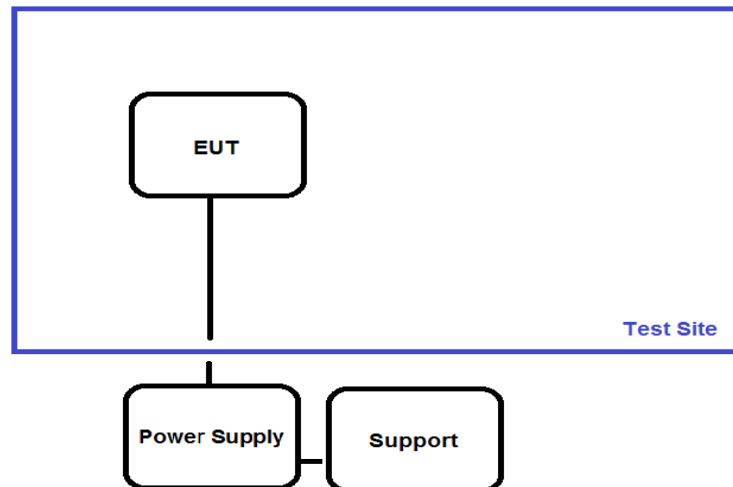
Device	Manufacturer	Model #	S/N
POE Injector/Hub	Phihong	POE29U-1AT(PL)	P191902307 A2
Router	Belkin	F5D7230-4	20828723009696
Laptop	Dell	Latitude E7240	77VQVZ1
Laptop Power Supply	Dell	DA65NM130	CN-03F1CN-48661-511-02EW-A02

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Operating Frequency Range:	902.75 - 927.25 MHz
Number of Hopping Channels:	50
Receiver Bandwidth and Synchronization:	The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter.
Modulation Type(s):	ASK
Maximum Duty Cycle:	100% Modulated (Tested Worst-Case)
Number of TX Chains:	1
Antenna Type(s) and Gain:	Patch Antenna Array, 7.1 - 9.9 dBi
Beamforming Type:	Phased Array
Antenna Connection Type:	External Connector
Nominal Input Voltage:	120VAC
Firmware / Software used for Test:	Impinj Item Tests V2.0.0-preview-340

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	8/18/2020
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, insertion loss of other equipment is accounted for and programmed into the spectrum analyzer.		

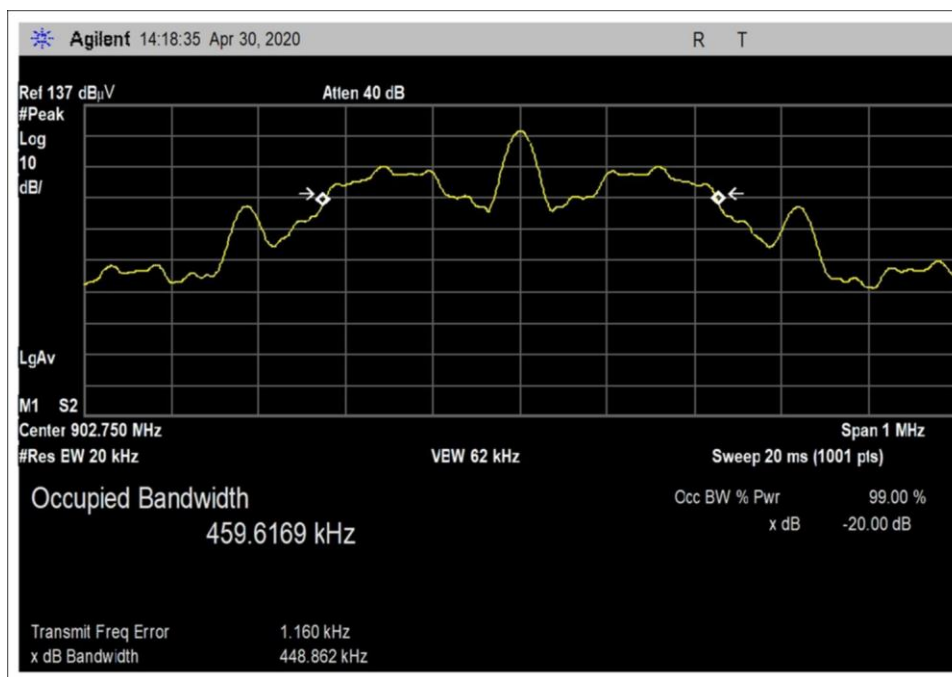
Environmental Conditions			
Temperature (°C)	23	Relative Humidity (%):	46

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
P07226	Attenuator	Pasternack	PE7004-6	10/2/2019	10/2/2021

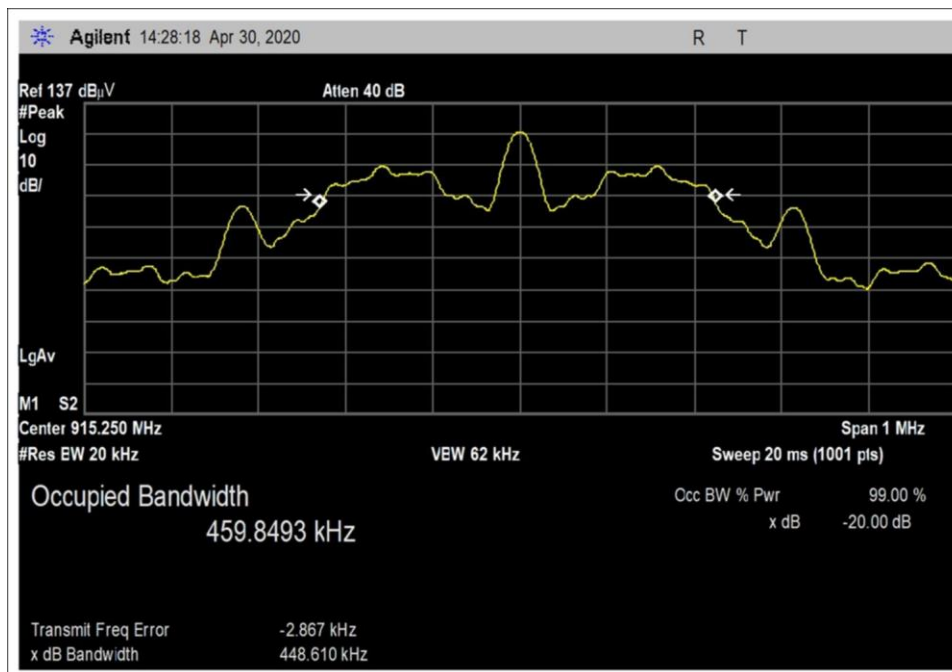
15.247(a)(1)(i) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.75	1	ASK	448.8	≤500	Pass
915.25	1	ASK	448.6	≤500	Pass
927.25	1	ASK	448.8	≤500	Pass

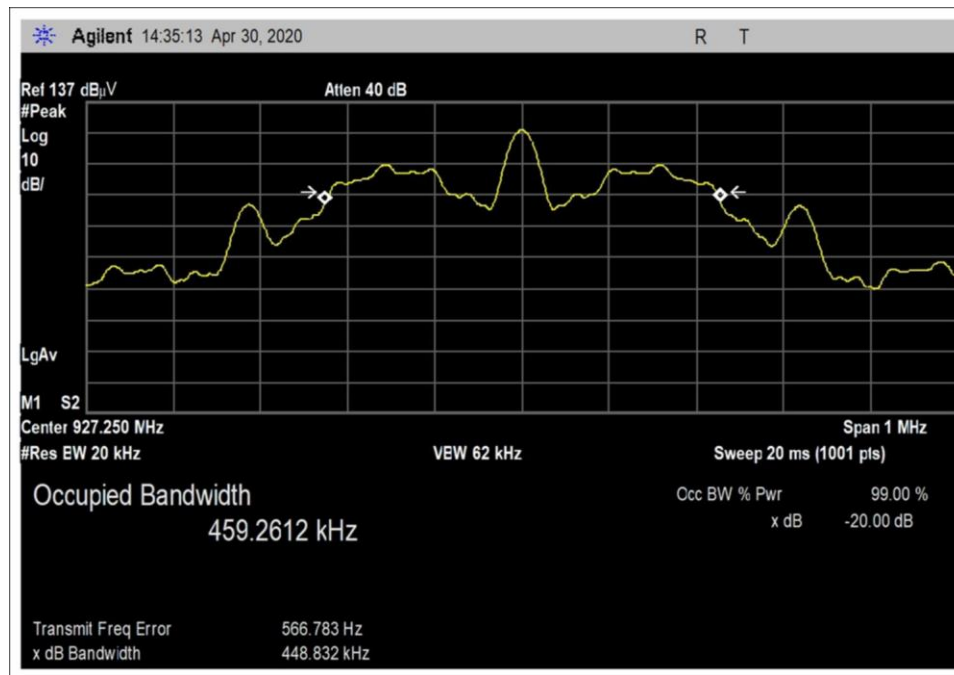
Plot(s)



Low Channel



Middle Channel

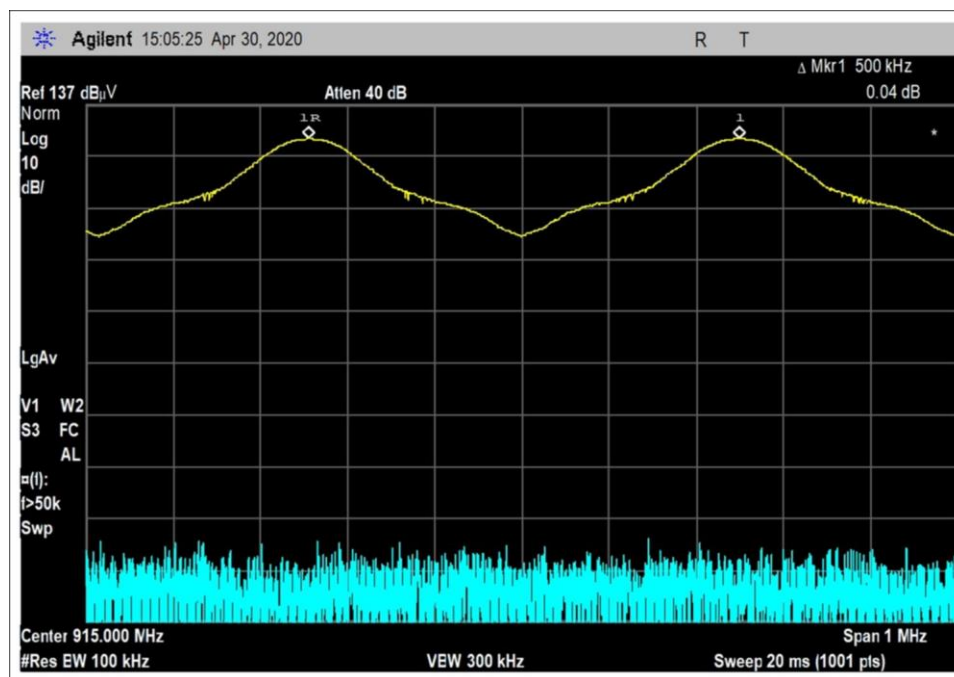


High Channel

15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: 20dB bandwidth of the hopping channel.				
Antenna Port	Operational Mode	Measured (kHz)	Limit (kHz)	Results
1	Hopping	500	> 459.8	Pass

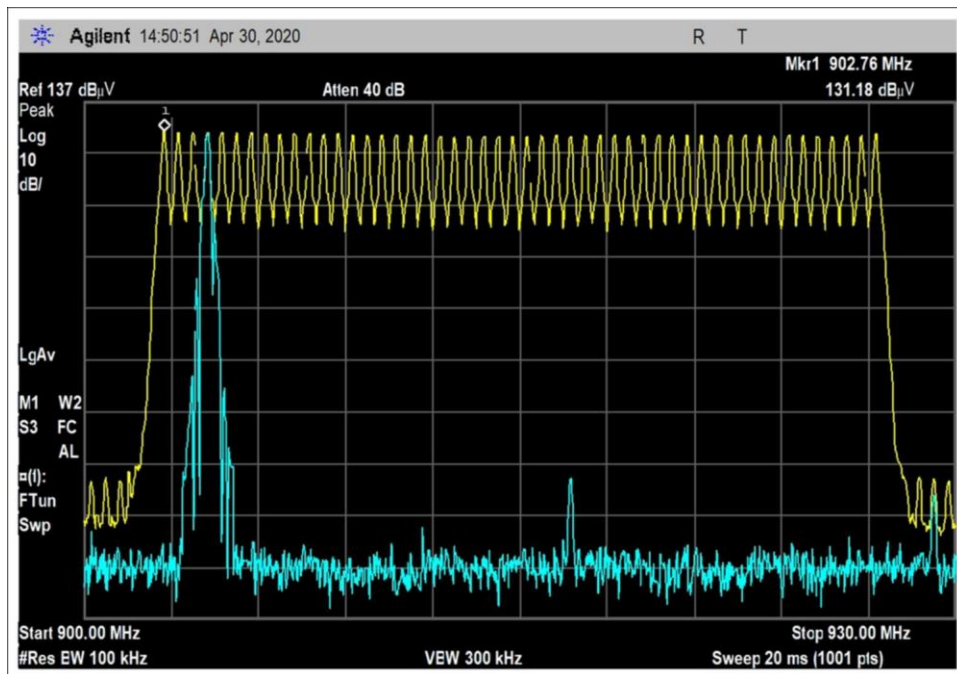
Plot(s)



15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50 \text{ Channels} & 20 \text{ dB BW} < 250 \text{ kHz} \\ 25 \text{ Channels} & 20 \text{ dB BW} \geq 250 \text{ kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (Channels)	Limit (Channels)	Results
1	Hopping	50	>25	Pass

Plot(s)



15.247(a)(1)(i) Time of Occupancy

Test Data Summary				
Observation Period, P_{obs} is derived from the following:				
$P_{obs} = \begin{cases} 20 \text{ Seconds} & 20 \text{ dB BW} < 250\text{kHz} \\ 10 \text{ Seconds} & 20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (ms)	Limit (ms/ P_{obs})	Results
1	Hopping	250	≤ 400	Pass

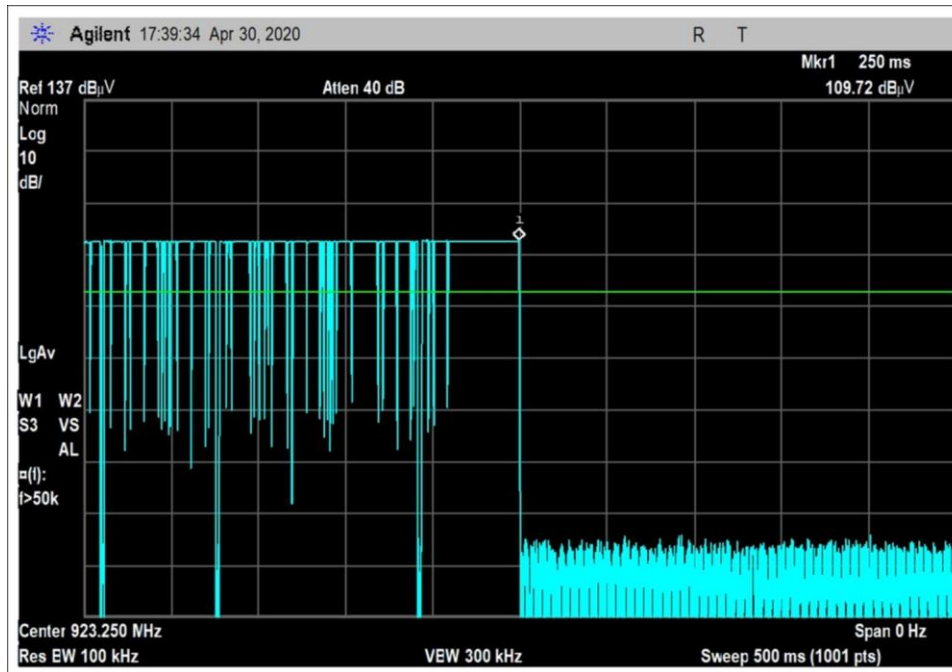
Measured results are calculated as follows:

$$Dwell\ time = \left(\sum_{Bursts} RF\ Burst\ On\ Time + \sum_{Control} Control\ Signal\ On\ time \right) \Big|_{P_{obs}}$$

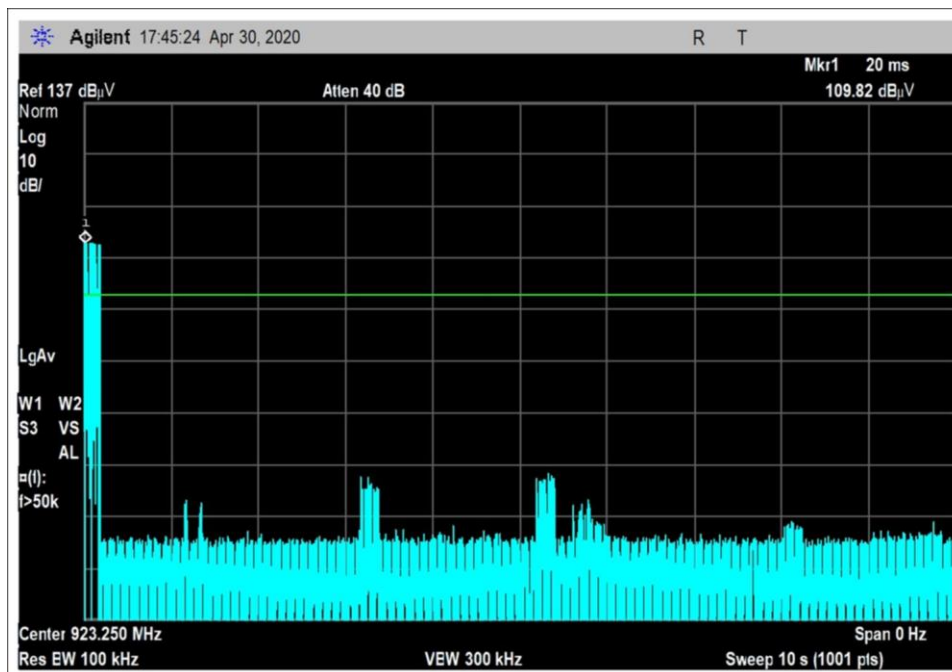
Actual Calculated Values:

Parameter	Value
Observation Period (P_{obs}):	10s
Number of RF Bursts / P_{obs} :	1
On time of RF Burst:	.25s
Number of Control or other signals / P_{obs} :	0
On time of Control or other Signals:	0
Total Measured On Time:	250ms

Plot(s)



TOO RFID



TOO RFID

Test Setup Photo(s)



15.247(b)(2) Output Power

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBm)	V _{Nominal} (dBm)	V _{Maximum} (dBm)	Max Deviation from V _{Nominal} (dB)
902.75	ASK / 1	28.4	28.4	28.3	0.1
915.25	ASK / 1	28.3	28.3	28.3	0
927.25	ASK / 1	28.5	28.5	28.4	0.1

Test performed using operational mode with the highest output power, representing worst case.

Voltage variations could not be performed on POE output due to Ethernet communication requirements for function.

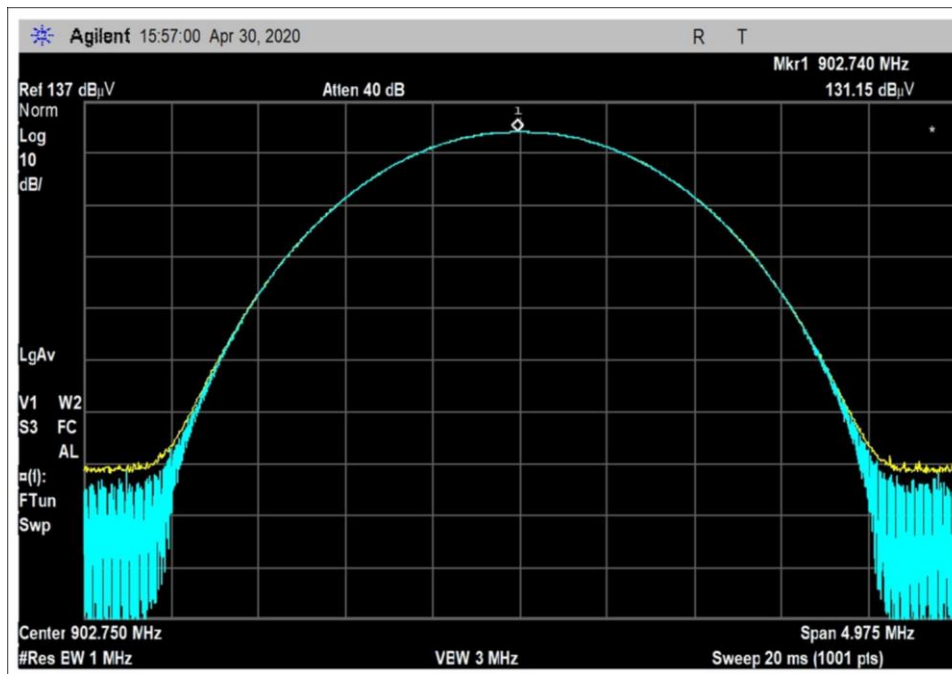
Parameter Definitions:

Measurements performed at input voltage V_{Nominal} ± 15%.

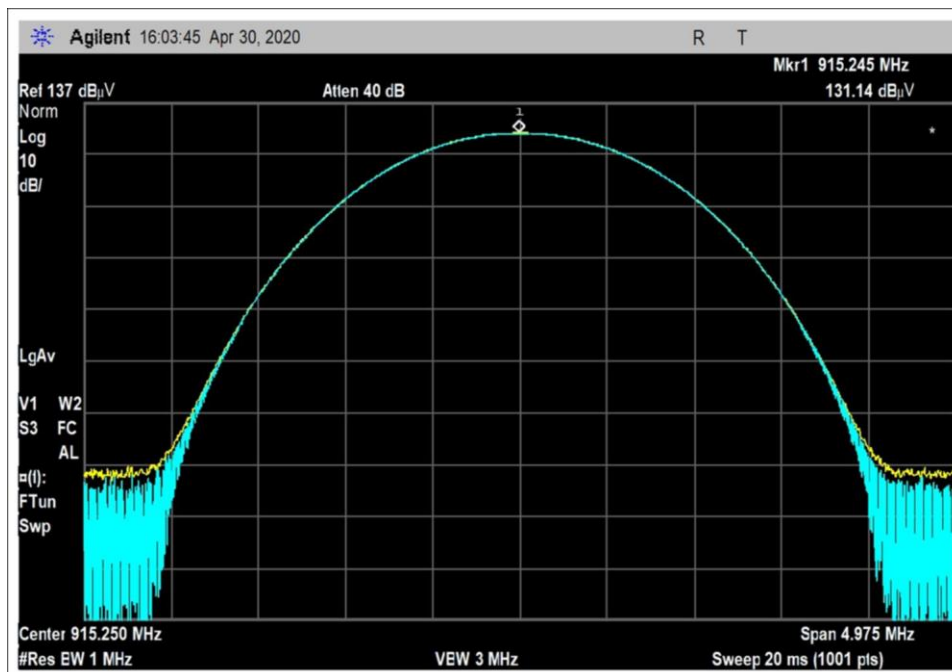
Parameter	Value
V _{Nominal} :	120
V _{Minimum} :	102
V _{Maximum} :	138

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)	Measured (dBm)	Limit (dBm)	Results
902.75	ASK	Patch / 7.1	28.4	≤ 28.9	Pass
915.25	ASK	Patch / 7.4	28.3	≤ 28.6	Pass
927.25	ASK	Patch / 7.1	28.5	≤ 28.9	Pass
902.75	ASK	Patch / 9.9	25.7	≤ 26.1	Pass
915.25	ASK	Patch / 9.6	26.1	≤ 26.4	Pass
927.25	ASK	Patch / 9.1	26.6	≤ 26.9	Pass

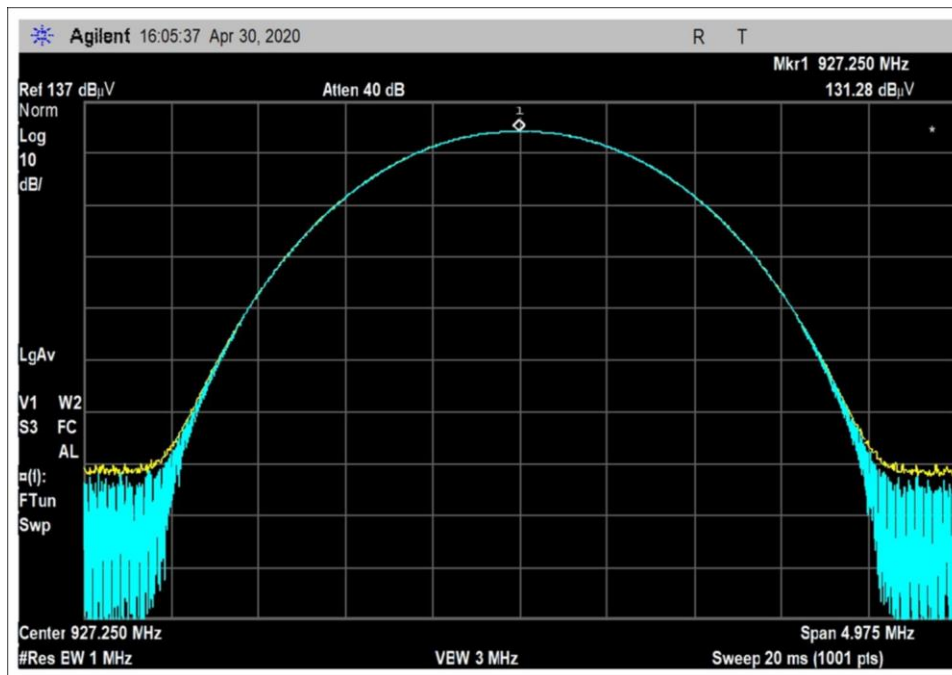
Plots



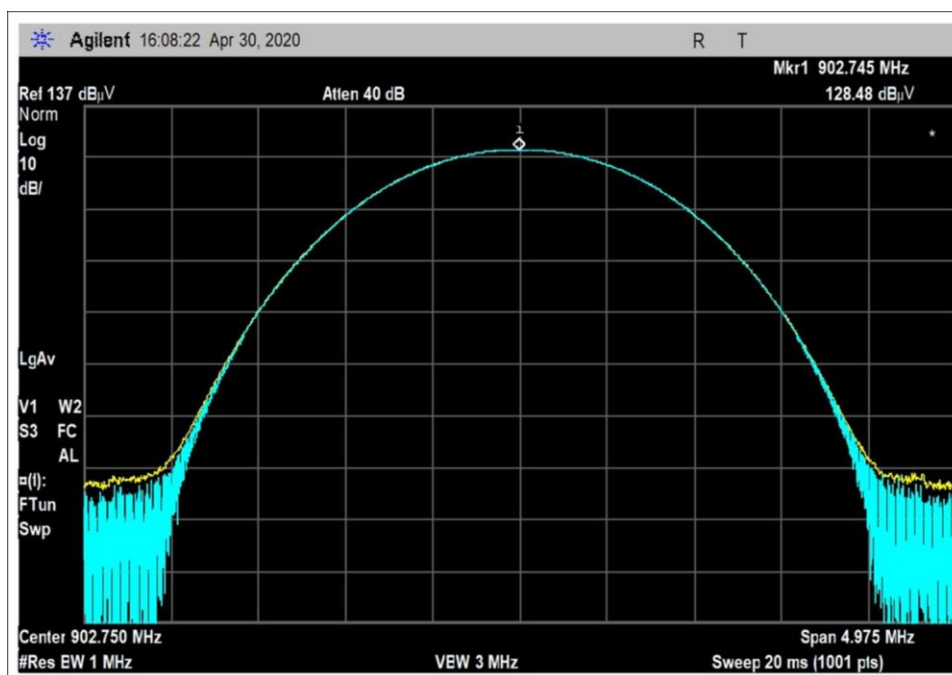
Low Channel 7.1dBi



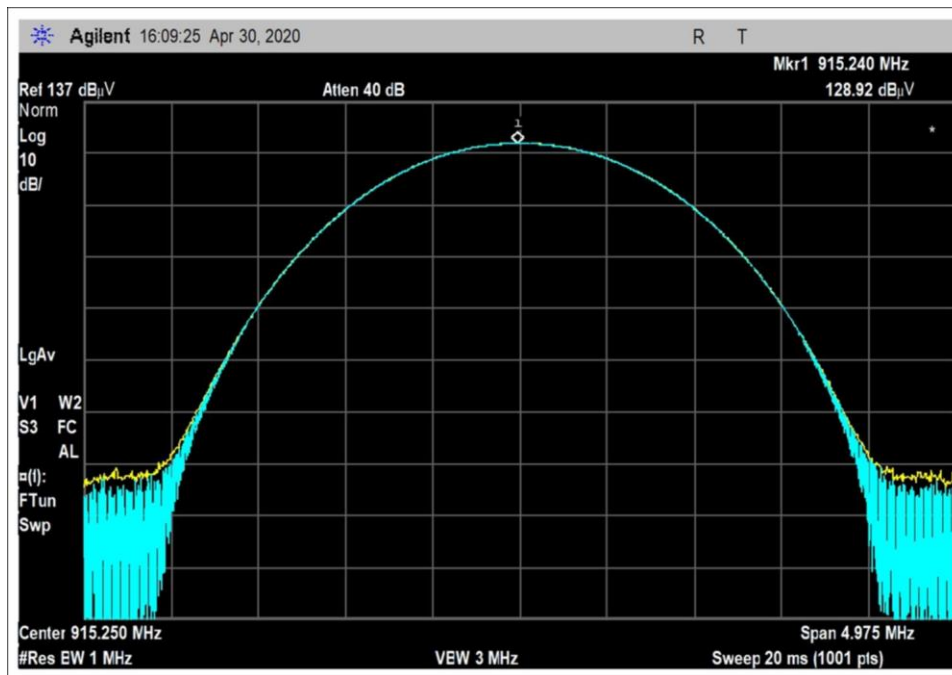
Middle Channel 7.4dBi



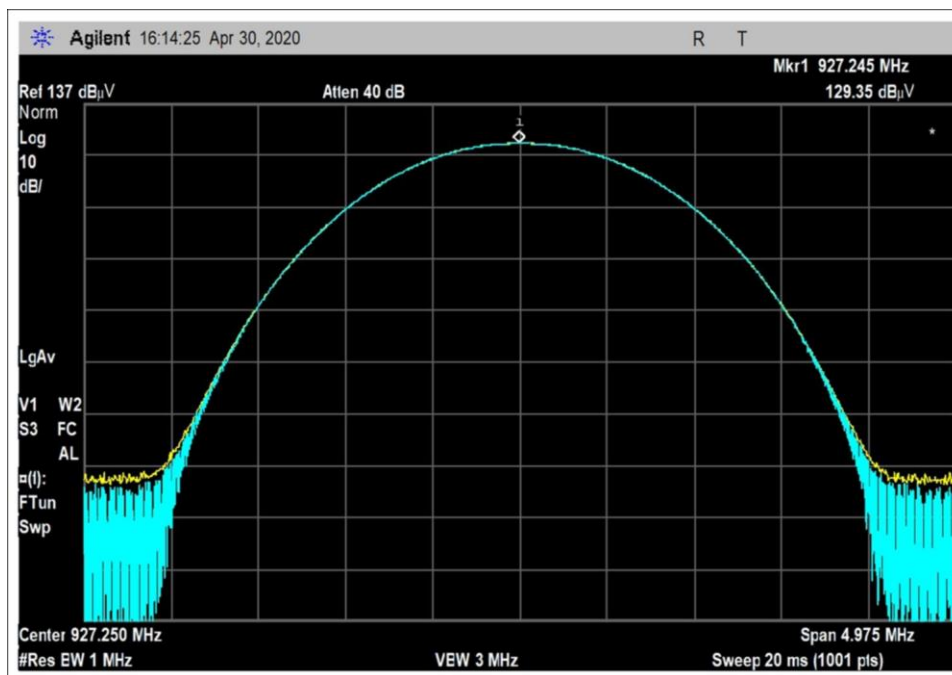
High Channel 7.1dBi



Low Channel 9.9dBi



Middle Channel 9.6dBi



High Channel 9.1dBi

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: 8/18/2020
 Test Type: **Conducted Emissions** Time: 10:20:54
 Tested By: Matthew Harrison Sequence#: 7
 Software: EMITest 5.03.19 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

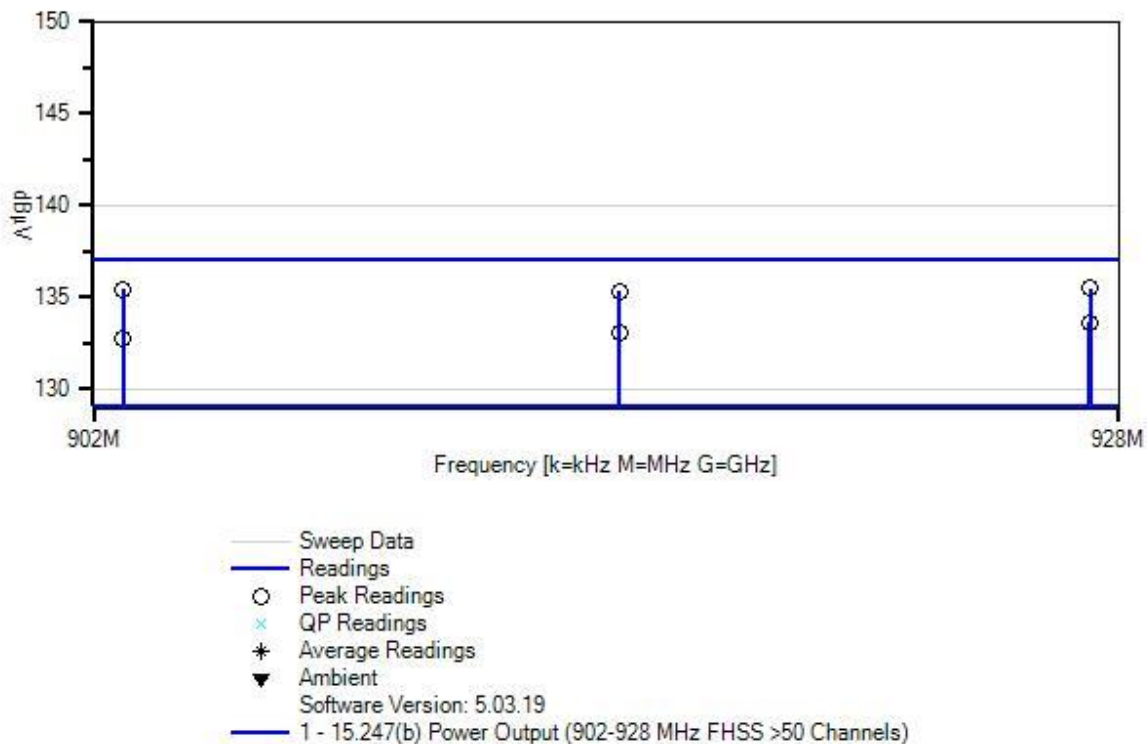
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C Humidity: 39% Pressure: 101.5kPa Frequency Range: 600-970 MHz 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#: 7 Date: 8/18/2020
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
T1	ANP07226	Attenuator	PE7004-6	10/2/2019	10/2/2021
T2	ANP06008	Cable	Heliac	1/22/2019	1/22/2021
T3	AN02871	Spectrum Analyzer	E4440A	3/12/2020	3/12/2022
T4	Manufacturers Declared system loss to antenna (2.5dB).				

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	927.250M	131.3	+5.9	+0.8	+0.0	+2.5	+0.0	135.5	137.0	-1.5	Anten
									7.1 dBi		
2	902.740M	131.2	+5.9	+0.8	+0.0	+2.5	+0.0	135.4	137.0	-1.6	Anten
									7.1 dBi		
3	915.245M	131.1	+5.9	+0.8	+0.0	+2.5	+0.0	135.3	137.0	-1.7	Anten
									7.4 dBi		
4	927.245M	129.4	+5.9	+0.8	+0.0	+2.5	+0.0	133.6	137.0	-3.4	Anten
									9.1 dBi		
5	915.240M	128.9	+5.9	+0.8	+0.0	+2.5	+0.0	133.1	137.0	-3.9	Anten
									9.6 dBi		
6	902.745M	128.5	+5.9	+0.8	+0.0	+2.5	+0.0	132.7	137.0	-4.3	Anten
									9.9 dBi		

Test Setup Photo(s)



15.247(d) RF Conducted 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) Conducted Spurious Emissions**
 Work Order #: **104294** Date: 8/18/2020
 Test Type: **Conducted Emissions** Time: 14:22:35
 Tested By: Matthew Harrison Sequence#: 9
 Software: EMITest 5.03.19 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

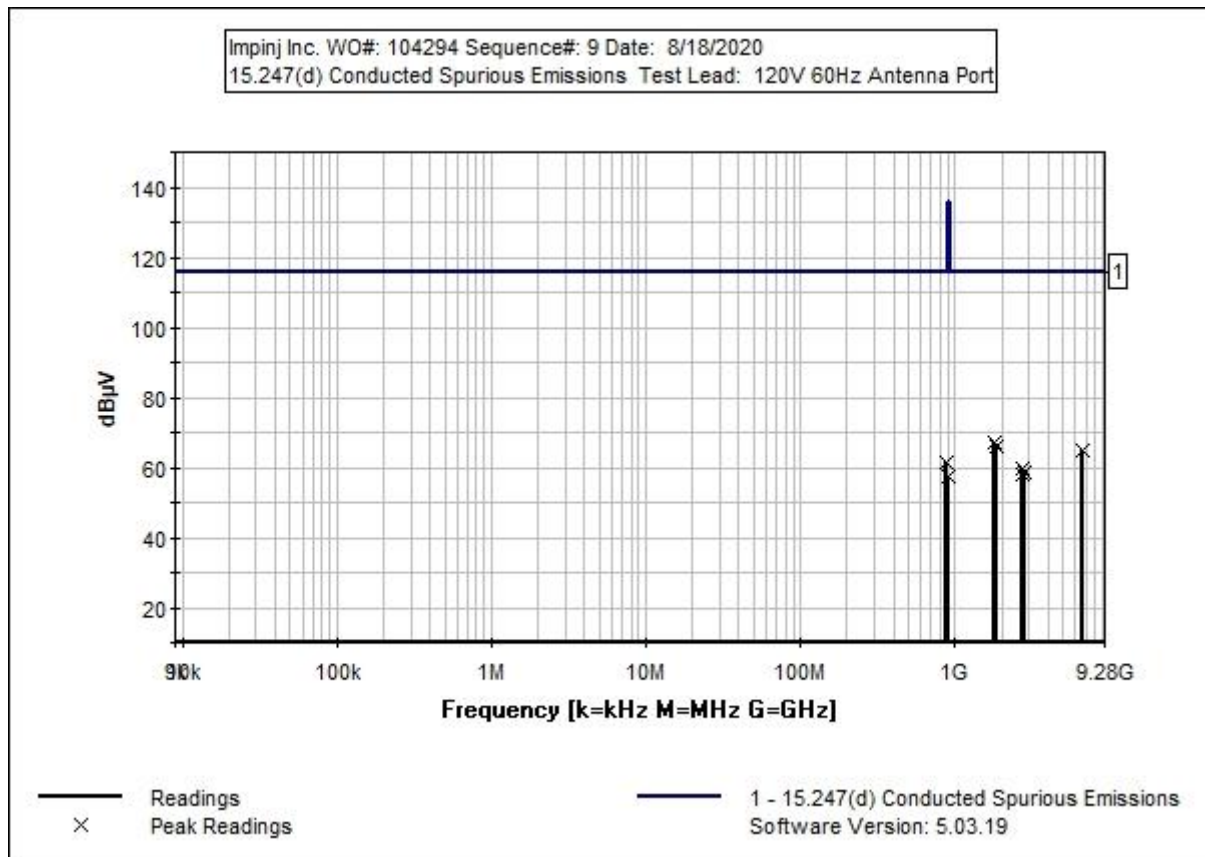
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C
 Humidity: 39%
 Pressure: 101.5kPa

 Frequency Range: 9kHz-9280 MHz
 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.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07226	Attenuator	PE7004-6	10/2/2019	10/2/2021
T2	ANP06008	Cable	Heliax	1/22/2019	1/22/2021
T3	AN02871	Spectrum Analyzer	E4440A	3/12/2020	3/12/2022

Measurement Data:		Reading listed by margin.					Test Lead: Antenna Port				
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB		Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1805.510M	60.2	+5.9	+1.1	+0.0		+0.0	67.2	115.5	-48.3	Anten
									Low Channel		
2	1854.510M	59.2	+5.9	+1.1	+0.0		+0.0	66.2	115.5	-49.3	Anten
									High Channel		
3	1830.496M	59.2	+5.9	+1.1	+0.0		+0.0	66.2	115.5	-49.3	Anten
									Mid Channel		
4	6661.000M	55.8	+6.3	+2.8	+0.0		+0.0	64.9	115.5	-50.6	Anten
									Low Channel		
5	890.100M	54.5	+5.9	+0.8	+0.0		+0.0	61.2	115.5	-54.3	Anten
									Low Channel		
6	2745.773M	52.4	+5.9	+1.4	+0.0		+0.0	59.7	115.5	-55.8	Anten
									Mid Channel		
7	2781.770M	51.5	+5.9	+1.4	+0.0		+0.0	58.8	115.5	-56.7	Anten
									High Channel		
8	2708.230M	50.5	+5.9	+1.4	+0.0		+0.0	57.8	115.5	-57.7	Anten
									Low Channel		
9	896.400M	50.5	+5.9	+0.8	+0.0		+0.0	57.2	115.5	-58.3	Anten
									High Channel		

Band Edge

Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

Operating Mode: Single Channel (Low and High)

Frequency (MHz)	Modulation	Measured (dBμV)	Limit (dBμV)	Results
902	ASK	72	< 115.5	Pass
928	ASK	72.1	< 115.5	Pass

Band Edge Summary

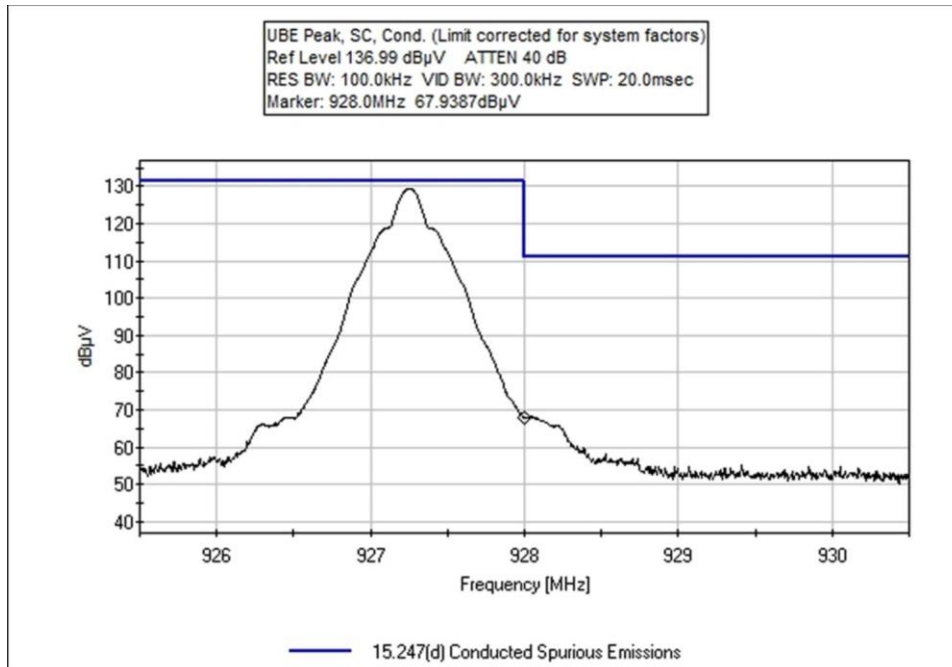
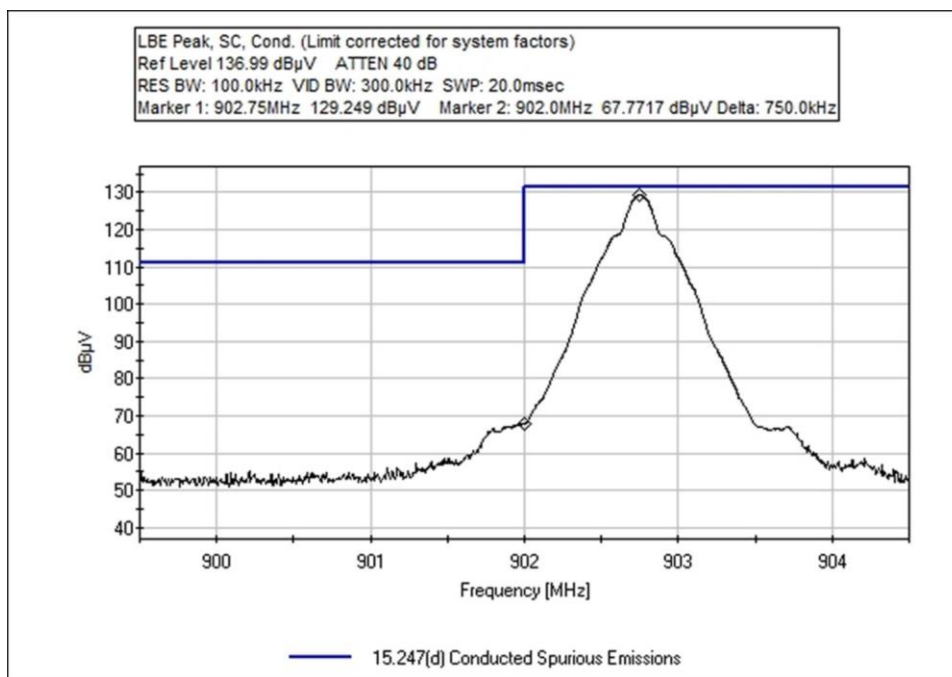
Limit applied: Max Power/100kHz - 20dB.

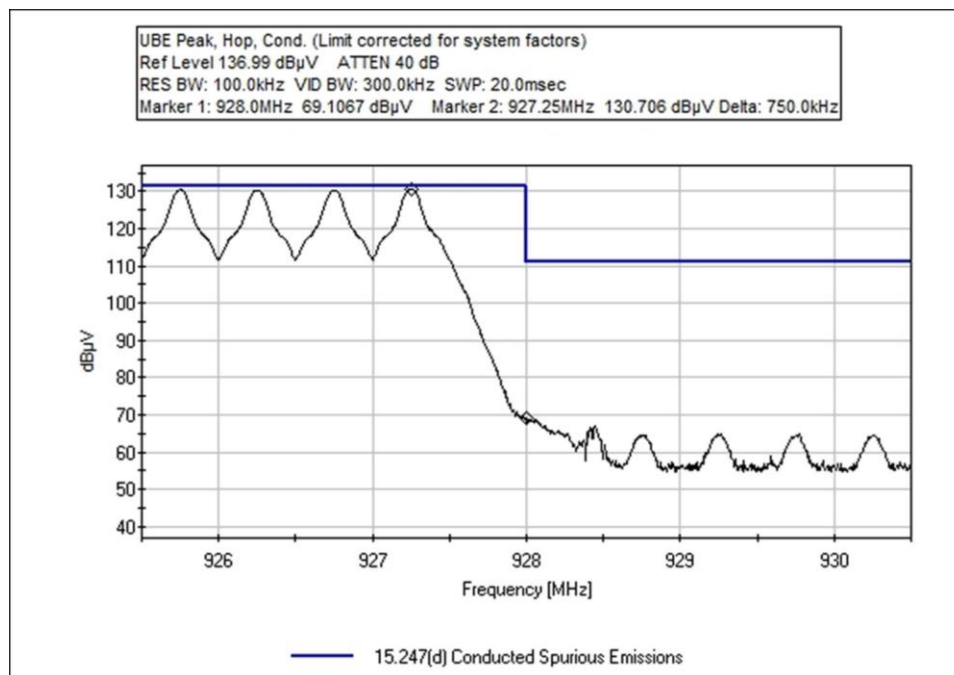
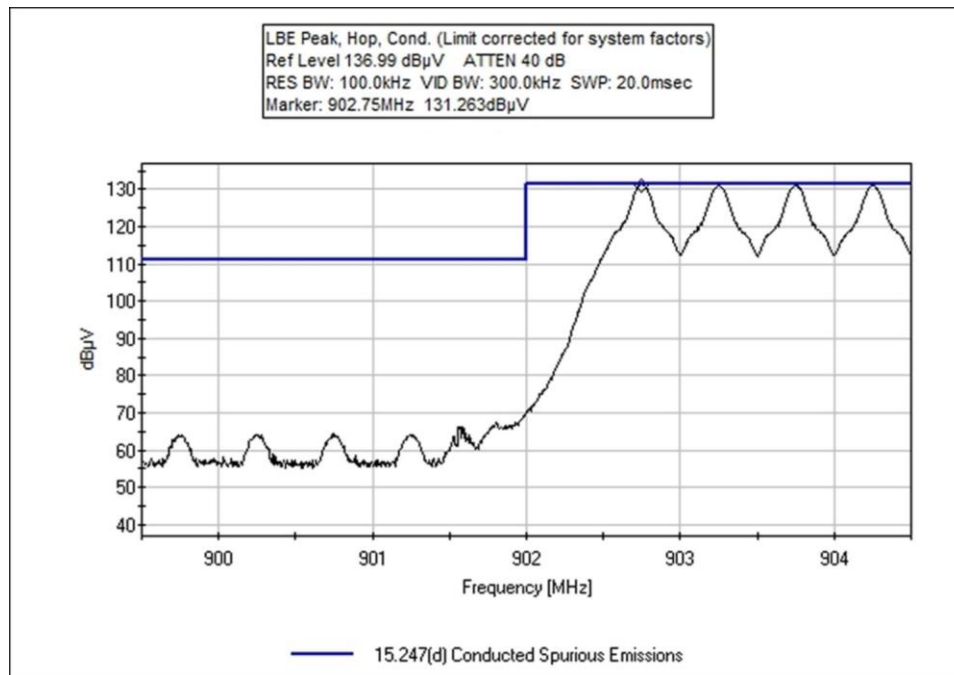
Operating Mode: Hopping

Frequency (MHz)	Modulation	Measured (dBμV)	Limit (dBμV)	Results
902	ASK	74.5	< 115.5	Pass
928	ASK	73.3	< 115.5	Pass

*Tests were performed at highest conducted output power levels.

Band Edge Plots





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) Conducted Spurious Emissions**
 Work Order #: **104294** Date: 8/18/2020
 Test Type: **Conducted Emissions** Time: 11:11:29
 Tested By: Matthew Harrison Sequence#: 8
 Software: EMITest 5.03.19 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C Humidity: 39% Pressure: 101.5kPa Frequency Range: 902-928 MHz Frequencies Tested: 902.75MHz and 927.25MHz 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.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07226	Attenuator	PE7004-6	10/2/2019	10/2/2021
T2	ANP06008	Cable	Heliac	1/22/2019	1/22/2021
T3	AN02871	Spectrum Analyzer	E4440A	3/12/2020	3/12/2022
T4	Manufacturers Declared system loss to antenna (2.5dB).				

Measurement Data: Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	902.750M	131.3	+5.9	+0.8	+0.0	+2.5	+0.0	135.5	135.5	+0.0	Anten
									Hop		
2	927.250M	130.7	+5.9	+0.8	+0.0	+2.5	+0.0	134.9	135.5	-0.6	Anten
									Hop		
3	902.750M	129.2	+5.9	+0.8	+0.0	+2.5	+0.0	133.4	135.5	-2.1	Anten
									SC		
4	902.000M	70.3	+5.9	+0.8	+0.0	+2.5	+0.0	74.5	115.5	-41.0	Anten
									Hop		
5	928.000M	69.1	+5.9	+0.8	+0.0	+2.5	+0.0	73.3	115.5	-42.2	Anten
									Hop		
6	928.000M	67.9	+5.9	+0.8	+0.0	+2.5	+0.0	72.1	115.5	-43.4	Anten
									SC		
7	902.000M	67.8	+5.9	+0.8	+0.0	+2.5	+0.0	72.0	115.5	-43.5	Anten
									SC		

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 #: **104294** Date: 8/19/2020
 Test Type: **Maximized Emissions** Time: 08:32:11
 Tested By: Matthew Harrison Sequence#: 1
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

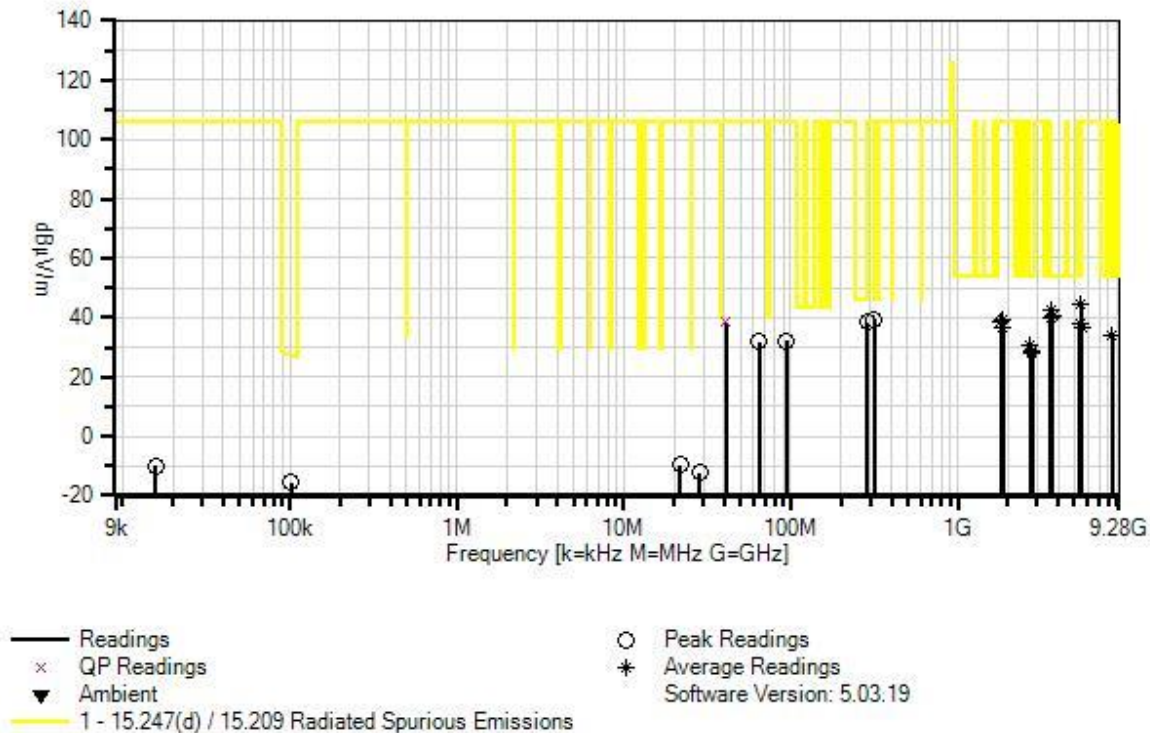
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C Humidity: 39% Pressure: 101.5kPa Frequency Range: 9kHz-10GHz Frequencies Tested: 902.75MHz, 915.25MHz and 927.25MHz 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, Middle, and High channels along with X, Y, & Z EUT axis investigated, worst case reported. Horizontal and Vertical polarities investigated, worst case reported.
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Impinj Inc. W/O#: 104294 Sequence#: 1 Date: 8/19/2020
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Para



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T2	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T3	ANP06515	Cable	Helix	7/1/2020	7/1/2022
T4	ANP06540	Cable	Helix	8/23/2019	8/23/2021
T5	ANP07504	Cable	CLU40-KMKM- 02.00F	1/17/2019	1/17/2021
T6	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T7	AN03170	High Pass Filter	HM1155-11SS	10/23/2019	10/23/2021
T8	AN02307	Preamp	8447D	1/10/2020	1/10/2022
T9	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T10	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T11	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T12	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T13	AN00052	Loop Antenna	6502	5/4/2020	5/4/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3610.980M	40.8	-33.8	+30.3	+3.4	+0.8	+0.0	42.6	54.0	-11.4	Vert
	Ave		+0.6	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	3610.980M	45.4	-33.8	+30.3	+3.4	+0.8	+0.0	47.2	54.0	-6.8	Vert
			+0.6	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
3	3709.000M	38.2	-33.7	+30.6	+3.5	+0.9	+0.0	40.5	54.0	-13.5	Vert
	Ave		+0.5	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	3709.000M	44.2	-33.7	+30.6	+3.5	+0.9	+0.0	46.5	54.0	-7.5	Vert
			+0.5	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
5	3660.940M	37.9	-33.7	+30.5	+3.4	+0.9	+0.0	40.0	54.0	-14.0	Vert
	Ave		+0.5	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	3660.940M	43.3	-33.7	+30.5	+3.4	+0.9	+0.0	45.4	54.0	-8.6	Vert
			+0.5	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
7	5416.480M	32.2	-33.7	+33.4	+4.3	+1.0	+0.0	38.0	54.0	-16.0	Horiz
	Ave		+0.4	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	5416.480M	39.3	-33.7	+33.4	+4.3	+1.0	+0.0	45.1	54.0	-8.9	Horiz
			+0.4	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
9	8345.140M	23.5	-34.9	+37.0	+5.3	+1.7	+0.0	33.9	54.0	-20.1	Horiz
	Ave		+0.5	+0.0	+0.8	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	8345.140M	38.5	-34.9	+37.0	+5.3	+1.7	+0.0	48.9	54.0	-5.1	Horiz
			+0.5	+0.0	+0.8	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

11	2708.195M Ave	32.5	-34.1 +0.2 +0.0 +0.0	+28.3 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	30.9	54.0	-23.1	Horiz
^	2708.195M	42.2	-34.1 +0.2 +0.0 +0.0	+28.3 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	40.6	54.0	-13.4	Horiz
13	2781.750M Ave	30.0	-34.1 +0.2 +0.0 +0.0	+28.5 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	28.6	54.0	-25.4	Horiz
^	2781.750M	41.4	-34.1 +0.2 +0.0 +0.0	+28.5 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	40.0	54.0	-14.0	Horiz
15	2745.605M Ave	29.6	-34.1 +0.2 +0.0 +0.0	+28.4 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	28.1	54.0	-25.9	Horiz
^	2745.605M	41.3	-34.1 +0.2 +0.0 +0.0	+28.4 +0.0 +0.0 +0.0	+2.9 +0.4 +0.0 +0.0	+0.7 +0.0 +0.0 +0.0	+0.0	39.8	54.0	-14.2	Horiz
17	101.919k	54.8	+0.0 +0.0 +0.0 +9.6	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	-80.0	-15.6	27.4	-43.0	Para
18	101.919k	45.7	+0.0 +0.0 +0.0 +9.6	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	-80.0	-24.7	27.4	-52.1	Perp
19	5491.435M Ave	38.7	-33.7 +0.4 +0.0 +0.0	+33.5 +0.0 +0.0 +0.0	+4.4 +0.4 +0.0 +0.0	+1.0 +0.0 +0.0 +0.0	+0.0	44.7	105.9	-61.2	Horiz
^	5491.435M	46.2	-33.7 +0.4 +0.0 +0.0	+33.5 +0.0 +0.0 +0.0	+4.4 +0.4 +0.0 +0.0	+1.0 +0.0 +0.0 +0.0	+0.0	52.2	105.9	-53.7	Horiz
21	316.200M	44.5	+0.0 +0.0 +13.9 +0.0	+0.0 +0.0 +5.8 +0.0	+0.0 +0.0 +0.9 +0.0	+0.2 -27.1 +1.1 +0.0	+0.0	39.3	105.9	-66.6	Horiz
22	1854.500M Ave	43.9	-34.7 +0.2 +0.0 +0.0	+26.5 +0.0 +0.0 +0.0	+2.4 +0.4 +0.0 +0.0	+0.5 +0.0 +0.0 +0.0	+0.0	39.2	105.9	-66.7	Horiz
^	1854.500M	50.5	-34.7 +0.2 +0.0 +0.0	+26.5 +0.0 +0.0 +0.0	+2.4 +0.4 +0.0 +0.0	+0.5 +0.0 +0.0 +0.0	+0.0	45.8	105.9	-60.1	Horiz

24	41.060M	48.5	+0.0	+0.0	+0.0	+0.1	+0.0	38.6	105.9	-67.3	Horiz
	QP		+0.0	+0.0	+0.0	-28.0					
			+11.6	+5.8	+0.3	+0.3					
			+0.0								
^	41.060M	50.7	+0.0	+0.0	+0.0	+0.1	+0.0	40.8	105.9	-65.1	Horiz
			+0.0	+0.0	+0.0	-28.0					
			+11.6	+5.8	+0.3	+0.3					
			+0.0								
26	287.000M	44.7	+0.0	+0.0	+0.0	+0.2	+0.0	38.5	105.9	-67.4	Horiz
			+0.0	+0.0	+0.0	-27.0					
			+12.9	+5.8	+0.8	+1.1					
			+0.0								
27	1805.445M	43.5	-34.8	+26.1	+2.3	+0.5	+0.0	38.3	105.9	-67.6	Horiz
	Ave		+0.2	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	1805.445M	48.2	-34.8	+26.1	+2.3	+0.5	+0.0	43.0	105.9	-62.9	Horiz
			+0.2	+0.0	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
29	1830.520M	41.5	-34.8	+26.3	+2.4	+0.5	+0.0	36.5	105.9	-69.4	Horiz
	Ave		+0.2	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	1830.520M	48.8	-34.8	+26.3	+2.4	+0.5	+0.0	43.8	105.9	-62.1	Horiz
			+0.2	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
31	5563.500M	30.1	-33.7	+33.7	+4.4	+1.0	+0.0	36.3	105.9	-69.6	Horiz
	Ave		+0.4	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	5563.500M	39.2	-33.7	+33.7	+4.4	+1.0	+0.0	45.4	105.9	-60.5	Horiz
			+0.4	+0.0	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
33	94.000M	45.5	+0.0	+0.0	+0.0	+0.1	+0.0	32.3	105.9	-73.6	Horiz
			+0.0	+0.0	+0.0	-27.7					
			+7.5	+5.8	+0.5	+0.6					
			+0.0								
34	64.900M	45.4	+0.0	+0.0	+0.0	+0.1	+0.0	31.9	105.9	-74.0	Horiz
			+0.0	+0.0	+0.0	-27.8					
			+7.5	+5.8	+0.4	+0.5					
			+0.0								
35	21.672M	23.0	+0.0	+0.0	+0.2	+0.1	-40.0	-9.7	105.9	-115.6	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+7.0								
36	15.768k	56.2	+0.0	+0.0	+0.0	+0.0	-80.0	-10.1	105.9	-116.0	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+13.7								

37	28.597M	22.5	+0.0	+0.0	+0.3	+0.1	-40.0	-12.3	105.9	-118.2	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+4.8								

Band Edge

Band Edge Summary

Operating Mode: Single Channel (Low and High)

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	ASK	Patch / 7.1	25.3	<46	Pass
902	ASK	Patch / 7.1	77.6	< 105.9	Pass
928	ASK	Patch / 7.1	81.2	< 105.9	Pass
960	ASK	Patch / 7.1	34.8	<54	Pass
614	ASK	Patch / 9.9	24.6	<46	Pass
902	ASK	Patch / 9.9	90.8	< 105.9	Pass
928	ASK	Patch / 9.1	92	< 105.9	Pass
960	ASK	Patch / 9.1	36.1	<54	Pass

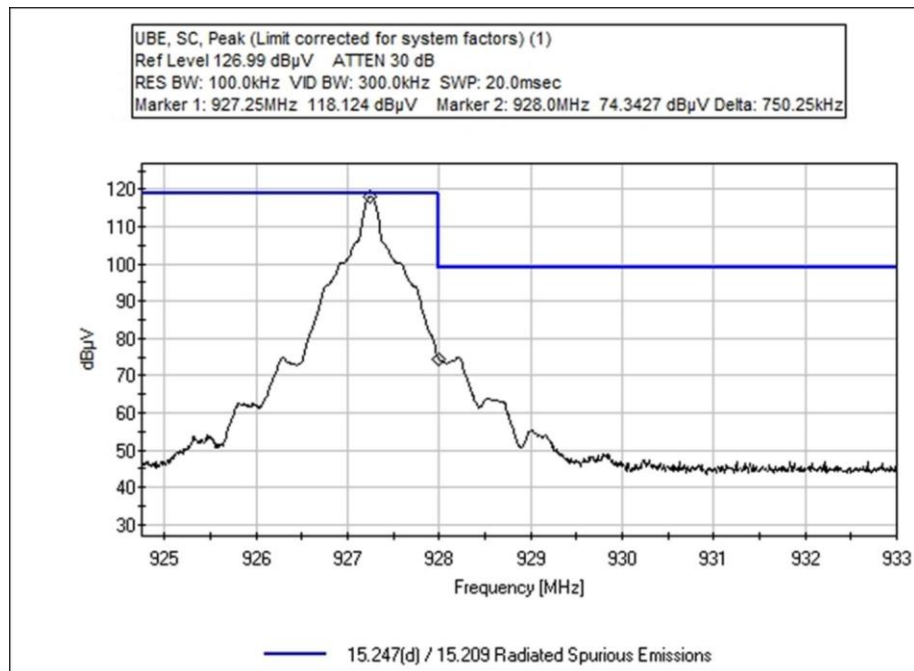
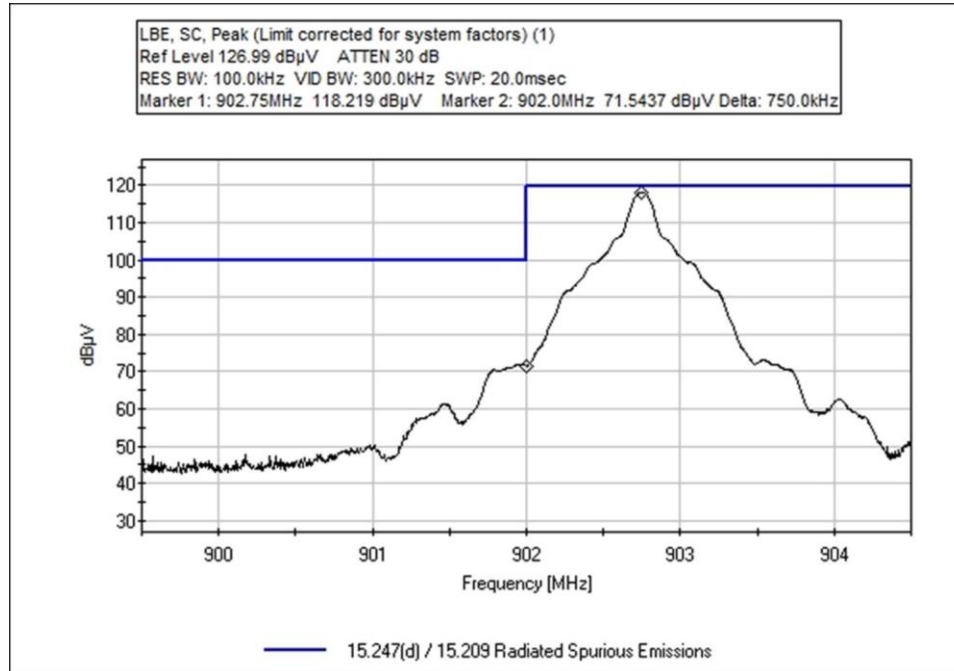
Band Edge Summary

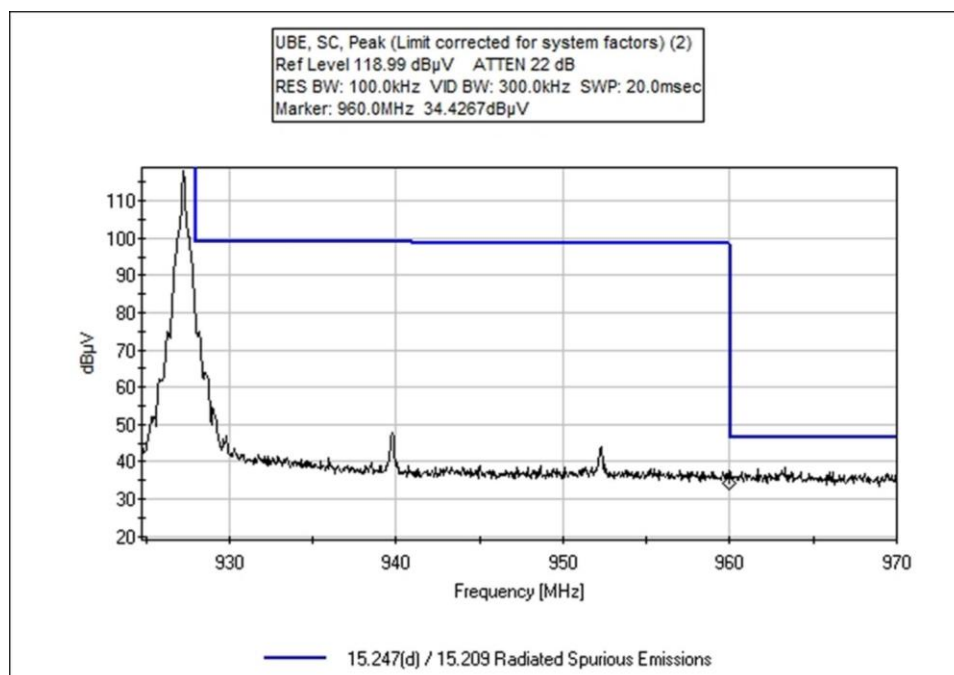
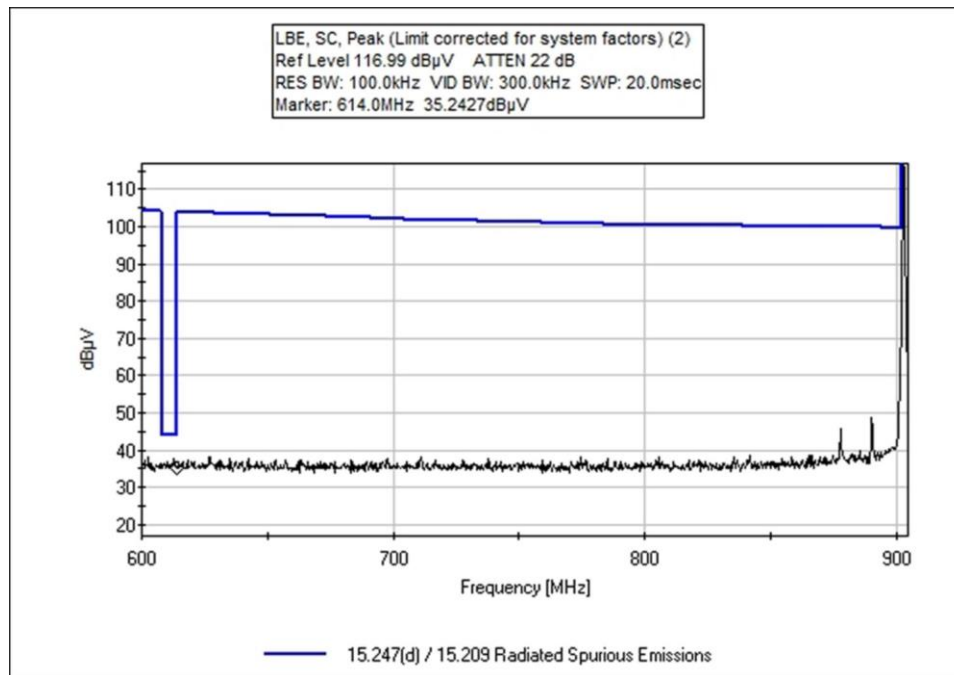
Operating Mode: Hopping

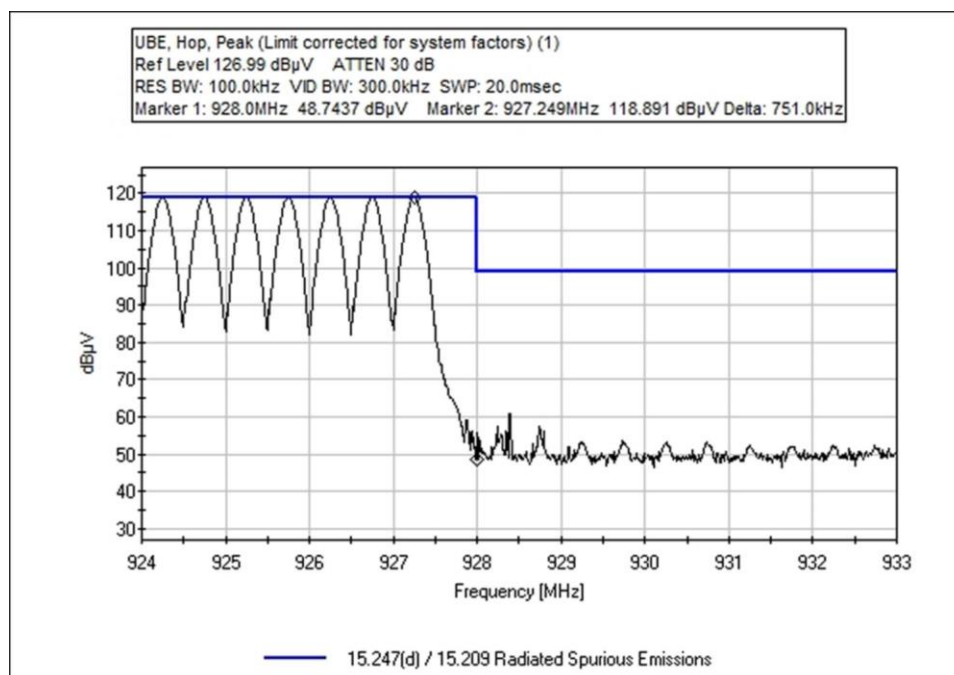
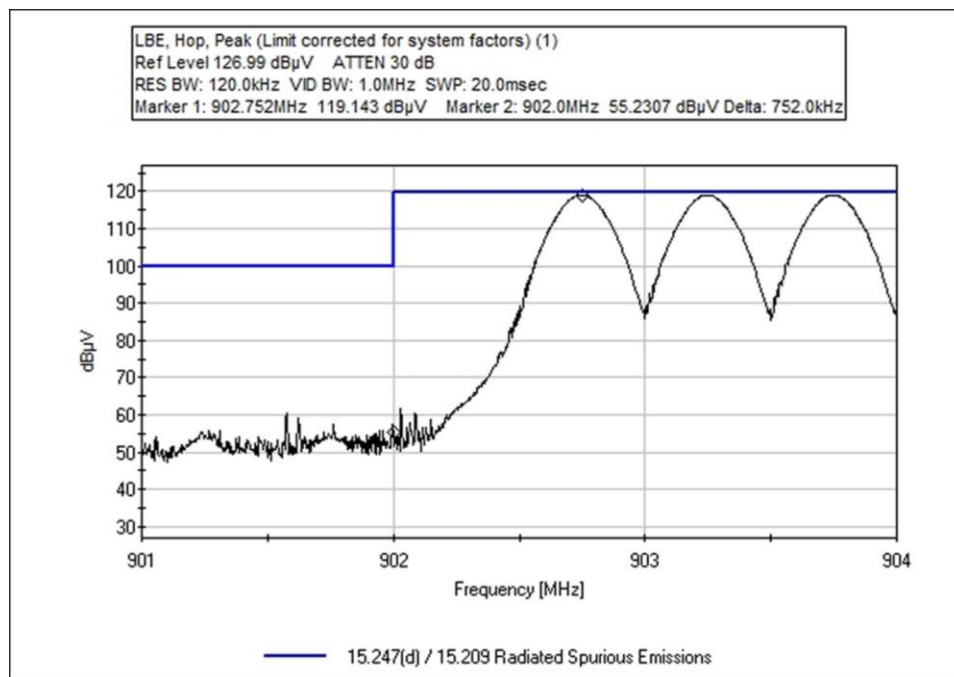
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	ASK	Patch / 7.1	25.4	<46	Pass
902	ASK	Patch / 7.1	61.3	< 105.9	Pass
928	ASK	Patch / 7.1	55.6	< 105.9	Pass
960	ASK	Patch / 7.1	33.4	<54	Pass
614	ASK	Patch / 9.9	25.4	<46	Pass
902	ASK	Patch / 9.9	93.1	< 105.9	Pass
928	ASK	Patch / 9.1	91.3	< 105.9	Pass
960	ASK	Patch / 9.1	37.8	<54	Pass

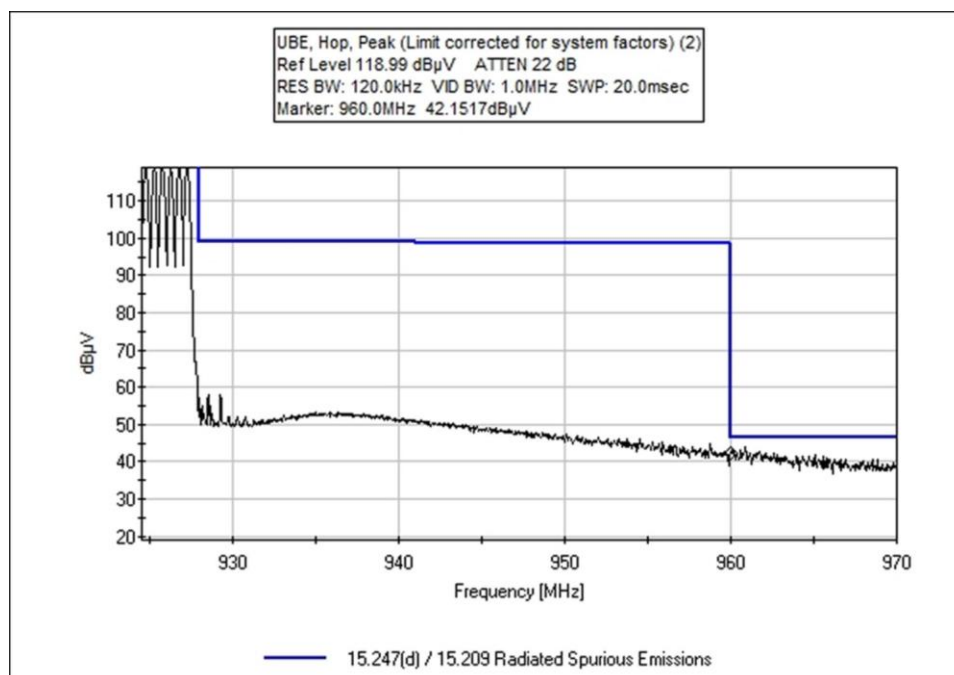
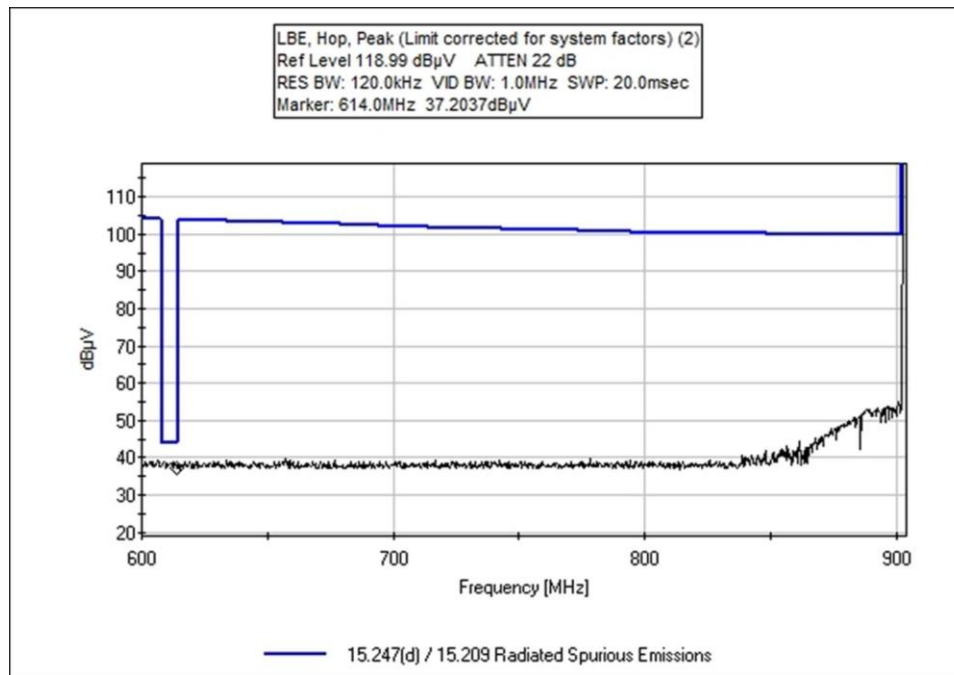
Band Edge Plots

7dBi

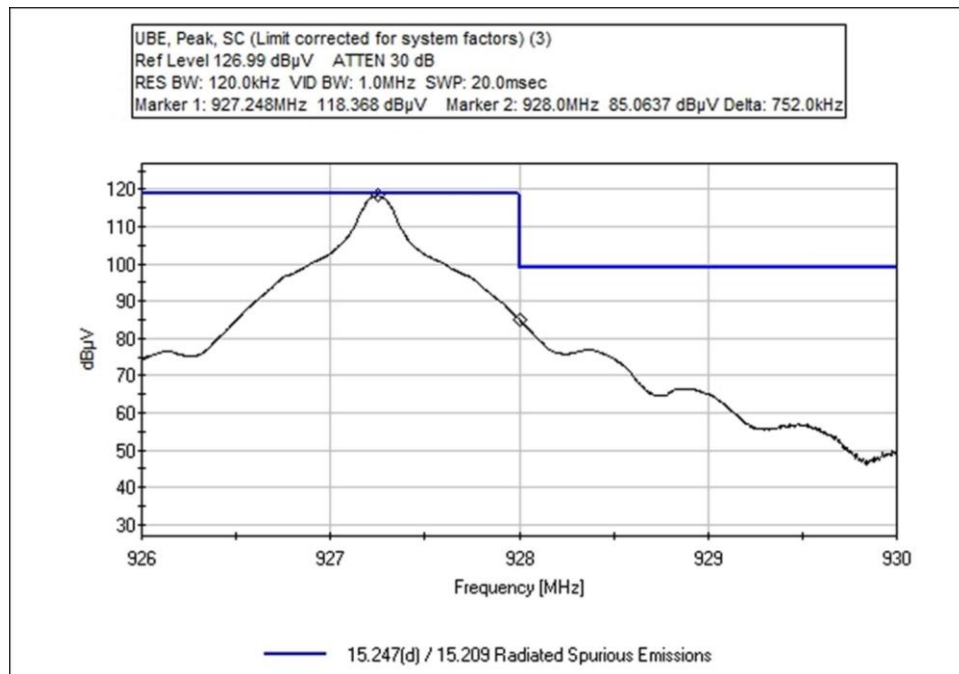
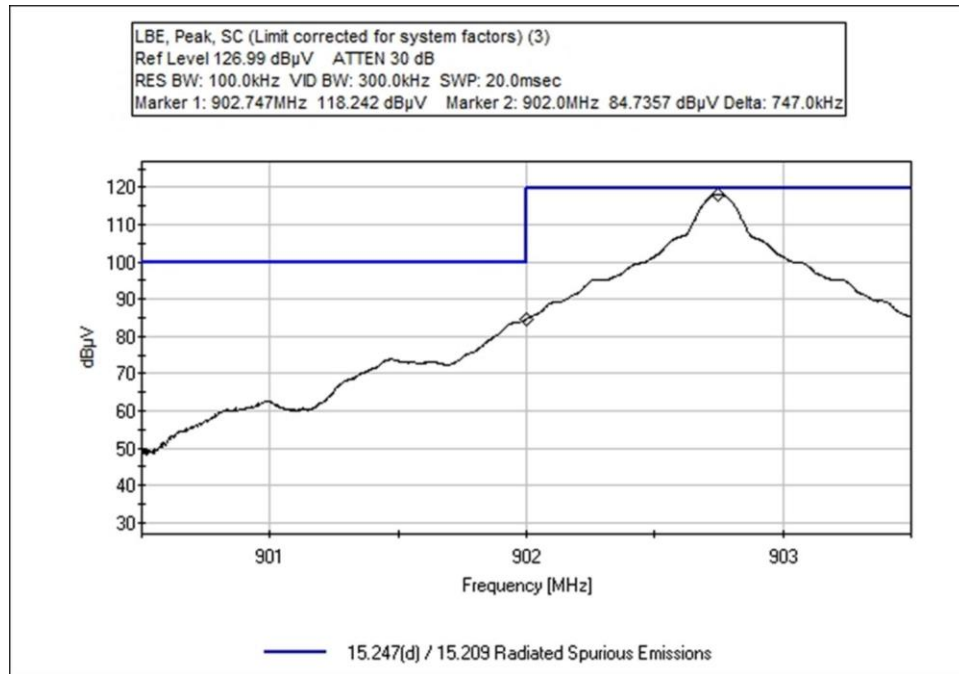


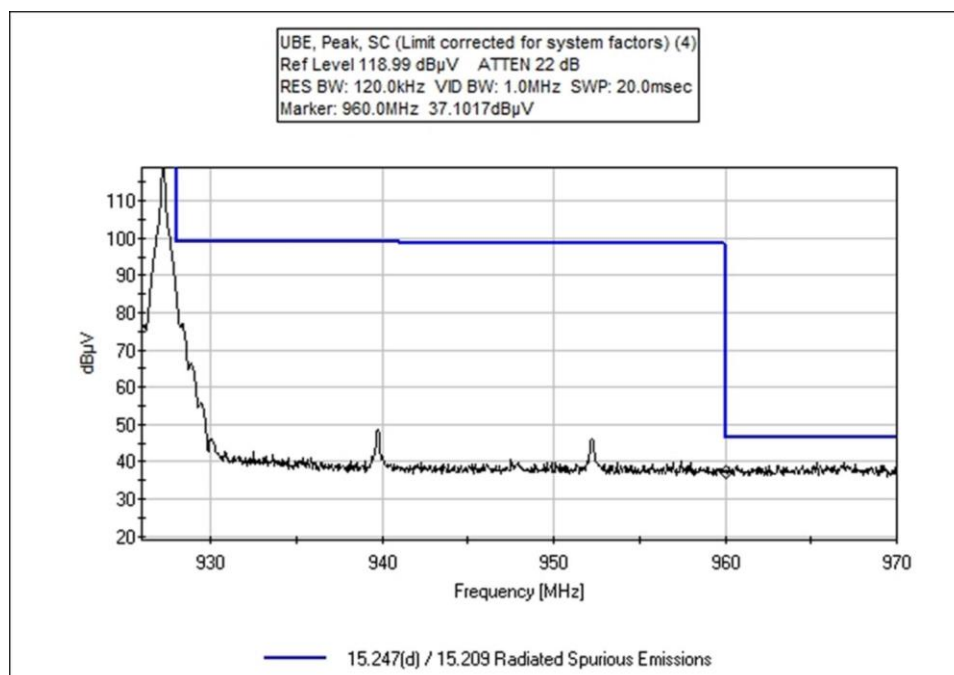
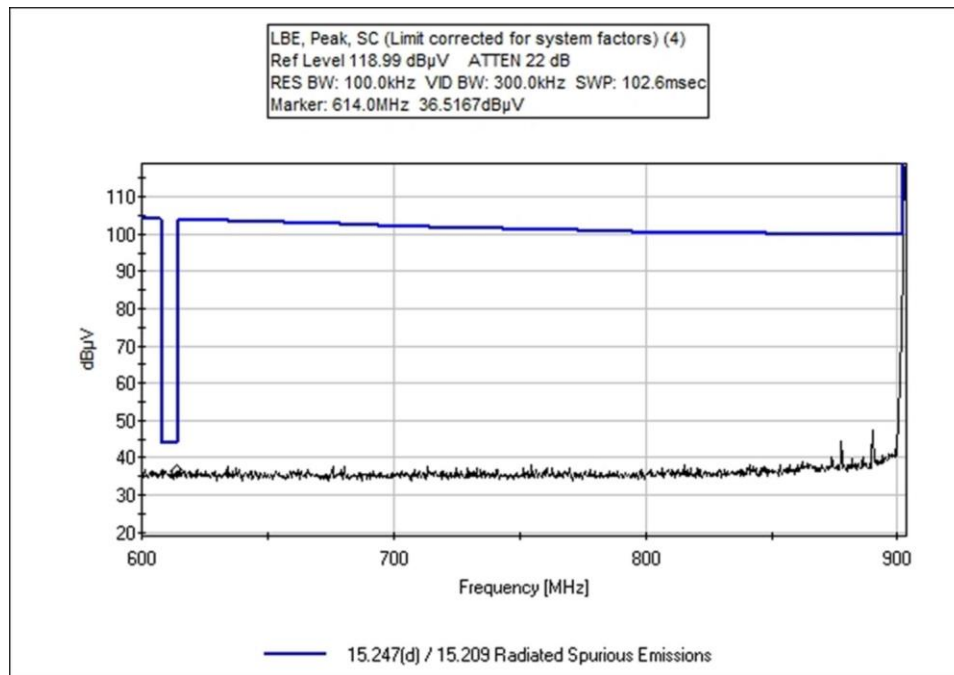


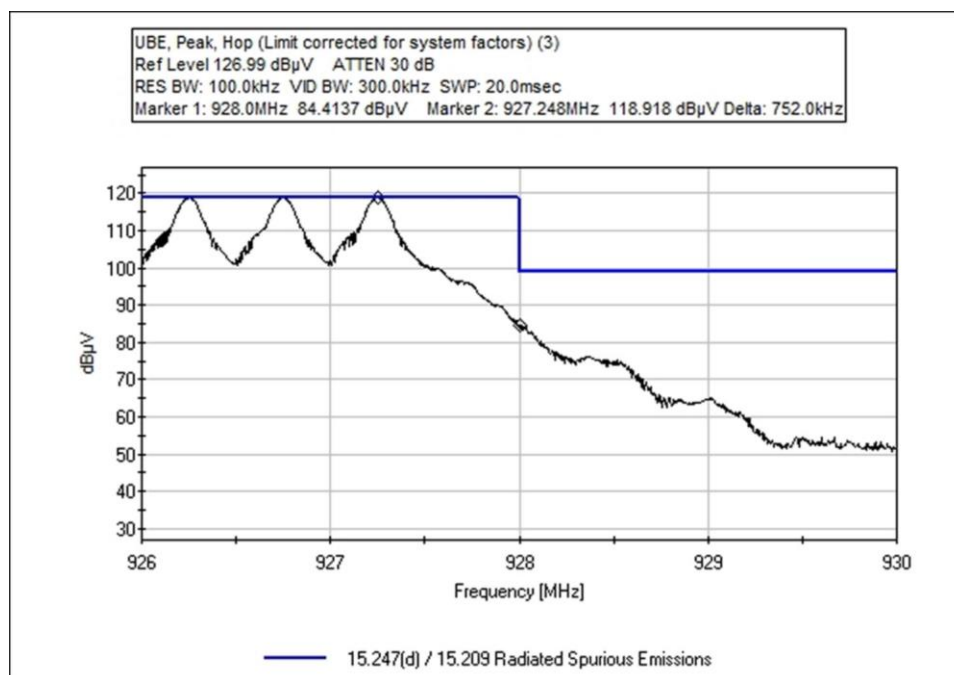
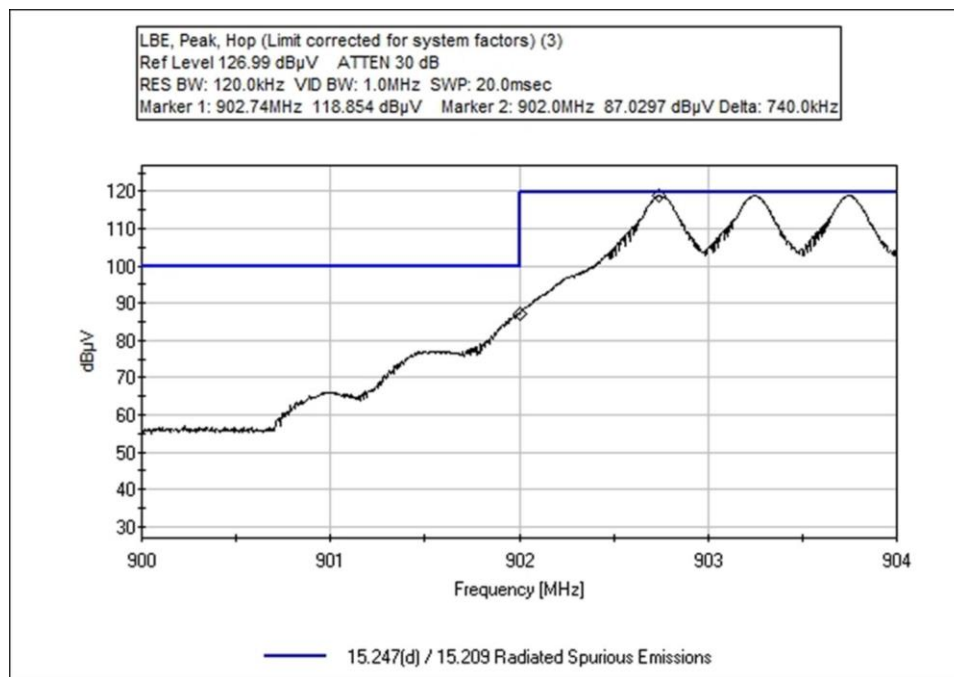


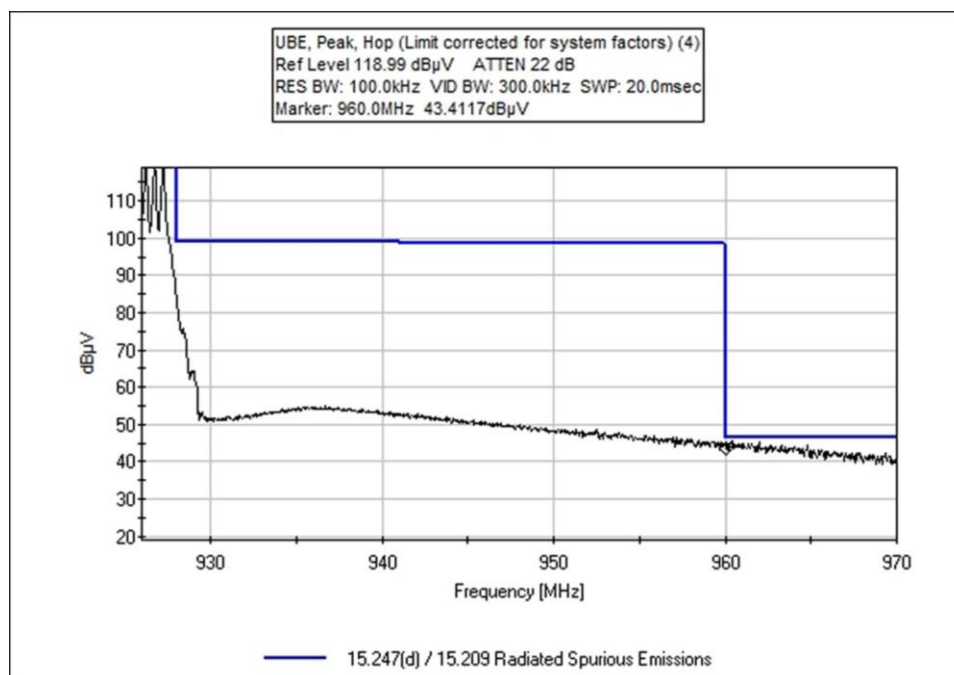
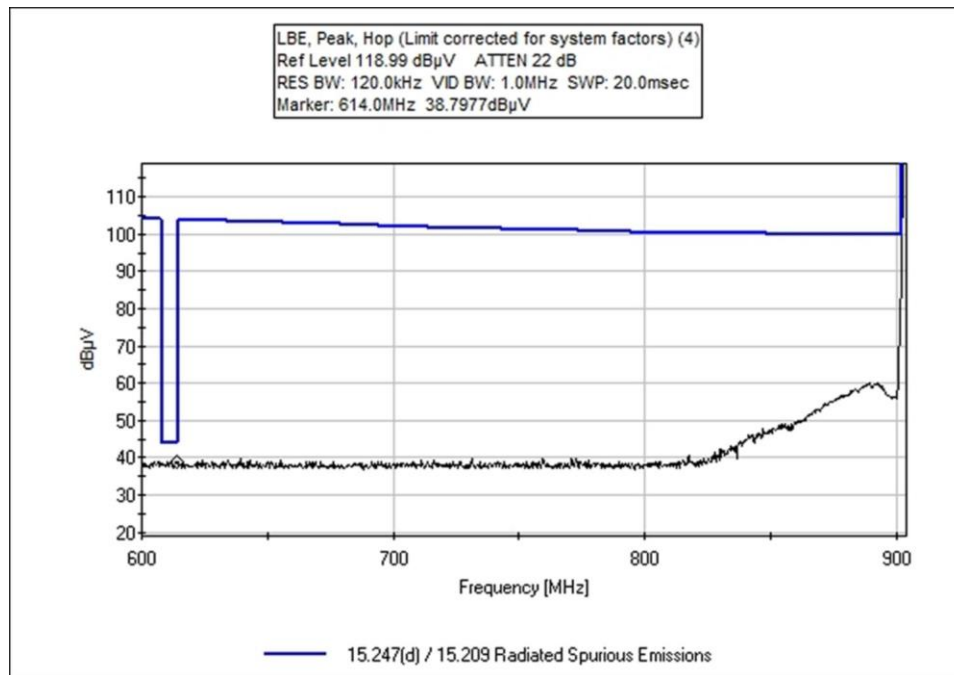


9dBi









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 #: **104294** Date: 8/17/2020
 Test Type: **Maximized Emissions** Time: 14:38:31
 Tested By: Matthew Harrison Sequence#: 6
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C
Humidity: 39%
Pressure: 101.5kPa
Antenna: 7dBi
Frequency Range: 600-970 MHz
Frequencies Tested: 902.75MHz and 927.25MHz
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, Middle, and High channels along with X, Y, & Z EUT axis investigated, worst case reported.
Horizontal and Vertical polarities investigated, worst case reported.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02307	Preamplifier	8447D	1/10/2020	1/10/2022
T2	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T3	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T4	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T5	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T6	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T7	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5 dB	T6 dB	T7 dB		Table	dB μ V/m	dB μ V/m	dB	Ant
1	927.249M	118.9	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	125.8	125.9 Hop	-0.1	Horiz
2	902.752M	119.1	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	125.2	125.9 Hop	-0.7	Horiz
3	927.250M	118.1	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	125.0	125.9 SC	-0.9	Horiz
4	902.750M	118.2	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	124.3	125.9 SC	-1.6	Horiz
5	960.000M QP	27.4	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	34.8	54.0 SC	-19.2	Horiz
6	614.000M QP	23.4	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	25.4	46.0 Hop	-20.6	Horiz
7	960.000M QP	26.0	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	33.4	54.0 Hop	-20.6	Horiz
^	960.000M	42.2	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	49.6	54.0 Hop	-4.4	Horiz
^	960.000M	35.9	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	43.3	54.0 SC	-10.7	Horiz
10	614.000M QP	23.3	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	25.3	46.0 SC	-20.7	Horiz
^	614.000M	37.2	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	39.2	46.0 Hop	-6.8	Horiz
^	614.000M	35.2	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	37.2	46.0 SC	-8.8	Horiz
13	928.000M	74.3	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	81.2	105.9 SC	-24.7	Horiz
14	902.000M	71.5	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	77.6	105.9 SC	-28.3	Horiz
15	902.000M	55.2	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	61.3	105.9 Hop	-44.6	Horiz
16	928.000M	48.7	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	55.6	105.9 Hop	-50.3	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 #: **104294** Date: 8/19/2020
 Test Type: **Maximized Emissions** Time: 10:48:31
 Tested By: Matthew Harrison Sequence#: 10
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C Humidity: 39% Pressure: 101.5kPa Antenna: 9dBi Frequency Range: 600-970 MHz Frequencies Tested: 902.75MHz and 927.25MHz 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, Middle, and High channels along with X, Y, & Z EUT axis investigated, worst case reported. Horizontal and Vertical polarities investigated, worst case reported.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02307	Preamplifier	8447D	1/10/2020	1/10/2022
T2	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T3	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T4	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T5	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T6	ANP06540	Cable	Helix	8/23/2019	8/23/2021
T7	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5 dB	T6 dB	T7 dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	927.248M	118.9	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	125.8	125.9 Hop	-0.1	Vert
2	927.248M	118.4	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	125.3	125.9 SC	-0.6	Vert
3	902.740M	118.9	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	125.0	125.9 Hop	-0.9	Vert
4	902.747M	118.2	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	124.3	125.9 SC	-1.6	Vert
5	902.000M	87.0	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	93.1	105.9 Hop	-12.8	Vert
6	928.000M	85.1	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	92.0	105.9 SC	-13.9	Vert
7	928.000M	84.4	-27.2 +2.2	+24.2 +0.4	+5.8 +0.0	+1.5	+0.0	91.3	105.9 Hop	-14.6	Vert
8	902.000M	84.7	-27.3 +2.1	+23.8 +0.3	+5.8 +0.0	+1.4	+0.0	90.8	105.9 SC	-15.1	Vert
9	960.000M QP	30.4	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	37.8	54.0	-16.2	Vert
10	960.000M QP	28.7	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	36.1	54.0 SC	-17.9	Vert
^	960.000M	43.4	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	50.8	54.0	-3.2	Vert
^	960.000M	37.1	-27.1 +2.2	+24.6 +0.4	+5.8 +0.0	+1.5	+0.0	44.5	54.0 SC	-9.5	Vert
13	614.000M QP	23.4	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	25.4	46.0 Hop	-20.6	Vert
14	614.000M QP	22.6	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	24.6	46.0 SC	-21.4	Vert
^	614.000M	38.8	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	40.8	46.0 Hop	-5.2	Vert
^	614.000M	36.5	-28.2 +1.7	+21.2 +0.3	+5.8 +0.0	+1.2	+0.0	38.5	46.0 SC	-7.5	Vert

Test Setup Photo(s)



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz



X Axis



Y Axis



Z Axis

15.207 AC Conducted Emissions

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: **15.207 AC Mains - Average**
 Work Order #: **104294** Date: 8/19/2020
 Test Type: **Conducted Emissions** Time: 11:23:51
 Tested By: Matthew Harrison Sequence#: 11
 Software: EMITest 5.03.19 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

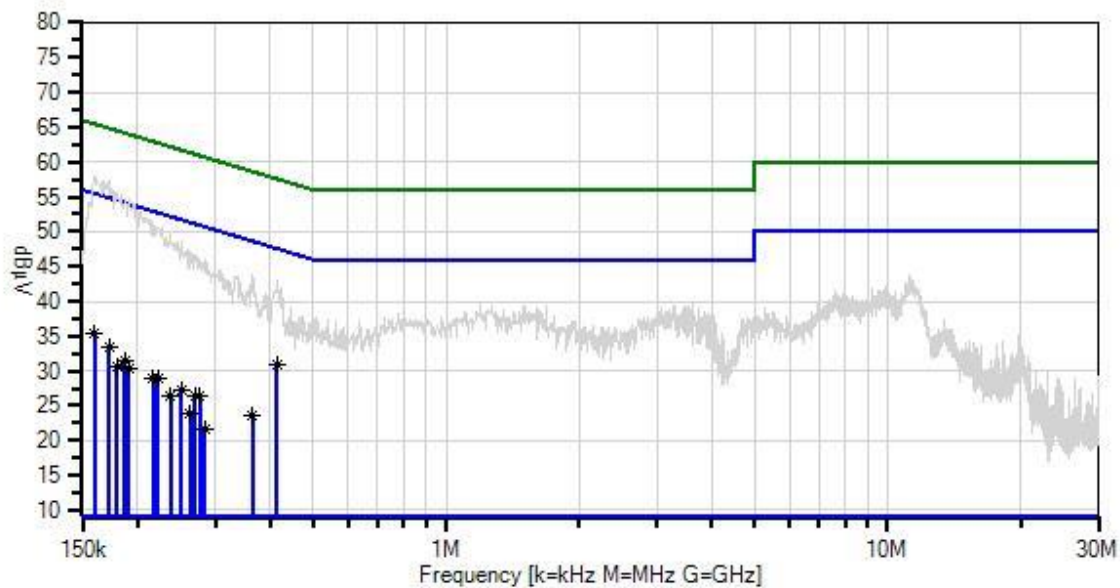
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C
 Humidity: 36%
 Pressure: 101.5kPa

 Frequency Range: 600-970 MHz
 Frequencies Tested: 902.75MHz and 927.25MHz
 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 POE hub and a remote PC via Ethernet cable.
 Low, Middle, and High channels along with X, Y, & Z EUT axis investigated, worst case reported.
 Horizontal and Vertical polarities investigated, worst case reported.

Impinj Inc. WO#: 104294 Sequence#: 11 Date: 8/19/2020
15.207 AC Mains - Average Test Lead: 120V 60Hz Line



— Sweep Data
× QP Readings
Software Version: 5.03.19
— Readings
* Average Readings
— 1 - 15.207 AC Mains - Average
○ Peak Readings
▼ Ambient
— 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
T2	ANP06515	Cable	Heliac	7/1/2020	7/1/2022
T3	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T4	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022

Measurement Data:		Reading listed by margin.						Test Lead: Line			
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V	dB μ V	dB	Ant
1	413.249k	22.0	+9.1	+0.0	+0.0	-0.5	+0.0	30.8	47.6	-16.8	Line
	Ave		+0.2								
^	413.248k	34.1	+9.1	+0.0	+0.0	-0.5	+0.0	42.9	47.6	-4.7	Line
			+0.2								
3	160.181k	27.3	+9.1	+0.0	+0.0	-1.7	+0.0	35.3	55.5	-20.2	Line
	Ave		+0.6								
^	160.180k	50.1	+9.1	+0.0	+0.0	-1.7	+0.0	58.1	55.5	+2.6	Line
			+0.6								
5	172.543k	25.3	+9.1	+0.0	+0.0	-1.5	+0.0	33.3	54.8	-21.5	Line
	Ave		+0.4								
^	172.543k	49.3	+9.1	+0.0	+0.0	-1.5	+0.0	57.3	54.8	+2.5	Line
			+0.4								
7	187.088k	23.3	+9.1	+0.0	+0.0	-1.3	+0.0	31.4	54.2	-22.8	Line
	Ave		+0.3								
8	190.724k	22.3	+9.1	+0.0	+0.0	-1.3	+0.0	30.4	54.0	-23.6	Line
	Ave		+0.3								
^	190.723k	46.6	+9.1	+0.0	+0.0	-1.3	+0.0	54.7	54.0	+0.7	Line
			+0.3								
^	187.087k	46.6	+9.1	+0.0	+0.0	-1.3	+0.0	54.7	54.2	+0.5	Line
			+0.3								
11	221.993k	20.4	+9.1	+0.0	+0.0	-1.0	+0.0	28.8	52.7	-23.9	Line
	Ave		+0.3								
^	221.993k	42.4	+9.1	+0.0	+0.0	-1.0	+0.0	50.8	52.7	-1.9	Line
			+0.3								
13	179.815k	22.5	+9.1	+0.0	+0.0	-1.4	+0.0	30.6	54.5	-23.9	Line
	Ave		+0.4								
^	179.815k	47.6	+9.1	+0.0	+0.0	-1.4	+0.0	55.7	54.5	+1.2	Line
			+0.4								
15	216.903k	20.5	+9.1	+0.0	+0.0	-1.1	+0.0	28.8	52.9	-24.1	Line
	Ave		+0.3								
^	216.902k	43.3	+9.1	+0.0	+0.0	-1.1	+0.0	51.6	52.9	-1.3	Line
			+0.3								
17	251.082k	18.9	+9.1	+0.0	+0.0	-0.9	+0.0	27.3	51.7	-24.4	Line
	Ave		+0.2								
^	251.081k	40.2	+9.1	+0.0	+0.0	-0.9	+0.0	48.6	51.7	-3.1	Line
			+0.2								
19	277.261k	17.9	+9.1	+0.0	+0.0	-0.8	+0.0	26.3	50.9	-24.6	Line
	Ave		+0.1								
^	277.261k	37.7	+9.1	+0.0	+0.0	-0.8	+0.0	46.1	50.9	-4.8	Line
			+0.1								
21	269.262k	17.8	+9.1	+0.0	+0.0	-0.8	+0.0	26.3	51.1	-24.8	Line
	Ave		+0.2								
^	269.261k	38.2	+9.1	+0.0	+0.0	-0.8	+0.0	46.7	51.1	-4.4	Line
			+0.2								
23	363.799k	15.1	+9.1	+0.0	+0.0	-0.6	+0.0	23.7	48.6	-24.9	Line
	Ave		+0.1								
^	363.798k	35.2	+9.1	+0.0	+0.0	-0.6	+0.0	43.8	48.6	-4.8	Line
			+0.1								

25	237.265k	18.2	+9.1	+0.0	+0.0	-1.0	+0.0	26.5	52.2	-25.7	Line
	Ave		+0.2								
^	237.264k	41.7	+9.1	+0.0	+0.0	-1.0	+0.0	50.0	52.2	-2.2	Line
			+0.2								
27	262.717k	15.5	+9.1	+0.0	+0.0	-0.8	+0.0	24.0	51.3	-27.3	Line
	Ave		+0.2								
^	262.716k	38.7	+9.1	+0.0	+0.0	-0.8	+0.0	47.2	51.3	-4.1	Line
			+0.2								
29	283.806k	13.2	+9.1	+0.0	+0.0	-0.8	+0.0	21.6	50.7	-29.1	Line
	Ave		+0.1								
^	283.805k	37.6	+9.1	+0.0	+0.0	-0.8	+0.0	46.0	50.7	-4.7	Line
			+0.1								

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Impinj Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **104294** Date: 8/19/2020
 Test Type: **Conducted Emissions** Time: 11:32:54
 Tested By: Matthew Harrison Sequence#: 12
 Software: EMITest 5.03.19 120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

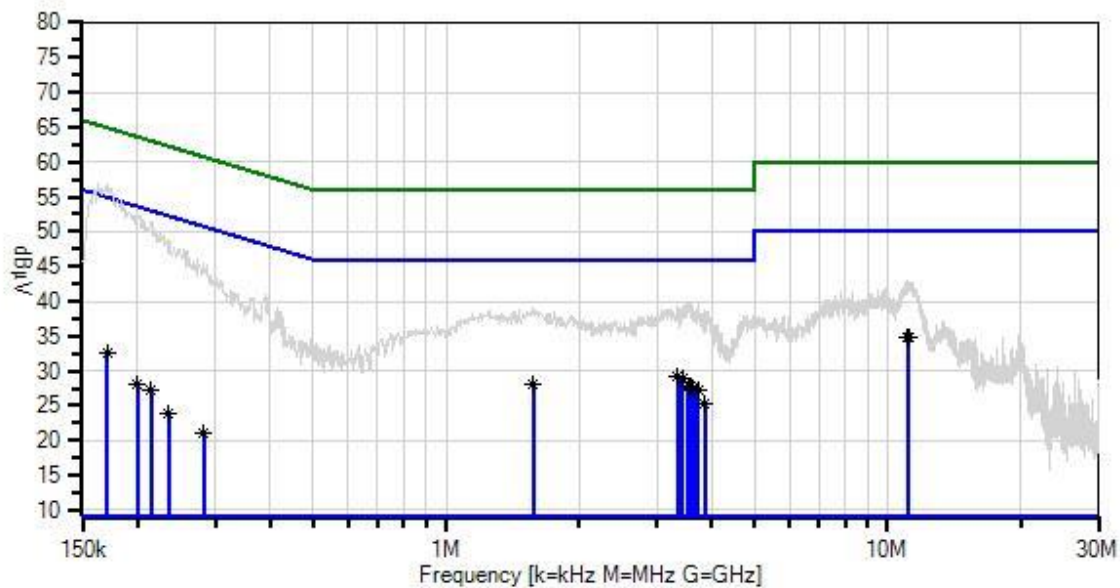
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24°C Humidity: 36% Pressure: 101.5kPa Frequency Range: 600-970 MHz Frequencies Tested: 902.75MHz and 927.25MHz 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 POE hub and a remote PC via Ethernet cable. Low, Middle, and High channels along with X, Y, & Z EUT axis investigated, worst case reported. Horizontal and Vertical polarities investigated, worst case reported.

Impinj Inc. WO#: 104294 Sequence#: 12 Date: 8/19/2020
15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral



— Sweep Data
× QP Readings
Software Version: 5.03.19
— Readings
* Average Readings
— 1 - 15.207 AC Mains - Average
○ Peak Readings
▼ Ambient
— 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
T2	ANP06515	Cable	Heliac	7/1/2020	7/1/2022
T3	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
T4	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022

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	11.139M	26.0	+9.1 +0.1	+0.1	+0.0	-0.5	+0.0	34.8	50.0	-15.2	Neutr
^	11.139M	34.0	+9.1 +0.1	+0.1	+0.0	-0.5	+0.0	42.8	50.0	-7.2	Neutr
3	11.121M	25.9	+9.1 +0.1	+0.1	+0.0	-0.5	+0.0	34.7	50.0	-15.3	Neutr
^	11.121M	34.4	+9.1 +0.1	+0.1	+0.0	-0.5	+0.0	43.2	50.0	-6.8	Neutr
5	3.352M	20.2	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	29.2	46.0	-16.8	Neutr
^	3.352M	30.5	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	39.5	46.0	-6.5	Neutr
7	3.437M	19.8	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	28.8	46.0	-17.2	Neutr
^	3.437M	30.4	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	39.4	46.0	-6.6	Neutr
9	1.579M	19.0	+9.1 +0.2	+0.1	+0.0	-0.3	+0.0	28.1	46.0	-17.9	Neutr
^	1.579M	30.0	+9.1 +0.2	+0.1	+0.0	-0.3	+0.0	39.1	46.0	-6.9	Neutr
11	3.539M	18.8	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	27.8	46.0	-18.2	Neutr
^	3.539M	31.0	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	40.0	46.0	-6.0	Neutr
13	3.599M	18.7	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	27.7	46.0	-18.3	Neutr
^	3.599M	30.4	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	39.4	46.0	-6.6	Neutr
15	3.624M	18.6	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	27.6	46.0	-18.4	Neutr
^	3.624M	30.3	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	39.3	46.0	-6.7	Neutr
17	3.727M	18.2	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	27.2	46.0	-18.8	Neutr
^	3.727M	30.6	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	39.6	46.0	-6.4	Neutr
19	3.854M	16.3	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	25.3	46.0	-20.7	Neutr
^	3.854M	29.8	+9.1 +0.1	+0.1	+0.0	-0.3	+0.0	38.8	46.0	-7.2	Neutr
21	171.088k	24.5	+9.1 +0.4	+0.0	+0.0	-1.5	+0.0	32.5	54.9	-22.4	Neutr
^	171.087k	48.8	+9.1 +0.4	+0.0	+0.0	-1.5	+0.0	56.8	54.9	+1.9	Neutr
23	199.449k	20.0	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	28.1	53.6	-25.5	Neutr
^	199.449k	45.2	+9.1 +0.2	+0.0	+0.0	-1.2	+0.0	53.3	53.6	-0.3	Neutr

25	214.720k	19.0	+9.1	+0.0	+0.0	-1.1	+0.0	27.3	53.0	-25.7	Neutr
	Ave		+0.3								
^	214.720k	43.2	+9.1	+0.0	+0.0	-1.1	+0.0	51.5	53.0	-1.5	Neutr
			+0.3								
27	235.809k	15.6	+9.1	+0.0	+0.0	-0.9	+0.0	24.0	52.2	-28.2	Neutr
	Ave		+0.2								
^	235.809k	40.7	+9.1	+0.0	+0.0	-0.9	+0.0	49.1	52.2	-3.1	Neutr
			+0.2								
29	282.350k	12.6	+9.1	+0.0	+0.0	-0.8	+0.0	21.0	50.7	-29.7	Neutr
	Ave		+0.1								
^	282.350k	37.1	+9.1	+0.0	+0.0	-0.8	+0.0	45.5	50.7	-5.2	Neutr
			+0.1								

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.