

Impinj Inc.

TEST REPORT FOR

R700 RAIN RFID Reader

Model: IPJ-R700-341

DC-DC Converter

Model: ADM00865

Sensor

Model: EQ-511

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

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

Report No.: 107623-1

Date of issue: October 31, 2022



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.

Test Certificate # 803.01

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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

REPORT PREPARED BY:

Viviana Prado
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107623

DATE OF EQUIPMENT RECEIPT:

October 21, 2022

DATE(S) OF TESTING:

October 21, 24, and 25, 2022

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.
Canyon Park
22116 23rd Drive S.E., 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	NP
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 Inc. was not contracted to perform test.

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

None

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

The manufacturer declares that the 4 x Ferrites 0431164281 (or equivalent) installed on the DC-DC converter and sensors are part of the standard bill of material for the EUT system.

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
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-p11US-FL-200	100016800220310000036

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-p12US-FLSMA-200.01	10020001222290000002

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-p13US-ESSMA-200.01	100024001220280000016

Configuration 4

Equipment Tested:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-p16US-FRSMA-200.01	10029201220280000008

Configuration 5

Equipment Tested:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-p33US-FLSMA-200.01	100033601213580000005

Configuration 6

Equipment Tested:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352
DC-DC Converter	Microchip Technology Inc.	ADM00865	NA
Sensor	Panasonic	EQ-511	NA
Sensor	Panasonic	EQ-511	NA

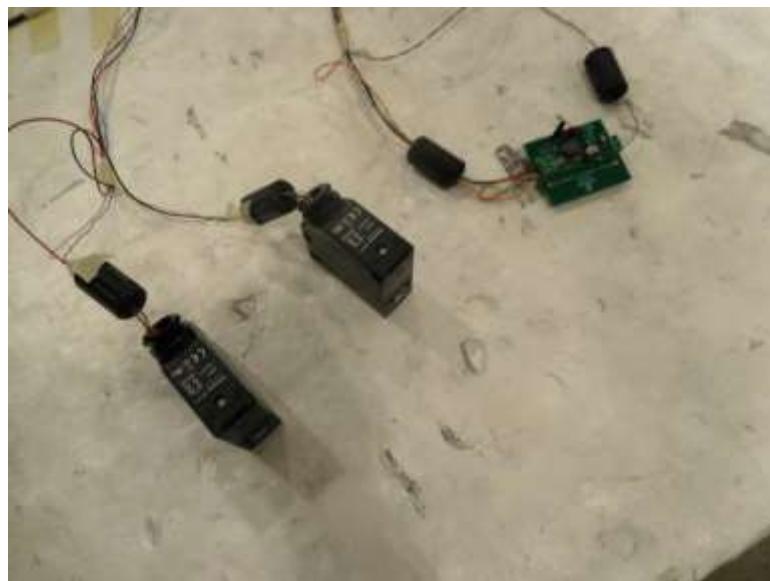
Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Keonn	ADAN-SP12US-PROSMA-1-100.04	10022204213630000002

General Product Information:

Product Information		Manufacturer-Provided Details
Equipment Type:		Stand-Alone Equipment
Type of Wideband System:		FHSS
Operating Frequency Range:		902.75 - 927.25MHz
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:		Various, 6 configurations tested in this report with the following linear gain values: 1.1dBi, 3.5dBi, 5.1dBi, 6.8dBi, 8.0dBi, 6.8dBi (depending on the antenna, a certain cable loss is declared and used)
Beamforming Type:		NA
Antenna Connection Type:		External Connector
Nominal Input Voltage:		120VAC
Firmware / Software used for Test:		Impinj Item Test v2.0.0-Preview-545
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)

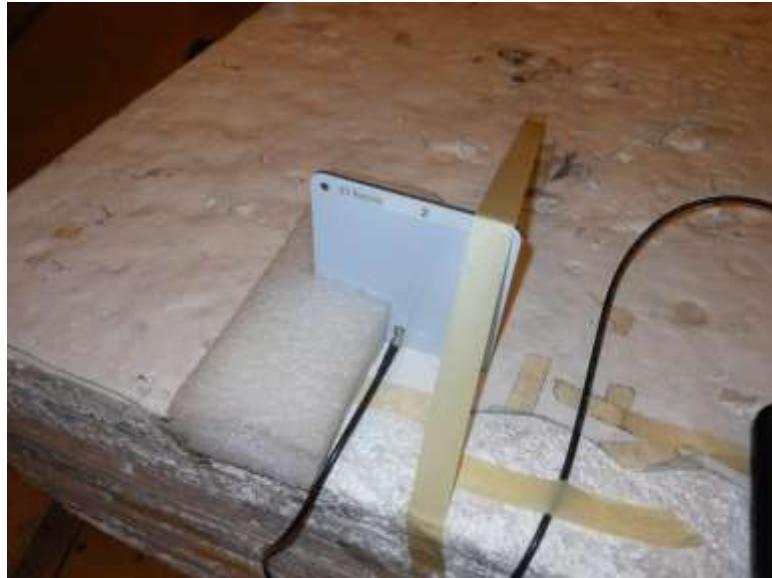


DC-DC and Sensors



EUT Reader

Support Equipment Photo(s)



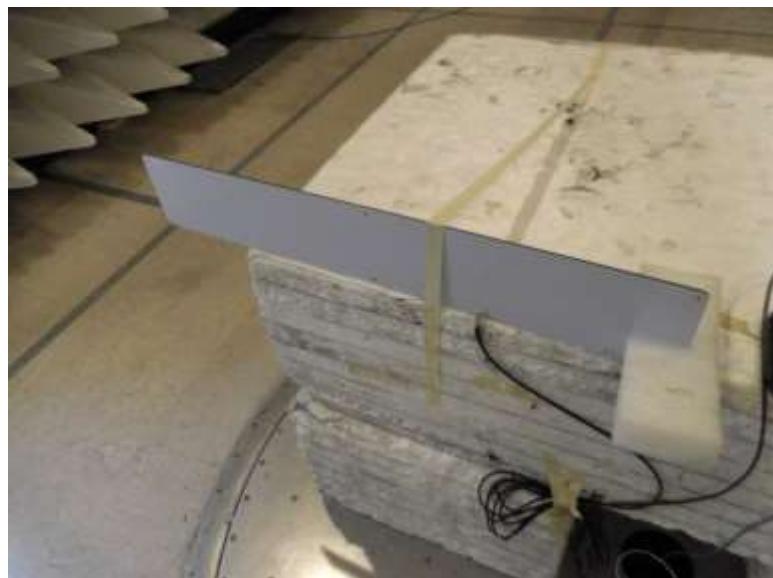
Configuration 1



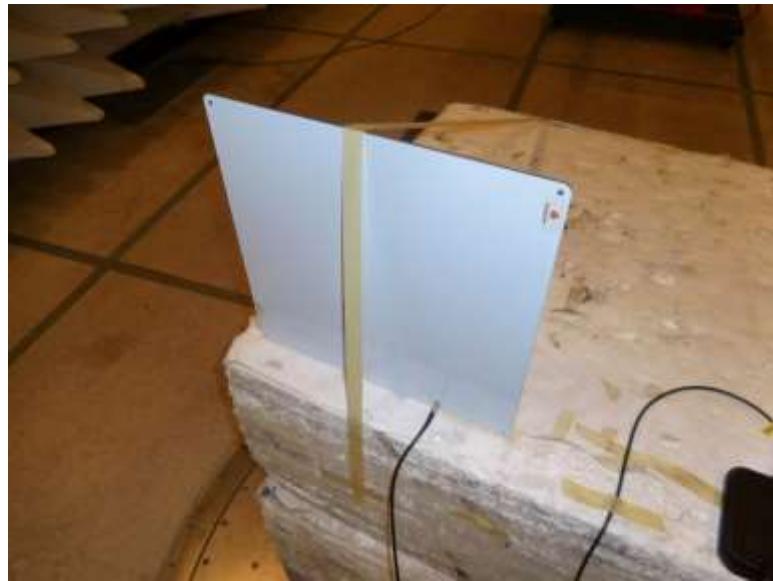
Configuration 2



Configuration 3



Configuration 4



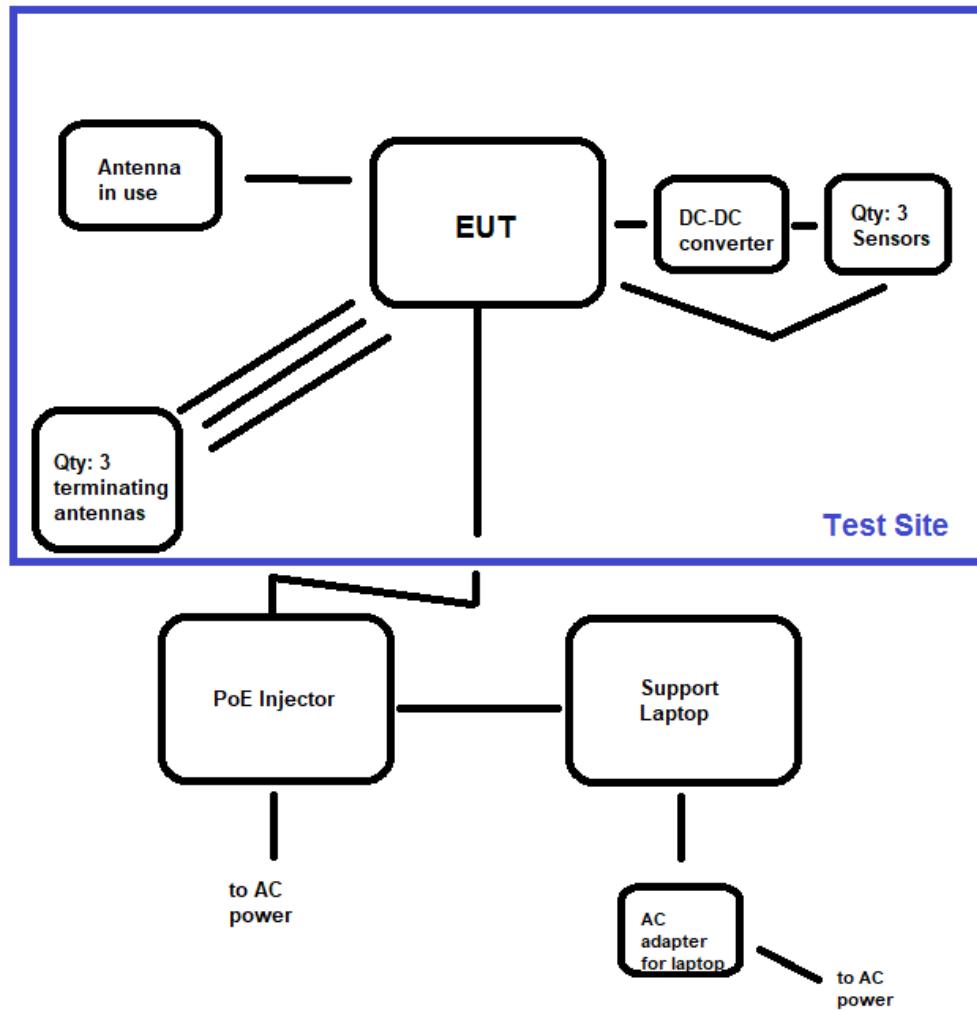
Configuration 5



Configuration 6

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Maximized Emissions** Time: 09:45:11
Tested By: Matt Harrison Sequence#: 2
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: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 9k-10GHz

Frequencies Tested: 902.75, 915.25, 927.25

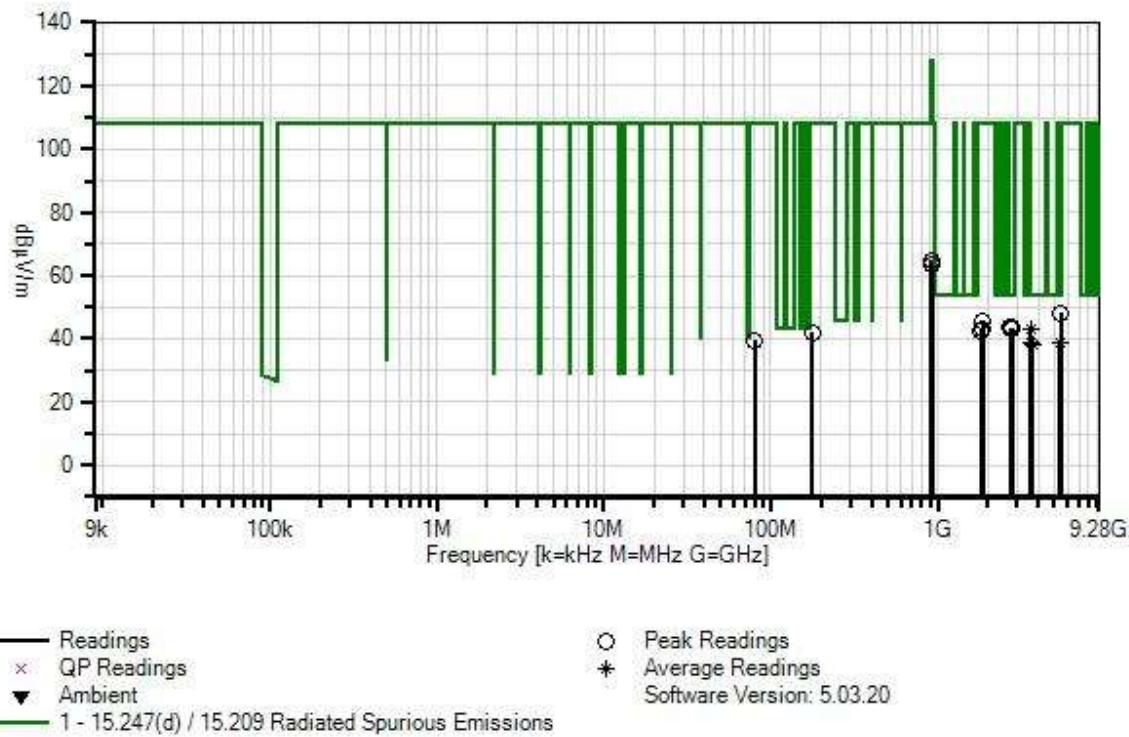
Firmware Power Setting: 33 dBm

Antenna Type: Patch

Antenna Gain: 1.1 dBiL.

Test Setup:

Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. W/O#: 107623 Sequence#: 2 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T4	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T5	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T9	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T10	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	2708.505M	44.3	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.2 +0.0	+29.5 +0.0	+0.0	43.6	54.0	-10.4	Vert	
2	2781.665M	44.2	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0	+0.0	43.4	54.0	-10.6	Vert	
3	2745.910M	44.1	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0	+0.0	43.3	54.0	-10.7	Vert	
4	3611.000M	40.9	+0.0 Ave	+0.5 +3.2 +0.0	-33.8 +0.3 +0.0	+31.7 +0.0	+0.0	43.2	54.0	-10.8	Horiz	
^	3611.000M	47.5	+0.0 +3.2 +0.0	+0.5 +0.4 +0.0	-33.8 +0.3 +0.0	+31.7 +0.0	+0.0	49.8	54.0	-4.2	Horiz	
6	5416.500M	31.9	+0.0 Ave	+0.8 +4.0 +0.0	-33.6 +0.6 +0.0	+34.7 +0.4 +0.0	+0.0	38.8	54.0	-15.2	Horiz	
^	5416.500M	43.1	+0.0 +4.0 +0.0	+0.8 +0.6 +0.0	-33.6 +0.4 +0.0	+34.7 +0.0	+0.0	50.0	54.0	-4.0	Horiz	
8	3661.000M	36.3	+0.0 Ave	+0.6 +3.3 +0.0	-33.8 +0.4 +0.0	+31.7 +0.2 +0.0	+0.0	38.7	54.0	-15.3	Horiz	
^	3661.000M	44.8	+0.0 +3.3 +0.0	+0.6 +0.4 +0.0	-33.8 +0.2 +0.0	+31.7 +0.0	+0.0	47.2	54.0	-6.8	Horiz	
10	3709.000M	35.4	+0.0 Ave	+0.6 +3.3 +0.0	-33.8 +0.3 +0.0	+32.0 +0.2 +0.0	+0.0	38.0	54.0	-16.0	Horiz	
^	3709.000M	44.4	+0.0 +3.3 +0.0	+0.6 +0.3 +0.0	-33.8 +0.2 +0.0	+32.0 +0.0	+0.0	47.0	54.0	-7.0	Horiz	
12	928.200M	28.5	+0.0 +1.5 +30.6	+0.3 +0.0 +2.4	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	63.3	108.0	-44.7	Horiz	
13	5491.295M	41.5	+0.0 +4.0 +0.0	+0.8 +0.5 +0.0	-33.6 +0.4 +0.0	+34.7 +0.0 +0.0	+0.0	48.3	108.0	-59.7	Horiz	
14	1854.655M	48.9	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.7 +0.0 +0.0	+0.0	45.3	108.0	-62.7	Vert	
15	915.600M	30.9	+0.0 +1.5 +29.9	+0.3 +0.0 +2.4	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	65.0	128.0	-63.0	Horiz	

16	1830.405M	46.9	+0.0	+0.4	-34.7	+27.5	+0.0	43.1	108.0	-64.9	Vert
			+2.1	+0.3	+0.6	+0.0					
			+0.0	+0.0							
17	1805.500M	46.2	+0.0	+0.4	-34.7	+27.3	+0.0	42.2	108.0	-65.8	Vert
			+2.1	+0.3	+0.6	+0.0					
			+0.0	+0.0							
18	177.400M	24.6	+0.0	+0.1	+0.0	+0.0	+0.0	41.9	108.0	-66.1	Vert
			+0.6	+0.0	+0.0	+0.0					
			+15.7	+0.9							
19	80.400M	25.7	+0.0	+0.1	+0.0	+0.0	+0.0	39.4	108.0	-68.6	Vert
			+0.4	+0.0	+0.0	+0.0					
			+12.6	+0.6							
20	28.687M	24.2	+0.0	+0.1	+0.0	+0.0	-40.0	-11.3	108.0	-119.3	Perp/
			+0.2	+0.0	+0.0	+4.2					
			+0.0	+0.0							
21	13.433M	17.2	+0.0	+0.0	+0.0	+0.0	-40.0	-14.0	108.0	-122.0	Perp/
			+0.2	+0.0	+0.0	+8.6					
			+0.0	+0.0							
22	28.567M	21.3	+0.0	+0.1	+0.0	+0.0	-40.0	-14.2	108.0	-122.2	Perp/
			+0.2	+0.0	+0.0	+4.2					
			+0.0	+0.0							



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Maximized Emissions** Time: 09:58:54
Tested By: Matt Harrison Sequence#: 3
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Test Environment Conditions:

Temperature: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 9k-10GHz

Frequencies Tested: 902.75, 915.25, 927.25

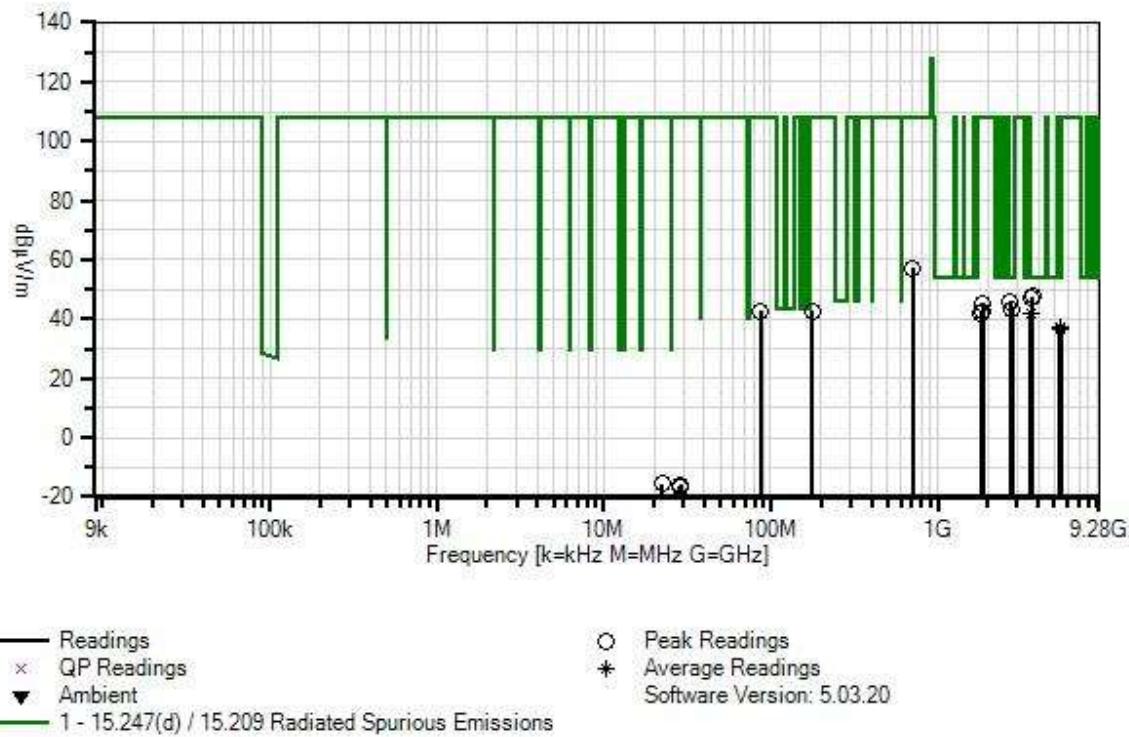
Firmware Power Setting: 33 dBm

Antenna Type: Patch

Antenna Gain: 3.5 dBiL.

Test Setup:

Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. WO#: 107623 Sequence#: 3 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T4	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T5	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T9	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T10	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3709.000M	45.0	+0.0 +3.3 +0.0	+0.6 +0.3 +0.0	-33.8 +0.2	+32.0 +0.0	+0.0	47.6	54.0	-6.4	Horiz	
2	3660.720M	44.5	+0.0 +3.3 +0.0	+0.6 +0.4 +0.0	-33.8 +0.2	+31.7 +0.0	+0.0	46.9	54.0	-7.1	Horiz	
3	2708.185M	46.6	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.2	+29.5 +0.0	+0.0	45.9	54.0	-8.1	Vert	
4	2781.635M	44.1	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+0.0	43.3	54.0	-10.7	Vert	
5	2745.770M	43.7	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+0.0	42.9	54.0	-11.1	Vert	
6	3611.000M	39.7	+0.0 Ave	+0.5 +0.4 +0.0	-33.8 +0.3	+31.7 +0.0	+0.0	42.0	54.0	-12.0	Horiz	
^	3611.000M	46.6	+0.0 +3.2 +0.0	+0.5 +0.4 +0.0	-33.8 +0.3	+31.7 +0.0	+0.0	48.9	54.0	-5.1	Horiz	
8	5416.500M	30.1	+0.0 Ave	+0.8 +0.6 +0.0	-33.6 +0.4	+34.7 +0.0	+0.0	37.0	54.0	-17.0	Horiz	
^	5416.455M	42.1	+0.0 +4.0 +0.0	+0.8 +0.6 +0.0	-33.6 +0.4	+34.7 +0.0	+0.0	49.0	54.0	-5.0	Horiz	
10	711.900M	25.3	+0.0 +1.3 +28.3	+0.3 +0.0 +2.1	+0.0 +0.0	+0.0 +0.0	+0.0	57.3	108.0	-50.7	Vert	
11	1854.285M	48.9	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.7 +0.0	+0.0	45.3	108.0	-62.7	Vert	
12	177.400M	25.4	+0.0 +0.6 +15.7	+0.1 +0.0 +0.9	+0.0 +0.0	+0.0 +0.0	+0.0	42.7	108.0	-65.3	Vert	
13	87.200M	29.0	+0.0 +0.4 +12.5	+0.1 +0.0 +0.6	+0.0 +0.0	+0.0 +0.0	+0.0	42.6	108.0	-65.4	Vert	
14	1830.200M	46.2	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.5 +0.0	+0.0	42.4	108.0	-65.6	Horiz	
15	1805.485M	45.9	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.3 +0.0	+0.0	41.9	108.0	-66.1	Horiz	

16	5491.500M	29.7	+0.0	+0.8	-33.6	+34.7	+0.0	36.5	108.0	-71.5	Vert
	Ave		+4.0	+0.5	+0.4	+0.0					
			+0.0	+0.0							
^	5491.500M	42.5	+0.0	+0.8	-33.6	+34.7	+0.0	49.3	108.0	-58.7	Vert
			+4.0	+0.5	+0.4	+0.0					
			+0.0	+0.0							
18	22.209M	17.8	+0.0	+0.1	+0.0	+0.0	-40.0	-15.7	108.0	-123.7	Perp/
			+0.2	+0.0	+0.0	+6.2					
			+0.0	+0.0							
19	28.687M	19.5	+0.0	+0.1	+0.0	+0.0	-40.0	-16.0	108.0	-124.0	Perp/
			+0.2	+0.0	+0.0	+4.2					
			+0.0	+0.0							
20	28.299M	18.6	+0.0	+0.1	+0.0	+0.0	-40.0	-16.7	108.0	-124.7	Perp/
			+0.2	+0.0	+0.0	+4.4					
			+0.0	+0.0							



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Maximized Emissions** Time: 10:21:46
Tested By: Matt Harrison Sequence#: 4
Software: EMITest 5.03.20

Equipment Tested:

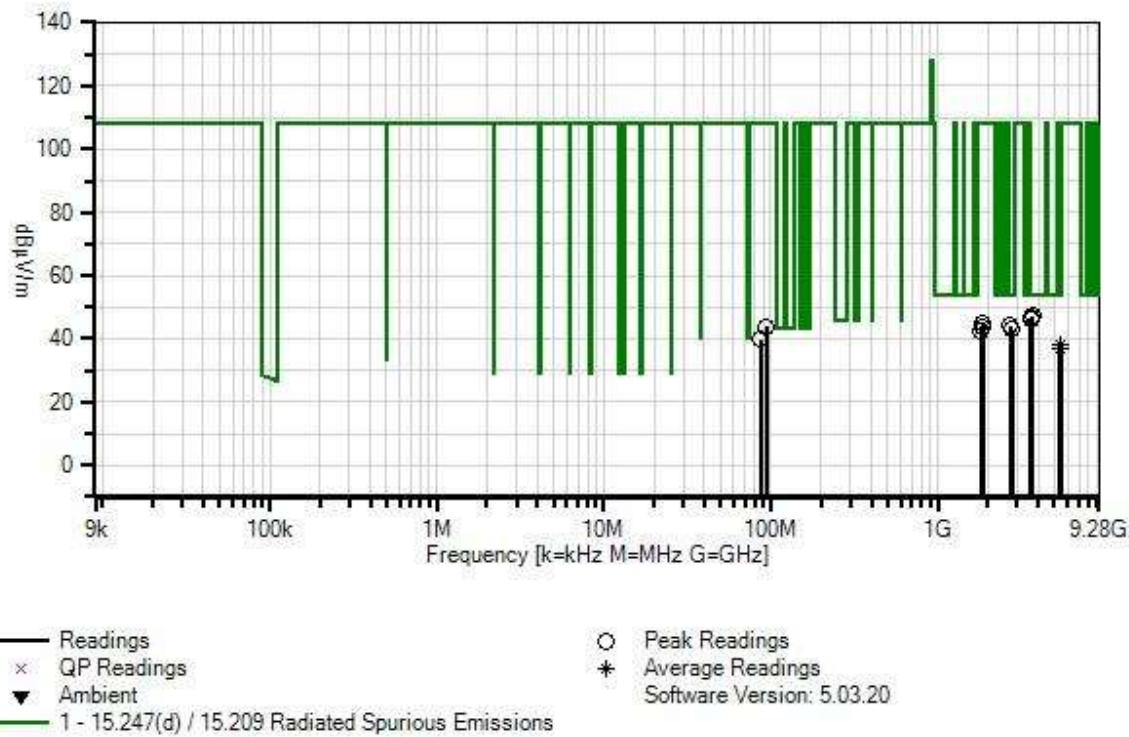
Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 51% Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency Range: 9k-10GHz Frequencies Tested: 902.75, 915.25, 927.25 Firmware Power Setting: 33 dBm
Antenna Type: Patch Antenna Gain: 5.1 dBiL.
Test Setup: Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. W/O#: 107623 Sequence#: 4 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T2	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T3	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T4	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T6	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T7	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T8	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T9	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
			dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
			MHz	dB μ V							
1	3708.985M	44.5	+0.6 +0.3 +0.0	-33.8 +0.2 +0.0	+32.0 +0.0 +0.0	+3.3 +0.0	+0.0	47.1	54.0	-6.9	Horiz
2	3610.930M	44.4	+0.5 +0.4 +0.0	-33.8 +0.3 +0.0	+31.7 +0.0 +0.0	+3.2 +0.0	+0.0	46.7	54.0	-7.3	Horiz
3	3660.905M	44.0	+0.6 +0.4 +0.0	-33.8 +0.2 +0.0	+31.7 +0.0 +0.0	+3.3 +0.0	+0.0	46.4	54.0	-7.6	Horiz
4	2708.250M	44.9	+0.5 +0.5 +0.0	-34.1 +0.2 +0.0	+29.5 +0.0 +0.0	+2.7 +0.0	+0.0	44.2	54.0	-9.8	Horiz
5	2781.305M	43.8	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0 +0.0	+2.7 +0.0	+0.0	43.0	54.0	-11.0	Horiz
6	2745.555M	43.6	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0 +0.0	+2.7 +0.0	+0.0	42.8	54.0	-11.2	Horiz
7	5416.500M	31.0	+0.8 Ave	-33.6 +0.6 +0.0	+34.7 +0.4 +0.0	+4.0 +0.0	+0.0	37.9	54.0	-16.1	Vert
^	5416.500M	42.1	+0.8 +0.6 +0.0	-33.6 +0.4 +0.0	+34.7 +0.0 +0.0	+4.0 +0.0	+0.0	49.0	54.0	-5.0	Vert
9	1854.565M	48.6	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.7 +0.0 +0.0	+2.1 +0.0	+0.0	45.0	108.0	-63.0	Vert
10	1830.485M	47.8	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.5 +0.0 +0.0	+2.1 +0.0	+0.0	44.0	108.0	-64.0	Horiz
11	94.000M	29.6	+0.1 +0.0 +0.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.5 +13.1	+0.0	43.9	108.0	-64.1	Vert
12	1805.250M	46.2	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.3 +0.0 +0.0	+2.1 +0.0	+0.0	42.2	108.0	-65.8	Horiz
13	86.300M	26.4	+0.1 +0.0 +0.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.4 +12.4	+0.0	39.9	108.0	-68.1	Vert

14	5491.500M	30.1	+0.8	-33.6	+34.7	+4.0	+0.0	36.9	108.0	-71.1	Horiz
	Ave		+0.5	+0.4	+0.0	+0.0					
			+0.0								
^	5491.500M	41.9	+0.8	-33.6	+34.7	+4.0	+0.0	48.7	108.0	-59.3	Horiz
			+0.5	+0.4	+0.0	+0.0					
			+0.0								
16	20.388M	20.5	+0.1	+0.0	+0.0	+0.2	-40.0	-12.9	108.0	-120.9	Perp/
			+0.0	+0.0	+6.3	+0.0					
			+0.0								
17	29.224M	22.4	+0.1	+0.0	+0.0	+0.3	-40.0	-13.3	108.0	-121.3	Perp/
			+0.0	+0.0	+3.9	+0.0					
			+0.0								



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Maximized Emissions** Time: 10:58:52
Tested By: Matt Harrison Sequence#: 5
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

Test Environment Conditions:

Temperature: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 9k-10GHz

Frequencies Tested: 902.75, 915.25, 927.25

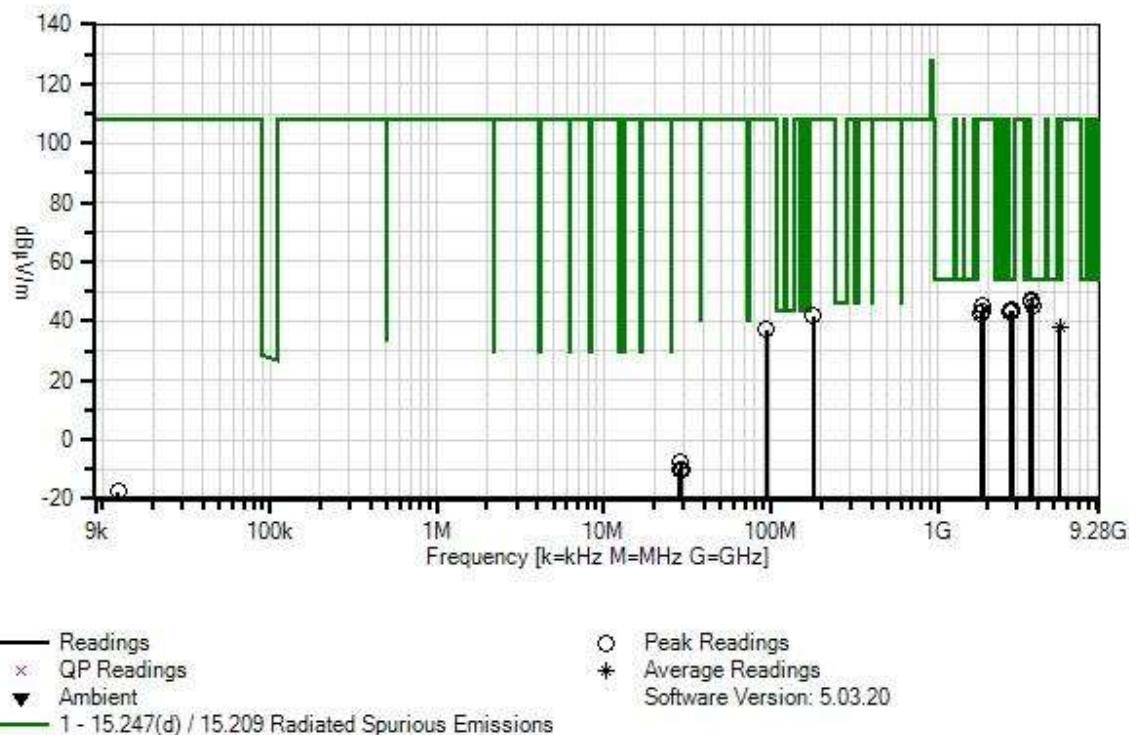
Firmware Power Setting: 33 dBm

Antenna Type: Patch

Antenna Gain: 6.8 dBiL.

Test Setup:

Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. W/O#: 107623 Sequence#: 5 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T4	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T5	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T9	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T10	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3661.085M	44.8	+0.0 +3.3 +0.0	+0.6 +0.4 +0.0	-33.8 +0.2	+31.7 +0.0	+0.0	47.2	54.0	-6.8	Horiz	
2	3611.155M	44.2	+0.0 +3.2 +0.0	+0.5 +0.4 +0.0	-33.8 +0.3	+31.7 +0.0	+0.0	46.5	54.0	-7.5	Horiz	
3	3709.435M	42.8	+0.0 +3.3 +0.0	+0.6 +0.3 +0.0	-33.8 +0.2	+32.0 +0.0	+0.0	45.4	54.0	-8.6	Vert	
4	2745.745M	44.4	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+0.0	43.6	54.0	-10.4	Horiz	
5	2708.125M	44.2	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.2	+29.5 +0.0	+0.0	43.5	54.0	-10.5	Vert	
6	2781.600M	44.2	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+0.0	43.4	54.0	-10.6	Vert	
7	5416.500M	30.8	+0.0 Ave	+0.8 +0.6 +0.0	-33.6 +0.4 +0.0	+34.7 +0.4	+0.0	37.7	54.0	-16.3	Horiz	
^	5416.500M	43.0	+0.0 +4.0 +0.0	+0.8 +0.6 +0.0	-33.6 +0.4	+34.7 +0.0	+0.0	49.9	54.0	-4.1	Horiz	
9	1854.610M	48.6	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.7 +0.0	+0.0	45.0	108.0	-63.0	Horiz	
10	1830.345M	47.3	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.5 +0.0	+0.0	43.5	108.0	-64.5	Horiz	
11	1805.735M	46.7	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.3 +0.0	+0.0	42.7	108.0	-65.3	Vert	
12	179.400M	24.4	+0.0 +0.6 +15.8	+0.1 +0.0 +0.9	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	41.8	108.0	-66.2	Vert	
13	94.000M	22.8	+0.0 +0.5 +13.1	+0.1 +0.0 +0.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	37.1	108.0	-70.9	Vert	

14	28.687M	27.7	+0.0	+0.1	+0.0	+0.0	-40.0	-7.8	108.0	-115.8	Perp/
			+0.2	+0.0	+0.0		+4.2				
			+0.0	+0.0							
15	28.567M	25.6	+0.0	+0.1	+0.0	+0.0	-40.0	-9.9	108.0	-117.9	Perp/
			+0.2	+0.0	+0.0		+4.2				
			+0.0	+0.0							
16	29.224M	25.5	+0.0	+0.1	+0.0	+0.0	-40.0	-10.2	108.0	-118.2	Perp/
			+0.3	+0.0	+0.0		+3.9				
			+0.0	+0.0							
17	12.384k	47.2	+0.0	+0.1	+0.0	+0.0	-80.0	-17.6	108.0	-125.6	Perp/
			+0.0	+0.0	+0.0		+15.1				
			+0.0	+0.0							



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Maximized Emissions** Time: 11:34:00
Tested By: Matt Harrison Sequence#: 6
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

Test Conditions / Notes:

Test Environment Conditions:

Temperature: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 9k-10GHz

Frequencies Tested: 902.75, 915.25, 927.25

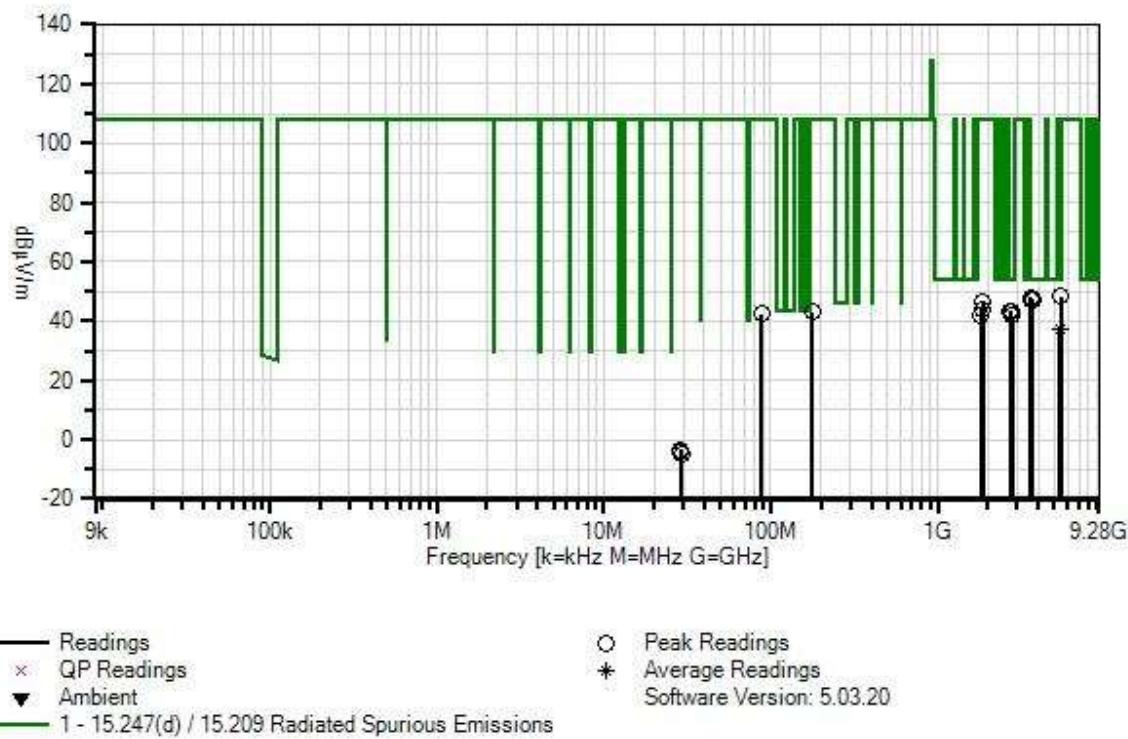
Firmware Power Setting: 33 dBm

Antenna Type: Patch

Antenna Gain: 8 dBiL.

Test Setup:

Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. W/O#: 107623 Sequence#: 6 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T2	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T3	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T4	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T6	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T7	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T8	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T9	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3611.085M	45.6	+0.5 +0.4 +0.0	-33.8 +0.3	+31.7 +0.0	+3.2 +0.0	+0.0	47.9	54.0	-6.1	Horiz	
2	3660.920M	45.0	+0.6 +0.4 +0.0	-33.8 +0.2	+31.7 +0.0	+3.3 +0.0	+0.0	47.4	54.0	-6.6	Horiz	
3	3709.050M	44.4	+0.6 +0.3 +0.0	-33.8 +0.2	+32.0 +0.0	+3.3 +0.0	+0.0	47.0	54.0	-7.0	Horiz	
4	2745.925M	44.2	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+2.7 +0.0	+0.0	43.4	54.0	-10.6	Horiz	
5	2708.000M	43.8	+0.5 +0.5 +0.0	-34.1 +0.2	+29.5 +0.0	+2.7 +0.0	+0.0	43.1	54.0	-10.9	Horiz	
6	2781.720M	42.6	+0.5 +0.5 +0.0	-34.1 +0.3	+29.3 +0.0	+2.7 +0.0	+0.0	41.8	54.0	-12.2	Horiz	
7	5416.510M	30.2	+0.8 Ave	-33.6 +0.4	+34.7 +0.0	+4.0 +0.0	+0.0	37.1	54.0	-16.9	Horiz	
^	5416.510M	42.4	+0.8 +0.6 +0.0	-33.6 +0.4	+34.7 +0.0	+4.0 +0.0	+0.0	49.3	54.0	-4.7	Horiz	
9	5491.775M	41.5	+0.8 +0.5 +0.0	-33.6 +0.4	+34.7 +0.0	+4.0 +0.0	+0.0	48.3	108.0	-59.7	Horiz	
10	1854.470M	49.8	+0.4 +0.3 +0.0	-34.7 +0.6	+27.7 +0.0	+2.1 +0.0	+0.0	46.2	108.0	-61.8	Horiz	
11	1830.440M	47.6	+0.4 +0.3 +0.0	-34.7 +0.6	+27.5 +0.0	+2.1 +0.0	+0.0	43.8	108.0	-64.2	Horiz	
12	177.400M	25.9	+0.1 +0.0 +0.9	+0.0	+0.0	+0.6 +15.7	+0.0	43.2	108.0	-64.8	Vert	
13	88.200M	28.9	+0.1 +0.0 +0.6	+0.0	+0.0	+0.4 +12.5	+0.0	42.5	108.0	-65.5	Vert	
14	1805.340M	46.0	+0.4 +0.3 +0.0	-34.7 +0.6	+27.3 +0.0	+2.1 +0.0	+0.0	42.0	108.0	-66.0	Horiz	
15	28.687M	32.2	+0.1 +0.0 +0.0	+0.0	+0.0	+0.2 +4.2	-40.0 +0.0	-3.3	108.0	-111.3	Perp/	

16	28.985M	31.3	+0.1	+0.0	+0.0	+0.3	-40.0	-4.2	108.0	-112.2	Perp/
			+0.0	+0.0	+4.1	+0.0					
			+0.0								
17	29.224M	30.6	+0.1	+0.0	+0.0	+0.3	-40.0	-5.1	108.0	-113.1	Perp/
			+0.0	+0.0	+3.9	+0.0					
			+0.0								
18	27.330k	44.4	+0.1	+0.0	+0.0	+0.0	-80.0	-24.0	108.0	-132.0	Perp/
			+0.0	+0.0	+11.5	+0.0					
			+0.0								

Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107623** Date: 10/25/2022
 Test Type: **Maximized Emissions** Time: 11:14:17
 Tested By: Matt Harrison Sequence#: 7
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 6			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 6			

Test Conditions / Notes:

Test Environment Conditions:

Temperature: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 9k-10GHz

Frequencies Tested: 902.75, 915.25, 927.25

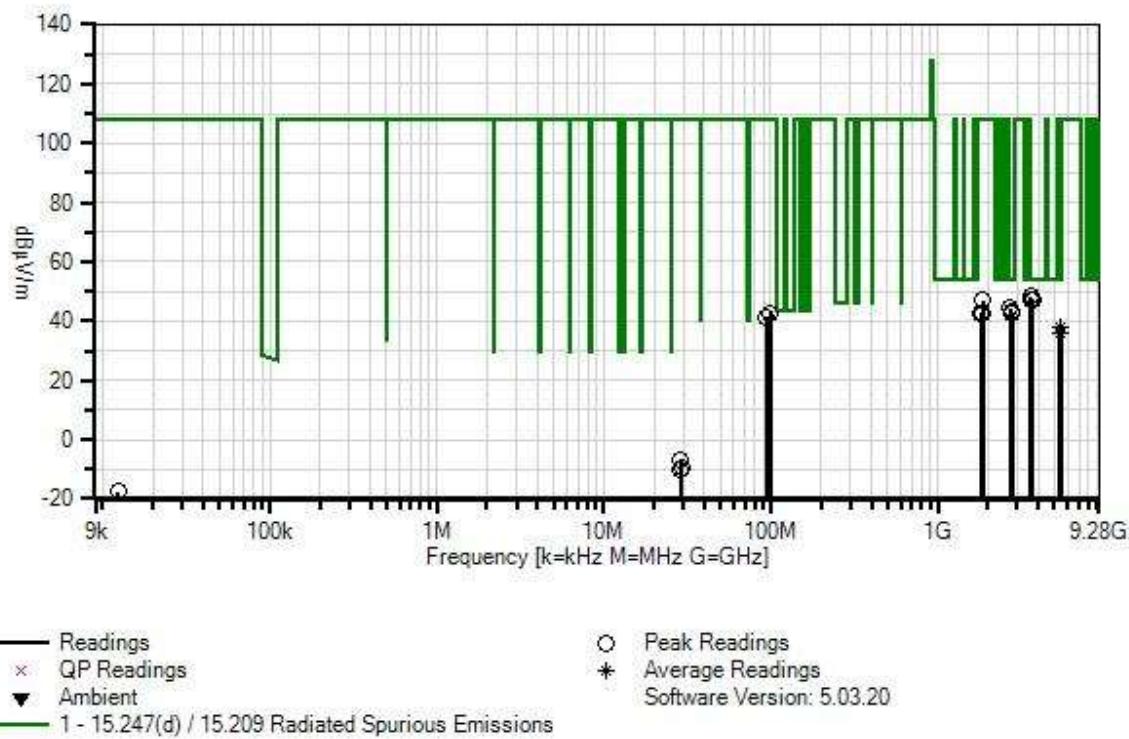
Firmware Power Setting: 33 dBm

Antenna Type: Patch

Antenna Gain: 6.8 dBiL.

Test Setup:

Unit is on foam table 80cm high below 1GHz and 1.5m high above 1GHz. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported.

Impinj Inc. W/O#: 107623 Sequence#: 7 Date: 10/25/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T4	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T5	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T9	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T10	ANP05360	Cable	RG214	2/4/2022	2/4/2024

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3611.155M	46.1	+0.0 +3.2 +0.0	+0.5 +0.4 +0.0	-33.8 +0.3 +0.0	+31.7 +0.0	+0.0	48.4	54.0	-5.6	Horiz	
2	3661.120M	44.9	+0.0 +3.3 +0.0	+0.6 +0.4 +0.0	-33.8 +0.2 +0.0	+31.7 +0.0	+0.0	47.3	54.0	-6.7	Horiz	
3	3708.995M	44.4	+0.0 +3.3 +0.0	+0.6 +0.3 +0.0	-33.8 +0.2 +0.0	+32.0 +0.0	+0.0	47.0	54.0	-7.0	Horiz	
4	2708.620M	44.9	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.2 +0.0	+29.5 +0.0	+0.0	44.2	54.0	-9.8	Horiz	
5	2745.770M	44.0	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0	+0.0	43.2	54.0	-10.8	Horiz	
6	2782.010M	43.2	+0.0 +2.7 +0.0	+0.5 +0.5 +0.0	-34.1 +0.3 +0.0	+29.3 +0.0	+0.0	42.4	54.0	-11.6	Vert	
7	5416.500M	31.1	+0.0 Ave	+0.8 +0.6 +0.0	-33.6 +0.4 +0.0	+34.7 +0.4 +0.0	+0.0	38.0	54.0	-16.0	Horiz	
^	5416.500M	42.5	+0.0 +4.0 +0.0	+0.8 +0.6 +0.0	-33.6 +0.4 +0.0	+34.7 +0.4 +0.0	+0.0	49.4	54.0	-4.6	Horiz	
9	1854.735M	50.7	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.7 +0.0 +0.0	+0.0	47.1	108.0	-60.9	Vert	
10	98.900M	27.9	+0.0 +0.5 +13.7	+0.1 +0.0 +0.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	42.8	108.0	-65.2	Vert	
11	1830.470M	46.6	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.5 +0.0 +0.0	+0.0	42.8	108.0	-65.2	Horiz	
12	1805.460M	46.5	+0.0 +2.1 +0.0	+0.4 +0.3 +0.0	-34.7 +0.6 +0.0	+27.3 +0.0 +0.0	+0.0	42.5	108.0	-65.5	Vert	
13	94.000M	27.1	+0.0 +0.5 +13.1	+0.1 +0.0 +0.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	41.4	108.0	-66.6	Vert	
14	5491.635M	29.1	+0.0 Ave	+0.8 +0.5 +0.0	-33.6 +0.4 +0.0	+34.7 +0.4 +0.0	+0.0	35.9	108.0	-72.1	Horiz	
^	5491.635M	42.2	+0.0 +4.0 +0.0	+0.8 +0.5 +0.0	-33.6 +0.4 +0.0	+34.7 +0.4 +0.0	+0.0	49.0	108.0	-59.0	Horiz	

16	28.691M	28.6	+0.0	+0.1	+0.0	+0.0	-40.0	-6.9	108.0	-114.9	Perp/
			+0.2	+0.0	+0.0		+4.2				
			+0.0	+0.0							
17	29.232M	26.4	+0.0	+0.1	+0.0	+0.0	-40.0	-9.3	108.0	-117.3	Perp/
			+0.3	+0.0	+0.0		+3.9				
			+0.0	+0.0							
18	29.004M	25.8	+0.0	+0.1	+0.0	+0.0	-40.0	-9.8	108.0	-117.8	Perp/
			+0.3	+0.0	+0.0		+4.0				
			+0.0	+0.0							
19	12.384k	47.2	+0.0	+0.1	+0.0	+0.0	-80.0	-17.6	108.0	-125.6	Perp/
			+0.0	+0.0	+0.0		+15.1				
			+0.0	+0.0							

Band Edge

Band Edge Summary

Configuration 1

Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	38.8	<46	Pass
902	Single Channel	ASK	Patch	73.9	<111.0	Pass
928	Single Channel	ASK	Patch	72.2	<108.0	Pass
960	Single Channel	ASK	Patch	43.1	<54	Pass
614	Hopping	ASK	Patch	38.6	<46	Pass
902	Hopping	ASK	Patch	75.2	<112.5	Pass
928	Hopping	ASK	Patch	72.7	<109.5	Pass
960	Hopping	ASK	Patch	43.0	<54	Pass

Band Edge Summary

Configuration 2

Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	38.8	<46	Pass
902	Single Channel	ASK	Patch	73.2	<110.5	Pass
928	Single Channel	ASK	Patch	74.4	<111.0	Pass
960	Single Channel	ASK	Patch	43	<54	Pass
614	Hopping	ASK	Patch	38.9	<46	Pass
902	Hopping	ASK	Patch	74.2	<112.0	Pass
928	Hopping	ASK	Patch	75.0	<112.0	Pass
960	Hopping	ASK	Patch	43.1	<54	Pass

Band Edge Summary

Configuration 3

Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	39.0	<46	Pass
902	Single Channel	ASK	Patch	75.8	<113.0	Pass
928	Single Channel	ASK	Patch	76.2	<113.0	Pass
960	Single Channel	ASK	Patch	43.3	<54	Pass
614	Hopping	ASK	Patch	39.0	<46	Pass
902	Hopping	ASK	Patch	77.0	<114.5	Pass
928	Hopping	ASK	Patch	78.3	<114.5	Pass
960	Hopping	ASK	Patch	43.3	<54	Pass

Band Edge Summary

Configuration 4

Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	38.7	<46	Pass
902	Single Channel	ASK	Patch	75.2	<112.0	Pass
928	Single Channel	ASK	Patch	74.9	<112.0	Pass
960	Single Channel	ASK	Patch	43.0	<54	Pass
614	Hopping	ASK	Patch	38.9	<46	Pass
902	Hopping	ASK	Patch	72.3	<114.0	Pass
928	Hopping	ASK	Patch	72.3	<114.0	Pass
960	Hopping	ASK	Patch	43.1	<54	Pass

Band Edge Summary

Configuration 5

Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	38.7	<46	Pass
902	Single Channel	ASK	Patch	75.3	<112.0	Pass
928	Single Channel	ASK	Patch	75.6	<112.0	Pass
960	Single Channel	ASK	Patch	43.1	<54	Pass
614	Hopping	ASK	Patch	38.5	<46	Pass
902	Hopping	ASK	Patch	76.5	<113.5	Pass
928	Hopping	ASK	Patch	76.7	<113.5	Pass
960	Hopping	ASK	Patch	43.0	<54	Pass

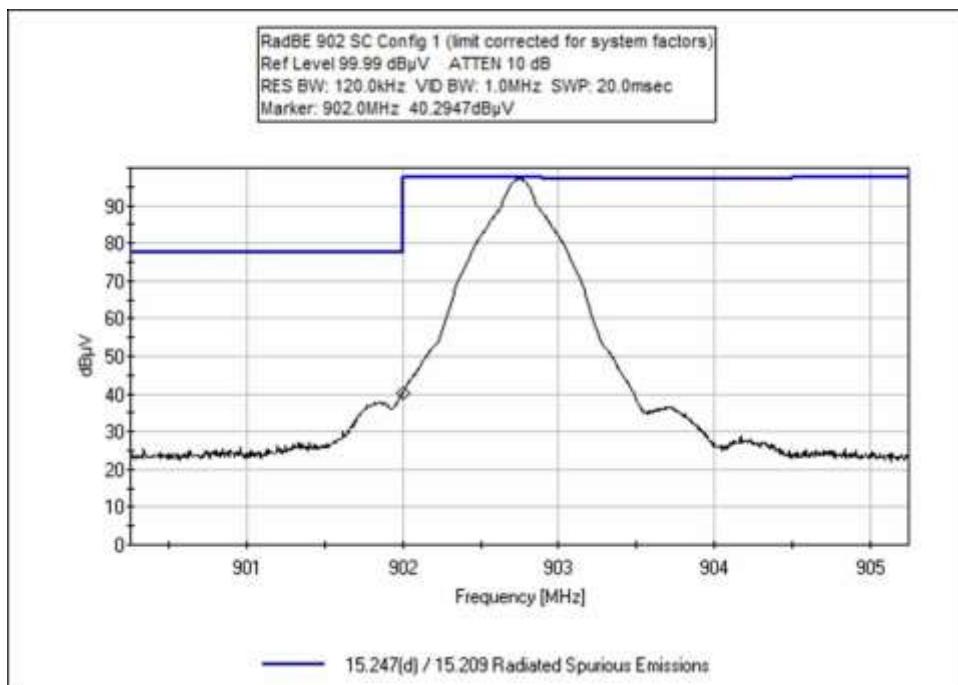
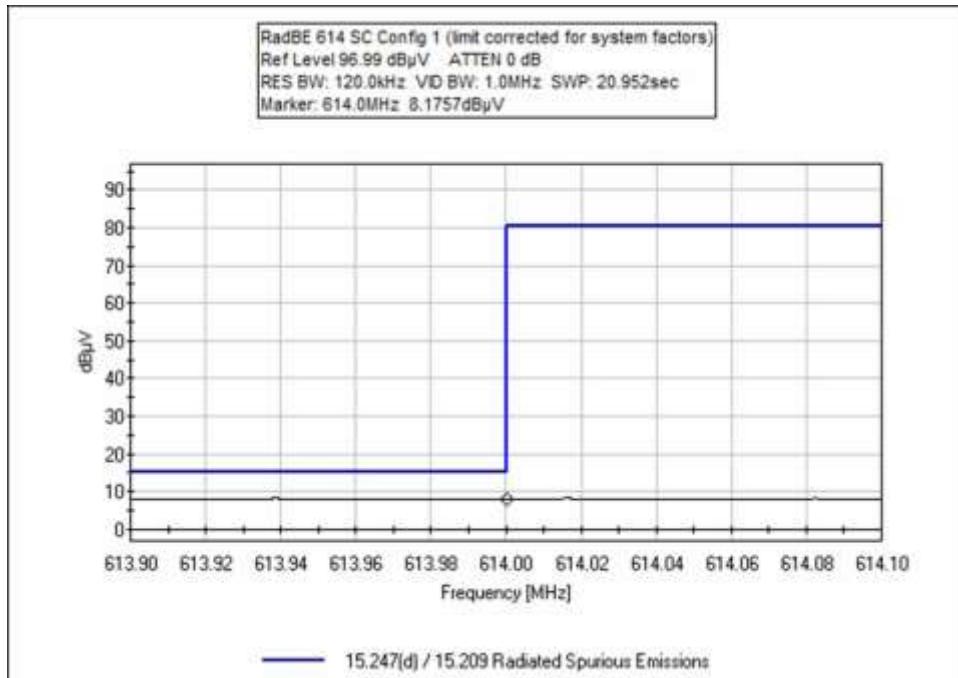
Band Edge Summary

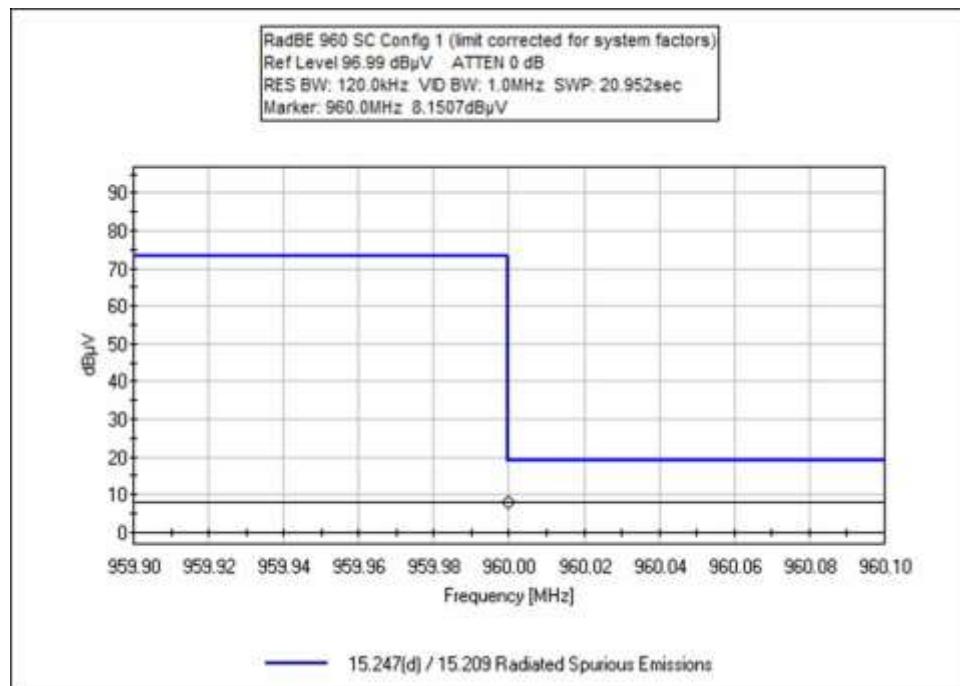
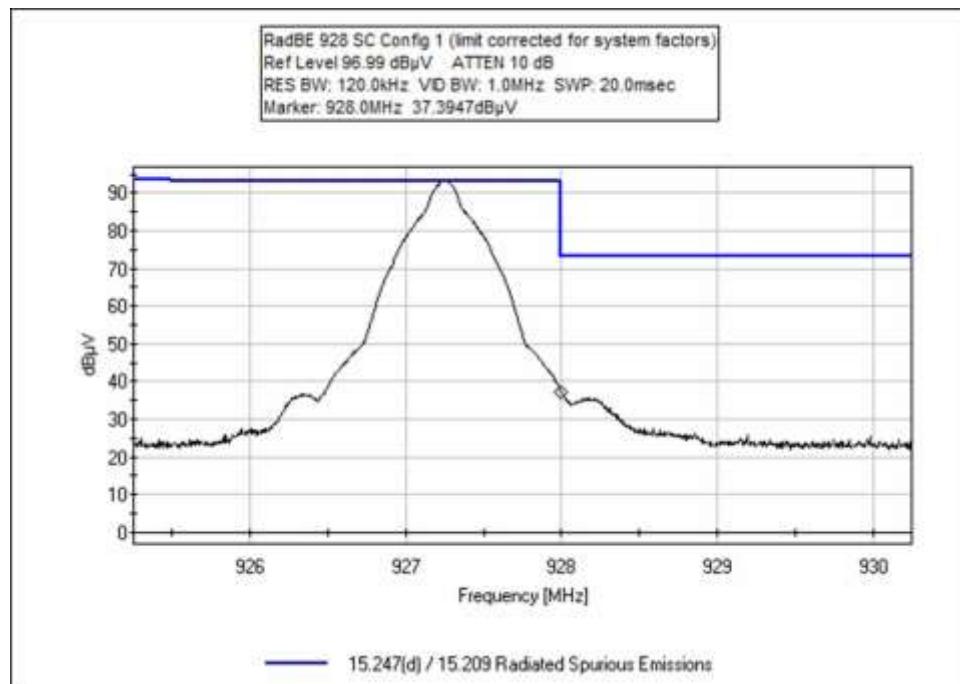
Configuration 6

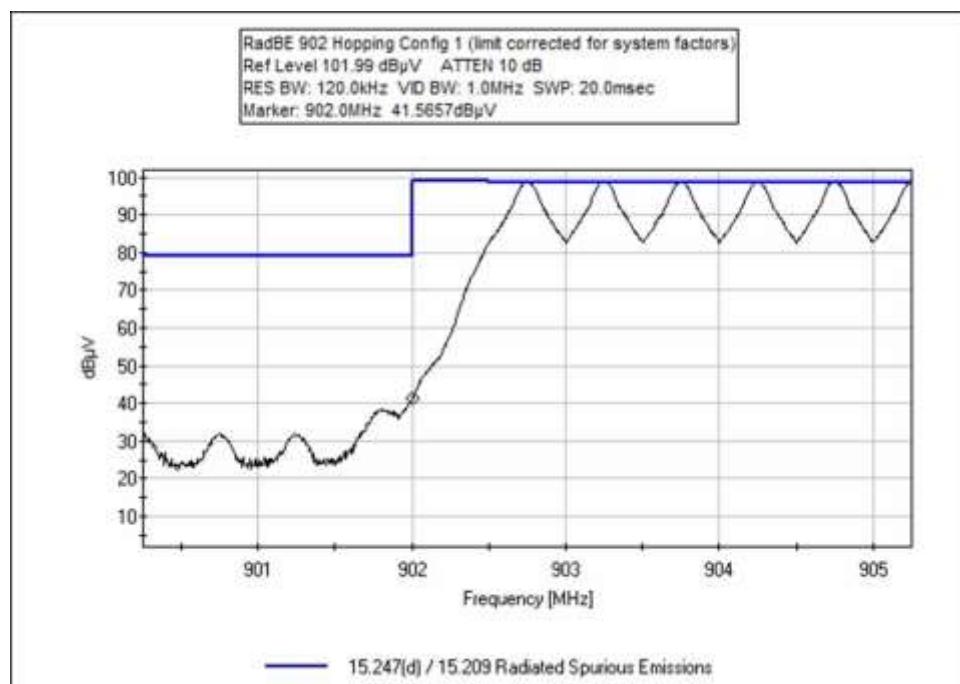
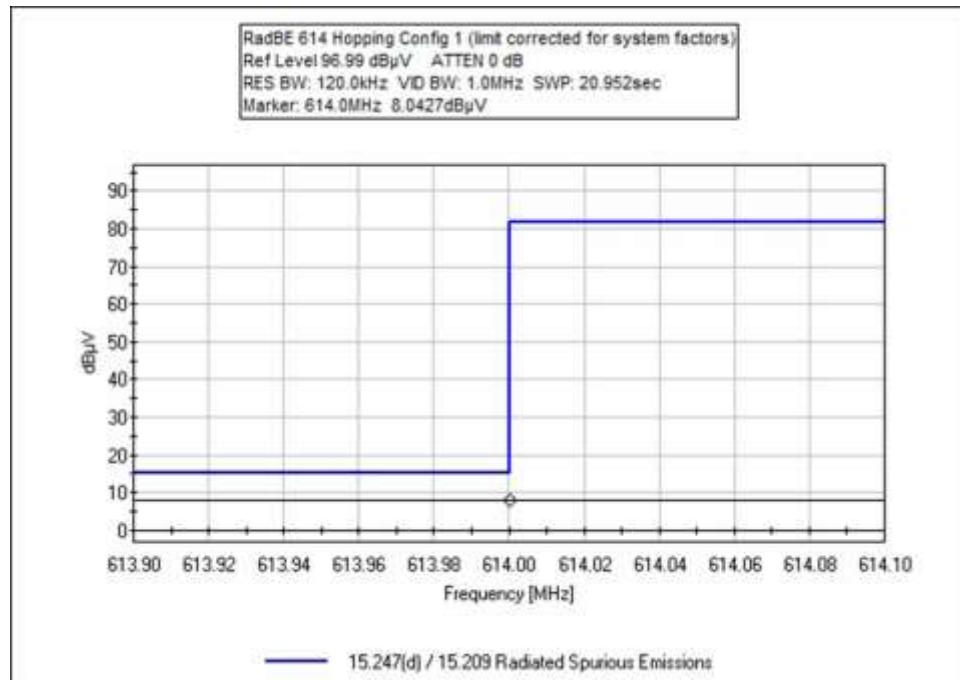
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614	Single Channel	ASK	Patch	38.8	<46	Pass
902	Single Channel	ASK	Patch	76.7	<113.5	Pass
928	Single Channel	ASK	Patch	78.2	<115.5	Pass
960	Single Channel	ASK	Patch	43.5	<54	Pass
614	Hopping	ASK	Patch	38.8	<46	Pass
902	Hopping	ASK	Patch	72.9	<115.0	Pass
928	Hopping	ASK	Patch	76.6	<117.0	Pass
960	Hopping	ASK	Patch	43.4	<54	Pass

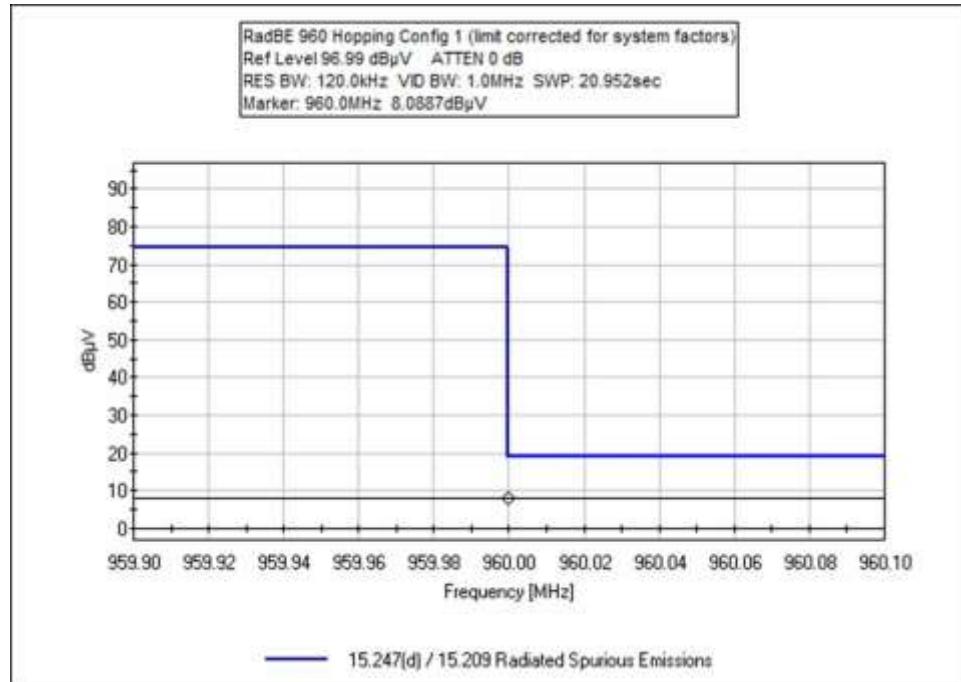
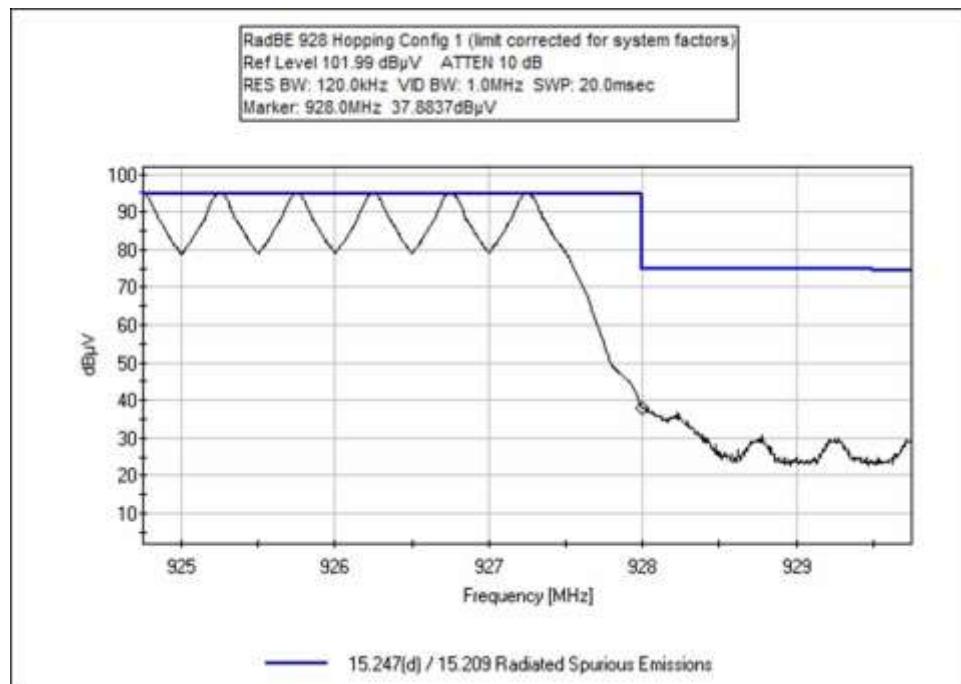
Band Edge Plots

Configuration 1

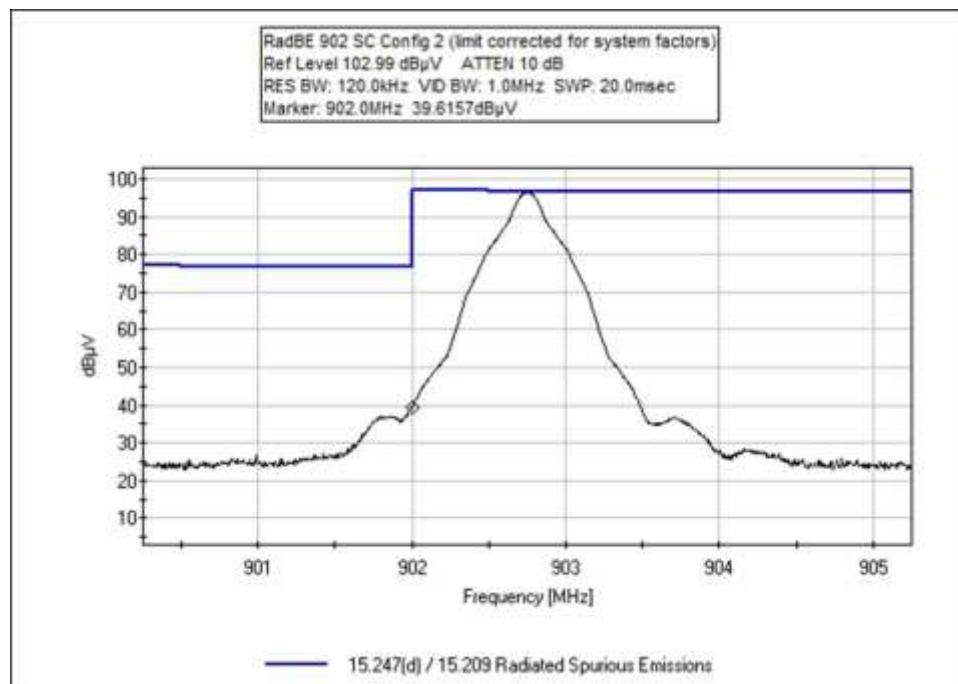
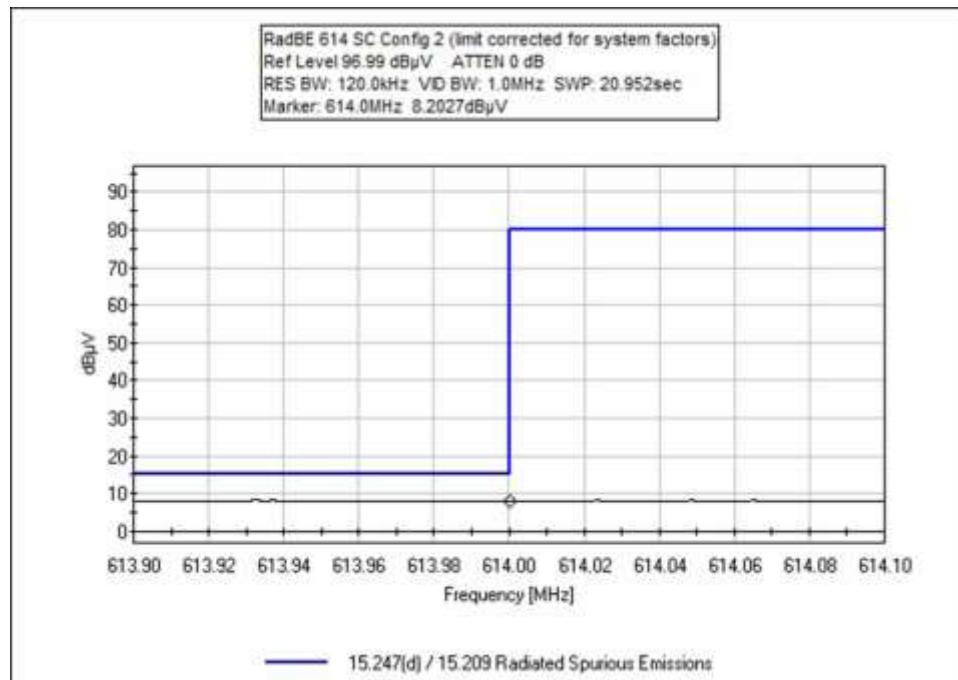


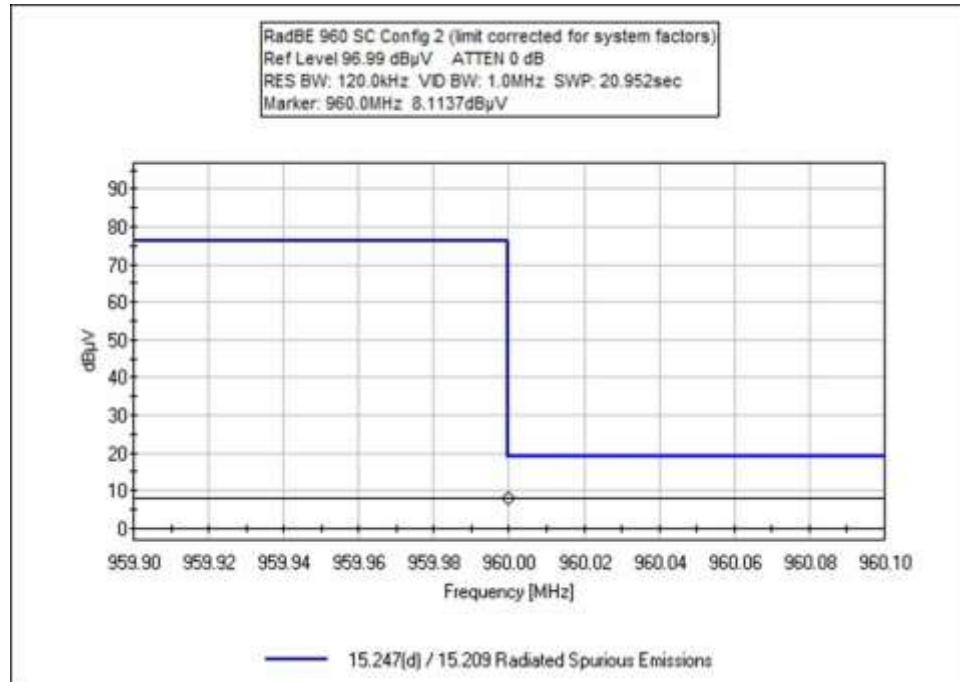
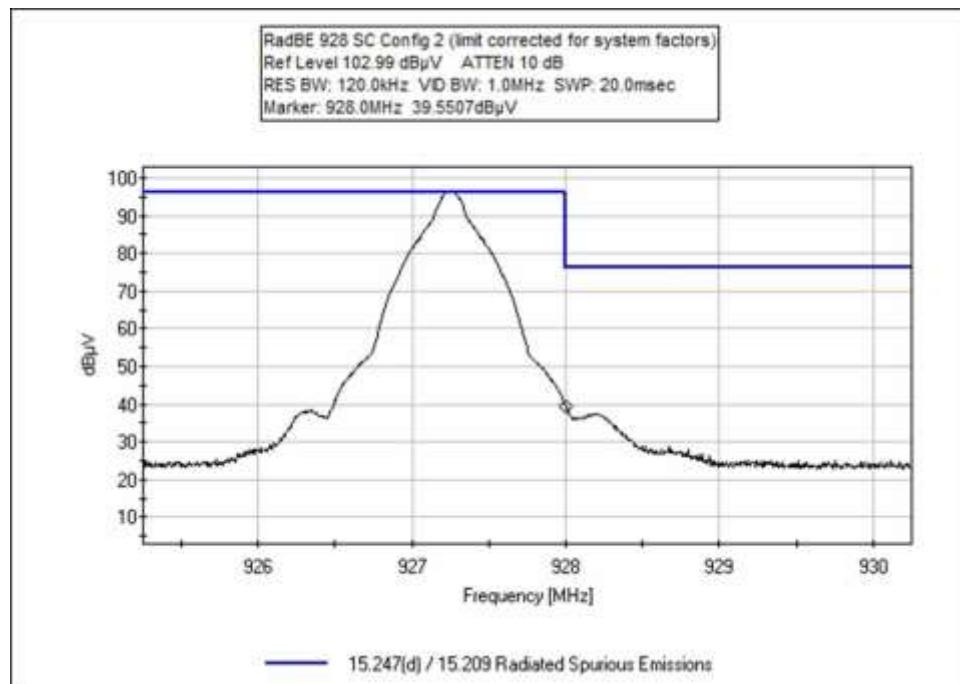


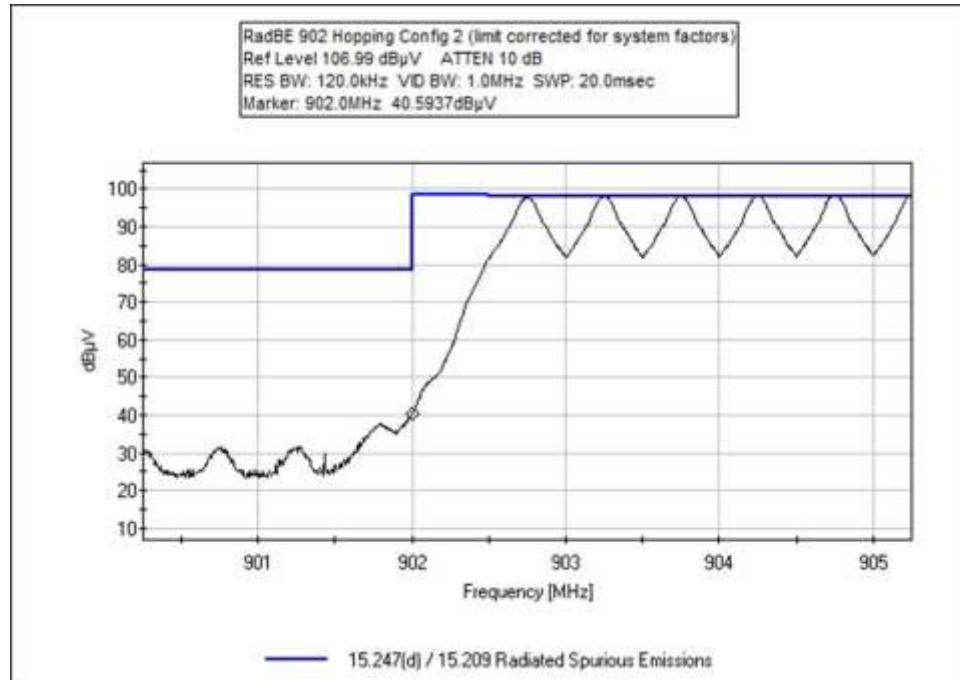
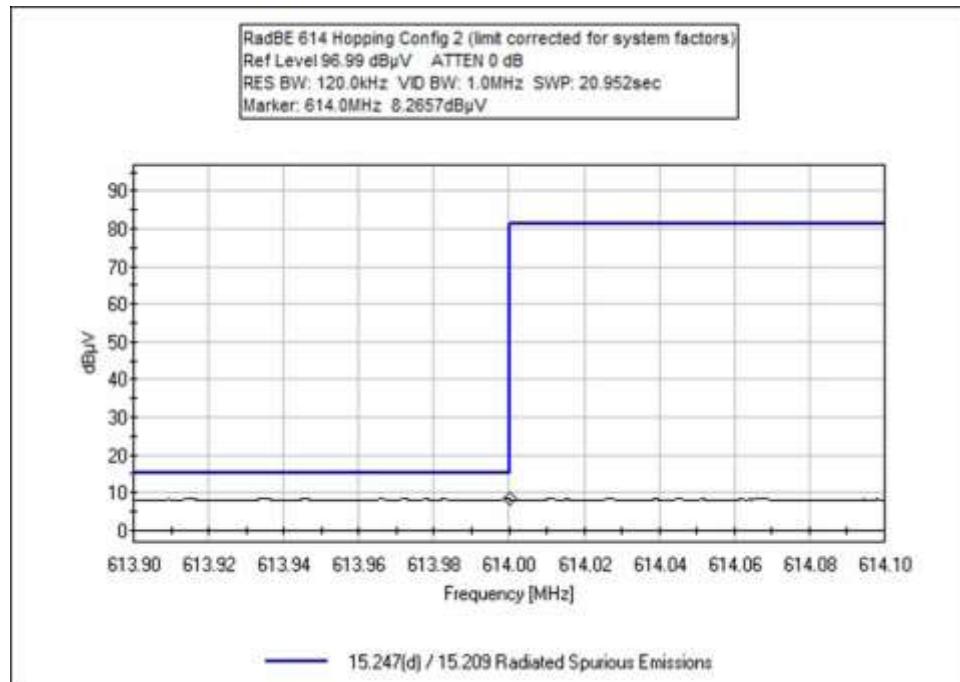


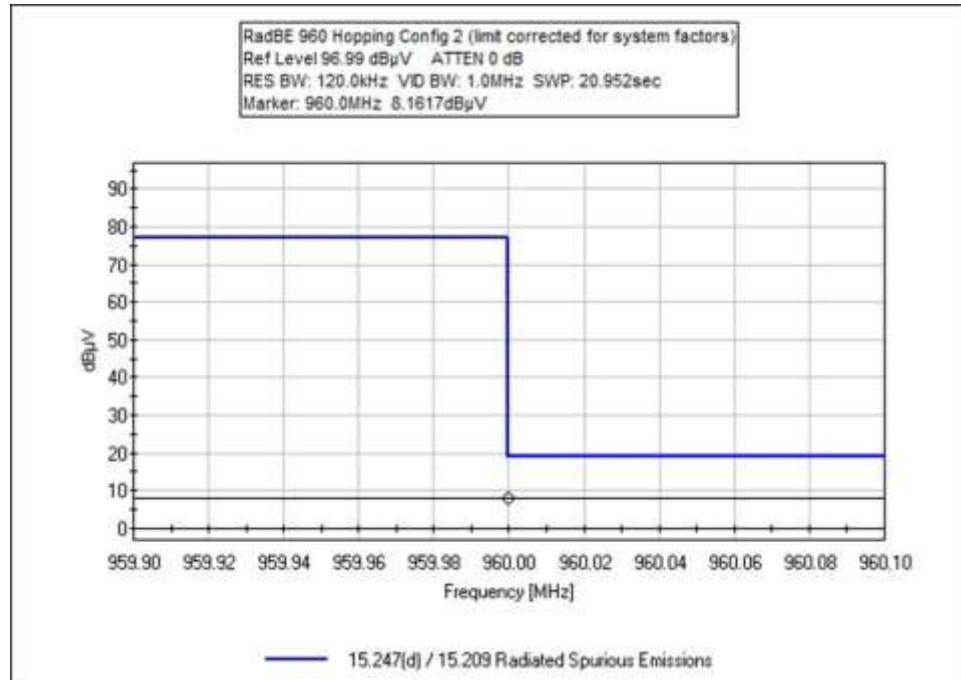
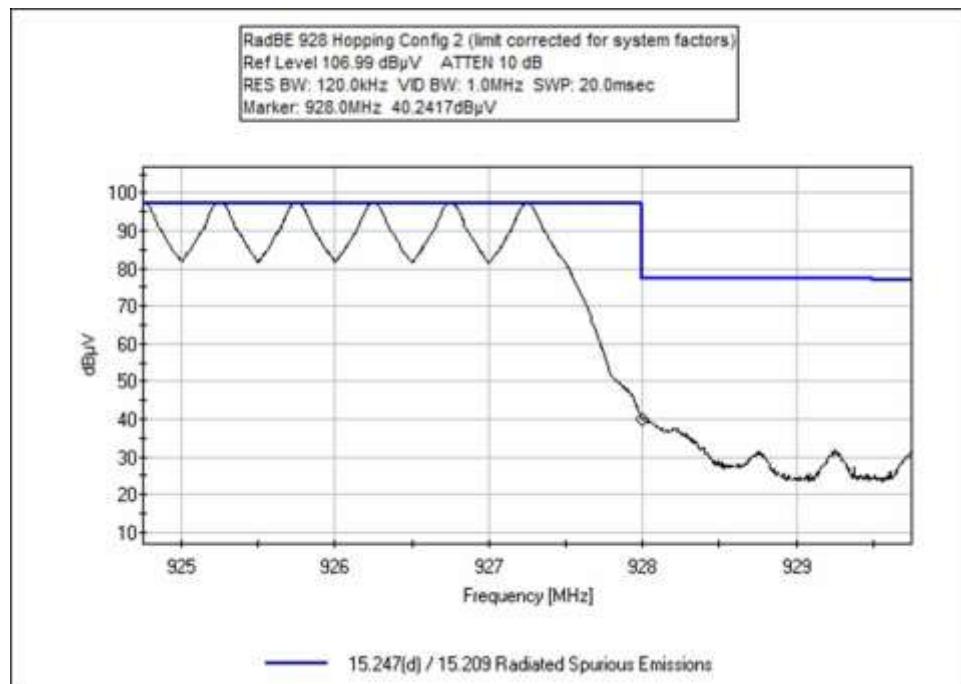


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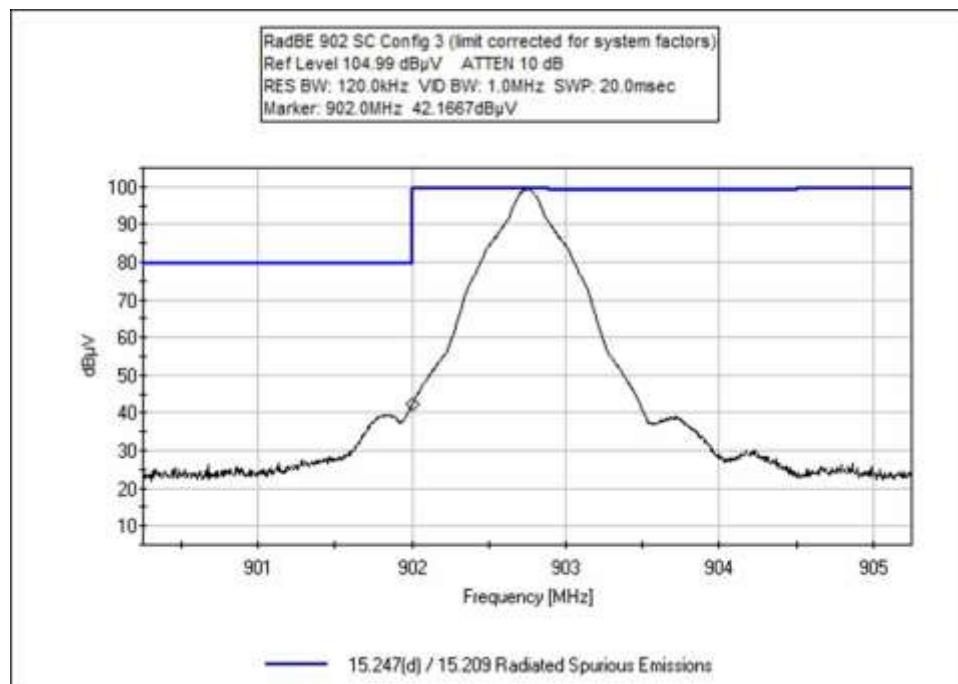
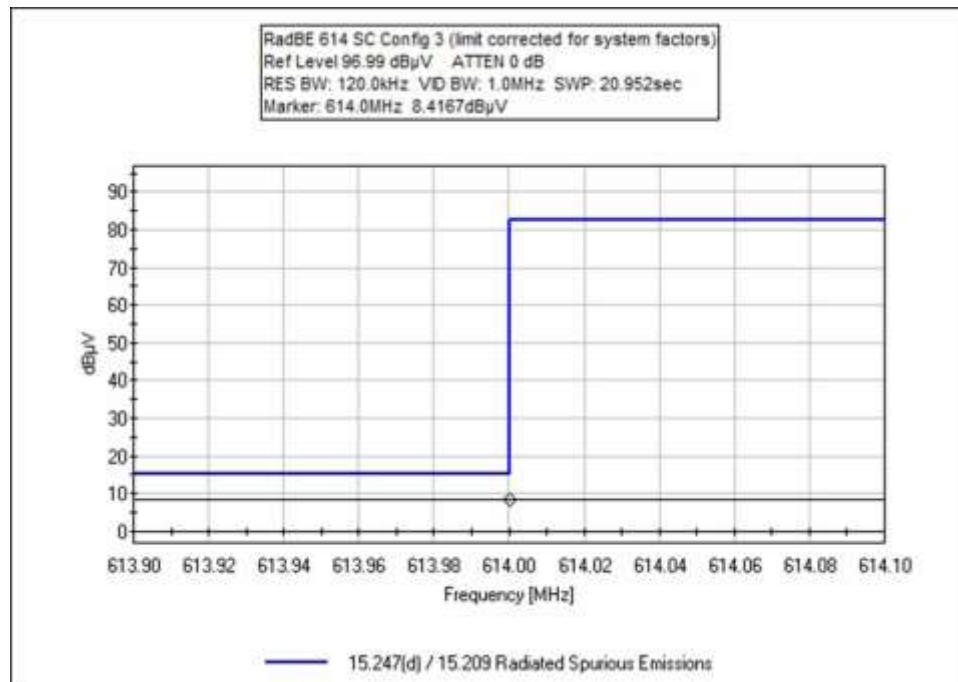


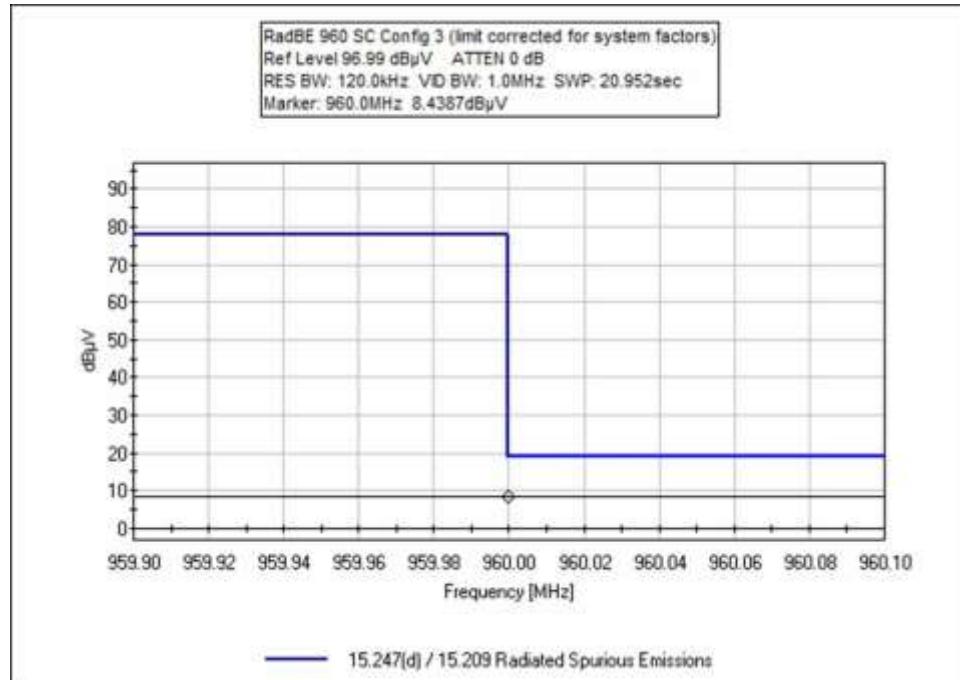
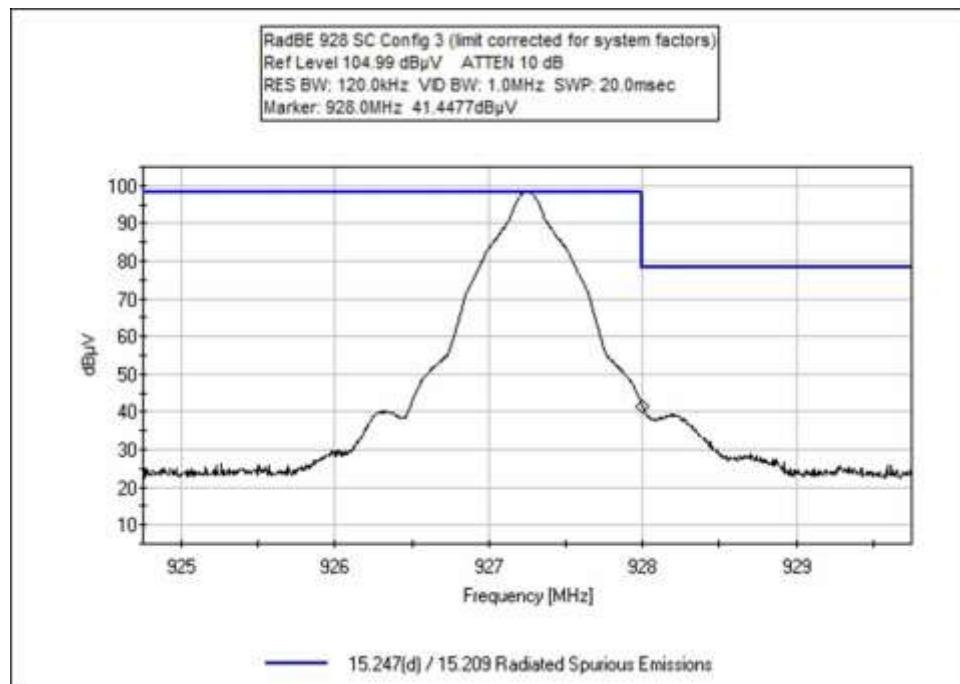


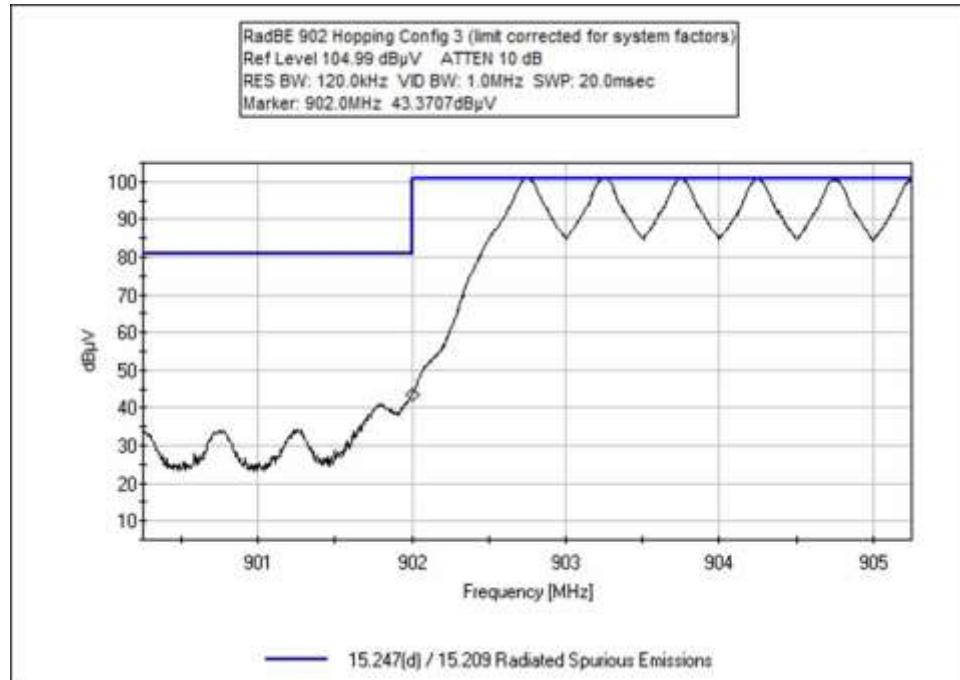
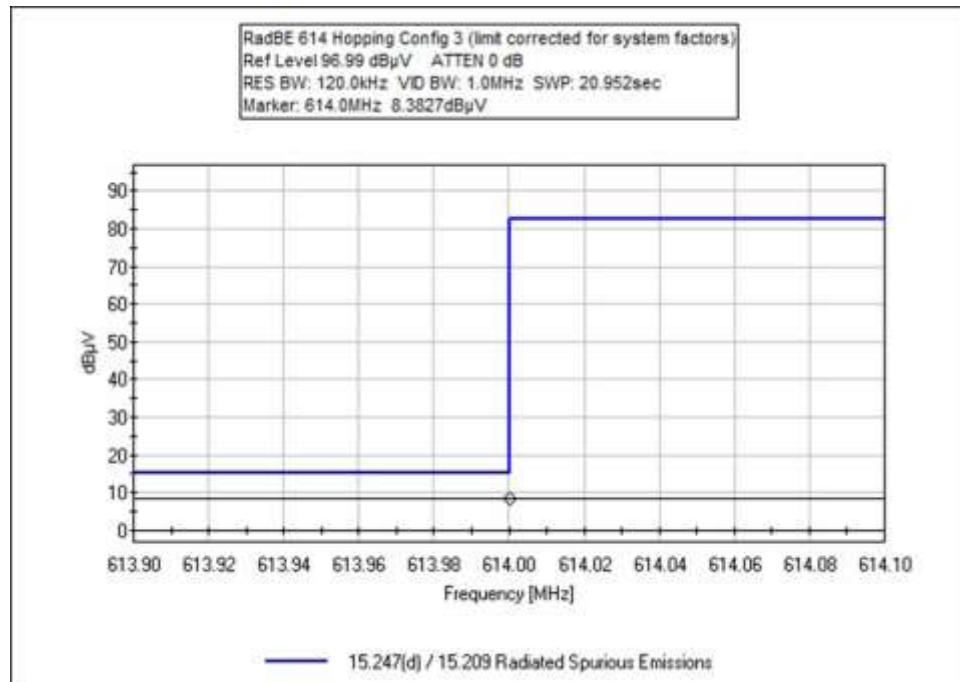


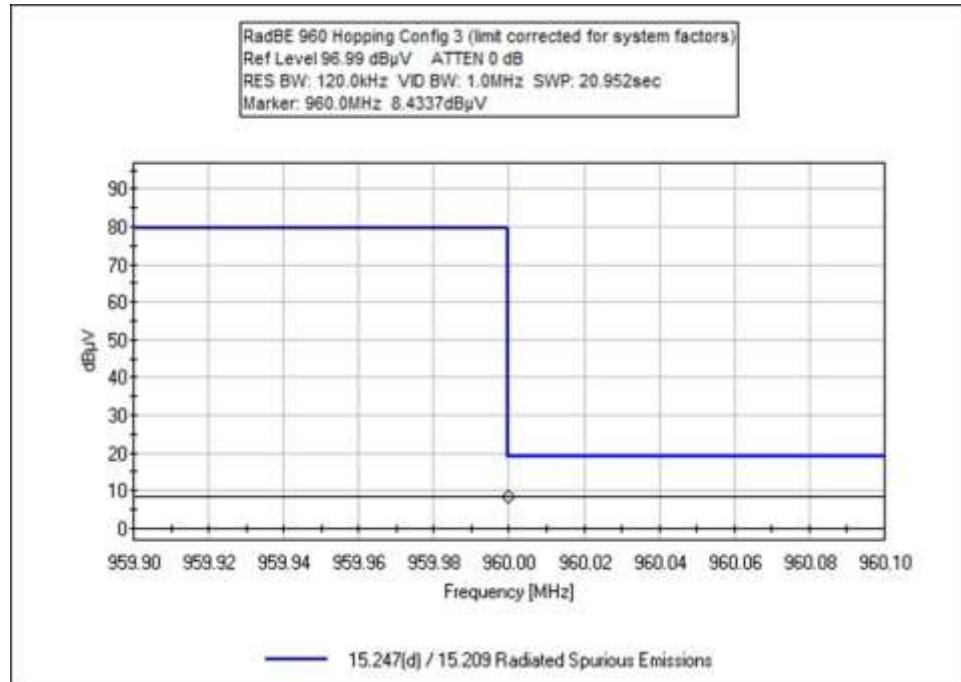
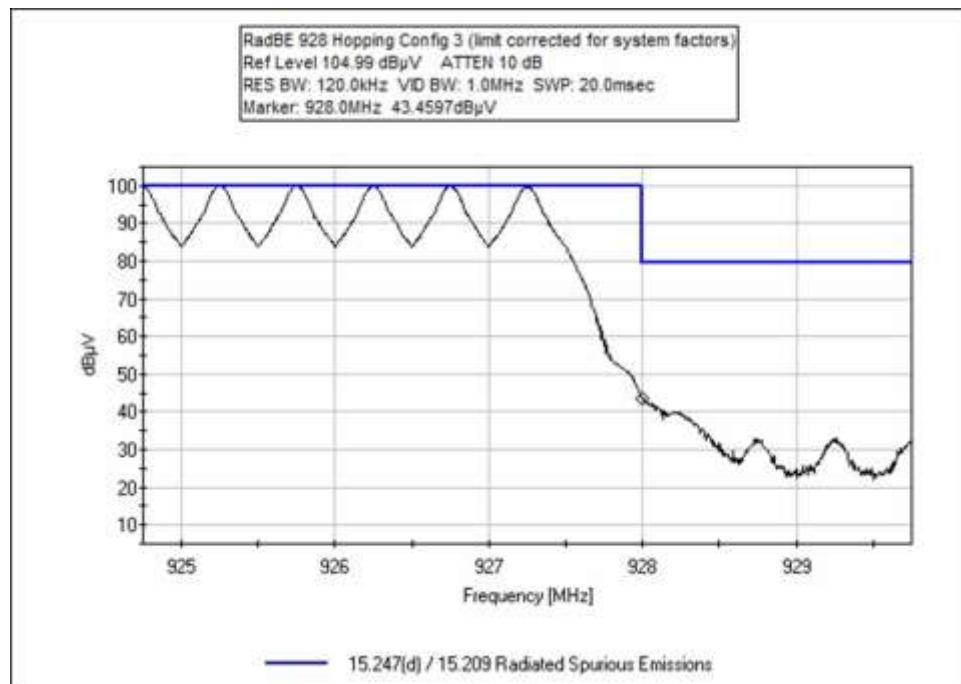


Configuration 3

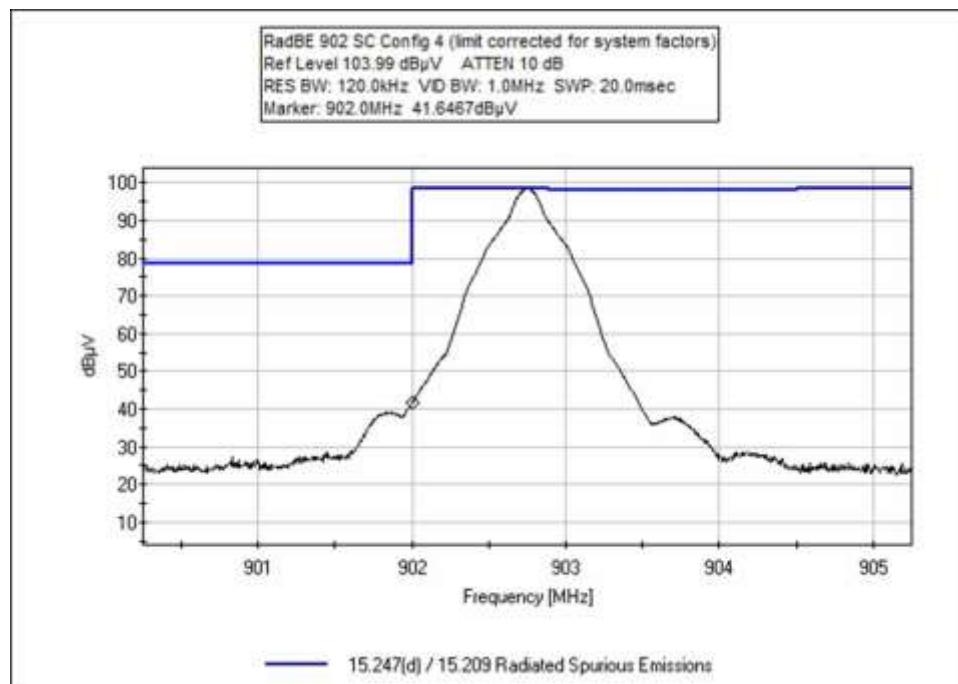
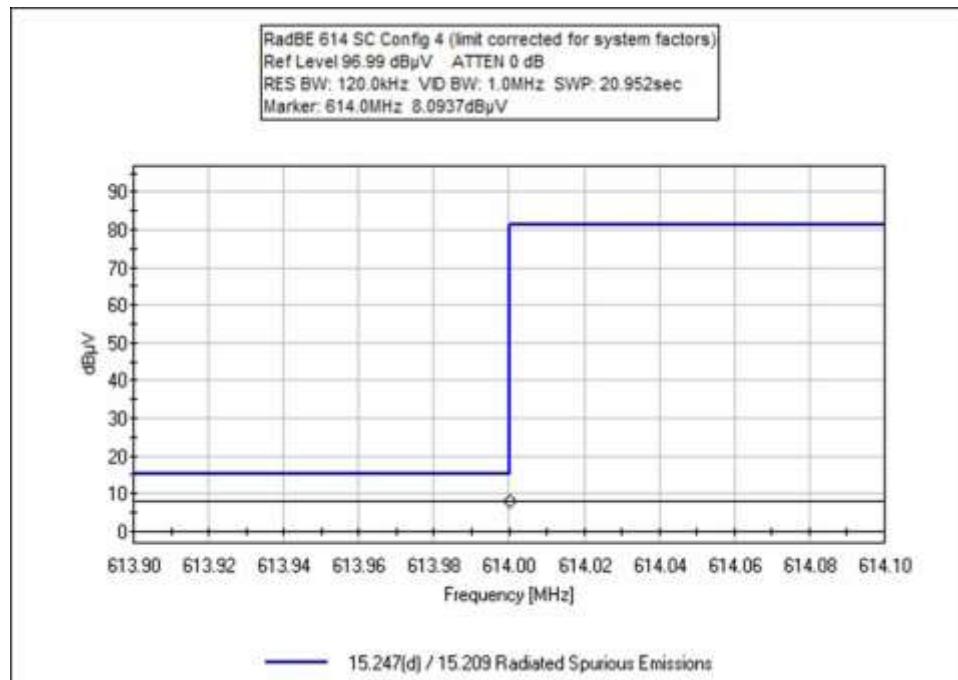


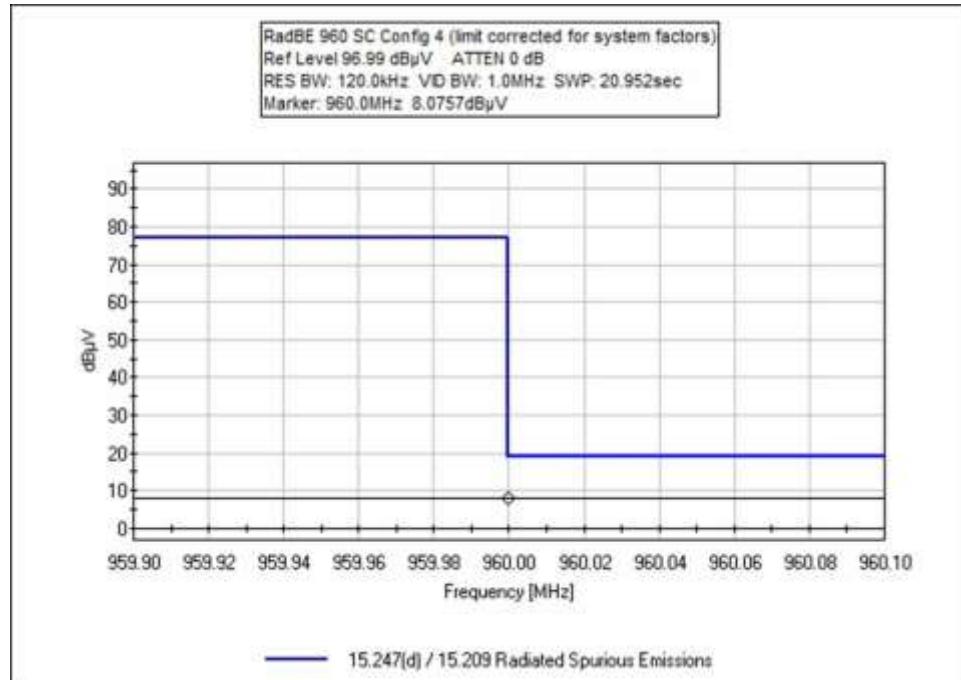
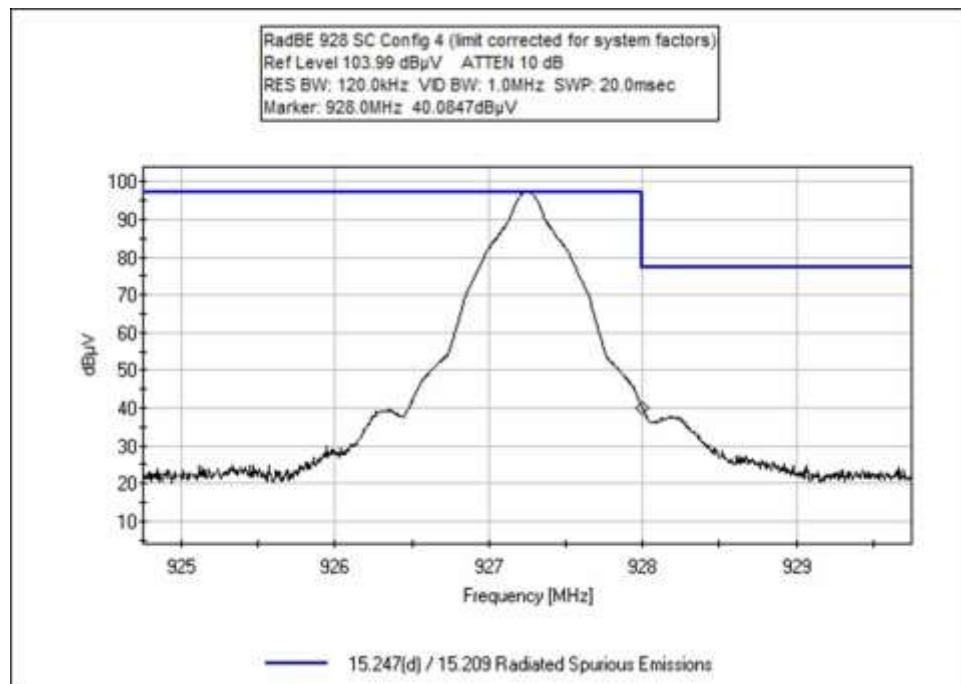


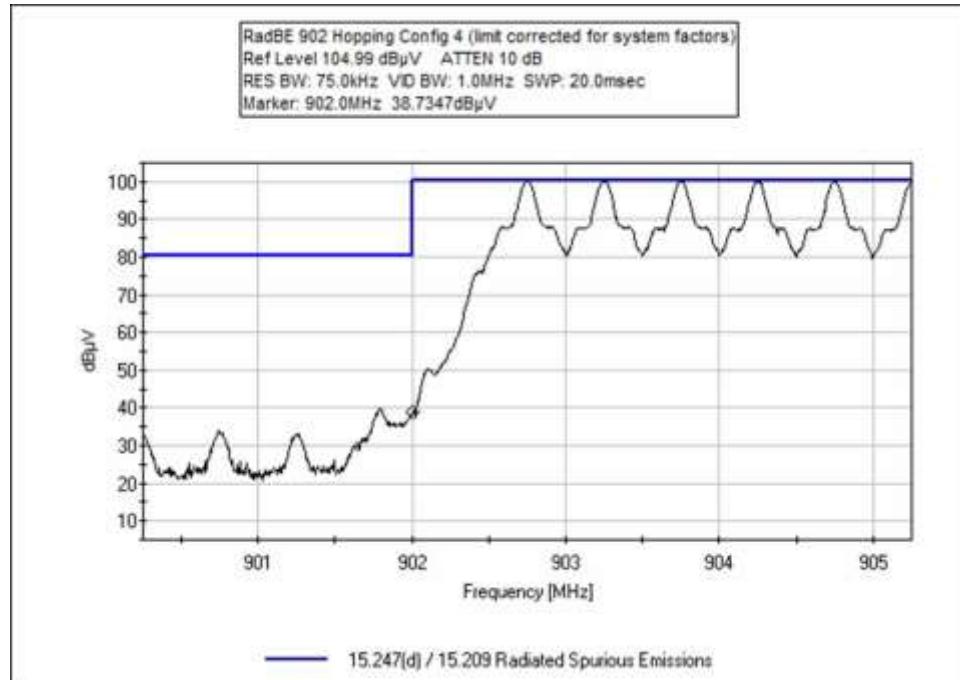
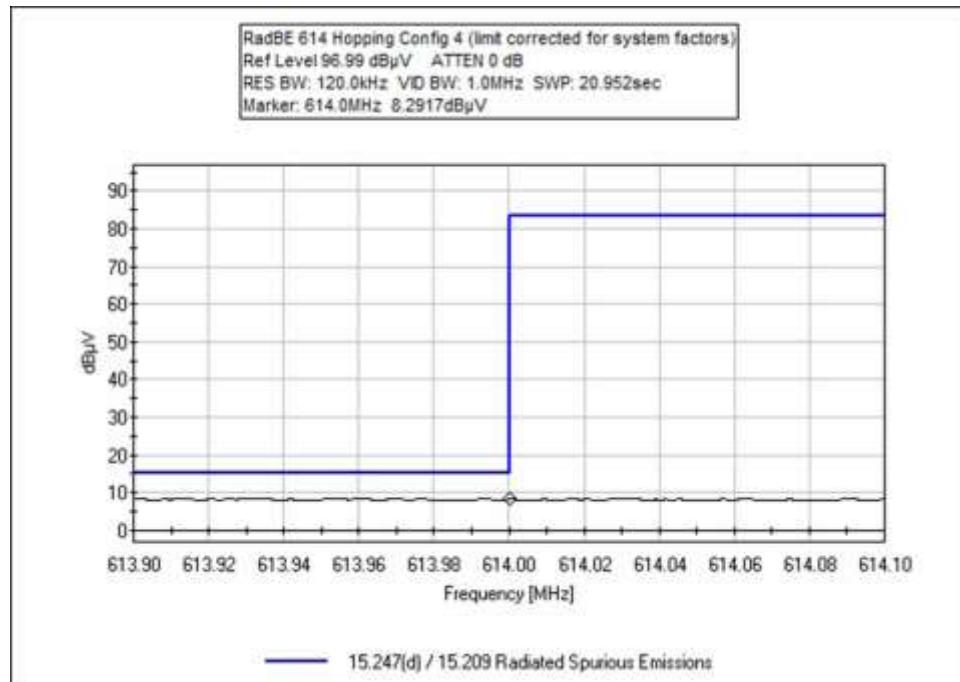


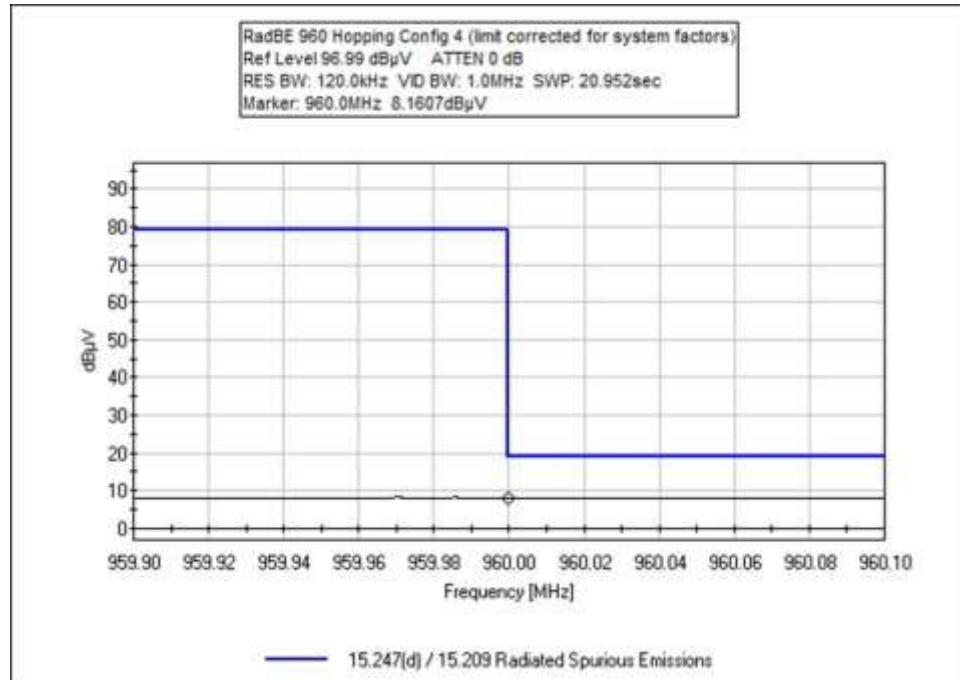
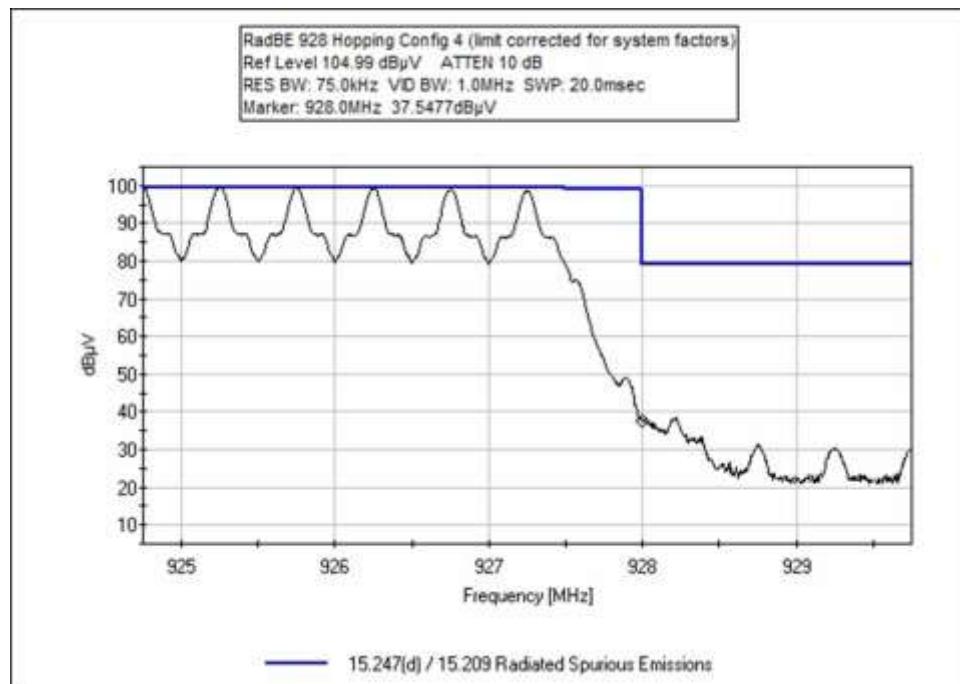


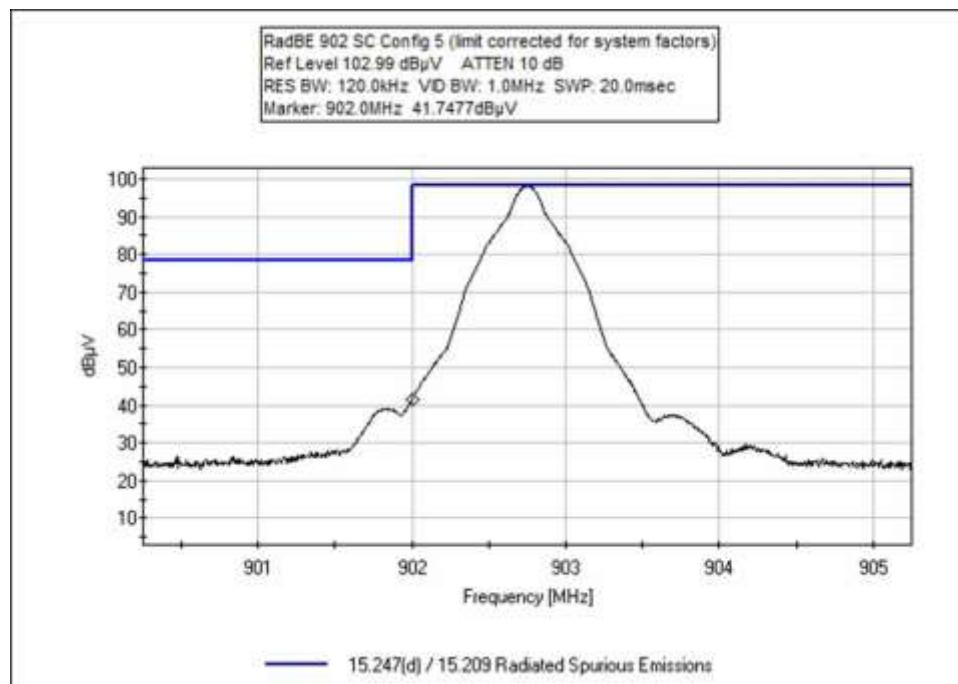
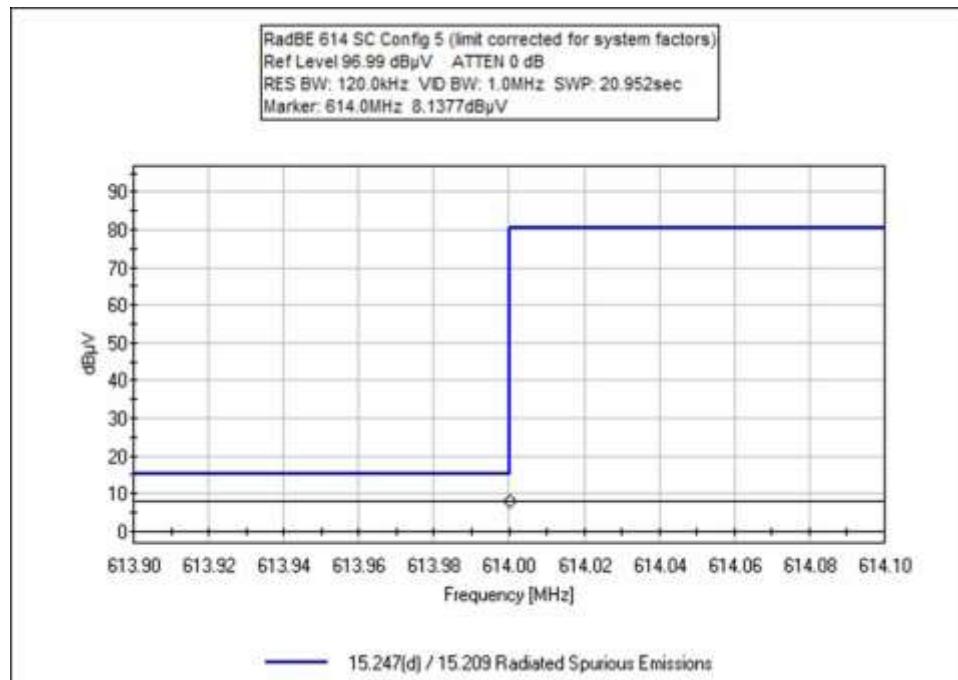
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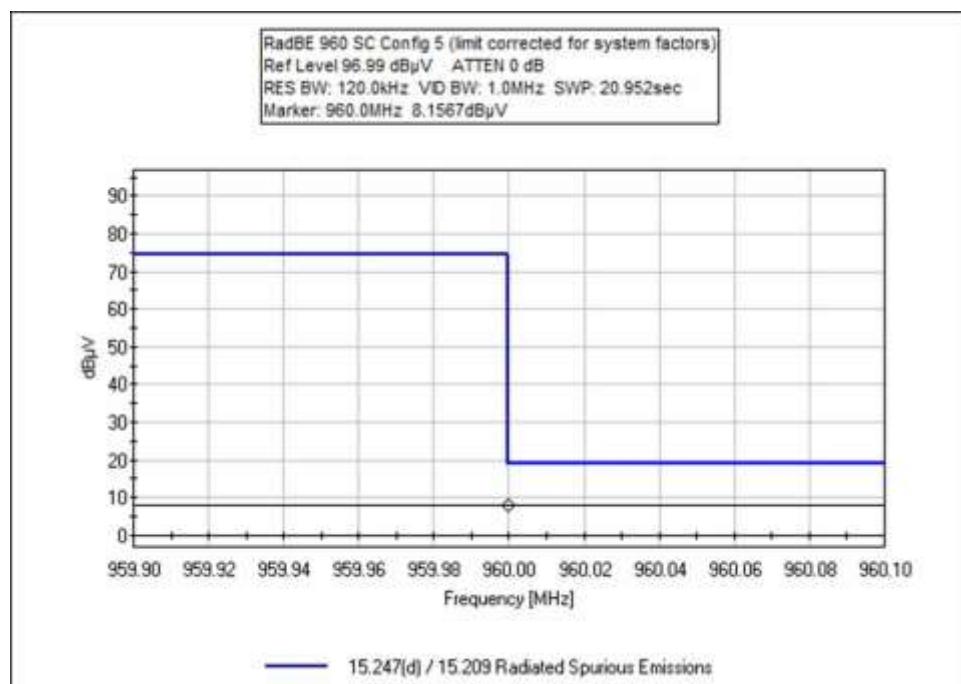
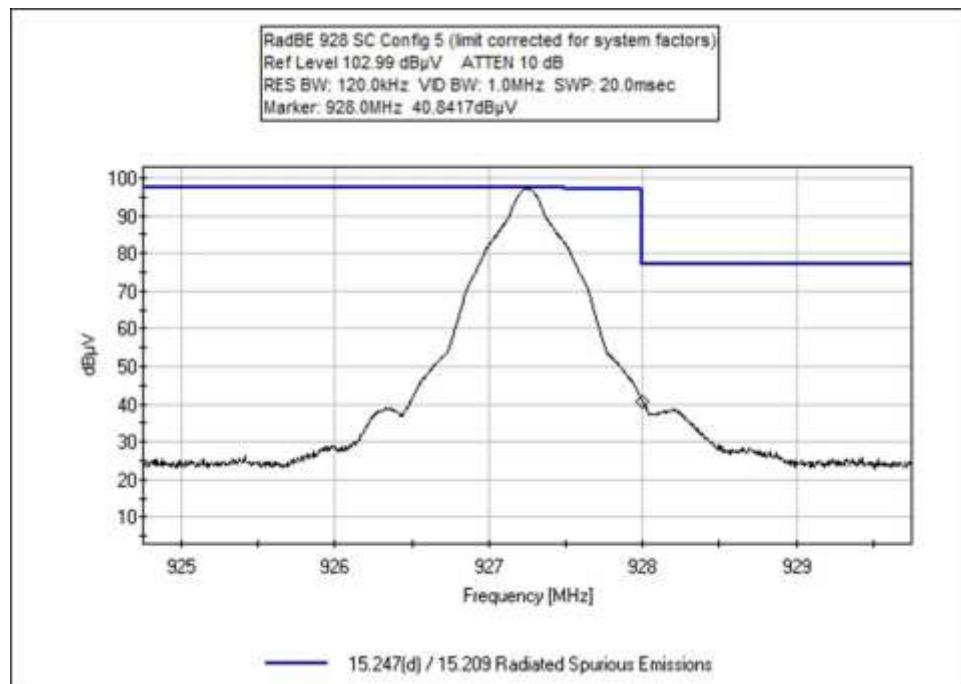


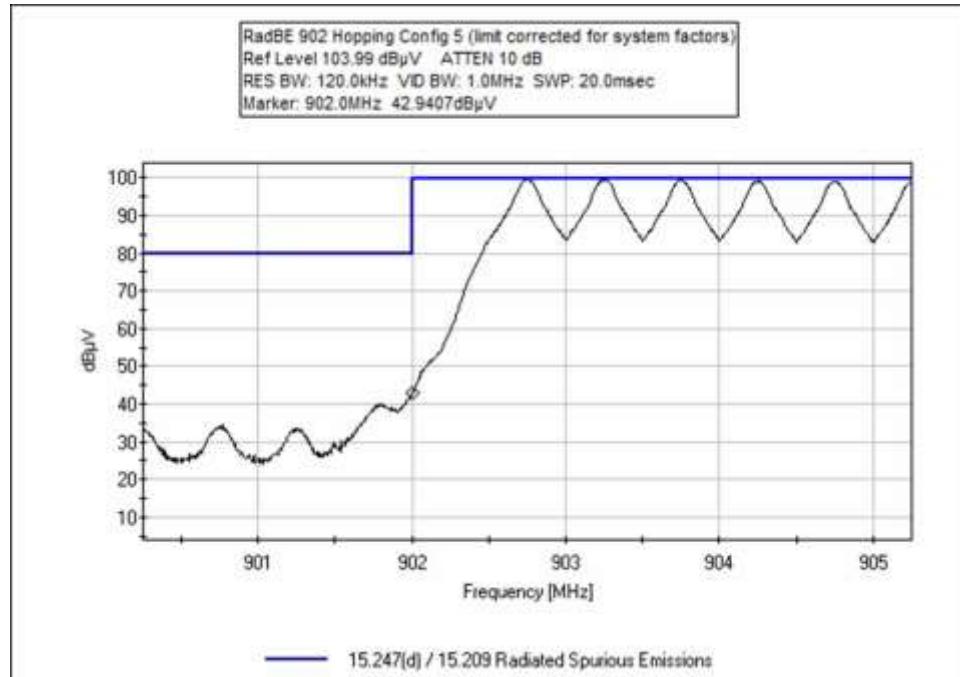
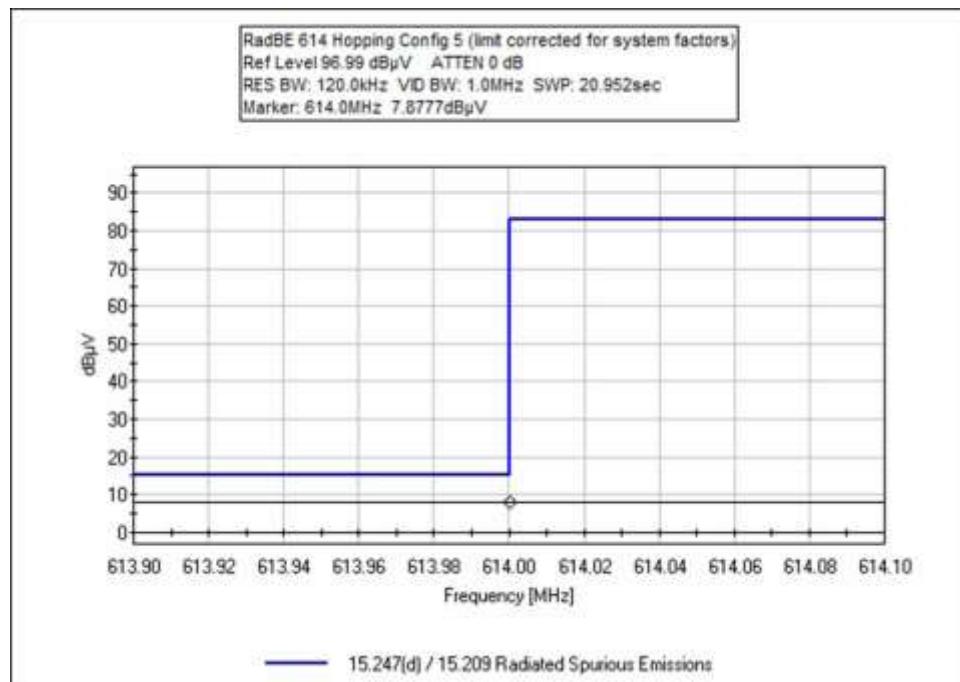


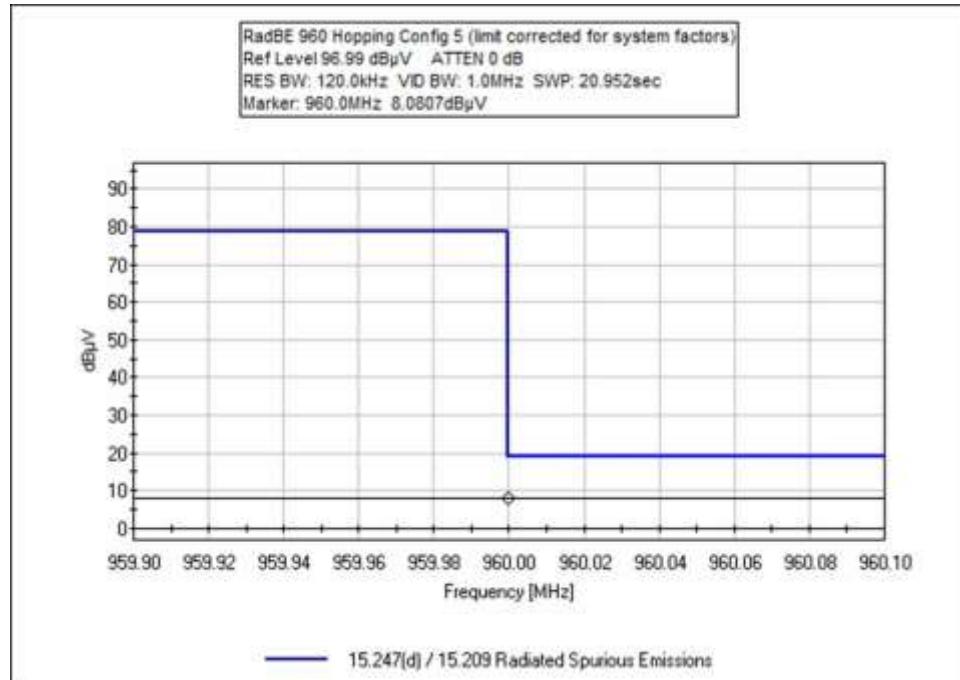
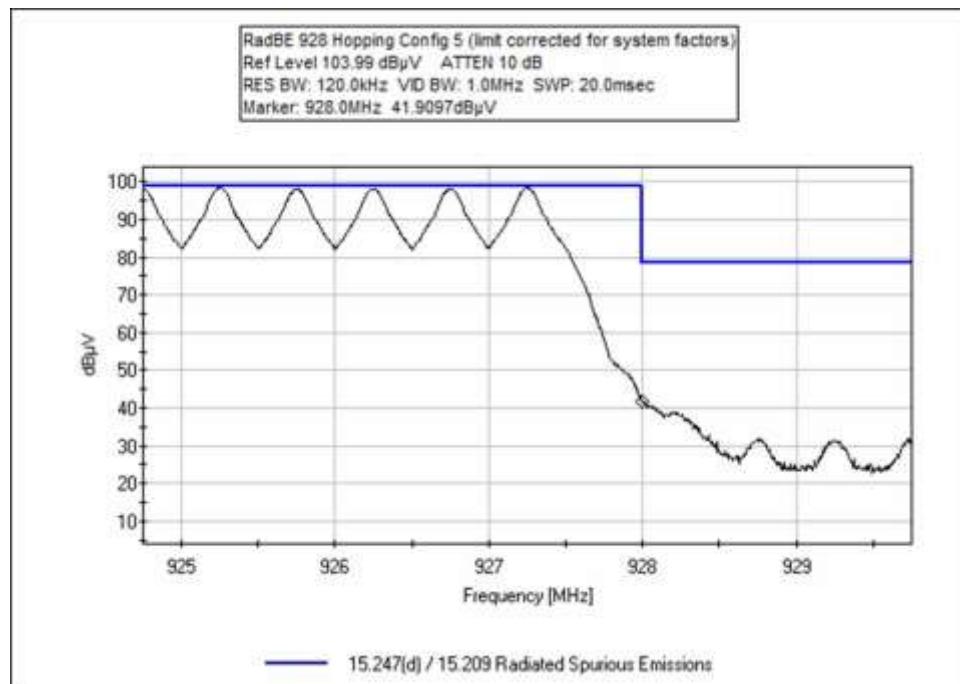




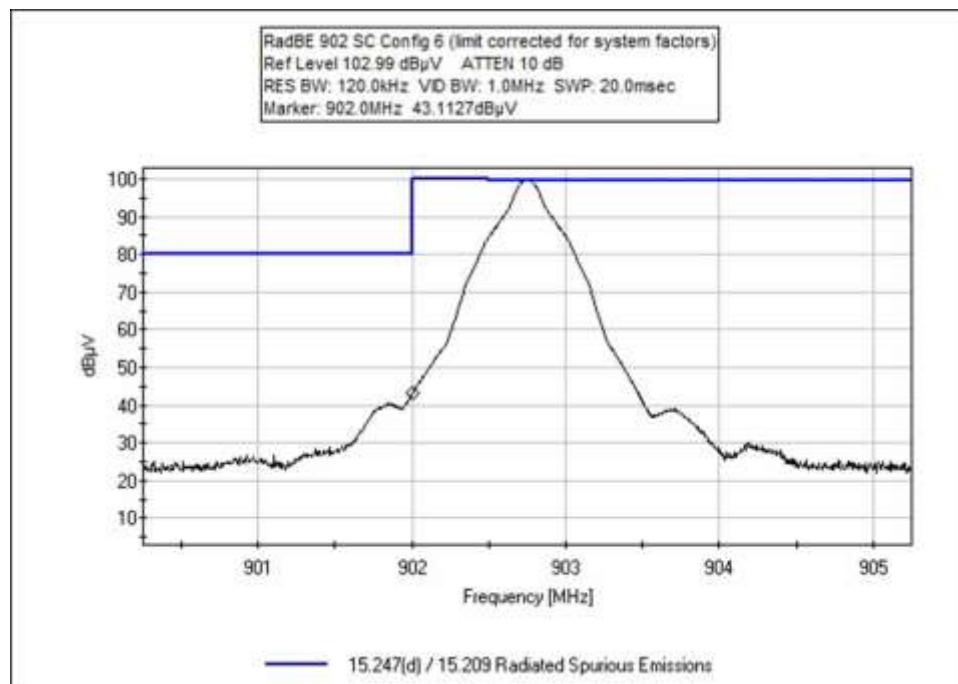
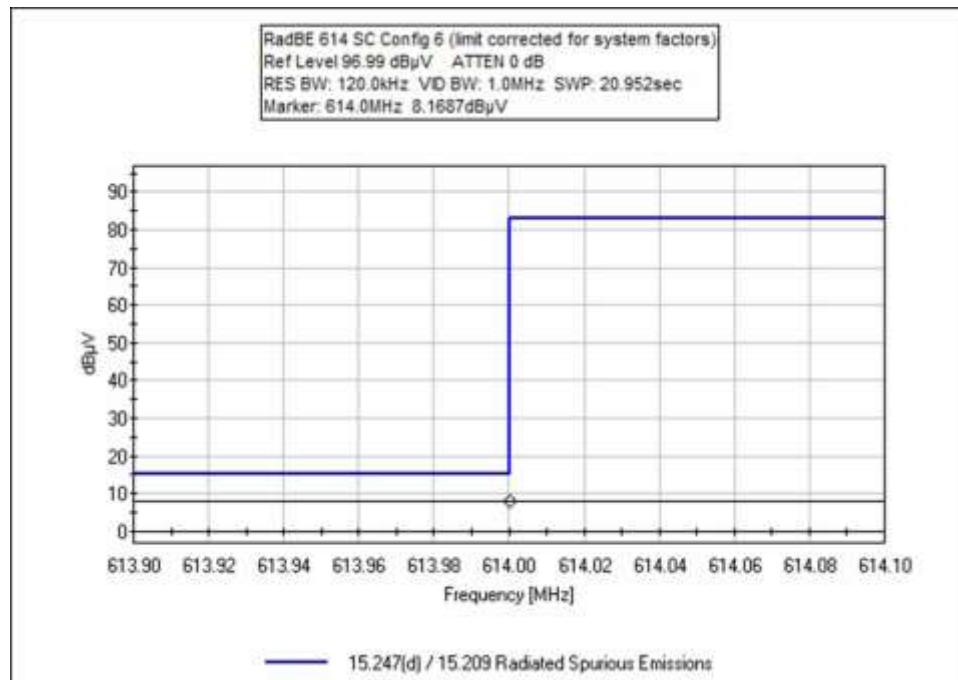
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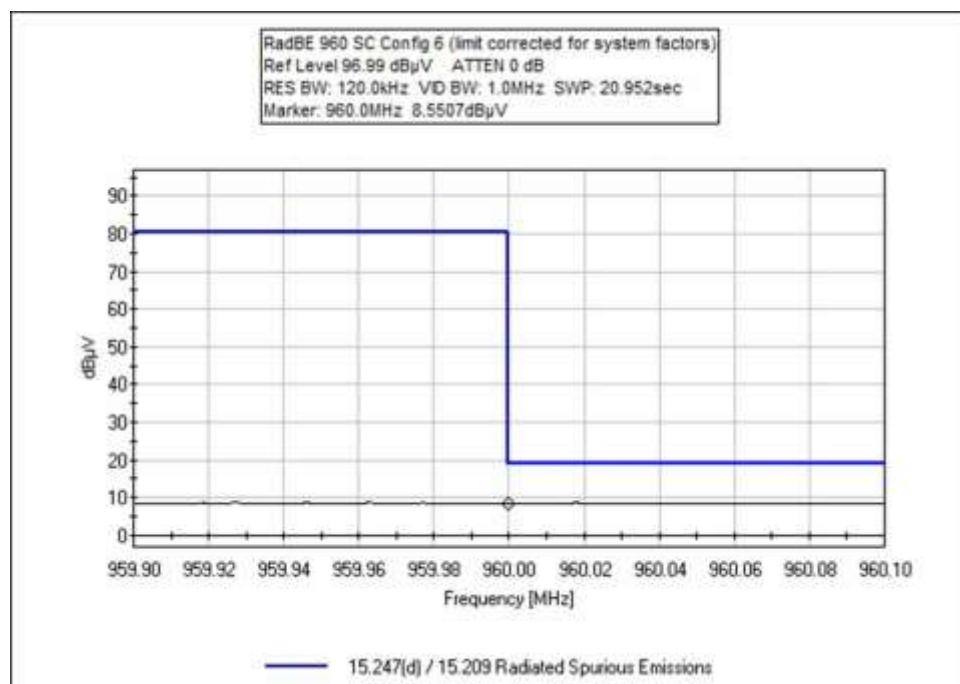
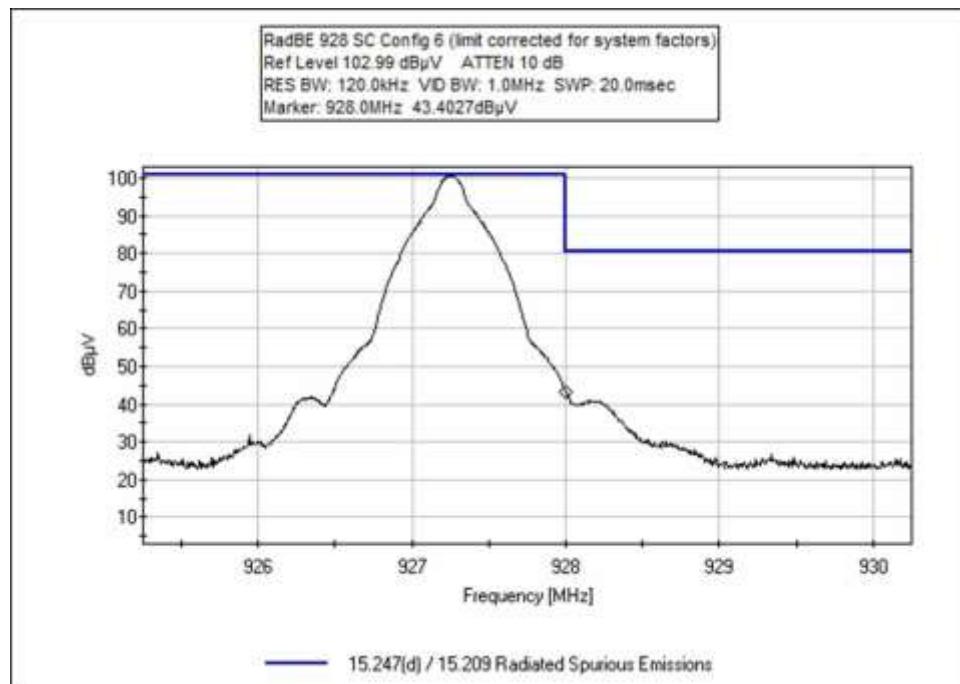


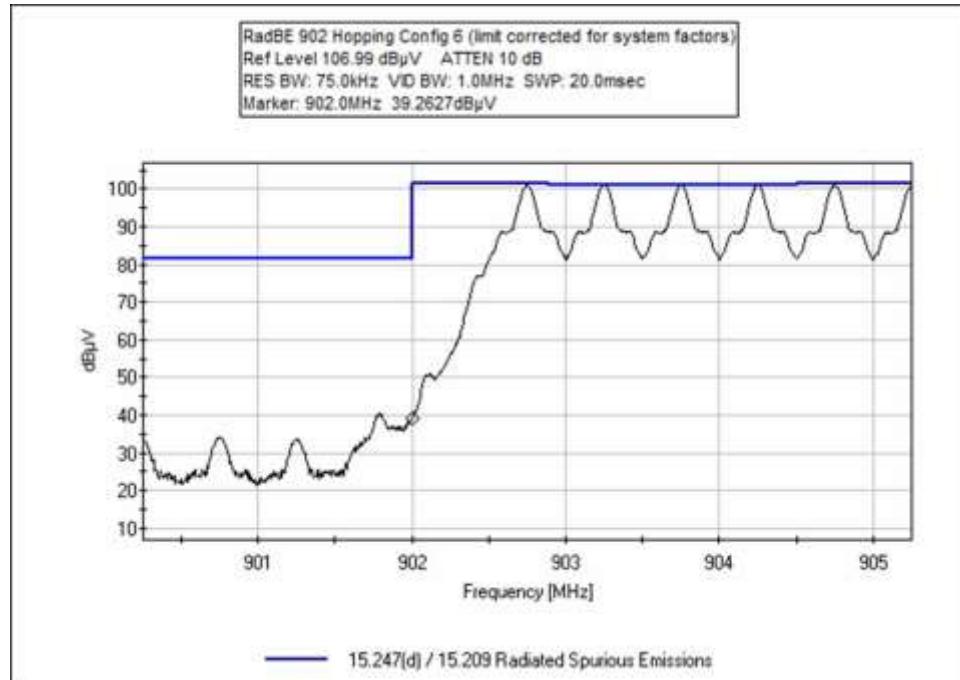
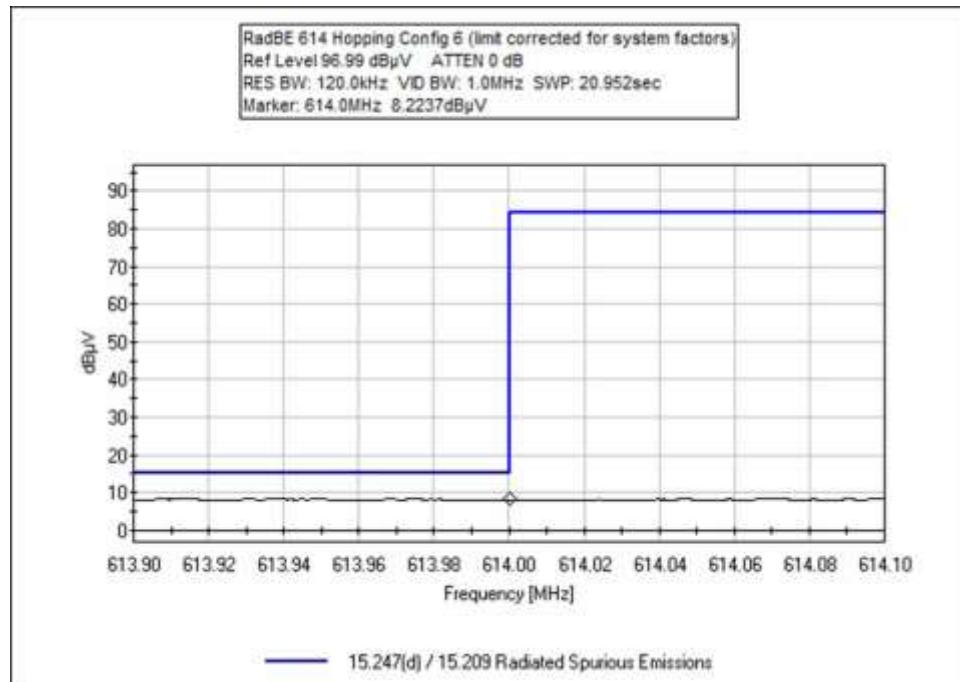


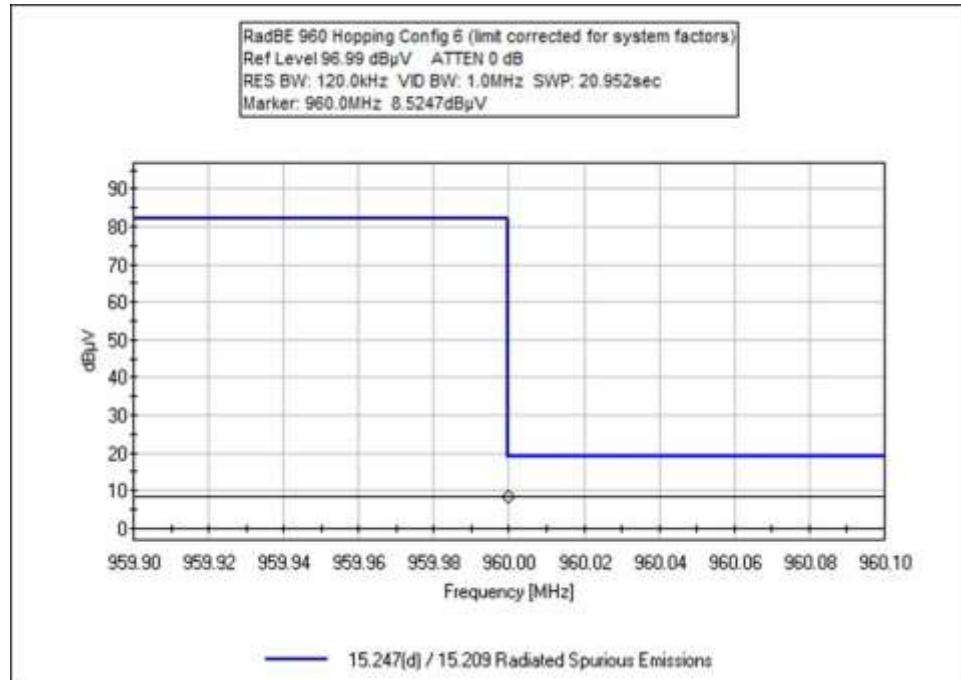
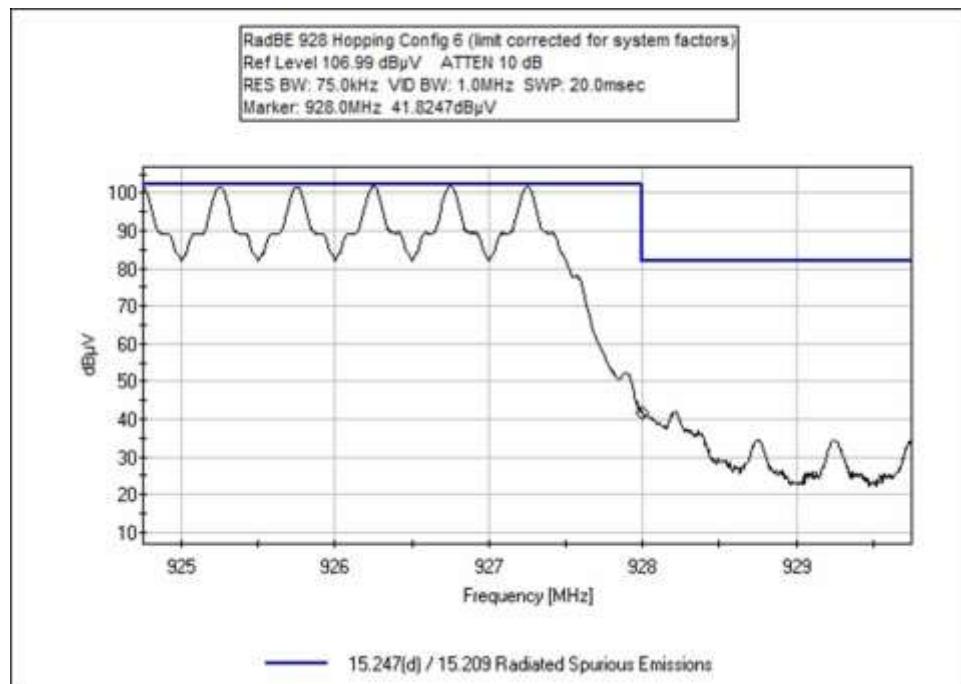


Configuration 6









Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107623** Date: 10/21/2022
 Test Type: **Maximized Emissions** Time: 17:17:41
 Tested By: Michael Atkinson Sequence#: 1
 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: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency: Band Edge

Test Setup:

Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T4	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T5	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

#	Freq MHz	Rdng dB μ V	Reading listed by margin.				Test Distance: 3 Meters				
			T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
			T5 dB								
1	614.000M QP	8.2	+0.0	+0.3	+1.2	+1.9	+0.0	38.8	46.0	-7.2	Vert
			+27.2								SC
2	614.000M QP	8.0	+0.0	+0.3	+1.2	+1.9	+0.0	38.6	46.0	-7.4	Vert
			+27.2								Hopping
3	960.000M QP	8.2	+0.0	+0.3	+1.5	+2.4	+0.0	43.1	54.0	-10.9	Vert
			+30.7								SC
4	960.000M QP	8.1	+0.0	+0.3	+1.5	+2.4	+0.0	43.0	54.0	-11.0	Vert
			+30.7								Hopping
5	928.000M	37.4	+0.0	+0.3	+1.5	+2.4	+0.0	72.2	108.0	-35.8	Vert
			+30.6								SC
6	928.000M	37.9	+0.0	+0.3	+1.5	+2.4	+0.0	72.7	109.5	-36.8	Vert
			+30.6								Hopping
7	902.000M	40.3	+0.0	+0.3	+1.4	+2.3	+0.0	73.9	111.0	-37.1	Vert
			+29.6								SC
8	902.000M	41.6	+0.0	+0.3	+1.4	+2.3	+0.0	75.2	112.5	-37.3	Vert
			+29.6								Hopping



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/21/2022
Test Type: **Maximized Emissions** Time: 18:52:07
Tested By: Michael Atkinson Sequence#: 2
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Test Environment Conditions:

Temperature: 24°C

Humidity: 51%

Pressure: 101.5kPa

Test Method: ANSI C63.10 (2013)

Frequency: Band Edge

Test Setup:

Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T4	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T5	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

#	Freq MHz	Rdng dB μ V	Reading listed by margin.				Test Distance: 3 Meters				
			T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar
			T5 dB								Ant
1	6140.000M	8.3	+0.0	+0.3	+1.2	+1.9	+0.0	38.9	46.0	-7.1	Vert
	QP		+27.2								Hopping
2	614.000M	8.2	+0.0	+0.3	+1.2	+1.9	+0.0	38.8	46.0	-7.2	Vert
	QP		+27.2								SC
3	960.000M	8.2	+0.0	+0.3	+1.5	+2.4	+0.0	43.1	54.0	-10.9	Vert
	QP		+30.7								Hopping
4	960.000M	8.1	+0.0	+0.3	+1.5	+2.4	+0.0	43.0	54.0	-11.0	Vert
	QP		+30.7								SC
5	928.000M	39.6	+0.0	+0.3	+1.5	+2.4	+0.0	74.4	111.0	-36.6	Vert
			+30.6								SC
6	928.000M	40.2	+0.0	+0.3	+1.5	+2.4	+0.0	75.0	112.0	-37.0	Vert
			+30.6								Hopping
7	902.000M	39.6	+0.0	+0.3	+1.4	+2.3	+0.0	73.2	110.5	-37.3	Vert
			+29.6								SC
8	902.000M	40.6	+0.0	+0.3	+1.4	+2.3	+0.0	74.2	112.0	-37.8	Vert
			+29.6								Hopping



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/21/2022
Test Type: **Maximized Emissions** Time: 19:49:44
Tested By: Michael Atkinson Sequence#: 3
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24°C
Humidity: 51%
Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency: Band Edge
Test Setup: Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T2	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T3	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T4	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

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	614.000M QP	8.4	+0.3	+1.2	+1.9	+27.2	+0.0	39.0	46.0	-7.0	Vert
2	614.000M QP	8.4	+0.3	+1.2	+1.9	+27.2	+0.0	39.0	46.0	-7.0	Vert
3	960.000M QP	8.4	+0.3	+1.5	+2.4	+30.7	+0.0	43.3	54.0	-10.7	Vert
4	960.000M QP	8.4	+0.3	+1.5	+2.4	+30.7	+0.0	43.3	54.0	-10.7	Vert
5	928.000M	43.5	+0.3	+1.5	+2.4	+30.6	+0.0	78.3	114.5	-36.2	Vert
6	928.000M	41.4	+0.3	+1.5	+2.4	+30.6	+0.0	76.2	113.0	-36.8	Vert
7	902.000M	42.2	+0.3	+1.4	+2.3	+29.6	+0.0	75.8	113.0	-37.2	Vert
8	902.000M	43.4	+0.3	+1.4	+2.3	+29.6	+0.0	77.0	114.5	-37.5	Vert



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/24/2022
Test Type: **Maximized Emissions** Time: 17:12:27
Tested By: Michael Atkinson Sequence#: 4
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 51% Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency: Band Edge
Test Setup: Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T4	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T5	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5				Table	dB μ V/m	dB μ V/m		
1	614.000M	8.3	+0.0	+0.3	+1.2	+1.9	+0.0	38.9	46.0	-7.1	Vert
	QP		+27.2								Hopping
2	614.000M	8.1	+0.0	+0.3	+1.2	+1.9	+0.0	38.7	46.0	-7.3	Horiz
	QP		+27.2								SC
3	960.000M	8.2	+0.0	+0.3	+1.5	+2.4	+0.0	43.1	54.0	-10.9	Vert
	QP		+30.7								Hopping
4	960.000M	8.1	+0.0	+0.3	+1.5	+2.4	+0.0	43.0	54.0	-11.0	Horiz
	QP		+30.7								SC
5	902.000M	41.6	+0.0	+0.3	+1.4	+2.3	+0.0	75.2	112.0	-36.8	Horiz
			+29.6								SC
6	928.000M	40.1	+0.0	+0.3	+1.5	+2.4	+0.0	74.9	112.0	-37.1	Vert
			+30.6								SC
7	902.000M	38.7	+0.0	+0.3	+1.4	+2.3	+0.0	72.3	114.0	-41.7	Vert
			+29.6								Hopping
8	928.000M	37.5	+0.0	+0.3	+1.5	+2.4	+0.0	72.3	114.0	-41.7	Vert
			+30.6								Hopping

Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
 Customer: **Impinj Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107623** Date: 10/24/2022
 Test Type: **Maximized Emissions** Time: 18:06:14
 Tested By: Michael Atkinson Sequence#: 5
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24°C
Humidity: 51%
Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency: Band Edge
Test Setup: Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T4	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T5	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

#	Freq	Rdng	Reading listed by margin.				Test Distance: 3 Meters				
			T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5				Table	dB μ V/m	dB μ V/m	dB	Ant
1	614.000M	8.1	+0.0	+0.3	+1.2	+1.9	+0.0	38.7	46.0	-7.3	Vert
			+27.2						SC		
2	614.000M	7.9	+0.0	+0.3	+1.2	+1.9	+0.0	38.5	46.0	-7.5	Vert
			+27.2						Hopping		
3	960.000M	8.2	+0.0	+0.3	+1.5	+2.4	+0.0	43.1	54.0	-10.9	Vert
			+30.7						SC		
4	960.000M	8.1	+0.0	+0.3	+1.5	+2.4	+0.0	43.0	54.0	-11.0	Vert
			+30.7						Hopping		
5	928.000M	40.8	+0.0	+0.3	+1.5	+2.4	+0.0	75.6	112.0	-36.4	Vert
			+30.6						SC		
6	902.000M	41.7	+0.0	+0.3	+1.4	+2.3	+0.0	75.3	112.0	-36.7	Vert
			+29.6						SC		
7	928.000M	41.9	+0.0	+0.3	+1.5	+2.4	+0.0	76.7	113.5	-36.8	Vert
			+30.6						Hopping		
8	902.000M	42.9	+0.0	+0.3	+1.4	+2.3	+0.0	76.5	113.5	-37.0	Vert
			+29.6						Hopping		



Test Location: CKC Laboratories Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107623** Date: 10/24/2022
Test Type: **Maximized Emissions** Time: 19:31:27
Tested By: Michael Atkinson Sequence#: 6
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 6			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 6			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24°C
Humidity: 51%
Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency: Band Edge
Test Setup: Unit is on foam table 80cm high. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. XYZ EUT and antenna orientations investigated, worst case reported. Low and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T2	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T3	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T4	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

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	614.000M QP	8.2	+0.3	+1.2	+1.9	+27.2	+0.0	38.8	46.0	-7.2	Vert Hopping
2	614.000M QP	8.2	+0.3	+1.2	+1.9	+27.2	+0.0	38.8	46.0	-7.2	Vert SC
3	960.000M QP	8.6	+0.3	+1.5	+2.4	+30.7	+0.0	43.5	54.0	-10.5	Vert SC
4	960.000M QP	8.5	+0.3	+1.5	+2.4	+30.7	+0.0	43.4	54.0	-10.6	Vert Hopping
5	902.000M	43.1	+0.3	+1.4	+2.3	+29.6	+0.0	76.7	113.5	-36.8	Vert SC
6	928.000M	43.4	+0.3	+1.5	+2.4	+30.6	+0.0	78.2	115.5	-37.3	Vert SC
7	928.000M	41.8	+0.3	+1.5	+2.4	+30.6	+0.0	76.6	117.0	-40.4	Vert Hopping
8	902.000M	39.3	+0.3	+1.4	+2.3	+29.6	+0.0	72.9	115.0	-42.1	Vert Hopping

Test Setup Photo(s)

Configuration 1



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1

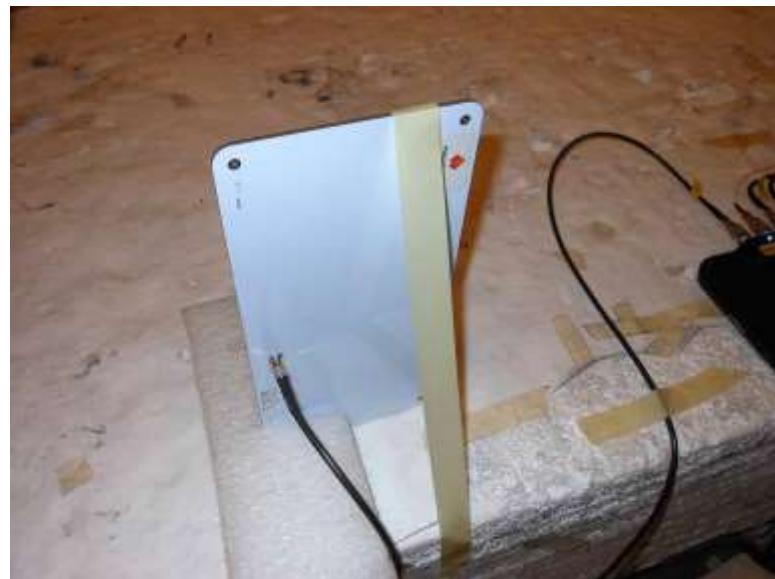


Above 1GHz; View 2

Configuration 2



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1



Above 1GHz; View 2

Configuration 3



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1

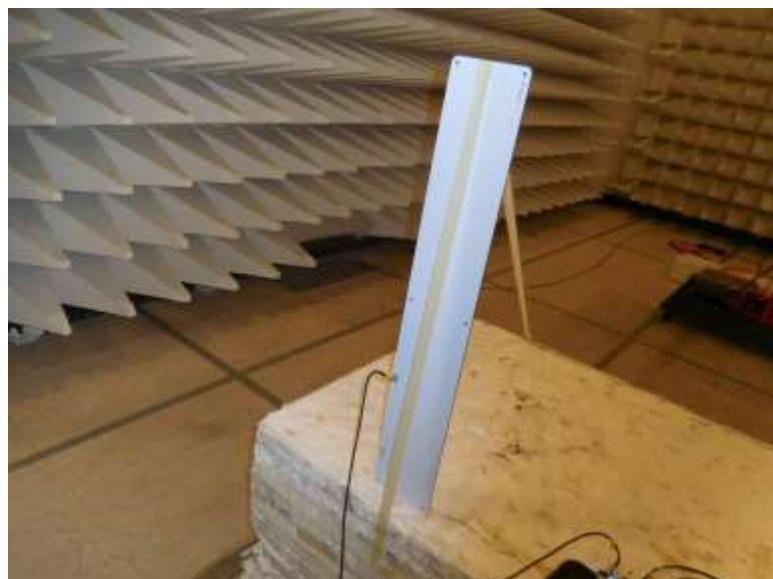


Above 1GHz; View 2

Configuration 4



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2

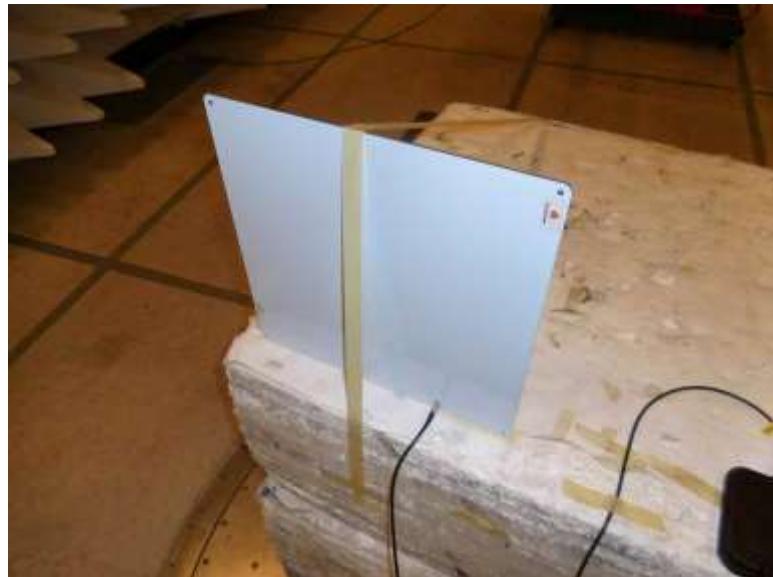


Above 1GHz; View 1

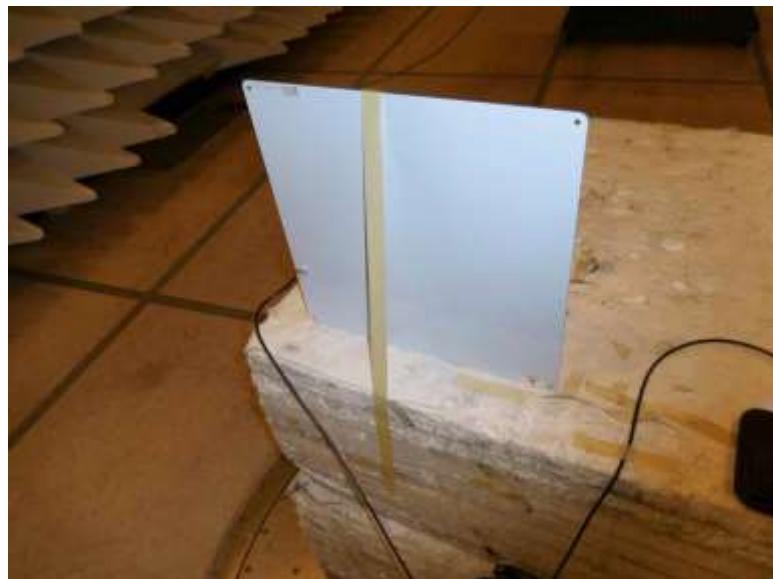


Above 1GHz; View 2

Configuration 5



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1

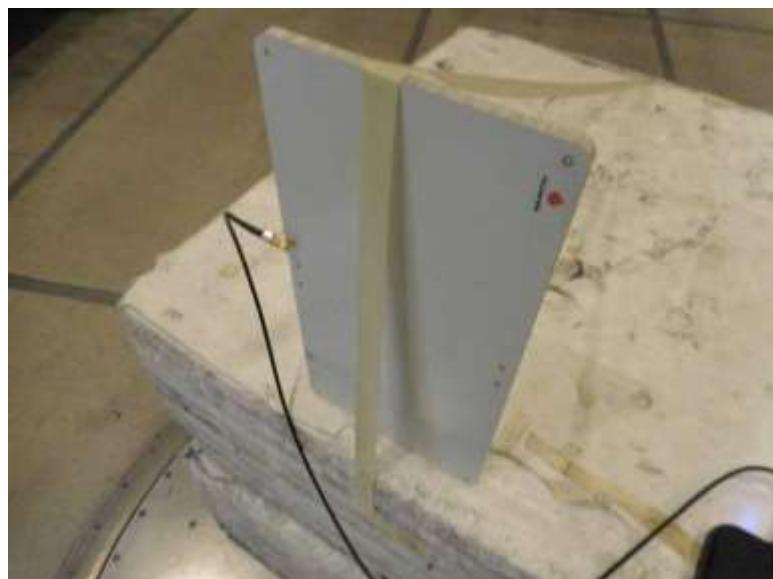


Above 1GHz; View 2

Configuration 6



X-Axis



Y-Axis



Z-Axis



Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1



Above 1GHz; View 2

15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
 Customer: **Impinj Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **107623** Date: 10/25/2022
 Test Type: **Conducted Emissions** Time: 14:03:43
 Tested By: Matt Harrison Sequence#: 6
 Software: EMITest 5.03.20 120V 60Hz

Equipment Tested:

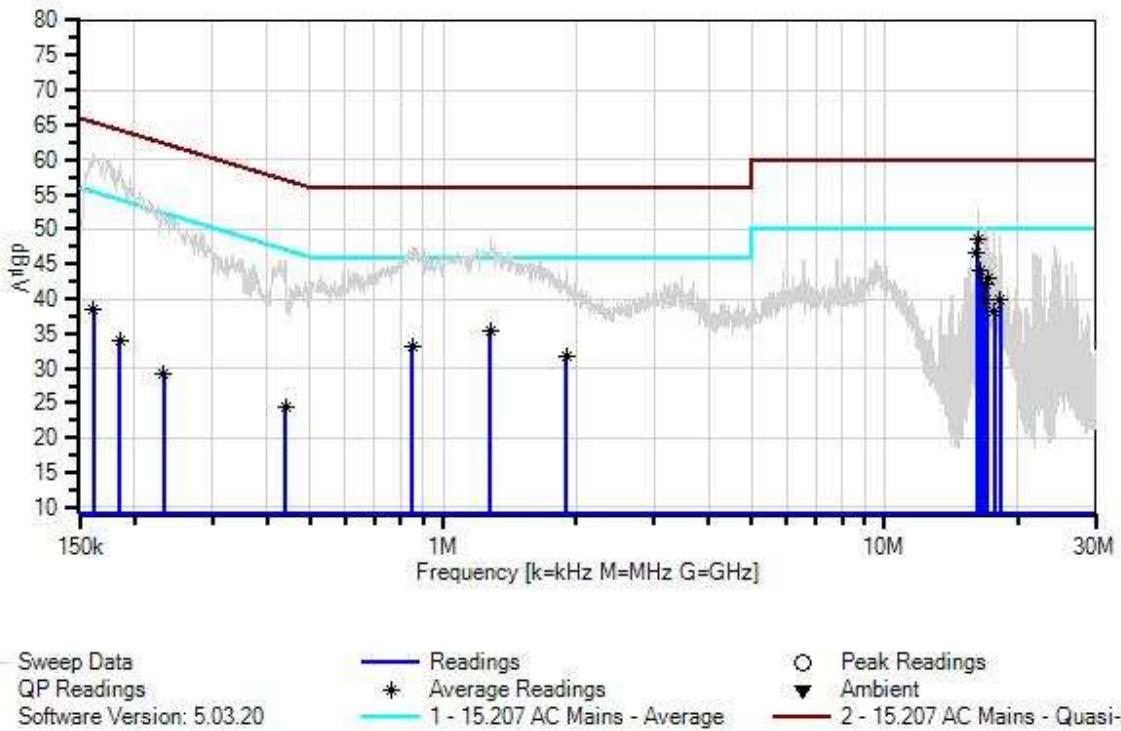
Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24°C
Humidity: 51%
Pressure: 101.5kPa
Test Method: ANSI C63.10 (2013)
Frequency Range: 150k-30MHz
Test Setup: Unit is on foam table 80cm high. It is connected to 4 antennas and a remote POE injector. EUT is continuously transmitting with modulation on mid channel as representative of worst case.

Impinj Inc. WO#: 107623 Sequence#: 6 Date: 10/25/2022
 15.207 AC Mains - Average Test Lead: 120V 60Hz Line

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	3/23/2022	3/23/2024
T2	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T4	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
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/5/2022	1/5/2024

Measurement Data:			Reading listed by margin.				Test Lead: Line				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5				Table	dB μ V	dB μ V		
			MHz	dB μ V	dB	dB	dB	Table	dB μ V	dB	Ant
1	16.228M	39.1	+9.1	+0.2	+0.0	+0.1	+0.0	48.5	50.0	-1.5	Line
	Ave		+0.0								
^	16.228M	43.9	+9.1	+0.2	+0.0	+0.1	+0.0	53.3	50.0	+3.3	Line
			+0.0								
3	16.166M	37.2	+9.1	+0.2	+0.0	+0.1	+0.0	46.6	50.0	-3.4	Line
	Ave		+0.0								
^	16.166M	40.9	+9.1	+0.2	+0.0	+0.1	+0.0	50.3	50.0	+0.3	Line
			+0.0								
5	16.472M	34.8	+9.1	+0.2	+0.0	+0.0	+0.0	44.1	50.0	-5.9	Line
	Ave		+0.0								
^	16.472M	38.9	+9.1	+0.2	+0.0	+0.0	+0.0	48.2	50.0	-1.8	Line
			+0.0								
7	17.085M	33.6	+9.1	+0.2	+0.0	+0.0	+0.0	43.0	50.0	-7.0	Line
	Ave		+0.1								
^	17.085M	39.7	+9.1	+0.2	+0.0	+0.0	+0.0	49.1	50.0	-0.9	Line
			+0.1								
9	16.959M	32.6	+9.1	+0.2	+0.0	+0.0	+0.0	42.0	50.0	-8.0	Line
	Ave		+0.1								
^	16.959M	38.9	+9.1	+0.2	+0.0	+0.0	+0.0	48.3	50.0	-1.7	Line
			+0.1								
11	18.247M	30.4	+9.1	+0.2	+0.1	+0.1	+0.0	40.0	50.0	-10.0	Line
	Ave		+0.1								
^	18.247M	39.6	+9.1	+0.2	+0.1	+0.1	+0.0	49.2	50.0	-0.8	Line
			+0.1								
13	16.896M	30.5	+9.1	+0.2	+0.0	+0.0	+0.0	39.9	50.0	-10.1	Line
	Ave		+0.1								
^	16.896M	40.9	+9.1	+0.2	+0.0	+0.0	+0.0	50.3	50.0	+0.3	Line
			+0.1								
15	1.281M	26.0	+9.1	+0.1	+0.1	+0.1	+0.0	35.5	46.0	-10.5	Line
	Ave		+0.1								
^	1.281M	39.0	+9.1	+0.1	+0.1	+0.1	+0.0	48.5	46.0	+2.5	Line
			+0.1								
17	17.688M	28.9	+9.1	+0.2	+0.0	+0.0	+0.0	38.3	50.0	-11.7	Line
	Ave		+0.1								
^	17.688M	40.7	+9.1	+0.2	+0.0	+0.0	+0.0	50.1	50.0	+0.1	Line
			+0.1								
19	851.753k	23.7	+9.1	+0.0	+0.1	+0.1	+0.0	33.1	46.0	-12.9	Line
	Ave		+0.1								
^	851.752k	38.1	+9.1	+0.0	+0.1	+0.1	+0.0	47.5	46.0	+1.5	Line
			+0.1								
21	1.906M	22.2	+9.1	+0.1	+0.1	+0.1	+0.0	31.6	46.0	-14.4	Line
	Ave		+0.0								
^	1.906M	34.9	+9.1	+0.1	+0.1	+0.1	+0.0	44.3	46.0	-1.7	Line
			+0.0								

23	161.634k	28.7	+9.1	+0.0	+0.1	+0.1	+0.0	38.5	55.4	-16.9	Line
Ave			+0.5								
^	161.634k	51.2	+9.1	+0.0	+0.1	+0.1	+0.0	61.0	55.4	+5.6	Line
			+0.5								
25	185.632k	24.4	+9.1	+0.0	+0.1	+0.1	+0.0	33.9	54.2	-20.3	Line
Ave			+0.2								
^	185.632k	49.6	+9.1	+0.0	+0.1	+0.1	+0.0	59.1	54.2	+4.9	Line
			+0.2								
27	438.700k	14.9	+9.1	+0.0	+0.1	+0.1	+0.0	24.3	47.1	-22.8	Line
Ave			+0.1								
^	438.699k	36.2	+9.1	+0.0	+0.1	+0.1	+0.0	45.6	47.1	-1.5	Line
			+0.1								
29	232.900k	19.7	+9.1	+0.0	+0.1	+0.1	+0.0	29.1	52.3	-23.2	Line
Ave			+0.1								
^	232.900k	43.2	+9.1	+0.0	+0.1	+0.1	+0.0	52.6	52.3	+0.3	Line
			+0.1								



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
Customer: **Impinj Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **107623** Date: 10/25/2022
Test Type: **Conducted Emissions** Time: 13:53:26
Tested By: Matt Harrison Sequence#: 5
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: 24°C

Humidity: 51%

Pressure: 101.5kPa

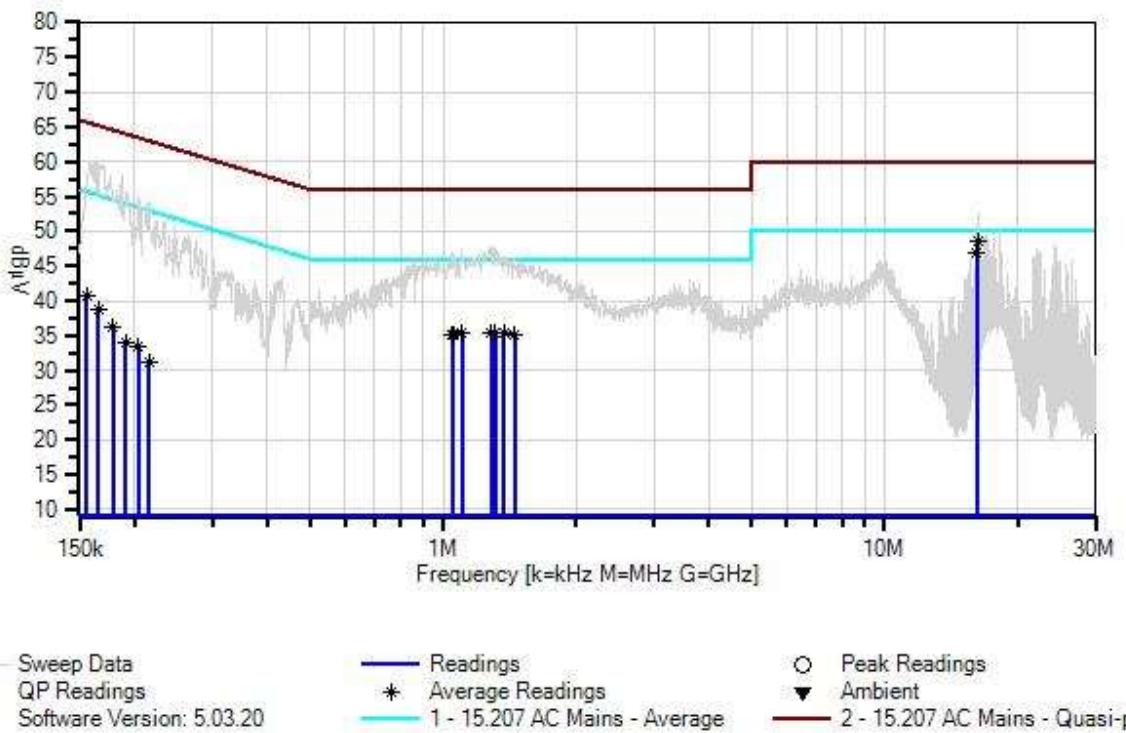
Test Method: ANSI C63.10 (2013)

Frequency Range: 150k-30MHz

Test Setup:

Unit is on foam table 80cm high. It is connected to 4 antennas and a remote POE injector. EUT is continuously transmitting with modulation on mid channel as representative of worst-case.

Impinj Inc. WO#: 107623 Sequence#: 5 Date: 10/25/2022
 15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral


Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	3/23/2022	3/23/2024
T2	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
	AN01311	50uH LISN-Line1 (L)	3816/2	2/23/2022	2/23/2024
T4	AN01311	50uH LISN-Line2 (N)	3816/2	2/23/2022	2/23/2024
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/5/2022	1/5/2024

Measurement Data:			Reading listed by margin.				Test Lead: Neutral				
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5				Table	dB μ V	dB μ V		
			MHz	dB μ V	dB	dB	dB	Table	dB μ V	dB	Ant
1	16.228M	39.4	+9.1	+0.2	+0.0	+0.0	+0.0	48.7	50.0	-1.3	Neutr
	Ave		+0.0								
^	16.228M	43.8	+9.1	+0.2	+0.0	+0.0	+0.0	53.1	50.0	+3.1	Neutr
			+0.0								
3	16.166M	37.5	+9.1	+0.2	+0.0	+0.0	+0.0	46.8	50.0	-3.2	Neutr
	Ave		+0.0								
^	16.166M	41.6	+9.1	+0.2	+0.0	+0.0	+0.0	50.9	50.0	+0.9	Neutr
			+0.0								
5	1.103M	26.0	+9.1	+0.1	+0.1	+0.1	+0.0	35.5	46.0	-10.5	Neutr
	Ave		+0.1								
^	1.103M	37.6	+9.1	+0.1	+0.1	+0.1	+0.0	47.1	46.0	+1.1	Neutr
			+0.1								
7	1.285M	25.9	+9.1	+0.1	+0.1	+0.1	+0.0	35.4	46.0	-10.6	Neutr
	Ave		+0.1								
^	1.285M	38.3	+9.1	+0.1	+0.1	+0.1	+0.0	47.8	46.0	+1.8	Neutr
			+0.1								
9	1.371M	25.9	+9.1	+0.1	+0.1	+0.1	+0.0	35.4	46.0	-10.6	Neutr
	Ave		+0.1								
^	1.371M	36.9	+9.1	+0.1	+0.1	+0.1	+0.0	46.4	46.0	+0.4	Neutr
			+0.1								
11	1.315M	25.8	+9.1	+0.1	+0.1	+0.1	+0.0	35.3	46.0	-10.7	Neutr
	Ave		+0.1								
^	1.315M	38.2	+9.1	+0.1	+0.1	+0.1	+0.0	47.7	46.0	+1.7	Neutr
			+0.1								
13	1.056M	25.7	+9.1	+0.1	+0.1	+0.1	+0.0	35.2	46.0	-10.8	Neutr
	Ave		+0.1								
14	1.451M	25.7	+9.1	+0.1	+0.1	+0.1	+0.0	35.2	46.0	-10.8	Neutr
	Ave		+0.1								
^	1.451M	36.7	+9.1	+0.1	+0.1	+0.1	+0.0	46.2	46.0	+0.2	Neutr
			+0.1								
16	1.047M	25.7	+9.1	+0.1	+0.1	+0.1	+0.0	35.2	46.0	-10.8	Neutr
	Ave		+0.1								
^	1.047M	37.4	+9.1	+0.1	+0.1	+0.1	+0.0	46.9	46.0	+0.9	Neutr
			+0.1								
^	1.056M	37.2	+9.1	+0.1	+0.1	+0.1	+0.0	46.7	46.0	+0.7	Neutr
			+0.1								
19	156.133k	30.7	+9.1	+0.0	+0.1	+0.1	+0.0	40.7	55.7	-15.0	Neutr
	Ave		+0.7								
^	156.133k	54.3	+9.1	+0.0	+0.1	+0.1	+0.0	64.3	55.7	+8.6	Neutr
			+0.7								
21	165.846k	29.0	+9.1	+0.0	+0.1	+0.1	+0.0	38.7	55.2	-16.5	Neutr
	Ave		+0.4								
^	165.846k	53.1	+9.1	+0.0	+0.1	+0.1	+0.0	62.8	55.2	+7.6	Neutr
			+0.4								

23	178.384k	26.6	+9.1	+0.0	+0.1	+0.1	+0.0	36.2	54.6	-18.4	Neutr
Ave			+0.3								
^	178.384k	50.4	+9.1	+0.0	+0.1	+0.1	+0.0	60.0	54.6	+5.4	Neutr
			+0.3								
25	191.451k	24.6	+9.1	+0.0	+0.1	+0.1	+0.0	34.0	54.0	-20.0	Neutr
Ave			+0.1								
^	191.450k	46.3	+9.1	+0.0	+0.1	+0.1	+0.0	55.7	54.0	+1.7	Neutr
			+0.1								
27	204.540k	23.9	+9.1	+0.0	+0.1	+0.1	+0.0	33.3	53.4	-20.1	Neutr
Ave			+0.1								
^	204.540k	45.4	+9.1	+0.0	+0.1	+0.1	+0.0	54.8	53.4	+1.4	Neutr
			+0.1								
29	216.176k	21.7	+9.1	+0.0	+0.1	+0.1	+0.0	31.1	53.0	-21.9	Neutr
Ave			+0.1								
^	216.175k	45.0	+9.1	+0.0	+0.1	+0.1	+0.0	54.4	53.0	+1.4	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 dB μ V/m, the spectrum analyzer reading in dB μ 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	(dB μ V)
+ Antenna Factor	(dB/m)
+ Cable Loss	(dB)
- Distance Correction	(dB)
- Preamplifier Gain	(dB)
= Corrected Reading	(dB μ V/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.