

Impinj Inc.

TEST REPORT FOR

R700 RAIN RFID Reader
Model: IPJ-R700-341

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)
15.247 (FHSS 902-928MHz)

Report No.: 108693-1_Vol.1

Date of issue: August 17, 2023



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: 2D-10723504

REPORT PREPARED BY:

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

Project Number: 108693

DATE OF EQUIPMENT RECEIPT:

July 18, 2023

DATE(S) OF TESTING:

July 18-26, 2023

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 SE, Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

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

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

SUMMARY OF RESULTS

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

Test Procedure	Description	Modifications	Results
15.247(a)(1)(i)	Occupied Bandwidth	NA	NP
15.247(a)(1)	Carrier Separation	NA	NP
15.247(a)(1)(i)	Number of Hopping Channels	NA	NP
15.247(a)(1)(i)	Average Time of Occupancy	NA	NP
15.247(b)(2)	Output Power	NA	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	NP

NA = Not Applicable

NP = CKC Laboratories, Inc was not contacted to perform test.

*Partial testing performed as contracted for permissive change testing. The band edge contracted to be measured from 902 to 960MHz and the spurious emissions contracted to be measured from 1-10GHz.

ISO/IEC 17025 Decision Rule

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

Modifications During Testing

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

Summary of Conditions

No modifications were made during testing; the customer declares that the ferrites installed on the cables at the EUT are part of the final bill of material.

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 Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
RFID UHF fan beam antenna	Keonn	ADAN-p16US-FRSMA-200.01	100029201220280000006
RFID UHF fan beam antenna	Keonn	ADAN-p16US-FRSMA-200.01	100029201220280000002
RFID UHF power splitter	Keonn	ADSP-2-eSMA -110	100085602230120000008
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 2

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
1x6 array antenna	Impaq Technology Co. LTD.	Ant16	1x6 array antenna
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 3

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
30deg tilted 1x2 array antenna	Impaq Technology Co. LTD.	Ant12	NA
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 4

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
3x3 array antenna	Impaq Technology Co. LTD.	Ant33	NA
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 5

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
1x6 array antenna	Impaq Technology Co. LTD.	Ant16	NA
1x6 array antenna	Impaq Technology Co. LTD.	Ant16	NA
RFID UHF power splitter	Keonn	ADSP-2-eSMA -110	100085602230120000008
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 6

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
Slimline UHF Ground Antenna	Times-7	A6590C	210215218
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 7

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
902-928 MHZ, 11 DBIC RHCP READER ANTENNA	Mti Wireless Edge Ltd.	MT-263020/TRH/A	100313
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 8

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

Device	Manufacturer	Model #	S/N
UHF RFID antenna	identix	85DL4090	NA
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

Configuration 9

Equipment Under Test:

Device	Manufacturer	Model #	S/N
R700 RAIN RFID Reader	Impinj Inc.	IPJ-R700-341	37021230352

Support Equipment:

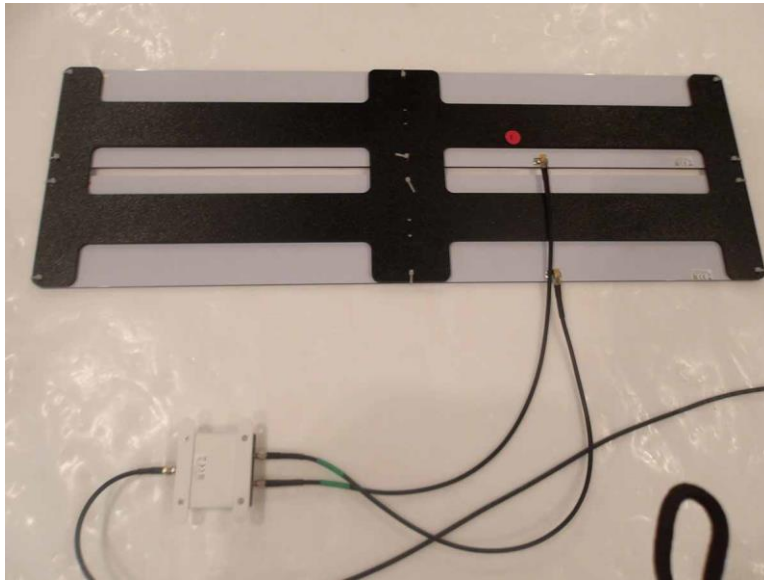
Device	Manufacturer	Model #	S/N
Slimline UHF Ground Antenna	Times-7	A6034-71800	230117672
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	ER605	22213C4002710
AC Adaptor	Hp	PPP009D	WECJQ0EARB12DM
Laptop	HP	EliteBook	REG-5CG5171595

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)

Product Information	Manufacturer-Provided Details
Number of TX Chains:	1
Antenna Type(s) and Gain:	Various, 9 configurations tested in this report. They are all patch antennas with the following gain values: Configuration 1: 9.4dBiC, 6.4dBi Configuration 2: 10dBiC, 7dBi Configuration 3: 8dBiC, 5dBi Configuration 4: 12dBiC, 9dBi Configuration 5: 11.5dBiC, 8.5dBi Configuration 6: 9dBiC, 6dBi Configuration 7: 11dBiC, 8dBi Configuration 8: 11.5dBiC, 8.5dBi Configuration 9: 9dBiC, 6dBi The manufacturer declares the following minimum cable losses shall be used with each configuration, however, during this round of testing a shorter cable was used and the output power was reduced in software to comply with the maximum EIRP requirement. With consideration of historical data on the conducted spurious emissions, as well as radiated spurious emissions with previously approved antennas set at maximum power in software this is deemed sufficient per manufacturer for this permissive change testing. Minimum Declared Cable Loss to use per Manufacturer: Configuration 1: 3.4dB Configuration 2: 4.0dB Configuration 3: 3.0dB Configuration 4: 6.0dB Configuration 5: 5.5dB Configuration 6: 3.0dB Configuration 7: 5.0dB Configuration 8: 5.5dB Configuration 9: 3.0dB
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	120VACd
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 Photo(s)



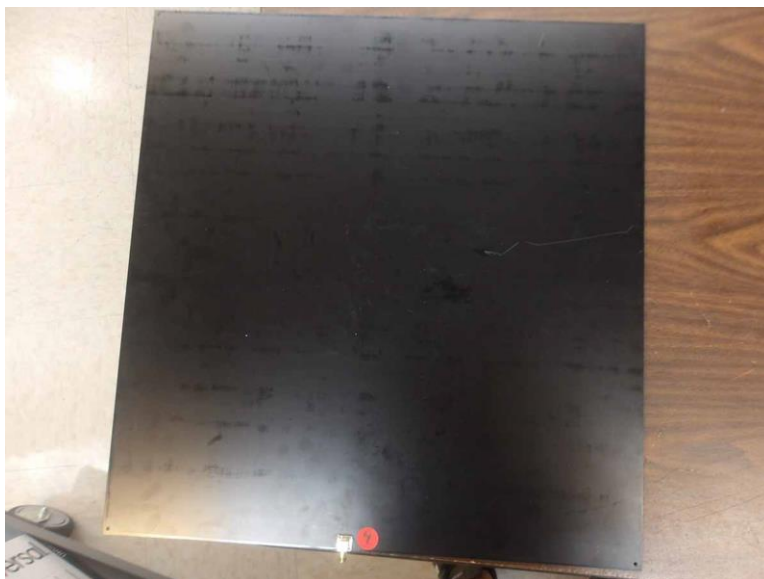
Configuration 1; Antenna



Configuration 2; Antenna



Configuration 3; Antenna



Configuration 4; Antenna



Configuration 5; Antenna



Configuration 6; Antenna



Configuration 7; Antenna



Configuration 8; Antenna

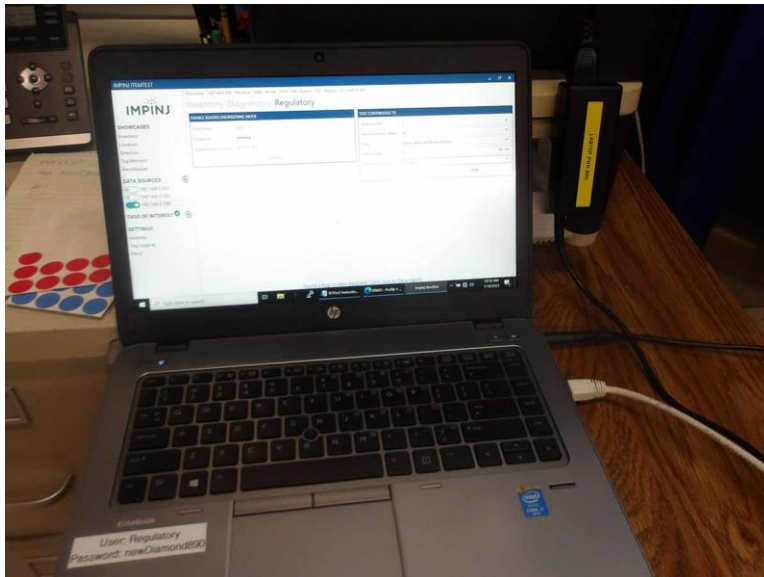


Configuration 9; Antenna



EUT Reader

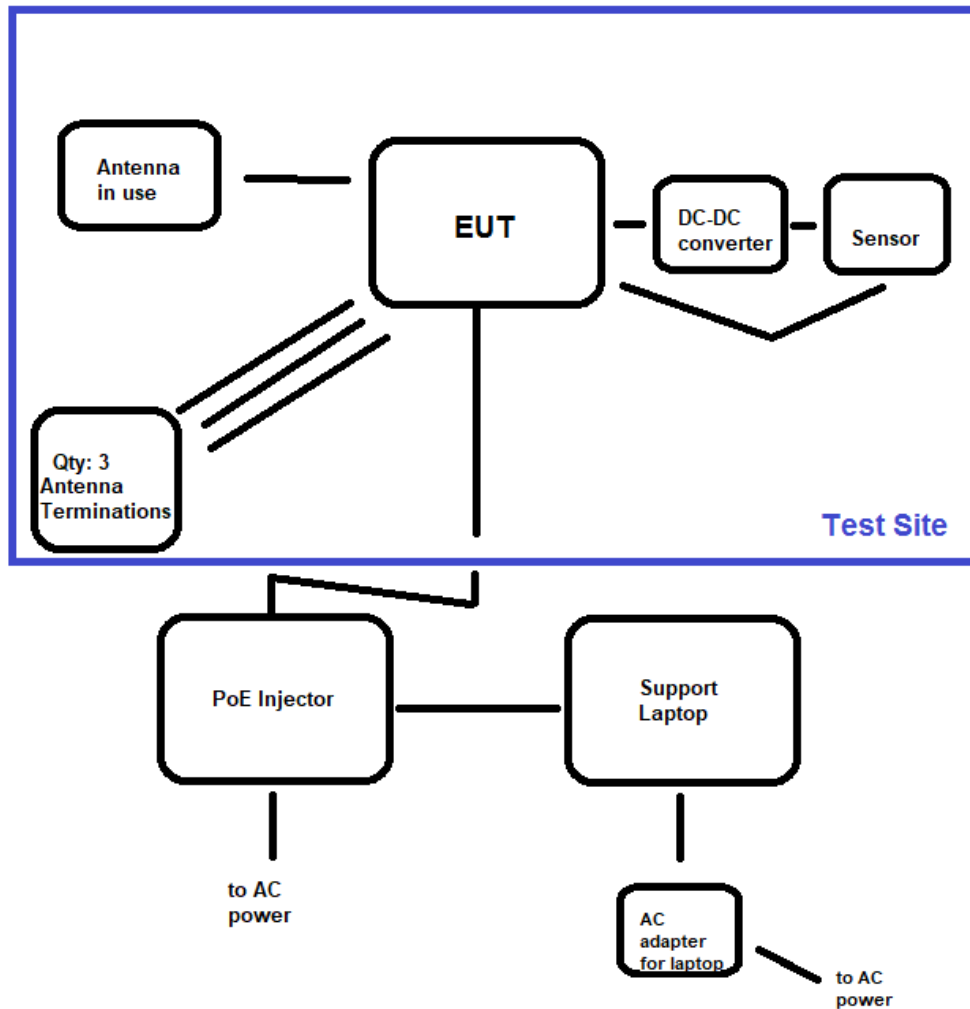
Support Equipment Photo(s)





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			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford & M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	7/18/2023 to 7/26/2023
Configuration:	1, 2, 3, 4, 5, 6, 7, 8 and 9		
Declarations:	Partial testing performed as contracted: 902MHz to 960MHz for band edge and 1-10GHz for spurious emissions. Band edge data at 614MHz noise floor has less than 6dB of margin to the limit, due to time constraints and equipment availability at time of test. The data at 614MHz was still recorded to show compliance to the limit. For Tx spurs 1-10GHz, the firmware power setting was set to 30dBm, the max allowed in test program as representative of worst case at time of test. For band edge testing, it was reduced from 30dBm if needed to meet 36dBm EIRP and the firmware power setting used was recorded in the datasheet. The partial testing and power settings were made with considerations to prior testing. Prior testing (including 13 previously approved antennas) with full frequency range of investigation showed no emissions in the frequency ranges omitted. The manufacturer declares there has been no modifications to the R700. Therefore, omission of the indicated frequency ranges continues to demonstrate compliance for the R700. The ferrites that are included on the standard bill of material for the system under test were initially not installed correctly on the Ethernet cables around the power splitter at the start of testing. During testing, additional spot checks were performed on band edge and tx spurs above 1GHz with the final ferrite configuration to confirm the same or worst case data. The photo of the final ferrite configuration is shown below, but may not accurately be shown in all setup photos for the various configurations. 		

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 #: **108693** Date: 7/20/2023
 Test Type: **Maximized Emissions** Time: 15:14:15
 Tested By: Michael Atkinson Sequence#: 21
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

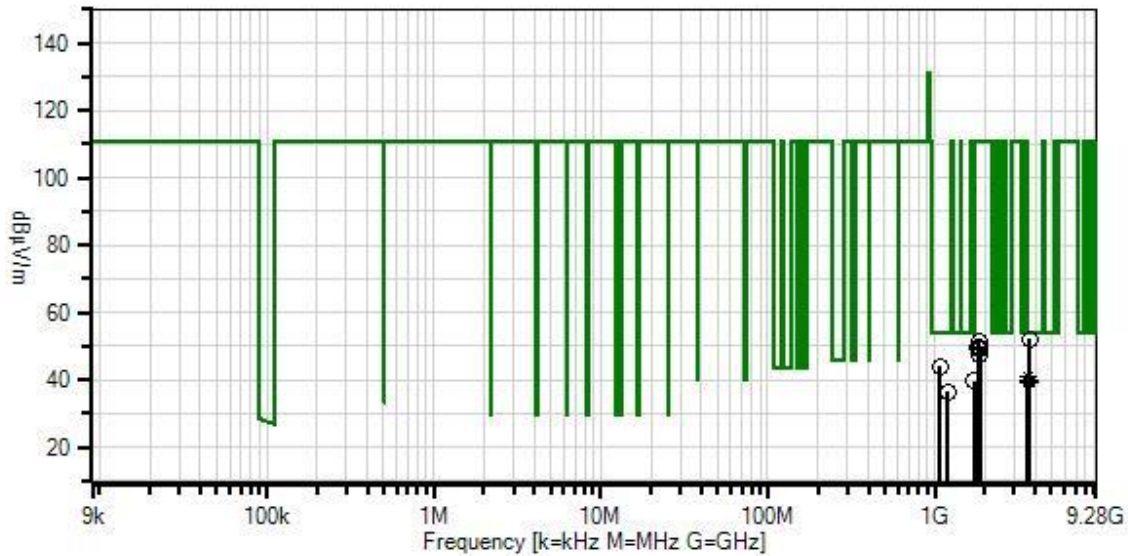
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.

Impinj Inc. W/O#: 108693 Sequence#: 21 Date: 7/20/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



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

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7	T8	Table	dBμV/m	dBμV/m	dB	Ant
1	3709.160M	38.5	+0.0	-33.9	+0.8	+1.4	+0.0	52.1	54.0	-1.9	Horiz
			+3.6	+31.6	+0.2	+9.9			High		
2	1076.000M	35.2	+0.0	-37.0	+0.3	+0.8	+0.0	44.0	54.0	-10.0	Horiz
			+1.8	+24.6	+8.6	+9.7					
3	3611.000M	27.5	+0.0	-34.0	+1.0	+1.3	+0.0	40.8	54.0	-13.2	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3611.030M	39.1	+0.0	-34.0	+1.0	+1.3	+0.0	52.4	54.0	-1.6	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
5	3709.000M	26.3	+0.0	-33.9	+0.8	+1.4	+0.0	39.9	54.0	-14.1	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.040M	39.4	+0.0	-33.9	+0.8	+1.4	+0.0	53.0	54.0	-1.0	Vert
			+3.6	+31.6	+0.2	+9.9			High		
7	3659.000M	26.3	+0.0	-34.0	+0.9	+1.4	+0.0	39.7	54.0	-14.3	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3659.060M	38.0	+0.0	-34.0	+0.9	+1.4	+0.0	51.4	54.0	-2.6	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
9	3659.000M	26.0	+0.0	-34.0	+0.9	+1.4	+0.0	39.4	54.0	-14.6	Horiz
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3658.930M	37.4	+0.0	-34.0	+0.9	+1.4	+0.0	50.8	54.0	-3.2	Horiz
			+3.7	+31.4	+0.2	+9.8			Mid		
11	3709.000M	25.4	+0.0	-33.9	+0.8	+1.4	+0.0	39.0	54.0	-15.0	Horiz
	Ave		+3.6	+31.6	+0.2	+9.9			High		
12	1192.000M	34.2	+0.0	-36.5	+0.4	+0.8	+0.0	36.5	54.0	-17.5	Horiz
			+1.9	+25.1	+0.9	+9.7					
13	1829.580M	44.5	+0.0	-35.1	+0.4	+1.0	+0.0	51.1	111.0	-59.9	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
14	1805.540M	43.6	+0.0	-35.1	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
15	1854.450M	42.9	+0.0	-35.0	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Vert
			+2.3	+27.8	+0.6	+9.8			High		
16	1805.510M	43.6	+0.0	-35.1	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Vert
			+2.2	+27.3	+0.6	+9.8			Low		
17	1854.660M	41.9	+0.0	-35.0	+0.4	+1.0	+0.0	48.8	111.0	-62.2	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
18	1829.570M	40.9	+0.0	-35.1	+0.4	+1.0	+0.0	47.5	111.0	-63.5	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
19	1728.000M	34.5	+0.0	-35.2	+0.4	+1.0	+0.0	39.6	111.0	-71.4	Horiz
			+2.2	+26.4	+0.5	+9.8					

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 #: **108693** Date: 7/20/2023
 Test Type: **Maximized Emissions** Time: 17:21:31
 Tested By: Michael Atkinson Sequence#: 22
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

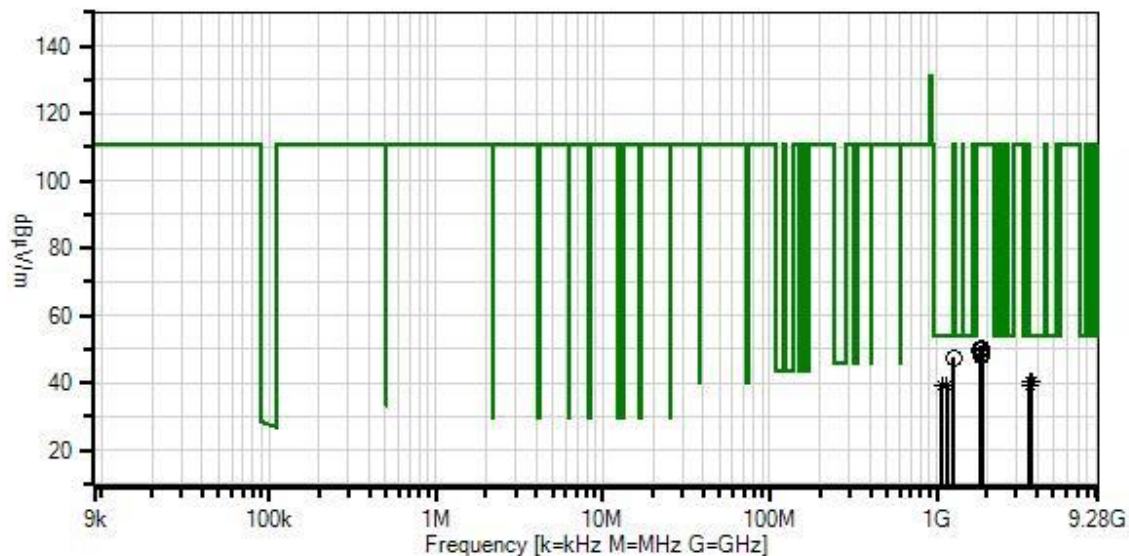
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.

Impinj Inc. W/O#: 108693 Sequence#: 22 Date: 7/20/2023
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	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamplifier	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 dB	T8 dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3709.000M	26.9	+0.0	-33.9	+0.8	+1.4	+0.0	40.5	54.0	-13.5	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.000M	38.6	+0.0	-33.9	+0.8	+1.4	+0.0	52.2	54.0	-1.8	Vert
			+3.6	+31.6	+0.2	+9.9			High		
3	3659.000M	26.7	+0.0	-34.0	+0.9	+1.4	+0.0	40.1	54.0	-13.9	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3659.040M	37.5	+0.0	-34.0	+0.9	+1.4	+0.0	50.9	54.0	-3.1	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
5	3611.000M	26.1	+0.0	-34.0	+1.0	+1.3	+0.0	39.4	54.0	-14.6	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3611.000M	37.2	+0.0	-34.0	+1.0	+1.3	+0.0	50.5	54.0	-3.5	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
7	1144.000M	37.1	+0.0	-36.7	+0.4	+0.8	+0.0	39.3	54.0	-14.7	Horiz
	Ave		+1.8	+24.9	+1.3	+9.7					
^	1144.000M	44.8	+0.0	-36.7	+0.4	+0.8	+0.0	47.0	54.0	-7.0	Horiz
			+1.8	+24.9	+1.3	+9.7					
9	1076.000M	30.1	+0.0	-37.0	+0.3	+0.8	+0.0	38.9	54.0	-15.1	Vert
	Ave		+1.8	+24.6	+8.6	+9.7					
^	1076.000M	44.5	+0.0	-37.0	+0.3	+0.8	+0.0	53.3	54.0	-0.7	Vert
			+1.8	+24.6	+8.6	+9.7					
11	1854.500M	43.5	+0.0	-35.0	+0.4	+1.0	+0.0	50.4	111.0	-60.6	Vert
			+2.3	+27.8	+0.6	+9.8			High		
12	1805.480M	43.6	+0.0	-35.1	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
13	1854.420M	42.5	+0.0	-35.0	+0.4	+1.0	+0.0	49.4	111.0	-61.6	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
14	1829.480M	41.7	+0.0	-35.1	+0.4	+1.0	+0.0	48.3	111.0	-62.7	Vert
			+2.3	+27.6	+0.6	+9.8			Mid		
15	1829.480M	41.3	+0.0	-35.1	+0.4	+1.0	+0.0	47.9	111.0	-63.1	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
16	1258.000M	44.7	+0.0	-36.2	+0.4	+0.8	+0.0	47.3	111.0	-63.7	Horiz
			+1.9	+25.3	+0.7	+9.7					

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 08:32:10
 Tested By: Michael Atkinson Sequence#: 23
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

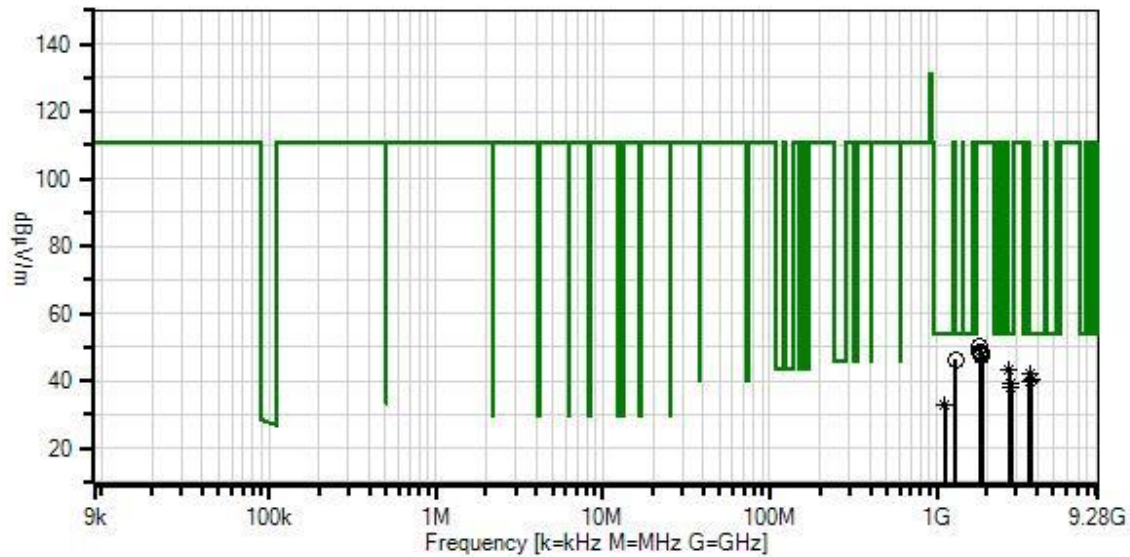
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.
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Impinj Inc. WO#: 108693 Sequence#: 23 Date: 7/21/2023
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	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamplifier	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 T8 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2708.250M	34.0	+0.0	-34.5	+0.5	+1.2	+0.0	43.5	54.0	-10.5	Vert
	Ave		+3.0	+29.3	+0.2	+9.8			Low		
^	2708.320M	40.4	+0.0	-34.5	+0.5	+1.2	+0.0	49.9	54.0	-4.1	Vert
			+3.0	+29.3	+0.2	+9.8			Low		
3	3611.000M	28.6	+0.0	-34.0	+1.0	+1.3	+0.0	41.9	54.0	-12.1	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
4	3709.000M	26.7	+0.0	-33.9	+0.8	+1.4	+0.0	40.3	54.0	-13.7	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.000M	38.2	+0.0	-33.9	+0.8	+1.4	+0.0	51.8	54.0	-2.2	Vert
			+3.6	+31.6	+0.2	+9.9			High		
6	3659.000M	26.6	+0.0	-34.0	+0.9	+1.4	+0.0	40.0	54.0	-14.0	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3659.060M	38.5	+0.0	-34.0	+0.9	+1.4	+0.0	51.9	54.0	-2.1	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
8	3611.000M	26.7	+0.0	-34.0	+1.0	+1.3	+0.0	40.0	54.0	-14.0	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3610.970M	39.5	+0.0	-34.0	+1.0	+1.3	+0.0	52.8	54.0	-1.2	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
^	3610.940M	38.7	+0.0	-34.0	+1.0	+1.3	+0.0	52.0	54.0	-2.0	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
11	2744.250M	29.7	+0.0	-34.5	+0.5	+1.2	+0.0	39.3	54.0	-14.7	Vert
	Ave		+3.0	+29.3	+0.3	+9.8			Mid		
^	2744.320M	40.3	+0.0	-34.5	+0.5	+1.2	+0.0	49.9	54.0	-4.1	Vert
			+3.0	+29.3	+0.3	+9.8			Mid		
13	2781.750M	28.2	+0.0	-34.5	+0.5	+1.2	+0.0	37.8	54.0	-16.2	Vert
	Ave		+3.0	+29.3	+0.3	+9.8			High		
^	2781.750M	39.3	+0.0	-34.5	+0.5	+1.2	+0.0	48.9	54.0	-5.1	Vert
			+3.0	+29.3	+0.3	+9.8			High		
15	1114.000M	29.7	+0.0	-36.8	+0.3	+0.8	+0.0	32.9	54.0	-21.1	Vert
	Ave		+1.8	+24.8	+2.6	+9.7					
^	1114.000M	44.3	+0.0	-36.8	+0.3	+0.8	+0.0	47.5	54.0	-6.5	Vert
			+1.8	+24.8	+2.6	+9.7					
17	1805.470M	44.0	+0.0	-35.1	+0.4	+1.0	+0.0	50.2	111.0	-60.8	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
18	1854.360M	41.6	+0.0	-35.0	+0.4	+1.0	+0.0	48.5	111.0	-62.5	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
19	1805.460M	42.0	+0.0	-35.1	+0.4	+1.0	+0.0	48.2	111.0	-62.8	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
20	1854.560M	41.2	+0.0	-35.0	+0.4	+1.0	+0.0	48.1	111.0	-62.9	Vert
			+2.3	+27.8	+0.6	+9.8			High		
21	1829.580M	41.1	+0.0	-35.1	+0.4	+1.0	+0.0	47.7	111.0	-63.3	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
22	1829.440M	40.5	+0.0	-35.1	+0.4	+1.0	+0.0	47.1	111.0	-63.9	Vert
			+2.3	+27.6	+0.6	+9.8			Mid		
23	1290.000M	43.5	+0.0	-36.1	+0.4	+0.8	+0.0	46.3	111.0	-64.7	Horiz
			+1.9	+25.4	+0.7	+9.7					

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 11:00:34
 Tested By: Michael Atkinson Sequence#: 24
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

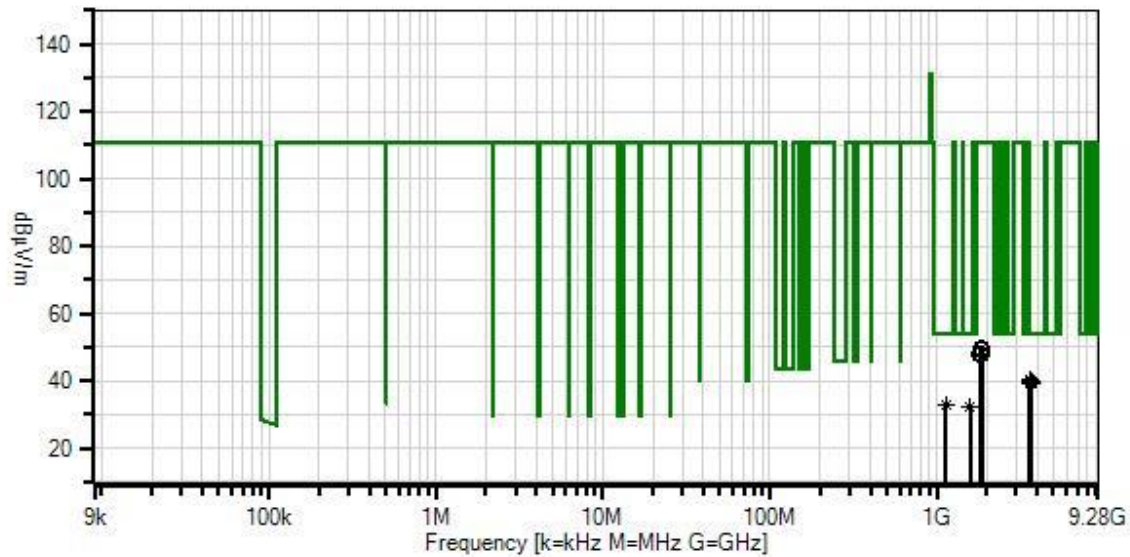
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.
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Impinj Inc. WO#: 108693 Sequence#: 24 Date: 7/21/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



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

1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamplifier	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 dB	T8 dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3659.000M	27.1	+0.0	-34.0	+0.9	+1.4	+0.0	40.5	54.0	-13.5	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3659.000M	38.8	+0.0	-34.0	+0.9	+1.4	+0.0	52.2	54.0	-1.8	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
3	3610.870M	26.7	+0.0	-34.0	+1.0	+1.3	+0.0	40.0	54.0	-14.0	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3610.870M	38.2	+0.0	-34.0	+1.0	+1.3	+0.0	51.5	54.0	-2.5	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
5	3709.000M	26.2	+0.0	-33.9	+0.8	+1.4	+0.0	39.8	54.0	-14.2	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3708.960M	38.6	+0.0	-33.9	+0.8	+1.4	+0.0	52.2	54.0	-1.8	Vert
			+3.6	+31.6	+0.2	+9.9			High		
7	3659.000M	26.0	+0.0	-34.0	+0.9	+1.4	+0.0	39.4	54.0	-14.6	Horiz
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3658.960M	37.8	+0.0	-34.0	+0.9	+1.4	+0.0	51.2	54.0	-2.8	Horiz
			+3.7	+31.4	+0.2	+9.8			Mid		
9	3709.000M	25.5	+0.0	-33.9	+0.8	+1.4	+0.0	39.1	54.0	-14.9	Horiz
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.000M	37.4	+0.0	-33.9	+0.8	+1.4	+0.0	51.0	54.0	-3.0	Horiz
			+3.6	+31.6	+0.2	+9.9			High		
11	1128.000M	30.1	+0.0	-36.8	+0.4	+0.8	+0.0	32.6	54.0	-21.4	Vert
	Ave		+1.8	+24.9	+1.7	+9.7					
^	1128.000M	44.6	+0.0	-36.8	+0.4	+0.8	+0.0	47.1	54.0	-6.9	Vert
			+1.8	+24.9	+1.7	+9.7					
13	1582.000M	28.5	+0.0	-35.4	+0.4	+0.9	+0.0	32.2	54.0	-21.8	Horiz
	Ave		+2.1	+25.5	+0.4	+9.8					
^	1582.000M	42.0	+0.0	-35.4	+0.4	+0.9	+0.0	45.7	54.0	-8.3	Horiz
			+2.1	+25.5	+0.4	+9.8					
15	1829.500M	43.2	+0.0	-35.1	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Vert
			+2.3	+27.6	+0.6	+9.8			Mid		
16	1854.460M	42.2	+0.0	-35.0	+0.4	+1.0	+0.0	49.1	111.0	-61.9	Vert
			+2.3	+27.8	+0.6	+9.8			High		
17	1829.720M	42.4	+0.0	-35.1	+0.4	+1.0	+0.0	49.0	111.0	-62.0	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
18	1805.530M	41.5	+0.0	-35.1	+0.4	+1.0	+0.0	47.7	111.0	-63.3	Vert
			+2.2	+27.3	+0.6	+9.8			Low		
19	1805.500M	41.5	+0.0	-35.1	+0.4	+1.0	+0.0	47.7	111.0	-63.3	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
20	1854.580M	40.7	+0.0	-35.0	+0.4	+1.0	+0.0	47.6	111.0	-63.4	Horiz
			+2.3	+27.8	+0.6	+9.8			High		

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 12:38:36
 Tested By: Michael Atkinson Sequence#: 25
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

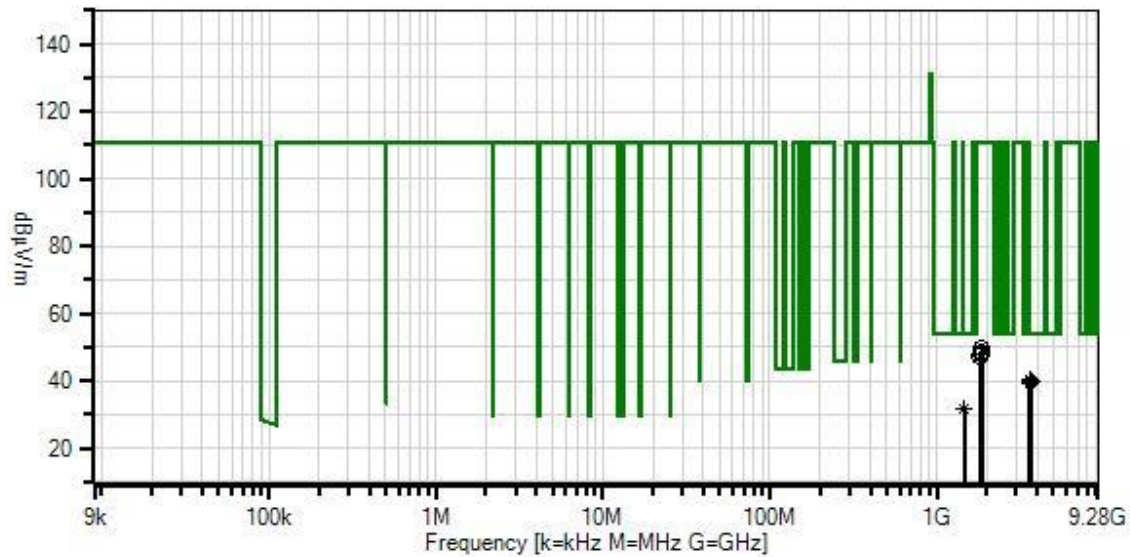
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.
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Impinj Inc. WO#: 108693 Sequence#: 25 Date: 7/21/2023
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	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7	T8	Table	dBμV/m	dBμV/m	dB	Ant
1	3659.320M	26.8	+0.0	-34.0	+0.9	+1.4	+0.0	40.2	54.0	-13.8	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3659.320M	38.5	+0.0	-34.0	+0.9	+1.4	+0.0	51.9	54.0	-2.1	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
3	3709.000M	26.4	+0.0	-33.9	+0.8	+1.4	+0.0	40.0	54.0	-14.0	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.000M	38.1	+0.0	-33.9	+0.8	+1.4	+0.0	51.7	54.0	-2.3	Vert
			+3.6	+31.6	+0.2	+9.9			High		
5	3611.000M	26.7	+0.0	-34.0	+1.0	+1.3	+0.0	40.0	54.0	-14.0	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3610.940M	38.0	+0.0	-34.0	+1.0	+1.3	+0.0	51.3	54.0	-2.7	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
7	3659.000M	26.2	+0.0	-34.0	+0.9	+1.4	+0.0	39.6	54.0	-14.4	Horiz
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
8	3659.000M	25.8	+0.0	-34.0	+0.9	+1.4	+0.0	39.2	54.0	-14.8	Horiz
	Ave		+3.7	+31.4	+0.2	+9.8					
^	3659.020M	39.0	+0.0	-34.0	+0.9	+1.4	+0.0	52.4	54.0	-1.6	Horiz
			+3.7	+31.4	+0.2	+9.8					
^	3658.980M	38.5	+0.0	-34.0	+0.9	+1.4	+0.0	51.9	54.0	-2.1	Horiz
			+3.7	+31.4	+0.2	+9.8			Mid		
11	1460.000M	28.4	+0.0	-35.6	+0.4	+0.9	+0.0	31.9	54.0	-22.1	Vert
	Ave		+2.1	+25.3	+0.6	+9.8					
^	1460.000M	42.7	+0.0	-35.6	+0.4	+0.9	+0.0	46.2	54.0	-7.8	Vert
			+2.1	+25.3	+0.6	+9.8					
13	1462.000M	28.4	+0.0	-35.6	+0.4	+0.9	+0.0	31.9	54.0	-22.1	Horiz
	Ave		+2.1	+25.3	+0.6	+9.8					
^	1462.000M	43.3	+0.0	-35.6	+0.4	+0.9	+0.0	46.8	54.0	-7.2	Horiz
			+2.1	+25.3	+0.6	+9.8					
15	1854.520M	42.8	+0.0	-35.0	+0.4	+1.0	+0.0	49.7	111.0	-61.3	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
16	1829.520M	41.9	+0.0	-35.1	+0.4	+1.0	+0.0	48.5	111.0	-62.5	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
17	1829.280M	41.4	+0.0	-35.1	+0.4	+1.0	+0.0	48.0	111.0	-63.0	Vert
			+2.3	+27.6	+0.6	+9.8			Mid		
18	1854.360M	40.8	+0.0	-35.0	+0.4	+1.0	+0.0	47.7	111.0	-63.3	Vert
			+2.3	+27.8	+0.6	+9.8			High		
19	1805.420M	41.3	+0.0	-35.1	+0.4	+1.0	+0.0	47.5	111.0	-63.5	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 14:31:07
 Tested By: Michael Atkinson Sequence#: 26
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 6			

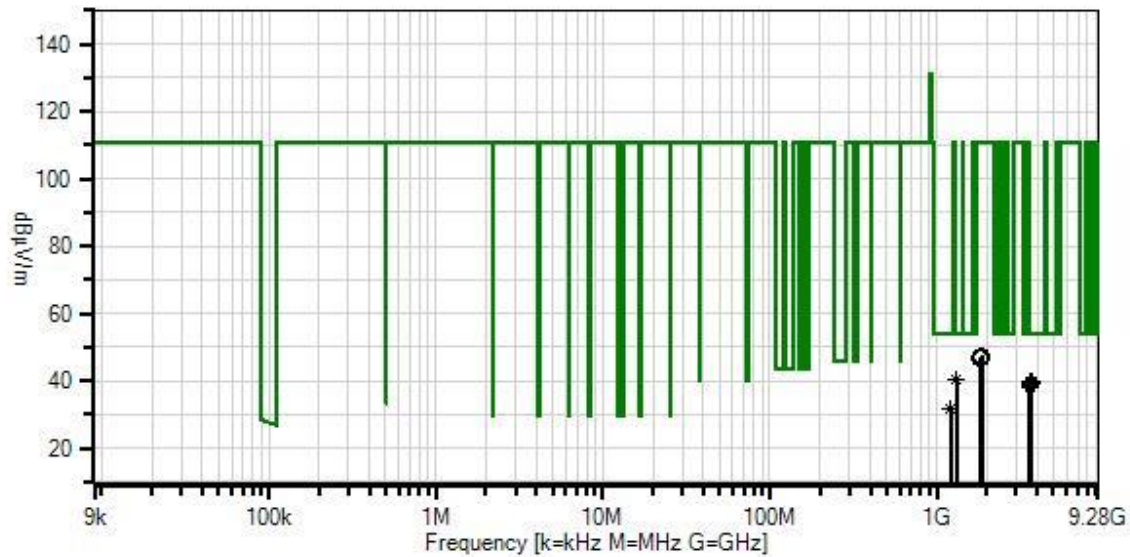
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 6			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.

Impinj Inc. WO#: 108693 Sequence#: 26 Date: 7/21/2023
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	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 T8 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	1308.000M Ave	37.3	+0.0 +1.9	-36.1 +25.4	+0.4 +0.7	+0.8 +9.7	+0.0	40.1	54.0	-13.9	Horiz
^	1308.000M	43.4	+0.0 +1.9	-36.1 +25.4	+0.4 +0.7	+0.8 +9.7	+0.0	46.2	54.0	-7.8	Horiz
3	3659.000M Ave	26.4	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	39.8	54.0 Mid	-14.2	Vert
4	3659.000M Ave	26.4	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	39.8	54.0 Mid	-14.2	Vert
^	3659.040M	38.3	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	51.7	54.0 Mid	-2.3	Vert
^	3659.000M	37.8	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	51.2	54.0 Mid	-2.8	Vert
7	3709.000M Ave	26.1	+0.0 +3.6	-33.9 +31.6	+0.8 +0.2	+1.4 +9.9	+0.0	39.7	54.0 High	-14.3	Vert
^	3708.940M	38.6	+0.0 +3.6	-33.9 +31.6	+0.8 +0.2	+1.4 +9.9	+0.0	52.2	54.0 High	-1.8	Vert
9	3611.000M Ave	25.8	+0.0 +3.7	-34.0 +31.3	+1.0 +0.3	+1.3 +9.7	+0.0	39.1	54.0 Low	-14.9	Vert
^	3611.060M	37.5	+0.0 +3.7	-34.0 +31.3	+1.0 +0.3	+1.3 +9.7	+0.0	50.8	54.0 Low	-3.2	Vert
11	3709.000M Ave	25.4	+0.0 +3.6	-33.9 +31.6	+0.8 +0.2	+1.4 +9.9	+0.0	39.0	54.0 High	-15.0	Horiz
^	3708.960M	37.7	+0.0 +3.6	-33.9 +31.6	+0.8 +0.2	+1.4 +9.9	+0.0	51.3	54.0 High	-2.7	Horiz
13	3659.000M Ave	25.4	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	38.8	54.0 Mid	-15.2	Horiz
^	3659.000M	37.9	+0.0 +3.7	-34.0 +31.4	+0.9 +0.2	+1.4 +9.8	+0.0	51.3	54.0 Mid	-2.7	Horiz
15	3610.760M Ave	25.0	+0.0 +3.7	-34.0 +31.3	+1.0 +0.3	+1.3 +9.7	+0.0	38.3	54.0 Low	-15.7	Horiz
^	3610.760M	37.5	+0.0 +3.7	-34.0 +31.3	+1.0 +0.3	+1.3 +9.7	+0.0	50.8	54.0 Low	-3.2	Horiz
17	1208.000M Ave	29.3	+0.0 +1.9	-36.4 +25.2	+0.4 +0.8	+0.8 +9.7	+0.0	31.7	54.0	-22.3	Horiz
^	1208.000M	42.7	+0.0 +1.9	-36.4 +25.2	+0.4 +0.8	+0.8 +9.7	+0.0	45.1	54.0	-8.9	Horiz
19	1854.540M	40.5	+0.0 +2.3	-35.0 +27.8	+0.4 +0.6	+1.0 +9.8	+0.0	47.4	111.0 High	-63.6	Horiz
20	1829.260M	40.2	+0.0 +2.3	-35.1 +27.6	+0.4 +0.6	+1.0 +9.8	+0.0	46.8	111.0 Mid	-64.2	Horiz
21	1805.560M	40.5	+0.0 +2.2	-35.1 +27.3	+0.4 +0.6	+1.0 +9.8	+0.0	46.7	111.0 Low	-64.3	Horiz

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 15:55:06
 Tested By: Michael Atkinson Sequence#: 27
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 7			

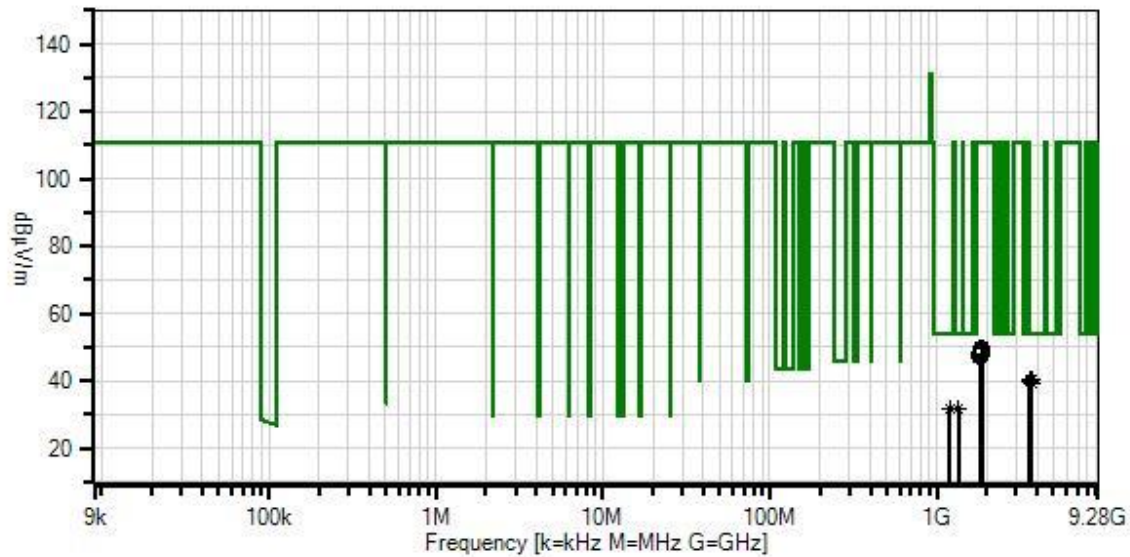
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 7			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.

Impinj Inc. WO#: 108693 Sequence#: 27 Date: 7/21/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



— Readings
× QP Readings
▼ Ambient
— 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

○ Peak Readings
* Average Readings
Software Version: 5.03.20

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 dB	T8 dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3709.000M	26.9	+0.0	-33.9	+0.8	+1.4	+0.0	40.5	54.0	-13.5	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.020M	37.8	+0.0	-33.9	+0.8	+1.4	+0.0	51.4	54.0	-2.6	Vert
			+3.6	+31.6	+0.2	+9.9			High		
3	3611.000M	26.9	+0.0	-34.0	+1.0	+1.3	+0.0	40.2	54.0	-13.8	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3611.040M	37.3	+0.0	-34.0	+1.0	+1.3	+0.0	50.6	54.0	-3.4	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
5	3659.000M	26.5	+0.0	-34.0	+0.9	+1.4	+0.0	39.9	54.0	-14.1	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3658.980M	37.8	+0.0	-34.0	+0.9	+1.4	+0.0	51.2	54.0	-2.8	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
7	3709.120M	25.4	+0.0	-33.9	+0.8	+1.4	+0.0	39.0	54.0	-15.0	Horiz
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3709.120M	38.0	+0.0	-33.9	+0.8	+1.4	+0.0	51.6	54.0	-2.4	Horiz
			+3.6	+31.6	+0.2	+9.9			High		
9	1198.000M	29.3	+0.0	-36.4	+0.4	+0.8	+0.0	31.8	54.0	-22.2	Vert
	Ave		+1.9	+25.2	+0.9	+9.7					
^	1198.000M	43.7	+0.0	-36.4	+0.4	+0.8	+0.0	46.2	54.0	-7.8	Vert
			+1.9	+25.2	+0.9	+9.7					
11	1342.000M	28.6	+0.0	-36.0	+0.4	+0.9	+0.0	31.7	54.0	-22.3	Horiz
	Ave		+2.0	+25.4	+0.7	+9.7					
^	1342.000M	42.2	+0.0	-36.0	+0.4	+0.9	+0.0	45.3	54.0	-8.7	Horiz
			+2.0	+25.4	+0.7	+9.7					
13	1854.460M	42.9	+0.0	-35.0	+0.4	+1.0	+0.0	49.8	111.0	-61.2	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
14	1854.600M	41.9	+0.0	-35.0	+0.4	+1.0	+0.0	48.8	111.0	-62.2	Vert
			+2.3	+27.8	+0.6	+9.8			High		
15	1829.520M	41.7	+0.0	-35.1	+0.4	+1.0	+0.0	48.3	111.0	-62.7	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		
16	1829.480M	41.4	+0.0	-35.1	+0.4	+1.0	+0.0	48.0	111.0	-63.0	Vert
			+2.3	+27.6	+0.6	+9.8			Mid		
17	1805.540M	41.6	+0.0	-35.1	+0.4	+1.0	+0.0	47.8	111.0	-63.2	Horiz
			+2.2	+27.3	+0.6	+9.8			Low		
18	1805.560M	41.1	+0.0	-35.1	+0.4	+1.0	+0.0	47.3	111.0	-63.7	Vert
			+2.2	+27.3	+0.6	+9.8			Low		

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 #: **108693** Date: 7/26/2023
 Test Type: **Maximized Emissions** Time: 15:10:06
 Tested By: Michael Atkinson Sequence#: 28
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 8			

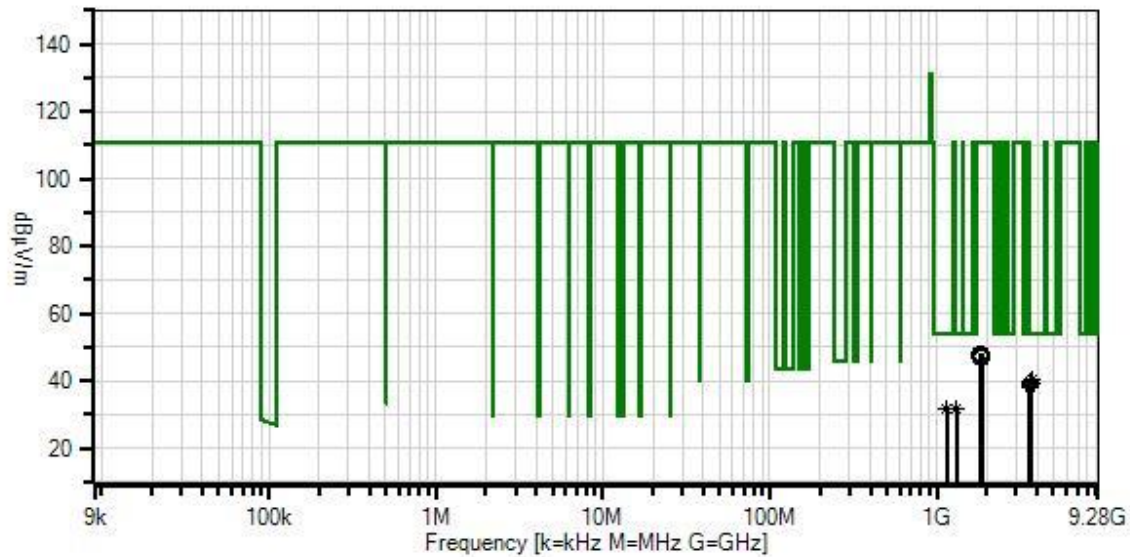
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 8			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 46% Pressure: 101.7kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.

Impinj Inc. W/O#: 108693 Sequence#: 28 Date: 7/26/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



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

1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T2	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T5	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T6	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T7	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025
T8	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 T8 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	3709.000M	26.9	-33.9	+0.8	+1.4	+3.6	+0.0	40.5	54.0	-13.5	Horiz
	Ave		+31.6	+0.2	+9.9	+0.0			High		
^	3709.000M	38.0	-33.9	+0.8	+1.4	+3.6	+0.0	51.6	54.0	-2.4	Horiz
			+31.6	+0.2	+9.9	+0.0			High		
3	3659.000M	26.5	-34.0	+0.9	+1.4	+3.7	+0.0	39.9	54.0	-14.1	Horiz
	Ave		+31.4	+0.2	+9.8	+0.0			Mid		
^	3659.000M	37.8	-34.0	+0.9	+1.4	+3.7	+0.0	51.2	54.0	-2.8	Horiz
			+31.4	+0.2	+9.8	+0.0			Mid		
5	3659.000M	25.9	-34.0	+0.9	+1.4	+3.7	+0.0	39.3	54.0	-14.7	Vert
	Ave		+31.4	+0.2	+9.8	+0.0			Mid		
^	3658.950M	37.1	-34.0	+0.9	+1.4	+3.7	+0.0	50.5	54.0	-3.5	Vert
			+31.4	+0.2	+9.8	+0.0			Mid		
7	3709.000M	25.6	-33.9	+0.8	+1.4	+3.6	+0.0	39.2	54.0	-14.8	Vert
	Ave		+31.6	+0.2	+9.9	+0.0			High		
^	3709.030M	37.0	-33.9	+0.8	+1.4	+3.6	+0.0	50.6	54.0	-3.4	Vert
			+31.6	+0.2	+9.9	+0.0			High		
9	3611.000M	25.4	-34.0	+1.0	+1.3	+3.7	+0.0	38.7	54.0	-15.3	Horiz
	Ave		+31.3	+0.3	+9.7	+0.0			Low		
^	3610.950M	36.9	-34.0	+1.0	+1.3	+3.7	+0.0	50.2	54.0	-3.8	Horiz
			+31.3	+0.3	+9.7	+0.0			Low		
11	3611.000M	25.0	-34.0	+1.0	+1.3	+3.7	+0.0	38.3	54.0	-15.7	Vert
	Ave		+31.3	+0.3	+9.7	+0.0			Low		
^	3610.950M	36.9	-34.0	+1.0	+1.3	+3.7	+0.0	50.2	54.0	-3.8	Vert
			+31.3	+0.3	+9.7	+0.0			Low		
13	1150.000M	29.4	-36.7	+0.4	+0.8	+1.8	+0.0	31.6	54.0	-22.4	Horiz
	Ave		+25.0	+1.2	+9.7	+0.0					
^	1150.000M	49.3	-36.7	+0.4	+0.8	+1.8	+0.0	51.5	54.0	-2.5	Horiz
			+25.0	+1.2	+9.7	+0.0					
15	1308.000M	28.8	-36.1	+0.4	+0.8	+1.9	+0.0	31.6	54.0	-22.4	Vert
	Ave		+25.4	+0.7	+9.7	+0.0					
^	1308.000M	48.2	-36.1	+0.4	+0.8	+1.9	+0.0	51.0	54.0	-3.0	Vert
			+25.4	+0.7	+9.7	+0.0					
17	1854.570M	41.1	-35.0	+0.4	+1.0	+2.3	+0.0	48.0	111.0	-63.0	Horiz
			+27.8	+0.6	+9.8	+0.0			High		
18	1805.380M	41.7	-35.1	+0.4	+1.0	+2.2	+0.0	47.9	111.0	-63.1	Vert
			+27.3	+0.6	+9.8	+0.0			Low		
19	1805.380M	41.3	-35.1	+0.4	+1.0	+2.2	+0.0	47.5	111.0	-63.5	Horiz
			+27.3	+0.6	+9.8	+0.0			Low		
20	1854.400M	40.5	-35.0	+0.4	+1.0	+2.3	+0.0	47.4	111.0	-63.6	Vert
			+27.8	+0.6	+9.8	+0.0			High		
21	1829.540M	40.6	-35.1	+0.4	+1.0	+2.3	+0.0	47.2	111.0	-63.8	Vert
			+27.6	+0.6	+9.8	+0.0			Mid		
22	1829.390M	40.4	-35.1	+0.4	+1.0	+2.3	+0.0	47.0	111.0	-64.0	Horiz
			+27.6	+0.6	+9.8	+0.0			Mid		

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 #: **108693** Date: 7/21/2023
 Test Type: **Maximized Emissions** Time: 17:19:53
 Tested By: Michael Atkinson Sequence#: 29
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 9			

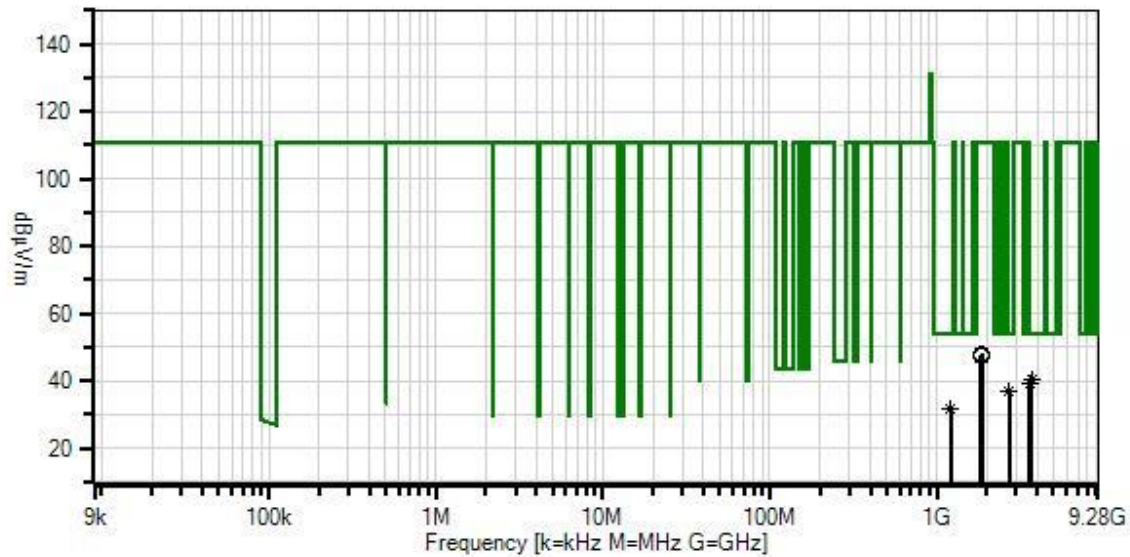
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 9			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 24°C Humidity: 41% Pressure: 101.9kPa Method: ANSI C63.10 (2013) Frequency: 1GHz-10GHz Firmware Setting: 30dBm as worst case. Test Setup: Unit is on foam table. Horizontal and Vertical antenna polarities investigated, worst case reported, unit is continuously transmitting with modulation. X, Y, Z EUT and antenna orientations investigated, worst case reported. Low, Mid, and High channels investigated.
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Impinj Inc. WO#: 108693 Sequence#: 29 Date: 7/21/2023
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T3	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06243	Attenuator	54A-10	2/13/2023	2/13/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 dB	T8 dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3709.000M	26.6	+0.0	-33.9	+0.8	+1.4	+0.0	40.2	54.0	-13.8	Vert
	Ave		+3.6	+31.6	+0.2	+9.9			High		
^	3708.920M	38.3	+0.0	-33.9	+0.8	+1.4	+0.0	51.9	54.0	-2.1	Vert
			+3.6	+31.6	+0.2	+9.9			High		
3	3659.000M	26.0	+0.0	-34.0	+0.9	+1.4	+0.0	39.4	54.0	-14.6	Vert
	Ave		+3.7	+31.4	+0.2	+9.8			Mid		
^	3658.960M	38.0	+0.0	-34.0	+0.9	+1.4	+0.0	51.4	54.0	-2.6	Vert
			+3.7	+31.4	+0.2	+9.8			Mid		
5	3610.940M	26.1	+0.0	-34.0	+1.0	+1.3	+0.0	39.4	54.0	-14.6	Vert
	Ave		+3.7	+31.3	+0.3	+9.7			Low		
^	3610.940M	37.3	+0.0	-34.0	+1.0	+1.3	+0.0	50.6	54.0	-3.4	Vert
			+3.7	+31.3	+0.3	+9.7			Low		
7	2708.150M	27.1	+0.0	-34.5	+0.5	+1.2	+0.0	36.6	54.0	-17.4	Vert
	Ave		+3.0	+29.3	+0.2	+9.8			Low		
^	2708.150M	42.6	+0.0	-34.5	+0.5	+1.2	+0.0	52.1	54.0	-1.9	Vert
			+3.0	+29.3	+0.2	+9.8			Low		
9	1204.000M	29.4	+0.0	-36.4	+0.4	+0.8	+0.0	31.9	54.0	-22.1	Horiz
	Ave		+1.9	+25.2	+0.9	+9.7					
^	1204.000M	43.8	+0.0	-36.4	+0.4	+0.8	+0.0	46.3	54.0	-7.7	Horiz
			+1.9	+25.2	+0.9	+9.7					
11	1210.000M	29.3	+0.0	-36.4	+0.4	+0.8	+0.0	31.7	54.0	-22.3	Vert
	Ave		+1.9	+25.2	+0.8	+9.7					
^	1210.000M	42.0	+0.0	-36.4	+0.4	+0.8	+0.0	44.4	54.0	-9.6	Vert
			+1.9	+25.2	+0.8	+9.7					
13	1854.460M	41.2	+0.0	-35.0	+0.4	+1.0	+0.0	48.1	111.0	-62.9	Horiz
			+2.3	+27.8	+0.6	+9.8			High		
14	1829.460M	40.8	+0.0	-35.1	+0.4	+1.0	+0.0	47.4	111.0	-63.6	Horiz
			+2.3	+27.6	+0.6	+9.8			Mid		

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	42.1 QP	<46	Pass
902	Single Channel	ASK	Patch	68.0	<111	Pass
928	Single Channel	ASK	Patch	68.9	<111	Pass
960	Single Channel	ASK	Patch	46.8 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	66.7	<111	Pass
928	Hopping	ASK	Patch	67.8	<111	Pass
960	Hopping	ASK	Patch	46.6	<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	41.9 QP	<46	Pass
902	Single Channel	ASK	Patch	68.4	<111	Pass
928	Single Channel	ASK	Patch	67.9	<111	Pass
960	Single Channel	ASK	Patch	46.8 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	69.8	<111	Pass
928	Hopping	ASK	Patch	68.3	<111	Pass
960	Hopping	ASK	Patch	46.7 QP	<54	Pass

Band Edge Summary						
Configuration 3						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dBμV/m @3m)	Limit (dBuV/m @3m)	Results
614	Single Channel	ASK	Patch	42.0 QP	<46	Pass
902	Single Channel	ASK	Patch	71.6	<111	Pass
928	Single Channel	ASK	Patch	71.4	<111	Pass
960	Single Channel	ASK	Patch	46.7 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	72.2	<111	Pass
928	Hopping	ASK	Patch	71.3	<111	Pass
960	Hopping	ASK	Patch	46.6 QP	<54	Pass

Band Edge Summary						
Configuration 4						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dBμV/m @3m)	Limit (dBuV/m @3m)	Results
614	Single Channel	ASK	Patch	41.9 QP	<46	Pass
902	Single Channel	ASK	Patch	69.3	<111	Pass
928	Single Channel	ASK	Patch	70.7	<111	Pass
960	Single Channel	ASK	Patch	46.5 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	63.1	<111	Pass
928	Hopping	ASK	Patch	66.3	<111	Pass
960	Hopping	ASK	Patch	46.7 QP	<54	Pass

Band Edge Summary						
Configuration 5						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dBμV/m @3m)	Limit (dBuV/m @3m)	Results
614	Single Channel	ASK	Patch	41.9	<46	Pass
902	Single Channel	ASK	Patch	69.5	<111	Pass
928	Single Channel	ASK	Patch	68.9	<111	Pass
960	Single Channel	ASK	Patch	47.1 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	65.5	<111	Pass
928	Hopping	ASK	Patch	66.8	<111	Pass
960	Hopping	ASK	Patch	46.5 QP	<54	Pass

Band Edge Summary						
Configuration 6						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dBμV/m @3m)	Limit (dBuV/m @3m)	Results
614	Single Channel	ASK	Patch	42.1 QP	<46	Pass
902	Single Channel	ASK	Patch	73.2	<111	Pass
928	Single Channel	ASK	Patch	72.7	<111	Pass
960	Single Channel	ASK	Patch	46.6 QP	<54	Pass
614	Hopping	ASK	Patch	41.9 QP	<46	Pass
902	Hopping	ASK	Patch	70.6	<111	Pass
928	Hopping	ASK	Patch	71.0	<111	Pass
960	Hopping	ASK	Patch	46.6 QP	<54	Pass

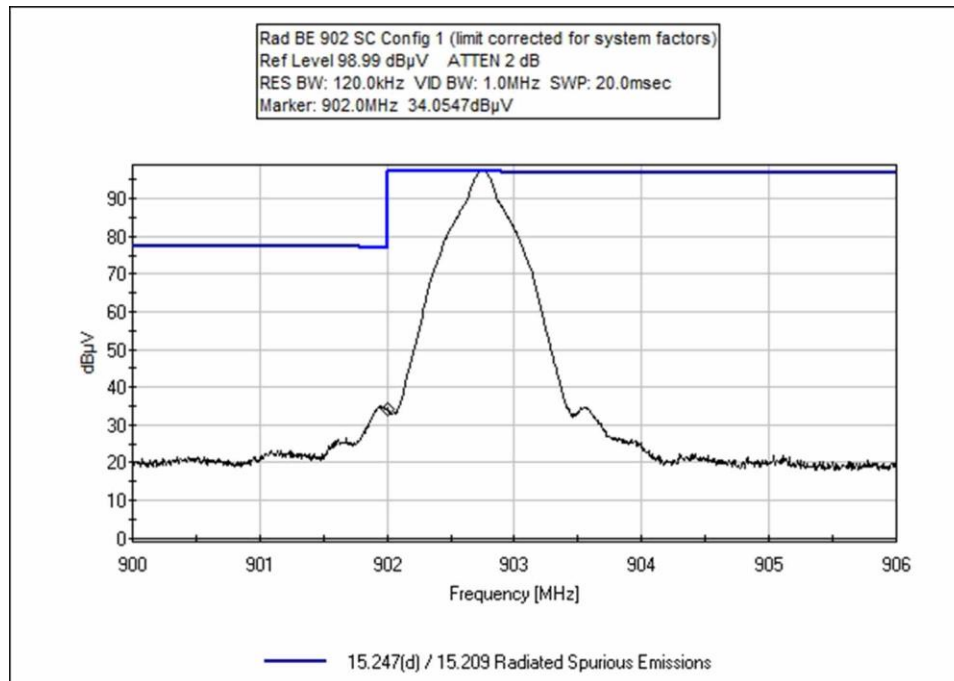
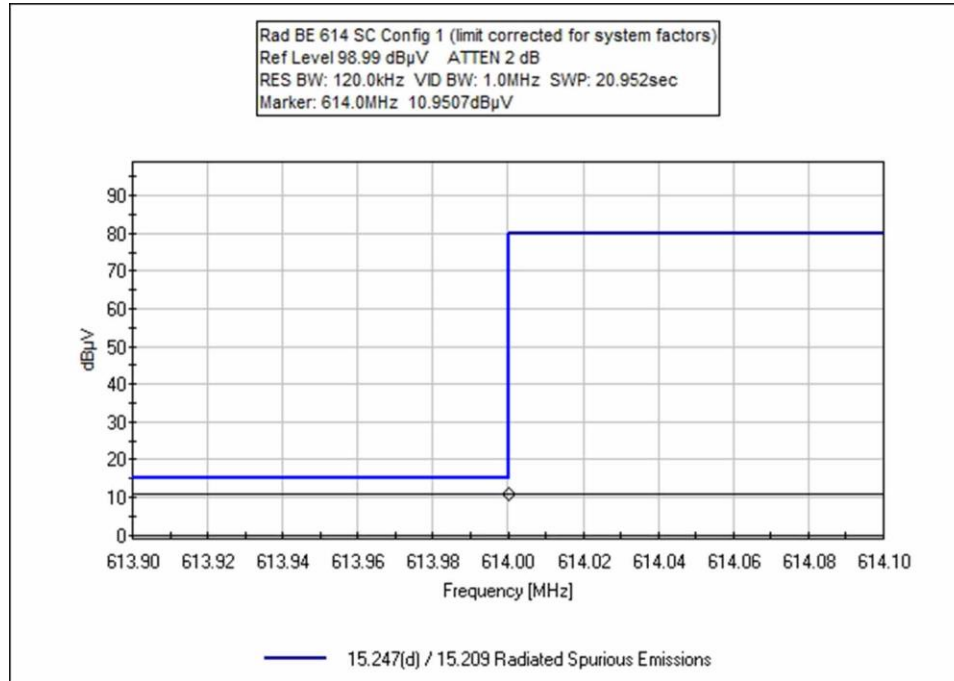
Band Edge Summary						
Configuration 7						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	42.1 QP	<46	Pass
902	Single Channel	ASK	Patch	70.4	<111	Pass
928	Single Channel	ASK	Patch	69.3	<111	Pass
960	Single Channel	ASK	Patch	46.9 QP	<54	Pass
614	Hopping	ASK	Patch	42.0 QP	<46	Pass
902	Hopping	ASK	Patch	67.6	<111	Pass
928	Hopping	ASK	Patch	65.6	<111	Pass
960	Hopping	ASK	Patch	47.0 QP	<54	Pass

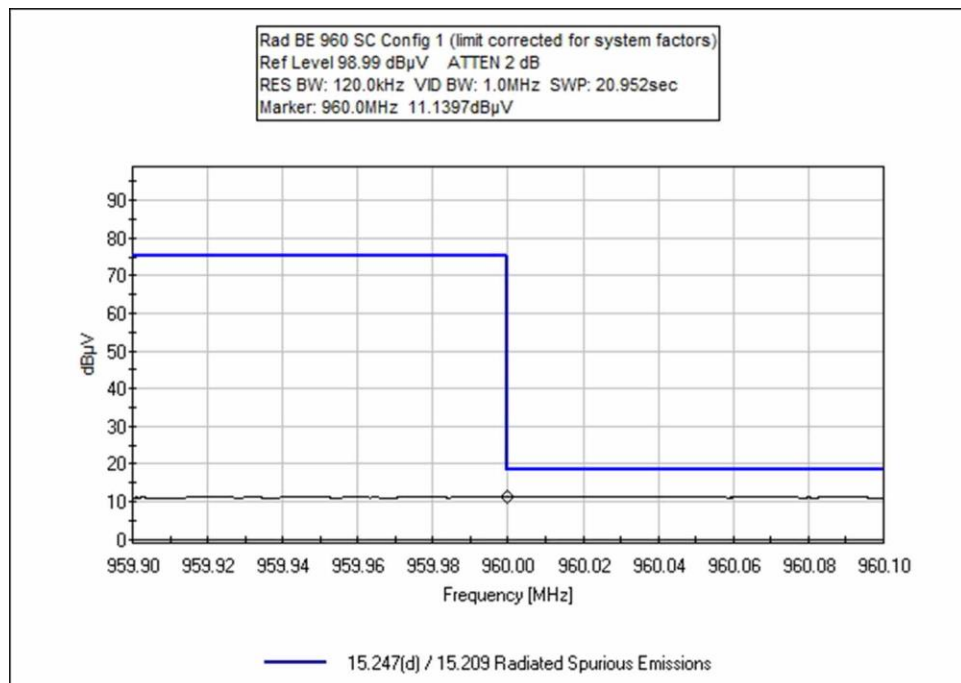
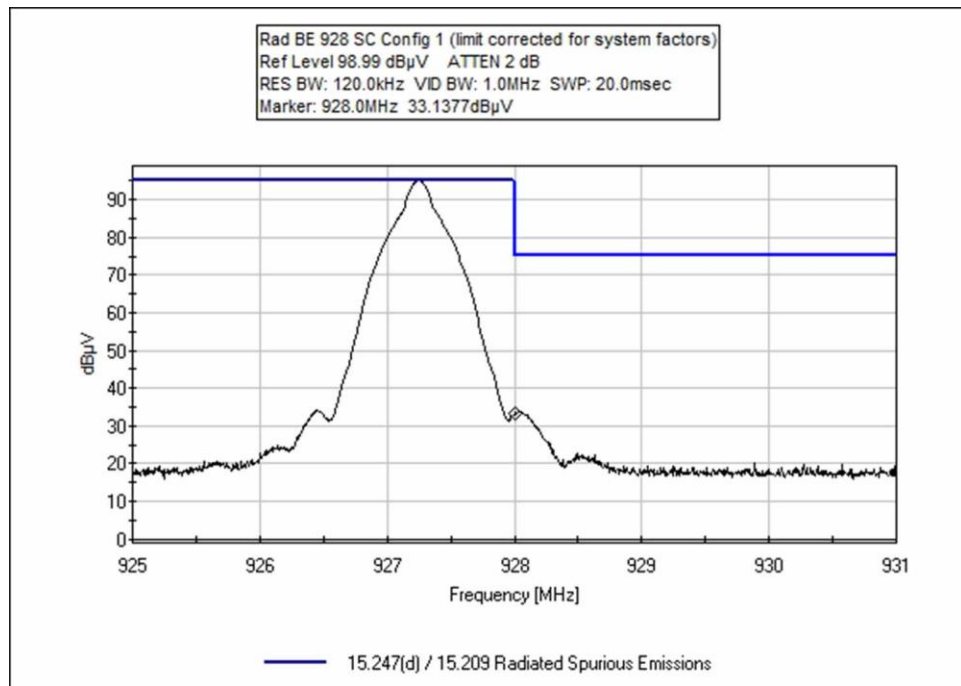
Band Edge Summary						
Configuration 8						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dB μ V/m @3m)	Limit (dB μ V/m @3m)	Results
614	Single Channel	ASK	Patch	42.5 QP	<46	Pass
902	Single Channel	ASK	Patch	69.7	<111	Pass
928	Single Channel	ASK	Patch	67.4	<111	Pass
960	Single Channel	ASK	Patch	47.8 QP	<54	Pass
614	Hopping	ASK	Patch	42.4 QP	<46	Pass
902	Hopping	ASK	Patch	68.6	<111	Pass
928	Hopping	ASK	Patch	66.6	<111	Pass
960	Hopping	ASK	Patch	47.9 QP	<54	Pass

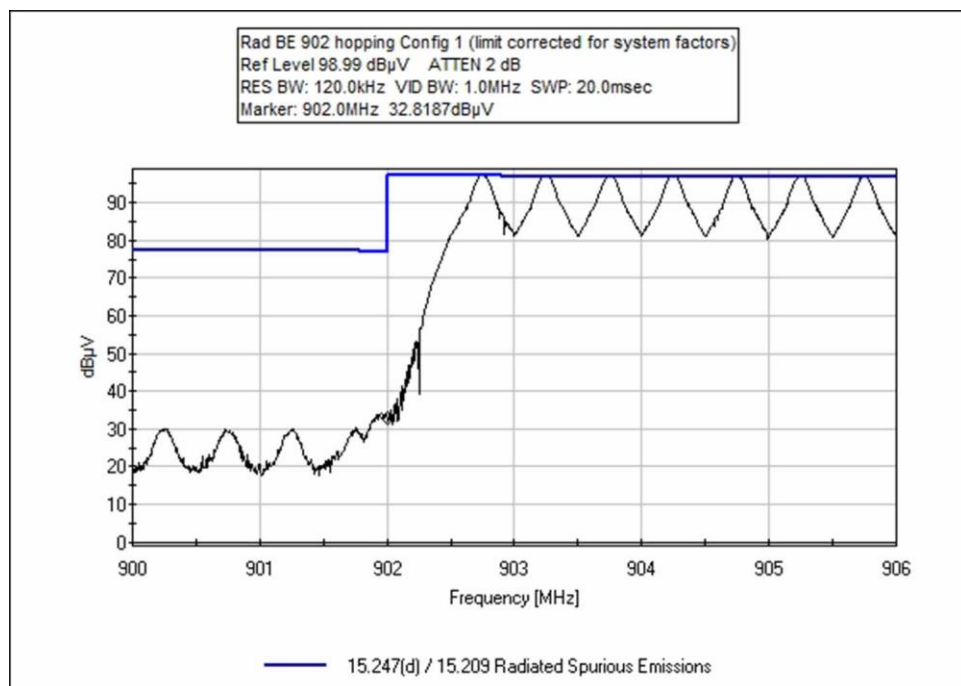
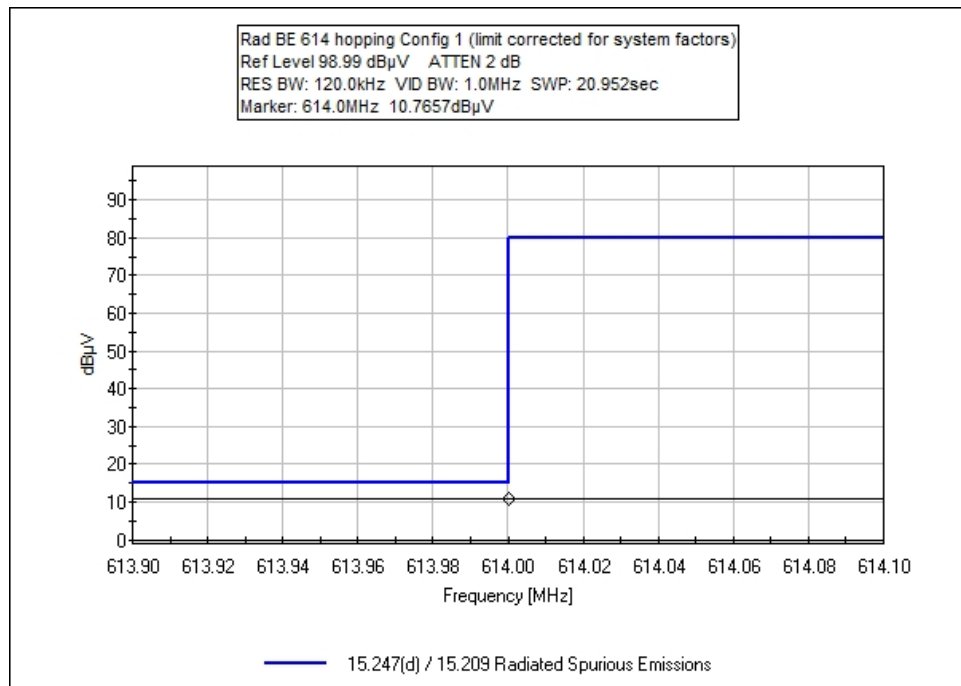
Band Edge Summary						
Configuration 9						
Frequency (MHz)	Operating Mode	Modulation	Ant. Type	Field Strength (dBμV/m @3m)	Limit (dBuV/m @3m)	Results
614	Single Channel	ASK	Patch	42.2 QP	<46	Pass
902	Single Channel	ASK	Patch	72.6	<111	Pass
928	Single Channel	ASK	Patch	70.1	<111	Pass
960	Single Channel	ASK	Patch	47.1 QP	<54	Pass
614	Hopping	ASK	Patch	42.2 QP	<46	Pass
902	Hopping	ASK	Patch	68.7	<111	Pass
928	Hopping	ASK	Patch	68.9	<111	Pass
960	Hopping	ASK	Patch	47.2 QP	<54	Pass

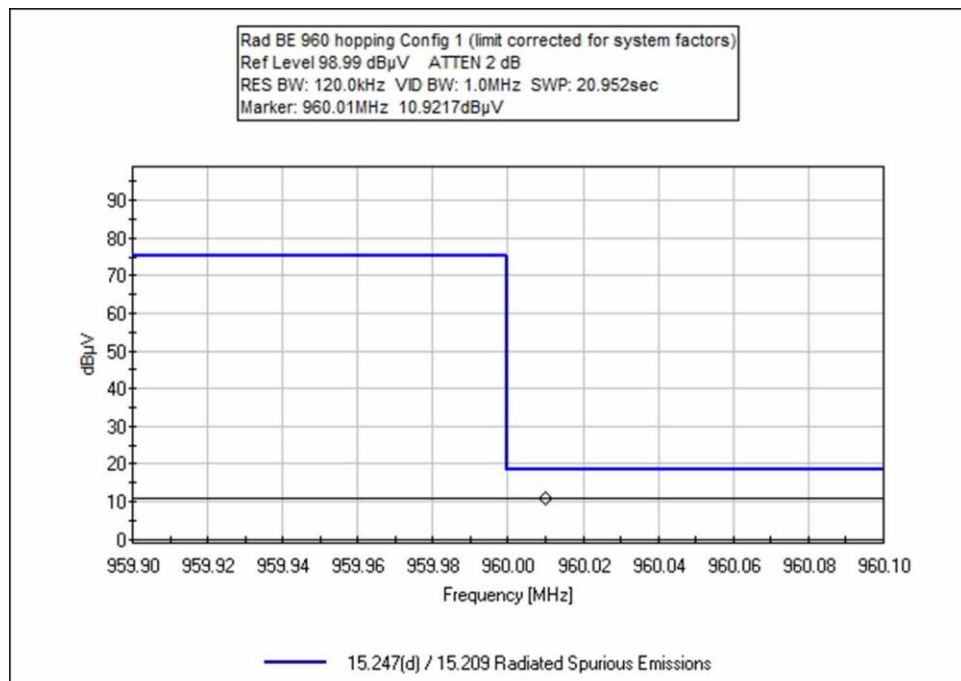
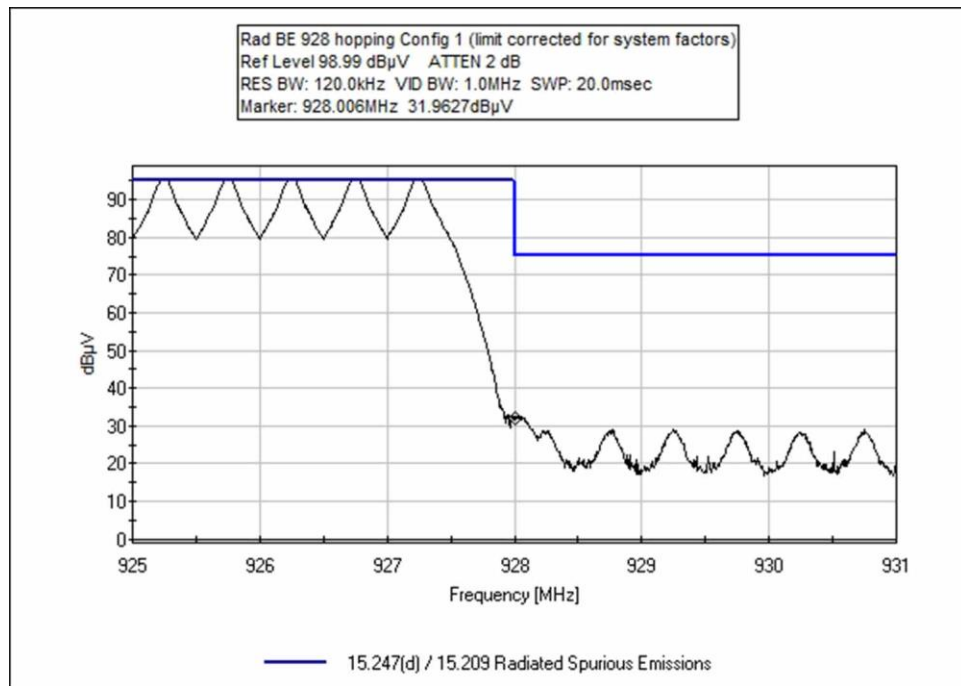
Band Edge Plots

Configuration 1

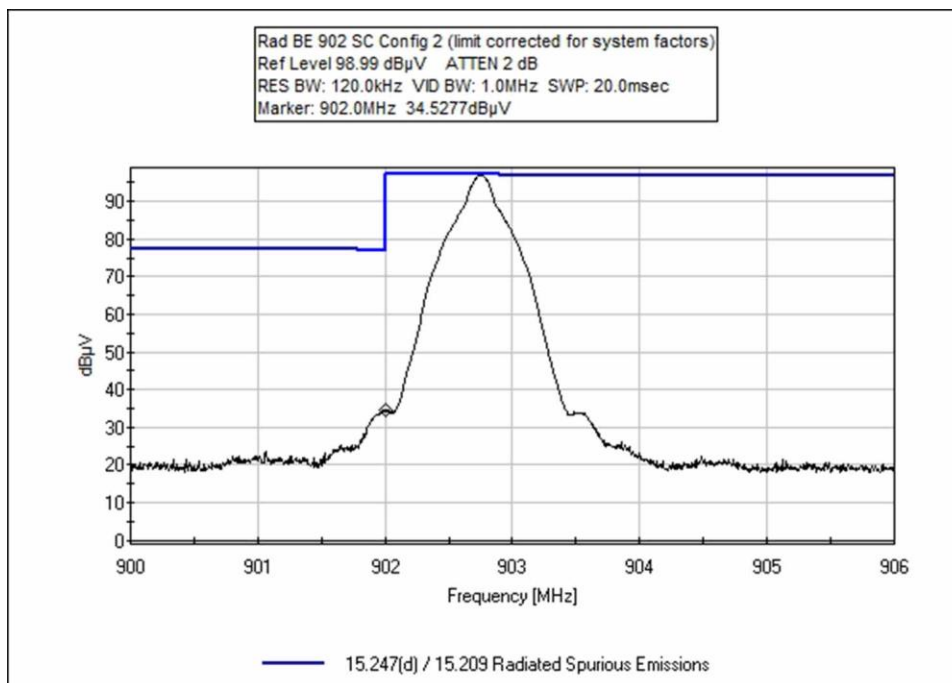
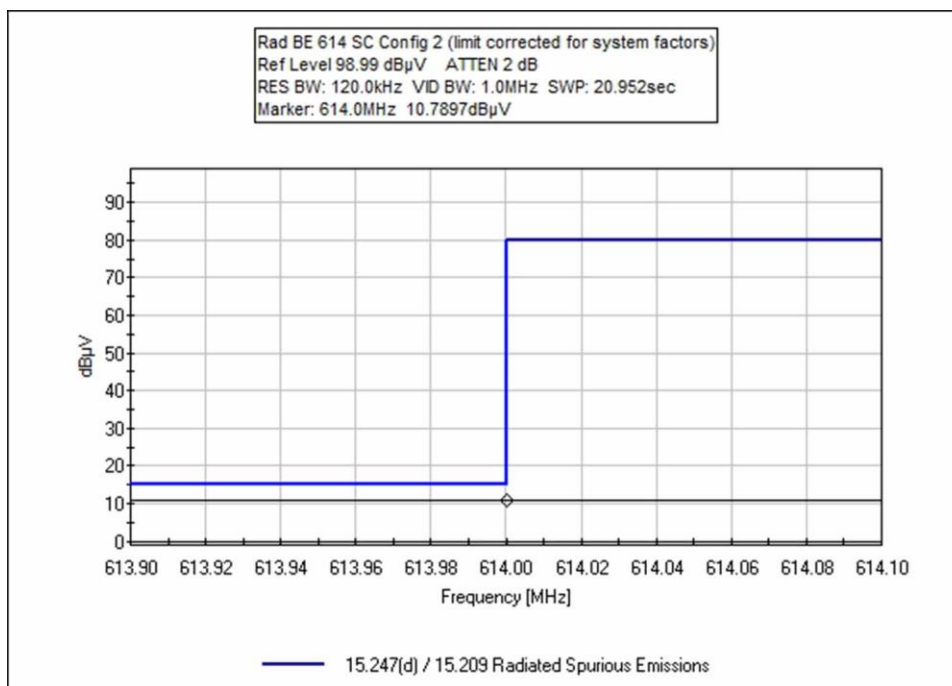


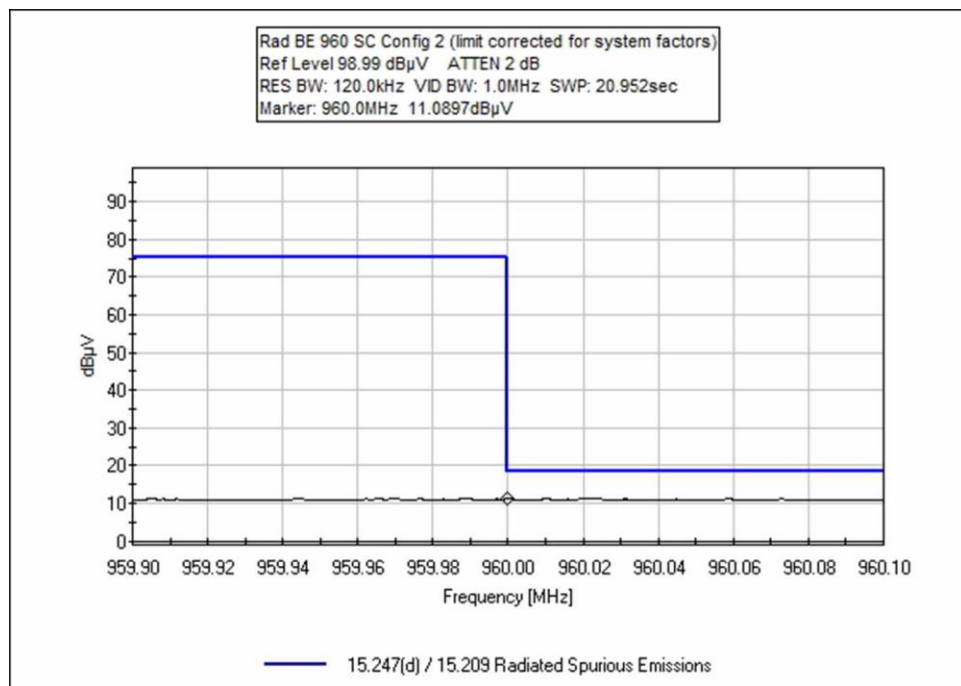
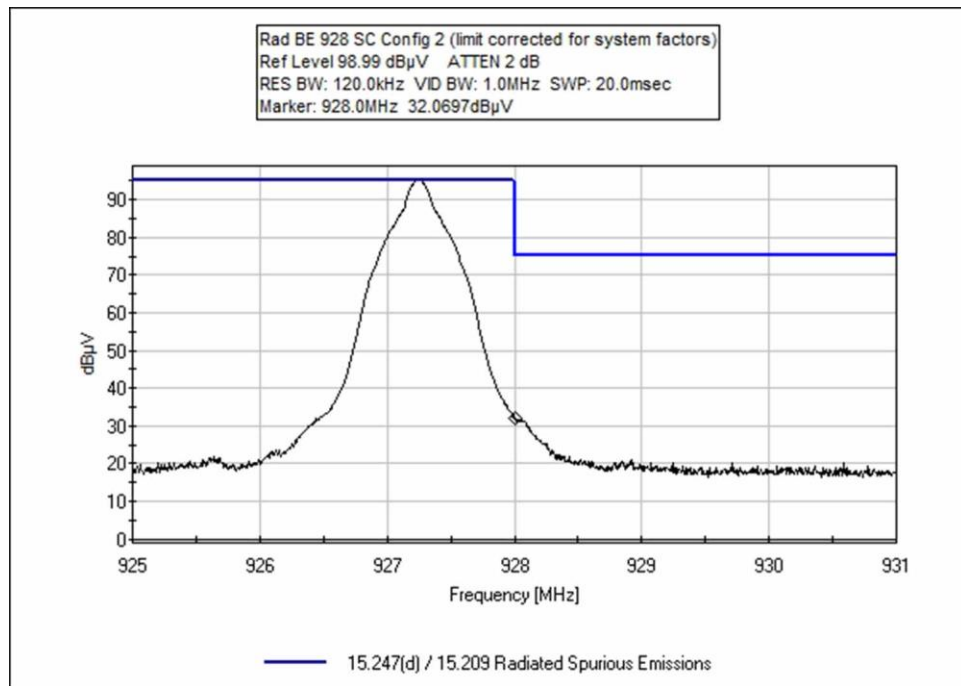


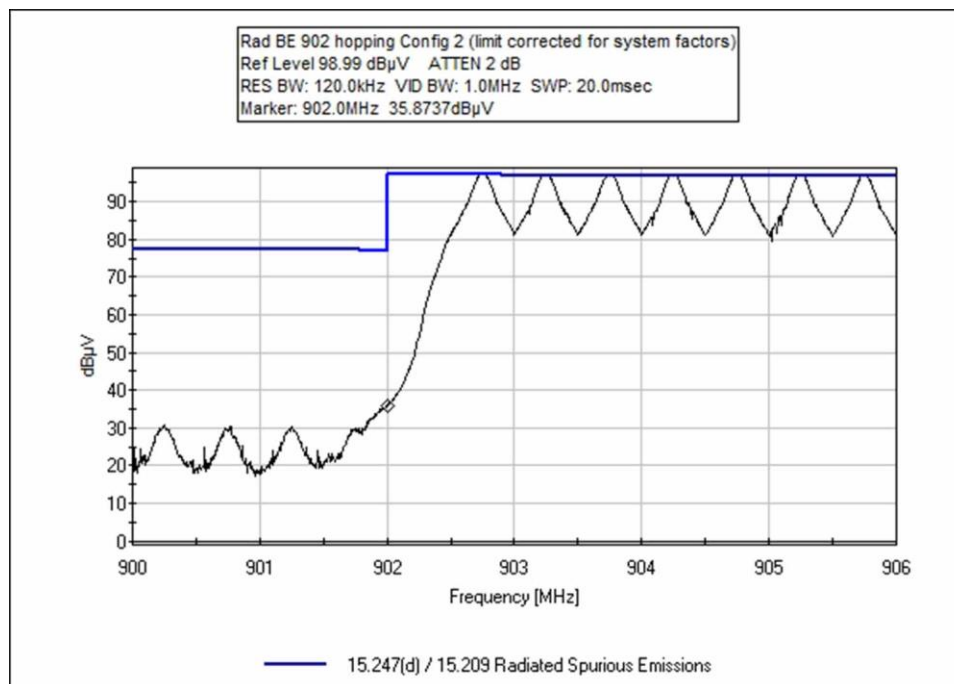
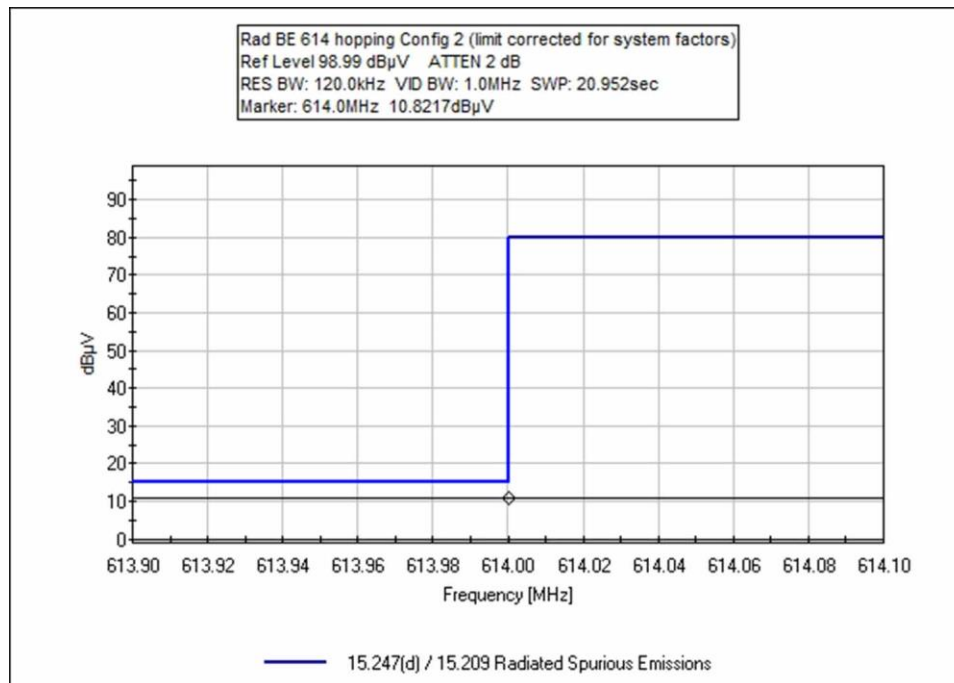


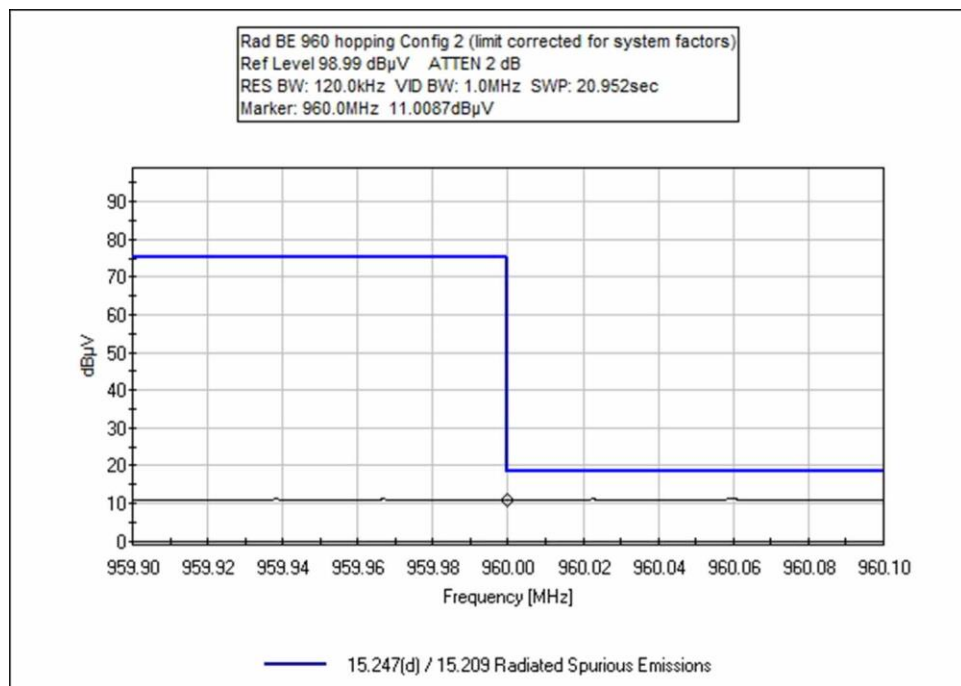
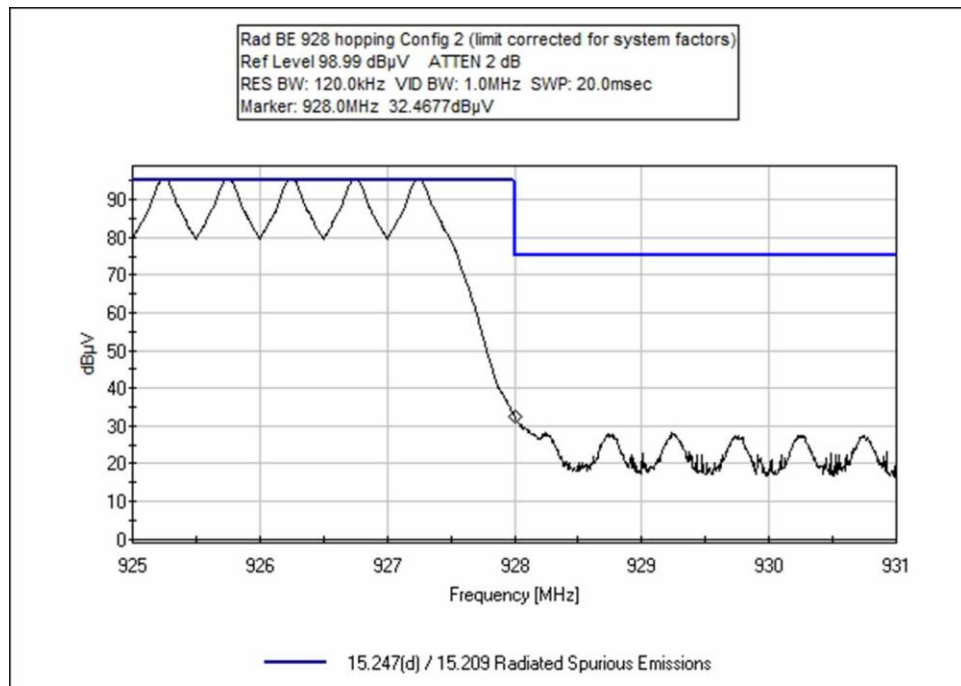


Configuration 2

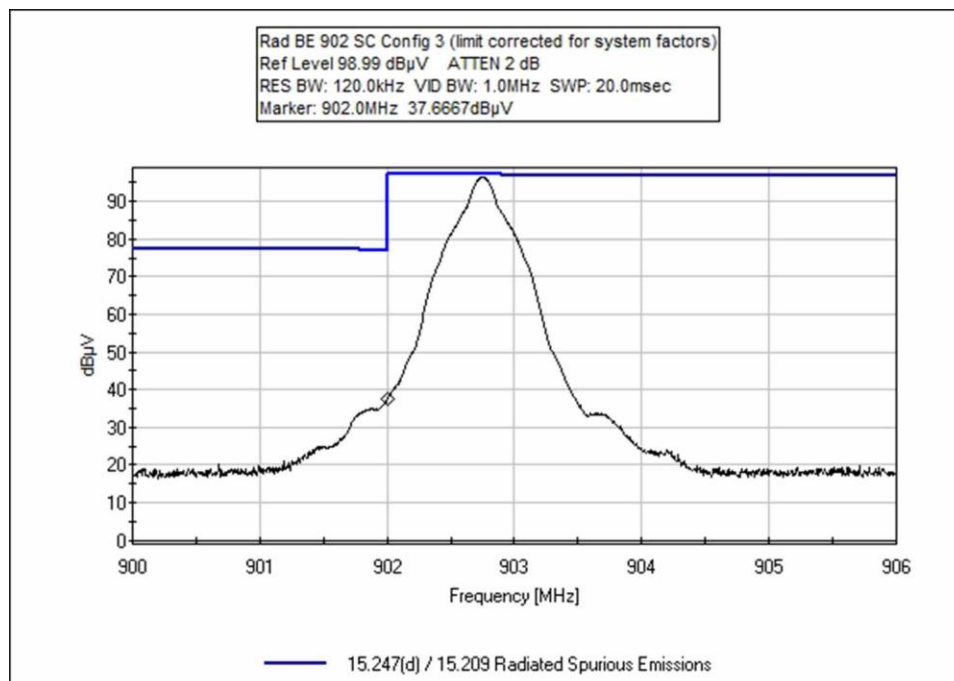
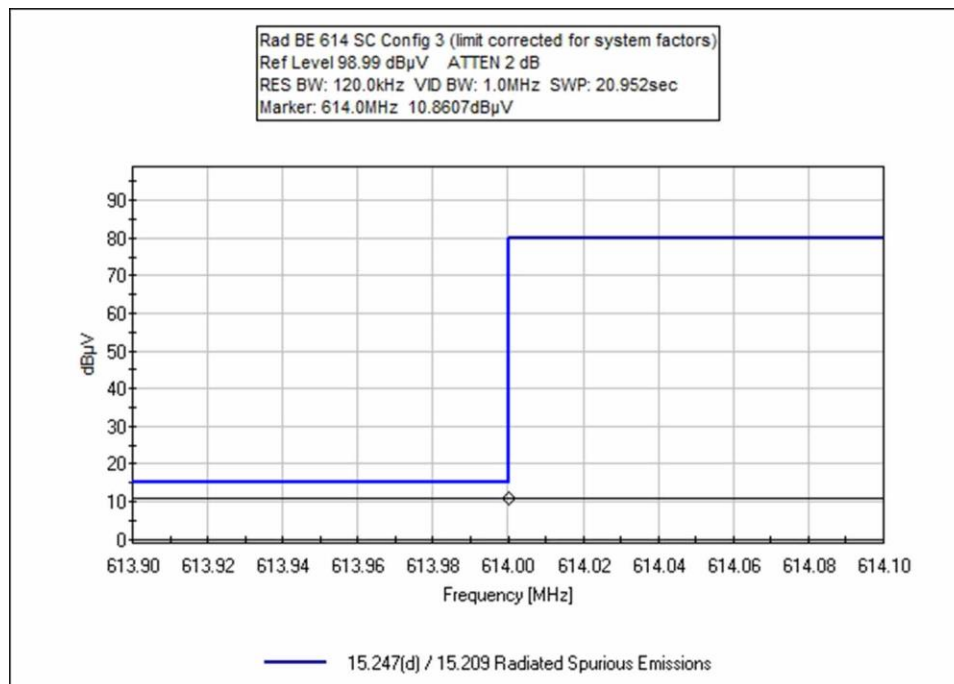


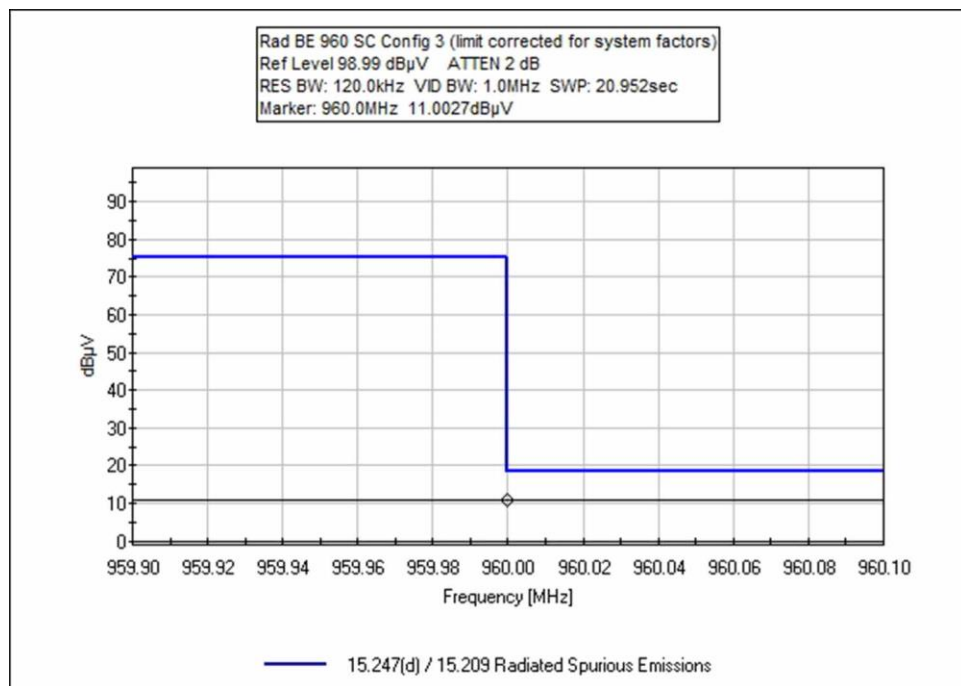
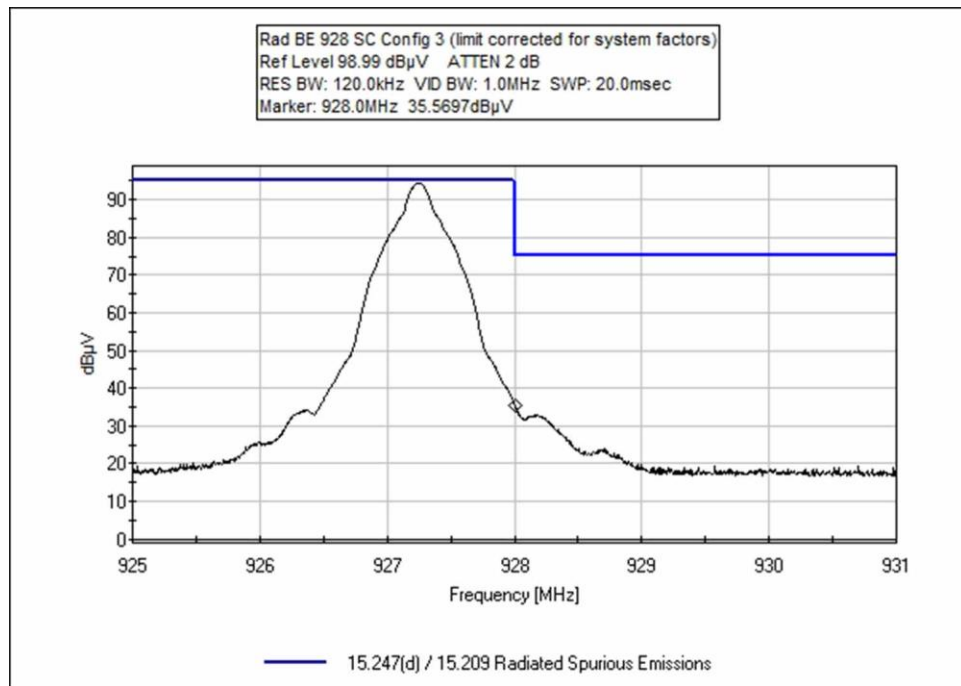


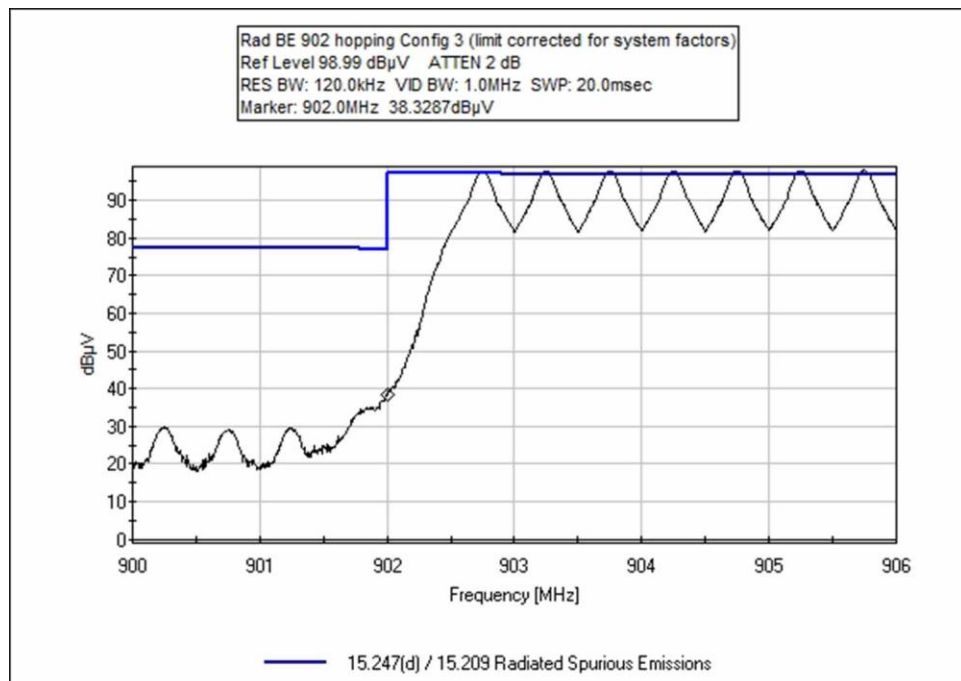
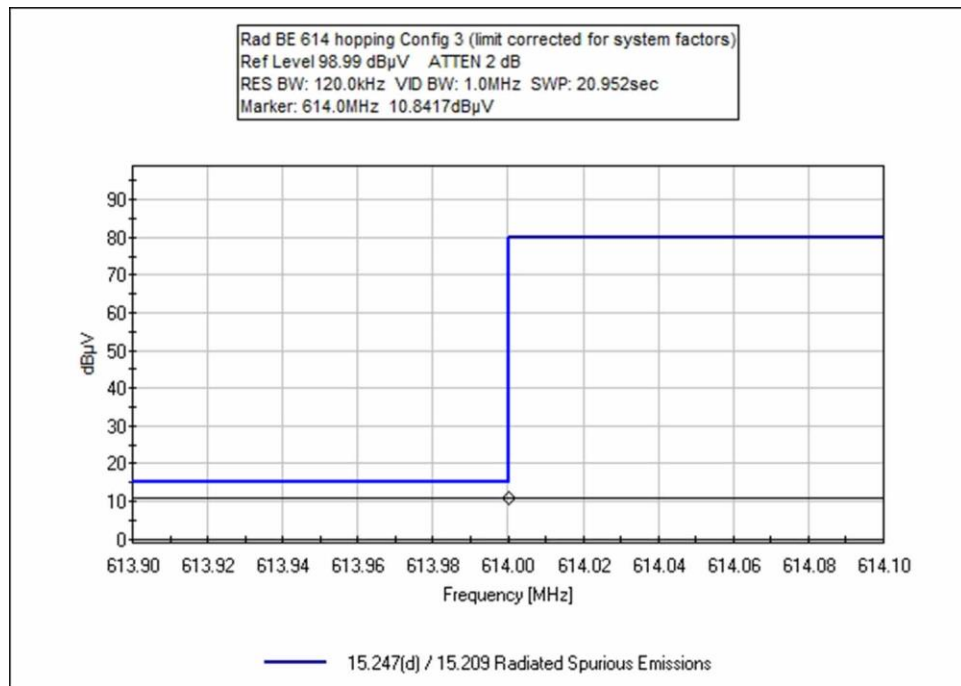


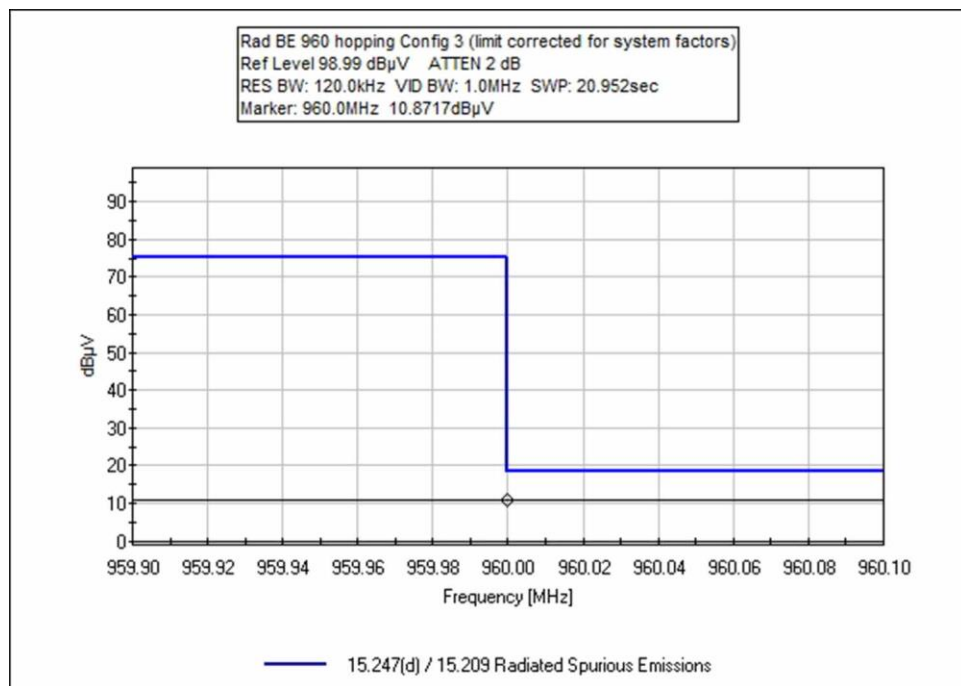
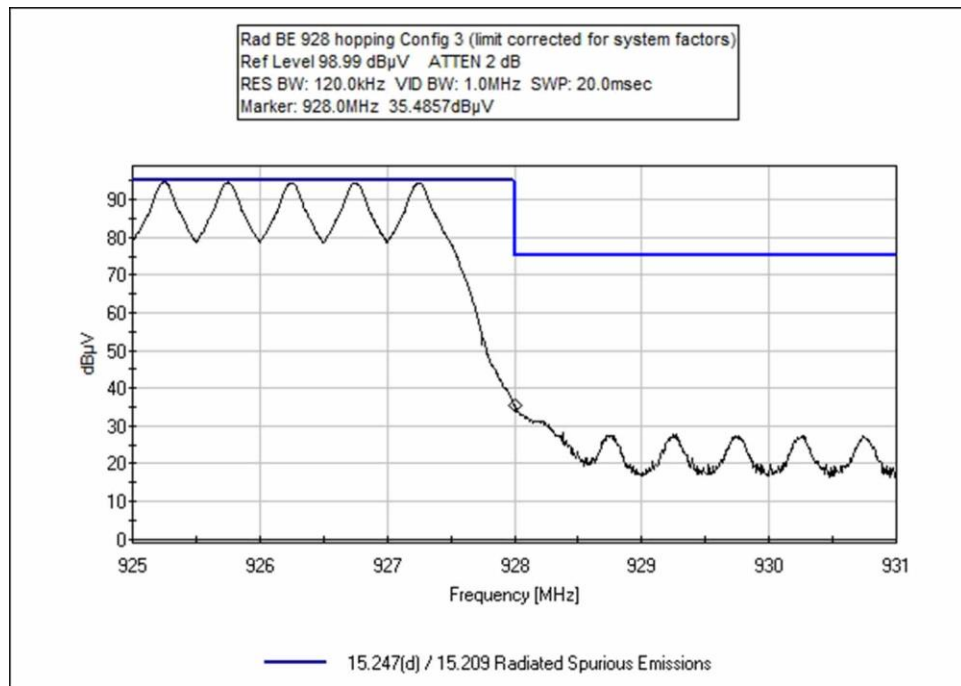


Configuration 3

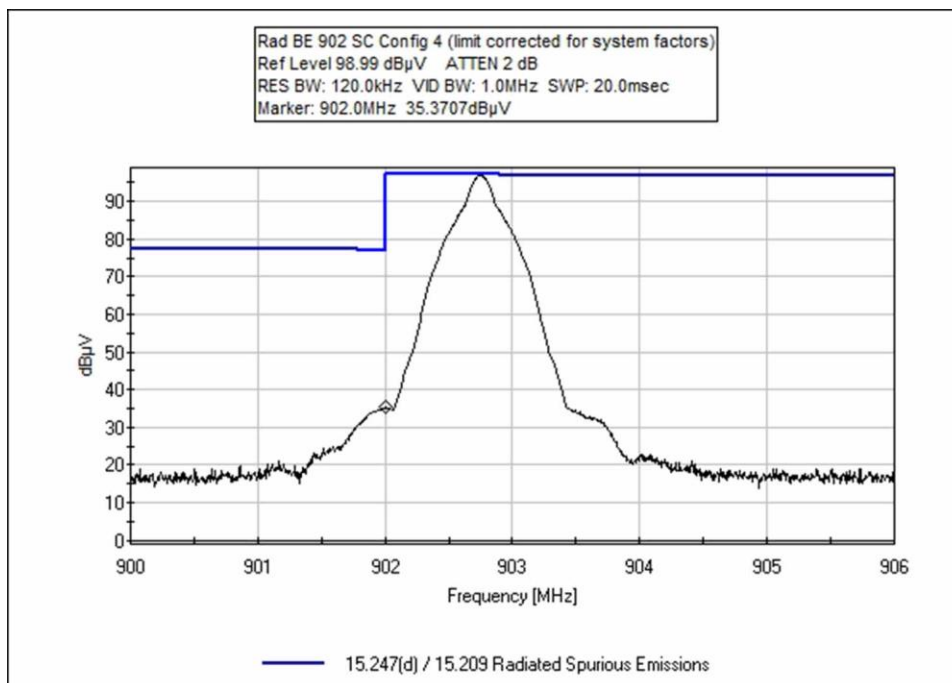
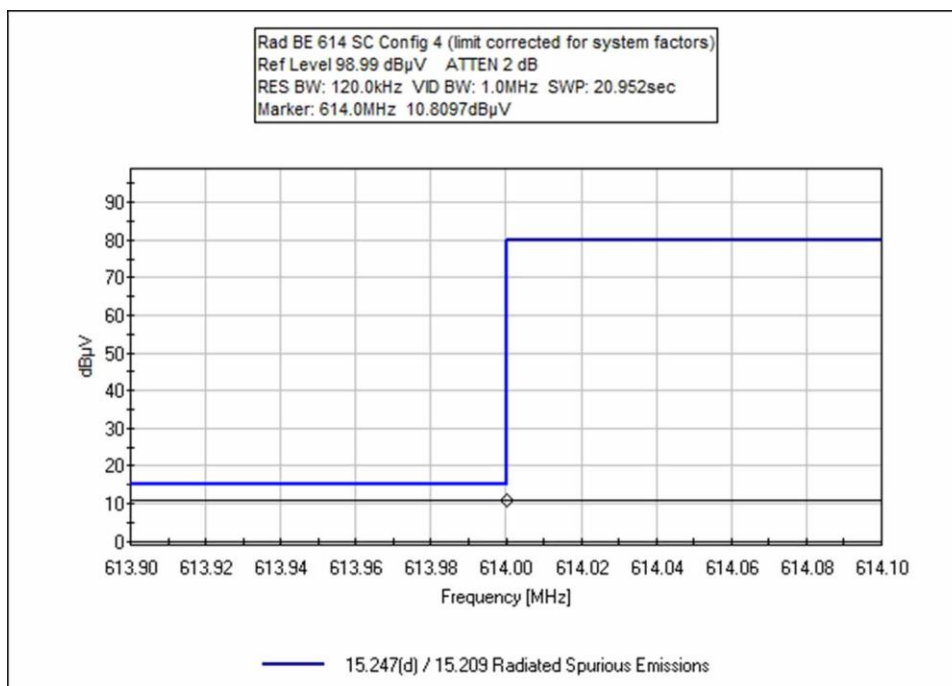


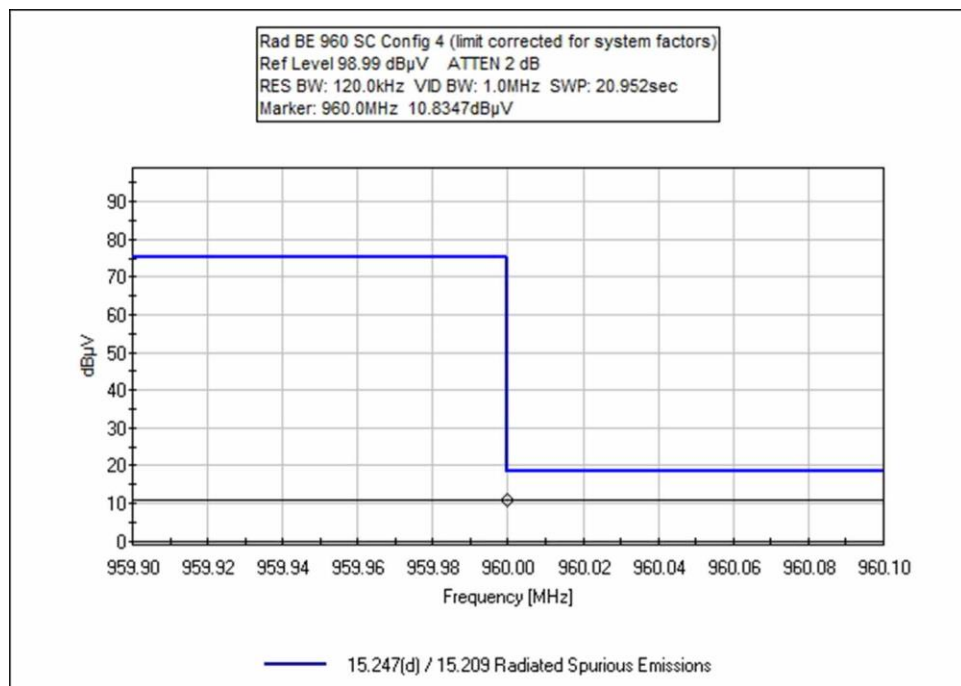
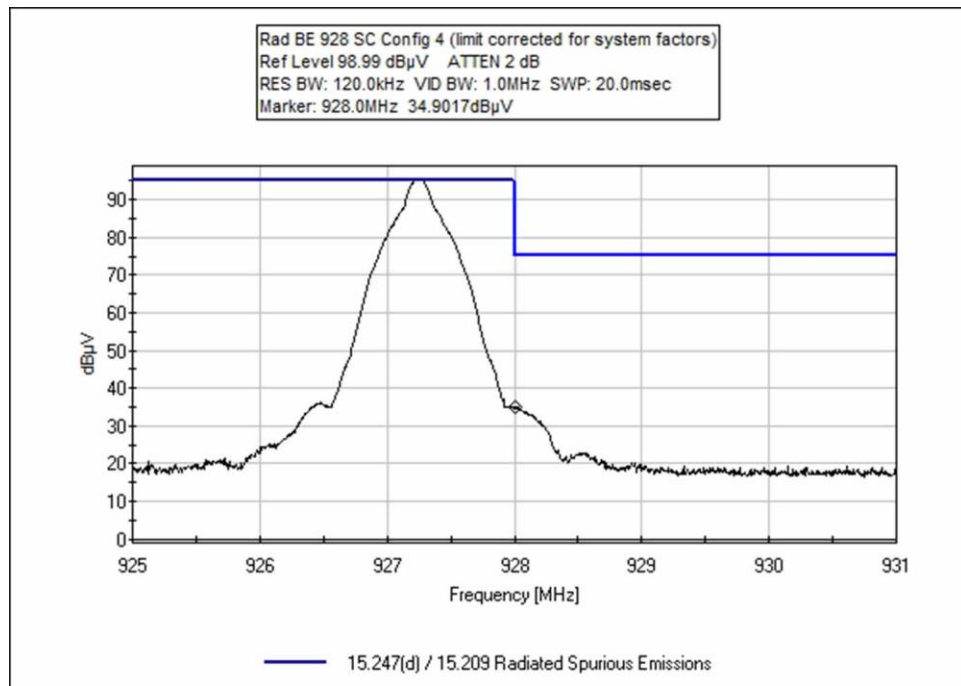


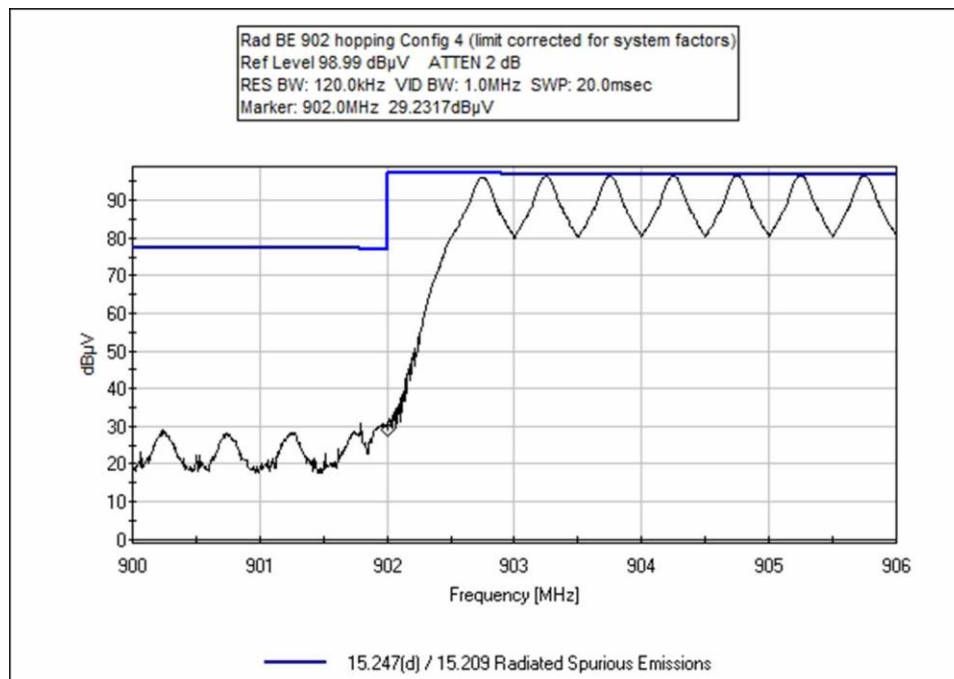
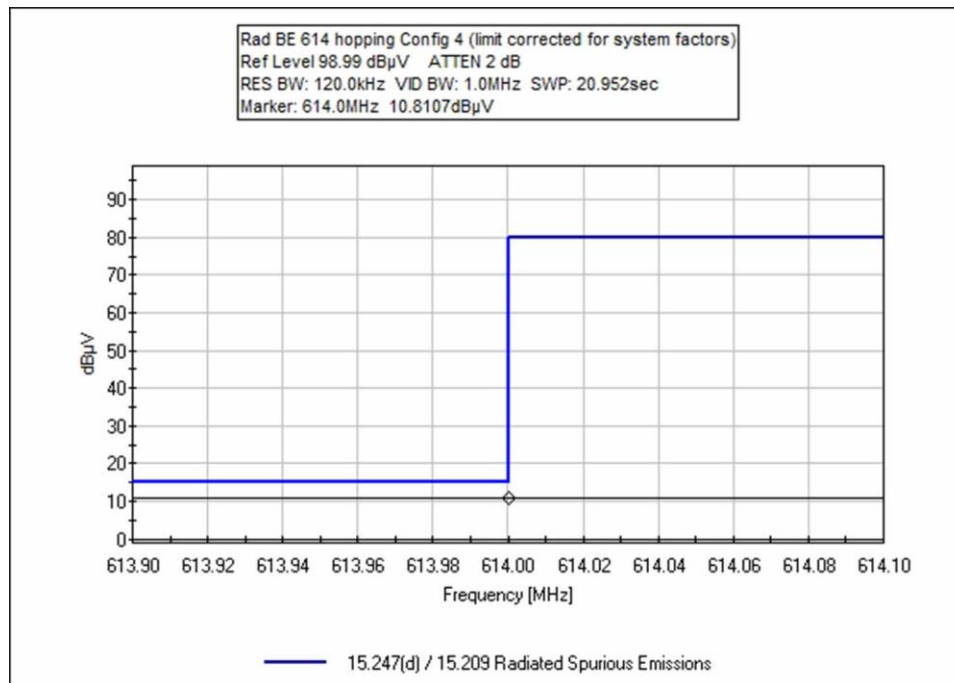


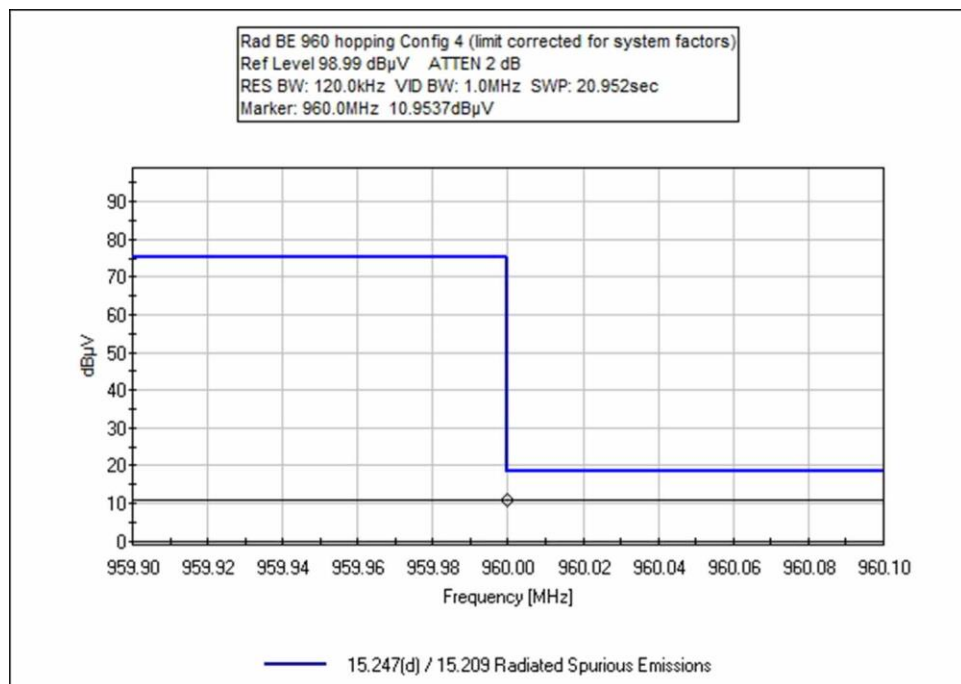
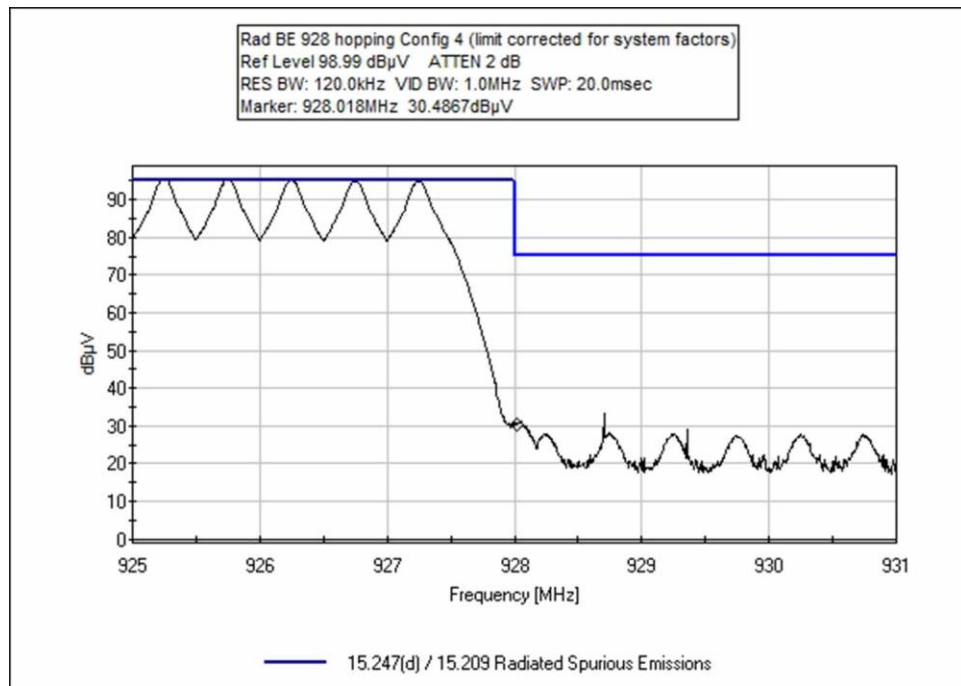


Configuration 4









Test Setup Photo(s)

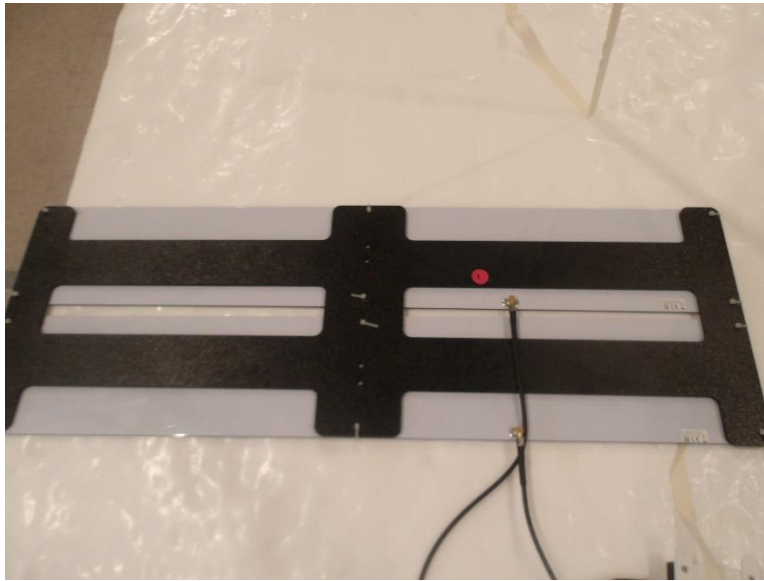
Configuration 1



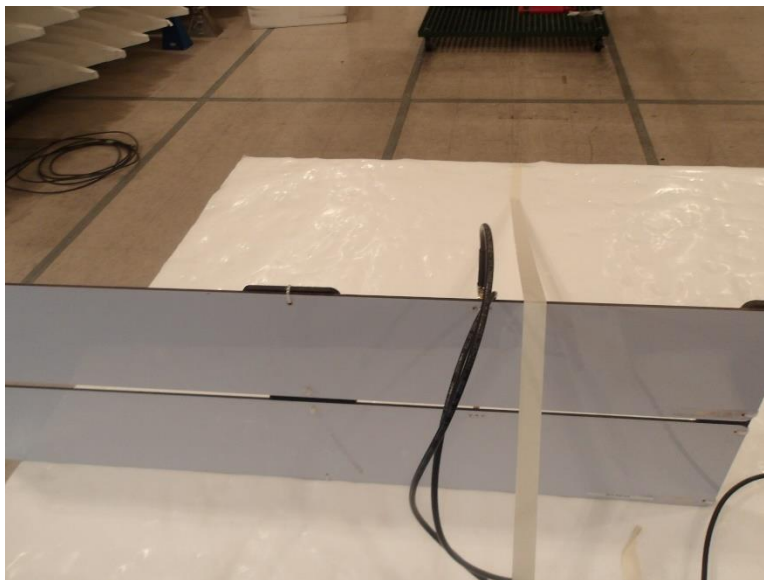
Below 1GHz



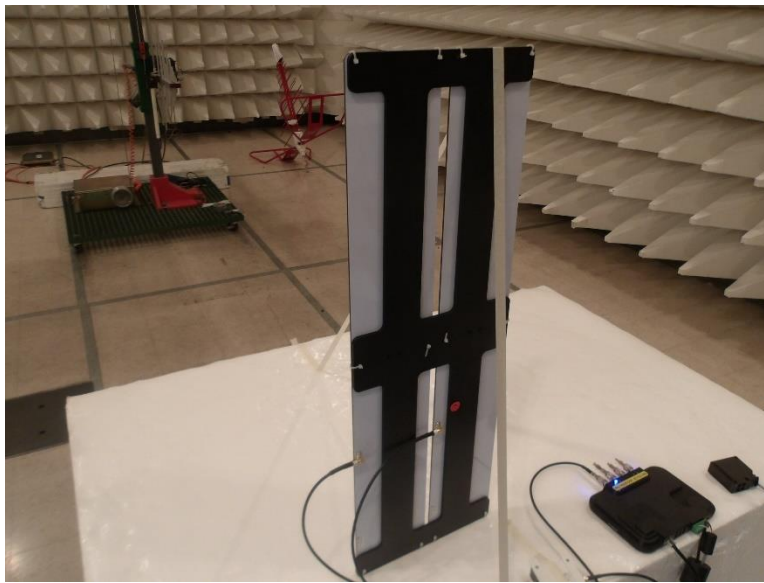
Above 1GHz



X-Axis

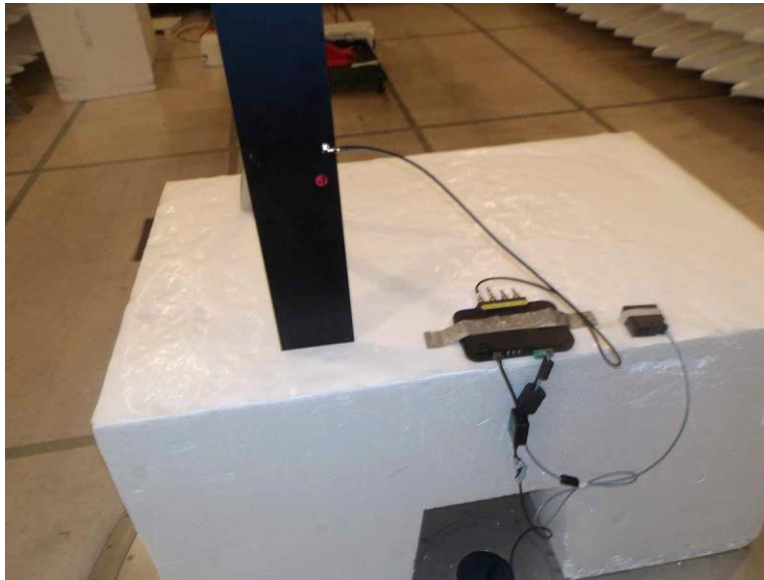


Y-Axis



Z-Axis

Configuration 2



Below 1GHz



Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 3



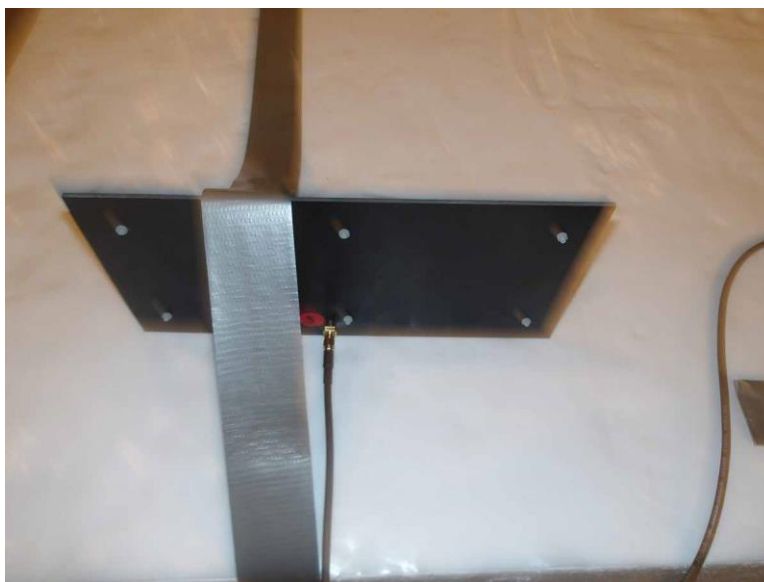
Below 1GHz



Above 1GHz



X-Axis

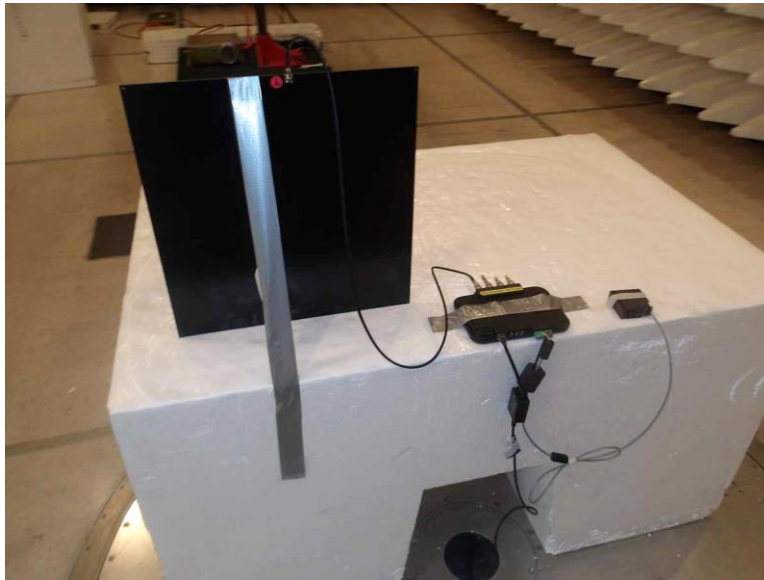


Y-Axis

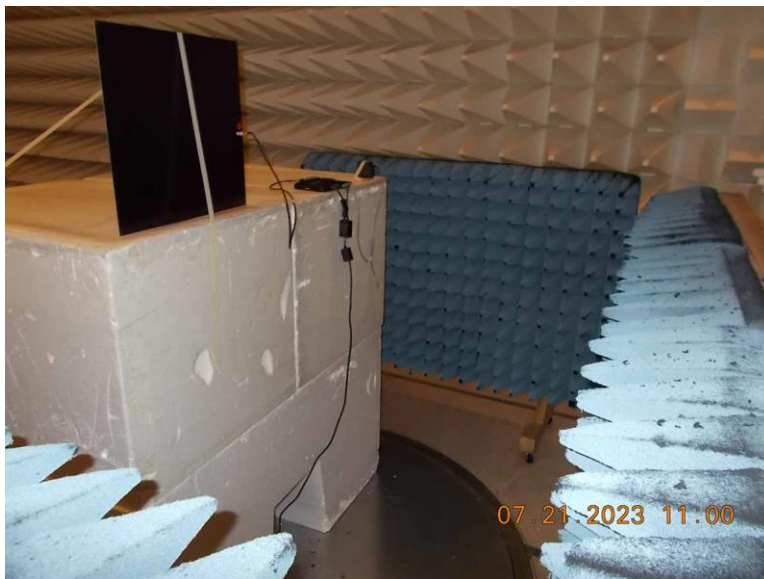


Z-Axis

Configuration 4



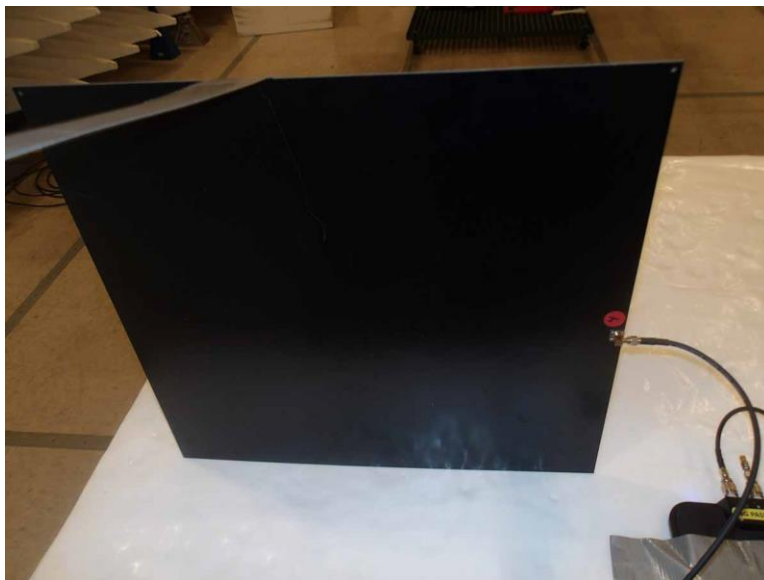
Below 1GHz



Above 1GHz



X-Axis

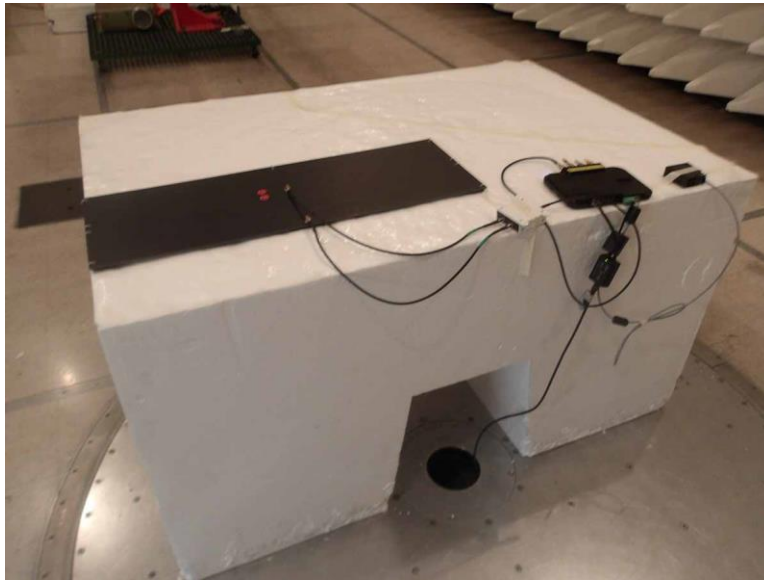


Y-Axis



Z-Axis

Configuration 5



Below 1GHz



Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 6



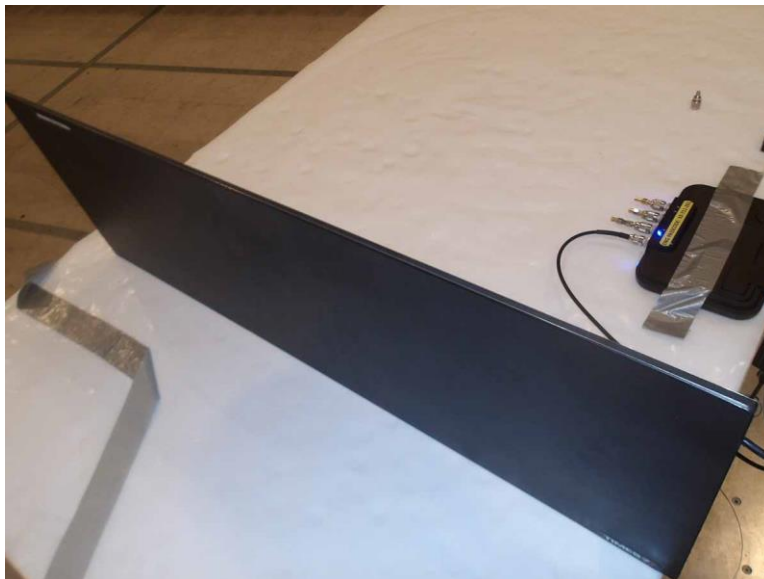
Below 1GHz



Above 1GHz



X-Axis



Y-Axis

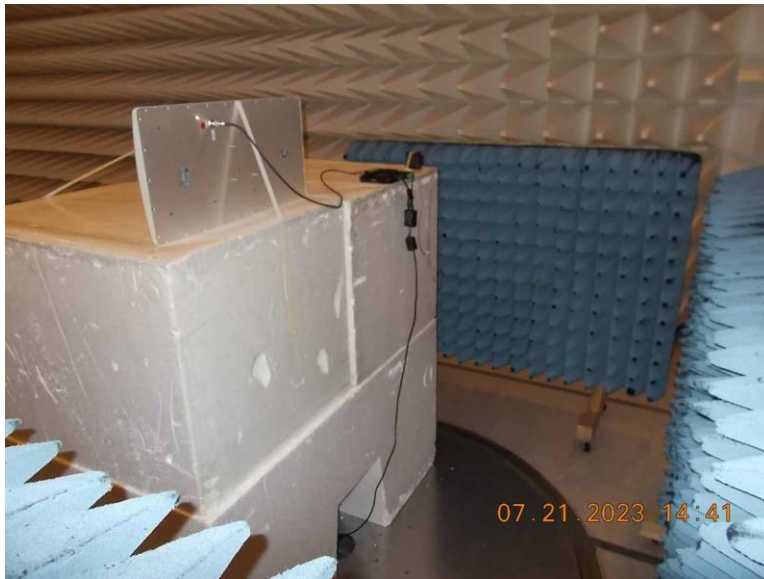


Z-Axis

Configuration 7



Below 1GHz



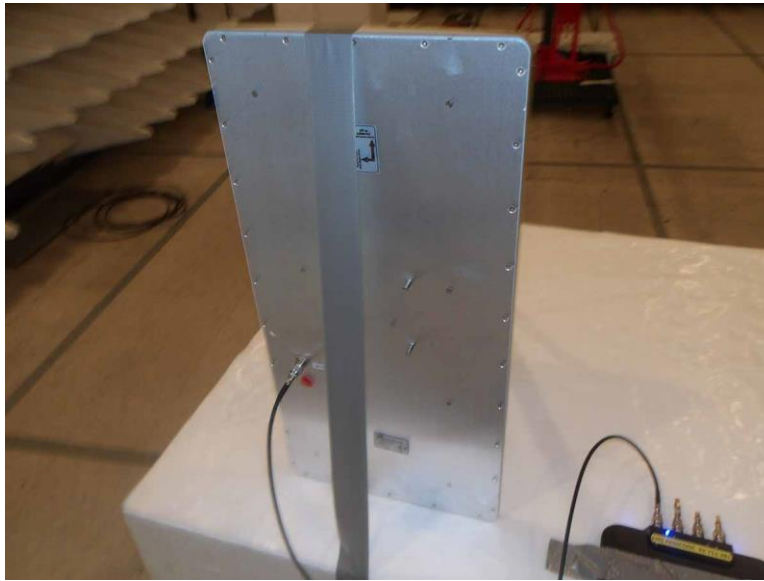
Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 8



Below 1GHz



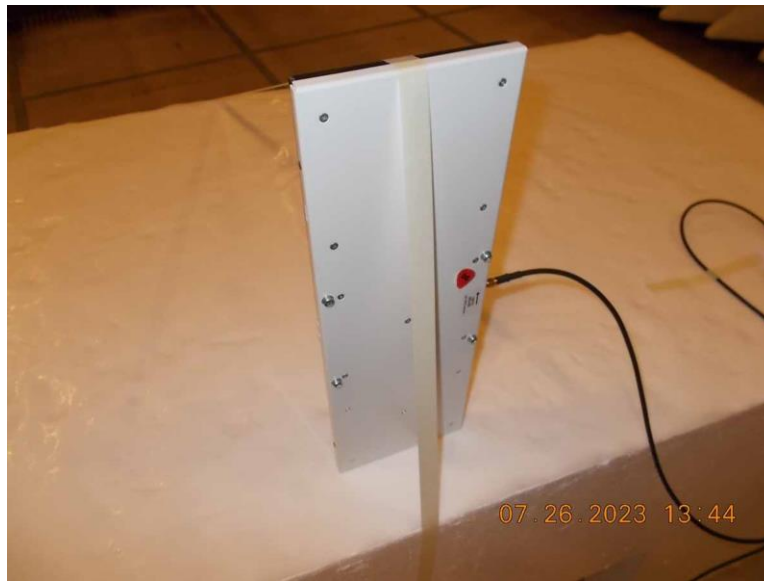
Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 9



Below 1GHz



Above 1GHz



X-Axis



Y-Axis



Z-Axis

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.