

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.2

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

DATE OF EQUIPMENT RECEIPT:
DATE(S) OF TESTING:

REPORT PREPARED BY:

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

Project Number: 108693

July 18, 2023
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:

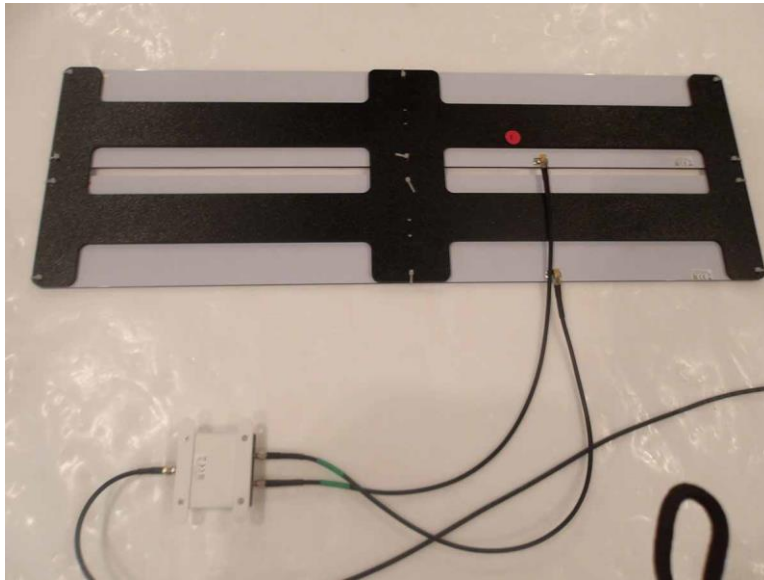
Device	Manufacturer	Model #	S/N
Slimline UHF Ground Antenna	Times-7	A6034-71800	230117672
PoE Splitter	Tycon Systems	POE-MSPLT-4812P	204100656ARC01
Sensor	Panasonic	EQ-511	NA
Single Point Power Over Ethernet	Phihong	POE29U-1AT(PL)	NA
ITE Power Supply	tp-link	T120100-2B1	NA
Omada Gigabit VPN Router	tp-link	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:	<p>Various, 9 configurations tested in this report. They are all patch antennas with the following gain values:</p> <ul style="list-style-type: none"> 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 <p>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.</p> <p>Minimum Declared Cable Loss to use per Manufacturer:</p> <ul style="list-style-type: none"> 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)



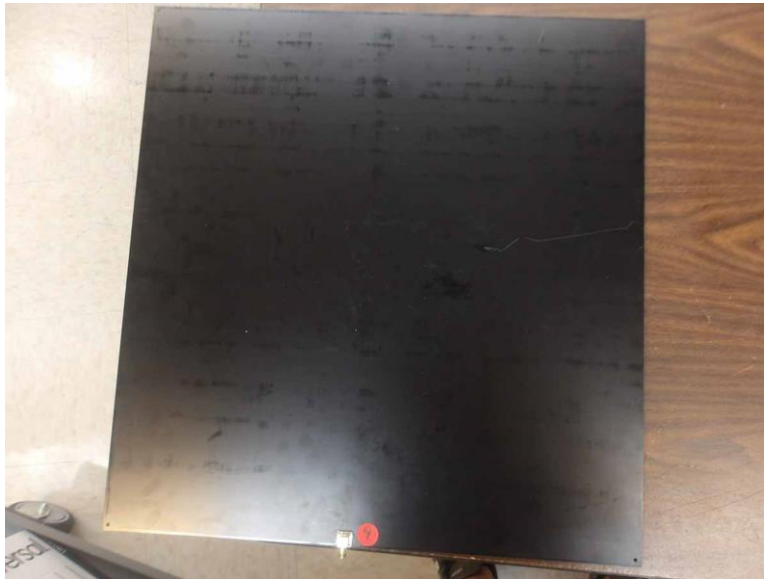
Configuration 1; Antenna



Configuration 2; Antenna



Configuration 3; Antenna



Configuration 4; Antenna



Configuration 5; Antenna



Configuration 6; Antenna



Configuration 7; Antenna



Configuration 8; Antenna

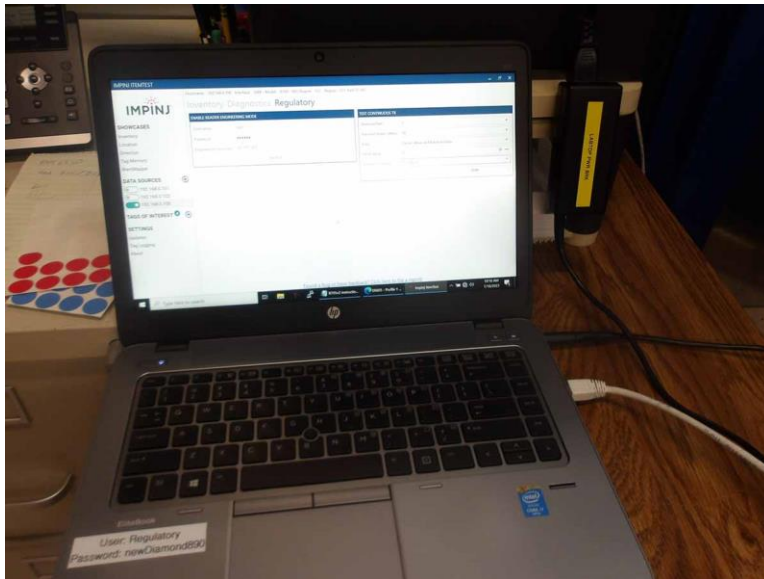


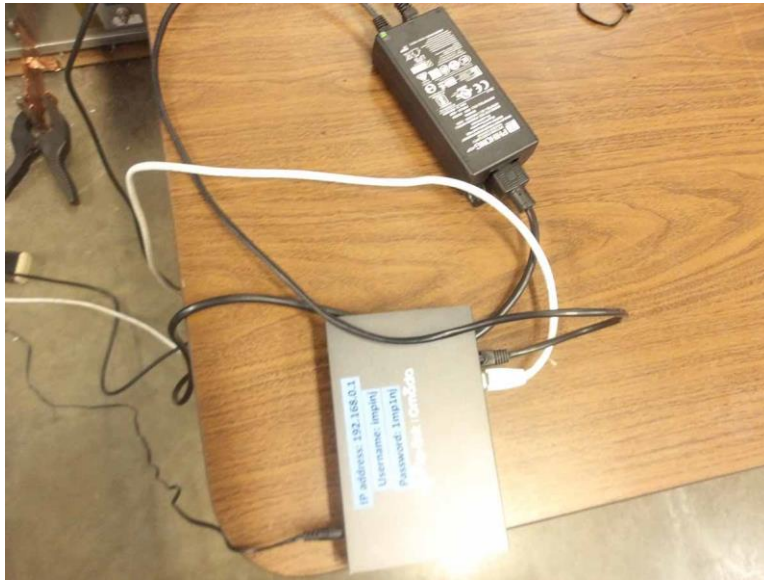
Configuration 9; Antenna



EUT Reader

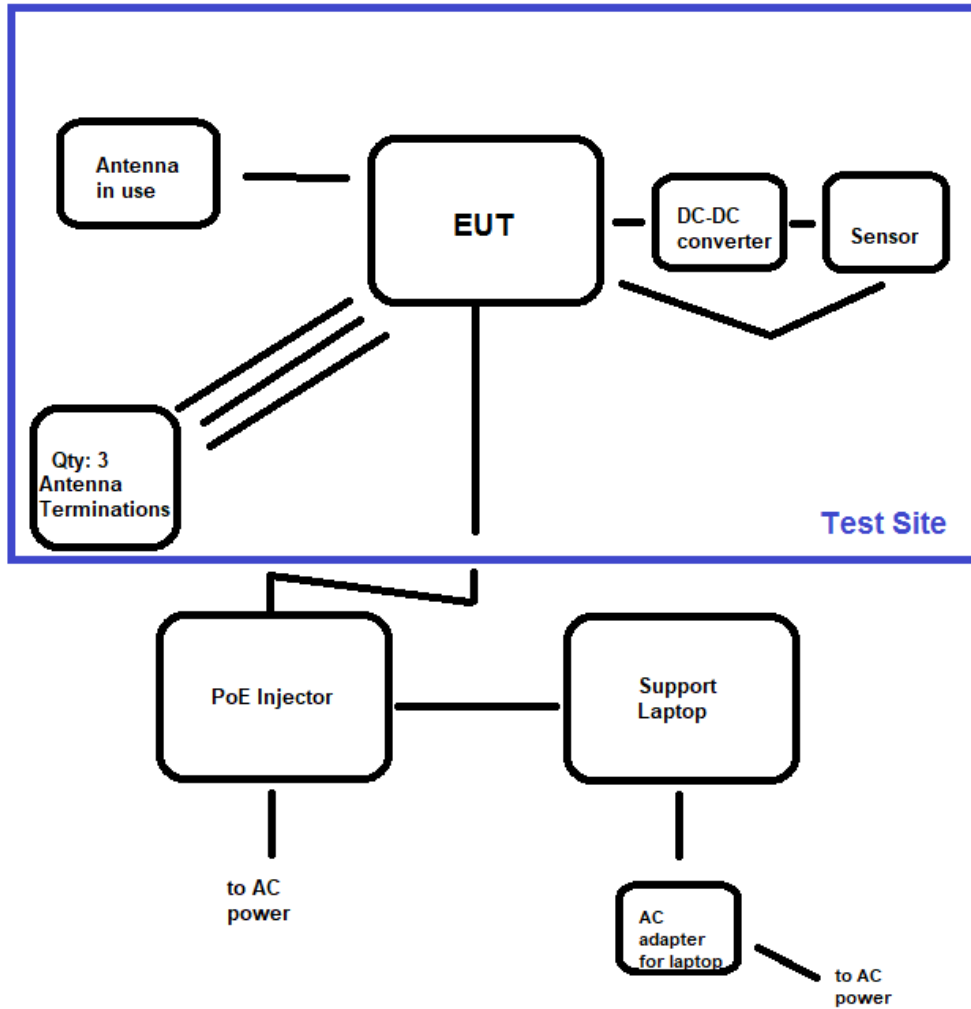
Support Equipment Photo(s)





Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

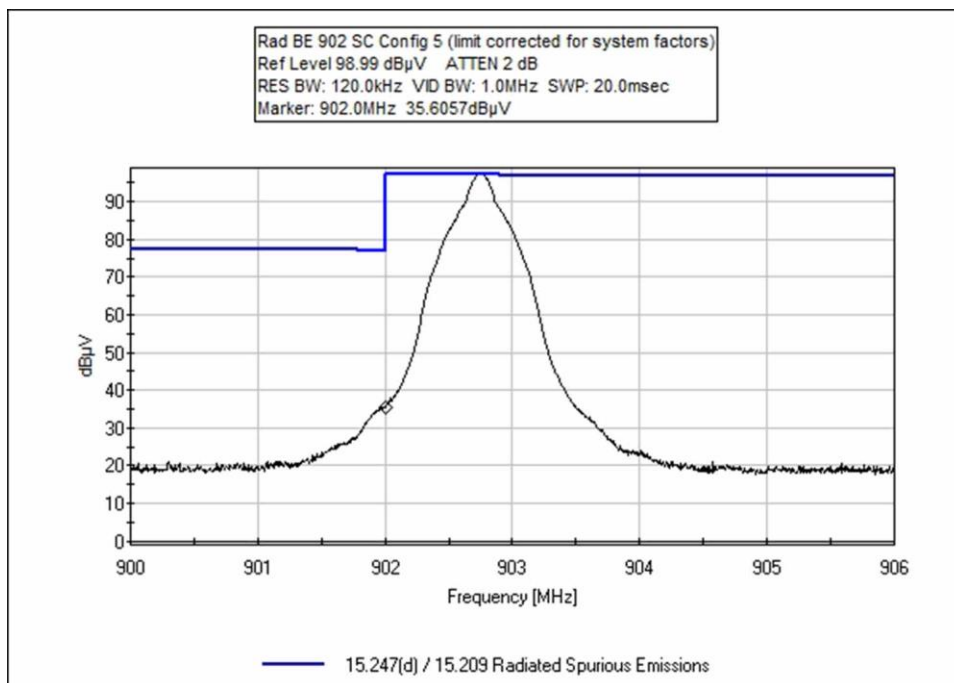
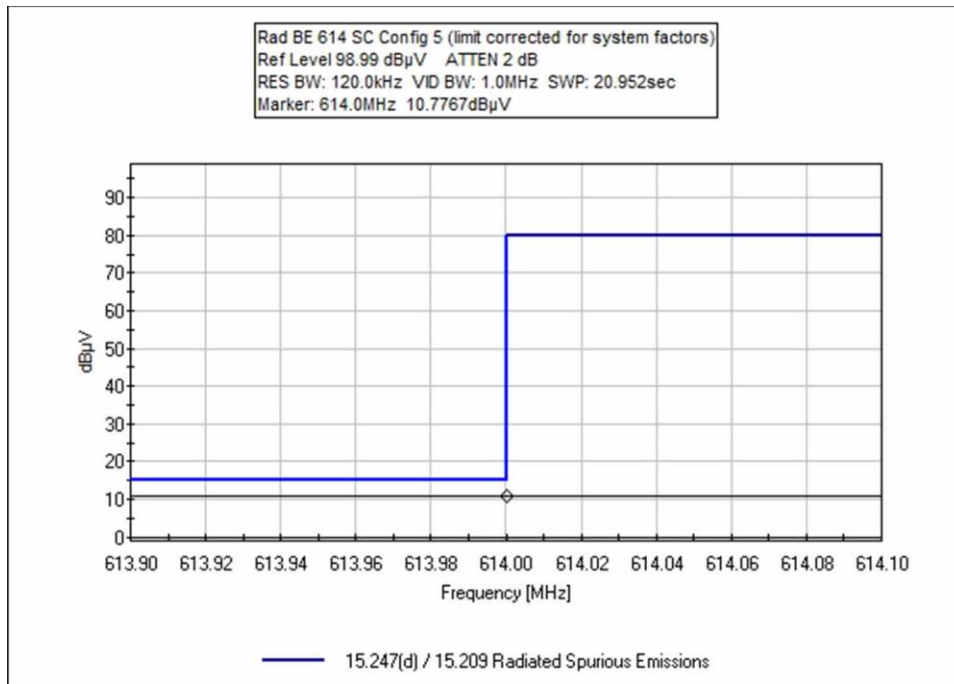
15.247(d) Radiated Emissions & Band Edge

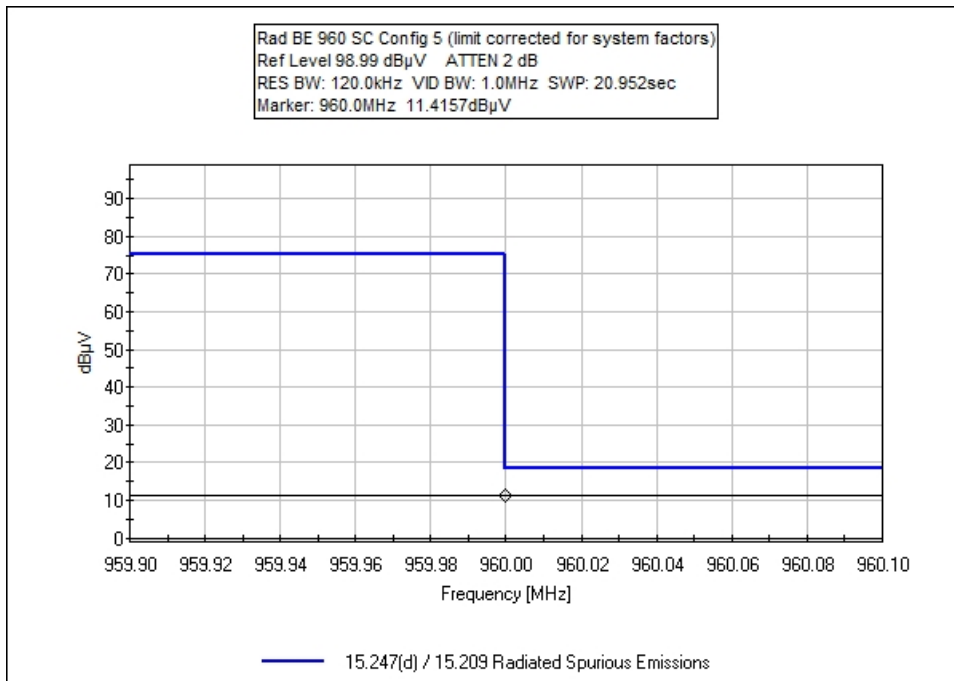
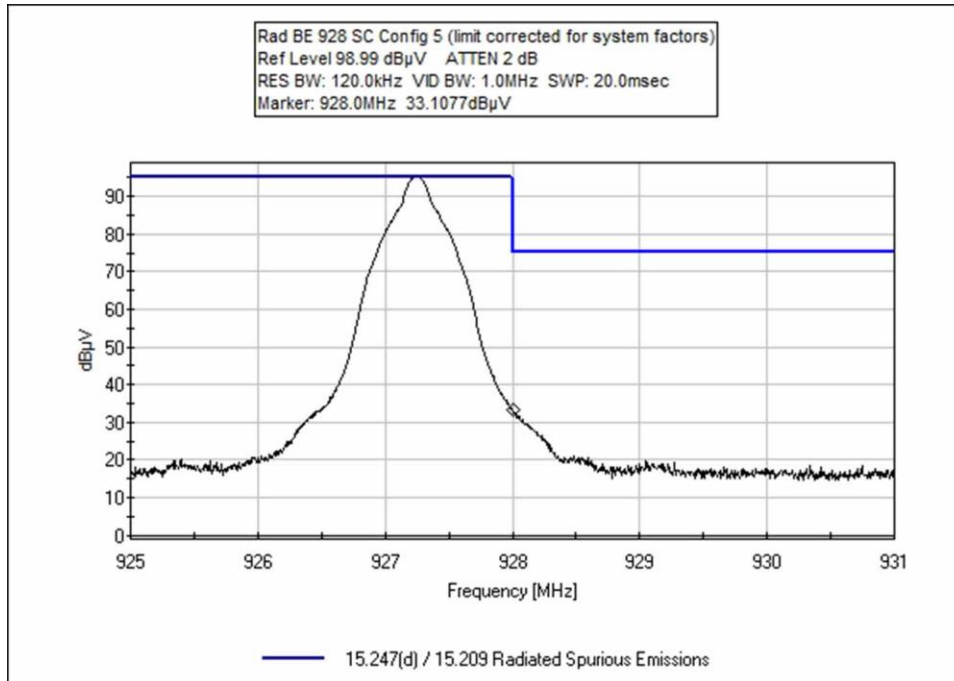
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford & M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	7/18/2023 to 7/26/2023
Configuration:	1, 2, 3, 4, 5, 6, 7, 8 and 9		
Declarations:	<p>Partial testing performed as contracted: 902MHz to 960MHz for band edge 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.</p> <p>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.</p> <p>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.</p> <p>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.</p>		

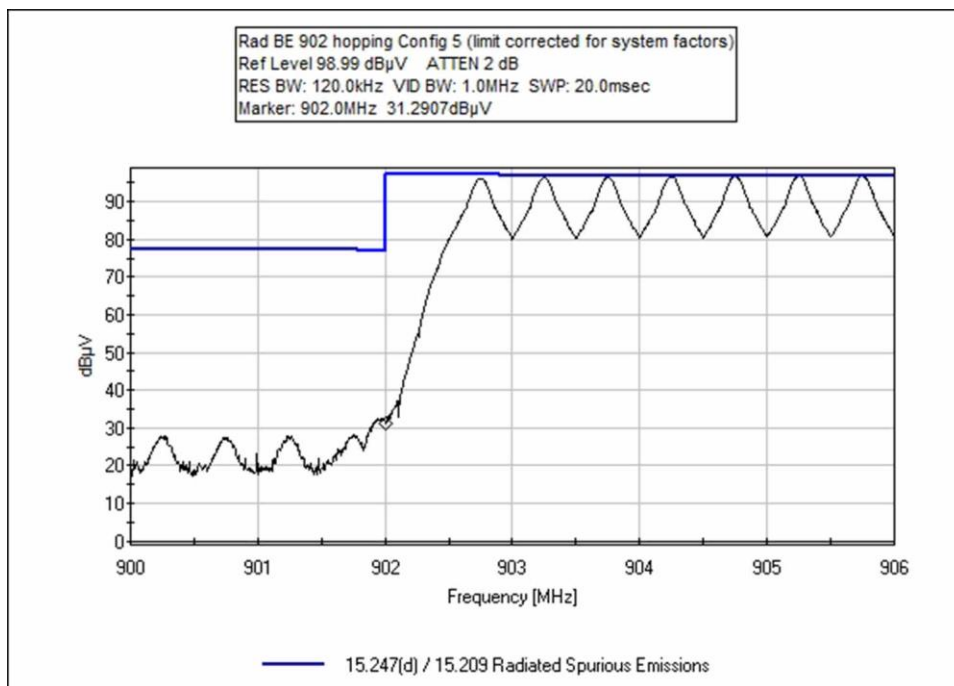
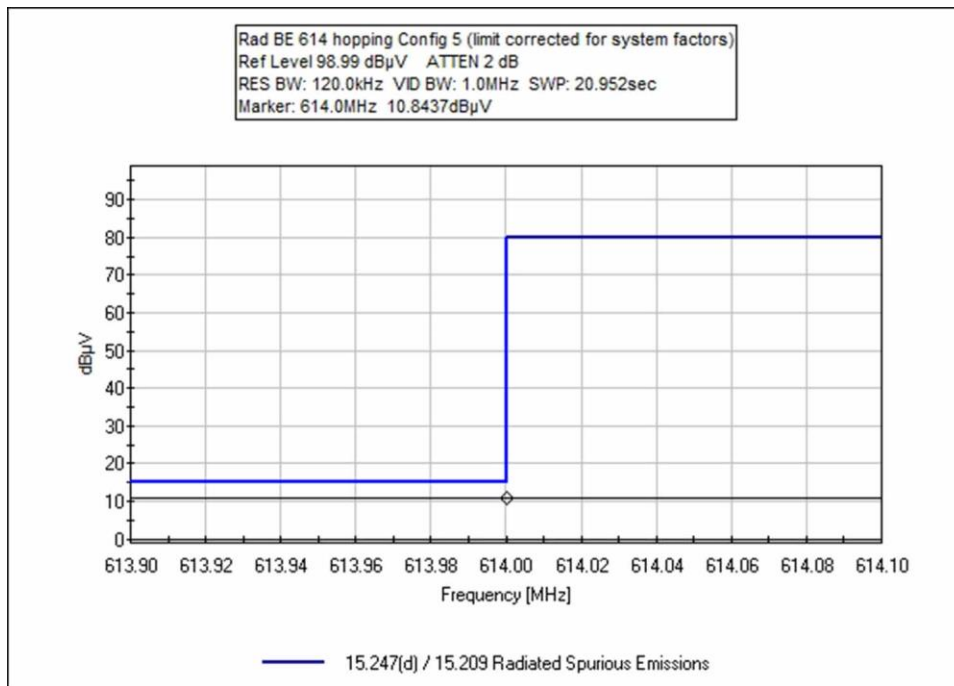


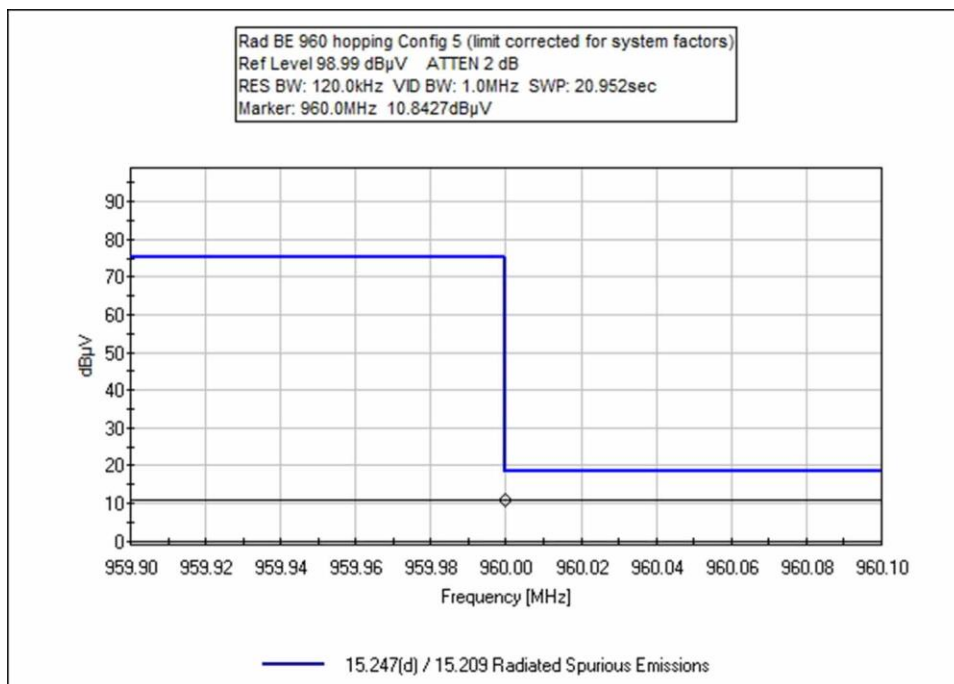
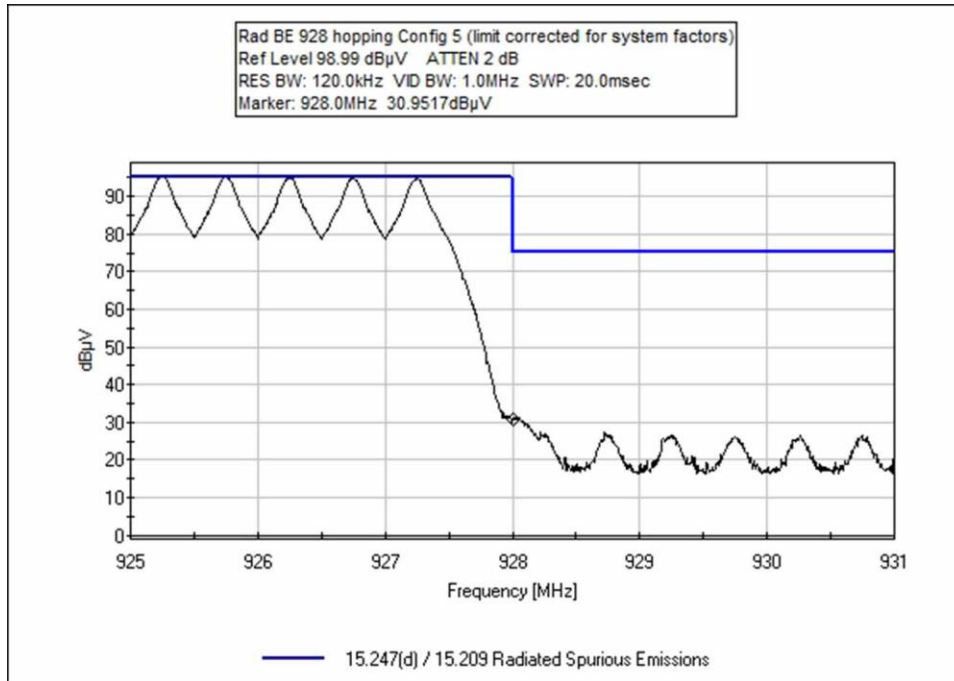
Band Edge Plots

Configuration 5

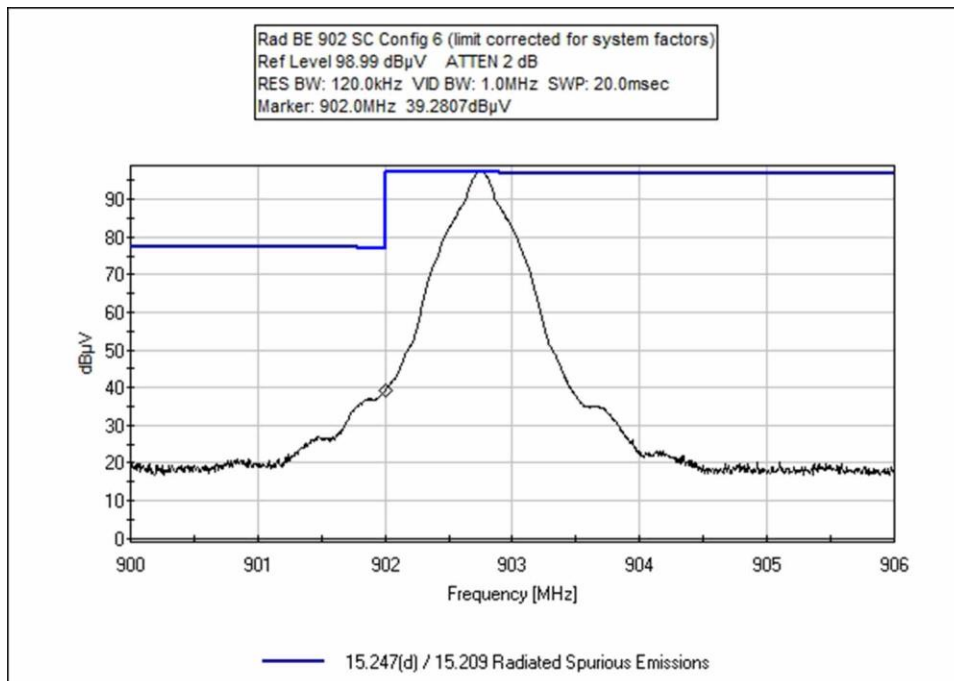
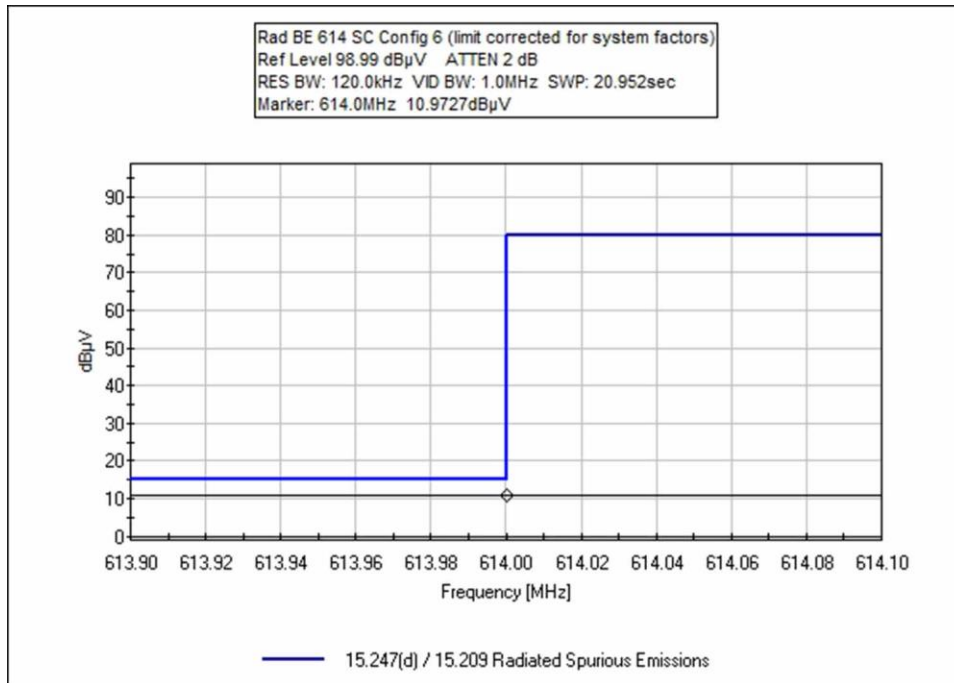


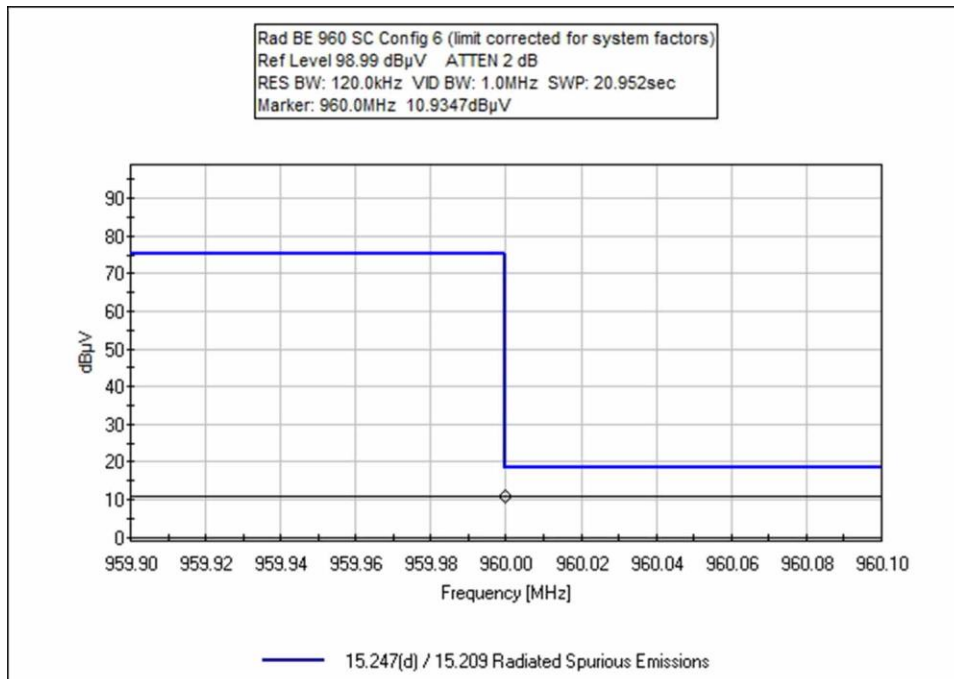
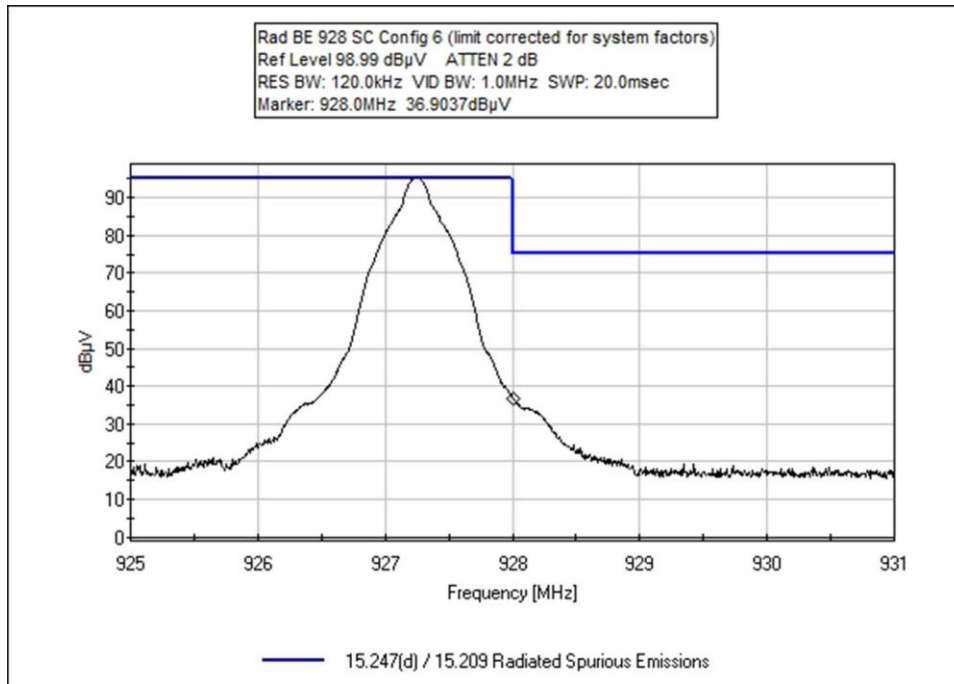


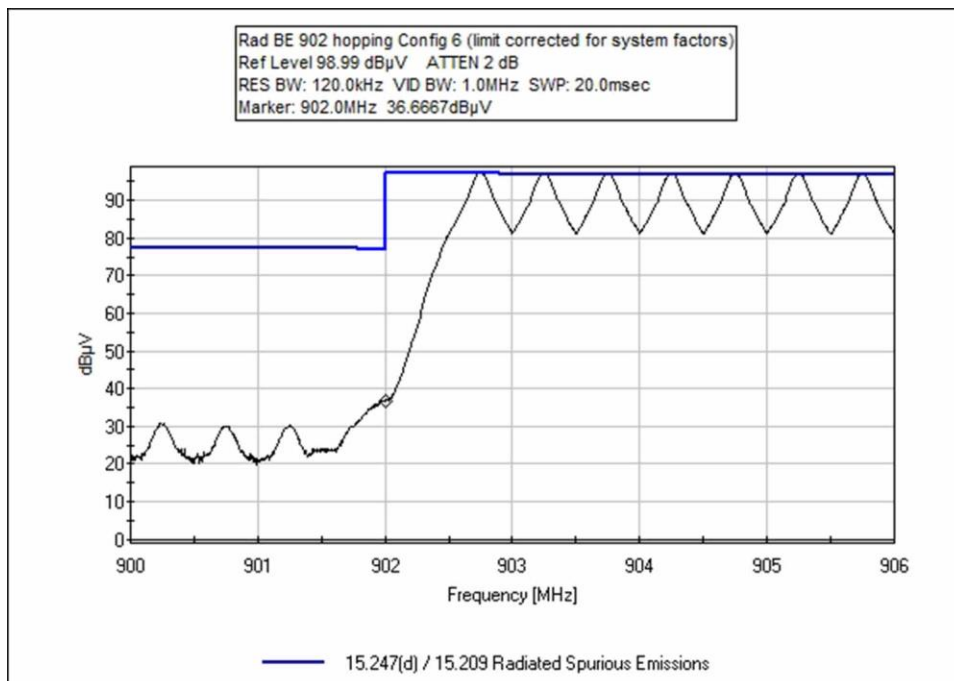
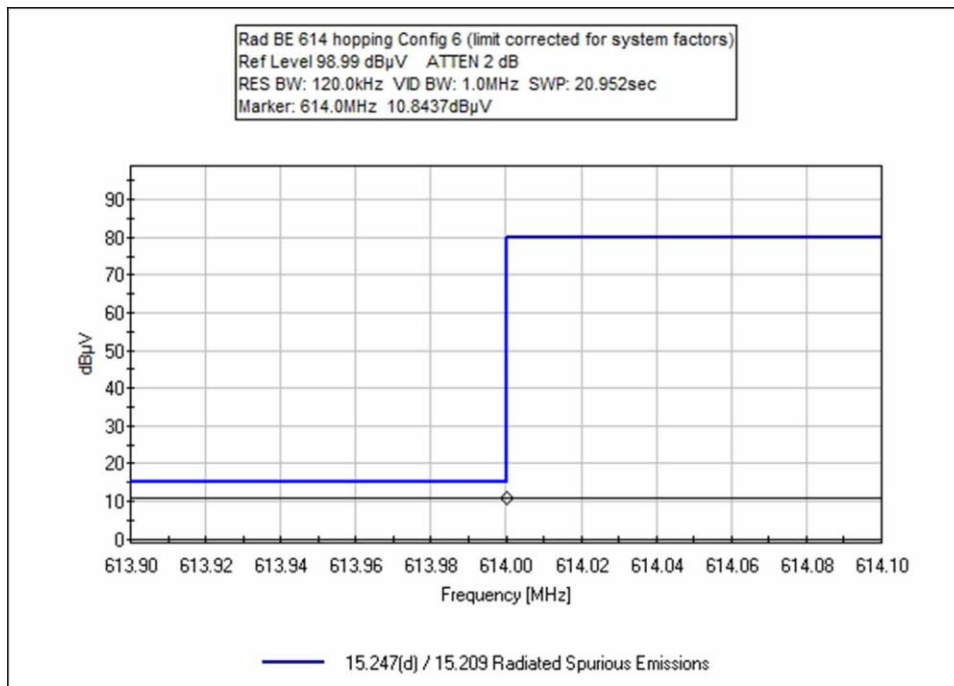


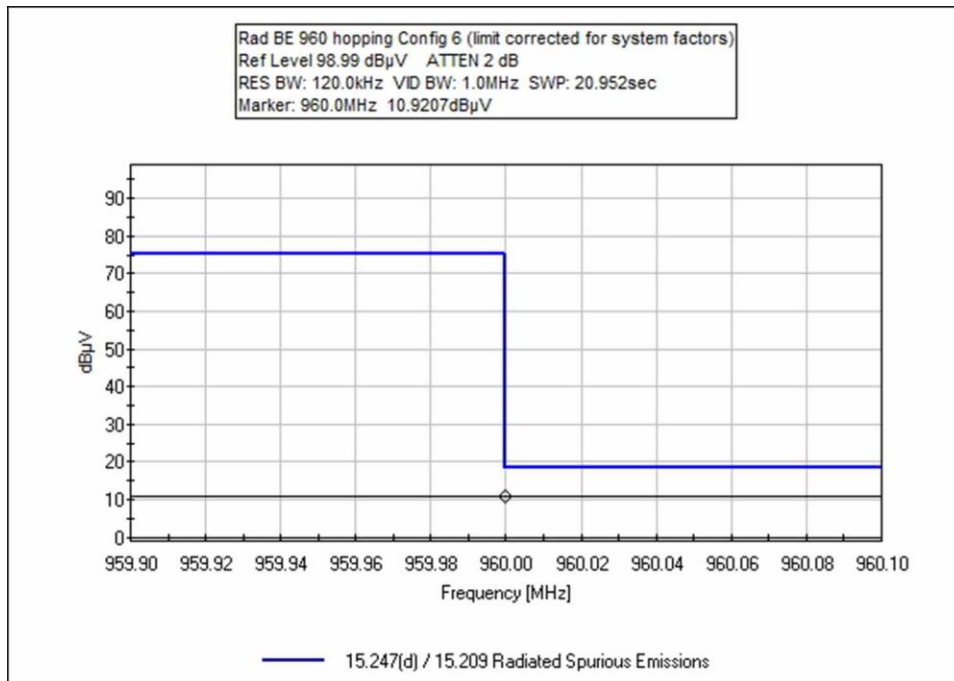
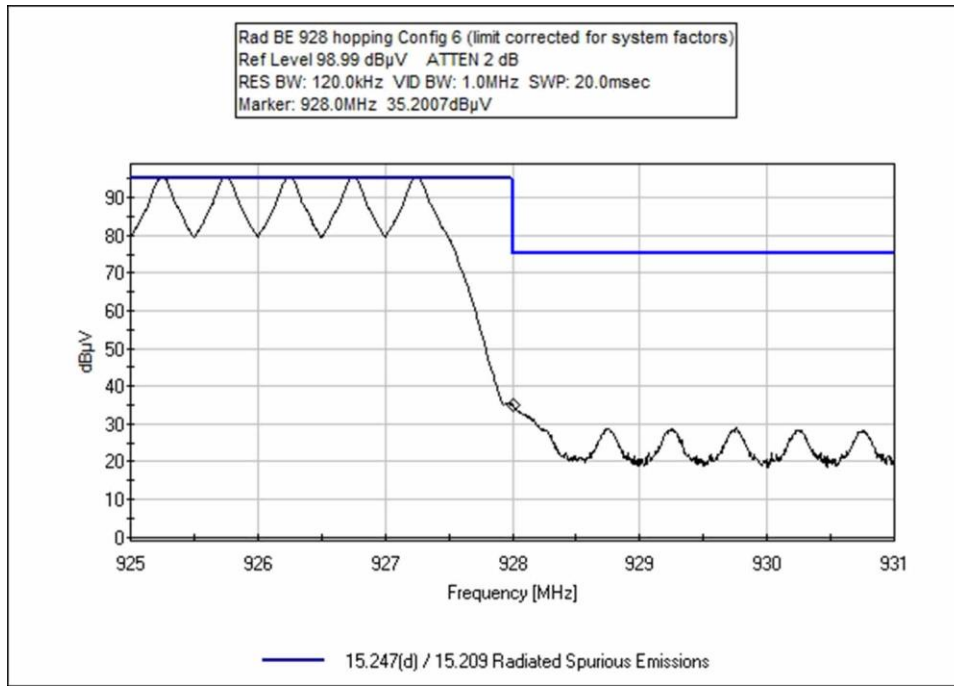


Configuration 6

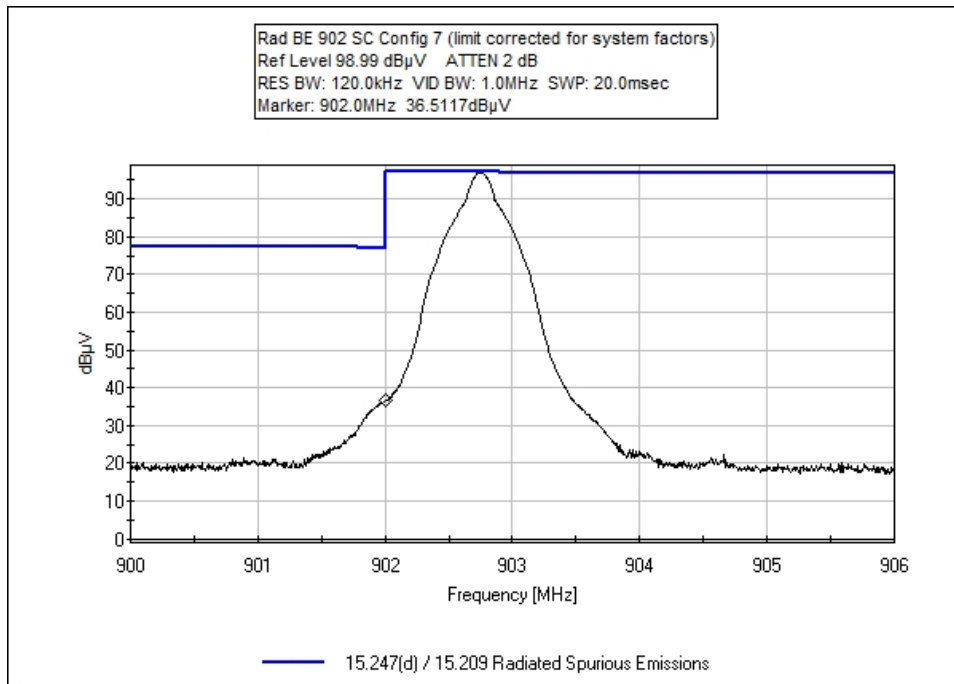
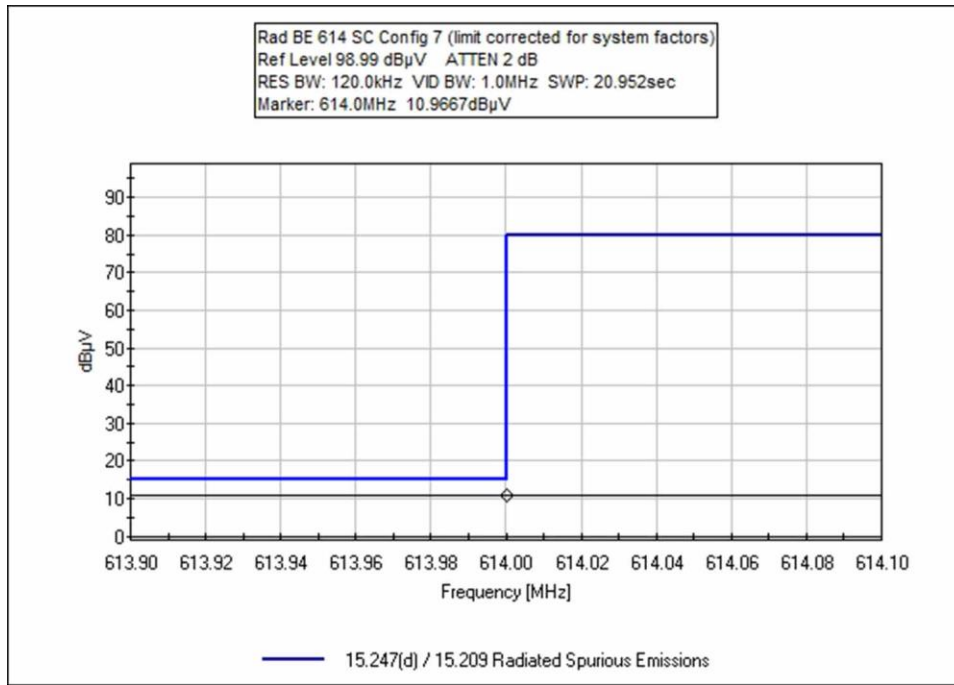


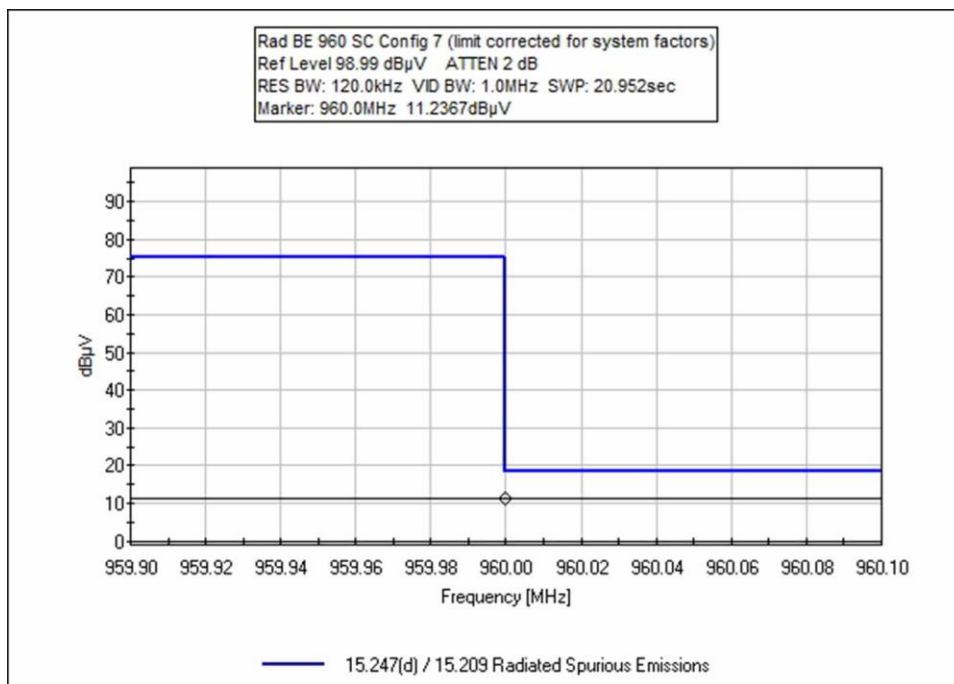
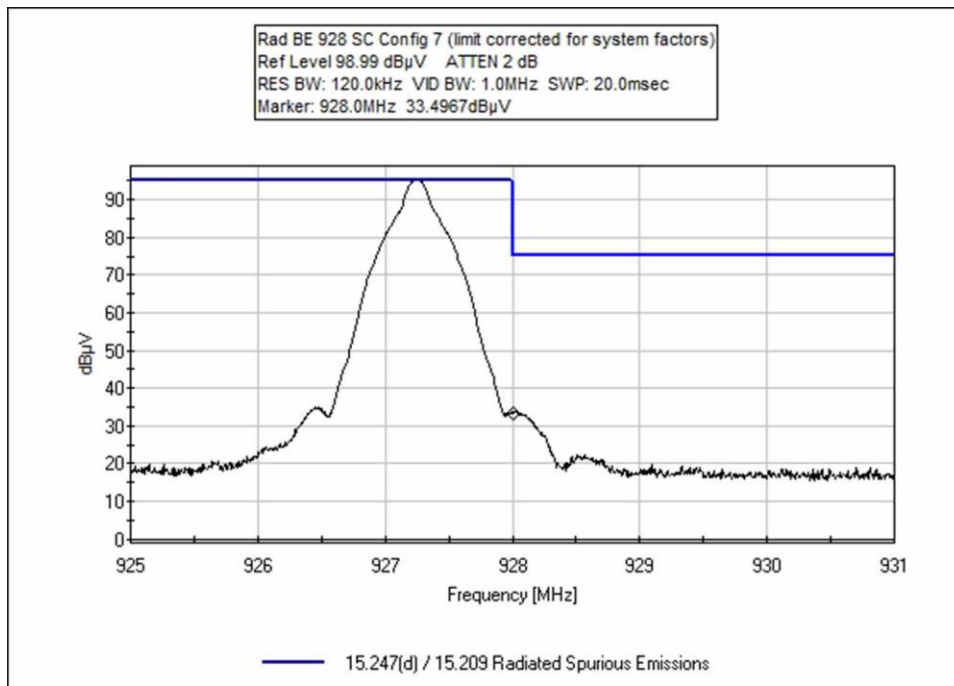


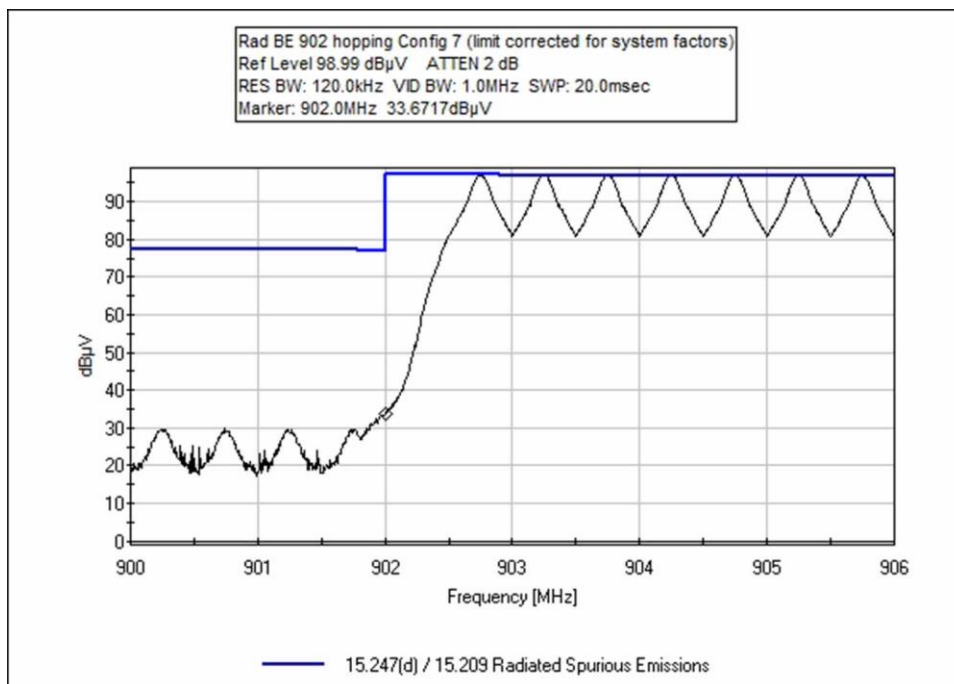
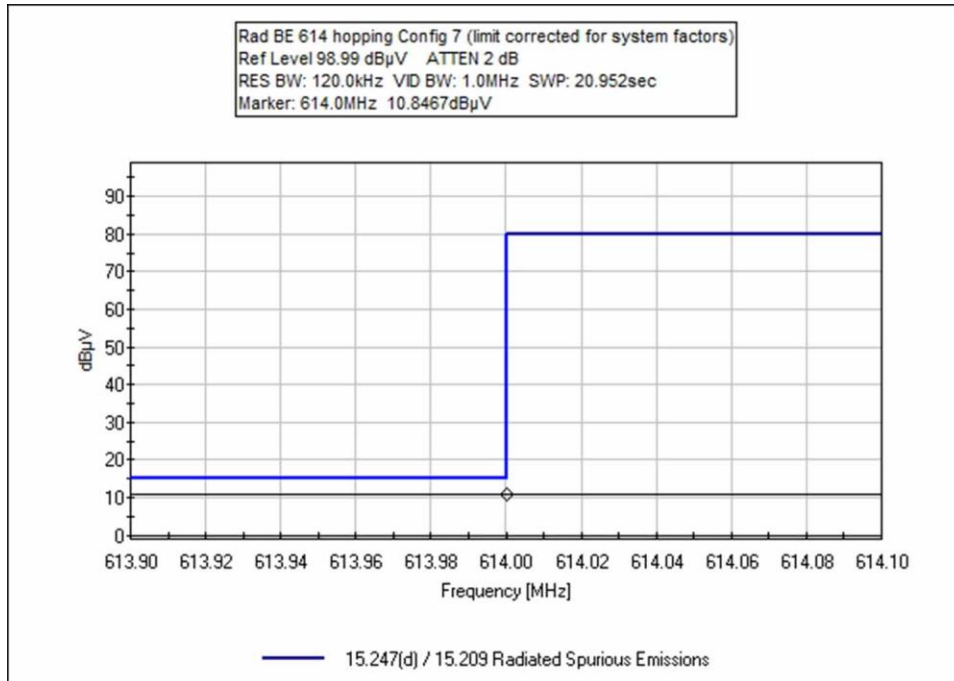


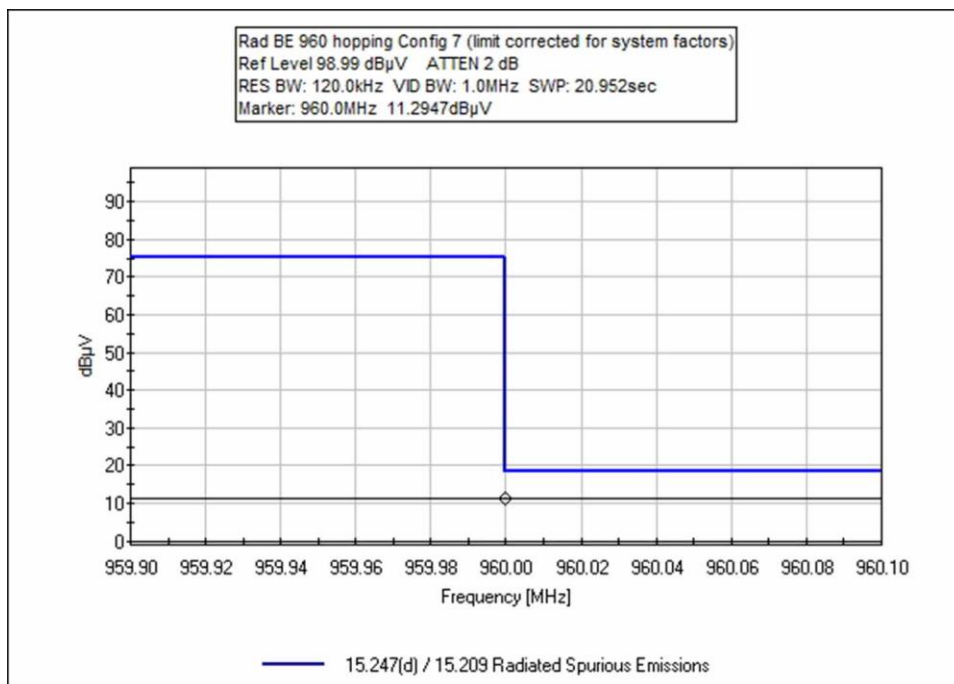
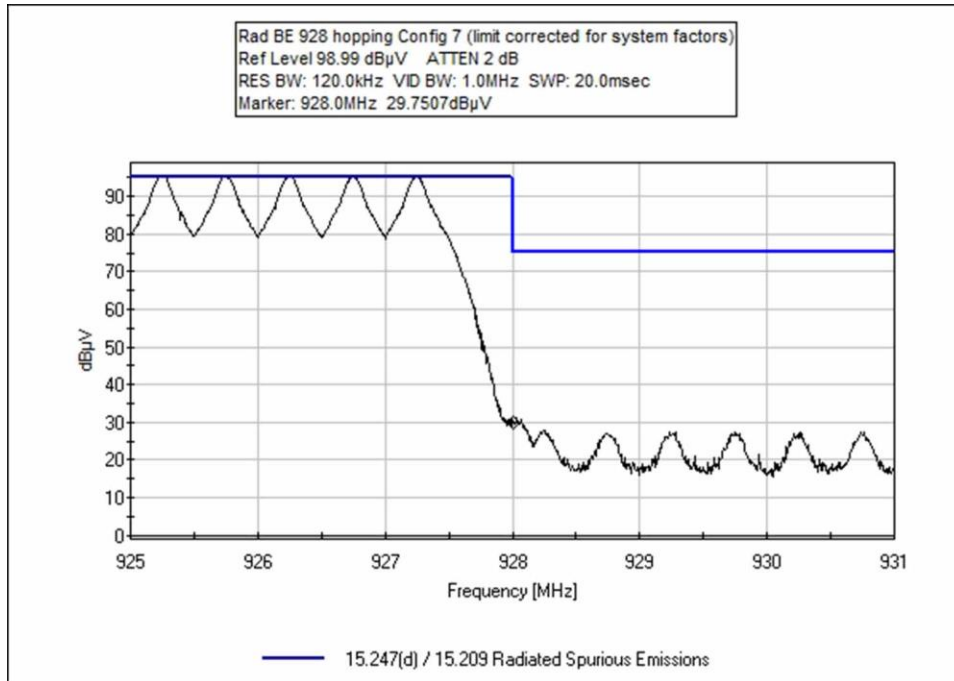


Configuration 7

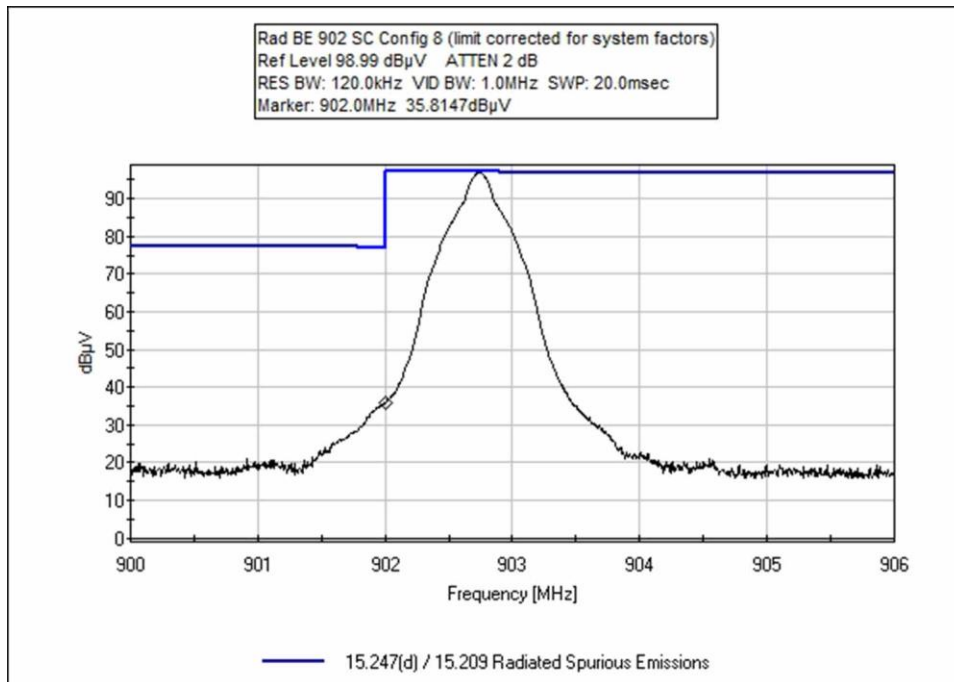
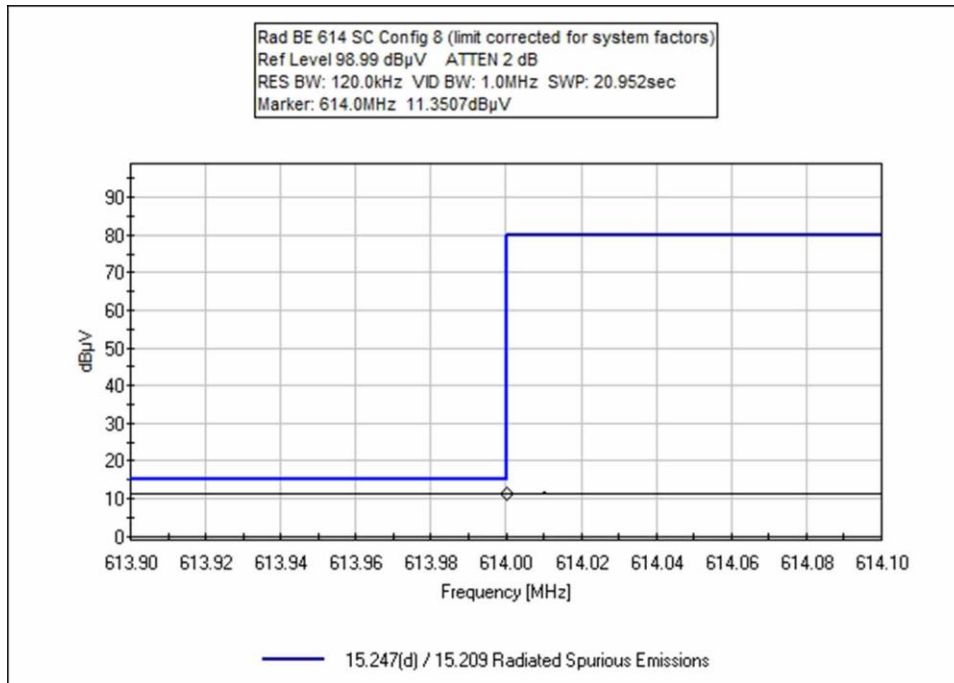


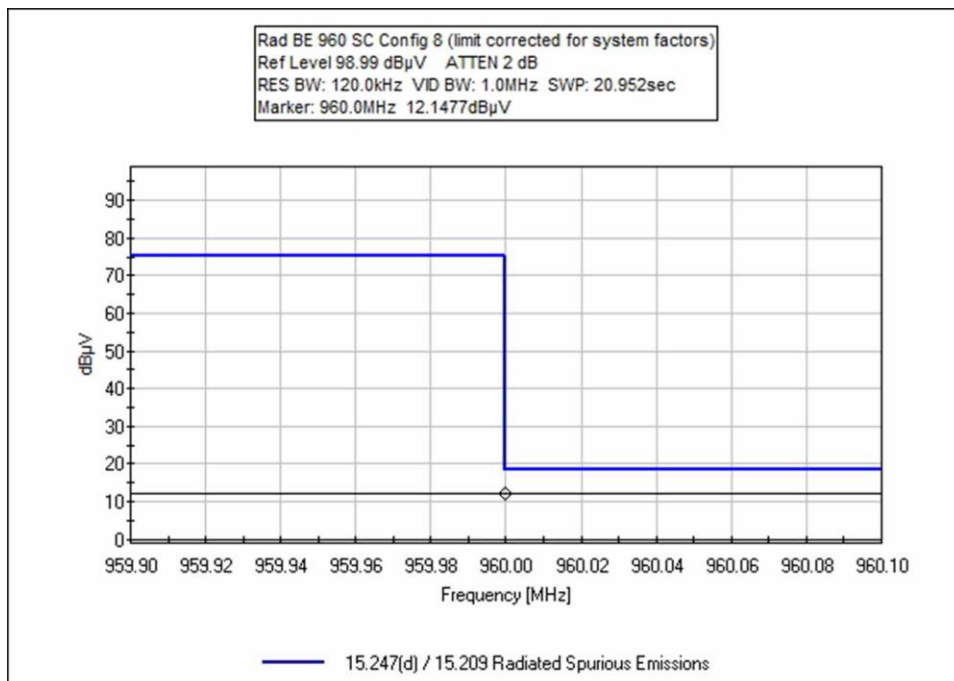
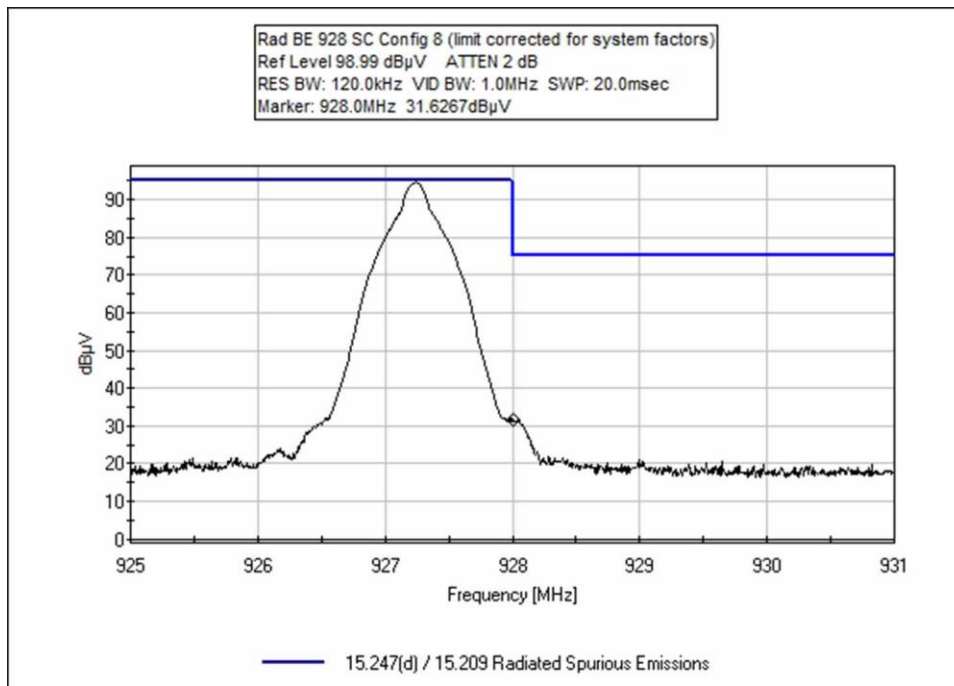


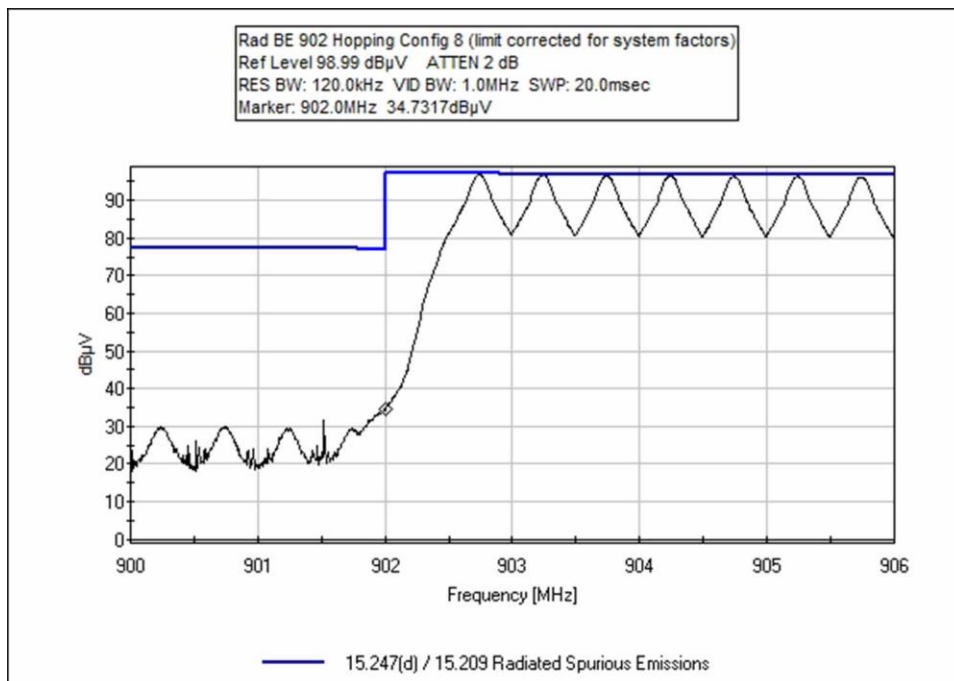
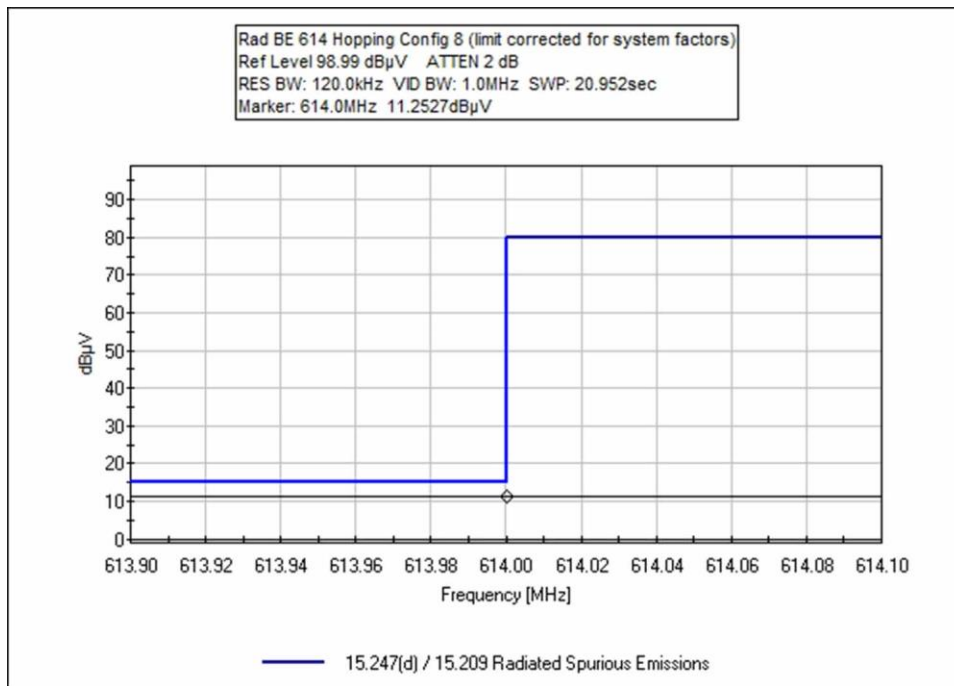


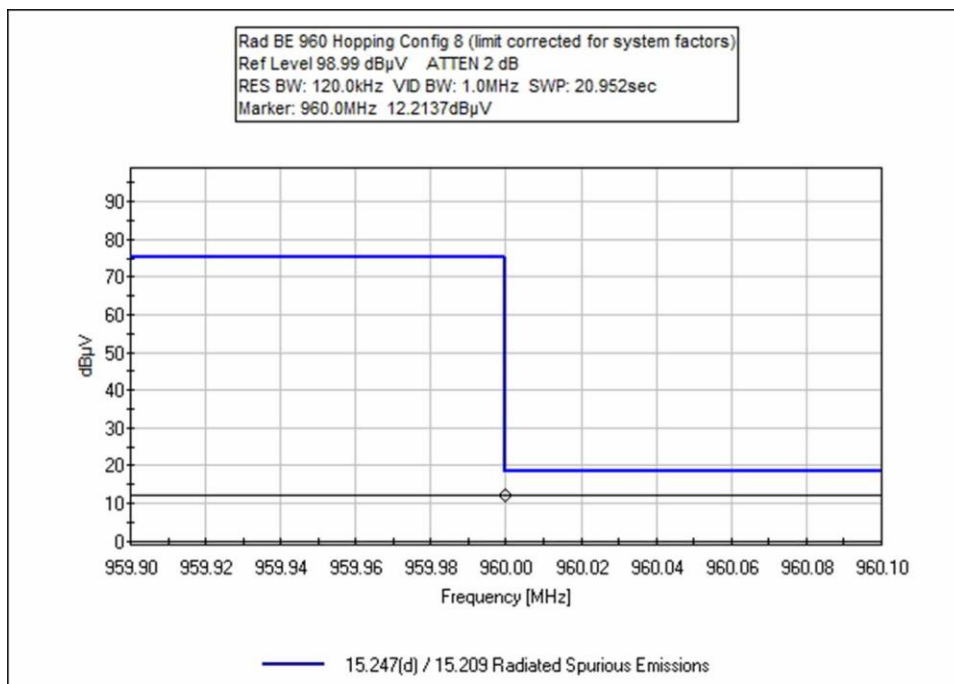
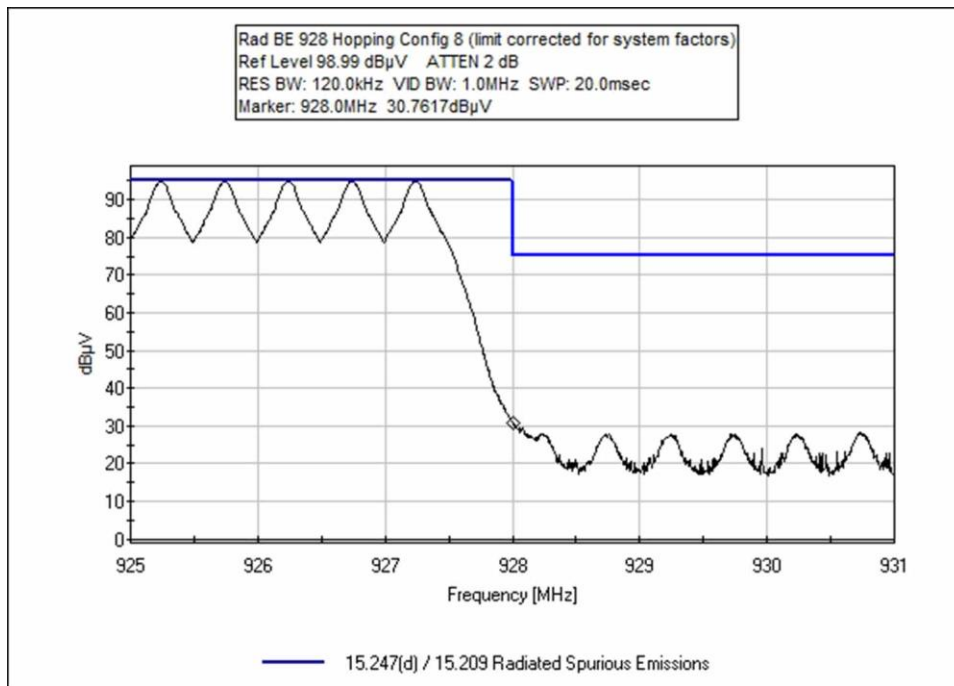


Configuration 8

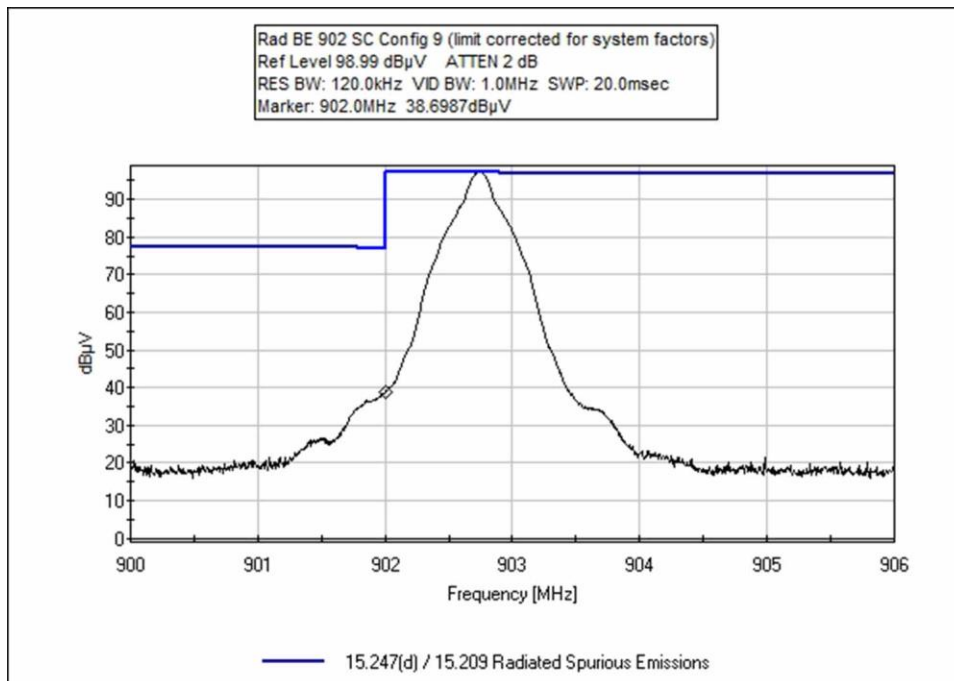
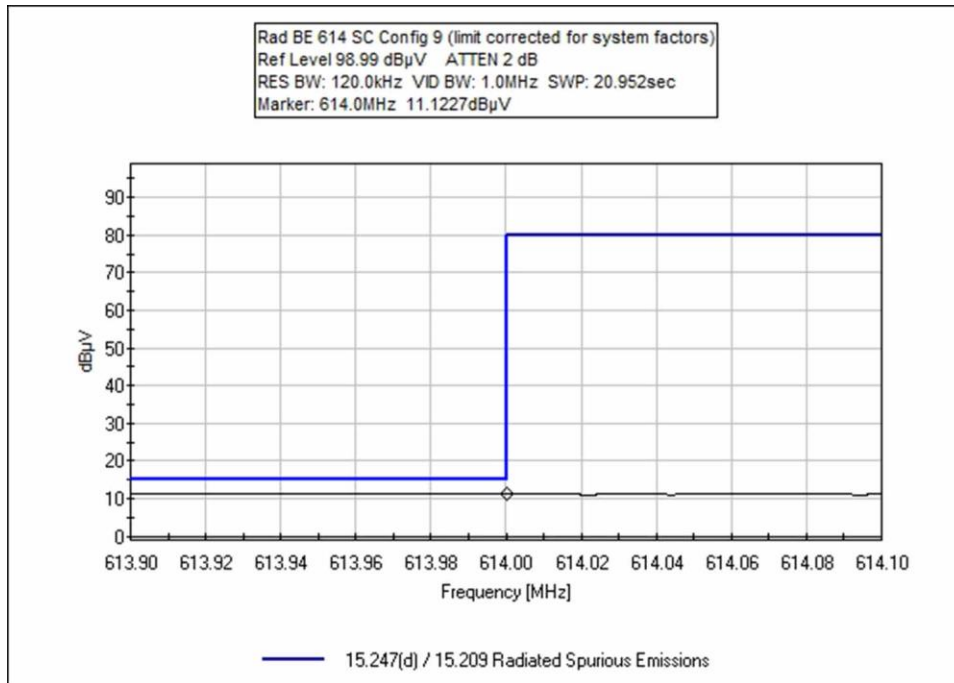


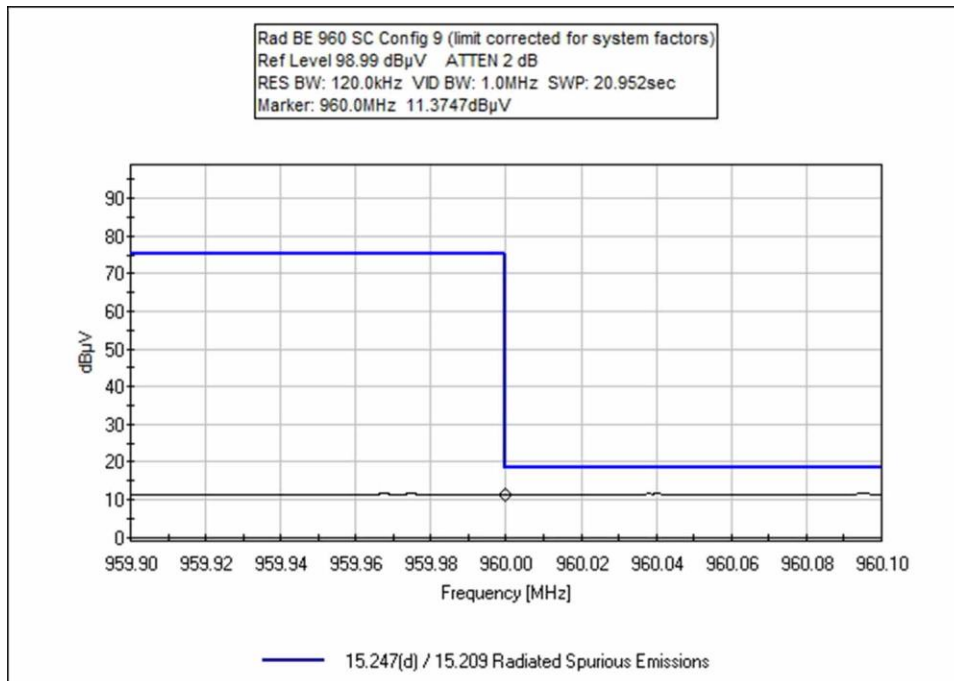
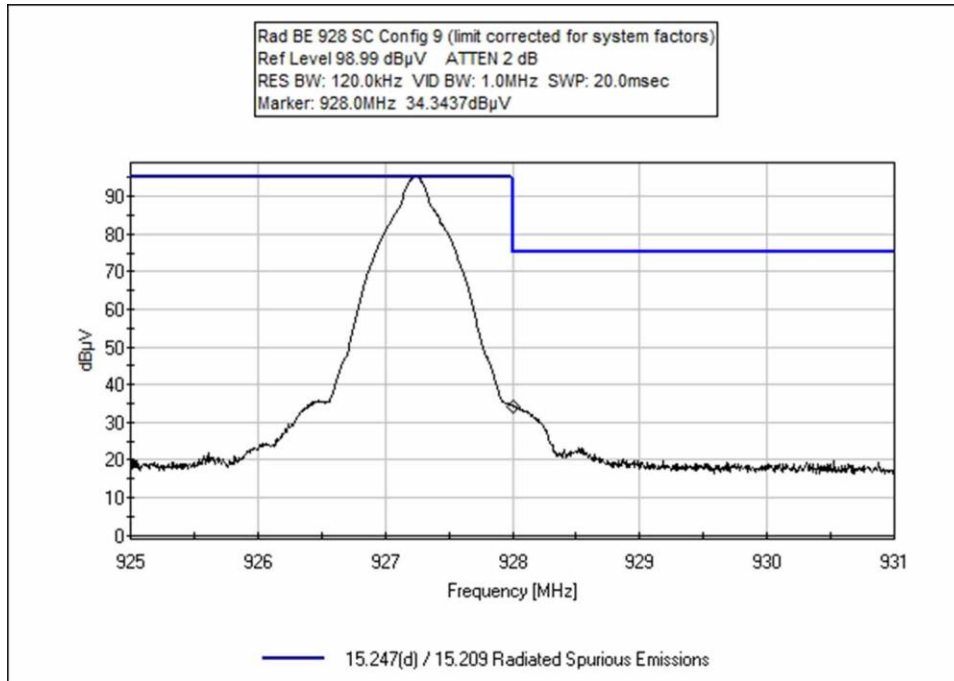


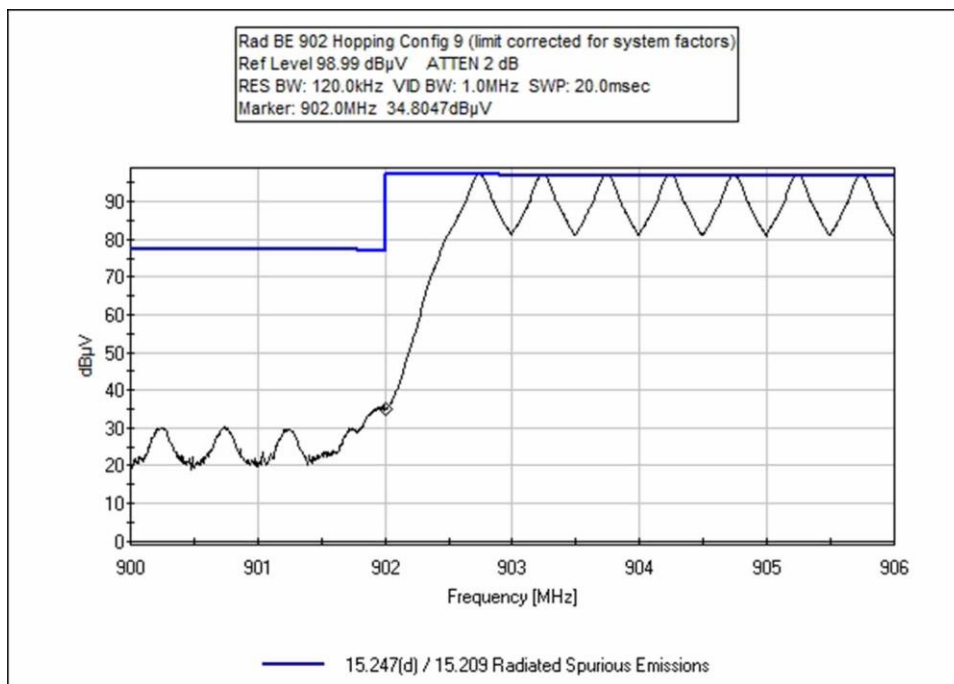
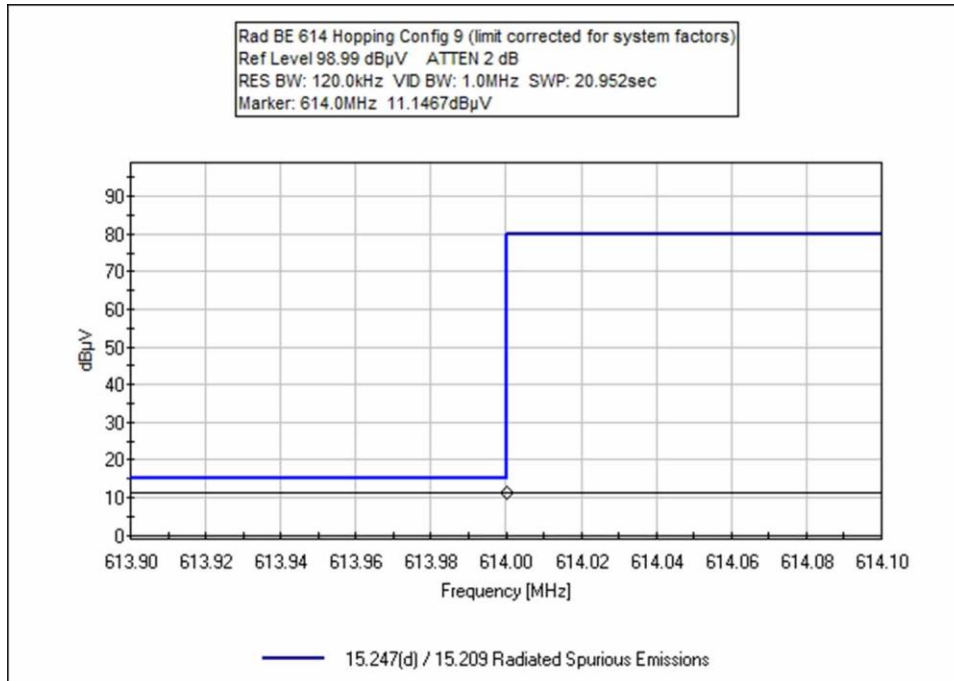


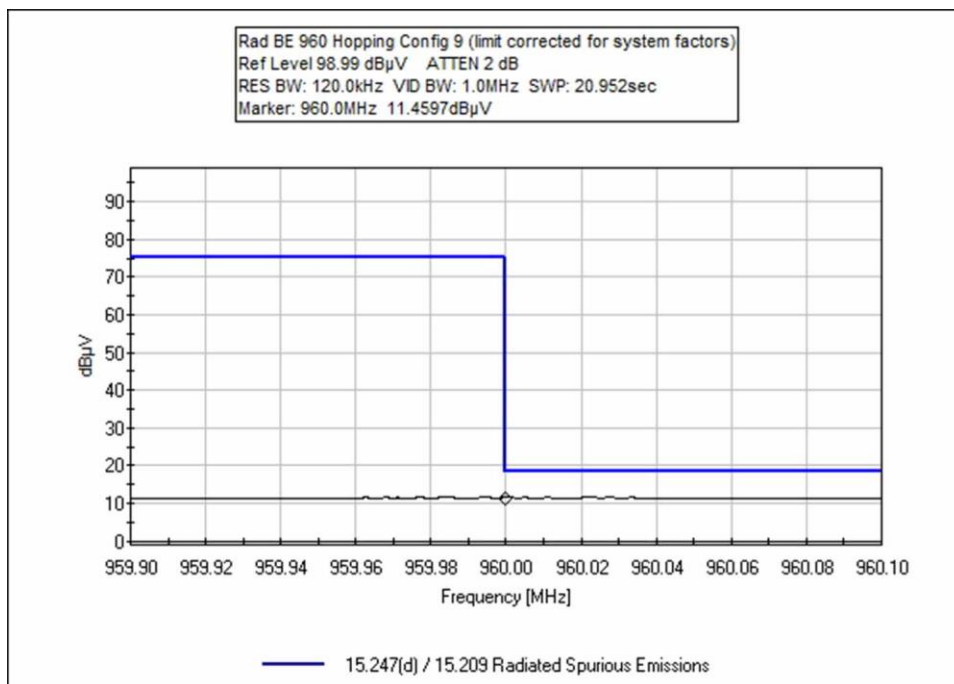
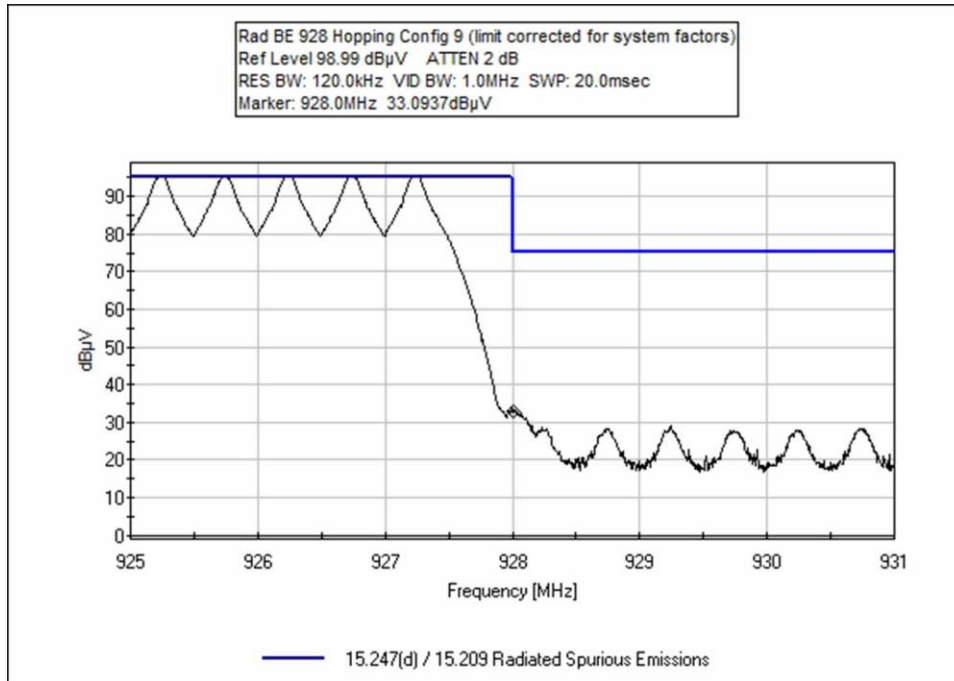


Configuration 9









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: 7/18/2023
 Test Type: **Maximized Emissions** Time: 12:43:35
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

 Method: ANSI C63.10 (2013)

 Frequency: Band Edge

 Firmware Setting: 28dBm

 Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	614.000M QP	11.0	+1.2	+1.9	+0.6	+27.4	+0.0	42.1	46.0 SC	-3.9	Vert
2	614.000M QP	10.8	+1.2	+1.9	+0.6	+27.4	+0.0	41.9	46.0 Hop	-4.1	Vert
3	960.000M QP	11.1	+1.5	+2.4	+0.7	+31.1	+0.0	46.8	54.0 SC	-7.2	Vert
4	960.010M QP	10.9	+1.5	+2.4	+0.7	+31.1	+0.0	46.6	54.0 Hop	-7.4	Vert
5	928.000M	33.1	+1.5	+2.4	+0.7	+31.2	+0.0	68.9	111.0 SC	-42.1	Vert
6	902.000M	34.1	+1.4	+2.3	+0.7	+29.5	+0.0	68.0	111.0 SC	-43.0	Vert
7	928.006M	32.0	+1.5	+2.4	+0.7	+31.2	+0.0	67.8	111.0 Hop	-43.2	Vert
8	902.000M	32.8	+1.4	+2.3	+0.7	+29.5	+0.0	66.7	111.0 Hop	-44.3	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 #: **108693** Date: 7/18/2023
 Test Type: **Maximized Emissions** Time: 14:51:32
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 28dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T4	ANP06454	Cable	Heliacx	1/25/2022	1/25/2024
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5				Table	dB μ V/m	dB μ V/m	dB	Ant
			dB	dB	dB	dB					
1	614.000M	10.8	+1.2	+1.9	+0.0	+0.6	+0.0	41.9	46.0	-4.1	Vert
	QP		+27.4						Hop		
2	614.000M	10.8	+1.2	+1.9	+0.0	+0.6	+0.0	41.9	46.0	-4.1	Vert
	QP		+27.4						SC		
3	960.000M	11.1	+1.5	+2.4	+0.0	+0.7	+0.0	46.8	54.0	-7.2	Vert
	QP		+31.1						SC		
4	960.000M	11.0	+1.5	+2.4	+0.0	+0.7	+0.0	46.7	54.0	-7.3	Vert
	QP		+31.1						Hop		
5	902.000M	35.9	+1.4	+2.3	+0.0	+0.7	+0.0	69.8	111.0	-41.2	Vert
			+29.5						Hop		
6	902.000M	34.5	+1.4	+2.3	+0.0	+0.7	+0.0	68.4	111.0	-42.6	Vert
			+29.5						SC		
7	928.000M	32.5	+1.5	+2.4	+0.0	+0.7	+0.0	68.3	111.0	-42.7	Vert
			+31.2						Hop		
8	928.000M	32.1	+1.5	+2.4	+0.0	+0.7	+0.0	67.9	111.0	-43.1	Vert
			+31.2						SC		

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: 7/18/2023
 Test Type: **Maximized Emissions** Time: 15:57:37
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 30dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	614.000M QP	10.9	+1.2	+1.9	+0.6	+27.4	+0.0	42.0	46.0 hop	-4.0	Vert
2	614.000M QP	10.8	+1.2	+1.9	+0.6	+27.4	+0.0	41.9	46.0 hop	-4.1	Vert
3	960.000M QP	11.0	+1.5	+2.4	+0.7	+31.1	+0.0	46.7	54.0 SC	-7.3	Vert
4	960.000M QP	10.9	+1.5	+2.4	+0.7	+31.1	+0.0	46.6	54.0 hop	-7.4	Vert
5	902.000M	38.3	+1.4	+2.3	+0.7	+29.5	+0.0	72.2	111.0 hop	-38.8	Vert
6	902.000M	37.7	+1.4	+2.3	+0.7	+29.5	+0.0	71.6	111.0 SC	-39.4	Vert
7	928.000M	35.6	+1.5	+2.4	+0.7	+31.2	+0.0	71.4	111.0 SC	-39.6	Vert
8	928.000M	35.5	+1.5	+2.4	+0.7	+31.2	+0.0	71.3	111.0 hop	-39.7	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 #: **108693** Date: 7/19/2023
 Test Type: **Maximized Emissions** Time: 09:16:37
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 27dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	614.000M QP	10.8	+1.2	+1.9	+0.6	+27.4	+0.0	41.9	46.0 SC	-4.1	Vert
2	614.000M QP	10.8	+1.2	+1.9	+0.6	+27.4	+0.0	41.9	46.0 Hop	-4.1	Vert
3	960.000M QP	11.0	+1.5	+2.4	+0.7	+31.1	+0.0	46.7	54.0 Hop	-7.3	Vert
4	960.000M QP	10.8	+1.5	+2.4	+0.7	+31.1	+0.0	46.5	54.0 SC	-7.5	Vert
5	928.000M	34.9	+1.5	+2.4	+0.7	+31.2	+0.0	70.7	111.0 SC	-40.3	Vert
6	902.000M	35.4	+1.4	+2.3	+0.7	+29.5	+0.0	69.3	111.0 SC	-41.7	Vert
7	928.018M	30.5	+1.5	+2.4	+0.7	+31.2	+0.0	66.3	111.0 Hop	-44.7	Vert
8	902.000M	29.2	+1.4	+2.3	+0.7	+29.5	+0.0	63.1	111.0 Hop	-47.9	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 #: **108693** Date: 7/18/2023
 Test Type: **Maximized Emissions** Time: 14:17:19
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 26dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T4	ANP06454	Cable	Heliacx	1/25/2022	1/25/2024
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5				Table	dB μ V/m	dB μ V/m	dB	Ant
1	614.000M QP	10.8	+1.2 +27.4	+1.9	+0.0	+0.6	+0.0	41.9	46.0 SC	-4.1	Vert
2	614.000M QP	10.8	+1.2 +27.4	+1.9	+0.0	+0.6	+0.0	41.9	46.0 Hop	-4.1	Vert
3	960.000M QP	11.4	+1.5 +31.1	+2.4	+0.0	+0.7	+0.0	47.1	54.0 SC	-6.9	Vert
4	960.000M QP	10.8	+1.5 +31.1	+2.4	+0.0	+0.7	+0.0	46.5	54.0 Hop	-7.5	Vert
5	902.000M	35.6	+1.4 +29.5	+2.3	+0.0	+0.7	+0.0	69.5	111.0 SC	-41.5	Vert
6	928.000M	33.1	+1.5 +31.2	+2.4	+0.0	+0.7	+0.0	68.9	111.0 SC	-42.1	Vert
7	928.000M	31.0	+1.5 +31.2	+2.4	+0.0	+0.7	+0.0	66.8	111.0 Hop	-44.2	Vert
8	902.000M	31.6	+1.4 +29.5	+2.3	+0.0	+0.7	+0.0	65.5	111.0 Hop	-45.5	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 #: **108693** Date: 7/19/2023
 Test Type: **Maximized Emissions** Time: 10:42:40
 Tested By: Steven Pittsford 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: 41%
 Pressure: 101.9kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 29dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	614.000M QP	11.0	+1.2	+1.9	+0.6	+27.4	+0.0	42.1	46.0 SC	-3.9	Vert
2	614.000M QP	10.8	+1.2	+1.9	+0.6	+27.4	+0.0	41.9	46.0 Hop	-4.1	Vert
3	960.000M QP	10.9	+1.5	+2.4	+0.7	+31.1	+0.0	46.6	54.0 SC	-7.4	Vert
4	960.000M QP	10.9	+1.5	+2.4	+0.7	+31.1	+0.0	46.6	54.0 Hop	-7.4	Vert
5	902.000M	39.3	+1.4	+2.3	+0.7	+29.5	+0.0	73.2	111.0 SC	-37.8	Vert
6	928.000M	36.9	+1.5	+2.4	+0.7	+31.2	+0.0	72.7	111.0 SC	-38.3	Vert
7	928.000M	35.2	+1.5	+2.4	+0.7	+31.2	+0.0	71.0	111.0 Hop	-40.0	Vert
8	902.000M	36.7	+1.4	+2.3	+0.7	+29.5	+0.0	70.6	111.0 Hop	-40.4	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 #: **108693** Date: 7/19/2023
 Test Type: **Maximized Emissions** Time: 11:22:17
 Tested By: Steven Pittsford Sequence#: 7
 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: Band Edge

Firmware Setting: 25.5dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T4	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	614.000M QP	11.0	+1.2 +27.4	+1.9	+0.0	+0.6	+0.0	42.1	46.0 SC	-3.9	Vert
2	614.000M QP	10.8	+1.2 +27.4	+1.9	+0.0	+0.6	+0.0	41.9	46.0 Hop	-4.1	Vert
3	960.000M QP	11.3	+1.5 +31.1	+2.4	+0.0	+0.7	+0.0	47.0	54.0 Hop	-7.0	Vert
4	960.000M QP	11.2	+1.5 +31.1	+2.4	+0.0	+0.7	+0.0	46.9	54.0 SC	-7.1	Vert
5	902.000M	36.5	+1.4 +29.5	+2.3	+0.0	+0.7	+0.0	70.4	111.0 SC	-40.6	Vert
6	928.000M	33.5	+1.5 +31.2	+2.4	+0.0	+0.7	+0.0	69.3	111.0 SC	-41.7	Vert
7	902.000M	33.7	+1.4 +29.5	+2.3	+0.0	+0.7	+0.0	67.6	111.0 Hop	-43.4	Vert
8	928.000M	29.8	+1.5 +31.2	+2.4	+0.0	+0.7	+0.0	65.6	111.0 Hop	-45.4	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 #: **108693** Date: 7/26/2023
 Test Type: **Maximized Emissions** Time: 13:37:52
 Tested By: Michael Atkinson Sequence#: 8
 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: 47%
 Pressure: 102.0kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 26dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T5	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	T5				Table	dB μ V/m	dB μ V/m	dB	Ant
			dB	dB	dB	dB					
1	614.000M	11.4	+1.2	+1.9	+0.6	+27.4	+0.0	42.5	46.0	-3.5	Vert
	QP		+0.0								
^	614.000M	11.3	+1.2	+1.9	+0.6	+27.4	+0.0	42.4	46.0	-3.6	Vert
			+0.0						Hop		
3	960.000M	12.2	+1.5	+2.4	+0.7	+31.1	+0.0	47.9	54.0	-6.1	Vert
	QP		+0.0						Hop		
4	960.000M	12.1	+1.5	+2.4	+0.7	+31.1	+0.0	47.8	54.0	-6.2	Vert
	QP		+0.0								
5	902.000M	35.8	+1.4	+2.3	+0.7	+29.5	+0.0	69.7	111.0	-41.3	Vert
			+0.0								
6	902.000M	34.7	+1.4	+2.3	+0.7	+29.5	+0.0	68.6	111.0	-42.4	Vert
			+0.0						Hop		
7	928.000M	31.6	+1.5	+2.4	+0.7	+31.2	+0.0	67.4	111.0	-43.6	Vert
			+0.0								
8	928.000M	30.8	+1.5	+2.4	+0.7	+31.2	+0.0	66.6	111.0	-44.4	Vert
			+0.0						Hop		

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: 09:59:05
 Tested By: Michael Atkinson Sequence#: 9
 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: 47%
 Pressure: 102.0kPa

Method: ANSI C63.10 (2013)

Frequency: Band Edge

Firmware Setting: 28.25dBm

Test Setup:
 Unit is on foam table 80cm high. 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 and High channels, as well as hopping investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05305	Cable	ETSI-50T	9/15/2021	9/15/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T5	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	614.000M QP	11.1	+1.2 +0.0	+1.9	+0.6	+27.4	+0.0	42.2	46.0 Hop	-3.8	Vert
2	614.000M QP	11.1	+1.2 +0.0	+1.9	+0.6	+27.4	+0.0	42.2	46.0	-3.8	Vert
3	960.000M QP	11.5	+1.5 +0.0	+2.4	+0.7	+31.1	+0.0	47.2	54.0 Hop	-6.8	Vert
4	960.000M QP	11.4	+1.5 +0.0	+2.4	+0.7	+31.1	+0.0	47.1	54.0	-6.9	Vert
5	902.000M	38.7	+1.4 +0.0	+2.3	+0.7	+29.5	+0.0	72.6	111.0	-38.4	Vert
6	928.000M	34.3	+1.5 +0.0	+2.4	+0.7	+31.2	+0.0	70.1	111.0	-40.9	Vert
7	928.000M	33.1	+1.5 +0.0	+2.4	+0.7	+31.2	+0.0	68.9	111.0 Hop	-42.1	Vert
8	902.000M	34.8	+1.4 +0.0	+2.3	+0.7	+29.5	+0.0	68.7	111.0 Hop	-42.3	Vert

Test Setup Photo(s)

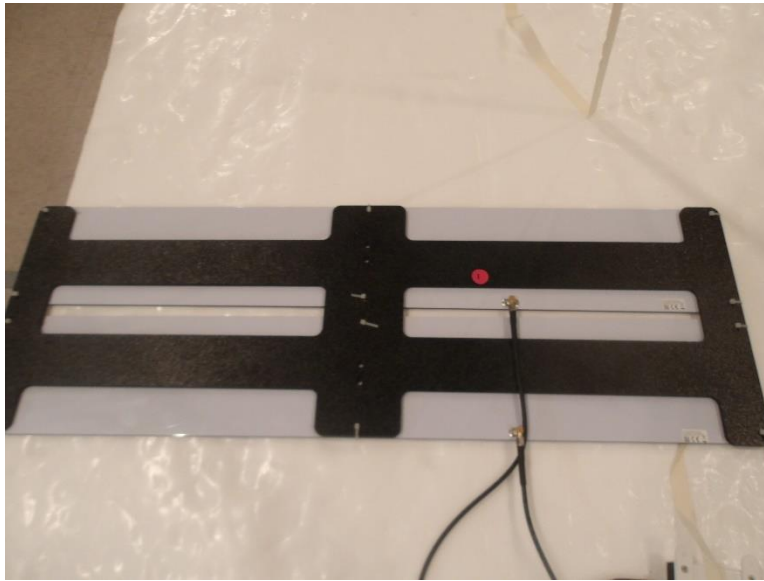
Configuration 1



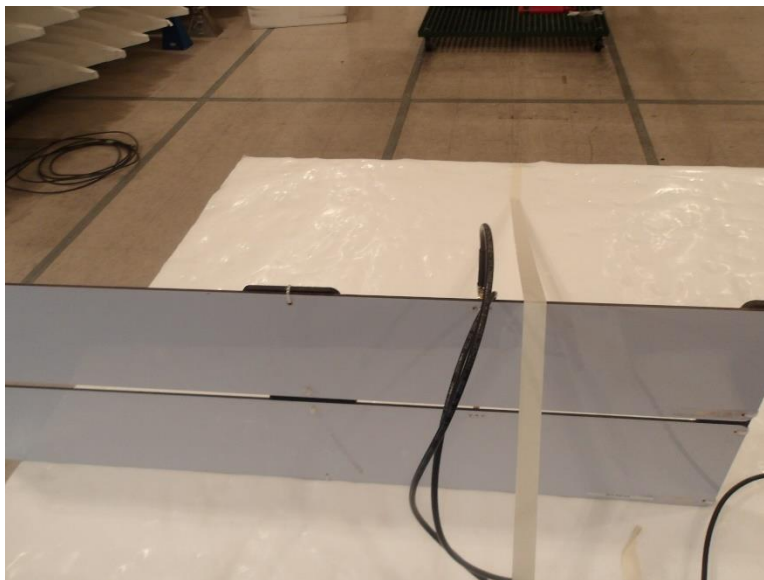
Below 1GHz



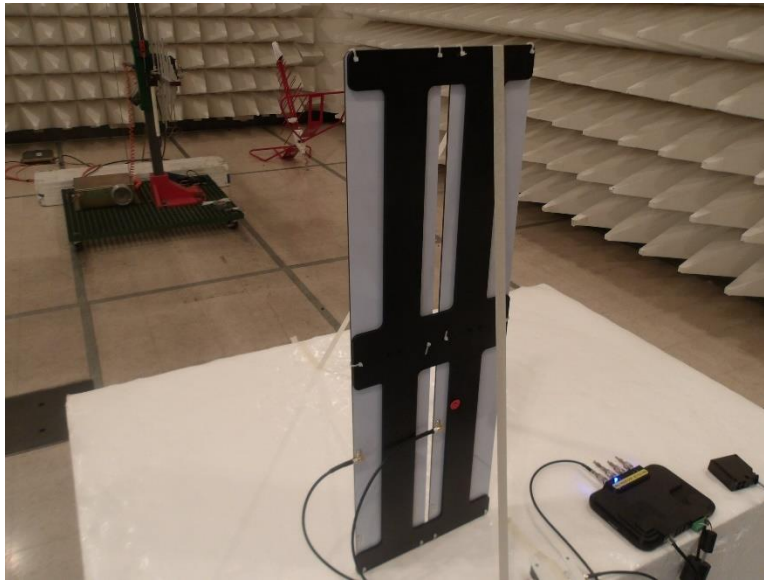
Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 2



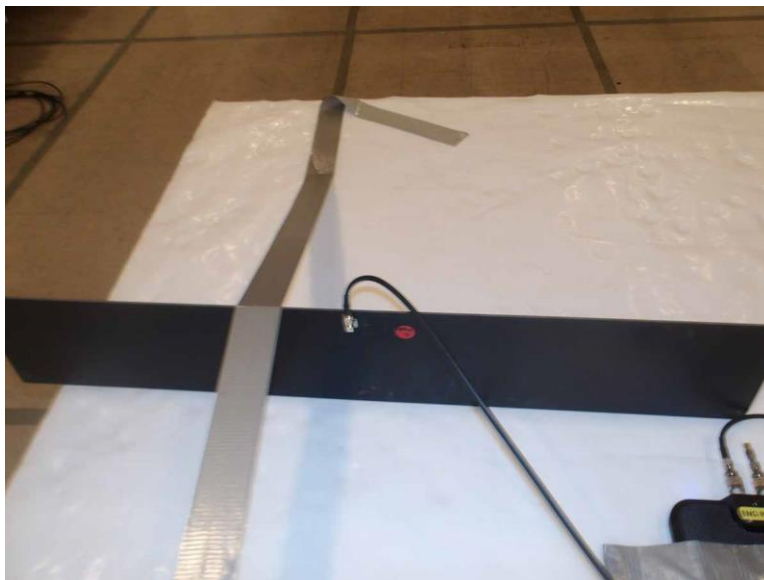
Below 1GHz



Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 3



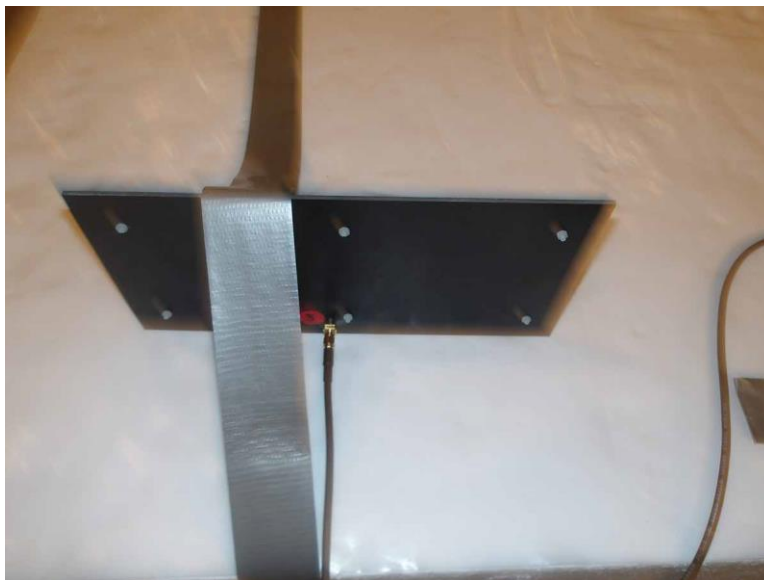
Below 1GHz



Above 1GHz



X-Axis

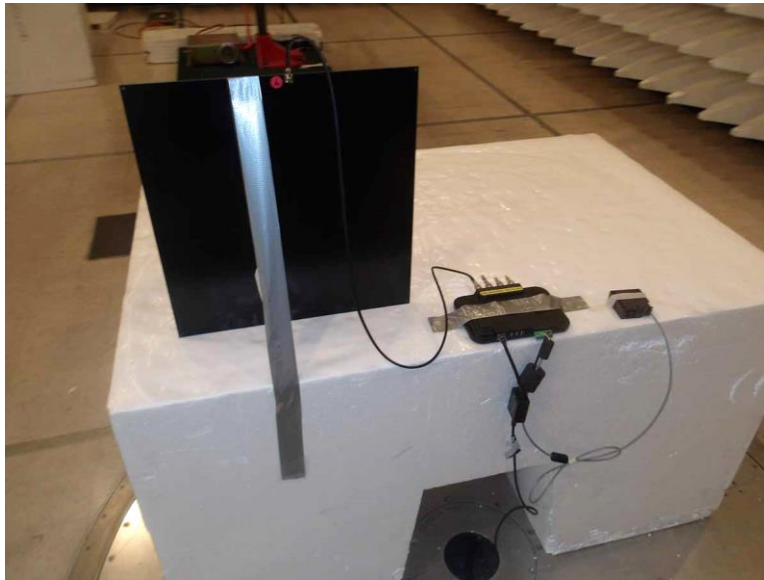


Y-Axis

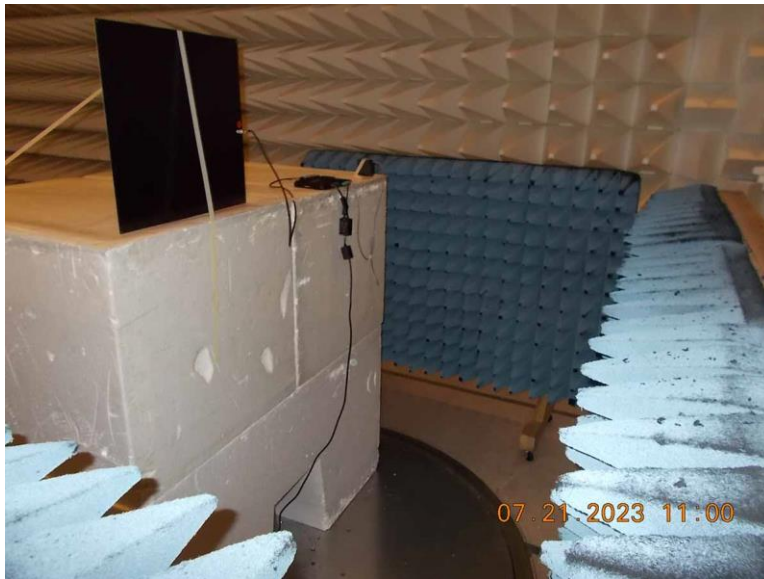


Z-Axis

Configuration 4



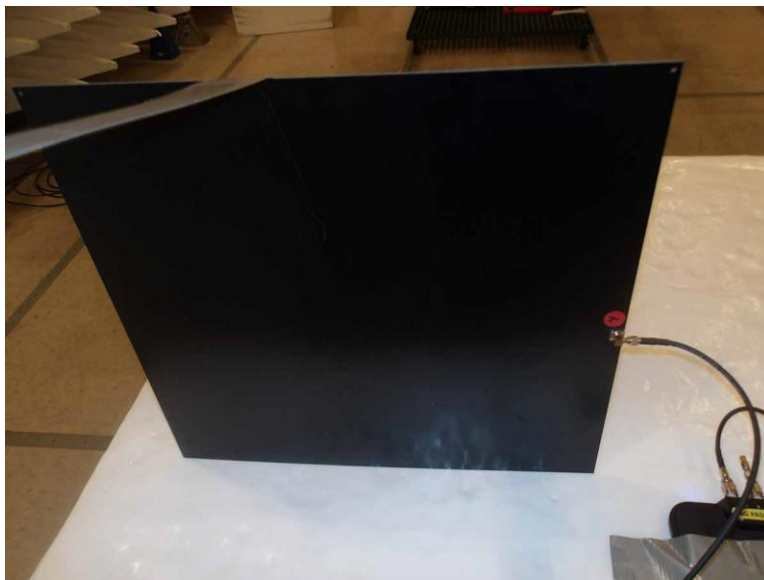
Below 1GHz



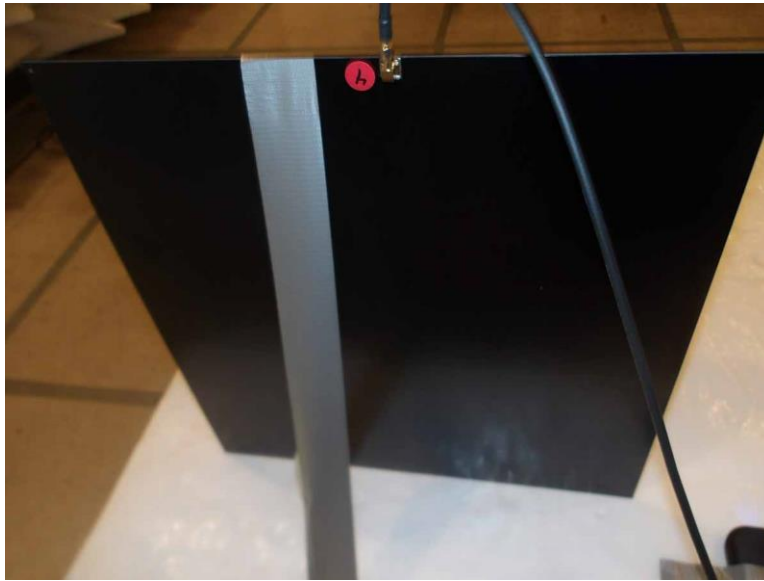
Above 1GHz



X-Axis

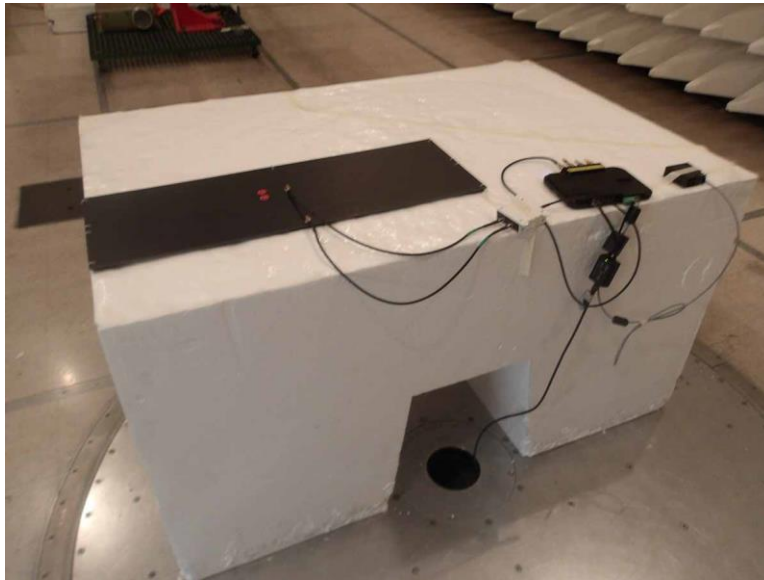


Y-Axis



Z-Axis

Configuration 5



Below 1GHz



Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 6



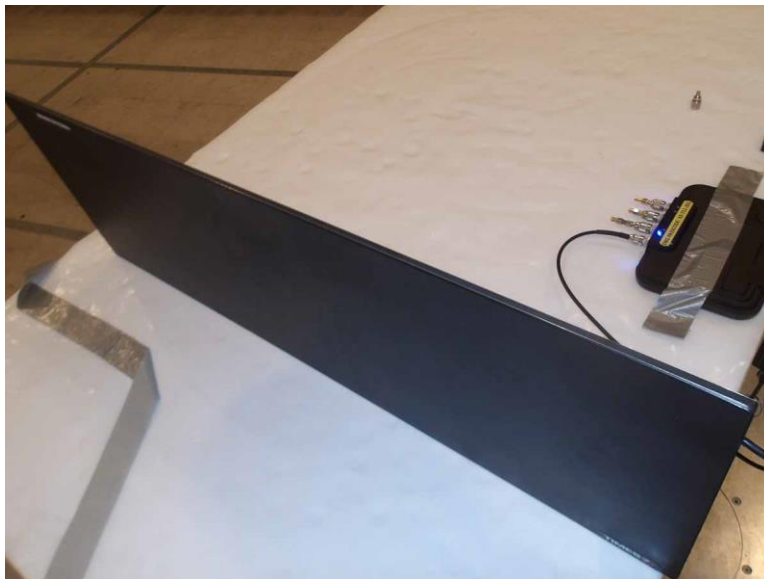
Below 1GHz



Above 1GHz



X-Axis



Y-Axis

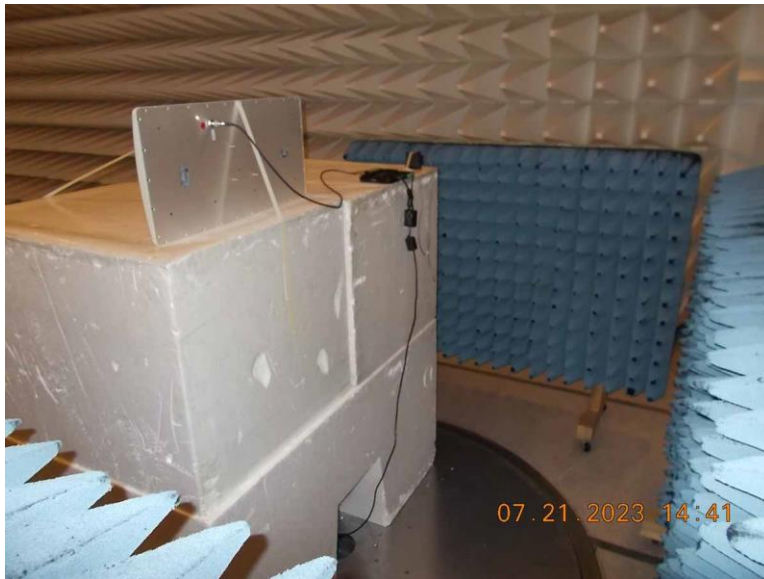


Z-Axis

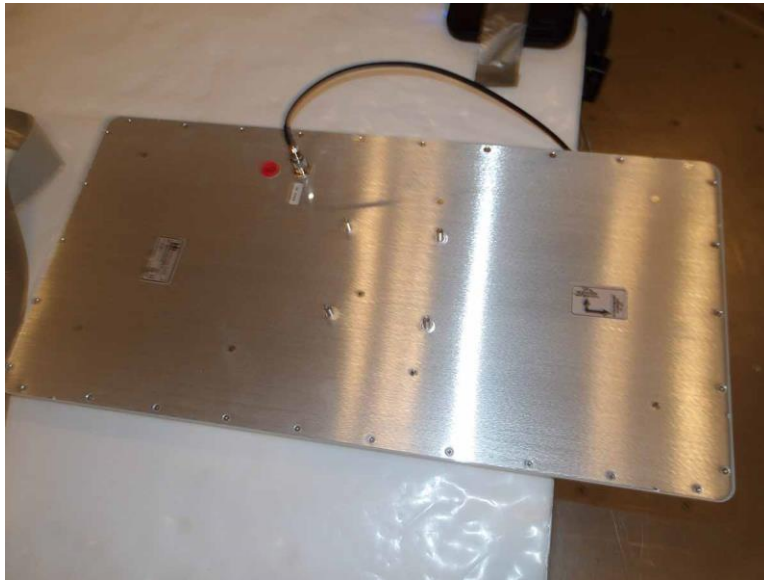
Configuration 7



Below 1GHz



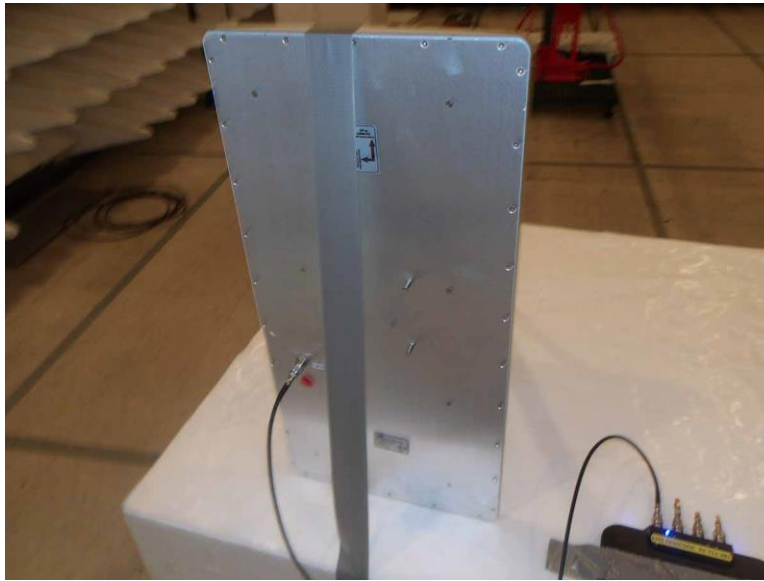
Above 1GHz



X-Axis



Y-Axis



Z-Axis

Configuration 8



Below 1GHz



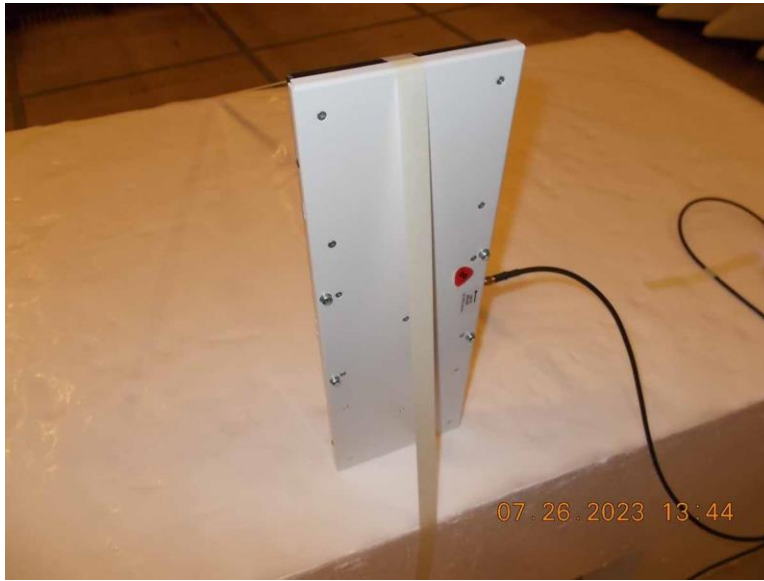
Above 1GHz



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 dBμV/m, the spectrum analyzer reading in dBμV was corrected by using the following formula. This reading was then compared to the applicable specification limit. 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	(dBμV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBμV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

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

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

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or 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.