Impinj Inc.

TEST REPORT FOR

Impinj R700 RAIN RFID Reader
Model: IPJ-R700-343

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(FHSS 902-928 MHz)

Report No.: 107695-1

Date of issue: December 5, 2022

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: P015900

REPORT PREPARED BY:

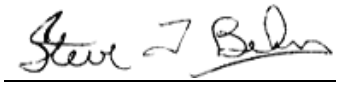
Lisa Bevington
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107695

DATE OF EQUIPMENT RECEIPT: November 17, 2022
DATE(S) OF TESTING: November 17-18, 22-23, 2022

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

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

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

SUMMARY OF RESULTS

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

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

NA = Not Applicable
NP = CKC Laboratories, Inc. was not contracted to preform test.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

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

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

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

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

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

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Impinj R700 RAIN RFID Reader	Impinj, Inc.	IPJ-R700-343	37022360274

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna	Times-7	A5010	0016246
PoE Injector	Phihong	POE29U-1AT(PL)	NA
Laptop	HP	EliteBook 840 G2	NA
AC Adapter (for Laptop)	HP	PPP009D	NA
Router	TP-Link	ER605	NA
AC Adapter (for Router)	TP-Link	T1200100-2B1	NA

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:	Tested 100% as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	Antenna used for this permissive change testing: Circular Polarized / +8.5dBiC (model A5010)
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	48V PoE Powered (120VAC to PoE injector)
Firmware / Software used for Test:	ItemTest 2.0.0-Preview-640
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)

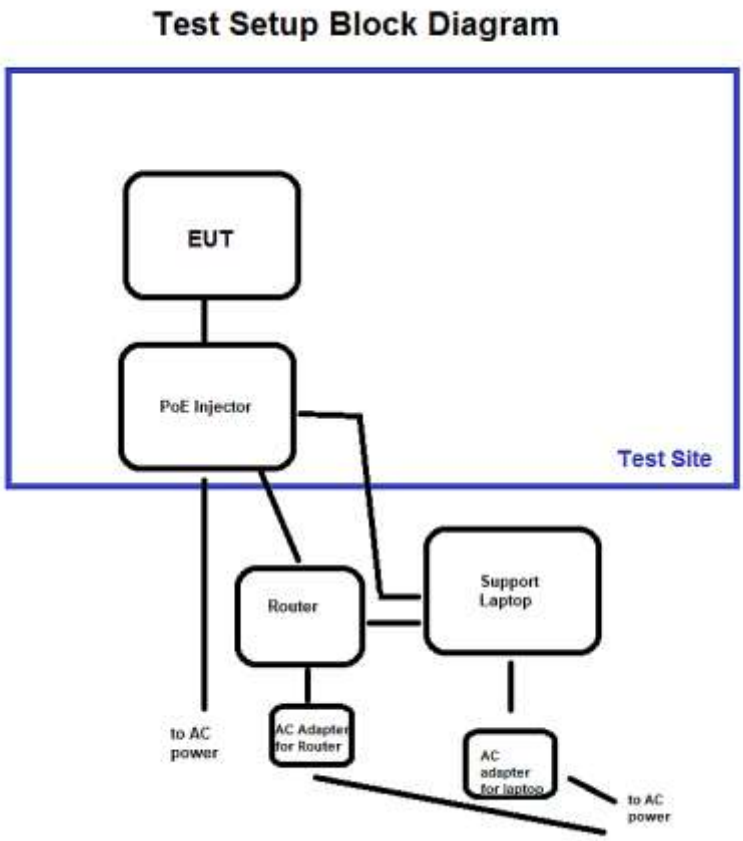
Support Equipment Photo(s)

Antenna

Laptop and Switch

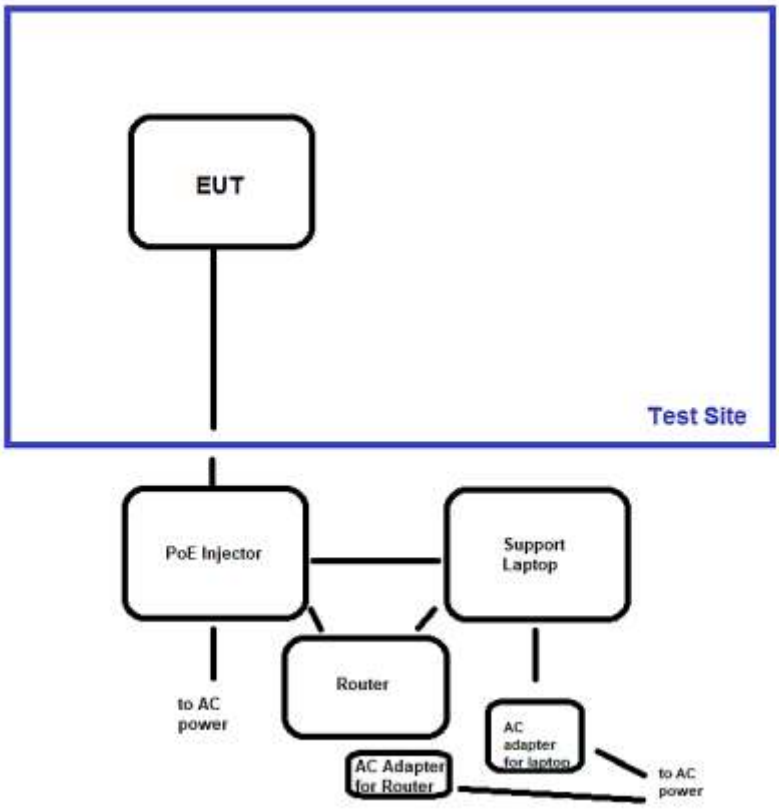
PoE Injector

Block Diagram of Test Setup(s)



AC Conducted Test Setup

Test Setup Block Diagram



Radiated Test Setup

FCC Part 15 Subpart C

15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	11/18/2022
Configuration:	1		
Test Setup:	EUT is continuously transmitting through the antenna port connector and is attached to the spectrum analyzer through appropriate cables and attenuation. Per manufacturer the AC voltage is varied to the PoE injector.		

Test Data Summary - Voltage Variations					
Frequency (MHz)	**Modulation / Ant Port**	**$V_{Minimum}$ (dBm)**	**$V_{Nominal}$ (dBm)**	**$V_{Maximum}$ (dBm)**	**Max Deviation from $V_{Nominal}$ (dB)**
902.75	ASK/Port 1	29.5	29.5	29.5	0.0
914.75	ASK/Port 1	29.7	29.7	29.7	0.0
927.25	ASK/Port 1	29.8	29.8	29.8	0.0

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

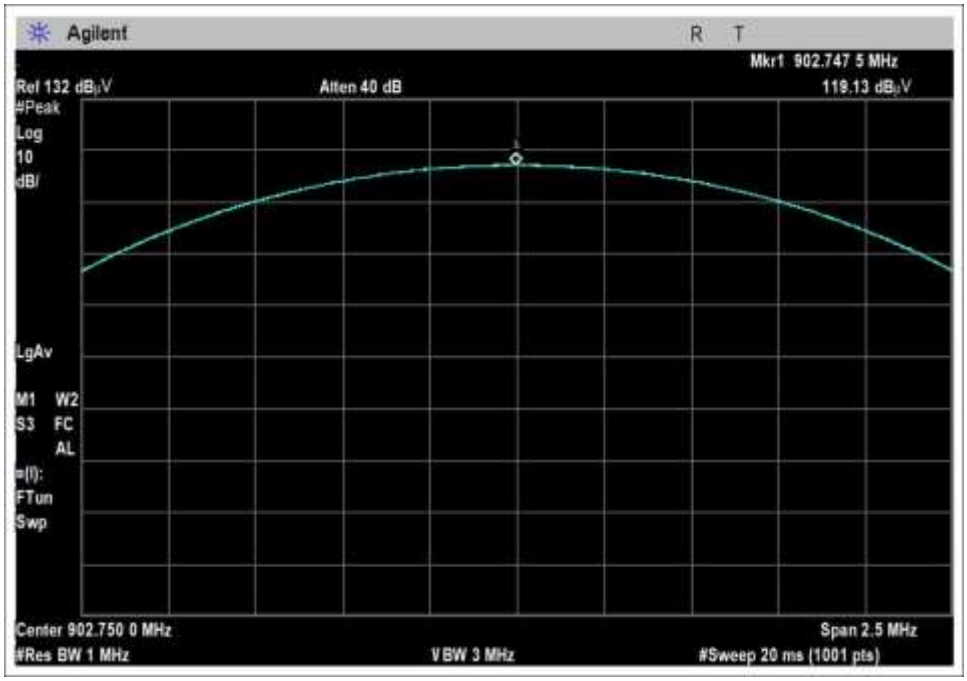
Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%.

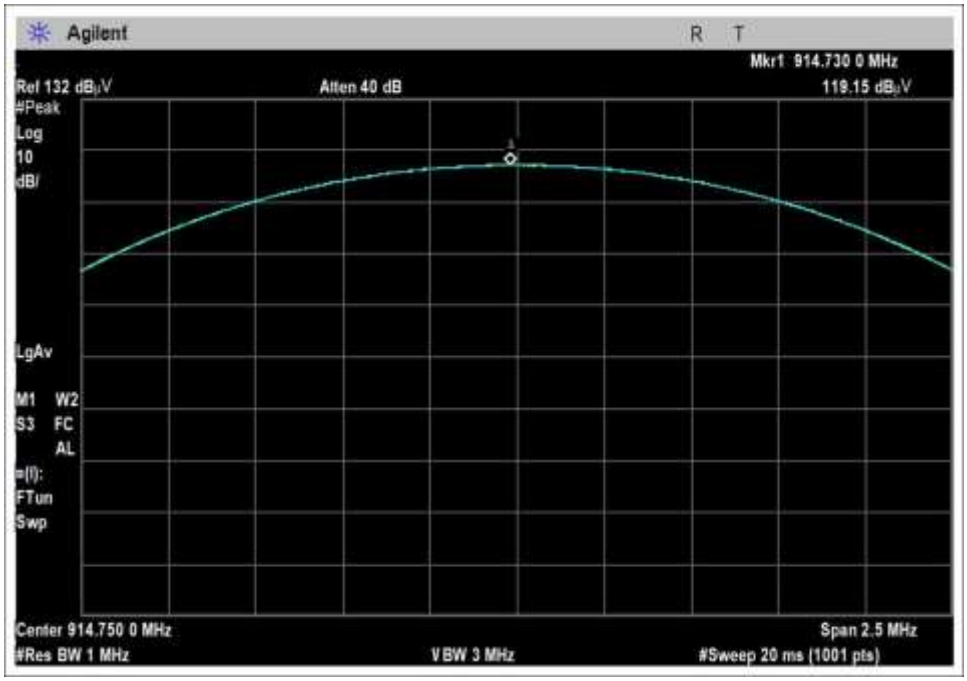
Parameter	Value
$V_{Nominal}$:	115
$V_{Minimum}$:	97
$V_{Maximum}$:	132

Test Data Summary - RF Conducted Measurement					
$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902.75	ASK	Circular Polarized / +8.5dBiC	29.5	≤30	Pass
914.75	ASK	Circular Polarized / +8.5dBiC	29.7	≤30	Pass
927.25	ASK	Circular Polarized / +8.5dBiC	29.8	≤30	Pass

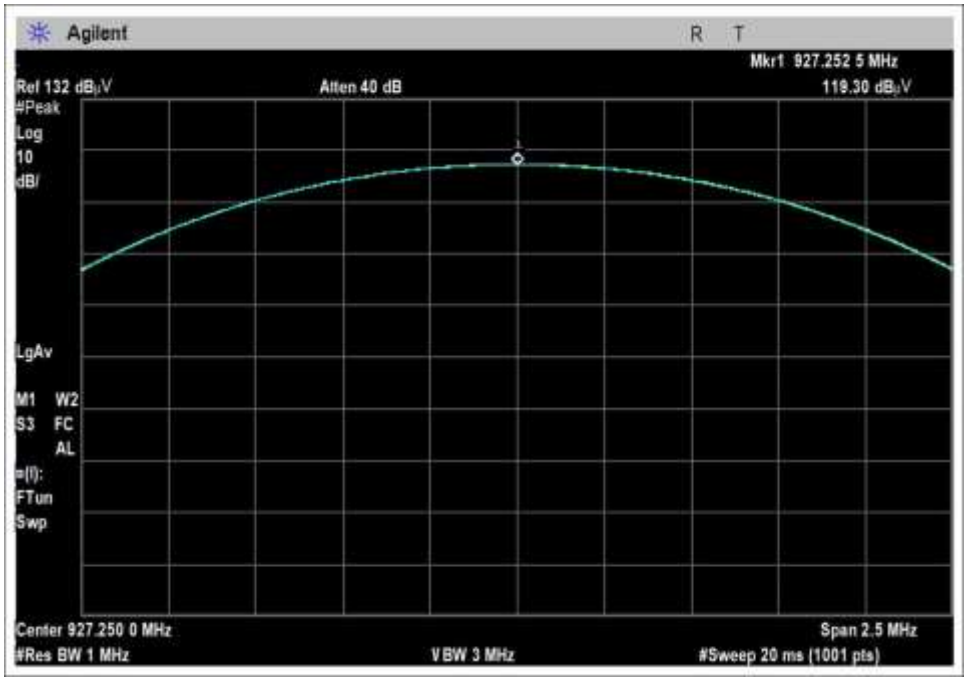
Plot Data



Low Channel



Middle Channel



High Channel

Test Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Impinj, Inc.**		
Specification:	**15.247(b) Power Output (902-928 MHz FHSS >50 Channels)**		
Work Order #:	**107695**	Date:	11/18/2022
Test Type:	**Conducted Emissions**	Time:	09:13:14
Tested By:	Michael Atkinson	Sequence#:	3
Software:	EMITest 5.03.20		115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

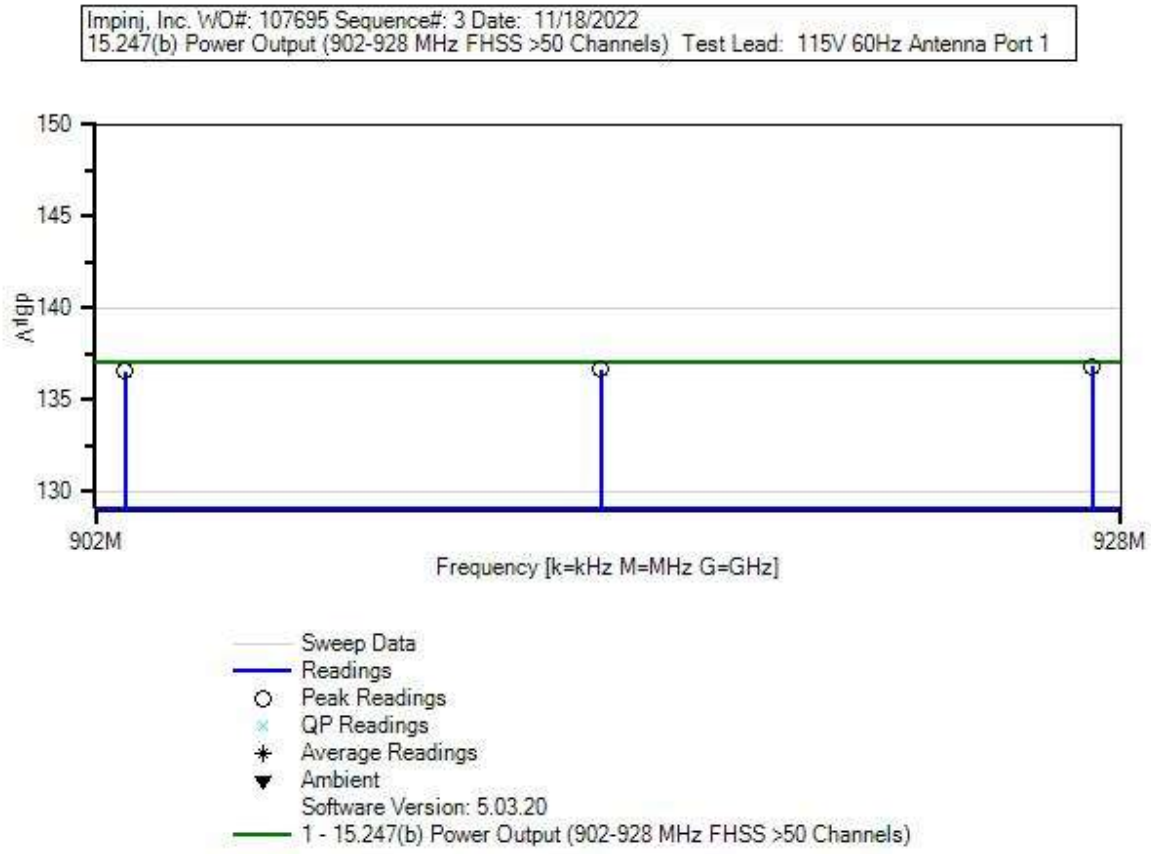
Environmental Conditions:
Temperature: 20°C
Humidity: 31%
Pressure: 103.1 kPa

Test Method: ANSI 63.10 (2013)

Frequency Range: 902-928 MHz
Frequency tested: 902.75, 914.75, 927.25
Firmware power setting; Max Power (with manufacturer declared 3dB of cable loss accounted for)

Setup: The EUT is set up for conducted measurements, the EUT is continuously transmitting with modulation.

Unit is connected to PoE injector via Cat5e cable, the POE injector is connected to a Switch which is connected to the support laptop.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP07638	Attenuator	47-20-34	5/3/2022	5/3/2024
T2	ANP06452	Cable	Heliax	1/17/2022	1/17/2024
T3	ANManuf Cab Loss	Cable	Multiple	No Cal Required	No Cal Required

Measurement Data: Reading listed by margin. Test Lead: Antenna Port 1

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	927.253M	119.3	+19.7	+0.8	+3.0		+0.0	136.8	137.0	-0.2	Anten
2	914.730M	119.2	+19.7	+0.8	+3.0		+0.0	136.7	137.0	-0.3	Anten
3	902.748M	119.1	+19.7	+0.7	+3.0		+0.0	136.5	137.0	-0.5	Anten

Test Setup Photo(s)

15.247(d) Radiated Emissions & Band Edge

Test Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Impinj, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107695**	Date:	11/23/2022
Test Type:	**Maximized Emissions**	Time:	12:38:27
Tested By:	Michael Atkinson	Sequence#:	6
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:

Environmental Conditions:
Temperature: 21°C
Humidity: 32%
Pressure: 103.0 kPa

Frequency Range: 9kHz to 10GHz
Frequency tested: 902.75, 914.75, 927.25

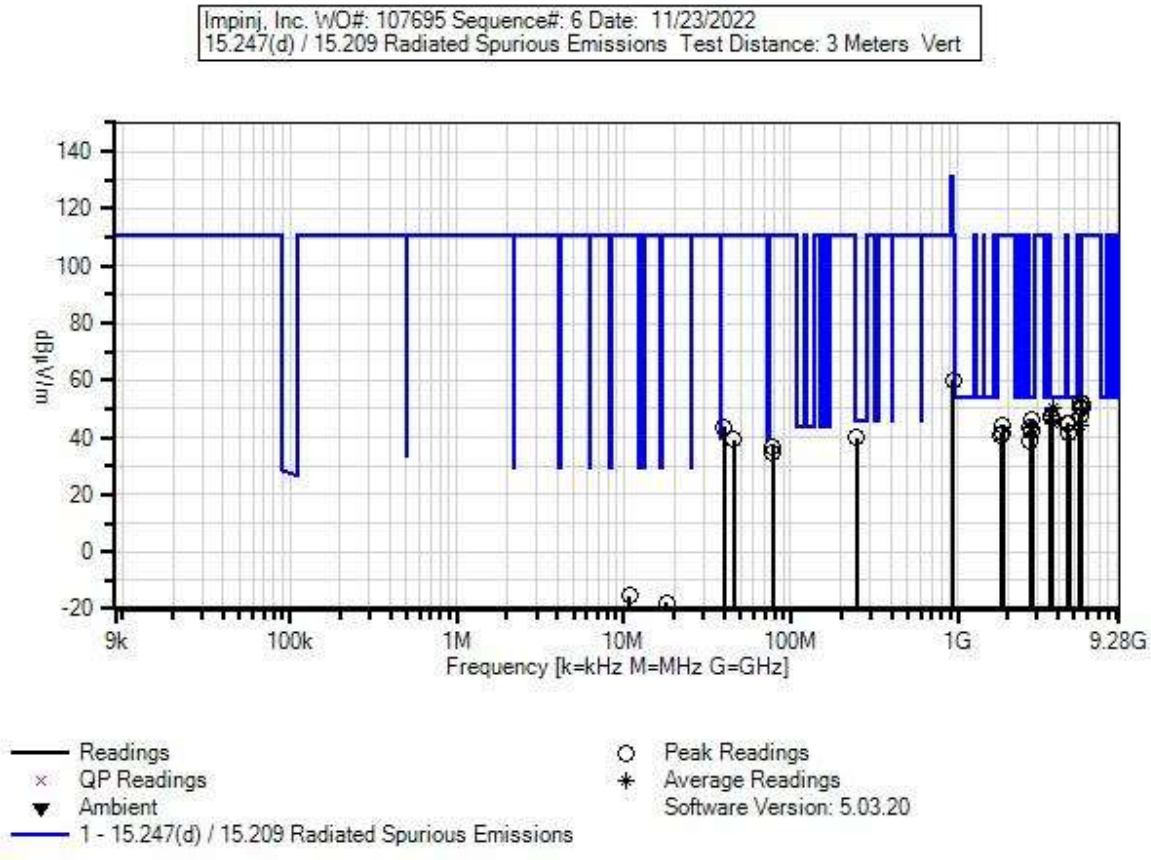
Antenna type: Circular Polarized
Antenna Gain: +8.5dBiC
Antenna in X, Y & Z axis investigated

Duty Cycle: 100%

Test Method: ANSI 63.10 (2013)

Setup: The EUT is set on a foam test table.
The antenna is connected to antenna port 1 via cable with declared 3dB of loss per manufacturer.
USB ports and GPIO (investigated with and without wires) terminated per manufacturer with cables and connectors
An unshielded Ethernet cable is run from the EUT to a POE injector which is connected to a switch which is connected to the support laptop all located outside the chamber.

Horizontal and Vertical polarities investigated above 30MHz, worst case report. Below 30MHz, 3 x orthogonal axes investigated, worst case reported.



Test Equipment:

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

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3709.000M	47.4	+0.0	+0.6	+3.3	+0.0	+0.0	50.0	54.0	-4.0	Horiz
	Ave		+0.0	+0.0	+0.2	-33.8			927.25		
			+0.3	+32.0							
^	3709.015M	53.4	+0.0	+0.6	+3.3	+0.0	+0.0	56.0	54.0	+2.0	Horiz
			+0.0	+0.0	+0.2	-33.8			927.25		
			+0.3	+32.0							
3	249.200M	19.6	+0.0	+0.2	+0.8	+1.1	+0.0	39.8	46.0	-6.2	Horiz
			+18.1	+0.0	+0.0	+0.0					
			+0.0	+0.0							
4	3659.035M	45.4	+0.0	+0.6	+3.3	+0.0	+0.0	47.8	54.0	-6.2	Vert
			+0.0	+0.0	+0.2	-33.8			914.75		
			+0.4	+31.7							
5	3659.065M	45.4	+0.0	+0.6	+3.3	+0.0	+0.0	47.8	54.0	-6.2	Horiz
	Ave		+0.0	+0.0	+0.2	-33.8			914.75		
			+0.4	+31.7							
^	3659.065M	51.1	+0.0	+0.6	+3.3	+0.0	+0.0	53.5	54.0	-0.5	Horiz
			+0.0	+0.0	+0.2	-33.8			914.75		
			+0.4	+31.7							
7	5416.530M	40.8	+0.0	+0.8	+4.0	+0.0	+0.0	47.7	54.0	-6.3	Vert
			+0.0	+0.0	+0.4	-33.6			902.75		
			+0.6	+34.7							
8	3610.985M	45.3	+0.0	+0.5	+3.2	+0.0	+0.0	47.6	54.0	-6.4	Horiz
			+0.0	+0.0	+0.3	-33.8			902.75		
			+0.4	+31.7							
9	3611.030M	44.4	+0.0	+0.5	+3.2	+0.0	+0.0	46.7	54.0	-7.3	Vert
			+0.0	+0.0	+0.3	-33.8			902.75		
			+0.4	+31.7							
10	2781.810M	47.2	+0.0	+0.5	+2.7	+0.0	+0.0	46.4	54.0	-7.6	Vert
			+0.0	+0.0	+0.3	-34.1			927.25		
			+0.5	+29.3							
11	2744.275M	46.7	+0.0	+0.5	+2.7	+0.0	+0.0	45.9	54.0	-8.1	Horiz
			+0.0	+0.0	+0.3	-34.1			914.75		
			+0.5	+29.3							
12	3709.000M	42.4	+0.0	+0.6	+3.3	+0.0	+0.0	45.0	54.0	-9.0	Vert
	Ave		+0.0	+0.0	+0.2	-33.8			927.25		
			+0.3	+32.0							
^	3709.060M	48.3	+0.0	+0.6	+3.3	+0.0	+0.0	50.9	54.0	-3.1	Vert
			+0.0	+0.0	+0.2	-33.8			927.25		
			+0.3	+32.0							
14	4573.815M	41.4	+0.0	+0.6	+3.5	+0.0	+0.0	45.0	54.0	-9.0	Horiz
			+0.0	+0.0	+0.5	-33.6			914.75		
			+0.4	+32.2							
15	4513.825M	41.1	+0.0	+0.6	+3.5	+0.0	+0.0	44.6	54.0	-9.4	Horiz
			+0.0	+0.0	+0.5	-33.6			902.75		
			+0.3	+32.2							

16	5416.500M Ave	37.4	+0.0 +0.0 +0.6	+0.8 +0.0 +34.7	+4.0 +0.4	+0.0 -33.6	+0.0	44.3	54.0 902.75	-9.7	Horiz
^	5416.530M	44.9	+0.0 +0.0 +0.6	+0.8 +0.0 +34.7	+4.0 +0.4	+0.0 -33.6	+0.0	51.8	54.0 902.75	-2.2	Horiz
18	2708.235M	44.4	+0.0 +0.0 +0.5	+0.5 +0.0 +29.5	+2.7 +0.2	+0.0 -34.1	+0.0	43.7	54.0 902.75	-10.3	Horiz
19	2781.750M Ave	44.4	+0.0 +0.0 +0.5	+0.5 +0.0 +29.3	+2.7 +0.3	+0.0 -34.1	+0.0	43.6	54.0 927.25	-10.4	Horiz
^	2781.745M	50.9	+0.0 +0.0 +0.5	+0.5 +0.0 +29.3	+2.7 +0.3	+0.0 -34.1	+0.0	50.1	54.0 927.25	-3.9	Horiz
21	2744.310M	42.6	+0.0 +0.0 +0.5	+0.5 +0.0 +29.3	+2.7 +0.3	+0.0 -34.1	+0.0	41.8	54.0 914.75	-12.2	Vert
22	4636.265M	37.6	+0.0 +0.0 +0.4	+0.6 +0.0 +32.4	+3.6 +0.4	+0.0 -33.6	+0.0	41.4	54.0 927.25	-12.6	Horiz
23	2708.280M	39.6	+0.0 +0.0 +0.5	+0.5 +0.0 +29.5	+2.7 +0.2	+0.0 -34.1	+0.0	38.9	54.0 902.75	-15.1	Vert
24	939.900M	24.7	+0.0 +31.2 +0.0	+0.3 +0.0 +0.0	+1.5 +0.0	+2.4 +0.0	+0.0	60.1	111.0	-50.9	Vert
25	5488.575M	45.9	+0.0 +0.0 +0.5	+0.8 +0.0 +34.7	+4.0 +0.4	+0.0 -33.6	+0.0	52.7	111.0 914.75	-58.3	Horiz
26	5563.520M	45.0	+0.0 +0.0 +0.5	+0.8 +0.0 +34.5	+4.0 +0.5	+0.0 -33.6	+0.0	51.7	111.0 927.25	-59.3	Horiz
27	5563.560M	43.7	+0.0 +0.0 +0.5	+0.8 +0.0 +34.5	+4.0 +0.5	+0.0 -33.6	+0.0	50.4	111.0 927.25	-60.6	Vert
28	5488.545M	43.4	+0.0 +0.0 +0.5	+0.8 +0.0 +34.7	+4.0 +0.4	+0.0 -33.6	+0.0	50.2	111.0 914.75	-60.8	Vert
29	1854.670M	48.1	+0.0 +0.0 +0.3	+0.4 +0.0 +27.7	+2.1 +0.6	+0.0 -34.7	+0.0	44.5	111.0 927.25	-66.5	Horiz
30	39.700M	26.8	+0.0 +16.1 +0.0	+0.1 +0.0 +0.0	+0.3 +0.0	+0.5 +0.0	+0.0	43.8	111.0	-67.2	Vert
31	1829.545M	45.0	+0.0 +0.0 +0.3	+0.4 +0.0 +27.5	+2.1 +0.6	+0.0 -34.7	+0.0	41.2	111.0 914.75	-69.8	Horiz
32	1805.345M	44.7	+0.0 +0.0 +0.3	+0.4 +0.0 +27.3	+2.1 +0.6	+0.0 -34.7	+0.0	40.7	111.0 902.75	-70.3	Horiz

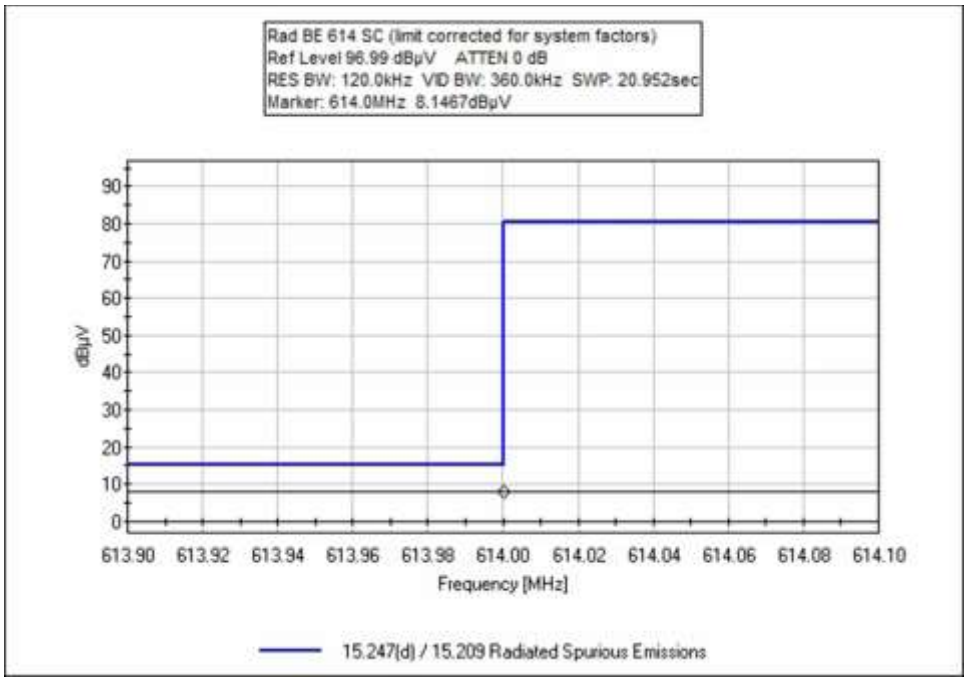
33	45.500M	24.9	+0.0 +13.5 +0.0	+0.1 +0.0 +0.0	+0.3 +0.0	+0.5 +0.0	+0.0	39.3	111.0	-71.7	Vert
34	78.500M	23.0	+0.0 +12.6 +0.0	+0.1 +0.0 +0.0	+0.4 +0.0	+0.6 +0.0	+0.0	36.7	111.0	-74.3	Vert
35	78.500M	20.6	+0.0 +12.6 +0.0	+0.1 +0.0 +0.0	+0.4 +0.0	+0.6 +0.0	+0.0	34.3	111.0	-76.7	Horiz
36	10.802M	15.6	+0.0 +0.0 +0.0	+0.0 +8.9 +0.0	+0.1 +0.0	+0.0 +0.0	-40.0	-15.4	111.0	-126.4	Para
37	18.023M	14.9	+0.0 +0.0 +0.0	+0.0 +7.1 +0.0	+0.2 +0.0	+0.0 +0.0	-40.0	-17.8	111.0	-128.8	Perp
38	28.637M	14.1	+0.0 +0.0 +0.0	+0.1 +4.2 +0.0	+0.2 +0.0	+0.0 +0.0	-40.0	-21.4	111.0	-132.4	Para

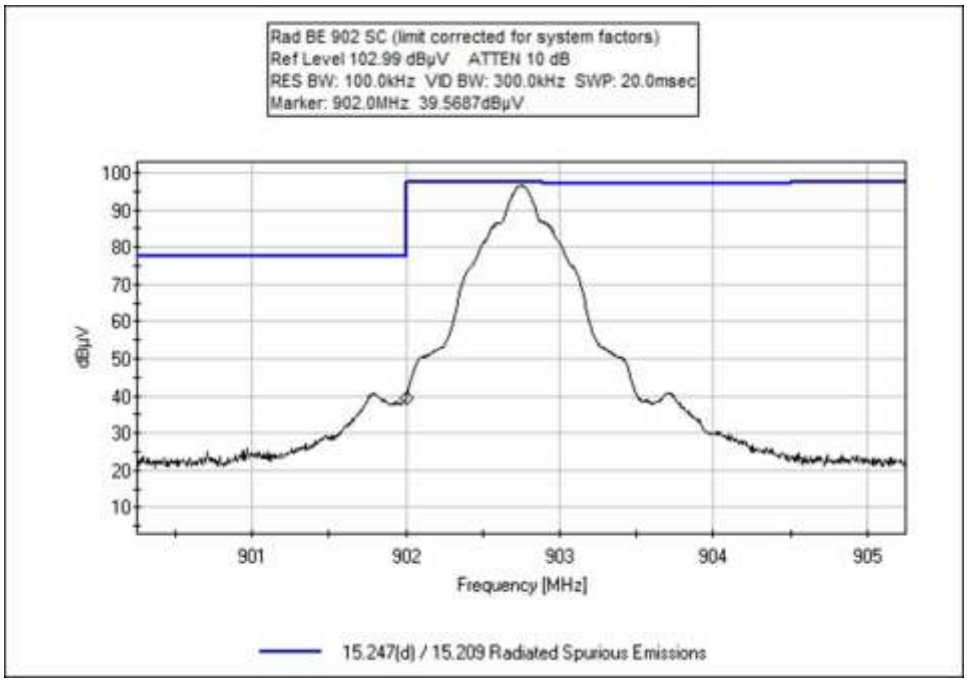
Band Edge

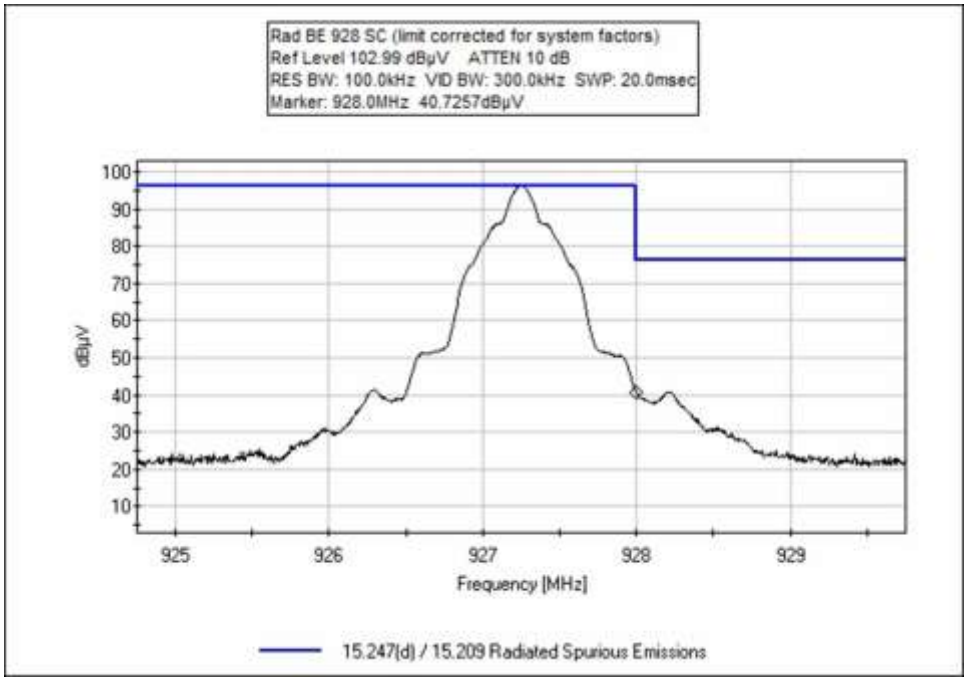
Band Edge Summary					
Operating Mode: Single Channel (Low and High)					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	ASK	Circular Polarized	38.7	<46	Pass
960	ASK	Circular Polarized	42.9	<54	Pass
902	ASK	Circular Polarized	73.2	< 111	Pass
928	ASK	Circular Polarized	75.5	< 111	Pass

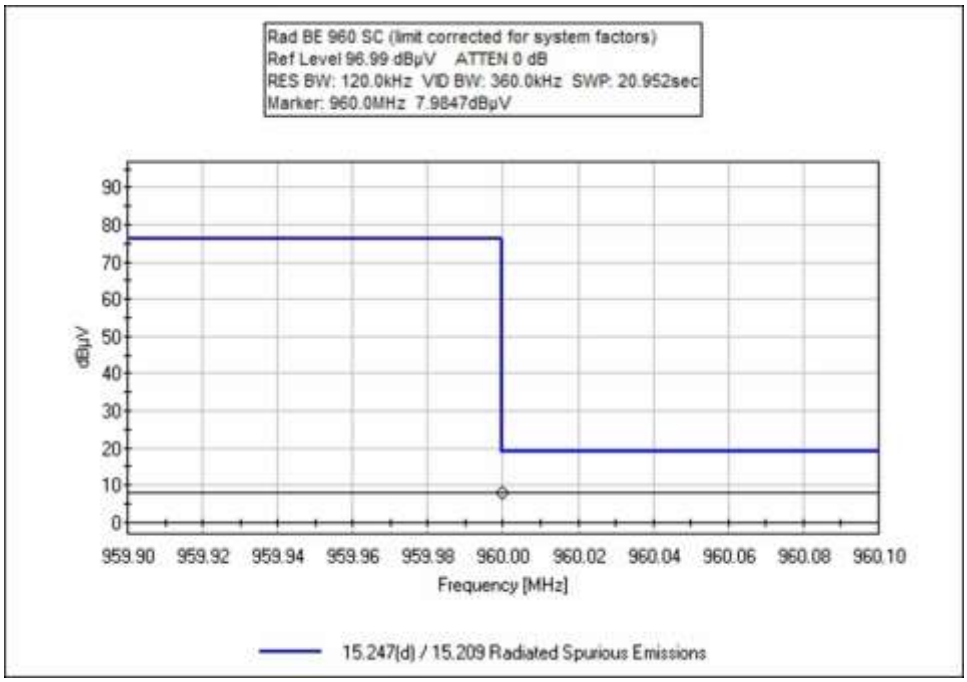
Band Edge Summary					
Operating Mode: Hopping					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	ASK	Circular Polarized	38.8	<46	Pass
960	ASK	Circular Polarized	43.0	<54	Pass
902	ASK	Circular Polarized	74.0	< 111	Pass
928	ASK	Circular Polarized	75.9	< 111	Pass

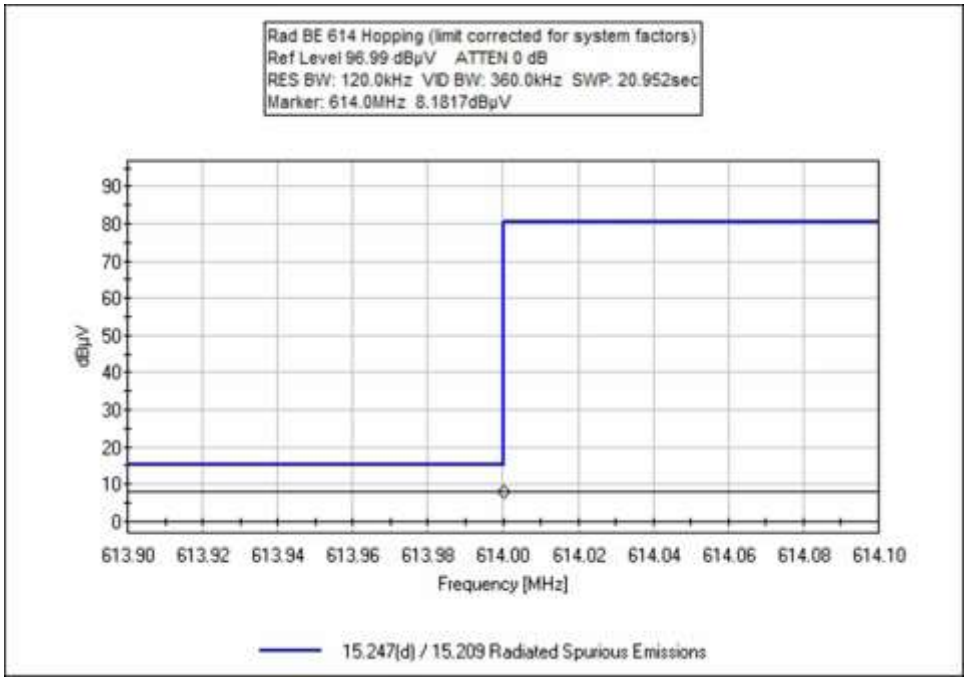
Band Edge Plots

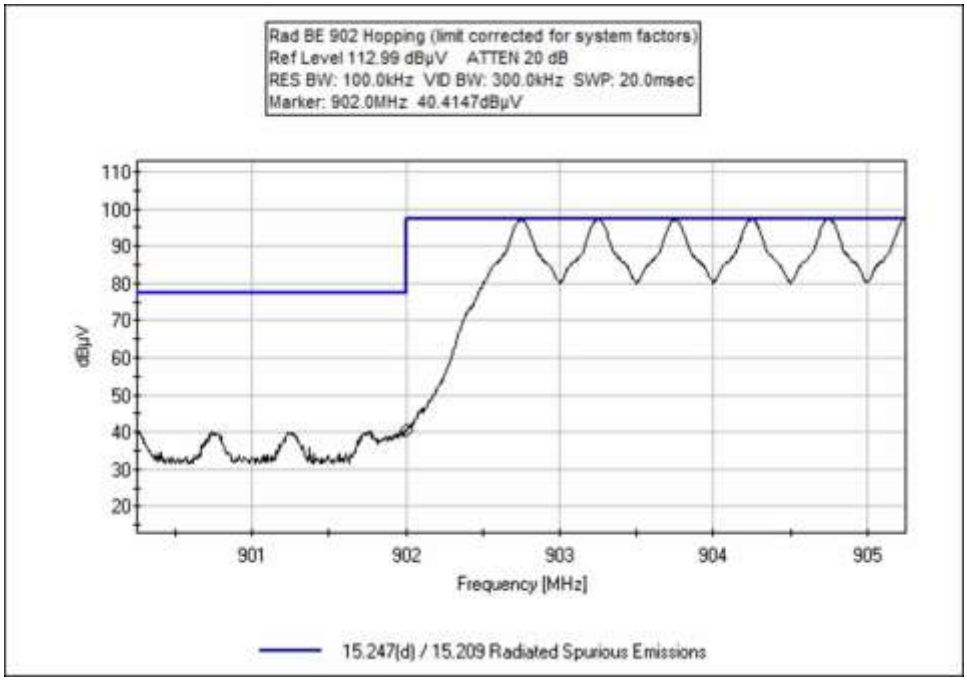


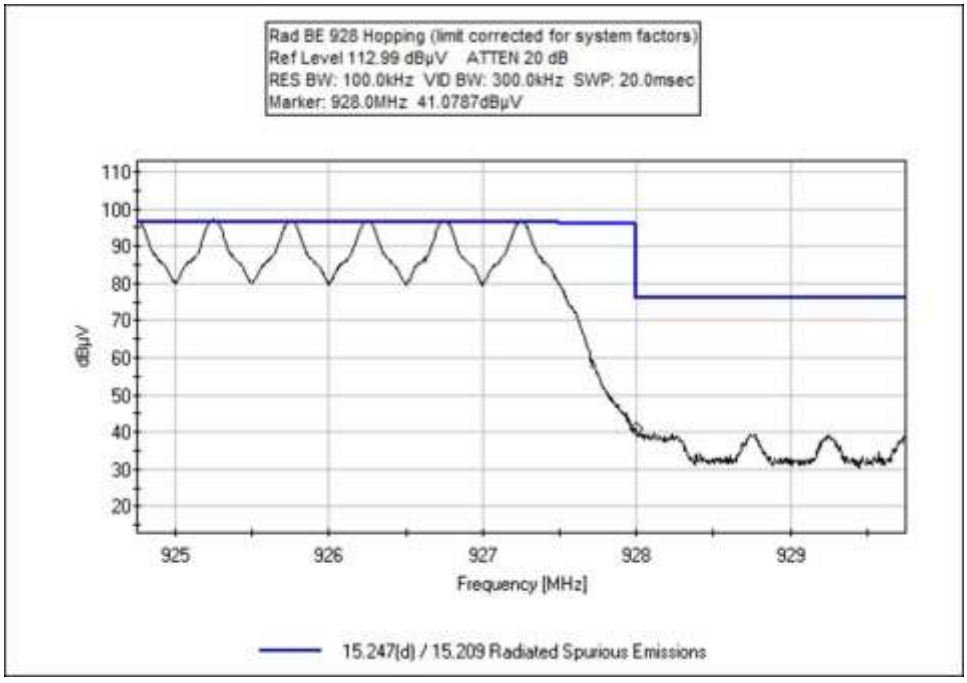


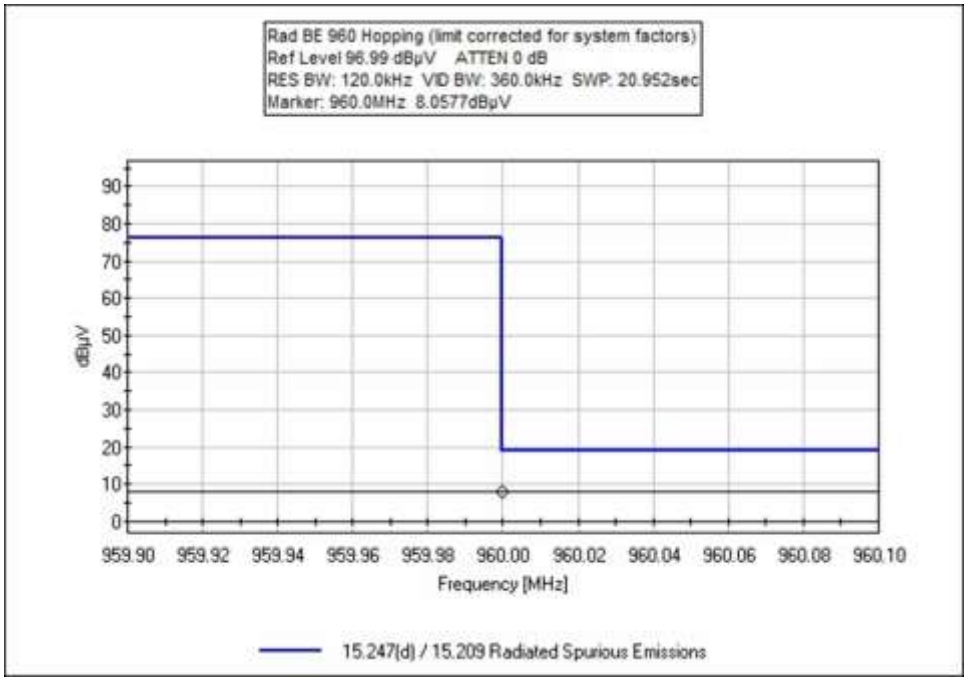

Rad BE 928 SC (limit corrected for system factors)
Ref Level 102.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 40.7257dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 960 SC (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 960.0MHz 7.9847dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 614 Hopping (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 614.0MHz 8.1817dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.90 613.92 613.94 613.96 613.98 614.00 614.02 614.04 614.06 614.08 614.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 902 Hopping (limit corrected for system factors)
Ref Level 112.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 40.4147dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
901 902 903 904 905
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 928 Hopping (limit corrected for system factors)
Ref Level 112.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 41.0787dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 960 Hopping (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 960.0MHz 8.0577dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Impinj, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107695**	Date:	11/18/2022
Test Type:	**Maximized Emissions**	Time:	11:12:26
Tested By:	Michael Atkinson	Sequence#:	5
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:

Environmental Conditions:
Temperature: 21°C
Humidity: 32%
Pressure: 103.0 kPa

Frequency Range: Band Edge
Frequency tested: 902.75, 927.25

Antenna type: Circular Polarized
Antenna Gain: +8.5dBiC
Antenna in X, Y & Z axis investigated

Duty Cycle: 100%

Test Method: ANSI 63.10 (2013)

Setup: The EUT is set on a foam test table.
The antenna is connected to antenna port 1 via cable with declared 3dB of loss per manufacturer.
USB ports and GPIO terminated per manufacturer with cables and connectors
An unshielded Ethernet cable is run from the EUT to a POE injector which is connected to a switch which is connected to the support laptop all located outside the chamber.

Test Equipment:

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

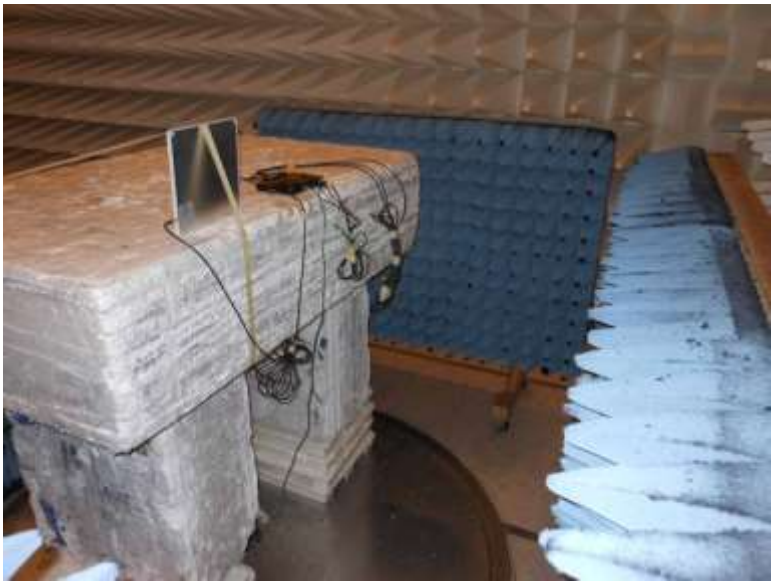
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	614.000M QP	8.2	+0.3	+1.2	+1.9	+27.2	+0.0	38.8	46.0 Hopping	-7.2	Vert
2	614.000M QP	8.1	+0.3	+1.2	+1.9	+27.2	+0.0	38.7	46.0 SC	-7.3	Vert
3	960.000M QP	8.1	+0.3	+1.5	+2.4	+30.7	+0.0	43.0	54.0 Hopping	-11.0	Vert
4	960.000M QP	8.0	+0.3	+1.5	+2.4	+30.7	+0.0	42.9	54.0 SC	-11.1	Vert
5	928.000M	41.1	+0.3	+1.5	+2.4	+30.6	+0.0	75.9	111.0 Hopping	-35.1	Vert
6	928.000M	40.7	+0.3	+1.5	+2.4	+30.6	+0.0	75.5	111.0 SC	-35.5	Vert
7	902.000M	40.4	+0.3	+1.4	+2.3	+29.6	+0.0	74.0	111.0 Hopping	-37.0	Vert
8	902.000M	39.6	+0.3	+1.4	+2.3	+29.6	+0.0	73.2	111.0 SC	-37.8	Vert

Test Setup Photo(s)

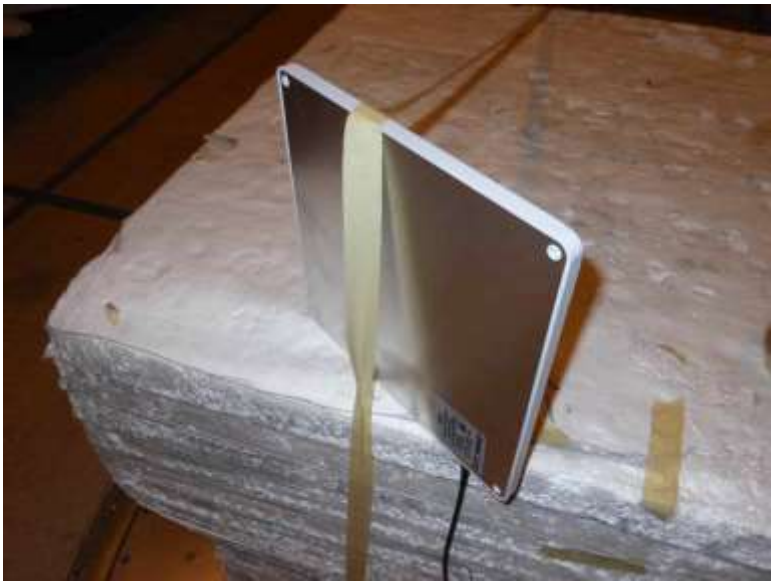
Investigate GPIO

Below 1GHz (0.08m)



Above 1GHz (1.5m)

X Axis



Y Axis

Z Axis

15.207 AC Conducted Emissions

Test Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Impinj, Inc.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**107695**	Date:	11/23/2022
Test Type:	**Conducted Emissions**	Time:	16:19:07
Tested By:	Michael Atkinson	Sequence#:	34
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 21°C
Humidity: 42%
Pressure: 102.7kPa

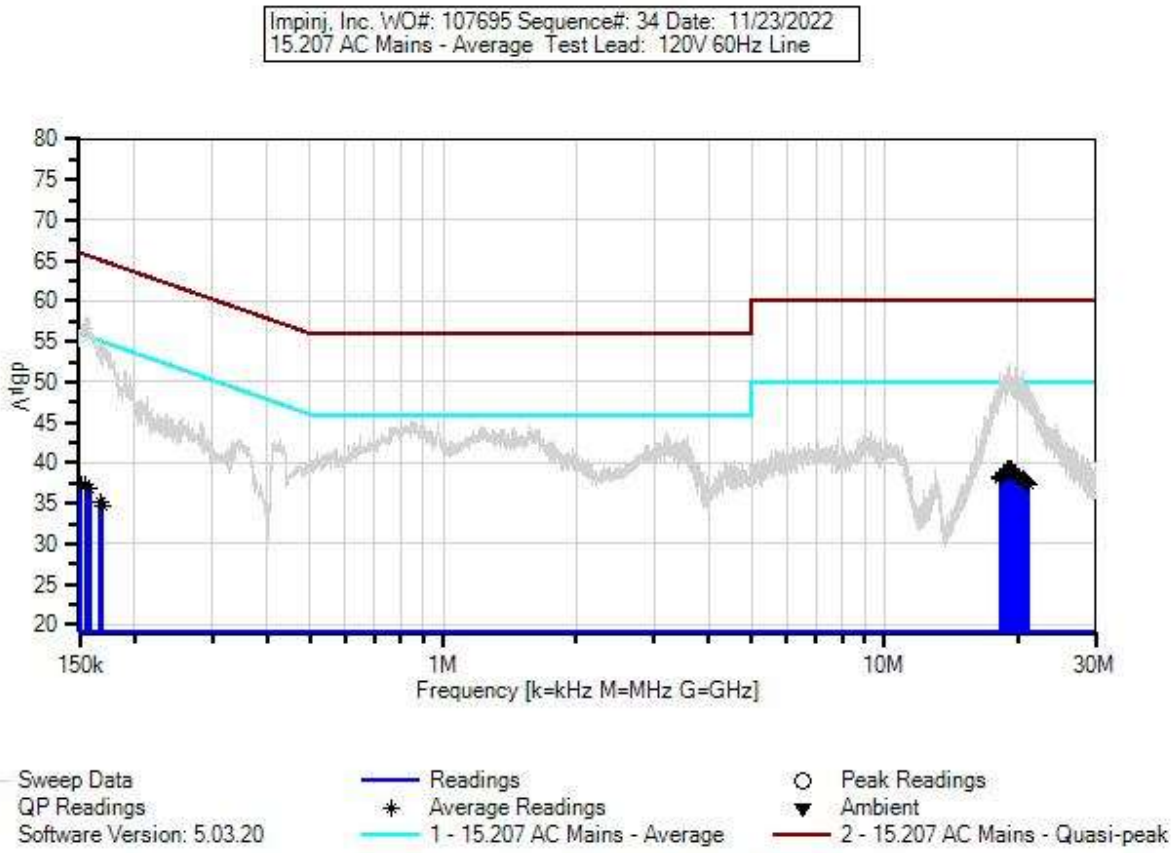
Frequency Range: 0.15-30MHz

Test Method: ANSI C63.10 (2013)

Setup: The EUT is set on a foam test table.
USB ports and GPIO terminated per manufacturer with cables and connectors
Unshielded between EUT and POE injector which is connected to a switch which is connected to the support laptop all located outside the chamber.

Antenna connected, the unit was investigated in standby mode as well as inventory mode with the radio transmitting, worst case reported.

US-CAN Unit



Test Equipment:

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

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	19.148M	29.7	+0.1	+0.1	+0.2	+9.1	+0.0	39.3	50.0	-10.7	Line
	Ave		+0.1								
^	19.148M	41.8	+0.1	+0.1	+0.2	+9.1	+0.0	51.4	50.0	+1.4	Line
			+0.1								
3	19.265M	29.7	+0.1	+0.1	+0.2	+9.1	+0.0	39.3	50.0	-10.7	Line
	Ave		+0.1								
^	19.265M	42.7	+0.1	+0.1	+0.2	+9.1	+0.0	52.3	50.0	+2.3	Line
			+0.1								
5	19.220M	29.7	+0.1	+0.1	+0.2	+9.1	+0.0	39.3	50.0	-10.7	Line
	Ave		+0.1								
^	19.220M	42.4	+0.1	+0.1	+0.2	+9.1	+0.0	52.0	50.0	+2.0	Line
			+0.1								
7	18.913M	29.7	+0.1	+0.1	+0.2	+9.1	+0.0	39.3	50.0	-10.7	Line
	Ave		+0.1								
^	18.913M	42.4	+0.1	+0.1	+0.2	+9.1	+0.0	52.0	50.0	+2.0	Line
			+0.1								
9	19.445M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.2	50.0	-10.8	Line
	Ave		+0.1								
^	19.445M	41.0	+0.1	+0.1	+0.2	+9.1	+0.0	50.6	50.0	+0.6	Line
			+0.1								
11	19.652M	29.2	+0.1	+0.1	+0.2	+9.1	+0.0	38.8	50.0	-11.2	Line
	Ave		+0.1								
^	19.652M	41.1	+0.1	+0.1	+0.2	+9.1	+0.0	50.7	50.0	+0.7	Line
			+0.1								
13	18.517M	29.1	+0.1	+0.1	+0.2	+9.1	+0.0	38.7	50.0	-11.3	Line
	Ave		+0.1								
^	18.517M	41.4	+0.1	+0.1	+0.2	+9.1	+0.0	51.0	50.0	+1.0	Line
			+0.1								
15	19.760M	29.0	+0.1	+0.1	+0.2	+9.1	+0.0	38.6	50.0	-11.4	Line
	Ave		+0.1								
^	19.760M	42.1	+0.1	+0.1	+0.2	+9.1	+0.0	51.7	50.0	+1.7	Line
			+0.1								
17	19.733M	29.0	+0.1	+0.1	+0.2	+9.1	+0.0	38.6	50.0	-11.4	Line
	Ave		+0.1								
^	19.733M	40.5	+0.1	+0.1	+0.2	+9.1	+0.0	50.1	50.0	+0.1	Line
			+0.1								
19	19.787M	29.0	+0.1	+0.1	+0.2	+9.1	+0.0	38.6	50.0	-11.4	Line
	Ave		+0.1								
^	19.787M	40.8	+0.1	+0.1	+0.2	+9.1	+0.0	50.4	50.0	+0.4	Line
			+0.1								
21	19.805M	28.9	+0.1	+0.1	+0.2	+9.1	+0.0	38.5	50.0	-11.5	Line
	Ave		+0.1								
^	19.805M	41.1	+0.1	+0.1	+0.2	+9.1	+0.0	50.7	50.0	+0.7	Line
			+0.1								

23	19.886M Ave	28.8	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.4	50.0	-11.6	Line
^	19.886M	40.8	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.4	50.0	+0.4	Line
25	20.220M Ave	28.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.3	50.0	-11.7	Line
^	20.220M	41.1	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.7	50.0	+0.7	Line
27	19.949M Ave	28.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.3	50.0	-11.7	Line
^	19.949M	40.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.3	50.0	+0.3	Line
29	20.058M Ave	28.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.3	50.0	-11.7	Line
^	20.058M	40.3	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	49.9	50.0	-0.1	Line
31	18.292M Ave	28.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.3	50.0	-11.7	Line
^	18.292M	41.6	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	51.2	50.0	+1.2	Line
33	20.139M Ave	28.6	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.2	50.0	-11.8	Line
^	20.139M	40.8	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.4	50.0	+0.4	Line
35	20.274M Ave	28.6	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.2	50.0	-11.8	Line
^	20.274M	40.5	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.1	50.0	+0.1	Line
37	18.256M Ave	28.5	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.1	50.0	-11.9	Line
^	18.256M	41.2	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.8	50.0	+0.8	Line
39	20.607M Ave	28.4	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.0	50.0	-12.0	Line
^	20.607M	41.7	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	51.3	50.0	+1.3	Line
41	20.634M Ave	28.4	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	38.0	50.0	-12.0	Line
^	20.634M	40.0	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	49.6	50.0	-0.4	Line
43	20.832M Ave	28.3	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	37.9	50.0	-12.1	Line
^	20.832M	39.9	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	49.5	50.0	-0.5	Line
45	20.769M Ave	28.2	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	37.8	50.0	-12.2	Line
^	20.769M	40.0	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	49.6	50.0	-0.4	Line
47	20.931M Ave	28.0	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	37.6	50.0	-12.4	Line
^	20.931M	40.1	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	49.7	50.0	-0.3	Line

49	21.148M	27.7	+0.1	+0.1	+0.2	+9.1	+0.0	37.3	50.0	-12.7	Line
	Ave		+0.1								
^	21.148M	40.4	+0.1	+0.1	+0.2	+9.1	+0.0	50.0	50.0	+0.0	Line
			+0.1								
51	154.821k	27.4	+0.7	+0.1	+0.0	+9.1	+0.0	37.4	55.7	-18.3	Line
	Ave		+0.1								
52	151.048k	26.5	+1.5	+0.1	+0.0	+9.1	+0.0	37.3	55.9	-18.6	Line
	Ave		+0.1								
^	151.047k	46.5	+1.5	+0.1	+0.0	+9.1	+0.0	57.3	55.9	+1.4	Line
			+0.1								
54	158.069k	27.0	+0.6	+0.1	+0.0	+9.1	+0.0	36.9	55.6	-18.7	Line
	Ave		+0.1								
^	158.069k	48.0	+0.6	+0.1	+0.0	+9.1	+0.0	57.9	55.6	+2.3	Line
			+0.1								
^	154.820k	48.0	+0.7	+0.1	+0.0	+9.1	+0.0	58.0	55.7	+2.3	Line
			+0.1								
57	167.606k	25.5	+0.3	+0.1	+0.0	+9.1	+0.0	35.1	55.1	-20.0	Line
	Ave		+0.1								
58	169.283k	25.2	+0.3	+0.1	+0.0	+9.1	+0.0	34.8	55.0	-20.2	Line
	Ave		+0.1								
^	167.606k	45.7	+0.3	+0.1	+0.0	+9.1	+0.0	55.3	55.1	+0.2	Line
			+0.1								
^	169.282k	45.0	+0.3	+0.1	+0.0	+9.1	+0.0	54.6	55.0	-0.4	Line
			+0.1								

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Impinj, Inc.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**107695**	Date:	11/23/2022
Test Type:	**Conducted Emissions**	Time:	16:31:11
Tested By:	Michael Atkinson	Sequence#:	35
Software:	EMITest 5.03.20		120V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 21°C
Humidity: 42%
Pressure: 102.7kPa

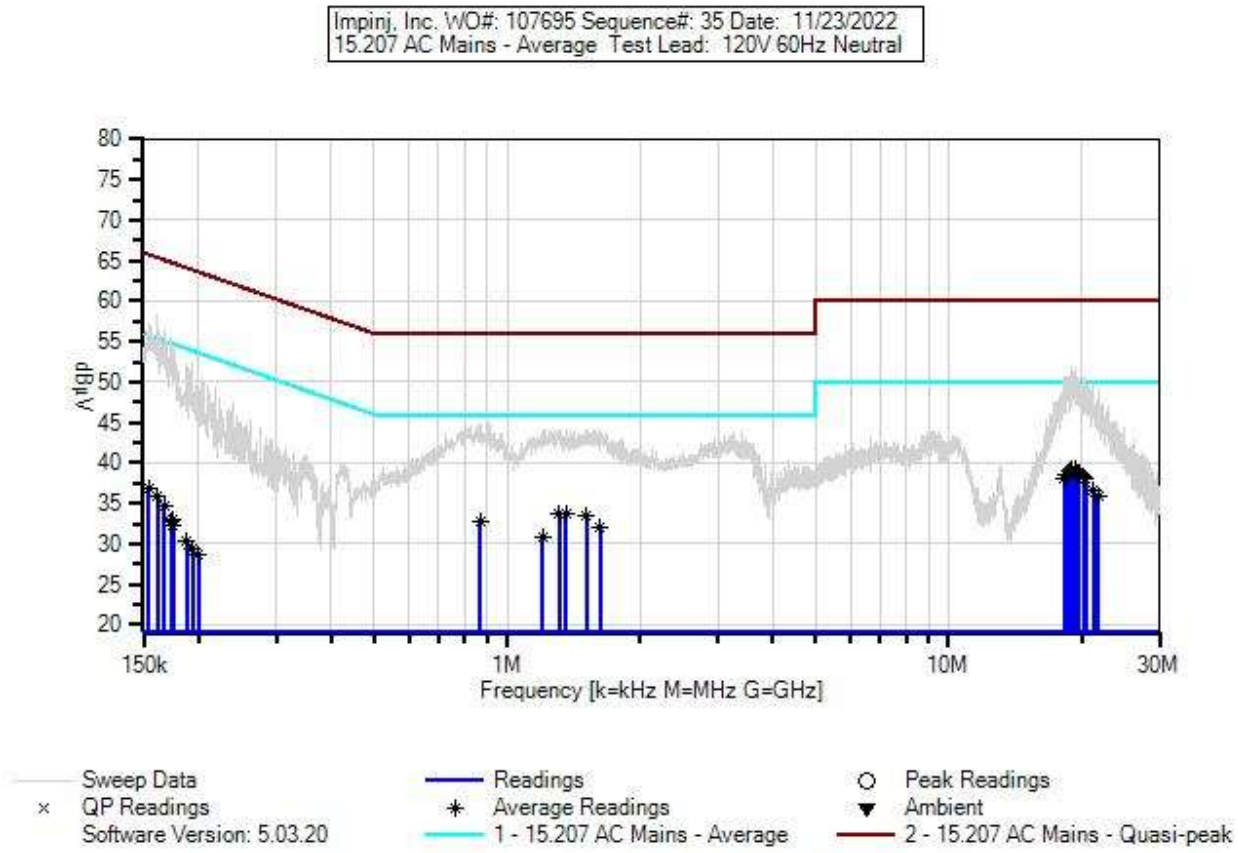
Frequency Range: 0.15-30MHz

Test Method: ANSI C63.10 (2013)

Setup: The EUT is set on a foam test table.
USB ports and GPIO terminated per manufacturer with cables and connectors
Unshielded between EUT and POE injector which is connected to a switch which is connected to the support laptop all located outside the chamber.

Antenna connected, the unit was investigated in standby mode as well as inventory mode with the radio transmitting, worst case reported.

US-CAN Unit



Test Equipment:

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

Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	19.283M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.1	50.0	-10.9	Neutr
	Ave		+0.0								
^	19.283M	41.6	+0.1	+0.1	+0.2	+9.1	+0.0	51.1	50.0	+1.1	Neutr
			+0.0								
3	18.931M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.1	50.0	-10.9	Neutr
	Ave		+0.0								
^	18.931M	42.3	+0.1	+0.1	+0.2	+9.1	+0.0	51.8	50.0	+1.8	Neutr
			+0.0								
5	19.030M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.1	50.0	-10.9	Neutr
	Ave		+0.0								
^	19.030M	41.7	+0.1	+0.1	+0.2	+9.1	+0.0	51.2	50.0	+1.2	Neutr
			+0.0								
7	18.796M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.1	50.0	-10.9	Neutr
	Ave		+0.0								
^	18.796M	41.4	+0.1	+0.1	+0.2	+9.1	+0.0	50.9	50.0	+0.9	Neutr
			+0.0								
9	19.400M	29.6	+0.1	+0.1	+0.2	+9.1	+0.0	39.1	50.0	-10.9	Neutr
	Ave		+0.0								
^	19.400M	42.2	+0.1	+0.1	+0.2	+9.1	+0.0	51.7	50.0	+1.7	Neutr
			+0.0								
11	19.562M	29.3	+0.1	+0.1	+0.2	+9.1	+0.0	38.8	50.0	-11.2	Neutr
	Ave		+0.0								
^	19.562M	41.2	+0.1	+0.1	+0.2	+9.1	+0.0	50.7	50.0	+0.7	Neutr
			+0.0								
13	19.742M	29.1	+0.1	+0.1	+0.2	+9.1	+0.0	38.6	50.0	-11.4	Neutr
	Ave		+0.0								
^	19.742M	41.0	+0.1	+0.1	+0.2	+9.1	+0.0	50.5	50.0	+0.5	Neutr
			+0.0								
15	18.499M	29.1	+0.1	+0.1	+0.2	+9.1	+0.0	38.6	50.0	-11.4	Neutr
	Ave		+0.0								
^	18.499M	41.3	+0.1	+0.1	+0.2	+9.1	+0.0	50.8	50.0	+0.8	Neutr
			+0.0								
17	20.247M	28.7	+0.1	+0.1	+0.2	+9.1	+0.0	38.2	50.0	-11.8	Neutr
	Ave		+0.0								
^	20.247M	40.3	+0.1	+0.1	+0.2	+9.1	+0.0	49.8	50.0	-0.2	Neutr
			+0.0								
19	20.229M	28.7	+0.1	+0.1	+0.2	+9.1	+0.0	38.2	50.0	-11.8	Neutr
	Ave		+0.0								
^	20.229M	41.2	+0.1	+0.1	+0.2	+9.1	+0.0	50.7	50.0	+0.7	Neutr
			+0.0								
21	18.274M	28.6	+0.1	+0.1	+0.2	+9.1	+0.0	38.1	50.0	-11.9	Neutr
	Ave		+0.0								
^	18.274M	41.1	+0.1	+0.1	+0.2	+9.1	+0.0	50.6	50.0	+0.6	Neutr
			+0.0								

23 Ave	20.481M	28.5	+0.1 +0.0	+0.1	+0.2	+9.1	+0.0	38.0	50.0	-12.0	Neutr
^	20.481M	40.4	+0.1 +0.0	+0.1	+0.2	+9.1	+0.0	49.9	50.0	-0.1	Neutr
25 Ave	20.346M	28.5	+0.1 +0.0	+0.1	+0.2	+9.1	+0.0	38.0	50.0	-12.0	Neutr
^	20.346M	41.0	+0.1 +0.0	+0.1	+0.2	+9.1	+0.0	50.5	50.0	+0.5	Neutr
27 Ave	1.358M	24.2	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	33.7	46.0	-12.3	Neutr
^	1.358M	34.6	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	44.1	46.0	-1.9	Neutr
29 Ave	1.315M	24.1	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	33.6	46.0	-12.4	Neutr
^	1.315M	34.6	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	44.1	46.0	-1.9	Neutr
31 Ave	1.515M	23.9	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	33.4	46.0	-12.6	Neutr
^	1.515M	34.6	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	44.1	46.0	-1.9	Neutr
33 Ave	867.196k	23.4	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	32.8	46.0	-13.2	Neutr
^	867.196k	35.5	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	44.9	46.0	-1.1	Neutr
35 Ave	21.328M	27.0	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	36.6	50.0	-13.4	Neutr
^	21.328M	40.4	+0.1 +0.1	+0.1	+0.2	+9.1	+0.0	50.0	50.0	+0.0	Neutr
37 Ave	1.625M	22.4	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	31.9	46.0	-14.1	Neutr
^	1.625M	34.6	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	44.1	46.0	-1.9	Neutr
39 Ave	21.859M	26.2	+0.1 +0.2	+0.1	+0.2	+9.1	+0.0	35.9	50.0	-14.1	Neutr
^	21.859M	39.3	+0.1 +0.2	+0.1	+0.2	+9.1	+0.0	49.0	50.0	-1.0	Neutr
41 Ave	1.202M	21.3	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	30.8	46.0	-15.2	Neutr
^	1.202M	34.7	+0.1 +0.1	+0.1	+0.1	+9.1	+0.0	44.2	46.0	-1.8	Neutr
43 Ave	154.086k	26.8	+0.7 +0.1	+0.1	+0.0	+9.1	+0.0	36.8	55.8	-19.0	Neutr
^	154.086k	47.1	+0.7 +0.1	+0.1	+0.0	+9.1	+0.0	57.1	55.8	+1.3	Neutr
45 Ave	161.736k	26.1	+0.5 +0.1	+0.1	+0.0	+9.1	+0.0	35.9	55.4	-19.5	Neutr
^	161.736k	48.5	+0.5 +0.1	+0.1	+0.0	+9.1	+0.0	58.3	55.4	+2.9	Neutr
47 Ave	167.395k	25.1	+0.4 +0.1	+0.1	+0.0	+9.1	+0.0	34.8	55.1	-20.3	Neutr
^	167.395k	46.8	+0.4 +0.1	+0.1	+0.0	+9.1	+0.0	56.5	55.1	+1.4	Neutr

49 Ave	173.998k	23.4	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	33.0	54.8	-21.8	Neutr
50 Ave	173.369k	23.2	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	32.8	54.8	-22.0	Neutr
51 Ave	175.570k	22.8	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	32.4	54.7	-22.3	Neutr
^	173.368k	45.8	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	55.4	54.8	+0.6	Neutr
^	173.997k	44.7	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	54.3	54.8	-0.5	Neutr
^	175.569k	44.6	+0.3 +0.1	+0.1	+0.0	+9.1	+0.0	54.2	54.7	-0.5	Neutr
55 Ave	188.250k	20.8	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	30.2	54.1	-23.9	Neutr
^	188.250k	43.0	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	52.4	54.1	-1.7	Neutr
57 Ave	193.909k	19.9	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	29.3	53.9	-24.6	Neutr
^	193.909k	43.0	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	52.4	53.9	-1.5	Neutr
59 Ave	199.673k	19.2	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	28.6	53.6	-25.0	Neutr
^	199.673k	43.2	+0.1 +0.1	+0.1	+0.0	+9.1	+0.0	52.6	53.6	-1.0	Neutr

Test Setup Photo(s)

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in 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.