RADIO TEST REPORT

For

MODEL NO.: 1846
FCC ID: C3K1846
IC ID: 3048A-1846

Test Report No. R-TR677-FCCISED-SRD-3
Issue Date: November 18th, 2020

FCC CFR47 Part 15 Subpart C
Innovation, Science and Economic Development
Canada RSS-210 Issue 10

Prepared by
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A2LA ACCREDITED
TESTING CERT #3472.01

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	10/29/20	All	All	Version 1.0	Daniel Salinas
2.0	11/09/2020	8.1.1	13	Included note on test site correlation and EUT axes measured.	Daniel Salinas
		9.2	19	Included 20 dB Bandwidth Measurement	
		9.3	20-21	Update Fundamental Field Strength Measurement and Analyzer Settings	
		9.4	23	Included notes on worst case EUT orientation, antenna orientation and alternative measurement method per ANSI C63.10	
		9.4	24	Included note on ISED limits below 30 MHz	
		9.4	25-42	Included notes on image frequencies, antenna polarizations, and worst case EUT orientations	
3.0	11/18/2020	9.3.4	21	Included note on worst case EUT orientation	Daniel Salinas
		9.4.5	30-41	Removed average image frequency table	

Table of Contents

Test Report Attestation

Microsoft Corporation
Model: 1846
FCC ID: C3K1846
IC ID: 3048A-1846

Applicable Standards

Specification	Test Result
FCC 47CFR Rule Parts 15.207, 15.205, 15.209, 15.249	Pass
Innovation, Science and Economic Development Canada RSS-210 Issue 10, RSS-GEN Issue 5	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces previously issued report # R-TR677-FCCISED-SRD-2 by Microsoft EMC Laboratories on October 30th, 2020.

Reviewed By: Nisha Nandakumar

RF Test Engineer

Written/ Issued By: Daniel Salinas

RF Lab Technical Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at
Microsoft EMC Laboratory,
17760 NE 67th Ct,
Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.
A2LA Accredited Testing Certificate Number: 3472.01
FCC Registration Number: US1141
IC Site Registration Numbers: 26315

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2014 and other equivalent applicable standards.
Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2014.
ANSI C63.10:2013 and the appropriate KDB test methods were followed.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor k=2. These levels are for reference only and not included to determine product compliance.
Expanded uncertainty calculations are available upon request.

Test item	Uncertainty	Unit
Radiated disturbance (9 kHz to 30 MHz)	5.32	dB
Radiated disturbance (30 MHz to 1 GHz)	5.99	dB
Radiated disturbance (1 GHz to 18 GHz)	5.12	dB
Radiated disturbance (18 GHz to 100 GHz)	5.08	dB
Conducted Disturbance at Mains Port	3.31	dB
Uncertainty for Conducted Power test	1.277	dB
Uncertainty for Conducted Spurious emission test	2.742	dB
Uncertainty for Bandwidth test	4.98	kHz
Uncertainty for DC power test	0.05	%
Uncertainty for test site temperature	0.5	ºC
Uncertainty for test site Humidity	3	%
Uncertainty for time	0.189	%

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Chaitrali Limaye
Functional Description of the EUT:	Short Range Device
Model:	1846
FCC ID:	C3K1846
IC ID:	3048A-1846
Radio under test:	SRD (24.15 – 24.25 GHz)
Modulation(s):	Pulse Modulation
Antenna Information:	Integral Antenna. **Manufacturer declared max Antenna Gain in 2.4GHz band of operation:** 4.0 dBi
Lowest Frequency:	Lowest frequency used or generated: < 9 kHz
EUT Classification:	SRD
Equipment Design State:	Prototype/Production Equivalent (DV)
Equipment Condition:	Good
Test Sample Details:	**RF Radiated Test Sample** S/N: 46428300

5.1 Test Configurations

The device was preprogrammed by the customer to force the EUT to transmit continuously. The device can operate in only pulsed modulation on a single channel.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 ºC to 40 ºC (50 ºF to 104 ºF) unless the EUT specified testing over a different temperature range. Humidity levels were in the

range of 10% to 90% relative humidity. Testing conditions were within tolerance, and any deviations required from the EUT are reported.

5.3 Antenna Requirements

The antennas are permanently attached and there are no provisions for connection to an external antenna.

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed from September 18th, 2020 to November 6th, 2020.

5.6 Test Engineers

Test Case	Test Engineers
Radiated	Akshay Landge Anusha Manavarthe Nagaraj

6 Test Results Summary

Test Description	FCC CFR 47/ ISED Rule Part	Limit	Test Result
Duty Cycle	N/A	N/A	Reporting & Measurement Purposes Only
Occupied Bandwidth and 20 dB Bandwidth	FCC 15.215 RSS-Gen [6.7]	N/A	Reporting Purposes Only
Field Strength of the Fundamental	15.249 (a) RSS-210 [F.10]	≤ 250 mV/m @ 3m	Pass
Frequency Stability	15.249 (b)(2) RSS-210 [B.10] RSS-Gen [8.11]	≤ ±0.001%	Pass(1)
Radiated Spurious Emissions/ Restricted Band Emissions	15.205, 15.209 RSS-210 [B.10] RSS-Gen [8.9]	FCC CFR 47 15.209 limits RSS-Gen [8.9]	Pass
AC Power Line Conducted Emissions	15.207 RSS-Gen [8.8]	FCC CFR 47 15.207 limits RSS-Gen [8.8]	Pass

Note1: Only applicable to fixed point to point systems. The EUT is not intended for fixed point to point operation and it is operating within the center 80% of the operating frequency band.

7 Test Equipment List

Equipment used for Radiated Measurements				
Manufacturer	**Description**	**Model #**	**Asset #**	**Calibration Due**
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-192	4/5/2021
Rohde & Schwarz	EMI test Receiver	ESR26	RF-568	6/4/2021
Agilent	Signal/Spectrum Analyzer	N9030A	EMC-607	9/4/2021
Madge Tech	THP Monitor	PRH Temp 2020	EMC-169	7/16/2021
Madge Tech	THP Monitor	P68935	EMC-879	7/16/2021
ETS-Lindgren	Antenna Passive-Loop	6512	RF-202	2/21/2021
Sunol Sciences	Antenna - Broadband Hybrid	JB6	EMC-640	1/28/2021
ETS-Lindgren	Antenna - Horn	3117	EMC-1022	6/30/2021
Sage Millimeter	Antenna - Horn	SAR-2309-19-S2	RF-877	N/A
Sage Millimeter	Antenna - Horn	SAR-2309-10-S2	RF-876	N/A
ETS-Lindgren	Antenna - Standard Gain Horn	3160-09	EMC-452	N/A
ETS-Lindgren	Antenna - Standard Gain Horn	3160-10	EMC-602	N/A
Sage Millimeter	Antenna -Standard Gain Horn	SAZ-2410-15-S1	RF-974	N/A
Rohde & Schwarz	Preamplifier	TS-PR40	RF-200	N/A
Rohde & Schwarz	Preamplifier	TS-PR26	RF-042	N/A
Sage Millimeter	Low Noise Amplifier,Waveguidee	SBL-4036033080	RF-965	N/A
Sage Millimeter	Low Noise Amplifier,Waveguidee	SBL-503753350-1515-E1	RF-984	N/A
Eravant	Low Noise Amplifier	SBL-7531143550-1010-E1	RF-1204	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP130	RF-018	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP150	RF-019	N/A

Equipment used for Radiated Measurements				
Manufacturer	**Description**	**Model #**	**Asset #**	**Calibration Due**
Rohde & Schwarz	Custom Filter Bank	SFUNIT RX	RF-322	N/A
Keysight	Waveguide Harmonic Mixer	M1970V	RF-951	12/21/2020
Keysight	Waveguide Harmonic Mixer	M1970W	RF-952	10/31/2020(1)
Keysight	Waveguide Harmonic Mixer	11970U	RF-953	12/22/2020
Teledyne	RF Cable	PR90-198-276	RF-1036	N/A
Huber & Suhner	RF Cable	Sucoflex 100	RF-452	N/A
MegaPhase	RF Cable	EMC3-N1N1-394	EMC-1037	N/A
Micro-Coax	RF Cable	UFB311A-1-0787-50U50U	RF-1211	N/A
Micro-Coax	RF Cable	UFB311A-1-0787-50U50U	EMC-351	N/A
Micro-Coax	RF Cable	UTI Flex	RF-359	N/A
Micro-Coax	RF Cable	UTI Flex	RF-1210	N/A
Maury Microwave	RF Cable	SP-292-MM-197	RF-1202	N/A
Pasternack	Attenuator	PE7004-6	EMC-950	N/A

Equipment used for AC Line Conducted Emissions Measurement				
Manufacturer	**Description**	**Model #**	**Asset #**	**Calibration Due**
Rohde & Schwarz	Analyzer/ Receiver	ESU26	RF-604	2/10/2021
Teseq	EUT LISN	NNB 51	EMC-676	1/28/2021
EMCO	AE LISN	3810/2	EMC-281	7/29/2022
Micro-Coax	Cable	UFA210A-1-1800-50U50U	EMC-367	12/6/2020
ETS Lindgren	TILE Software	v7.3.1.27	EMC-987	N/A
Fluke	Multimeter	87V	EMC-839	11/4/2020(1)
MadgeTech	Environmental Monitor	PRHTemp2000	EMC-881	10/31/2021(1)
Chroma	AC Power Source	61602	EMC-055	N/A

Note: Items with Calibration Due date marked as N/A are characterized before use, where applicable.
Note(1): All equipment was within calibration dates during time of test.

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers are placed on the ground plane between the receiving antenna and the EUT to meet Site VSWR requirements in accordance with ANSI C63.4:2014.

8.1.1 Radiated Measurements in 9 kHz- 30 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A loop antenna is positioned at 3m from the EUT periphery at 1m height from the ground. The turntable is rotated 360 degrees to determine the highest emissions. This is repeated for three measurement antenna orientations – parallel, perpendicular, and ground parallel. All possible orientations, X, Y, and Z axes, of the EUT were investigated for emissions and the flat orientation was identified as the worst-case configuration.

Measurements were performed on an alternative test site that demonstrate equivalence to an open field site per KDB 414788 D01.

8.1.2 Radiated Measurements in 30 MHz - 1000 MHz

The EUT was positioned on a 80cm non-conducted tables on top of a turntable. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees, and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both horizontal and vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the vertical standing orientation was identified as the worst-case configuration.

8.1.3 Radiated Measurements1 GHz – 40 GHz

The EUT was placed on a 1.5m device positioner on top of a turntable. A linearly polarized antenna is positioned 3m from the EUT periphery. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The device positioner rotated the EUT in elevation from 0 to 150 degree in 30-degree increments while the turntable was rotated 360 degrees. This is repeated for both horizontal and vertical polarizations of the measurement antenna. Measurements above 18GHz were performed at a 3m distance. Near field scanning is performed to identify suspect frequencies above 1GHz.

8.1.4 Radiated Measurements 40 GHz – 100 GHz

The EUT was positioned on top of a 1.5m foam support device positioner. Near field scanning was performed to identify any suspect frequencies and their take off angle and measurement antenna orientation. The measurement antenna and harmonic mixer setup is swept 360 degrees around the EUT through 3 axes. The orientation of the antenna was swept through 180 degrees to determine the maximized position. The measurement antennas were moved back to 0.5m or 1m (40 GHz – 60 GHz) to ensure measurements are performed in the far field.

8.2 Antenna port conducted measurements

Antenna port measurements are not required. All measurements were performed using radiated measurements. Since duty cycle and occupied bandwidth are relative measurements, they were performed without accurate amplitude correction factors.

8.3 Test Setup Diagrams

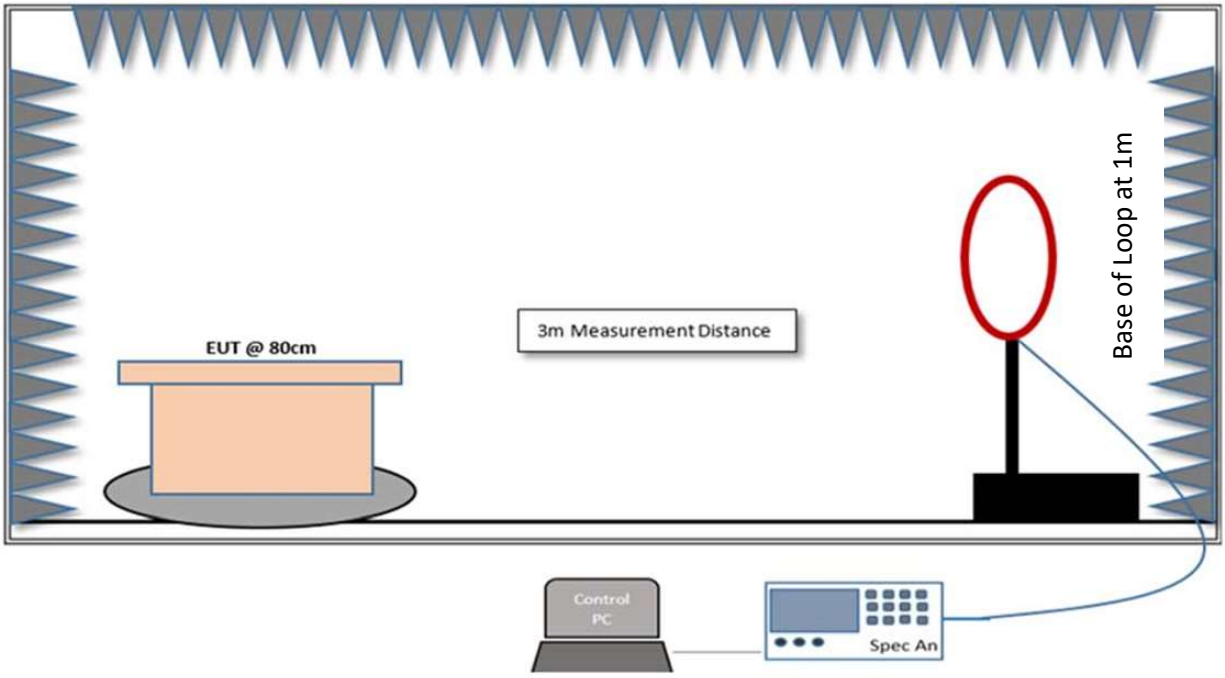

Fig.2. Test Setup for Radiated measurements in 9kHz - 30MHz Range

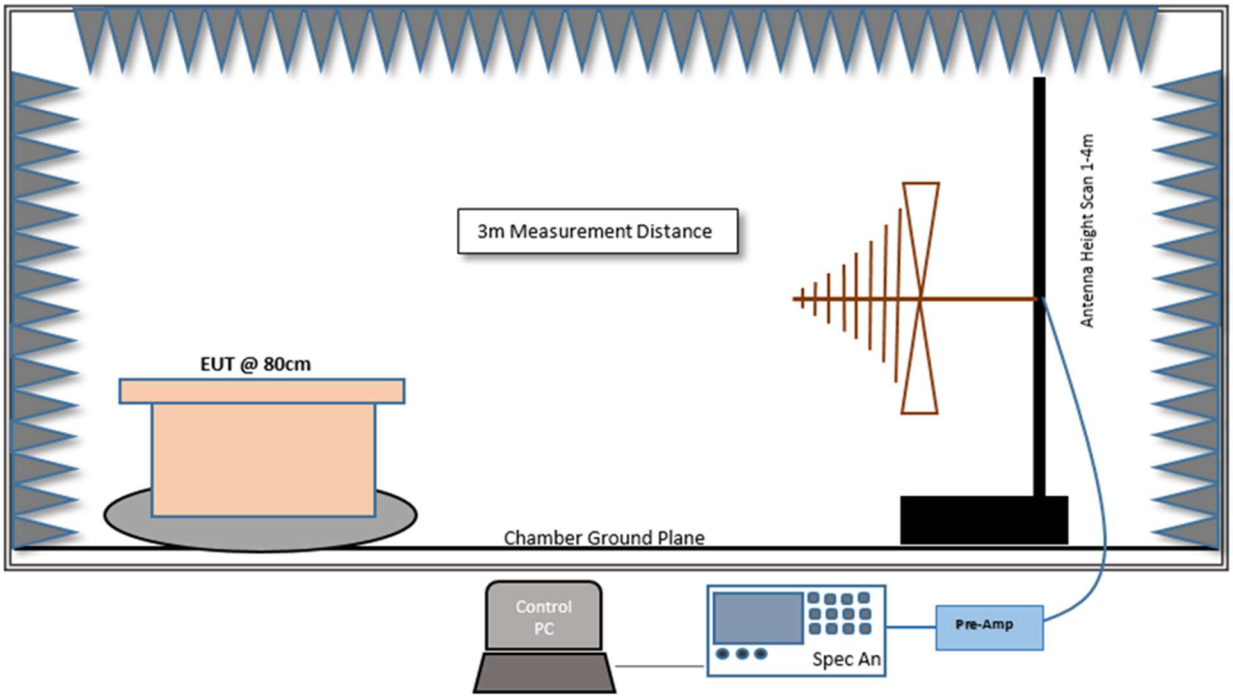

Fig.3. Test Setup for Radiated measurements in 30MHz- 1GHz Range

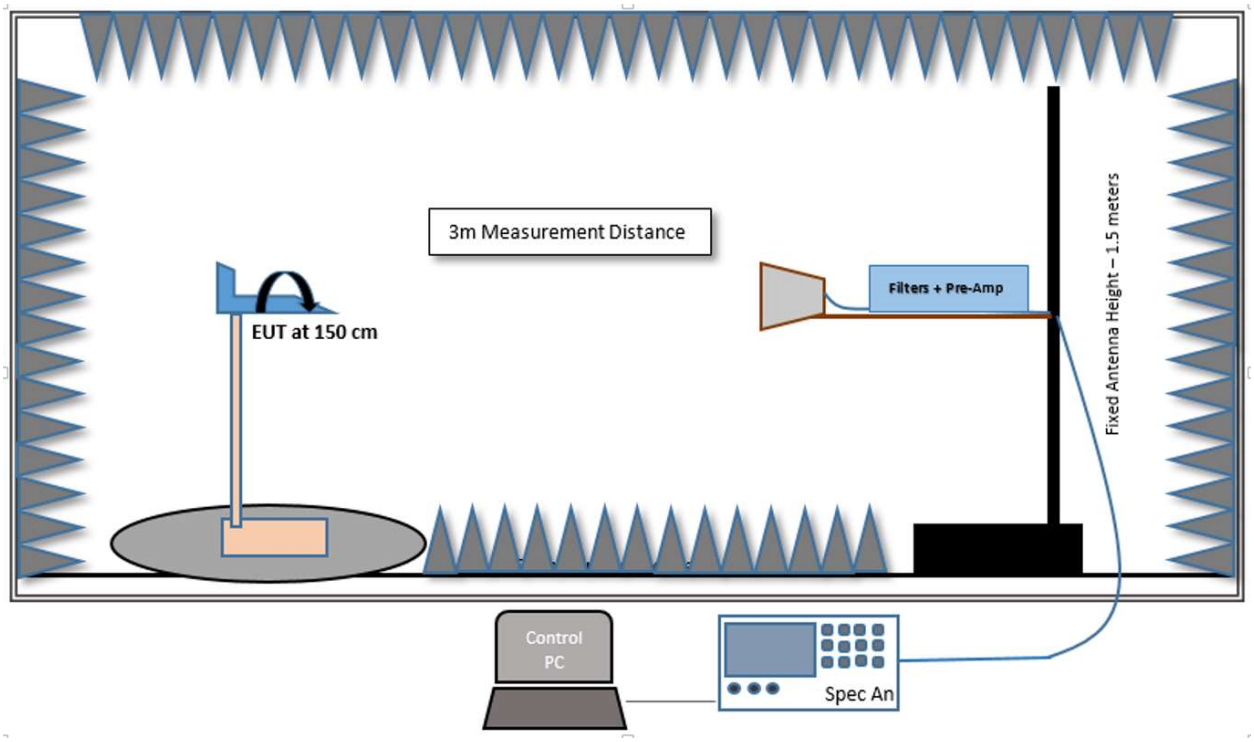

Fig.4. Test Setup for Radiated measurements in 1GHz- 18GHz Range

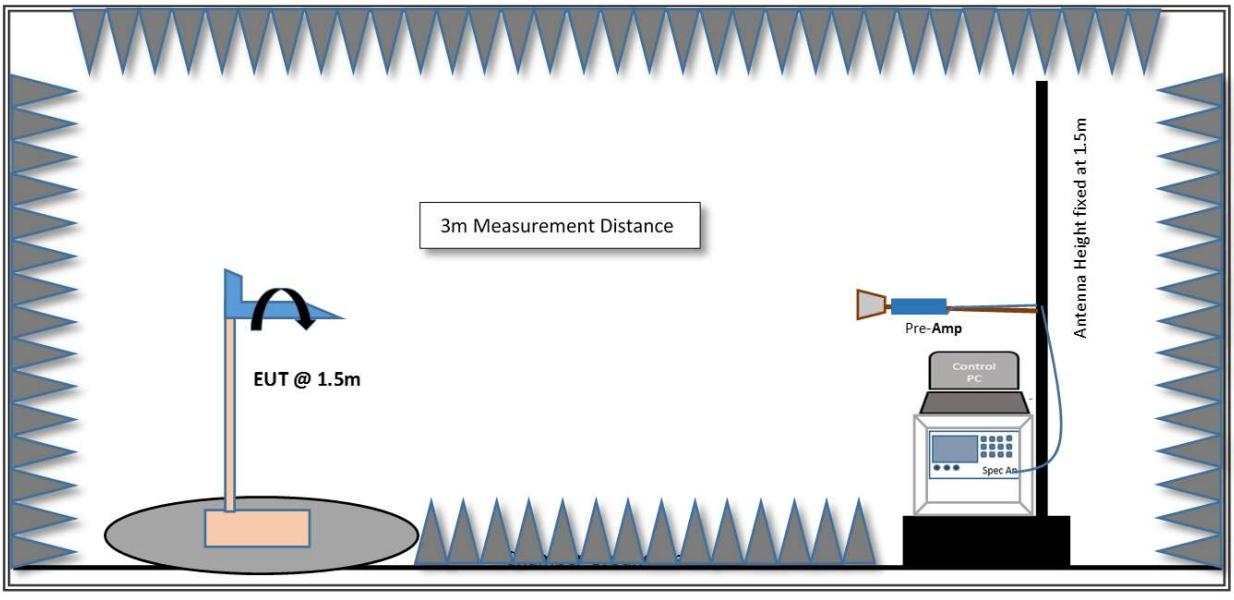

Fig.5. Test Setup for Radiated measurements 18GHz- 40GHz Range

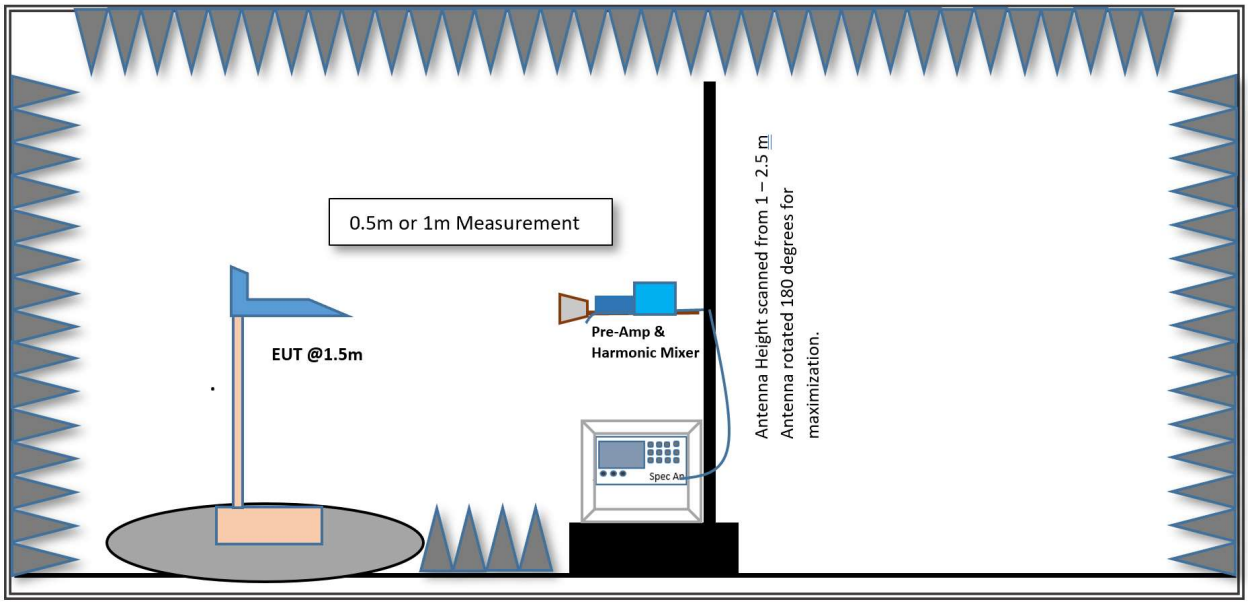

Figure 8-16 Test Setup for Radiated Measurement 40GHz- 100GHz Range

9 Test Results

9.1 Duty Cycle

9.1.1 Test Requirement:

Not applicable. Reporting and measurement purposes only.

9.1.2 Test Method

Measurements were performed using a horn antenna and a spectrum analyzer.

Spectrum Analyzer Settings:
RBW = 10 MHz
VBW = 10 MHz
Trace = Peak Clear Write
Sweep Time = 1 s

9.1.3 Test Results

Frequency (MHz)	Mode	On Time (ms)	Period (ms)	Duty Cycle (%)
24200	Pulsed	115.94	320.29	36.20

Note: On Time is > 100 ms, therefore duty cycle correction factor cannot be applied.

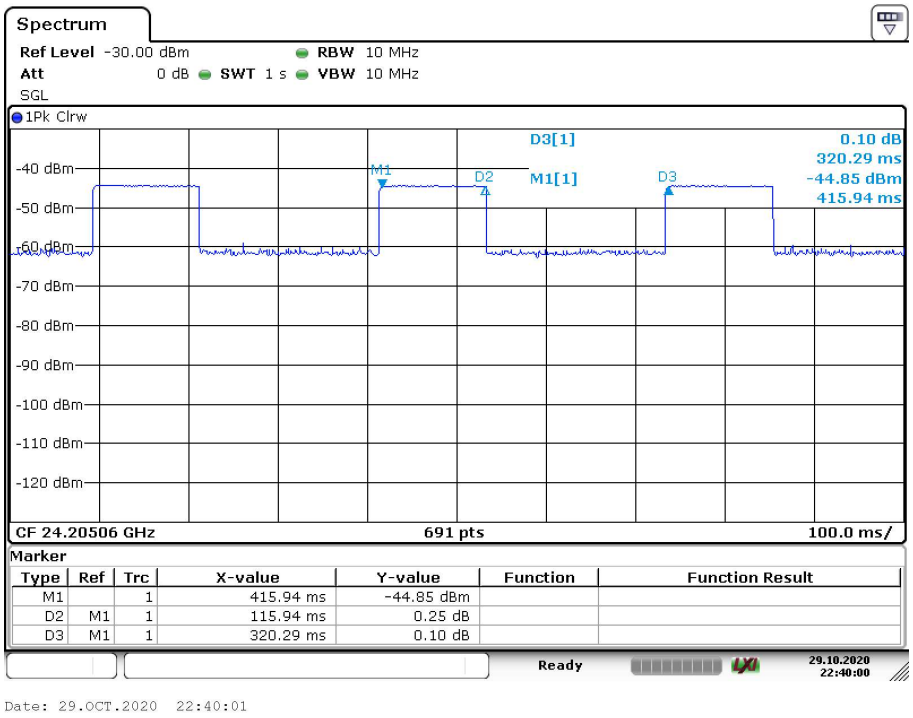

Figure 9-1. Duty Cycle

9.2 Occupied Bandwidth and 20 dB Bandwidth

9.2.1 Test Requirement

FCC 15.215

RSS-Gen [6.7]

9.2.2 Test Method

The measurement was performed according to ANSI C63.10:2013 section 6.9.3.

Spectrum Analyzer Settings:
RBW = 1% to 5% of OBW
VBW = 3 x RBW
Trace Mode = Peak Detector (Max Hold)
Sweep time = Auto Couple
Span = 1 to 5 times OBW

9.2.3 Limits

Not Applicable. Reporting purposes only.

9.2.4 Test Results

Carrier Frequency (MHz)	Mode	Occupied Bandwidth (MHz)
24200	Pulsed	4.04

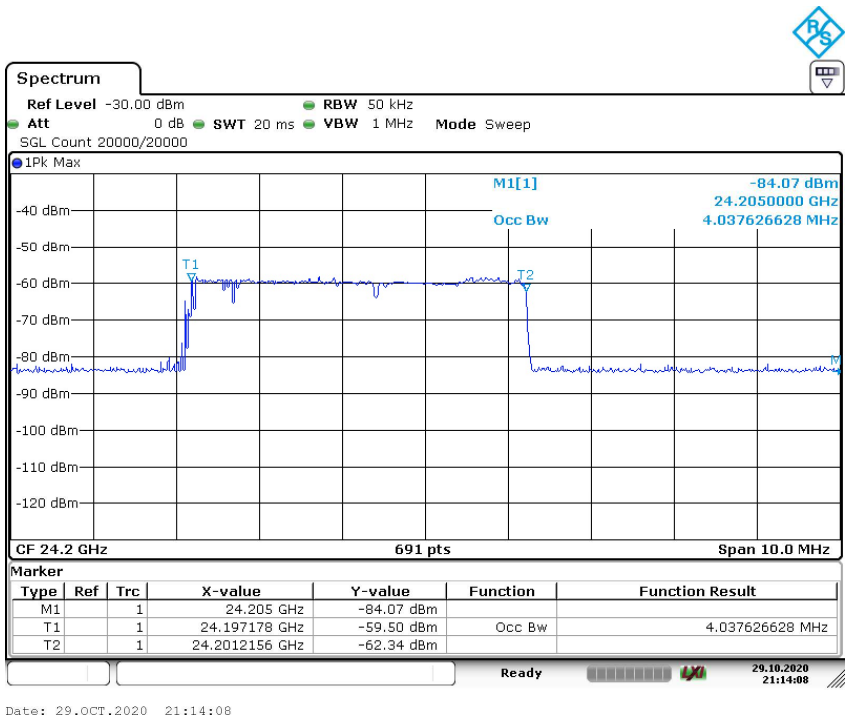

Figure 9-2. Occupied Bandwidth 24.2 GHz

Example Calculation

20 dB Bandwidth = Δ Marker 3 (MHz) – Δ Marker 2 (MHz)

e.g. 20 dB Bandwidth = 0.5 MHz - -4 MHz = 4.5 MHz

Carrier Frequency (MHz)	Mode	20 dB Bandwidth (MHz)
24200	Pulsed	4.28

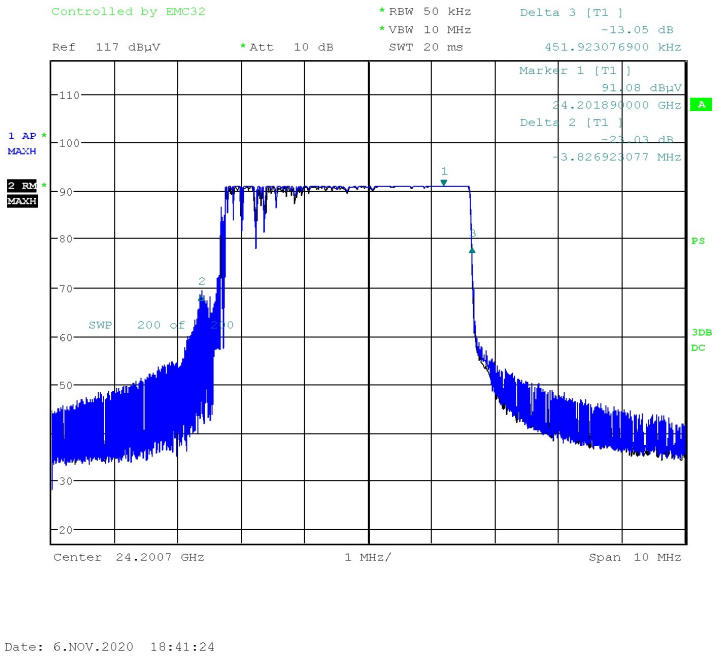

Figure 3. 20 dB Bandwidth

9.3 Field Strength of the Fundamental

9.3.1 Test Requirement:

FCC CFR 47 Rule Part 15.249 (a)(e)

ISED RSS-210 [B.10]

9.3.2 Test Method:

Measurements were performed according to ANSI C63.10: 2013. Average measurement was made over a 100ms/point averaging window.

Spectrum Analyzer settings:
Peak Fundamental Field Strength:
RBW = 10 MHz
VBW = 10 MHz
Trace Mode = Peak Detector (Max Hold)
Sweep time = Auto Couple
Span = 250 MHz

Average Fundamental Field Strength:
RBW = 10 MHz
VBW = 10 MHz
Trace Mode = RMS Average Detector (Max Hold)
Sweep time = 15.5 s
Sweep points = 155
Span = 0 Hz
Sweep Count = 10

9.3.3 Limits:

15.249: The maximum permissible fundamental field strength is 108 dBµV/m (250mV/m)

RSS-210: The maximum fundamental field strength shall not exceed 108 dBµV/m (250mV/m).

Peak Limits are 20 dB higher than Average limits.

9.3.4 Test Results:

Pass.

9.3.5 Test Data:

The data presented below is worst case. The alternative method per ANSI C63.10 was used and the EUT was positioned on its X axis with elevation at 0 degrees.

Example Calculations:

Peak Field Strength Level = Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain = 50 dBµV + 33 dB – 25 dB = 58 dBµV/m

Frequency (MHz)	Mode	H/V Pol	Peak Fundamental Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
24201.457	Pulsed	V	106.35	128	-21.65	Pass

Frequency (MHz)	Mode	H/V Pol	Duty Cycle Correction Factor (dB)	Average Fundamental Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
24201.475	Pulsed	V	0	105.97	108	-2.03	Pass

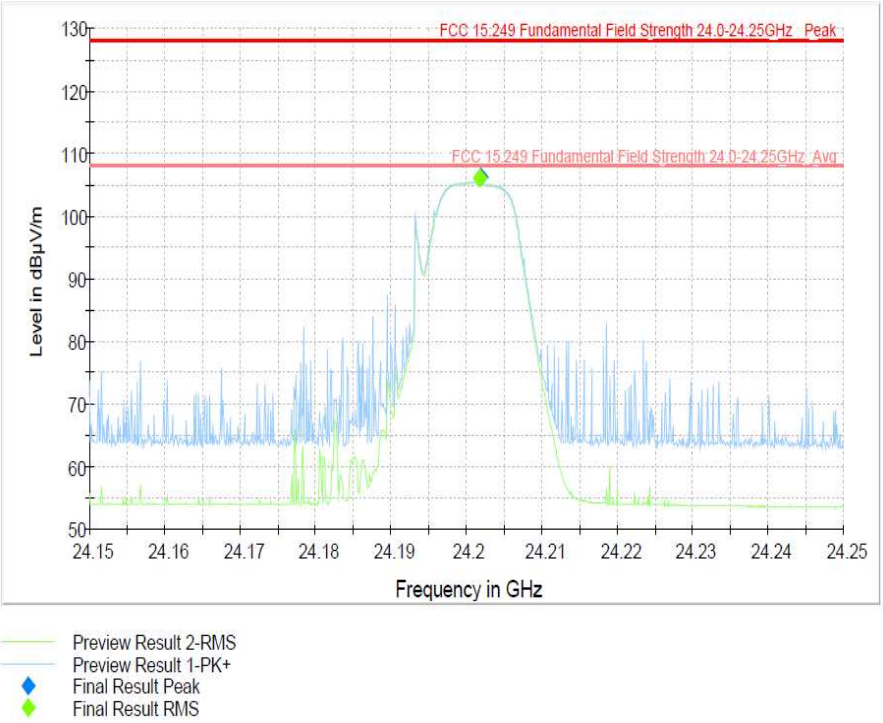

Figure 9-4. Peak Fundamental Field Strength 24.2 GHz

9.4 Radiated Spurious and Band Edge Emissions

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.249 (d) and 15.209 (a)

ISED RSS-210 [B.10] and RSS GEN [8.9]

9.4.2 Test Method:

Measurements were performed according to the procedure defined in ANSI C63.10: 2013.

Radiated spurious measurements are made from 9kHz to the 5th harmonic of the fundamental frequency of the transmitter or 100 GHz, whichever is lesser. Measurements below 30MHz were performed since the radio circuitry of the EUT generates frequencies below 30MHz. The limit for radiated spurious emissions is per 15.249 and RSS-210 [B.10]. Additionally, emissions found in the restricted bands listed in 15.205 and RSS-Gen [8.9] were tested for compliance per limits in 15.209 and RSS-Gen [8.9].

The EUT was tested on the channel of operation. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions.

An external pre-amp was required for measurements above 1 GHz, to provide the measuring system with sufficient sensitivity. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength.

Below 30 MHz, the loop antenna was used in Parallel, Perpendicular, and Ground Parallel orientations. For measurements from 9 kHz – 1000 MHz, the EUT was measured in X, Y, and Z orientations.

Above 30 MHz both horizontal and vertical antenna polarizations were investigated. Worst-case maximized data for both polarizations is shown in this test report.

Measurements above 1 GHz were performed using the alternative measurement method per ANSI C63.10. The EUT was scanned in Azimuth from 0 to 360 degrees and in elevation from 0 to 150 degrees in 30 degree increments.

Measurements above 40 GHz were performed with harmonic mixers. The spectrum analyzer's "Signal ID" function was used to identify real emissions from image frequencies generated by the measurement equipment. Measurements were first performed by hand in the near field to determine the takeoff angle and antenna orientation. Scanning was performed in 360 degree sweeps about 3 axes. The antenna orientation was scanned 180 degrees once an emission was identified. Final measurements were taken using an antenna boom with the horn antenna's in the far field, meeting $\frac{2D^2}{\lambda}$ criterion.

Radiated Spurious Emissions

Spectrum Analyzer Settings:

30 MHz- 1 GHz:

RBW = 120 kHz
VBW ≥ 3 X RBW
Trace Mode: Peak Detector (Max Hold). Final measurements performed using QP Detector.
Span= 30 MHz - 1 GHz
Sweep time= Auto
Sweep points ≥ 2 x Span/RBW

Above 1 GHz:

RBW= 1 MHz
VBW= 3 MHz
Trace Mode: Peak Detector (Max Hold)
Span= 1 - 18 GHz and 18 - 26.5 GHz.
Sweep time= Auto
Sweep points ≥ 2 x Span/RBW

Final Measurements above 1 GHz

Peak Measurements

Spectrum Analyzer Settings:

RBW= 1 MHz
VBW= 3 MHz
Trace Mode: Peak Detector (Max Hold)
Span= wide enough to encompass the emission
Sweep Points ≥ 2 × Span/RBW
Sweep Time = Auto

9.4.3 Limits:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (meters)	Corrected Field Strength for 3m measurement distance (dBµV/m)
0.009-0.490	2400/F (kHz)	300	48.5 - 13.8
0.490-1.705	24000/F (kHz)	30	33.8- 23.0
1.705-30	30	30	29.5
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
960-1000	500	3	54
Above 1000 (Restricted Frequency Bands)	500	3	54 (Average) 74 (Peak)

Note: Emissions not within restricted frequency bands are required to be more than 50 dB below the fundamental or meet the limits above.

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X kHz resulted in a level of Y dBµV/m, which is equivalent to Y-51.5 = Z dBµA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Harmonic Emissions Limits				
Frequency Band (MHz)	**Average Harmonic Emissions Limit (mV/m)**	**Measurement Distance (meters)**	**Average Harmonic Emissions Limit (dBµV/m)**	**Peak Harmonic Emissions Limit (dBµV/m)**
24000 - 24250	2.5	3	68	88

9.4.4 Test Result:

Pass.

9.4.5 Test Data:

Sample Calculations:

Peak Field Strength Level: Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain = 50 dBµV + 33 dB – 25 dB = 58 dBµV/m

9.4.5.1 Band Edge Emissions

The alternative method per ANSI C63.10 was used and the EUT was positioned on its X axis with elevation at 0 degrees.

Band Edge Average Data							
Carrier Frequency (MHz)	**Frequency (MHz)**	**H/V Pol**	**Raw Peak. Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	23826.096	V	35.75	14.0	49.75	54	-4.25

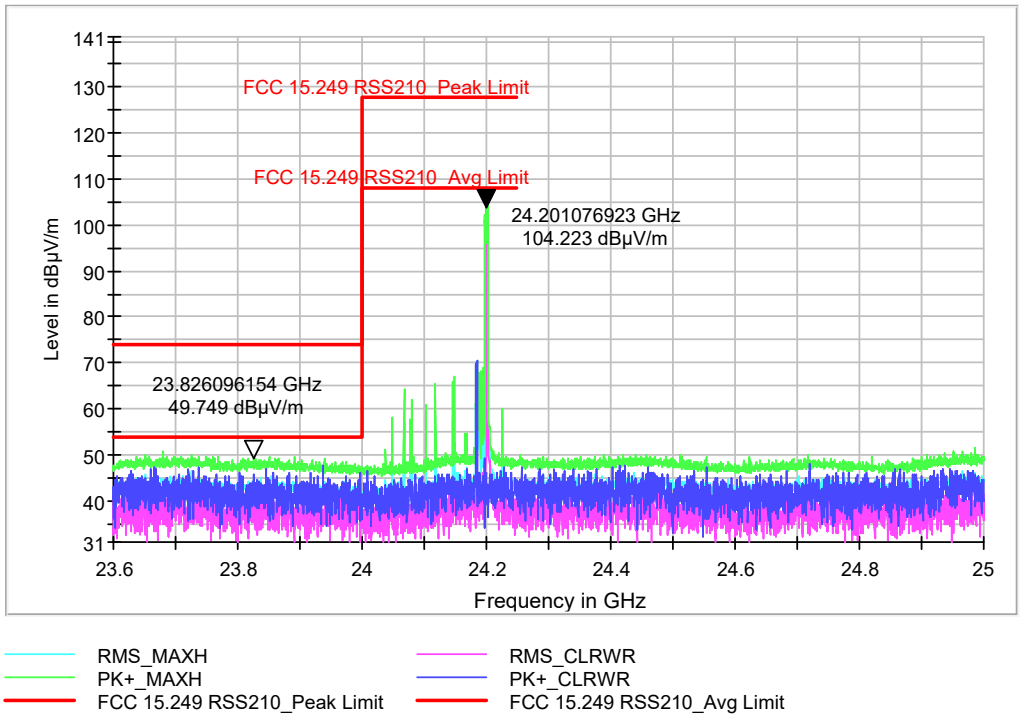

Figure 9-2 Radiated Restricted Band Emissions at the Band Edge 24.2 GHz SRD

9.4.5.2 Emissions in 9 kHz – 30 MHz range

Worst case results are shown. The data was taken with the EUT is X orientation and the measurement antenna in Ground Parallel Orientation.

RSE 9 kHz-30 MHz							
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**Loop Orientation**	**Raw Peak Amplitude (dBµV/m)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	0.0099	Ground Parallel	3.88	4.1	7.98	47.71	-39.73
24200	0.1605	Ground Parallel	22.8	-17.1	5.7	24.58	-18.88

RSE 9 kHz -30 MHz							
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**Loop Orientation**	**Raw Quasi-Peak Amplitude (dBµV/m)**	**Correction Factor (dB)**	**Corrected Quasi-Peak Field Strength (dBµV/m)**	**Quasi-Peak Limit (dBµV/m)**	**Quasi-Peak Margin (dB)**
24200	0.529	Ground Parallel	-0.1	12.1	12	33.59	-21.59
24200	0.677	Ground Parallel	-1	9.7	8.7	31	-22.3
24200	6.417	Ground Parallel	-7.9	-4.4	-12.3	29.5	-41.8
24200	22.988	Ground Parallel	-8.2	-5	-13.2	29.5	-42.7

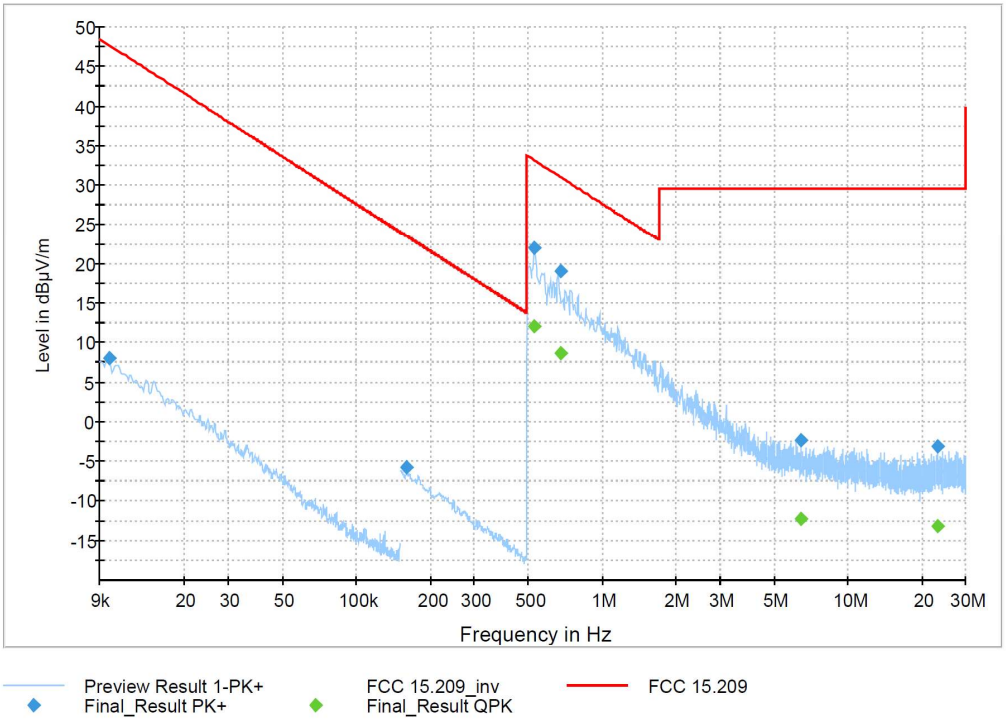

Figure 9-5. Radiated Spurious Emissions 24.2 GHz SRD (9 kHz – 30 MHz)

9.4.5.3 Emissions in 30 MHz- 1 GHz range

Worst case results are shown here. Measurements about the EUT's X-axis were worst case.

RSE 30-1000 MHz							
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**H/V Pol**	**Raw Quasi-Peak Amplitude (dBµV/m)**	**Correction Factor (dB)**	**Corrected Quasi-Peak Field Strength (dBµV/m)**	**Quasi-Peak Limit (dBµV/m)**	**Quasi-Peak Margin (dB)**
24200	30.34	V	1.84	27.4	29.24	40.00	-38.16
24200	36.45	V	3.54	23.1	26.64	40.00	-36.46
24200	45.81	V	-1.7	16.6	14.9	40.00	-41.7
24200	55.45	V	5.47	14.1	19.57	40.00	-34.53
24200	64.00	V	10.24	14.6	24.84	40.00	-29.76
24200	80.00	V	11.05	14.4	25.45	40.00	-28.95
24200	96.01	V	12.23	16.3	28.53	43.52	-31.29
24200	127.97	V	5.7	20.6	26.3	43.52	-37.82
24200	144.02	H	9.6	19.9	29.5	43.52	-33.92
24200	259.68	V	6.25	19.9	26.15	46.02	-39.77
24200	917.58	V	-1.01	31.7	30.69	46.02	-47.03

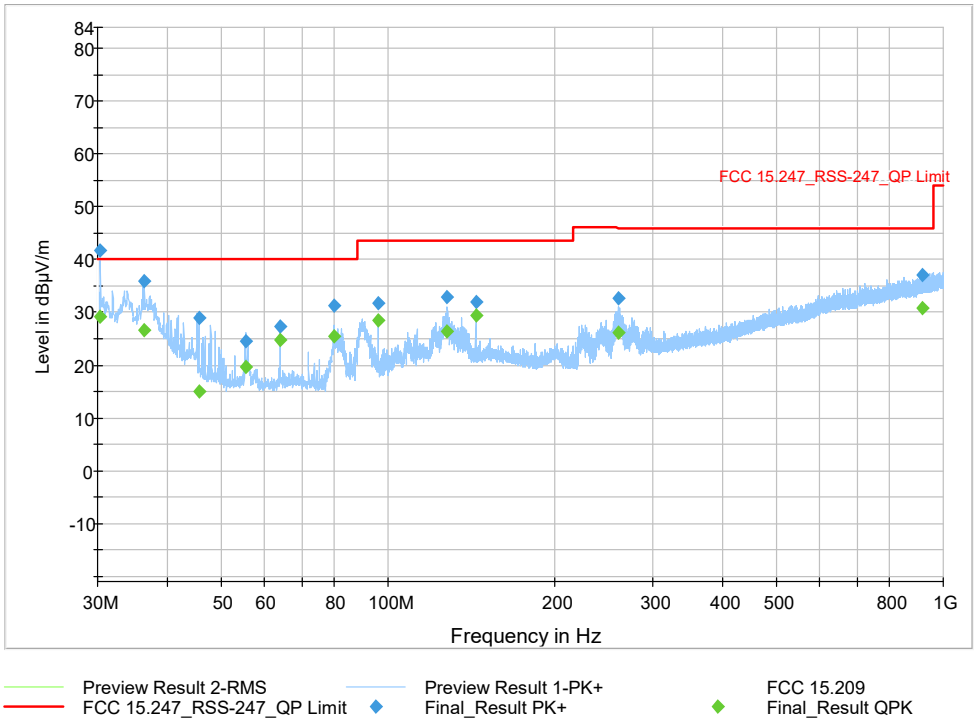

Figure 9-6. Radiated Spurious Emissions 24.2 GHz SRD (30MHz - 1GHz)

9.4.5.4 Emissions in 1-18 GHz range

Worst case results shown here. The alternative method per ANSI C63.10 was used and the EUT was positioned on its X axis with elevation at 0 degrees.

RSE 1 - 18GHz Average Data							
Carrier Frequency (MHz)	**Frequency (MHz)**	**Raw Avg. Amplitude (dBµV)**	**Correction Factor (dB)**	**DC Correction Factor (dB)**	**Corrected Avg. Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	17896.042	19.91	23.7	0	43.61	54	-10.39

RSE 1 - 18GHz Peak Data						
Carrier Frequency (MHz)	**Frequency (MHz)**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Peak Limit (dBµV/m)**	**Margin (dB)**
24200	17908.842	31.36	23.7	55.06	74	-18.94

Note1: Emission does not fall in a restricted band

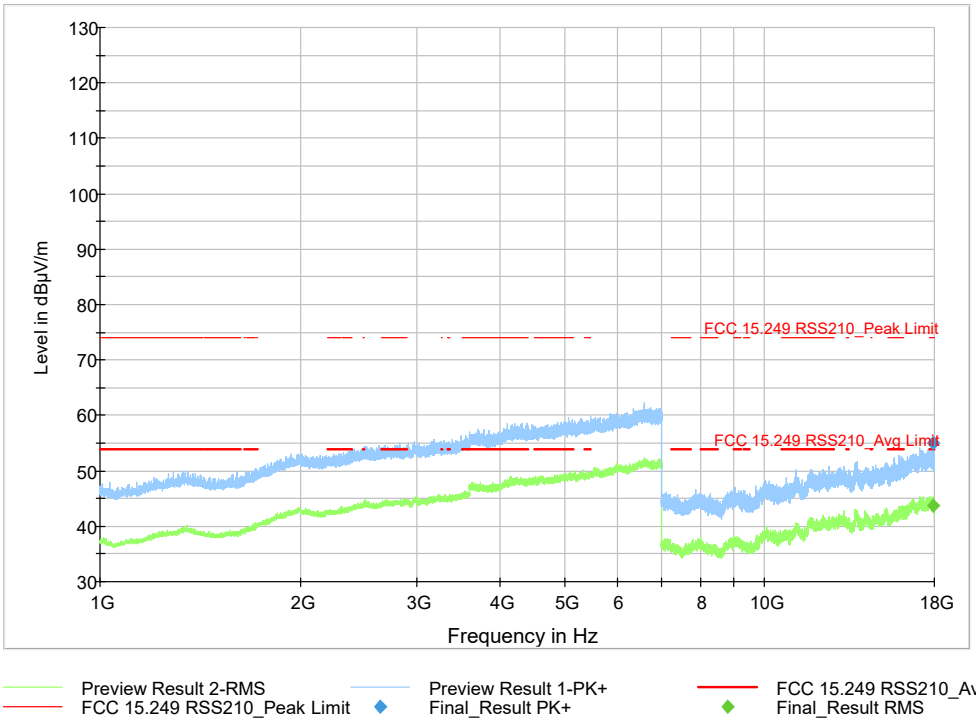

Figure 9-7. Radiated Spurious Emissions 24.2 GHz SRD (1-18 GHz)

9.4.5.5 Emissions in 18-26.5 GHz range

Worst case results are shown here. The alternative method per ANSI C63.10 was used and the EUT was positioned on its X axis with elevation at 0 degrees.

RSE 18 – 26.5GHz Average Data								
Carrier Frequency (MHz)	**Frequency (MHz)**	**H/V Pol**	**Raw Avg. Amplitude (dBµV)**	**Correction Factor (dB)**	**DC Correction Factor (dB)**	**Corrected Avg. Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	23688.625	V	35.05	14	0	49.05	54	-4.95
24200	26381.250	V	34.04	14.3	0	48.34	54	-5.66

RSE 18 – 26.5GHz Peak Data							
Carrier Frequency (MHz)	**Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Peak Limit (dBµV/m)**	**Margin (dB)**
24200	23709.025	V	21.77	14.2	57.94	74	-16.06
24200	26383.550	V	44.00	14.2	58.20	74	-15.80

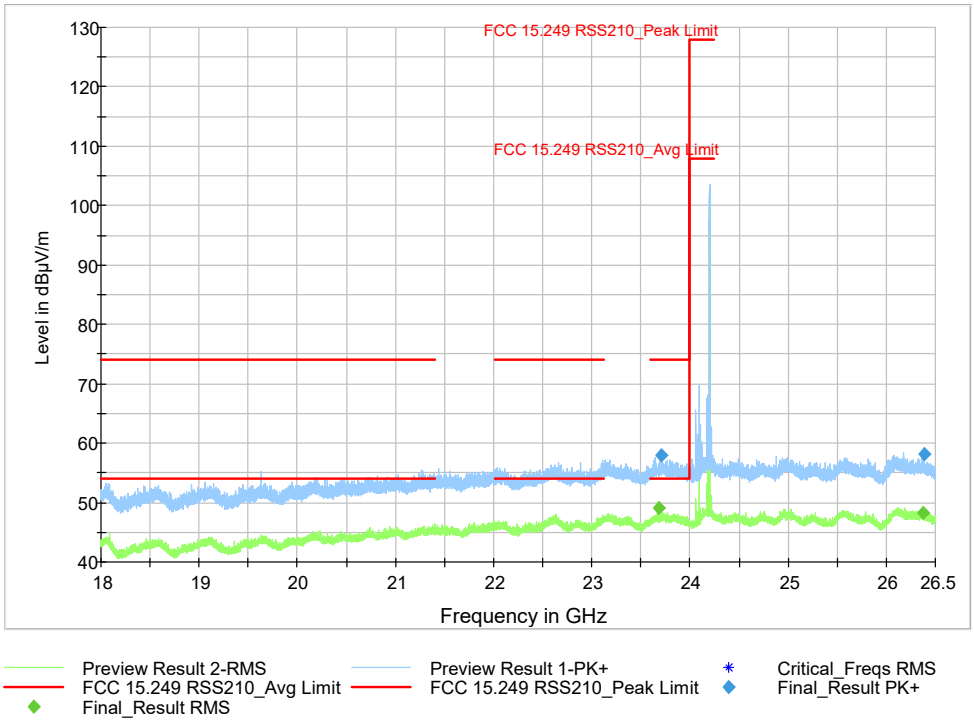

Figure 9-8. Radiated Spurious Emissions 24.2 GHz SRD (18 – 26.5 GHz)

9.4.5.6 Emissions in 26.5-40 GHz range

Worst case results are shown here. The alternative method per ANSI C63.10 was used and the EUT was positioned on its X axis with elevation at 0 degrees.

RSE 26.5 – 40 GHz Average Data								
Carrier Frequency (MHz)	**Frequency (MHz)**	**H/V Pol**	**Raw Avg. Amplitude (dBµV)**	**Correction Factor (dB)**	**DC Correction Factor (dB)**	**Corrected Avg. Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	39820.450	V	40.7	3.6	0	44.30	54	-9.70

RSE 26.5 – 40 GHz Peak Data							
Carrier Frequency (MHz)	**Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Peak Limit (dBµV/m)**	**Margin (dB)**
24200	39820.450	V	50.08	3.6	53.68	74	-20.32

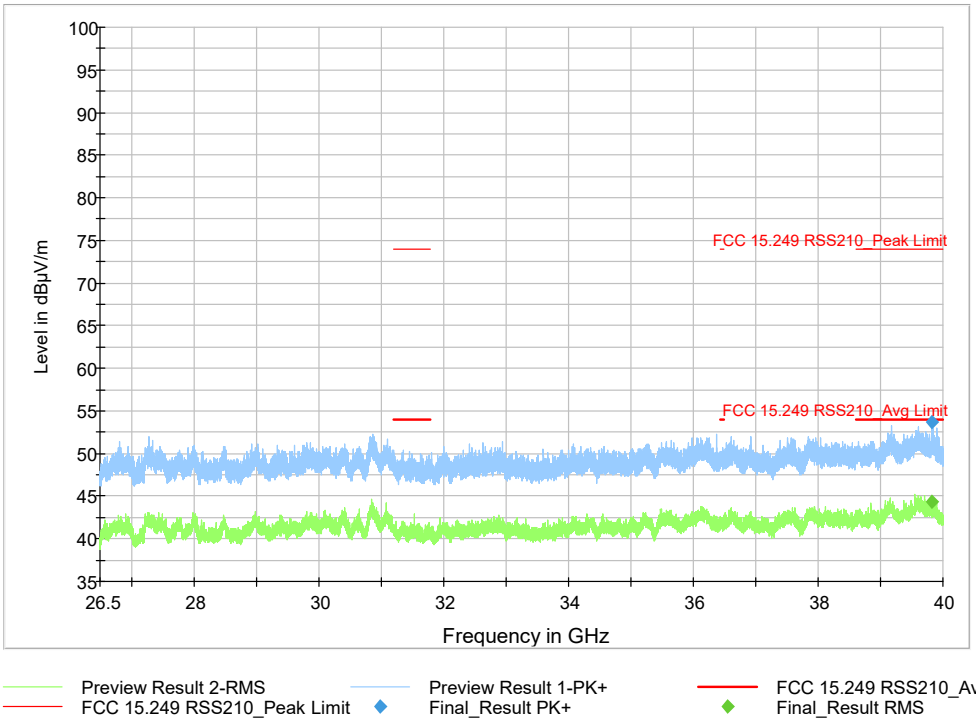

Figure 9-9. Radiated Spurious Emissions 24.2 GHz SRD (26.5 - 40 GHz)

9.4.5.7 Emissions in 40 GHz – 60 GHz range

Note: Image frequencies are frequencies produced by the measurement equipment and are not from the EUT. Since these emissions were identified in the pre-scan, they were investigated further. The spectrum analyzer's "Signal ID" function was used to discern real emissions from image frequencies. Worst case results are reported below for the X axis orientation of the EUT.

RSE 40 - 60GHz Image Frequencies (Peak Data)					
Carrier Frequency (MHz)	**Image Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**
24200	59777.0	V	60.64	-9.54	60.64
24200	53872.5	V	66.83	-9.54	57.29
24200	48403.0	V	65.92	-9.54	56.38
24200	47758.0	V	64.72	-9.54	55.18
24200	40281.5	V	61.34	-9.54	51.80

RSE 40 - 60 GHz Average Data								
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**H/V Pol**	**Raw Avg. Amplitude (dBµV)**	**Correction Factor (dB)**	**Duty Cycle Correction Factor (dB)**	**Corrected Avg. Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	48402.32	V	57.85	-9.54	0	48.31	68	-19.69

RSE 40 - 60GHz Peak Data							
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Peak Limit (dBµV/m)**	**Margin (dB)**
24200	48402.32	V	65.448	-9.54	55.91	88	-32.09

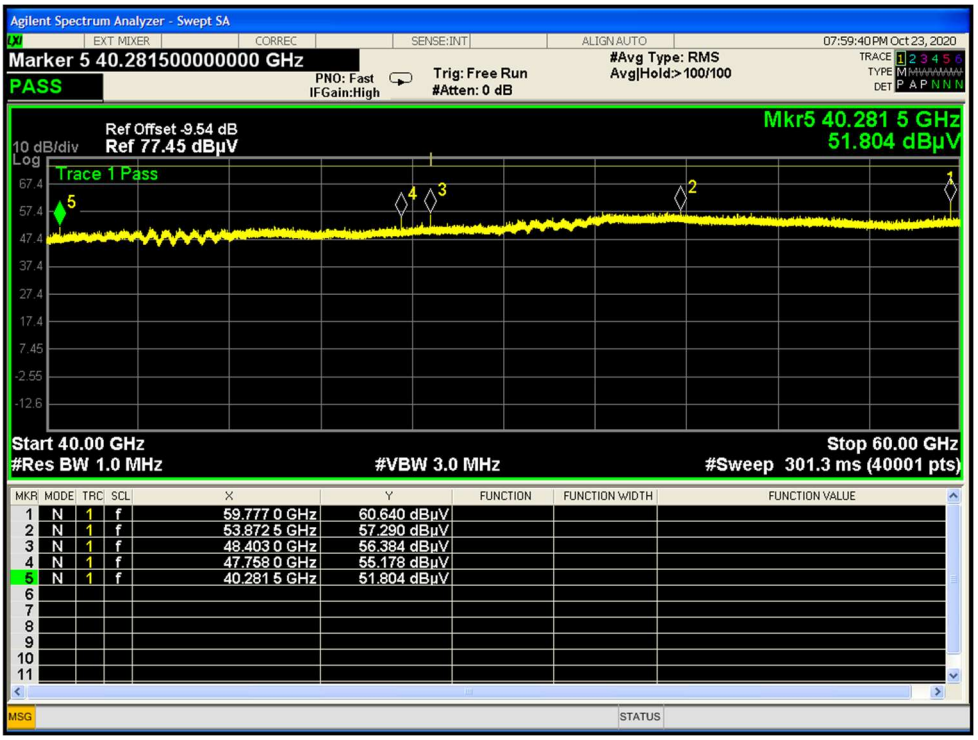

Figure 9-10. Radiated Spurious Emissions 24.2 GHz SRD_Pre Scan_Vertical_(40 - 60 GHz)

Figure 9-11. Radiated Spurious Emissions 24.2 GHz SRD_Vertical_(40 - 60GHz)_Average

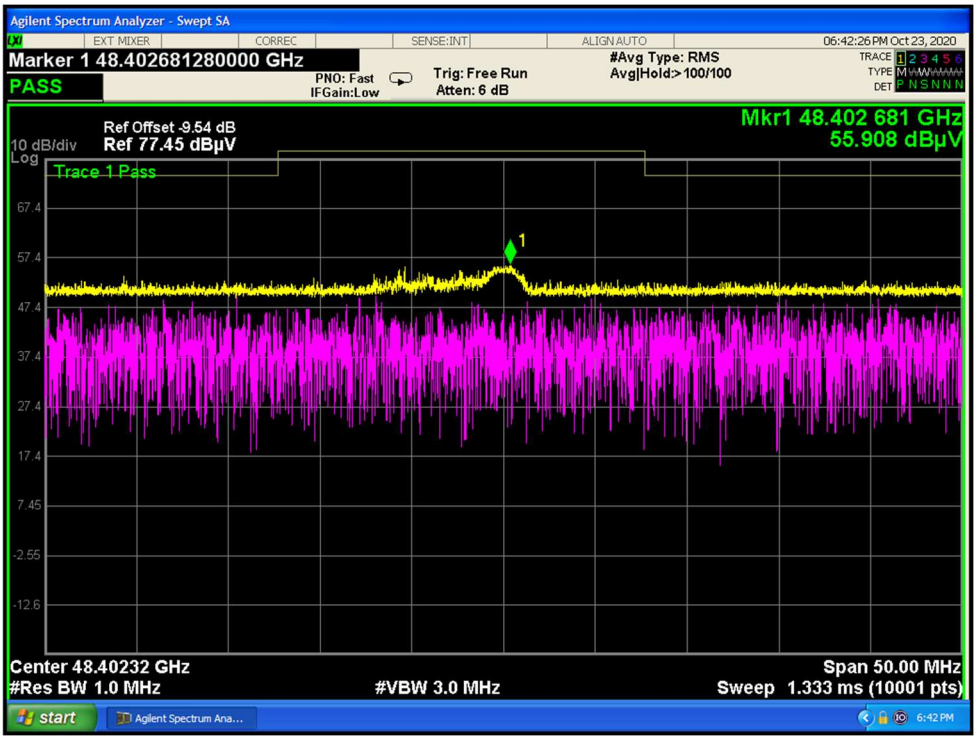

Figure 9-12. Radiated Spurious Emissions 24.2 GHz SRD_Vertical_(40 - 60 GHz)_Peak

9.4.5.8 Emissions in 50 – 75 GHz range

Note: Image frequencies are frequencies produced by the measurement equipment and are not from the EUT. Since these emissions were identified in the pre-scan, they were investigated further. The spectrum analyzer's "Signal ID" function was used to discern real emissions from image frequencies. Measurements about the EUT's X-axis were worst case.

RSE 50 - 75GHz Image Frequencies (Peak Data)					
Carrier Frequency (MHz)	**Image Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**
24200	72765.63	V	73.34	-15.56	57.78
24200	71797.50	V	74.46	-15.56	58.90
24200	58146.88	V	58.02	-15.56	42.46
24200	52831.88	V	56.35	-15.56	40.79
24200	52128.13	V	55.87	-15.56	40.31
24200	72765.10	H	78.54	-15.56	62.98
24200	71797.20	H	78.32	-15.56	62.76
24200	58147.40	H	60.08	-15.56	44.52
24200	57373.60	H	59.53	-15.56	43.97
24200	52831.60	H	59.76	-15.56	44.20
24200	52128.10	H	60.39	-15.56	44.83

RSE 50 - 75 GHz Average Data								
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**H/V Pol**	**Raw Avg. Amplitude (dBµV)**	**Correction Factor (dB)**	**DC Correction Factor (dB)**	**Corrected Avg. Field Strength (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**
24200	72603.56	H	60.59	-15.56	0	45.03	68	-22.97

RSE 50 - 75GHz Peak Data							
Carrier Frequency (MHz)	**Emission Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**	**Peak Limit (dBµV/m)**	**Margin (dB)**
24200	72600.00	H	72.88	-15.56	57.32	88	-30.68

Figure 9-13. Radiated Spurious Emissions 24.2 GHz SRD_Pre Scan_Vertical_(50-75 GHz)
Note: Pre-scan data shows image frequencies above the average limit. These are not from the EUT.

Figure 9-14. Radiated Spurious Emissions 24.2 GHz SRD_Pre Scan_Horizontal (50-75 GHz)

Note: Pre-scan data shows image frequencies above the average limit. These are not from the EUT.

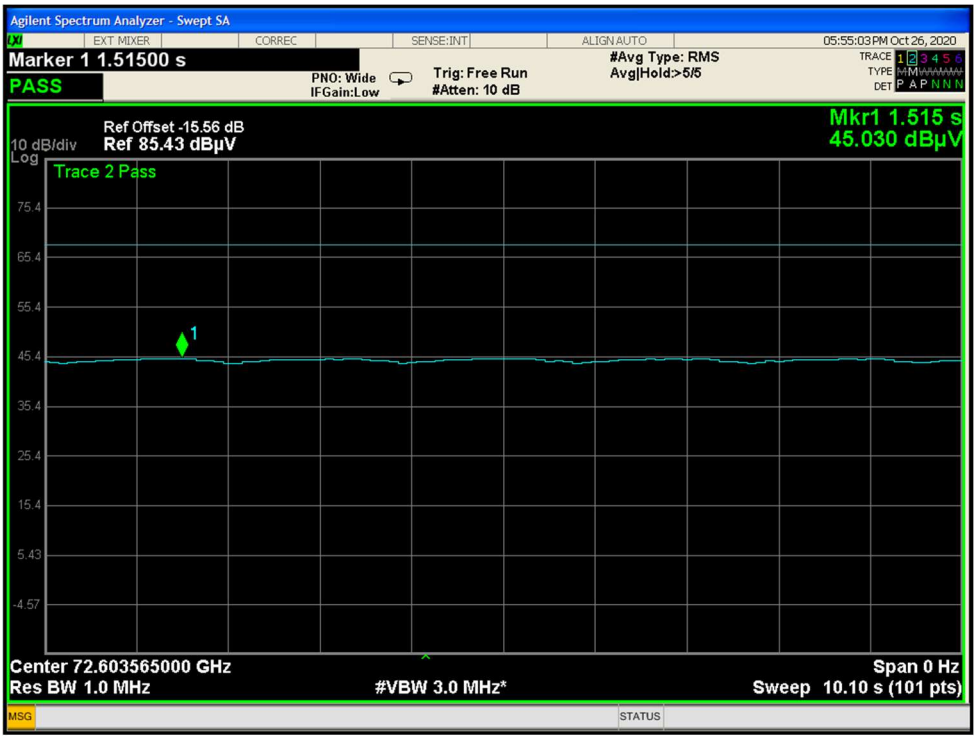

Figure 9-15. Radiated Spurious Emissions 24.2 GHz SRD_Horizontal_

(50-75 GHz)_Average

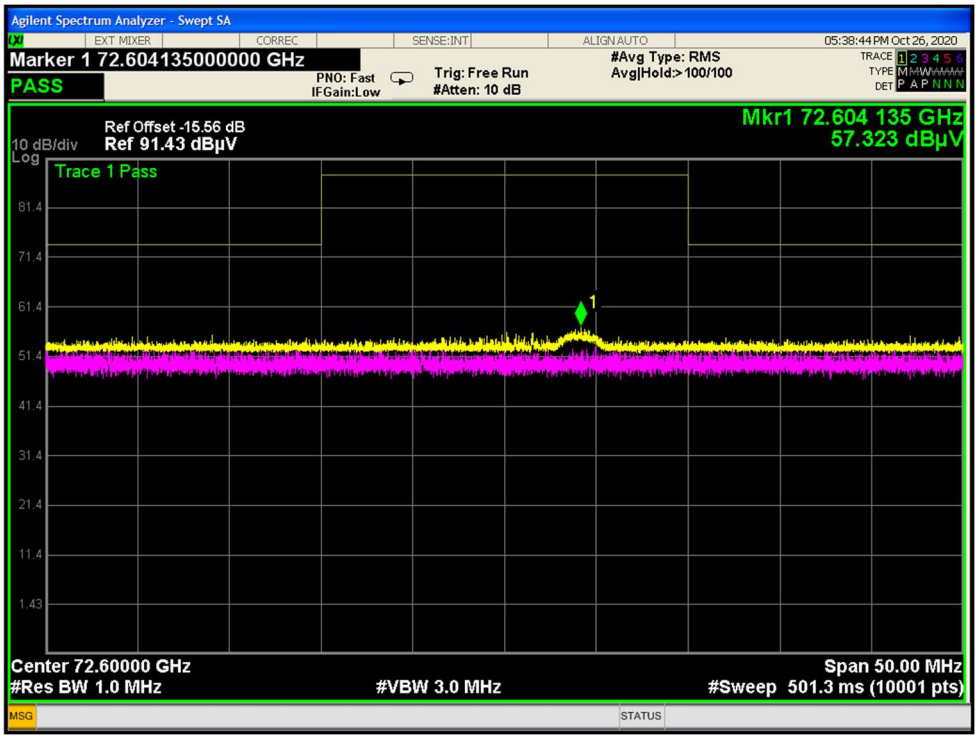

Figure 9-16. Radiated Spurious Emissions 24.2 GHz SRD_Horizontal_(50-75 GHz)_Peak

9.4.5.9 Emissions in 75 - 100 GHz range

Note: Image frequencies are frequencies produced by the measurement equipment and are not from the EUT. Since these emissions were identified in the pre-scan, they were investigated further. The spectrum analyzer's "Signal ID" function was used to discern real emissions from image frequencies. Measurements about the EUT's X-axis were worst case.

RSE 75 - 100GHz Image Frequencies (Peak Data)					
Carrier Frequency (MHz)	**Image Frequency (MHz)**	**H/V Pol**	**Raw Peak Amplitude (dBµV)**	**Correction Factor (dB)**	**Corrected Peak Field Strength (dBµV/m)**
24200	96915.63	V	67.66	-15.56	52.10
24200	96056.25	V	67.42	-15.56	51.86
24200	83025.00	V	58.04	-15.56	42.48
24200	82287.50	V	58.02	-15.56	42.46
24200	76775.00	V	55.21	-15.56	39.65
24200	96916.25	H	74.97	-15.56	59.41
24200	96056.25	H	74.06	-15.56	58.50
24200	83023.75	H	64.12	-15.56	48.56
24200	82286.88	H	63.34	-15.56	47.78
24200	76779.38	H	60.86	-15.56	45.30

Figure 9-17. Radiated Spurious Emissions 24.2 GHz SRD_Pre Scan_Vertical_(75-100 GHz)

Figure 9-18. Radiated Spurious Emissions 24.2 GHz SRD_Pre Scan_Horizontal (75-100 GHz)

Note: Pre-scan data shows image frequencies above the average limit. These are not from the EUT. No harmonics observed for 75 – 100 GHz.

9.5 AC Line Conducted Emissions

9.5.1 Test Requirements

FCC CFR 47 Rule Part 15.207 (a)

ISED RSS Gen [8.8]

9.5.2 Test Method

Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the unsymmetric radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with the power cords that are used under normal operating conditions. These measurements are made using a LISN (Line Impedance Stabilization Network). AC powered peripherals are attached to a second LISN with the 50 ohm measuring port terminated by a 50 ohm resistive load.

The EUT is set to continuously transmit at 24.2 GHz with maximum output power.

EMI Receiver Settings:
150 kHz – 30 MHz:
RBW= 9 kHz
VBW ≥ 3 X RBW
Trace Mode: Peak Detector (Max Hold).
Final measurements were performed using Quasi-Peak and Average Detectors.
Span= 150 kHz – 30 MHz
Sweep time= Auto

9.5.3 Limit

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

9.5.4 Test Result:

Pass

Test Data:

Sample Calculations:

Emission Level:

Amplitude (Analyzer level) + LCF (LISN Factor and Cable loss) = 20dBµV + 12dB = 32dBµV

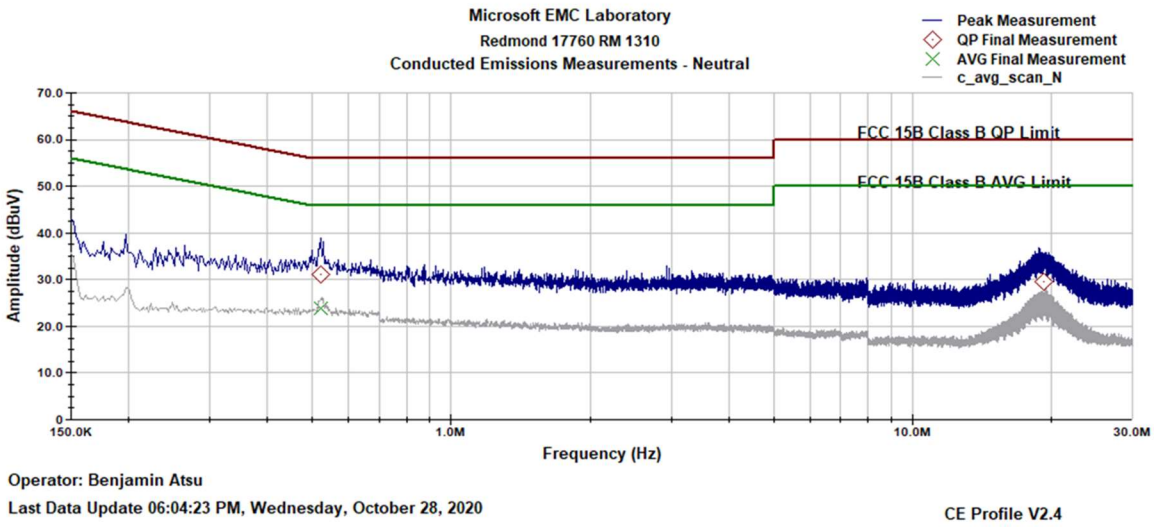

Figure 9-19 AC Line Conducted Emissions- Neutral (150 kHz- 30 MHz)

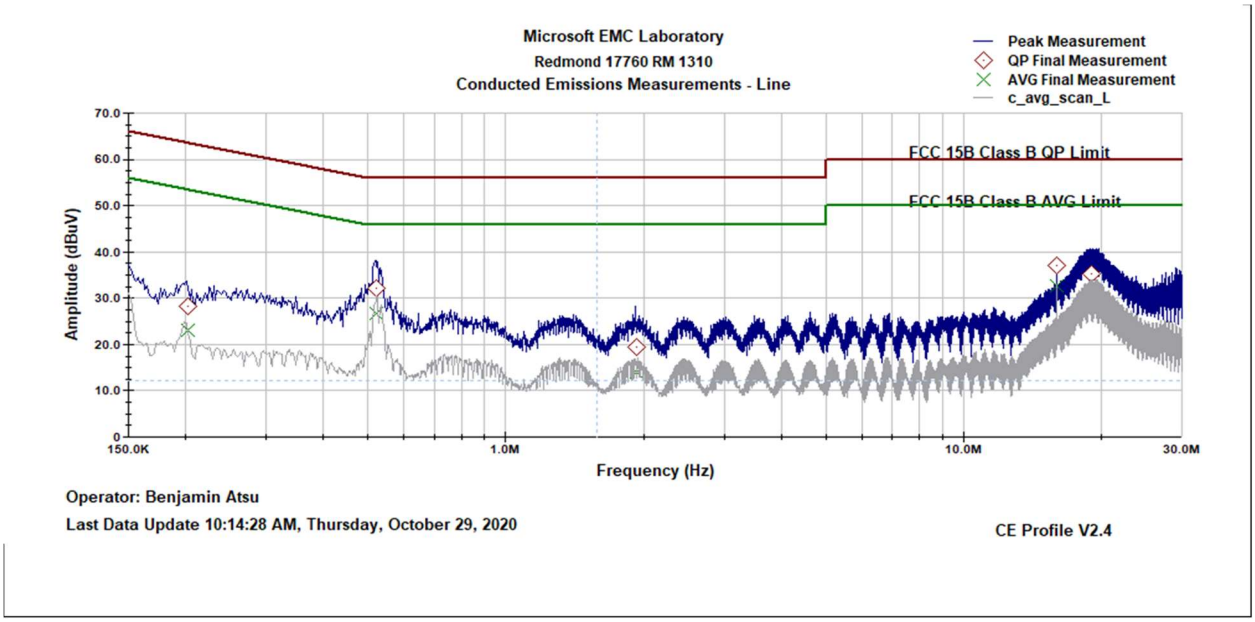

Figure 9-20 AC Line Conducted Emissions- Line (150 kHz- 30 MHz)

Frequency (MHz)	QP Net Reading (dBµV)	AVG Net Reading (dBµV)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)	Line Tested (L or N)	Quasi-Peak Margin (dB)	Average Margin (dB)
0.196	26.52	21.89	63.79	53.79	N	-37.27	-31.90
0.524	30.13	21.50	56.00	46.00	N	-25.87	-24.50
18.97	28.80	23.63	60.00	50.00	N	-31.20	-26.37
0.202	28.37	23.14	63.52	53.52	L	-35.15	-30.38
0.521	32.22	26.64	56.00	46.00	L	-23.78	-19.36
1.932	19.31	14.02	56.00	46.00	L	-36.69	-31.98
16	37.02	32.71	60.00	50.00	L	-22.98	-17.29
19.012	35.35	30.32	60.00	50.00	L	-24.65	-19.68

End of Report