TEST REPORT

Report Number. : 13214419-E4V4

Applicant	:	Microsoft Corporation One Microsoft Way Redmond, WA 98052-6399 USA
Model	:	1873
FCC ID	:	C3K1873
IC	:	3048A-1873
EUT Description	:	Portable Computing Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART E ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
April 22, 2020

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888

NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/13/2020	Initial Issue	---
V2	4/16/2020	Section 6.2 updated Section 9.3 Updated	Henry Lau
V3	4/21/2020	Section 2 updated Section 6.2 updated	Henry Lau
V4	4/22/2020	Section 6.2 updated	Henry Lau

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Portable Computing Device

MODEL: 1873

SERIAL NUMBER: 030239493757

DATE TESTED: January 23, 2020 – February 4, 2020

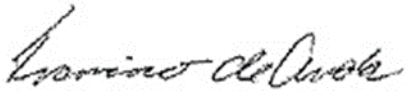
APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

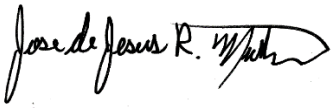
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For
UL Verification Services Inc. By:



FRANCISCO DE ANDA
OPERATIONS LEADER
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



JOSE MARTINEZ
TEST ENGINEER
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:

HENRY LAU
PROJECT ENGINEER
Consumer Technology Division
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v02/D03 v01r02/D06 v02, FCC KDB 789033 D02 v02r01, FCC KDB 644545 D03 v01, ANSI C63.10-2013, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. REFERENCE DOCUMENTS

Measurements of original parameters as referenced in this report are documented in UL Verification Services report number 12857633-E4.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☒ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

Uncertainty figures are valid to a confidence level of 95%.

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a portable computing device.

6.2. PERMISSIVE CHANGE SCOPE

Purpose for C2PC permissive change is to introduce a version that has a fabric keyboard. There are no rf changes or changes to the antenna but at a system level, the antenna peak gains have changed.

Radiated Spurious Emissions was performed in U-NII1 and U-NII-2A bands due to changes of antenna gain. Original results for U-NII-2C and U-NII-3 remain representative as worst case.

Results for all other tests, Duty Cycle, Output Power, PSD, Bandwidth, conducted emissions, BE, and AC line conducted emissions from the original report (12857633-E4) remain representative as worst case.

Radiated Band Edge was omitted due to the overall direction gains being lower than original filing which would yield improved margins.

6.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5.2 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 2TX			
5180-5240	802.11a Legacy	10.16	10.38
5180-5240	802.11n HT20	10.25	10.59
5190-5230	802.11n HT40	13.57	22.75
5210	802.11ac VHT80	14.28	26.79

5.3 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 2TX			
5260 - 5320	802.11a Legacy	16.38	43.45
5260 - 5320	802.11n HT20	16.61	45.81
5270 - 5310	802.11n HT40	19.33	85.70
5290	802.11ac VHT80	17.24	52.97

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

5.6 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 2TX			
5500-5720	802.11a Legacy	16.05	40.27
5500-5720	802.11n HT20	16.40	43.65
5510-5710	802.11n HT40	19.54	89.95
5530-5690	802.11ac VHT80	19.83	96.16

5.8 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 2TX			
5745-5825	802.11a Legacy	19.17	82.60
5745-5825	802.11n HT20	19.41	87.30
5755-5795	802.11n HT40	19.06	80.54
5775	802.11ac VHT80	19.42	87.50

Note: Above maximum output powers levels remain the same as the original filing.

6.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two PIFA antennas, with a maximum gain of:

	Peak Antenna Gain (dBi)	
Frequency (GHz)	Chain 0	Chain 1
5150-5250	5.5	3.6
5250-5350	5.4	4.8
5470-5725	6.4	4.4
5725-5850	6.9	3.5

NOTE:
Antenna 1 = Chain 0
Antenna 2 = Chain 1

6.5. SOFTWARE AND FIRMWARE

The operating system installed on the EUT is Windows 10 Home build 18362.418.

The Driver installed on the EUT is version 12.0.0.916.

The test utility software used during testing was QRCT v4.0.00123.

6.6. WORST-CASE CONFIGURATION AND MODE

Radiated emissions for 9kHz-1GHz,1GHz-18GHz and above 18GHz were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

For all modes, tests were performed with the EUT set at the 2Tx CDD mode with power setting equal to SISO modes as the worst case scenario thus MIMO is representative of SISO.

802.11ac VHT20 and VHT40 mode have the same power settings as 802.11n HT20 and HT40, thus 802.11n HT20 and HT40 are representative of VHT20 and VHT40.

The EUT has one intended orientations, X; therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates as provided by the client were:

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0
802.11ac VHT80 mode: MCS0

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

6.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC DC Adapter	Microsoft	1706	0D130POEUBG9A	DoC
AC DC Adapter	Lenovo	ADLX45NCC2A	8SSA10E75794C1SG85N27C8	DoC
Laptop	Lenovo	Yoga 11e	R9-0R7JR3	PD99260NG
Mouse	Microsoft	1113	X821908-017	DoC
USB 3.0 Gigabit Ethernet Adapter	Linksys	USB3GIGV1	15710S08406234	DoC
USB Type C to Audio Jack	SONY	1310-9798	N/A	DoC
Earphone	SONY	AG-0501	N/A	DoC
Earphone	SONY	AG-1100	N/A	DoC

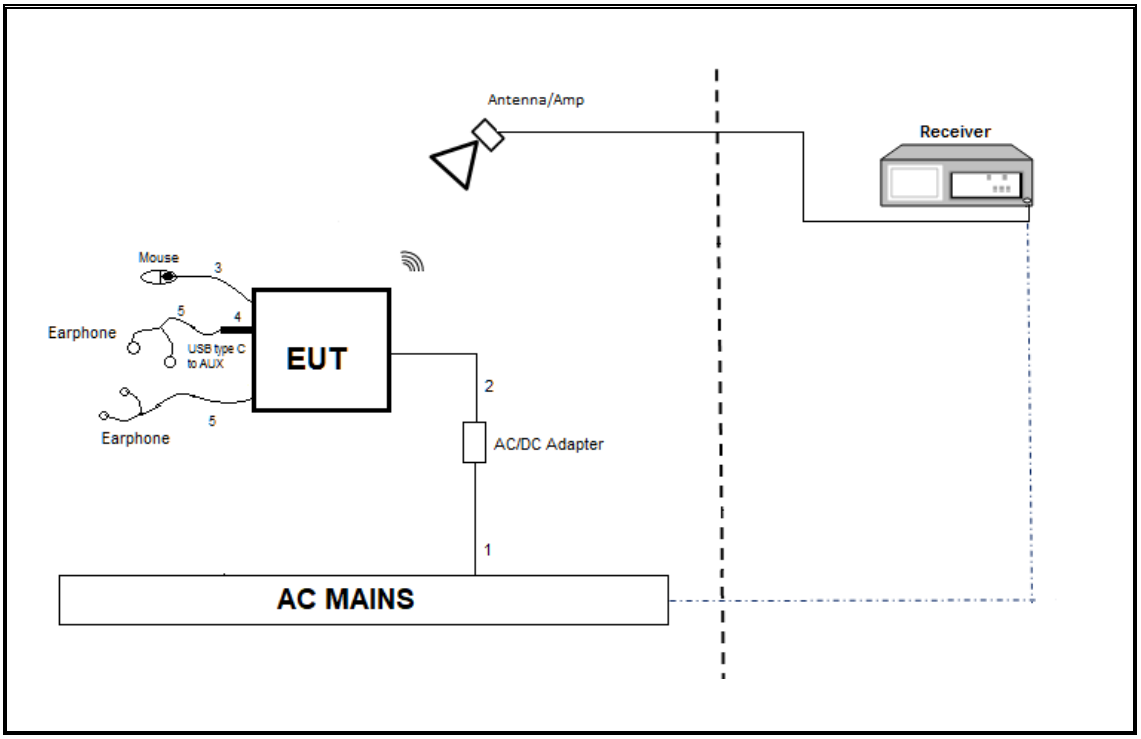
I/O CABLES (RADIATED EMISSIONS)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-shielded	1	to AC/DC Adapter
2	DC	1	DC	Shielded	1.2	to EUT
3	USB	1	TYPE A	Shielded	1.5	EUT to Mouse
4	USB	1	Type C	Shielded	0.1	USB-C to Audio Jack converter
5	Earphone	2	3.5mm	Un-shielded	1	EUT to earphone

TEST SETUP

For conducted tests, the EUT was connected to a laptop. The test software exercises the radio.

RADIATED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT is connected to all support equipment. The test software exercises the radio. Support laptop was removed after EUT was configured.

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

7. MEASUREMENT METHOD

Unwanted emissions in restricted bands: KDB 789033 D02 v02r01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v02r01, Sections G.3, G.4, and G.5.

8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020	02/16/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	EMC4294	06/14/2020	06/14/2019
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	05/04/2020	06/04/2019
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO METRICS	EM-6871	PRE0179465	05/31/2020	05/31/2019
Antenna, Passive Loop 100KHz - 30MHz	ELECTRO METRICS	EM-6872	PRE0179467	05/31/2020	05/31/2019
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	175953	01/23/2021	01/23/2020
Antenna, BroadBand Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	PRE0181574	10/14/2020	10/14/2019
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2020	08/13/2019
Rf Amplifier, 18-26.5GHz, 60dB gain	AMPLICAL	AMP18G26.5-60	171590	05/01/2020	05/01/2019
Antenna, Horn 26.5 to 40GHz	ARA	MWH-2640/B	T446	08/13/2020	08/13/2019
Rf Amplifier, 26-40GHz, 60dB gain	AMPLICAL	AMP26G40-60	PRE0181239	05/01/2020	05/01/2019
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020	05/16/2019

TEST SOFTWARE LIST			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, Oct 20, 2019
Radiated Software	UL	UL EMC	Ver 9.5, Sep 24, 2019
Radiated Software	UL	UL EMC	Ver 9.5, Oct 21, 2019

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209 -Restriced bands

FCC §15.407(b)(1-3) -Un-Restriced bands

After January 01, 2019 for Outside of the Restricted Bands Emissions

RSS 247 Issue 2 Sections
6.2.1.2 (for 5150-5250 MHz band)
6.2.2.2 (for 5250-5350 MHz band)
6.2.3.2 (for 5470-5600 MHz and 5650-5725 MHz bands)
6.2.4.2 (for 5725-5850 MHz band)

NCC LP0002 §2.7 and §2.8

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 9kHz to 1GHz and 18GHz to 40 GHz is investigated with the transmitter set to transmit at the channel with highest output power as worst-case scenario. 1GHz to 18GHz was set to transmit at the channel with highest output power per mode as worst-case scenario.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

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 impdedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to Y – 51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

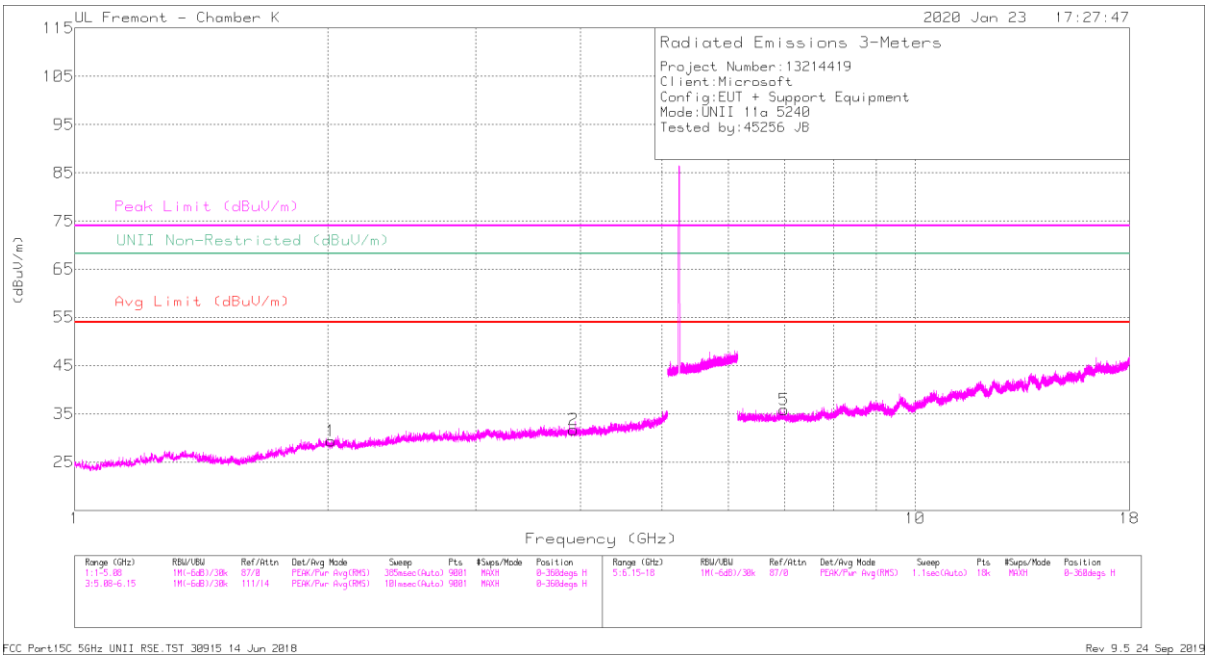
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

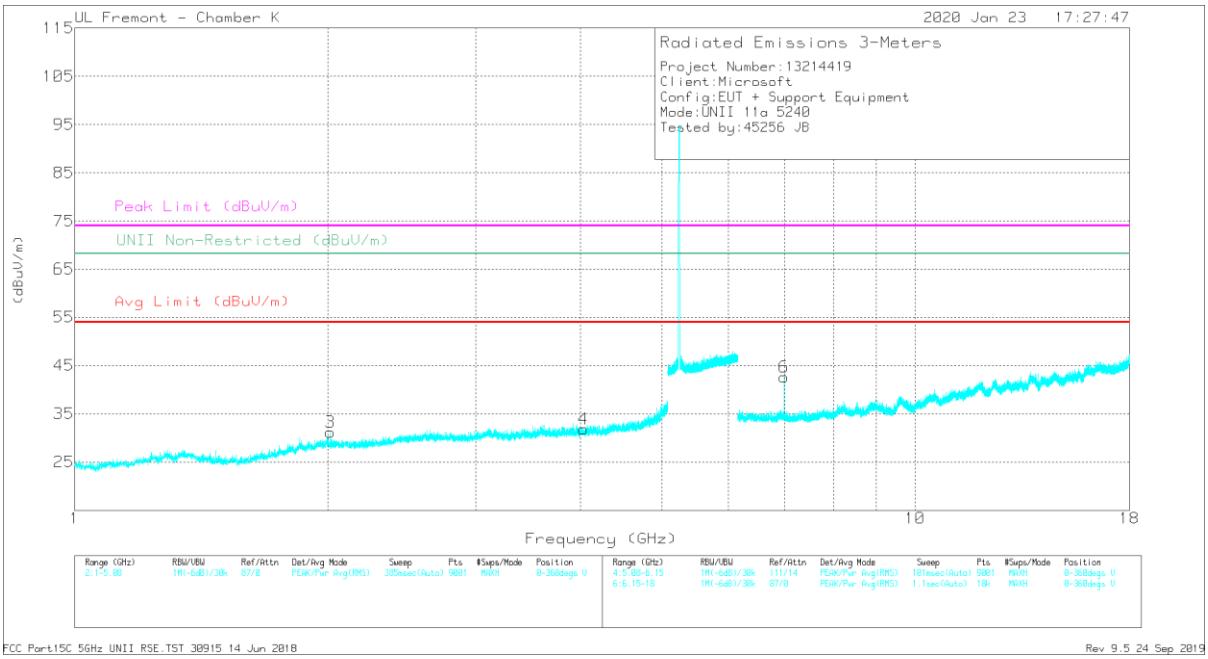
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.92376	37.82	PK-U	33.3	-31.6	0	39.52	-	-	74	-34.48	-	-	183	146	H
	* 3.92557	27.65	ADR	33.3	-31.6	.22	29.57	54	-24.43	-	-	-	-	183	146	H
1	2.01799	41.06	PK-U	31.4	-35.1	0	37.36	-	-	-	-	68.2	-30.84	161	218	H
4	* 4.03216	36.99	PK-U	33.4	-31.4	0	38.99	-	-	74	-35.01	-	-	292	123	V
	* 4.03419	27.4	ADR	33.4	-31.4	.22	29.62	54	-24.38	-	-	-	-	292	123	V
3	2.01684	41.33	PK-U	31.4	-35.1	0	37.63	-	-	-	-	68.2	-30.57	21	119	V
5	6.98668	35.67	PK-U	35.8	-26.6	0	44.87	-	-	-	-	68.2	-23.33	254	333	H
6	6.98669	38.57	PK-U	35.8	-26.6	0	47.77	-	-	-	-	68.2	-20.43	261	225	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

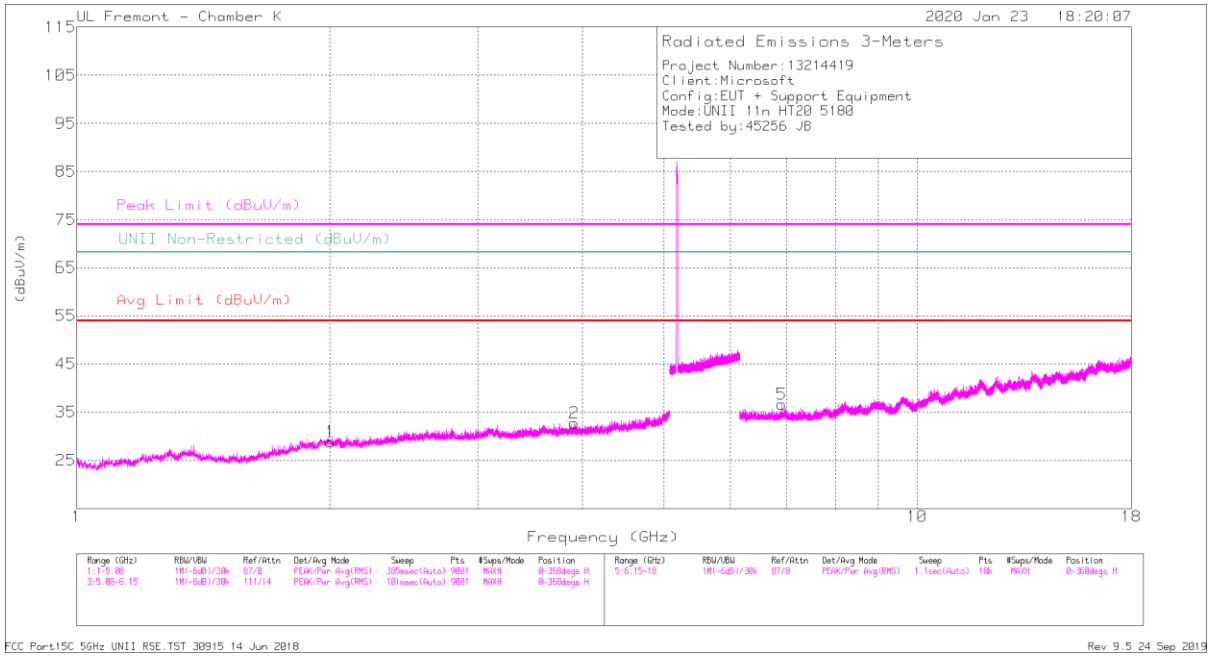
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

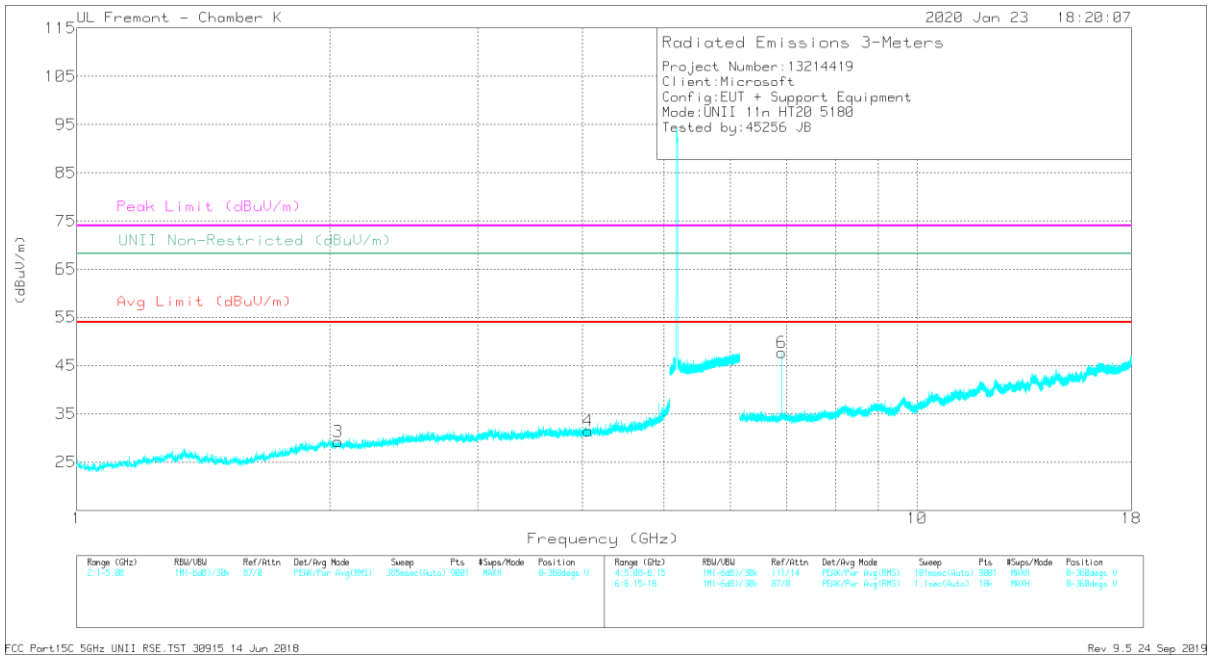
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.90965	39.33	PK-U	33.4	-31.6	0	41.13	-	-	74	-32.87	-	-	15	323	H
	* 3.91148	28.13	ADR	33.4	-31.6	.24	30.17	54	-23.83	-	-	-	-	15	323	H
1	2.00655	41.51	PK-U	31.5	-35.2	0	37.81	-	-	-	-	68.2	-30.39	23	175	H
4	* 4.06056	37.35	PK-U	33.4	-31.2	0	39.55	-	-	74	-34.45	-	-	166	208	V
	* 4.06057	27.17	ADR	33.4	-31.2	.24	29.61	54	-24.39	-	-	-	-	166	208	V
3	2.04513	41.05	PK-U	31.4	-35.1	0	37.35	-	-	-	-	68.2	-30.85	346	396	V
5	6.90668	37.76	PK-U	35.7	-26.6	0	46.86	-	-	-	-	68.2	-21.34	4	402	H
6	6.90666	40.93	PK-U	35.7	-26.6	0	50.03	-	-	-	-	68.2	-18.17	278	212	V

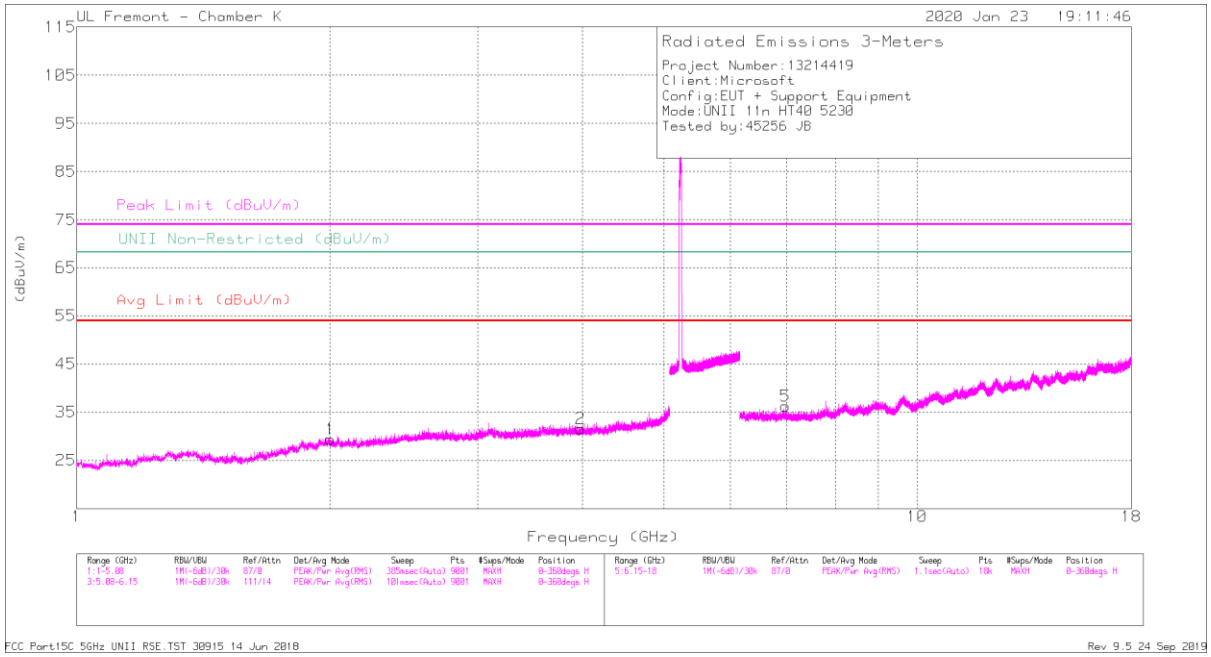
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

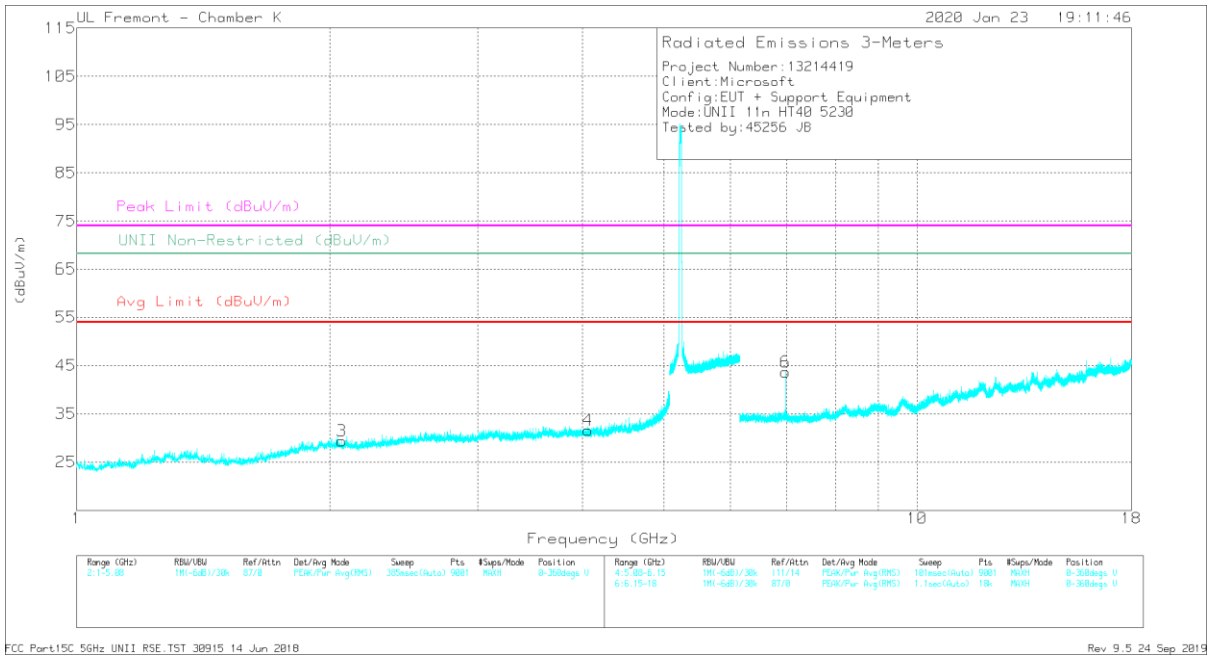
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.97638	37.72	PK-U	33.3	-31.4	0	39.62	-	-	74	-34.38	-	-	312	340	H
	* 3.97687	27.55	ADR	33.3	-31.4	.44	29.89	54	-24.11	-	-	-	-	312	340	H
1	2.00555	41.3	PK-U	31.5	-35.2	0	37.6	-	-	-	-	68.2	-30.6	304	317	H
4	* 4.06053	37.69	PK-U	33.4	-31.2	0	39.89	-	-	74	-34.11	-	-	352	332	V
	* 4.0589	27.02	ADR	33.4	-31.2	.44	29.66	54	-24.34	-	-	-	-	352	332	V
3	2.0667	40.73	PK-U	31.4	-35.2	0	36.93	-	-	-	-	68.2	-31.27	150	351	V
5	6.97334	37	PK-U	35.8	-26.5	0	46.3	-	-	-	-	68.2	-21.9	252	405	H
6	6.97333	38.25	PK-U	35.8	-26.5	0	47.55	-	-	-	-	68.2	-20.65	276	213	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

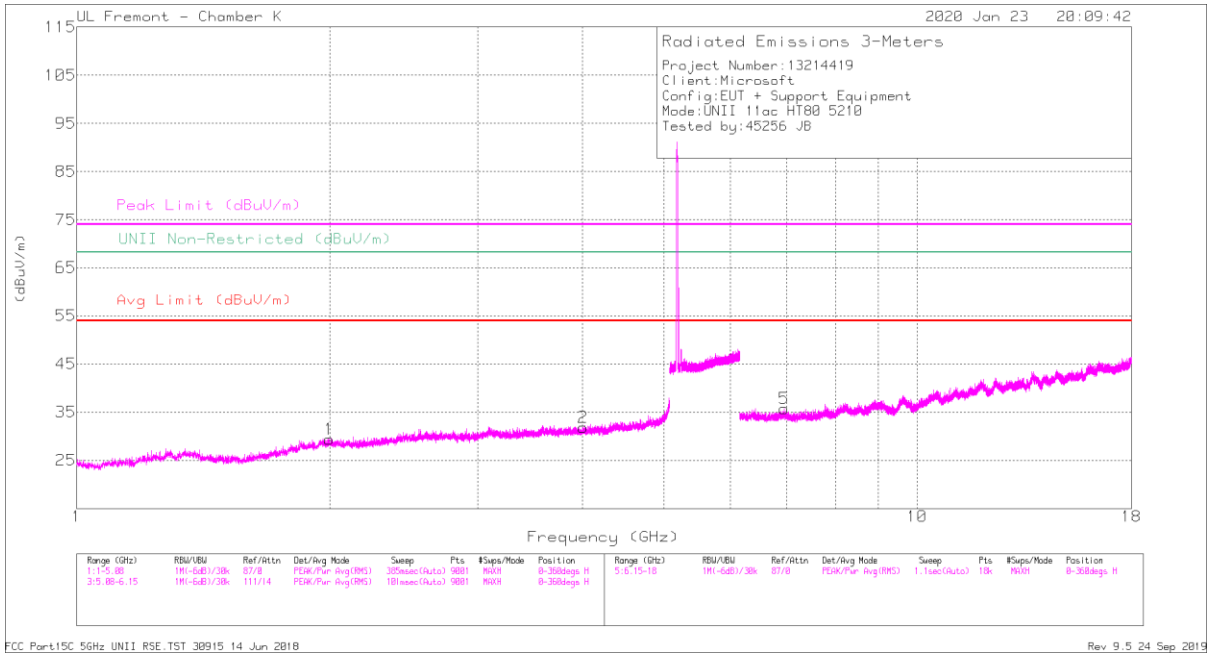
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.4. TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.2 GHz BAND

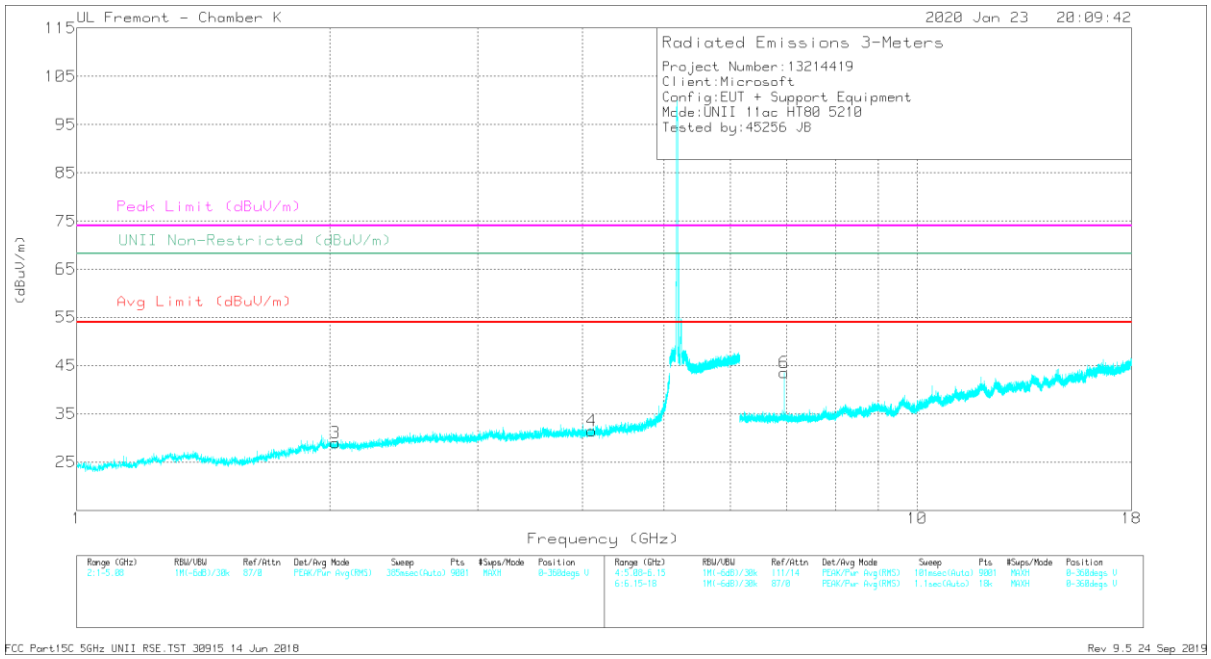
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 4.00893	37.6	PK-U	33.4	-31.3	0	39.7	-	-	74	-34.3	-	-	40	232	H
	* 4.0093	27.87	ADR	33.4	-31.3	.82	30.79	54	-23.21	-	-	-	-	40	232	H
1	1.99669	40.92	PK-U	31.5	-35.2	0	37.22	-	-	-	-	68.2	-30.98	186	218	H
4	* 4.10601	38.1	PK-U	33.4	-31.5	0	40	-	-	74	-34	-	-	164	251	V
	* 4.10365	27.6	ADR	33.5	-31.4	.82	30.52	54	-23.48	-	-	-	-	164	251	V
3	2.03213	41.39	PK-U	31.4	-35.1	0	37.69	-	-	-	-	68.2	-30.51	75	261	V
5	6.95404	33.13	PK-U	35.8	-26.5	0	42.43	-	-	-	-	68.2	-25.77	167	326	H
6	6.94667	38.43	PK-U	35.7	-26.5	0	47.63	-	-	-	-	68.2	-20.57	277	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

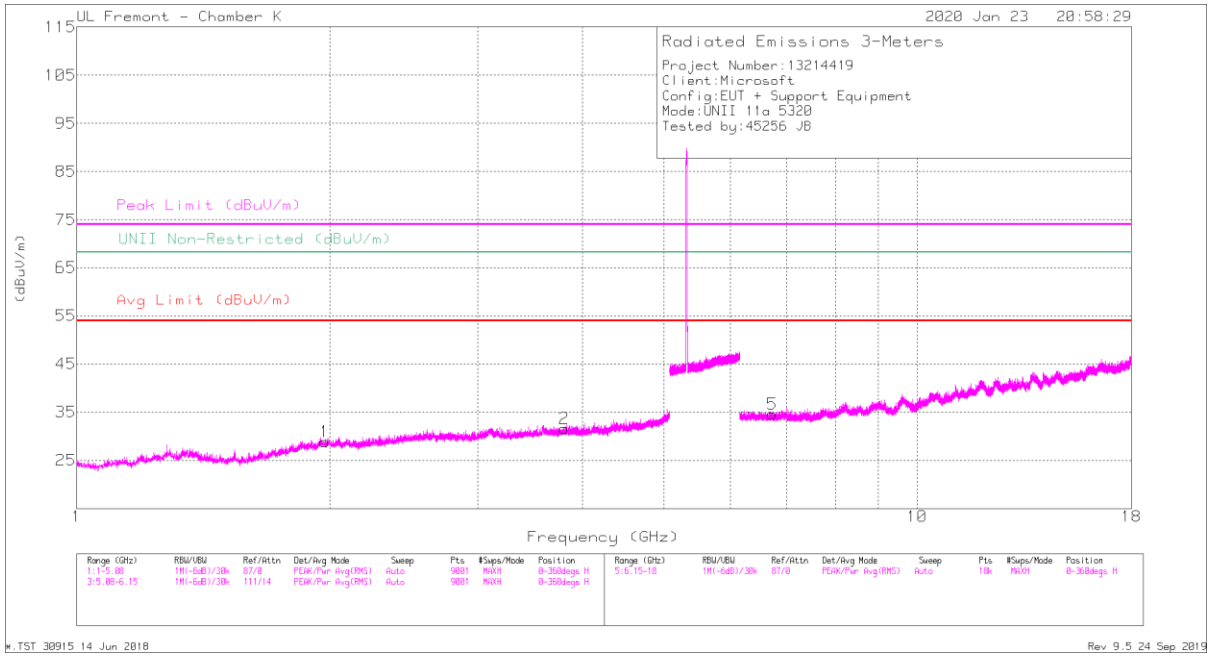
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.5. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND

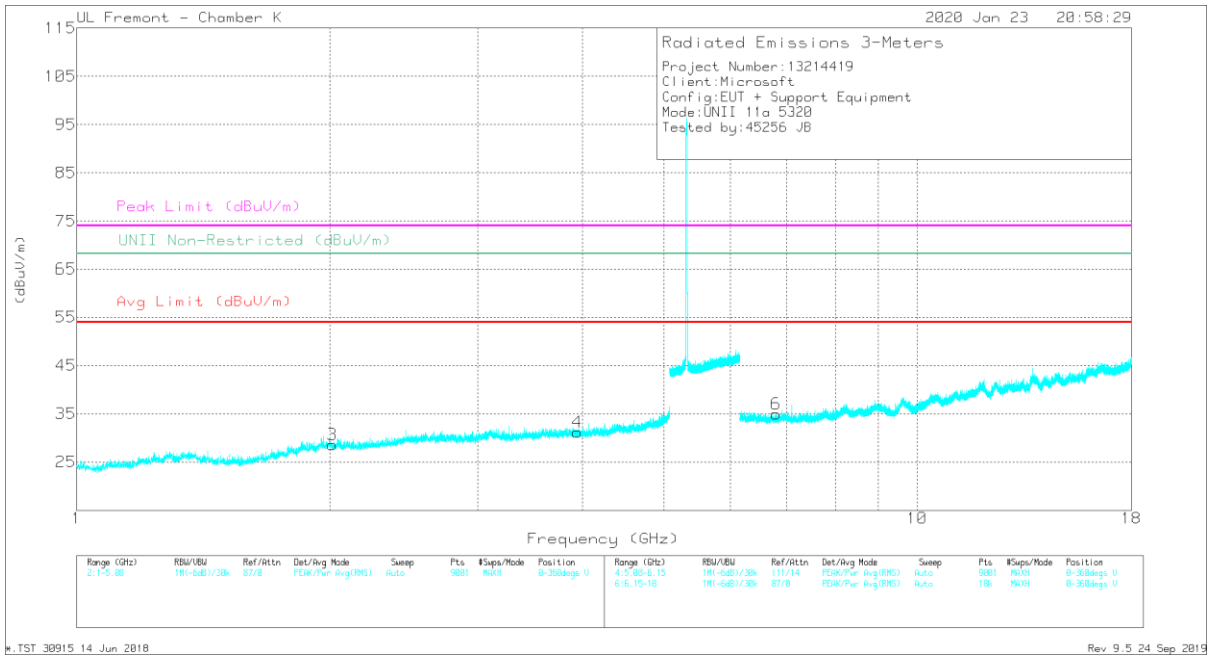
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.80478	39.28	PK-U	33.4	-31.8	0	40.88	-	-	74	-33.12	-	-	38	404	H
	* 3.80193	27.48	ADR	33.4	-31.8	.22	29.3	54	-24.7	-	-	-	-	38	404	H
1	1.97452	40.22	PK-U	31.6	-35.2	0	36.62	-	-	-	-	68.2	-31.58	253	390	H
4	* 3.94113	36.98	PK-U	33.3	-31.5	0	38.78	-	-	74	-35.22	-	-	135	325	V
	* 3.94154	27.4	ADR	33.3	-31.5	.22	29.42	54	-24.58	-	-	-	-	135	325	V
3	2.01542	42.28	PK-U	31.4	-35.1	0	38.58	-	-	-	-	68.2	-29.62	159	147	V
5	6.72478	33.68	PK-U	35.8	-26.9	0	42.58	-	-	-	-	68.2	-25.62	327	319	H
6	6.80122	33.88	PK-U	35.7	-27.2	0	42.38	-	-	-	-	68.2	-25.82	165	196	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

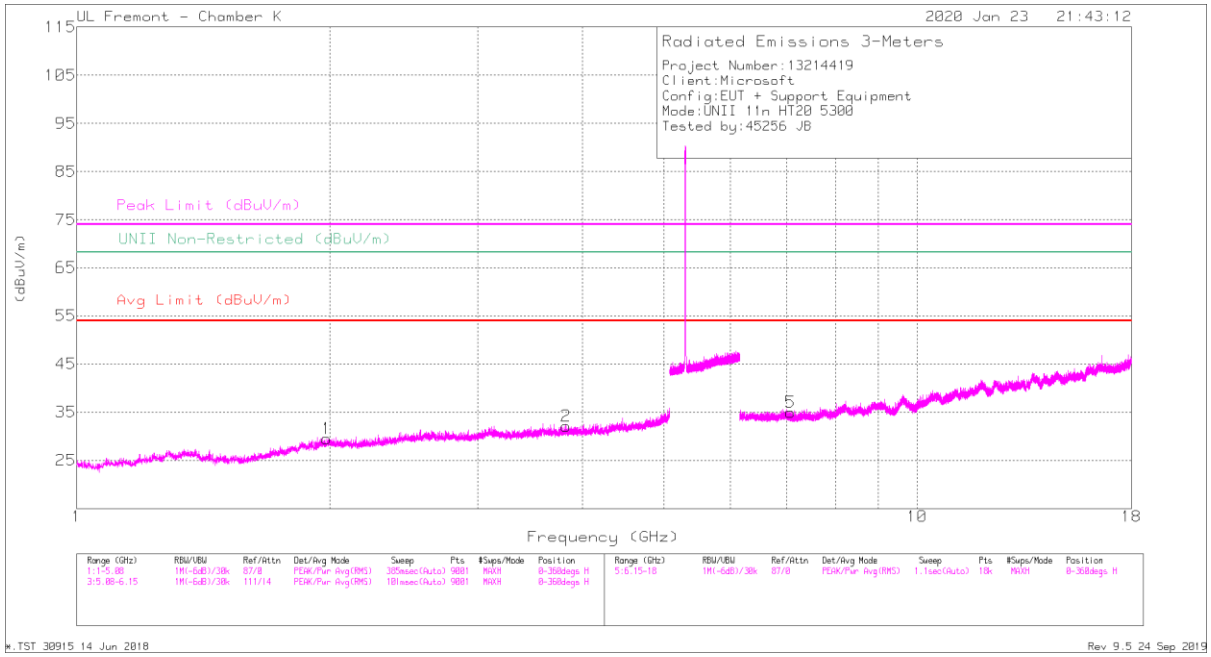
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.6. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

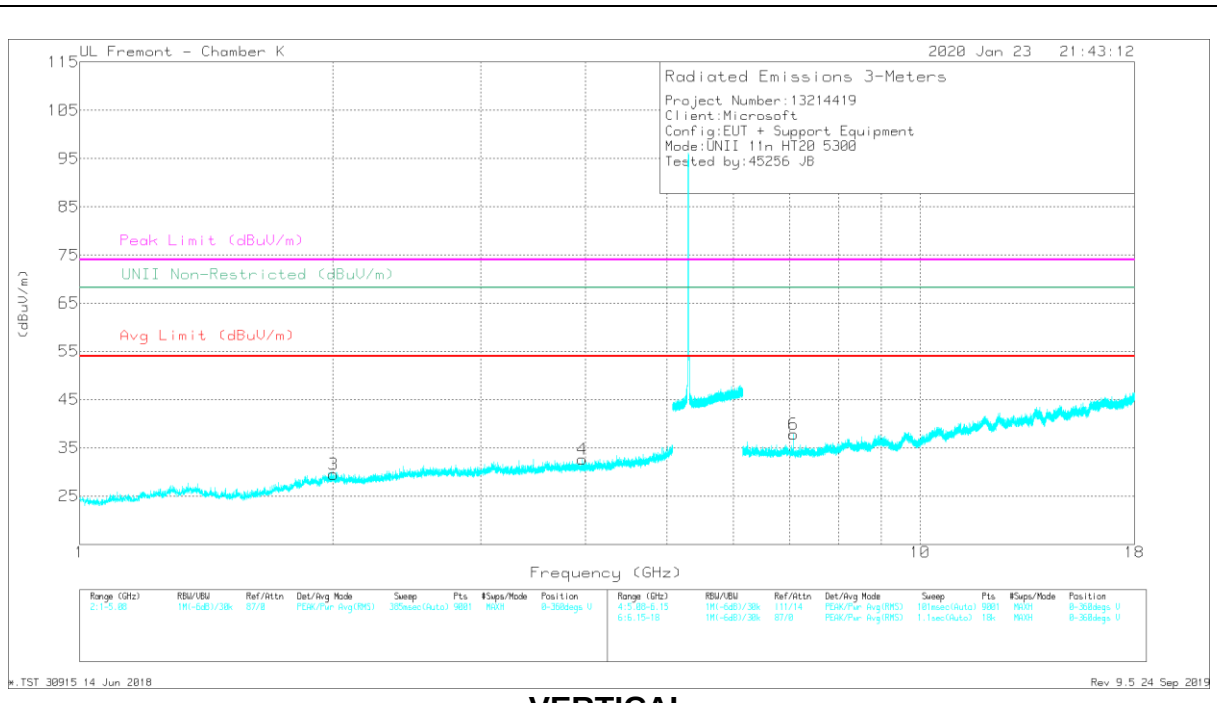
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.82142	37.76	PK-U	33.4	-31.8	0	39.36	-	-	74	-34.64	-	-	236	169	H
	* 3.8235	27.83	ADR	33.4	-31.7	.24	29.77	54	-24.23	-	-	-	-	236	169	H
1	1.9865	40.08	PK-U	31.6	-35.2	0	36.48	-	-	-	-	68.2	-31.72	21	277	H
4	* 3.96329	37.22	PK-U	33.3	-31.4	0	39.12	-	-	74	-34.88	-	-	45	113	V
	* 3.96536	27.31	ADR	33.3	-31.4	.24	29.45	54	-24.55	-	-	-	-	45	113	V
3	2.00345	40.71	PK-U	31.5	-35.1	0	37.11	-	-	-	-	68.2	-31.09	246	245	V
5	7.06716	34.13	PK-U	35.7	-26.9	0	42.93	-	-	-	-	68.2	-25.27	164	405	H
6	7.06662	36.47	PK-U	35.7	-26.9	0	45.27	-	-	-	-	68.2	-22.93	267	178	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

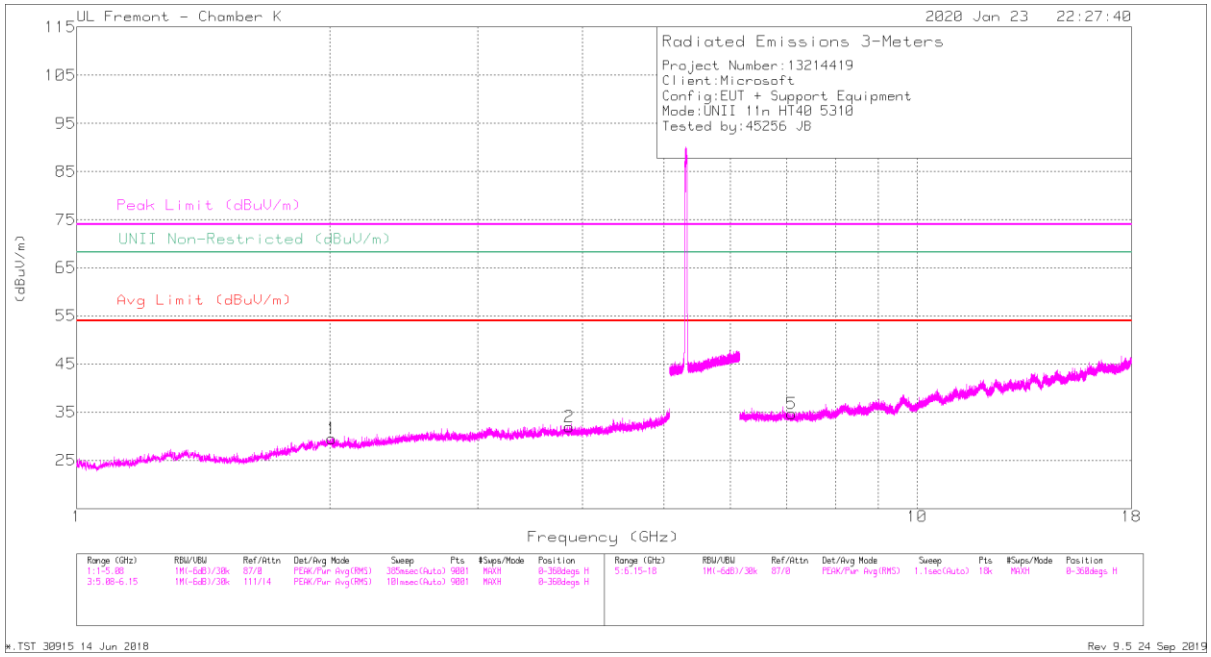
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.7. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

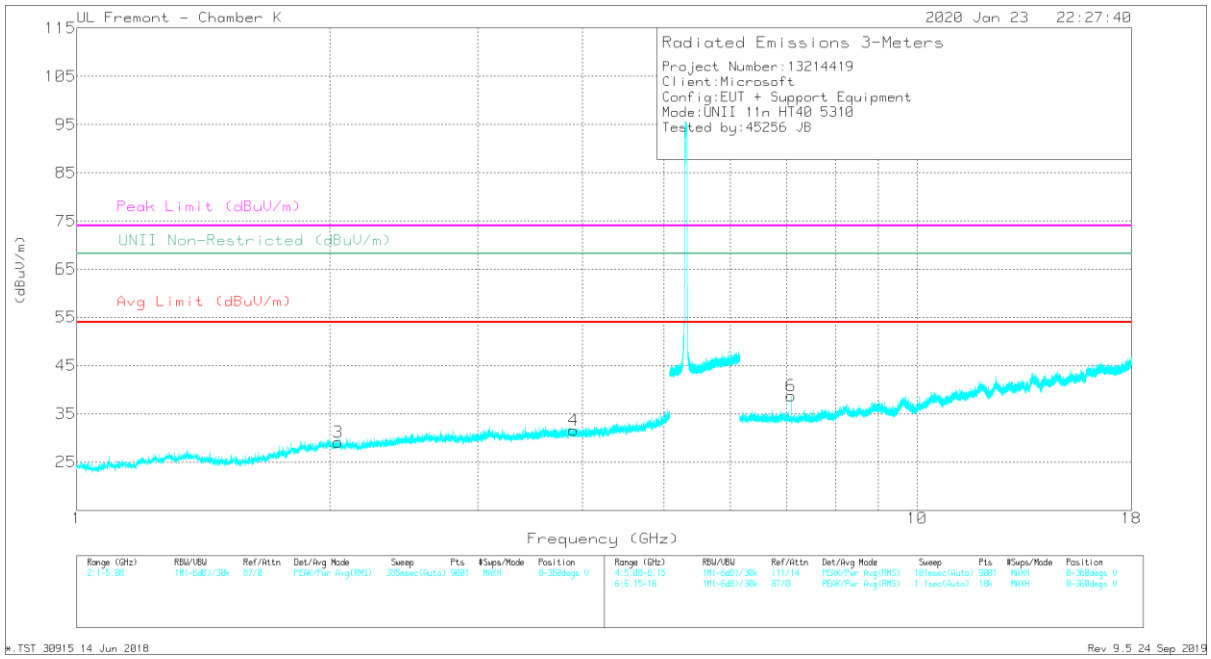
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.85696	38	PK-U	33.5	-31.6	0	39.9	-	-	74	-34.1	-	-	9	102	H
	* 3.8589	27.33	ADR	33.4	-31.6	.44	29.57	54	-24.43	-	-	-	-	9	102	H
1	2.0118	41.23	PK-U	31.4	-35.2	0	37.43	-	-	-	-	68.2	-30.77	212	388	H
4	* 3.90239	37.85	PK-U	33.4	-31.7	0	39.55	-	-	74	-34.45	-	-	11	202	V
	* 3.90066	27.49	ADR	33.4	-31.7	.44	29.63	54	-24.37	-	-	-	-	11	202	V
3	2.04913	40.64	PK-U	31.4	-35.1	0	36.94	-	-	-	-	68.2	-31.26	187	303	V
5	7.09235	33.72	PK-U	35.6	-26.9	0	42.42	-	-	-	-	68.2	-25.78	273	161	H
6	7.08002	35.08	PK-U	35.7	-27	0	43.78	-	-	-	-	68.2	-24.42	262	183	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

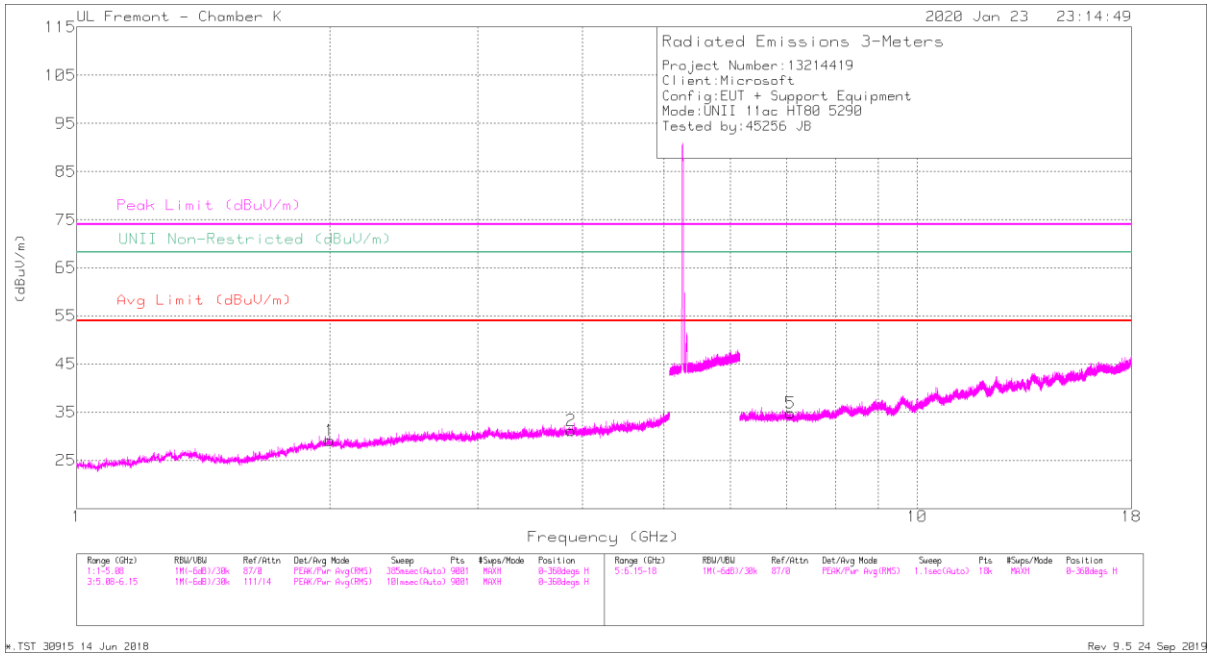
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.2.8. TX ABOVE 1 GHz 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

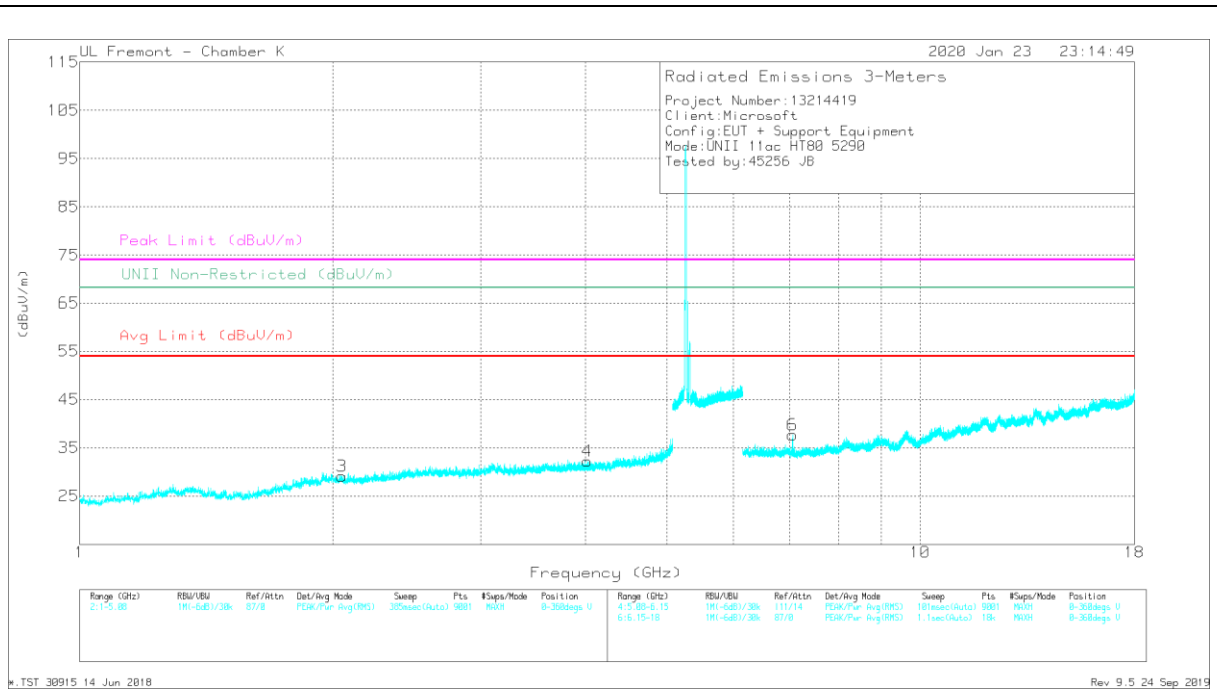
2TX Antenna 1 + Antenna 2 CDD MODE

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

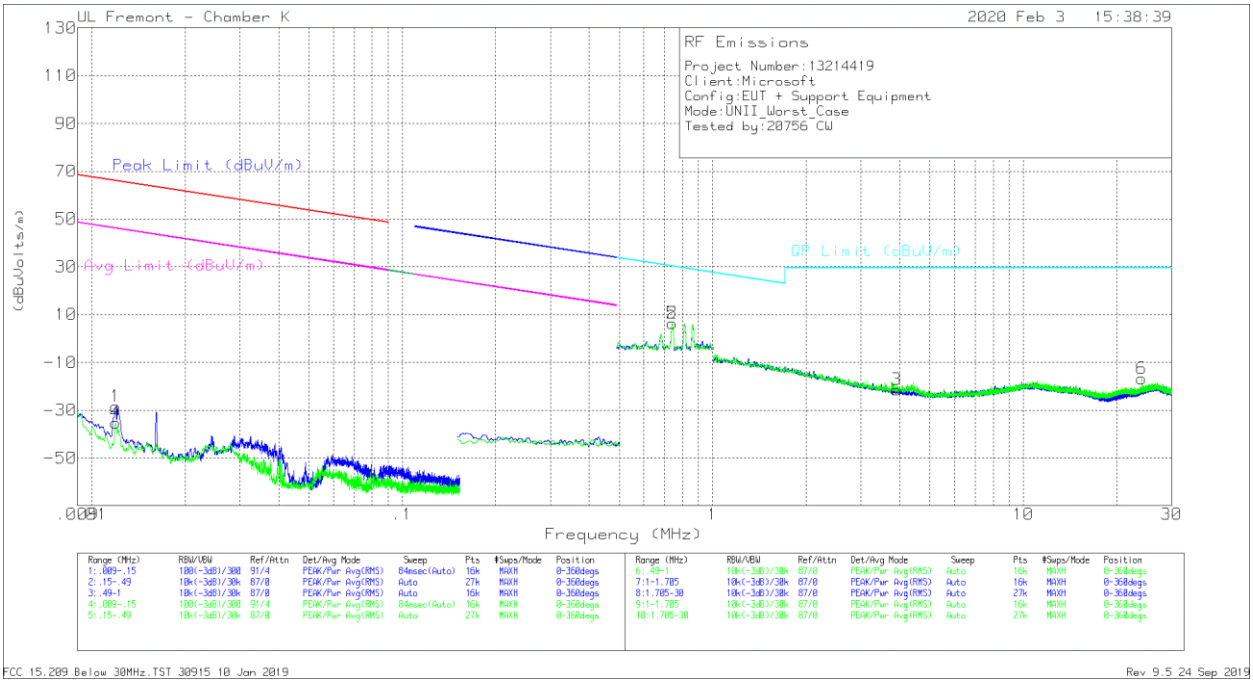
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.87651	38.01	PK-U	33.4	-31.8	0	39.61	-	-	74	-34.39	-	-	141	155	H
	* 3.87525	28.09	ADR	33.4	-31.8	.82	30.51	54	-23.49	-	-	-	-	141	155	H
1	2.00223	40.73	PK-U	31.5	-35.1	0	37.13	-	-	-	-	68.2	-31.07	357	347	H
4	* 4.01917	37.84	PK-U	33.4	-31.3	0	39.94	-	-	74	-34.06	-	-	336	338	V
	* 4.02162	26.83	ADR	33.4	-31.4	.82	29.65	54	-24.35	-	-	-	-	336	338	V
3	2.05188	41.06	PK-U	31.4	-35.2	0	37.26	-	-	-	-	68.2	-30.94	214	180	V
5	7.07029	33.37	PK-U	35.7	-26.9	0	42.17	-	-	-	-	68.2	-26.03	210	223	H
6	7.05332	35.41	PK-U	35.7	-26.9	0	44.21	-	-	-	-	68.2	-23.99	264	181	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

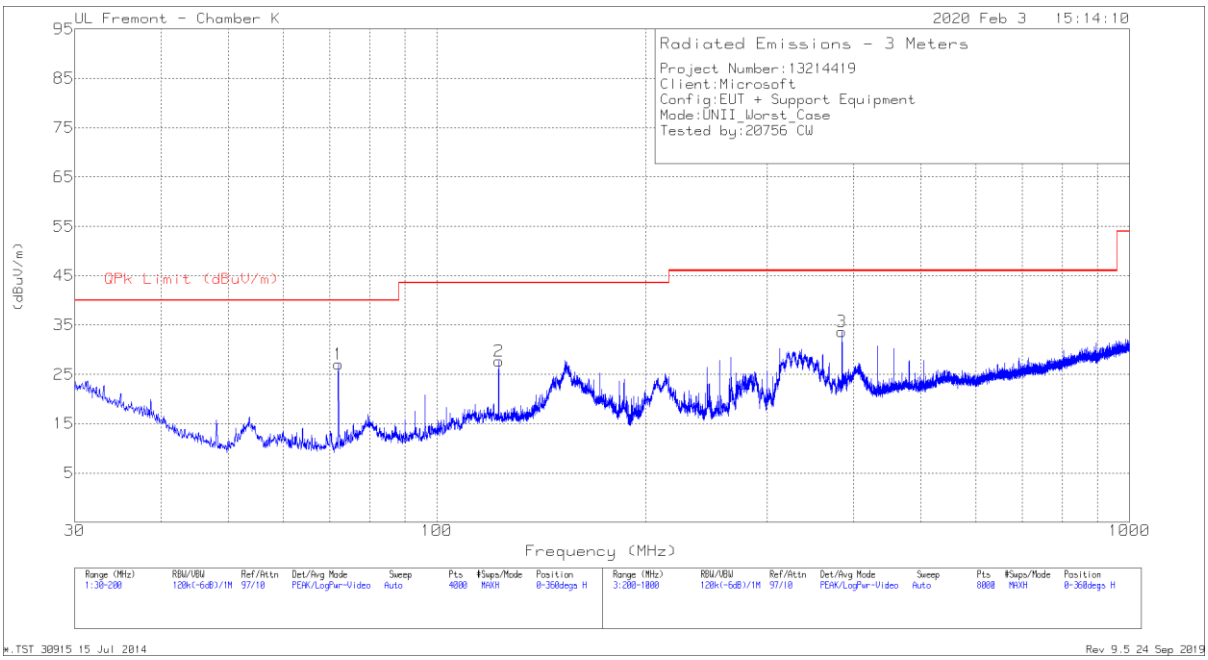
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 300m	Corrected Reading (dBuVolts/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01196	23.54	Pk	59.9	-31.8	-80	-28.36	66.03	-94.39	46.03	-74.39	0-360
4	.01195	16.72	Pk	59.9	-31.8	-80	-35.18	66.04	-101.22	46.04	-81.22	0-360

Pk - Peak detector

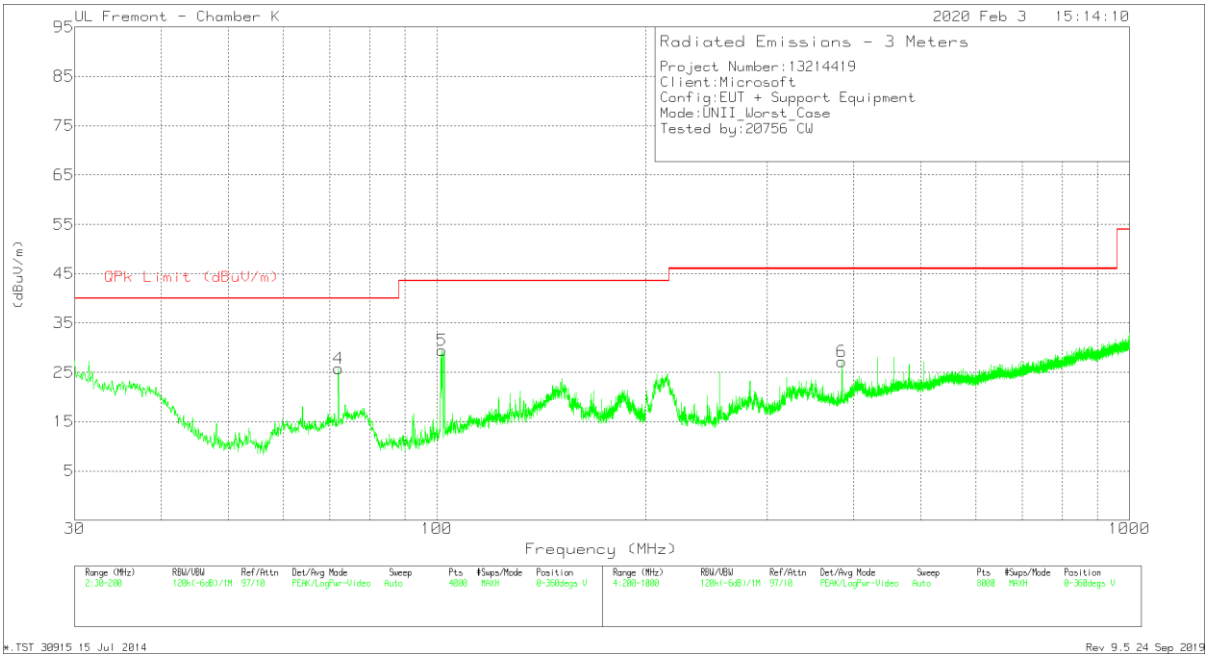
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.74013	22.3	Pk	56.1	-32.1	-40	6.3	30.23	-23.93	0-360
5	.74077	22.35	Pk	56.1	-32.1	-40	6.35	30.22	-23.87	0-360
3	3.90894	13.31	Pk	37.3	-32	-40	-21.39	29.5	-50.89	0-360
6	24.04102	20.86	Pk	33.8	-31.5	-40	-16.84	29.5	-46.34	0-360

Pk - Peak detector

9.4. WORST CASE BELOW 1 GHZ



HORIZONTAL



VERTICAL

Below 1GHz DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	72.0859	44.11	Pk	14.1	-31.2	27.01	40	-12.99	0-360	299	H
2	* 122.8865	38.54	Pk	19.9	-30.8	27.64	43.52	-15.88	0-360	199	H
4	72.0859	42.94	Pk	14.1	-31.2	25.84	40	-14.16	0-360	95	V
5	101.8011	43.66	Pk	16.7	-30.9	29.46	43.52	-14.06	0-360	95	V
3	384.6739	42.83	Pk	20.9	-29.5	34.23	46.02	-11.79	92	96	H
	384.6537	41.22	Qp	20.9	-29.5	32.62	46.02	-13.4	92	96	H
6	384.624	35.79	Pk	20.9	-29.5	27.19	46.02	-18.83	0-360	299	V

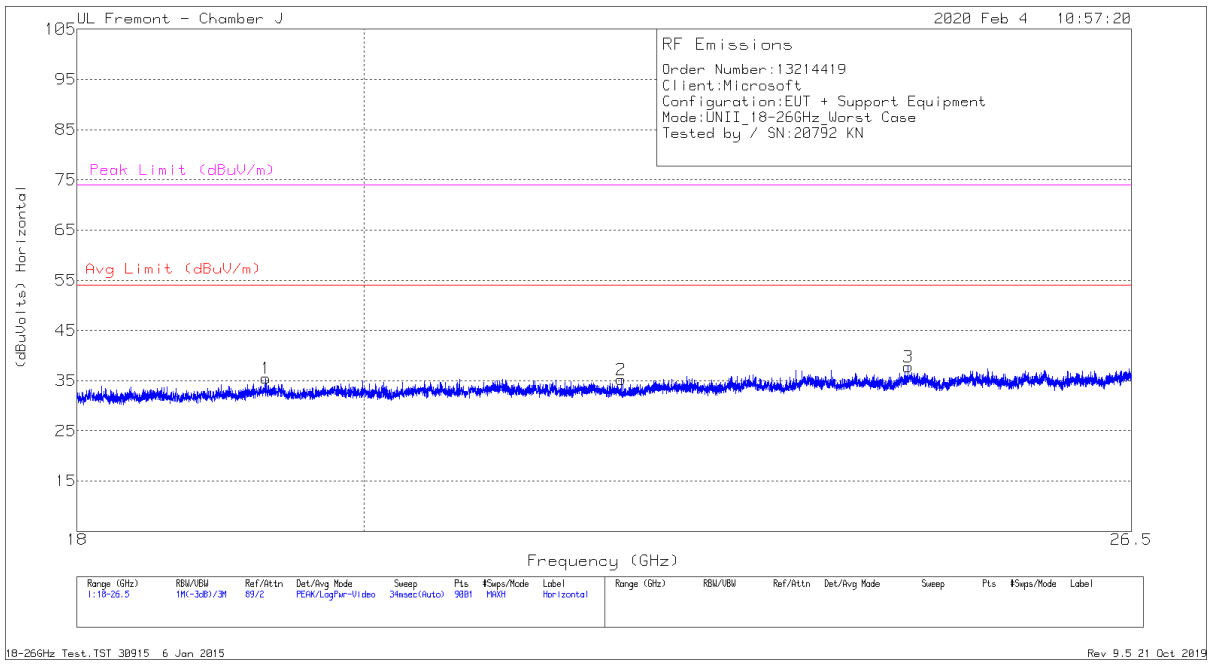
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

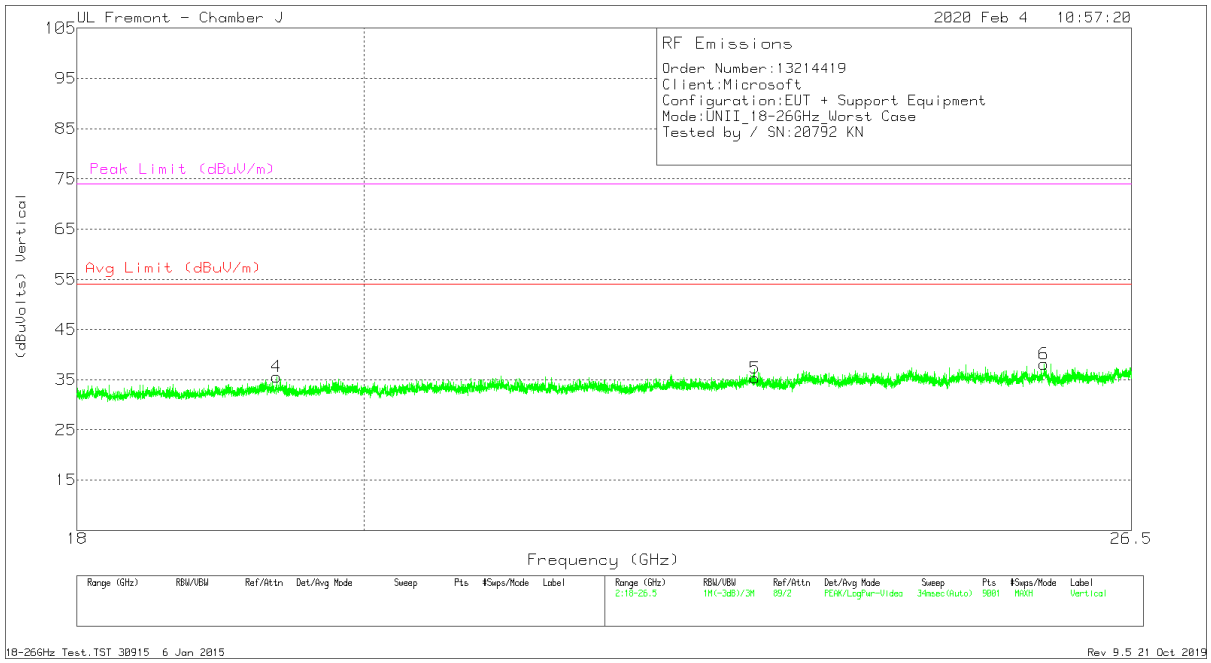
Qp - Quasi-Peak detector

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.5. WORST CASE 18-26 GHZ



HORIZONTAL



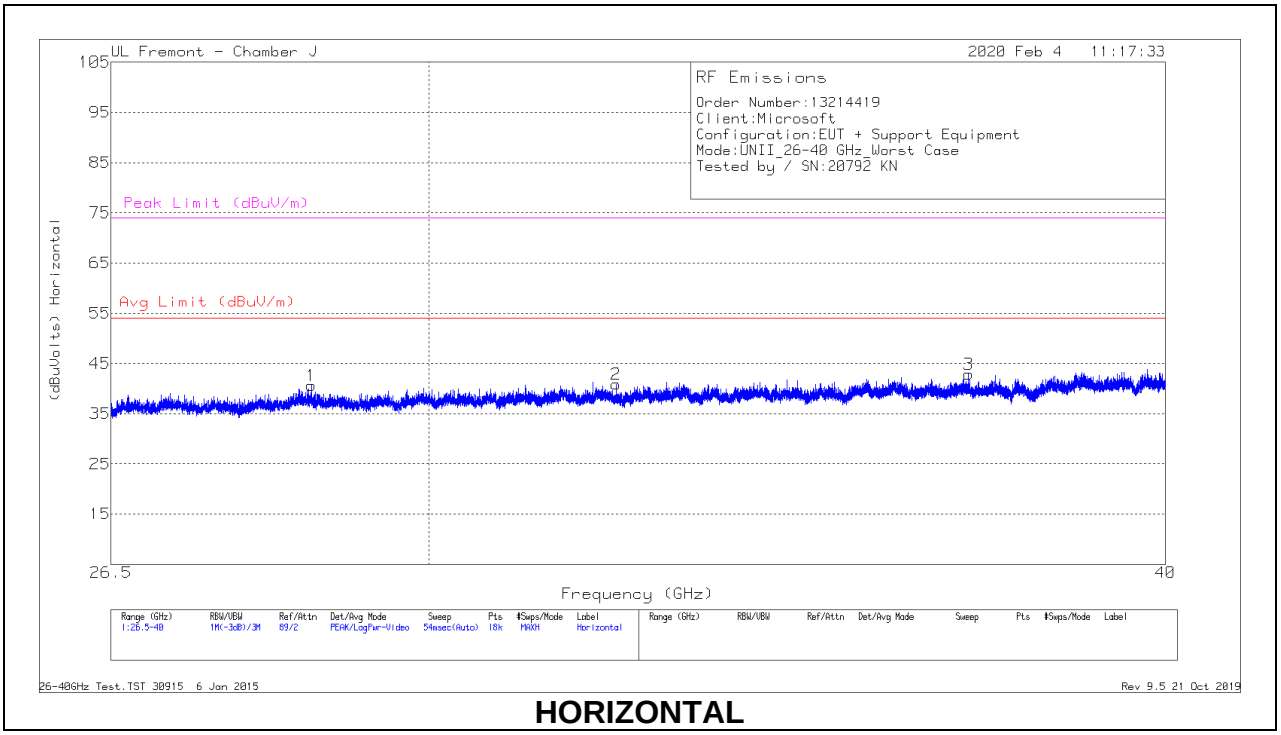
VERTICAL

18 – 26GHz DATA

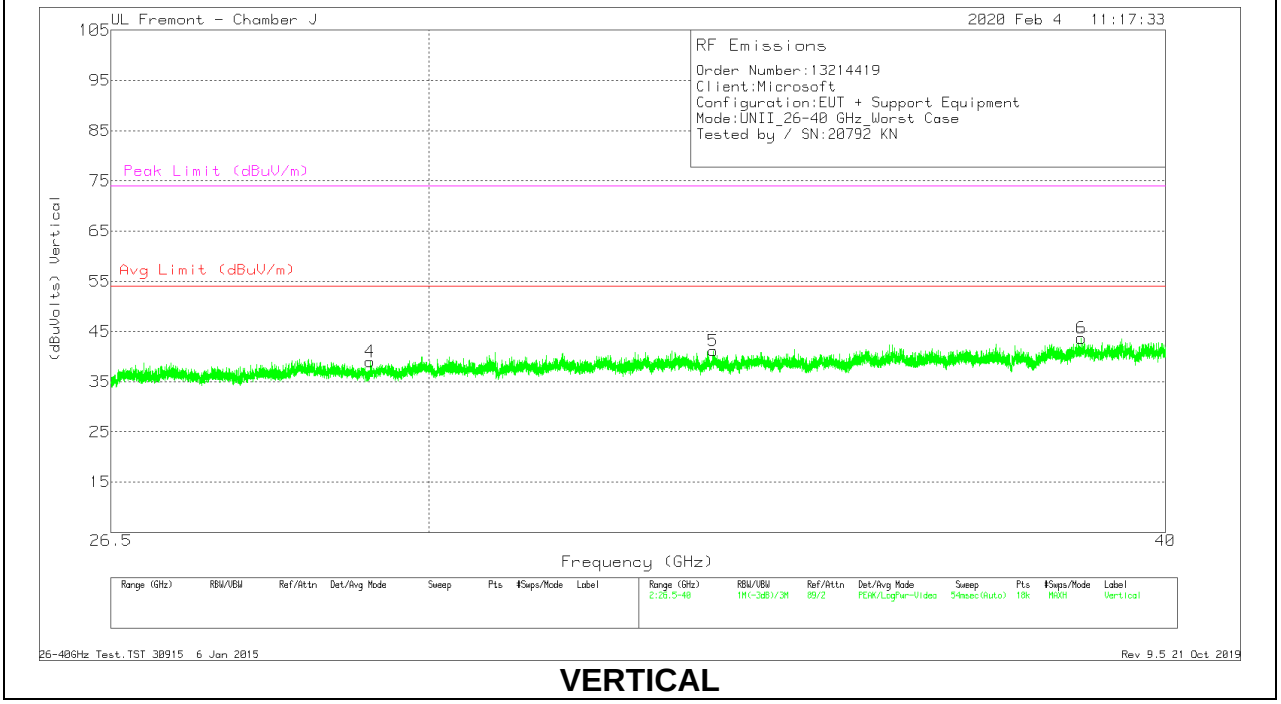
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.29105	69.47	Pk	32.7	-57.2	-9.5	35.47	54	-18.53	74	-38.53
2	21.97611	69.12	Pk	33.4	-57.8	-9.5	35.22	54	-18.78	74	-38.78
3	24.41561	69.56	Pk	34.3	-56.6	-9.5	37.76	54	-16.24	74	-36.24
4	19.36755	69.49	Pk	32.7	-57.1	-9.5	35.59	54	-18.41	74	-38.41
5	23.08111	68.53	Pk	33.8	-57.5	-9.5	35.33	54	-18.67	74	-38.67
6	25.66322	68.1	Pk	34.4	-54.9	-9.5	38.1	54	-15.9	74	-35.9

Pk - Peak detector

9.6. WORST CASE 26-40 GHZ



HORIZONTAL



VERTICAL

26 – 40GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T446 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	28.65475	66.71	Pk	36.5	-53.1	-9.5	40.61	54	-13.39	74	-33.39
2	32.27875	66.77	Pk	37.2	-53.6	-9.5	40.87	54	-13.13	74	-33.13
3	37.03825	69.08	Pk	38.4	-55.1	-9.5	42.88	54	-11.12	74	-31.12
4	29.32075	64.69	Pk	36.5	-52.7	-9.5	38.99	54	-15.01	74	-35.01
5	33.526	66.77	Pk	37.2	-53.3	-9.5	41.17	54	-12.83	74	-32.83
6	38.70625	69.29	Pk	39.1	-55.2	-9.5	43.69	54	-10.31	74	-30.31

Pk - Peak detector

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888