CERTIFICATION TEST REPORT

Report Number. : 12857633-E1V2

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 C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
September 26, 2019

Prepared by:
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	9/3/2019	Initial Issue	---
V2	9/26/2019	Section 6: Statement Removed	Henry Lau

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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: 009075792757 (Conducted)
009060692757 (Radiated)
009059592757 (Radiated)

DATE TESTED: July 30, 2019 – August 9, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. 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 Road
☐ 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

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4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. 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

4.3. 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	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 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%.

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a portable computing device.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	-0.07	0.98

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -2.2 dBi.

5.4. SOFTWARE AND FIRMWARE

The operating system installed on the EUT is Windows 10 Pro build 18362.19h1_release.190318-1202.

The Driver installed on the EUT is version 12.0.0.835.

The test utility software used during testing was QRCT v4.0.00125

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 30MHz, 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

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:

BLE 1Mbps

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC DC Adapter	Microsoft	1706	0CI30J0IZ9396	DoC
AC DC Adapter	Lenovo	ADLX45NDC2A	11S45N0291Z1ZS925 3E2N9	DoC
Laptop	Lenovo	E555	6449237	TX2-RTL8723BE
Mouse	Logitech	B100	1451HS05PX68	DoC
USB 3.0 Gigabit Ethernet Adapter	Linksys	1113	X821908-002	DoC
USB Type C to Audio Jack	SONY	A1-0231	N/A	DoC

I/O CABLES (CONDUCTED TEST)

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 Adaptor
2	DC	1	DC	Shielded	1.2	to Laptop, to EUT
3	Antenna	1	SMA	Un-Shielded	0.2	to Analyzer
4	USB	1	TYPE A	Shielded	0.2	USB-A to RJ45 converter
5	Ethernet	1	RJ45	Un-Shielded	0.5	Support Laptop to Ethernet Adapter
6	AC	1	AC	Un-Shielded	1	to AC/DC Adaptor
7	DC	1	DC	Shielded	1.2	to Support Equipment

I/O CABLES (RADIATED AND CONDUCTED 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

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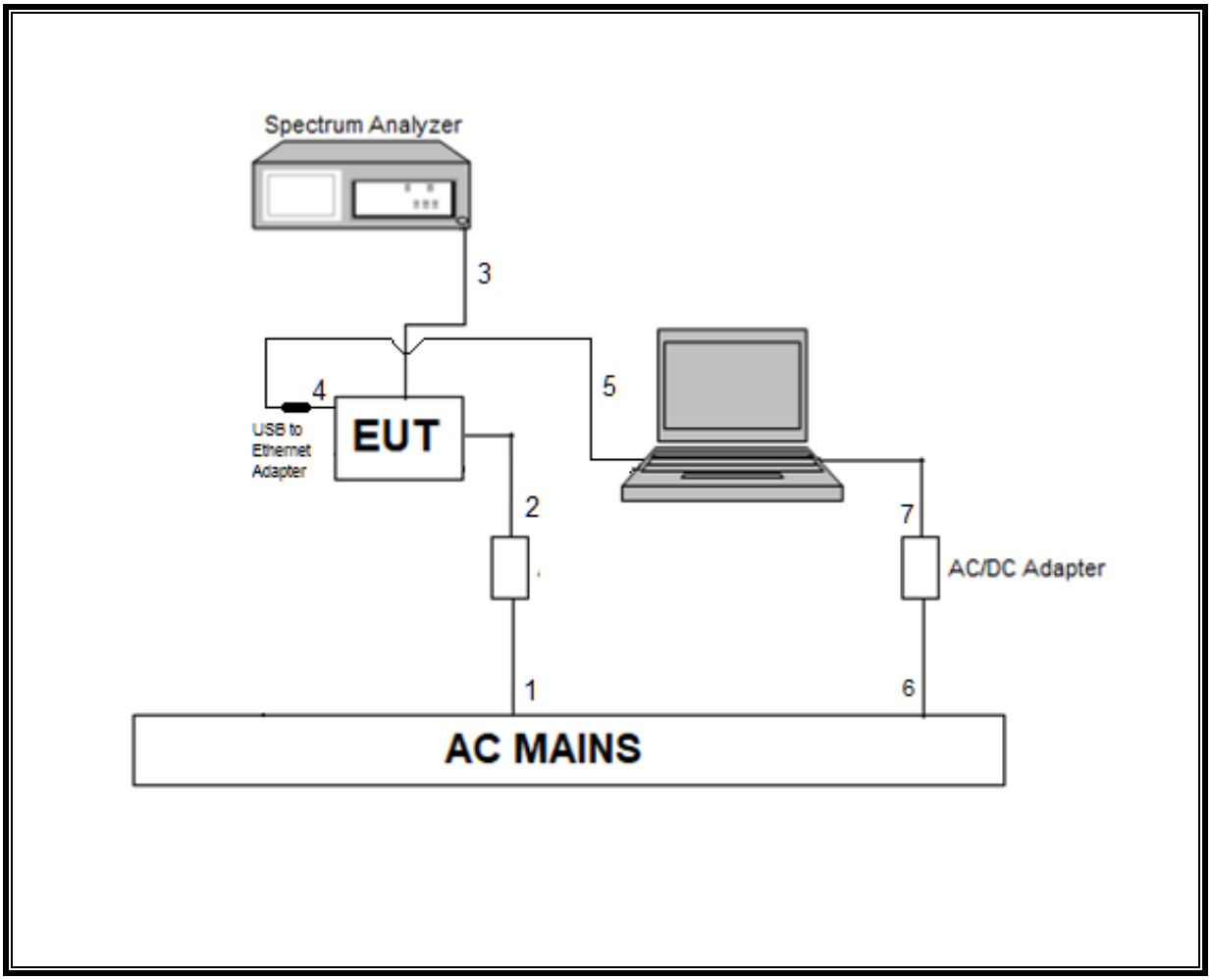
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

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

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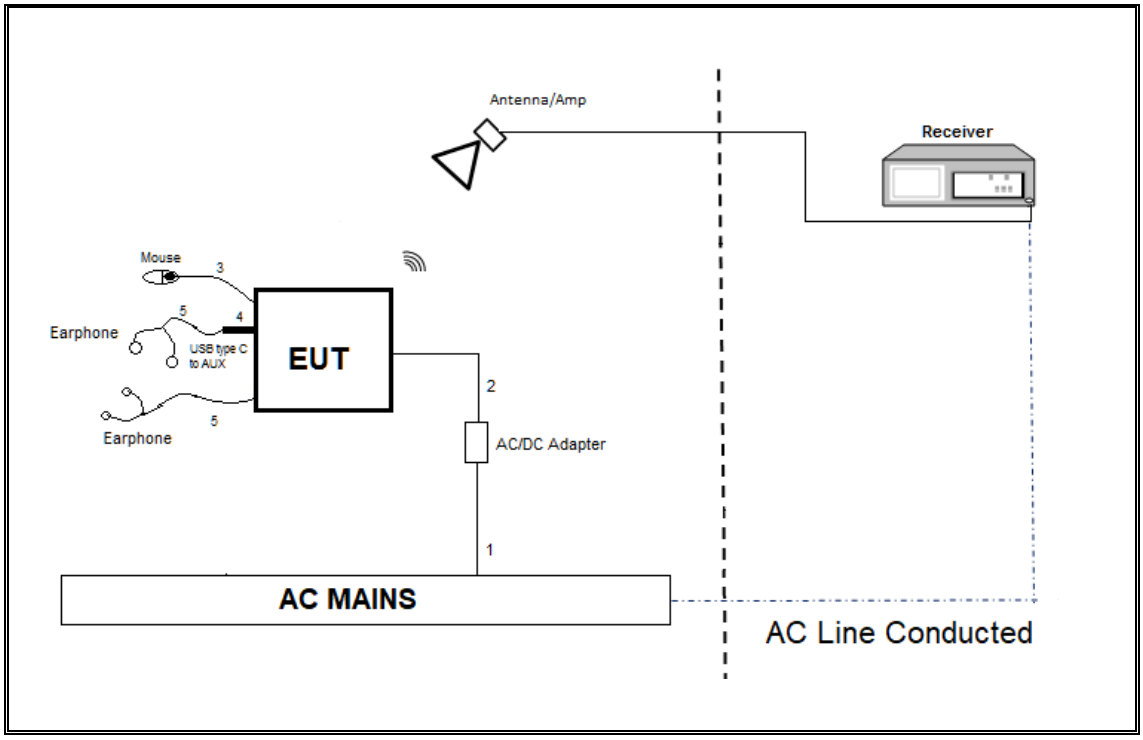
RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

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

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6. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Subclause -11.6.

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

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7. 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**
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/31/2020	05/31/2019
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/31/2020	05/31/2019
Horn Antenna	AR	AMPL-ATH1G18	PRE0189055	04/20/2020	04/20/2018
Amplifier, 1 to18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0181078	08/31/2019	08/01/2018
Amplifier, 1 to18GHz	MITEQ	AFS42-00101800-25-S-42	PRE0181078	08/24/2020	08/24/2019
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences Corp.	JB3	PRE0184971	11/13/2019	11/13/2018
Amplifier, 9kHz to 1GHz, 32 dB	Sonoma Instrument	310	PRE0180175	06/29/2020	06/29/2019
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	PRE0182188	08/29/2019	08/29/2018
Rf Amplifier, 18-26.5GHz, 60dB gain	Amplical	AMP18G26.5-60	PRE0181238	05/01/2020	05/01/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1265	01/29/2020	01/29/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1227	02/05/2020	02/05/2019
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179376	02/14/2020	02/14/2019
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E4440A	T200	01/28/2020	01/28/2019
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020	01/24/2019
Test Software List					
Radiated Software	UL	UL EMC		Ver 9.5, June 15, 2019	
Antenna Port Software	UL	UL RF		Ver 10.0.1, July 23, 2019	
AC Line Conducted Software	UL	UL EMC		Ver 9.5, May 26, 2015	

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

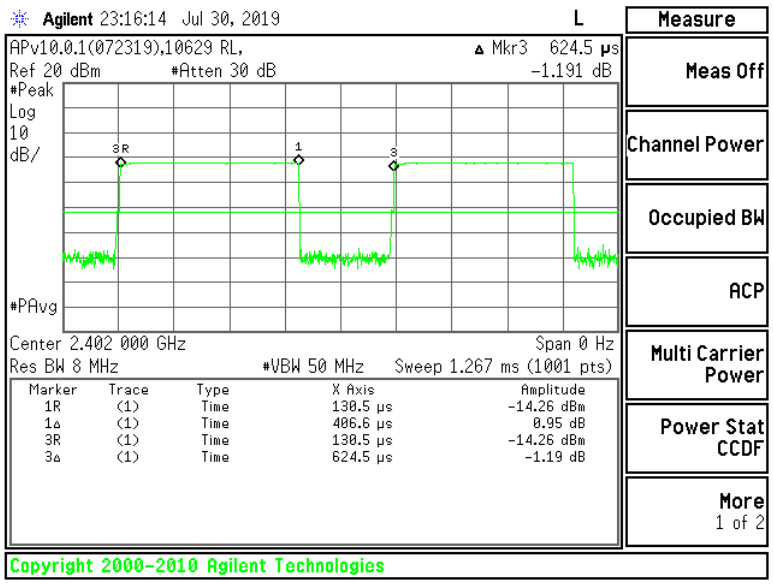
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.407	0.625	0.651	65.11%	1.86	2.459

DUTY CYCLE PLOTS



DUTY CYCLE BLE

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8.2. 99% BANDWIDTH

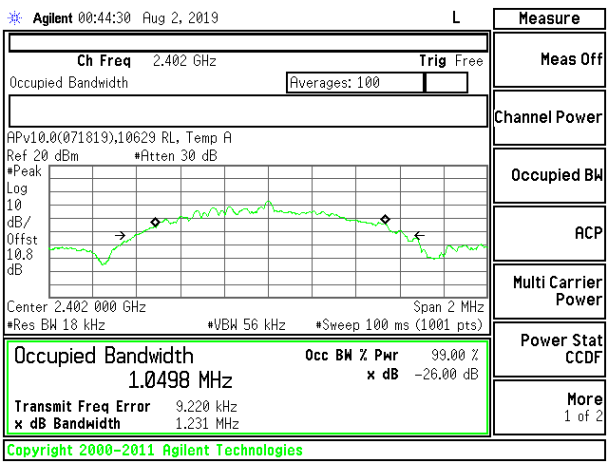
LIMITS

None; for reporting purposes only.

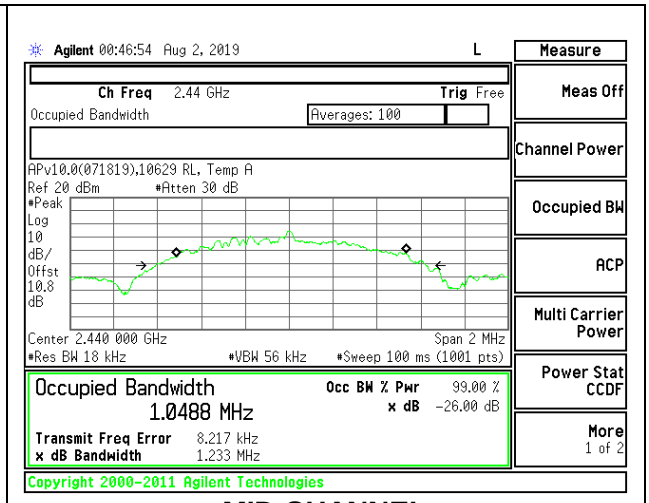
RESULTS

8.2.1. BLE (1Mbps)

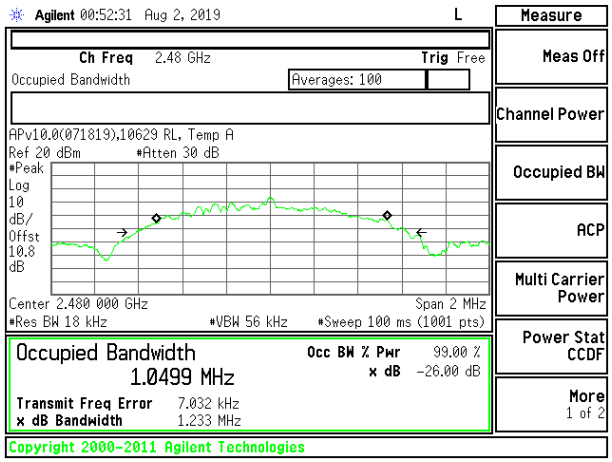
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0498
Middle	2440	1.0488
High	2480	1.0499



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.3. 6 dB BANDWIDTH

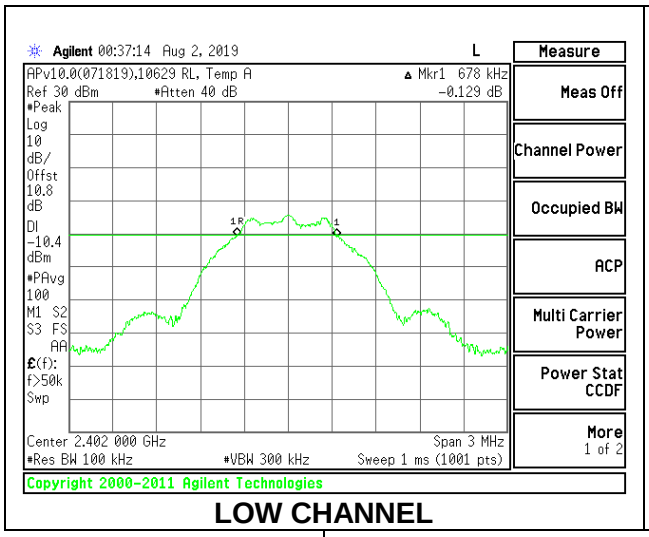
LIMITS
FCC §15.247 (a) (2)
RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

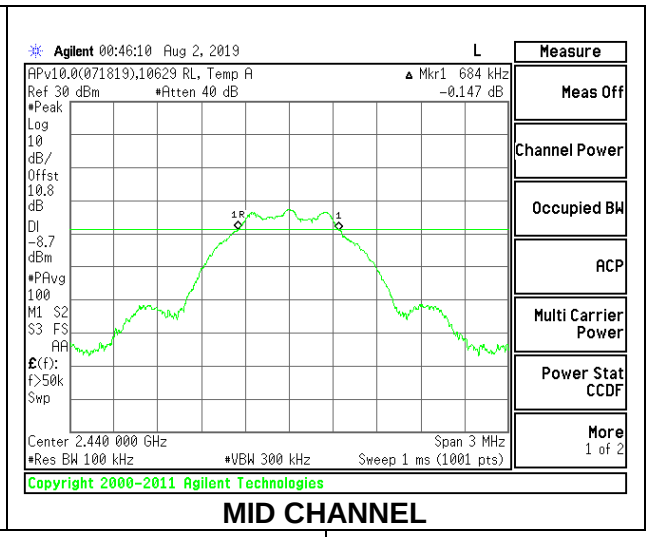
RESULTS

8.3.1. BLE (1Mbps)

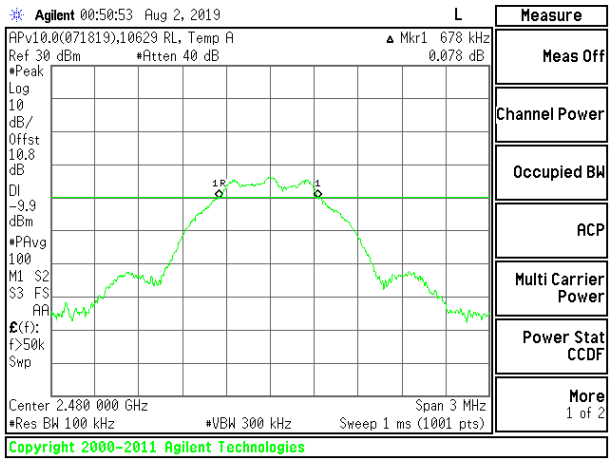
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.678	0.5
Middle	2440	0.684	0.5
High	2480	0.678	0.5



LOW CHANNEL



MID CHANNEL



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8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE
The transmitter output is connected to a power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

8.4.1. BLE (1Mbps)

Tested By:	10629 RL
Date:	8/2/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.600	30	-31.600
Middle	2440	-0.070	30	-30.070
High	2480	-1.320	30	-31.320

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8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE
The transmitter output is connected to a power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.5.1. BLE (1Mbps)

Tested By:	10629 RL
Date:	8/2/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.81
Middle	2440	-0.25
High	2480	-1.49

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8.6. POWER SPECTRAL DENSITY

LIMITS

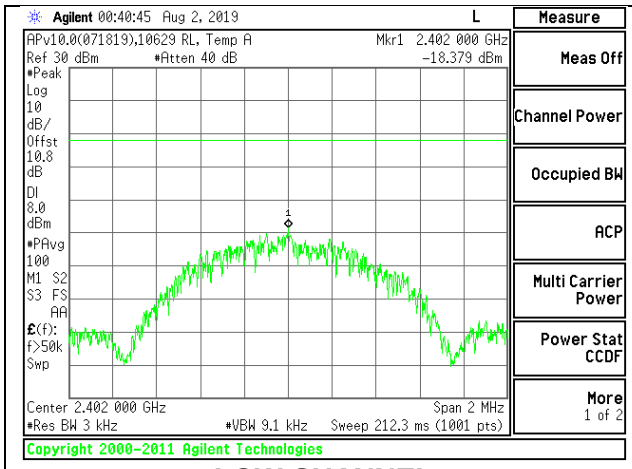
FCC §15.247 (e)
RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

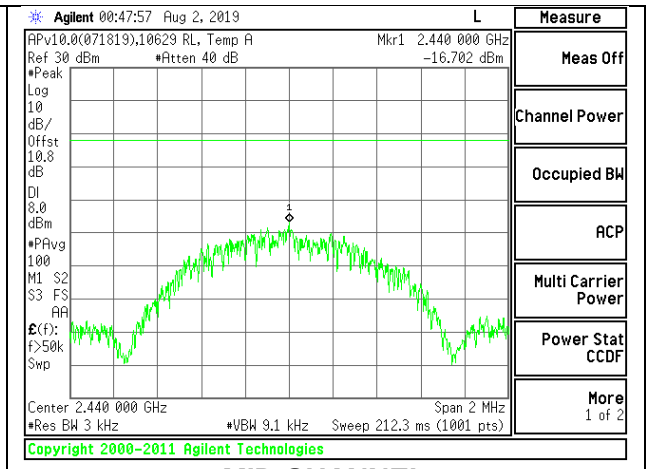
RESULTS

8.6.1. BLE (1Mbps)

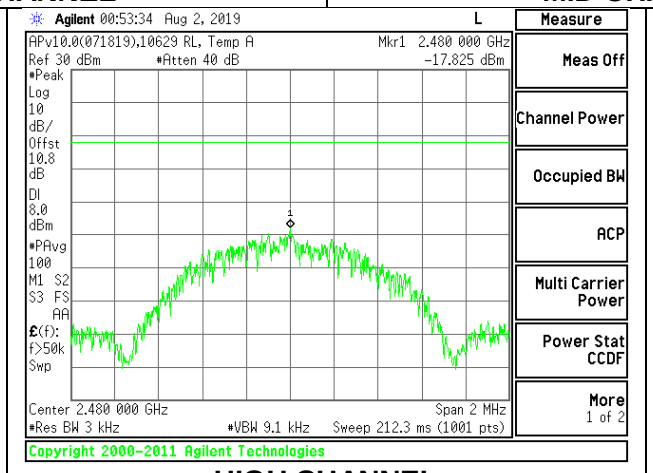
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-18.38	8	-26.38
Middle	2440	-16.70	8	-24.70
High	2480	-17.83	8	-25.83



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

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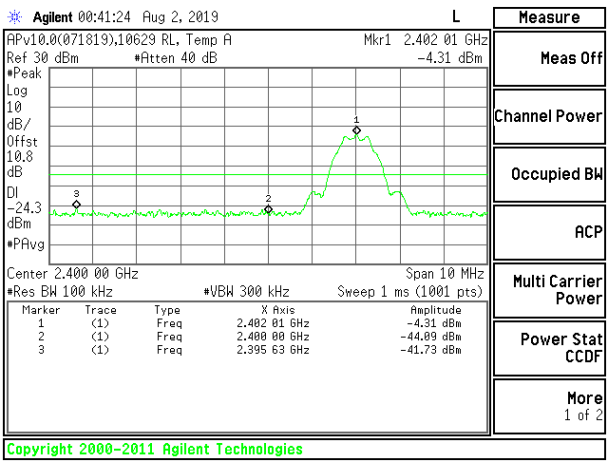
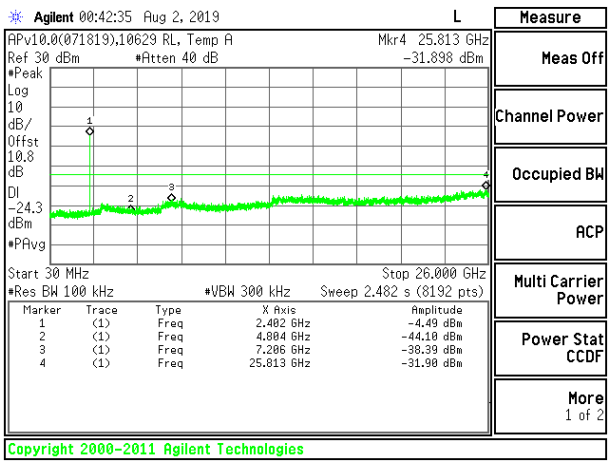
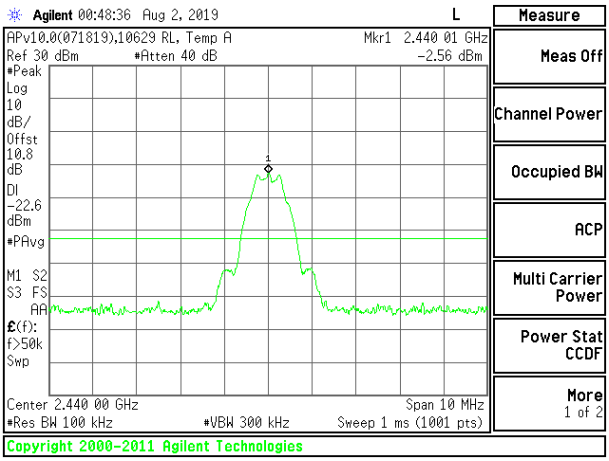
8.7.1. BLE (1Mbps)



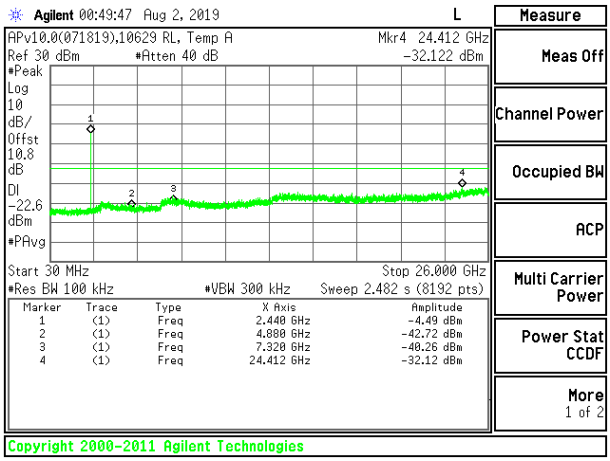
LOW CHANNEL BANDEDGE



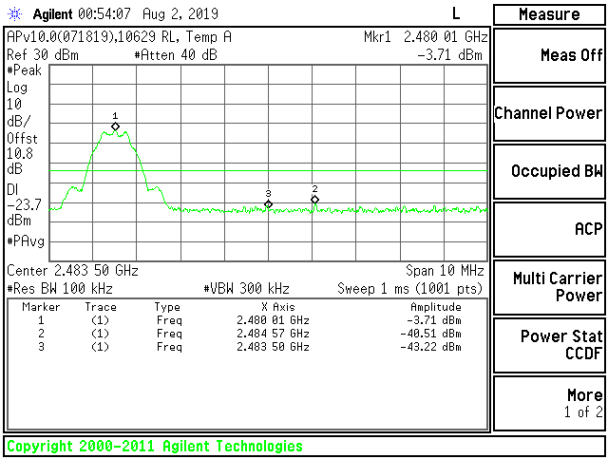
OUT-OF-BAND LOW CHANNEL



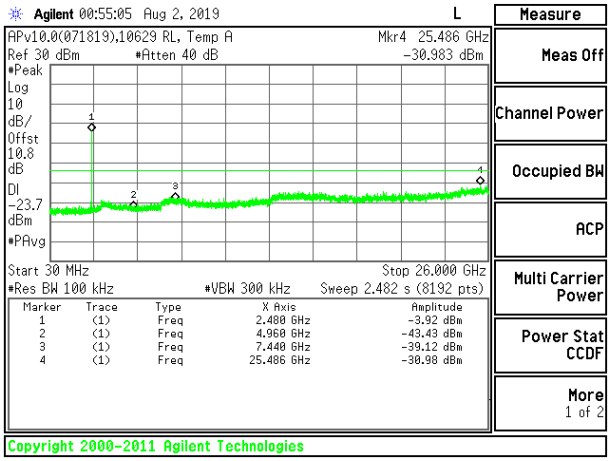
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 30MHz, below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

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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.

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.

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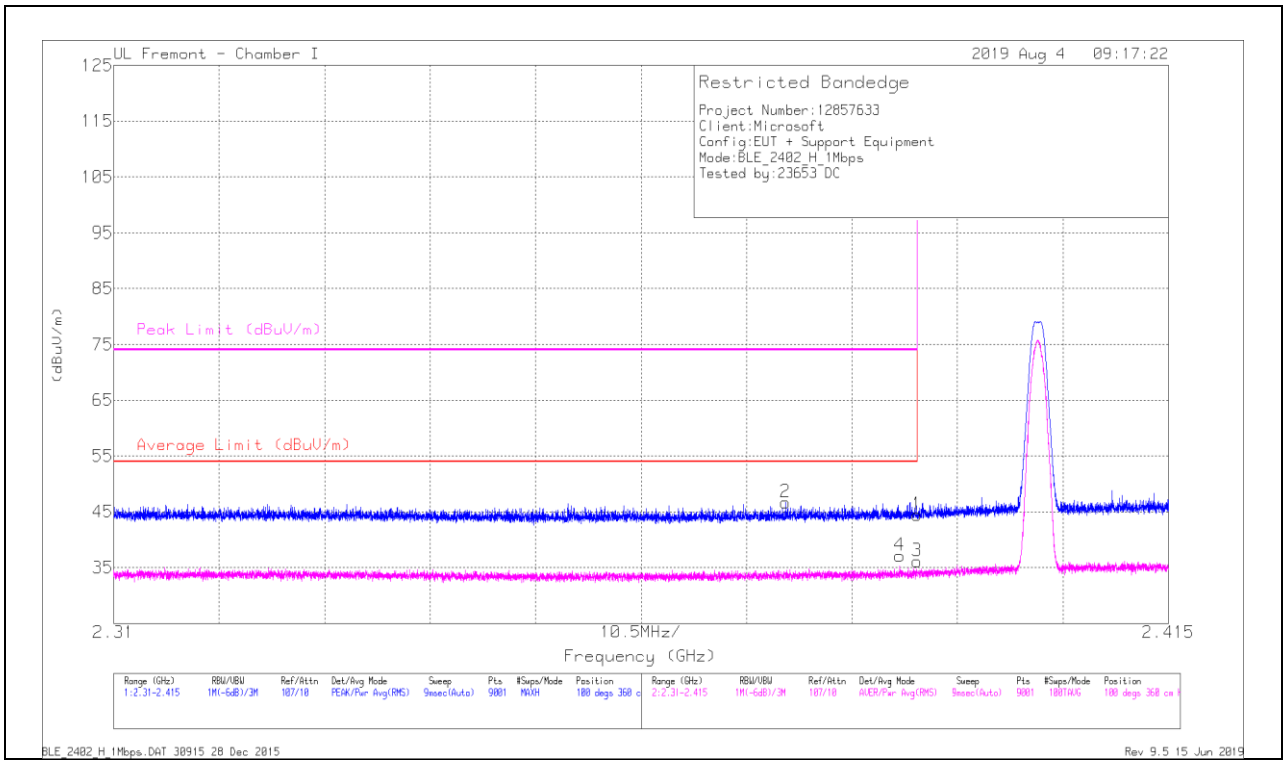
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.38999	40.49	Pk	29.5	-25.5	0	44.49	-	-	74	-29.51	100	360	H
2	2.37688	42.78	Pk	29.4	-25.5	0	46.68	-	-	74	-27.32	100	360	H
3	2.38999	30.28	RMS	29.5	-25.5	1.86	36.14	54	-17.86	-	-	100	360	H
4	2.38826	31.27	RMS	29.5	-25.5	1.86	37.13	54	-16.87	-	-	100	360	H

Pk - Peak detector
RMS - RMS detection

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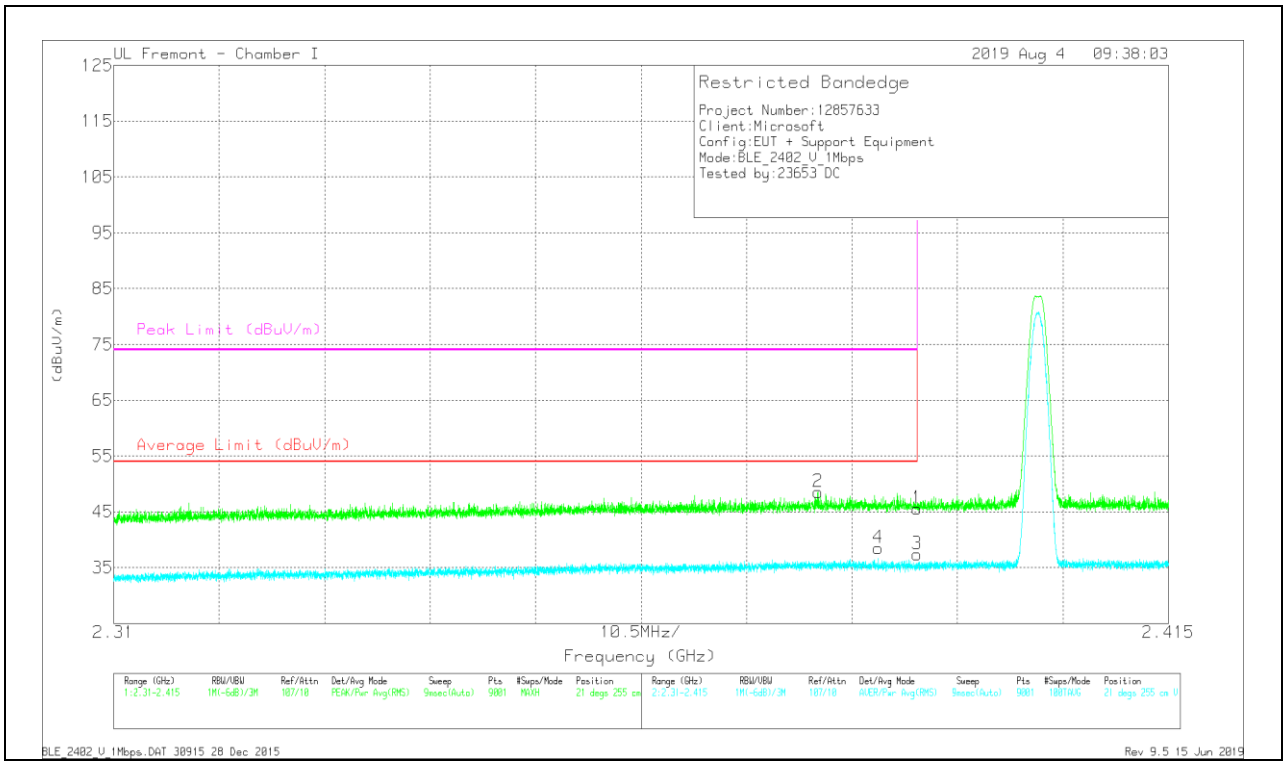
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.38999	41.6	Pk	29.5	-25.5	0	45.6	-	-	74	-28.4	21	255	V
2	2.3801	44.63	Pk	29.4	-25.5	0	48.53	-	-	74	-25.47	21	255	V
3	2.38999	31.56	RMS	29.5	-25.5	1.86	37.42	54	-16.58	-	-	21	255	V
4	2.38609	32.64	RMS	29.5	-25.5	1.86	38.5	54	-15.5	-	-	21	255	V

Pk - Peak detector
RMS - RMS detection

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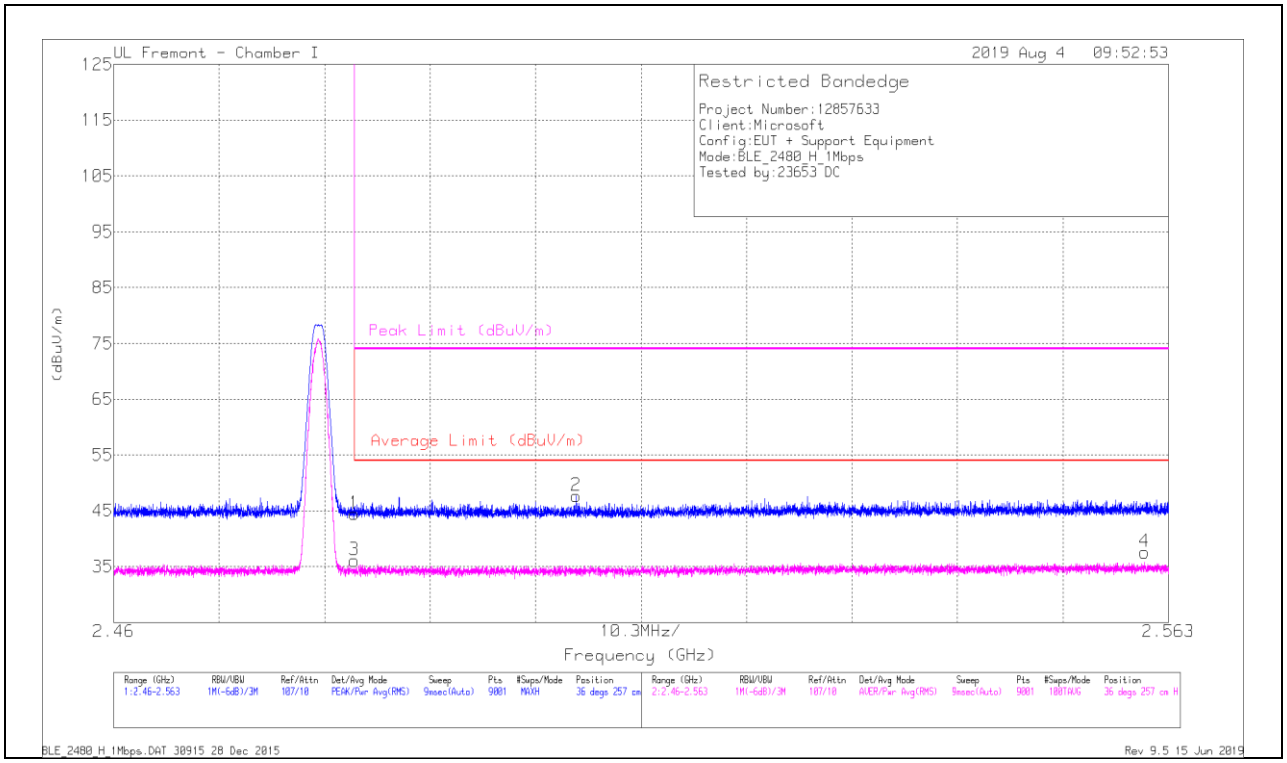
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.48351	40.09	Pk	29.9	-25.5	0	44.49	-	-	74	-29.51	36	257	H
2	2.50518	43.17	Pk	30	-25.5	0	47.67	-	-	74	-26.33	36	257	H
3	2.48351	29.82	RMS	29.9	-25.5	1.86	36.08	54	-17.92	-	-	36	257	H
4	2.5607	30.91	RMS	30.2	-25.4	1.86	37.57	54	-16.43	-	-	36	257	H

Pk - Peak detector
RMS - RMS detection

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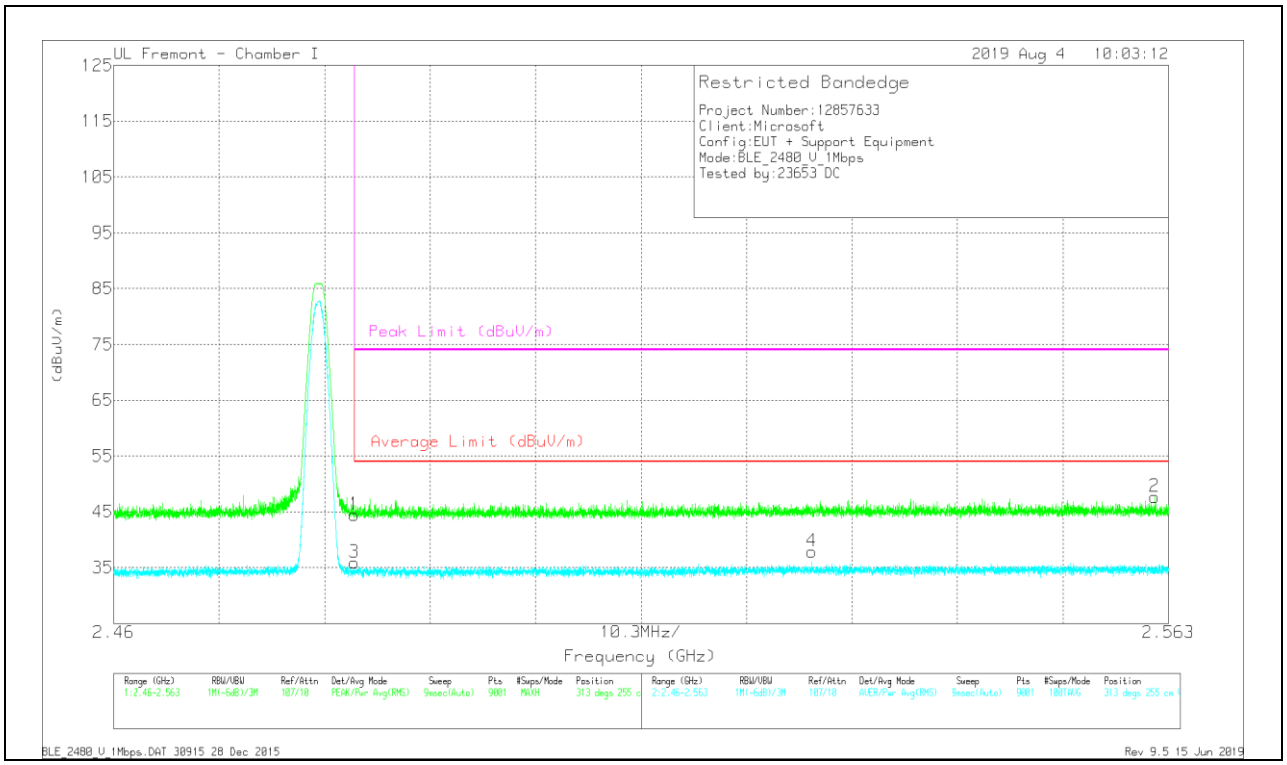
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.48351	40.02	Pk	29.9	-25.5	0	44.42	-	-	74	-29.58	313	255	V
2	2.56166	42.87	Pk	30.2	-25.4	0	47.67	-	-	74	-26.33	313	255	V
3	2.48351	29.59	RMS	29.9	-25.5	1.86	35.85	54	-18.15	-	-	313	255	V
4	2.52817	31.32	RMS	30.1	-25.4	1.86	37.88	54	-16.12	-	-	313	255	V

Pk - Peak detector
RMS - RMS detection

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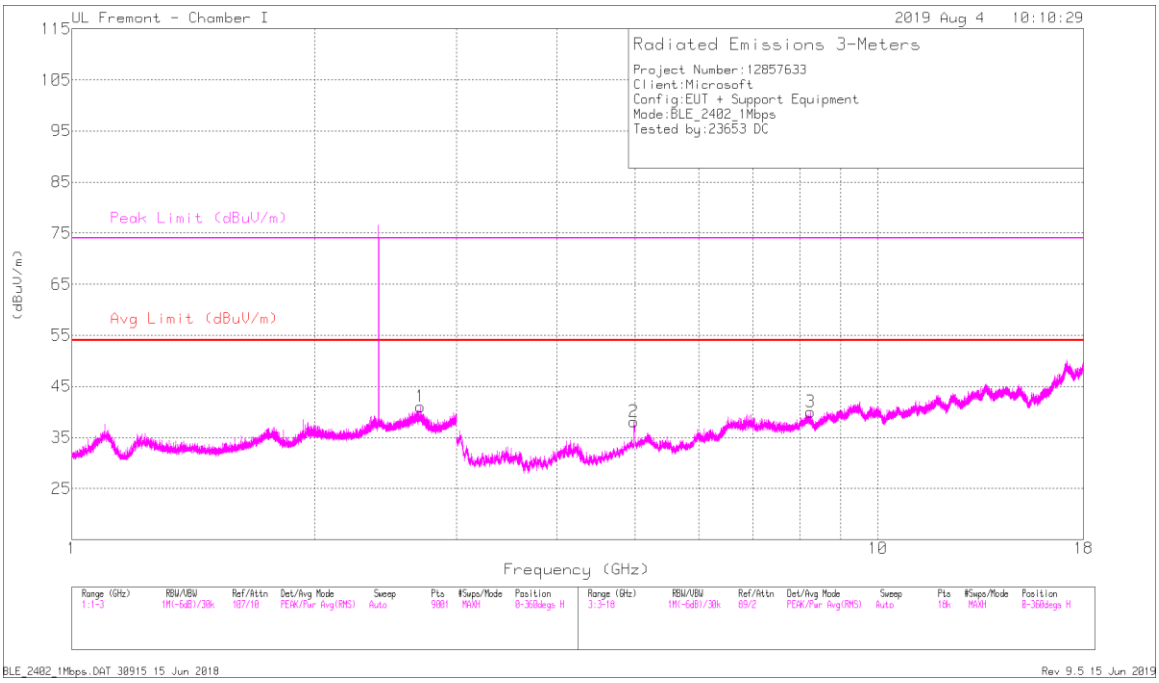
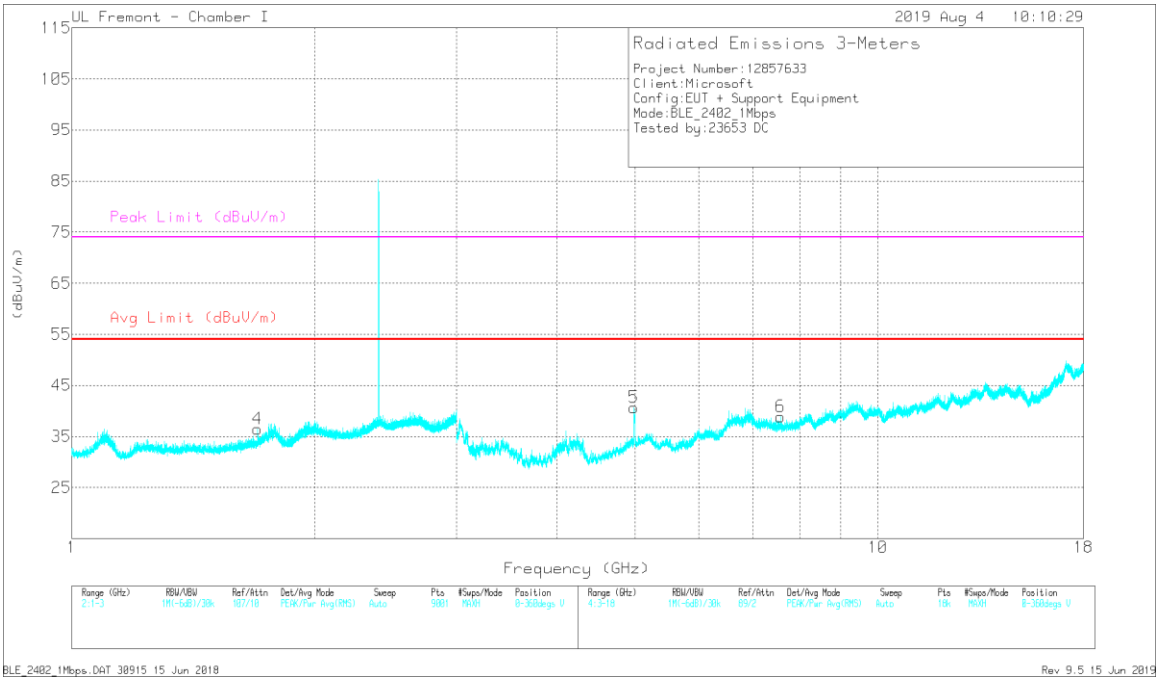
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (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)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.70882	41.87	PK2	29.6	-25.2	0	46.27	-	-	74	-27.73	346	390	H
	* 2.70894	31.12	MAv1	29.6	-25.2	1.86	37.38	54	-16.62	-	-	346	390	H
4	* 1.70006	42.27	PK2	25.9	-25.8	0	42.37	-	-	74	-31.63	151	350	V
	* 1.69875	31.42	MAv1	25.9	-25.8	1.86	33.38	54	-20.62	-	-	151	350	V
2	* 4.98549	45.03	PK2	35	-30.2	0	49.83	-	-	74	-24.17	170	101	H
	* 4.98233	31.84	MAv1	35	-30.2	1.86	38.5	54	-15.5	-	-	170	101	H
3	* 8.26126	35.47	PK2	38.3	-26.1	0	47.67	-	-	74	-26.33	214	213	H
	* 8.25877	23.19	MAv1	38.3	-26.1	1.86	37.25	54	-16.75	-	-	214	213	H
5	* 4.98449	42.71	PK2	35	-30.2	0	47.51	-	-	74	-26.49	198	187	V
	* 4.98325	29.78	MAv1	35	-30.2	1.86	36.44	54	-17.56	-	-	198	187	V
6	* 7.57957	32.97	PK2	37.3	-27.1	0	43.17	-	-	74	-30.83	89	346	V
	* 7.57921	22.62	MAv1	37.3	-27.1	1.86	34.68	54	-19.32	-	-	89	346	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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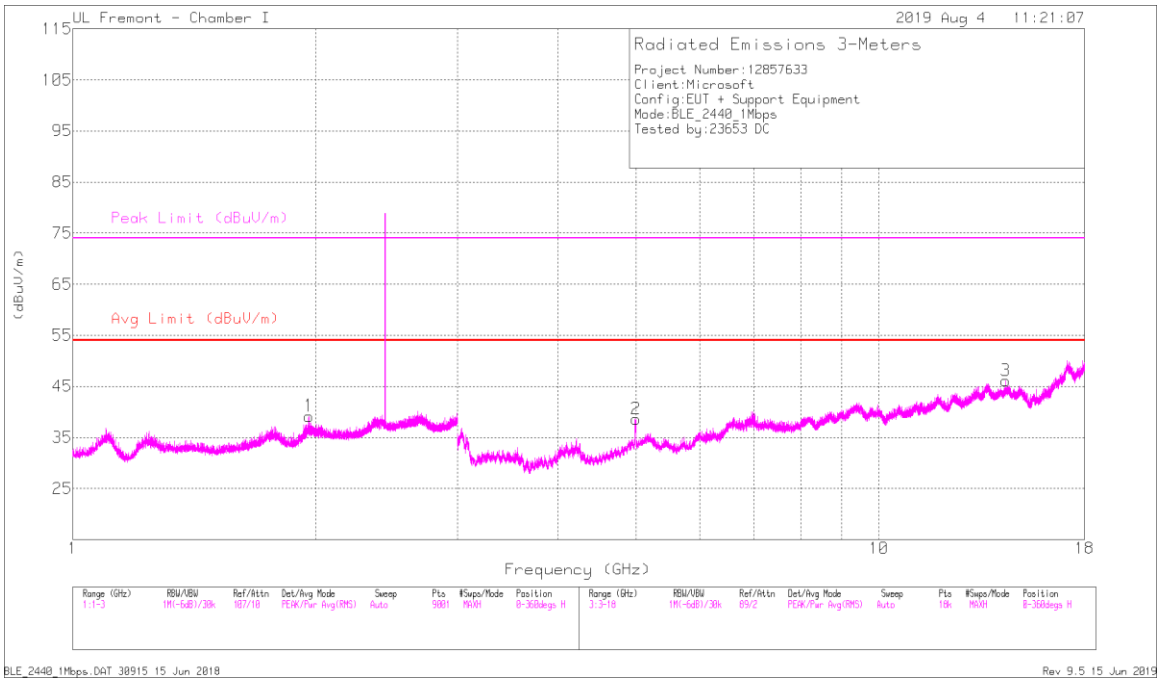
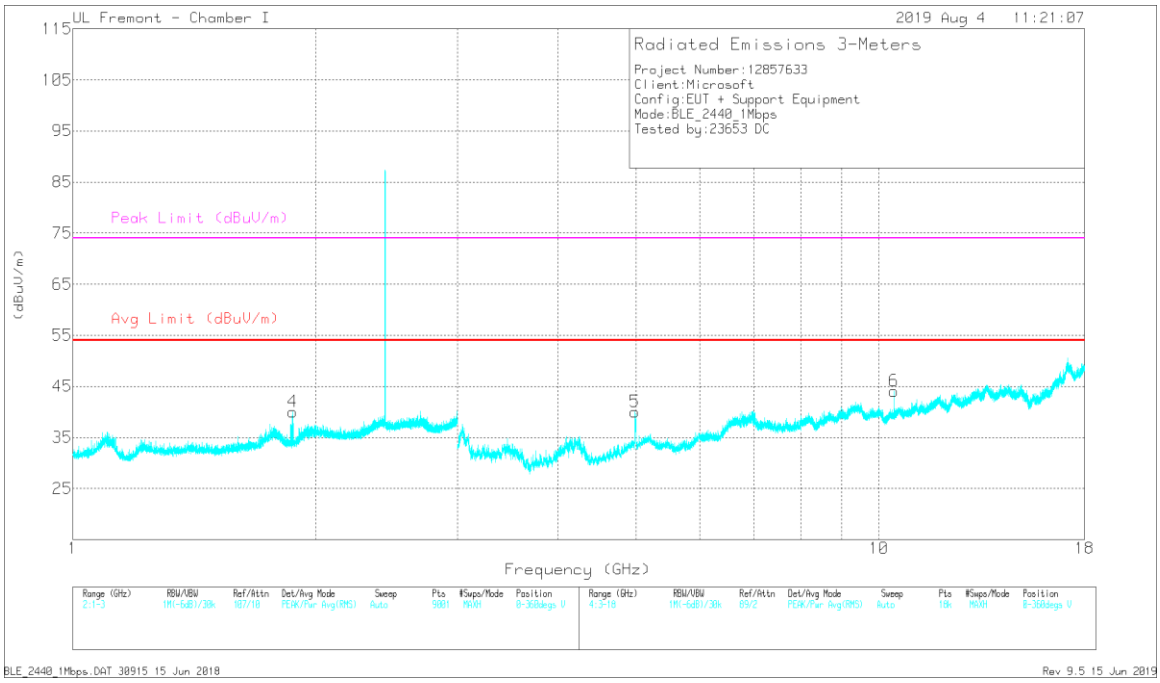
MID CHANNEL RESULTS



HORIZONTAL



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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)	Azimuth (Degs)	Height (cm)	Polarity
3	9.5745	33.93	PK2	37.1	-23	0	48.03	-	-	-	-	150	302	H
1	* 3.60133	41.19	PK2	33.4	-32.3	0	42.29	-	-	74	-31.71	233	121	H
	* 3.60123	30.94	MAv1	33.4	-32.3	1.86	33.9	54	-20.1	-	-	233	121	H
2	* 4.99428	44.67	PK2	34.1	-30.4	0	48.37	-	-	74	-25.63	244	282	H
	* 4.99401	31.53	MAv1	34.1	-30.4	1.86	37.09	54	-16.91	-	-	244	282	H
6	10.43983	33.47	PK2	37.6	-22.9	0	48.17	-	-	-	-	358	268	V
4	* 3.78887	38.1	PK2	33.3	-31.4	0	40	-	-	74	-34	53	244	V
	* 3.78837	27.67	MAv1	33.3	-31.4	1.86	31.43	54	-22.57	-	-	53	244	V
5	* 4.98153	43.46	PK2	34.1	-30.5	0	47.06	-	-	74	-26.94	158	157	V
	* 4.98614	29.94	MAv1	34.1	-30.4	1.86	35.5	54	-18.5	-	-	158	157	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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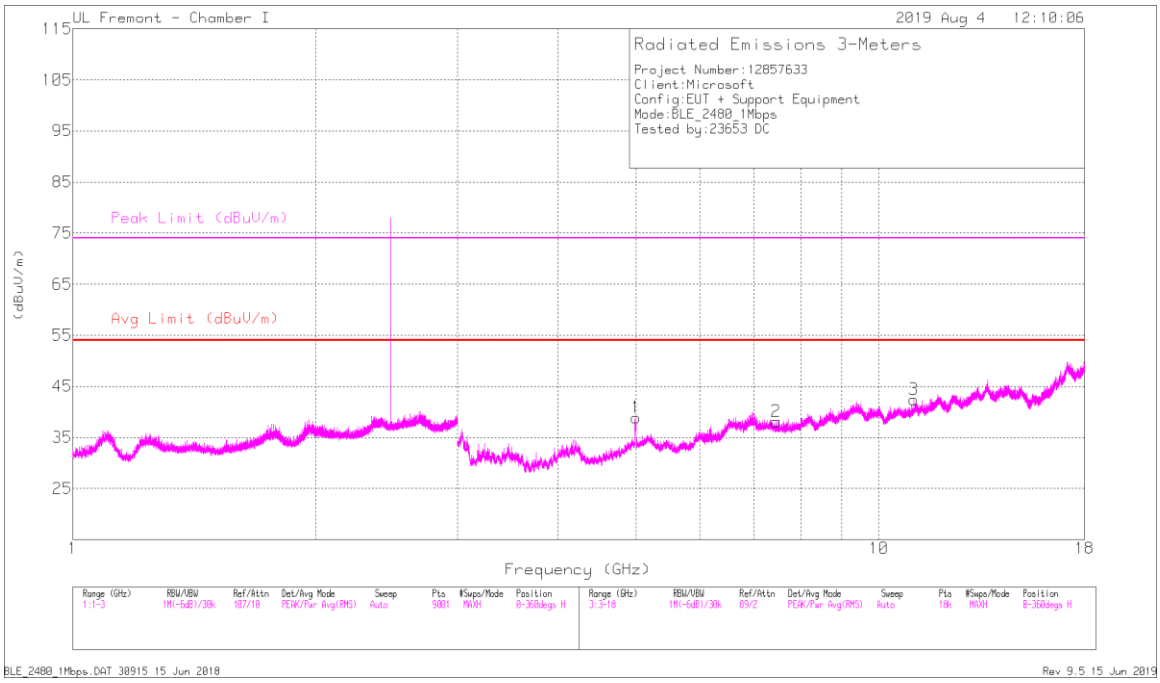
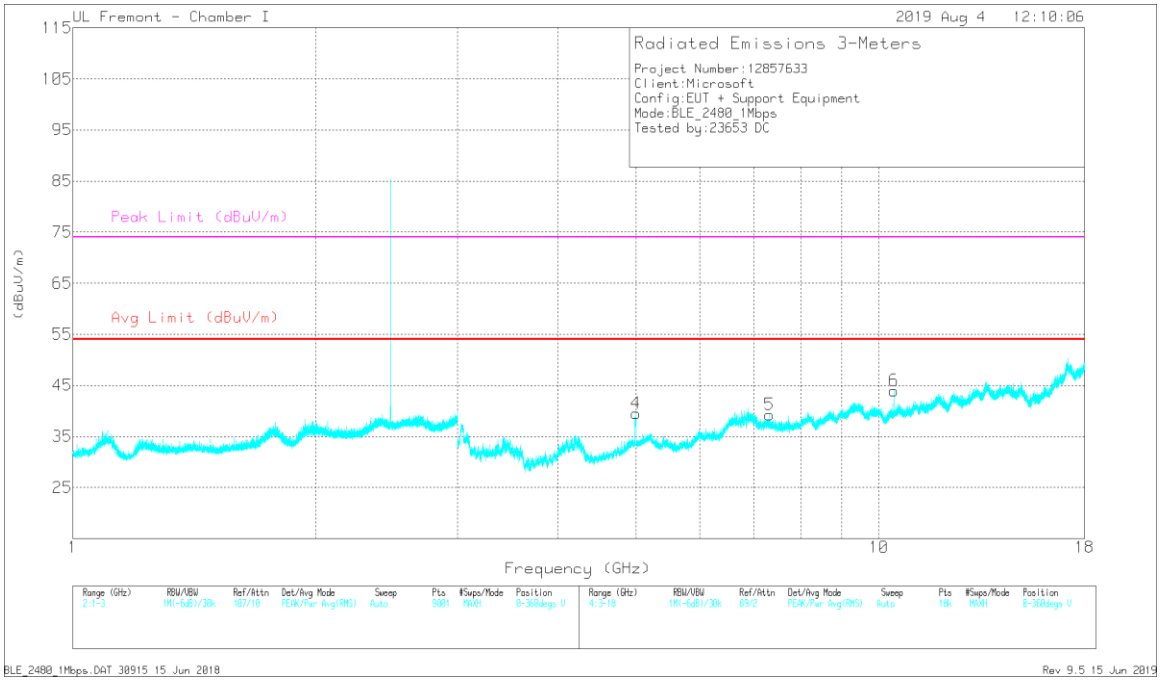
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0189055 (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)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.9937	43.82	PK2	35	-30	0	48.82	-	-	74	-25.18	225	236	H
	* 4.99212	31.54	MAv1	35	-30	1.86	38.4	54	-15.6	-	-	225	236	H
2	* 7.46247	33.41	PK2	37.5	-27.2	0	43.71	-	-	74	-30.29	169	203	H
	* 7.45909	22.9	MAv1	37.5	-27.2	1.86	35.06	54	-18.94	-	-	169	203	H
3	* 11.0549	31.2	PK2	39.1	-22.9	0	47.4	-	-	74	-26.6	14	367	H
	* 11.0559	20.93	MAv1	39.1	-22.9	1.86	38.99	54	-15.01	-	-	14	367	H
6	10.43996	34.65	PK2	38.3	-24.4	0	48.55	-	-	-	-	48	207	V
4	* 4.99999	43.71	PK2	35.1	-29.9	0	48.91	-	-	74	-25.09	156	128	V
	* 4.99496	30.99	MAv1	35	-30	1.86	37.85	54	-16.15	-	-	156	128	V
5	* 7.32134	33.47	PK2	38	-27.1	0	44.37	-	-	74	-29.63	10	353	V
	* 7.31974	23.72	MAv1	38	-27.1	1.86	36.48	54	-17.52	-	-	10	353	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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9.3. SPURIOUS EMISSIONS FOR COLLOCATION

TEST-CASE CONDITIONS

Test Case #	Antenna	Mode	Frequency (MHz)
1	**Antenna 1**	BLE, & WLAN 5GHz, 11n HT20	2440 & 5500
2	**Antenna 1**	BLE	2440
	Antenna 2	WLAN 2.4GHz, 11g	2437
3	**Antenna 1**	BLE	2440
	Antenna 2	WLAN 5GHz, 11n HT20	5500

For simultaneous transmission of any BLE (2.4GHz) and WLAN (2.4 GHz) bands, and BLE (2.4GHz) and WLAN (5GHz) bands, investigation has been performed and no noticeable new emission was found.

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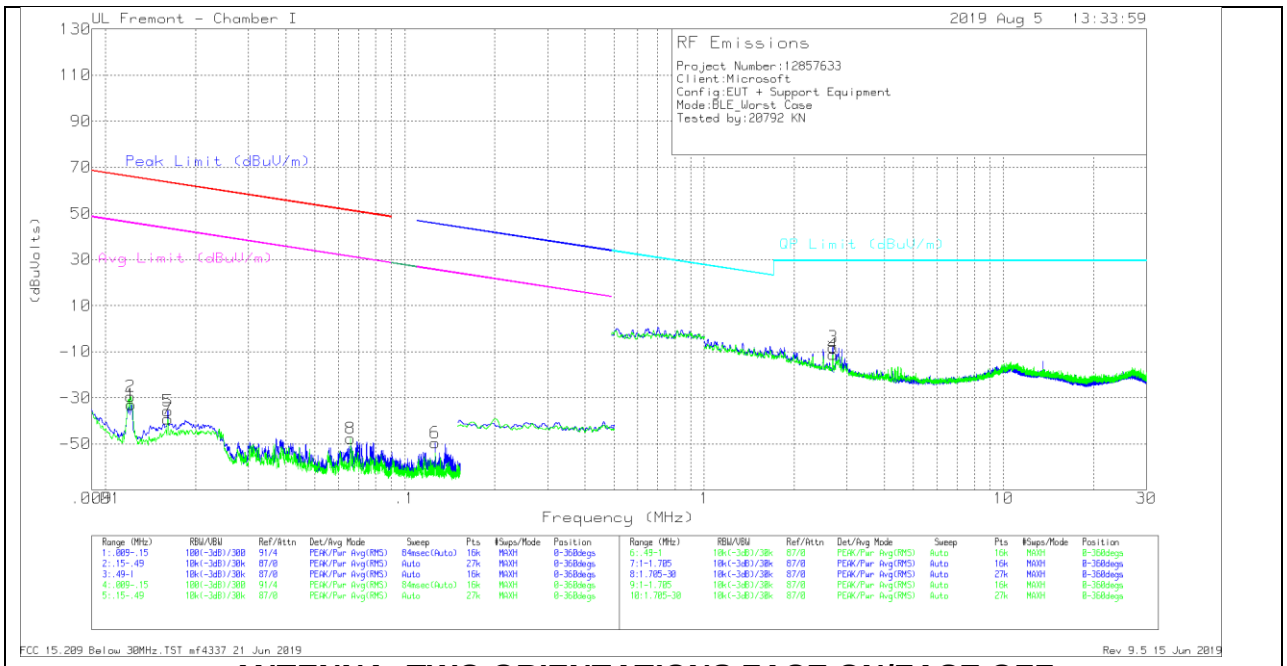
9.4. WORST CASE BELOW 30MHZ

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/ PRE0180175 (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.0122	19.56	Pk	59.9	-32.4	-80	-32.94	65.85	-98.79	45.85	-78.79	-	-	-	-	0-360
5	.01616	17.56	Pk	59.3	-32.4	-80	-35.54	63.42	-98.96	43.42	-78.96	-	-	-	-	0-360
6	.12623	6.8	Pk	55.6	-31.9	-80	-49.5	-	-	-	-	45.6	-95.1	25.6	-75.1	0-360
2	.01214	23.18	Pk	59.9	-32.4	-80	-29.32	65.9	-95.22	45.9	-75.22	-	-	-	-	0-360
7	.01616	13.89	Pk	59.3	-32.4	-80	-39.21	63.42	-102.63	43.42	-82.63	-	-	-	-	0-360
8	.06592	8.41	Pk	55.9	-32	-80	-47.69	51.21	-98.9	31.21	-78.9	-	-	-	-	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0180175 (dB)	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	2.69012	23.96	Pk	39.7	-31.7	-40	-8.04	29.5	-37.54	0-360
4	2.68802	20.85	Pk	39.7	-31.7	-40	-11.15	29.5	-40.65	0-360

Pk - Peak detector

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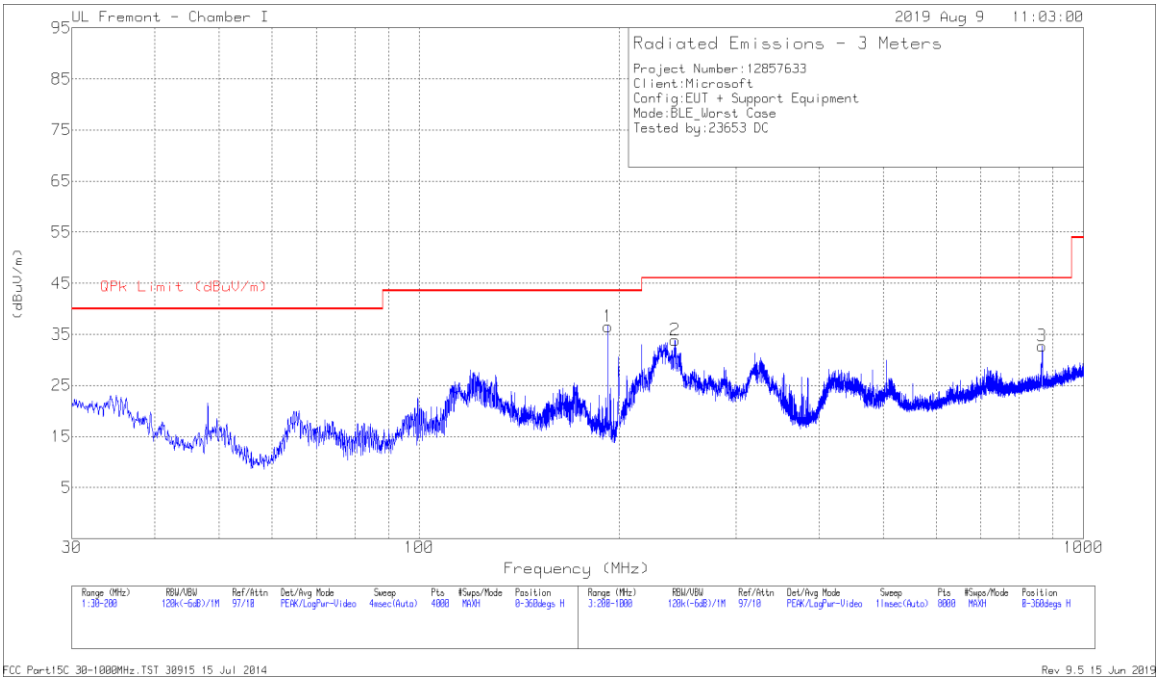
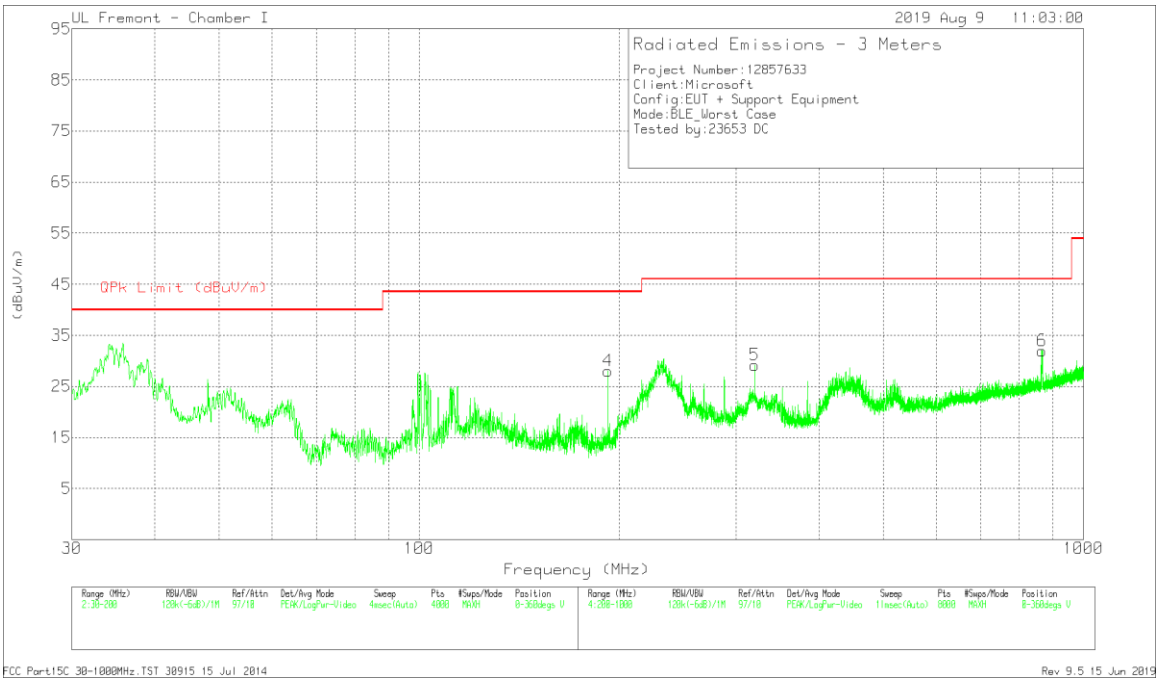
9.5. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0184971 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	192.392	49.67	Pk	17.1	-30.3	36.47	43.52	-7.05	0-360	100	H
	192.3613	50.31	Qp	17.1	-30.3	37.11	43.52	-6.41	189	118	H
4	192.3495	41.18	Pk	17.1	-30.3	27.98	43.52	-15.54	0-360	102	V
2	* 242.7056	46.24	Pk	17.6	-30	33.84	46.02	-12.18	0-360	102	H
3	865.9866	32.55	Pk	27.7	-27.5	32.75	46.02	-13.27	0-360	299	H
5	319.9156	39.1	Pk	19.8	-29.8	29.1	46.02	-16.92	0-360	200	V
6	866.6867	31.85	Pk	27.6	-27.5	31.95	46.02	-14.07	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

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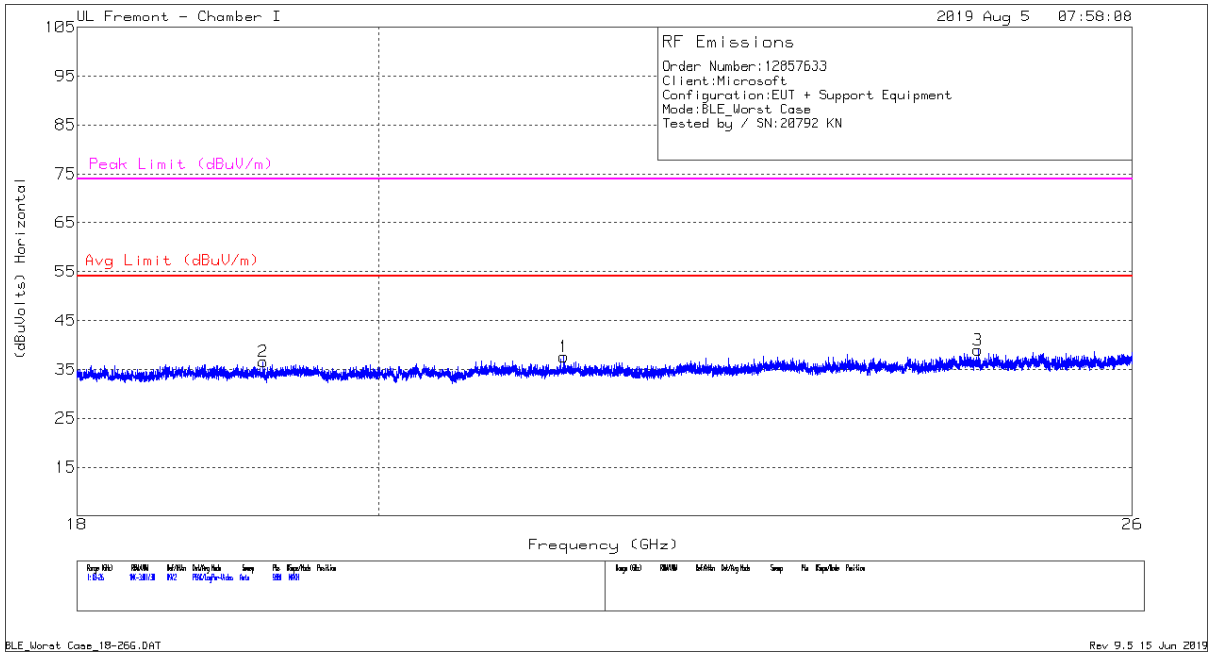
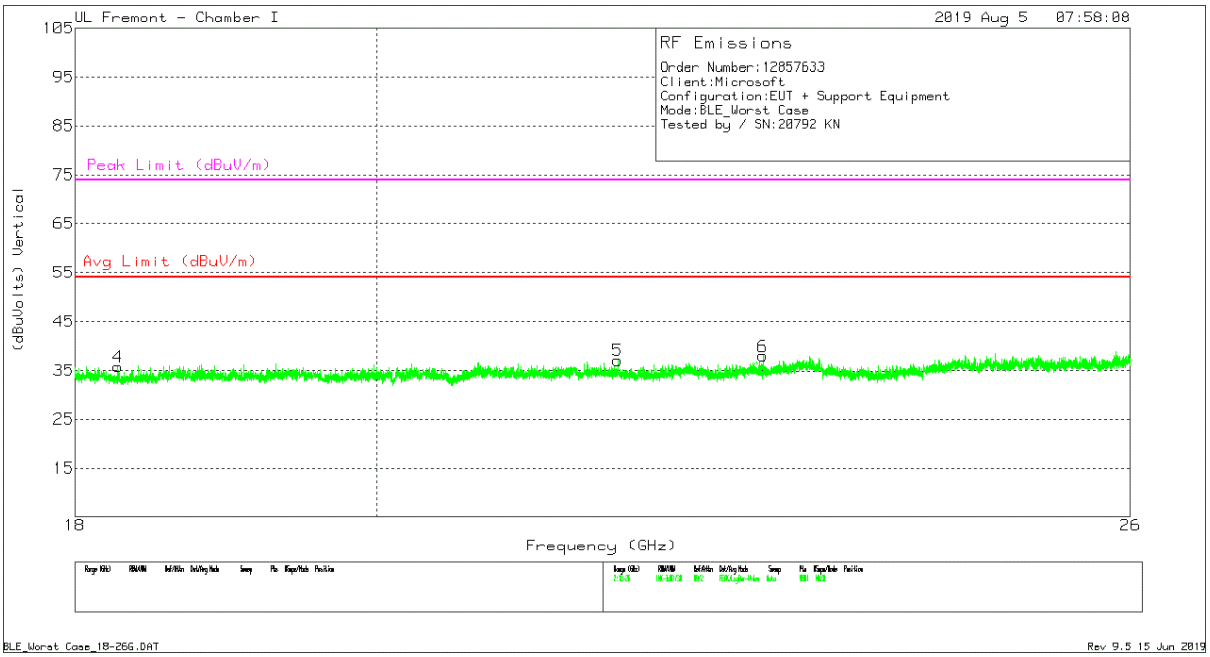
9.6. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE018218 8 (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	21.32978	70.72	Pk	33.6	-57.2	-9.5	37.62	54	-16.38	74	-36.38
2	19.20889	70.4	Pk	33.1	-57.4	-9.5	36.6	54	-17.4	74	-37.4
3	24.63911	69.53	Pk	34.8	-55.9	-9.5	38.93	54	-15.07	74	-35.07
4	18.27378	72.01	Pk	32.9	-59.7	-9.5	35.71	54	-18.29	74	-38.29
5	21.74845	70.04	Pk	33.9	-57.4	-9.5	37.04	54	-16.96	74	-36.96
6	22.85956	70.24	Pk	34.3	-57.4	-9.5	37.64	54	-16.36	74	-36.36

Qp - Quasi-Peak detector

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10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

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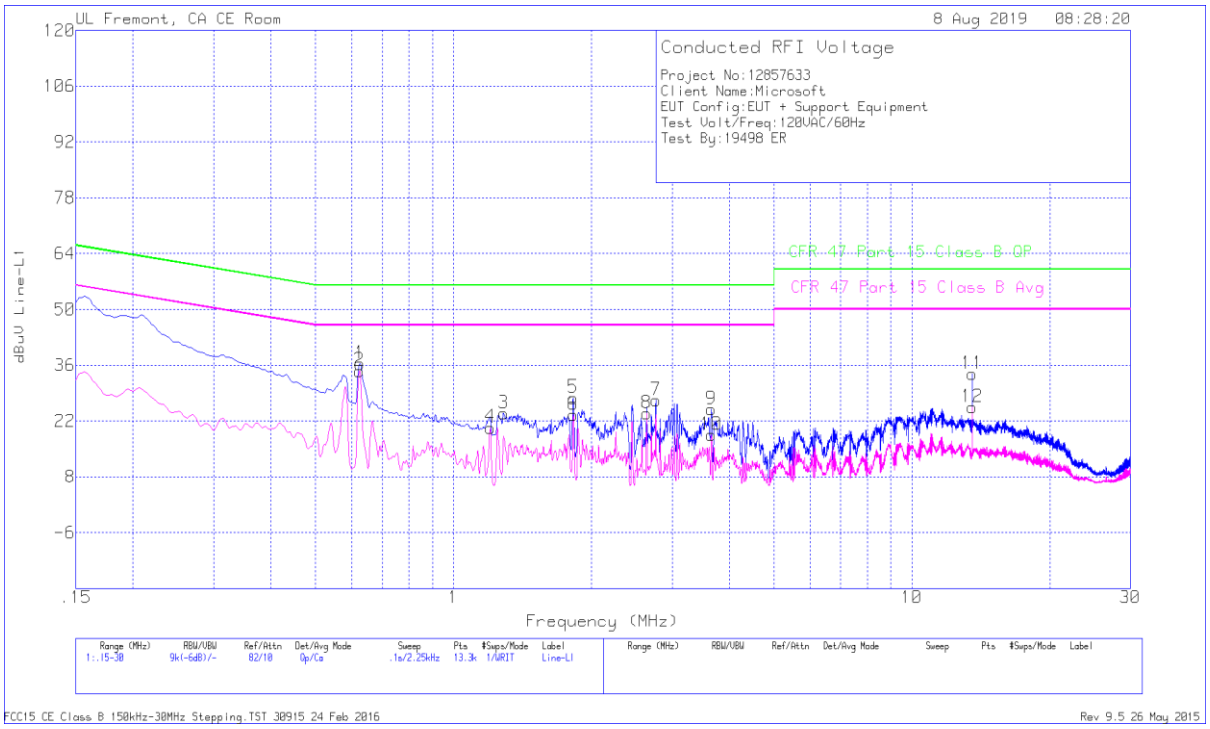
10.1.1. AC Power Line Norm

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.62475	26.26	Qp	0	0	10.1	36.36	56	-19.64	-	-
2	.6225	24.51	Ca	0	0	10.1	34.61	-	-	46	-11.39
3	1.28625	13.76	Qp	0	.1	10.1	23.96	56	-32.04	-	-
4	1.203	10.16	Ca	0	.1	10.1	20.36	-	-	46	-25.64
5	1.824	17.63	Qp	0	.1	10.1	27.83	56	-28.17	-	-
6	1.82625	13.39	Ca	0	.1	10.1	23.59	-	-	46	-22.41
7	2.7645	16.98	Qp	0	.1	10.1	27.18	56	-28.82	-	-
8	2.6385	13.72	Ca	0	.1	10.1	23.92	-	-	46	-22.08
9	3.651	14.73	Qp	0	.1	10.1	24.93	56	-31.07	-	-
10	3.6555	8.3	Ca	0	.1	10.1	18.5	-	-	46	-27.5
11	13.56	23.28	Qp	.1	.2	10.2	33.78	60	-26.22	-	-
12	13.56	14.91	Ca	.1	.2	10.2	25.41	-	-	50	-24.59

Qp - Quasi-Peak detector
Ca - CISPR average detection
NOTE: Markers 11 and 12, 13.56MHz is an external NFC signal unrelated to the EUT.

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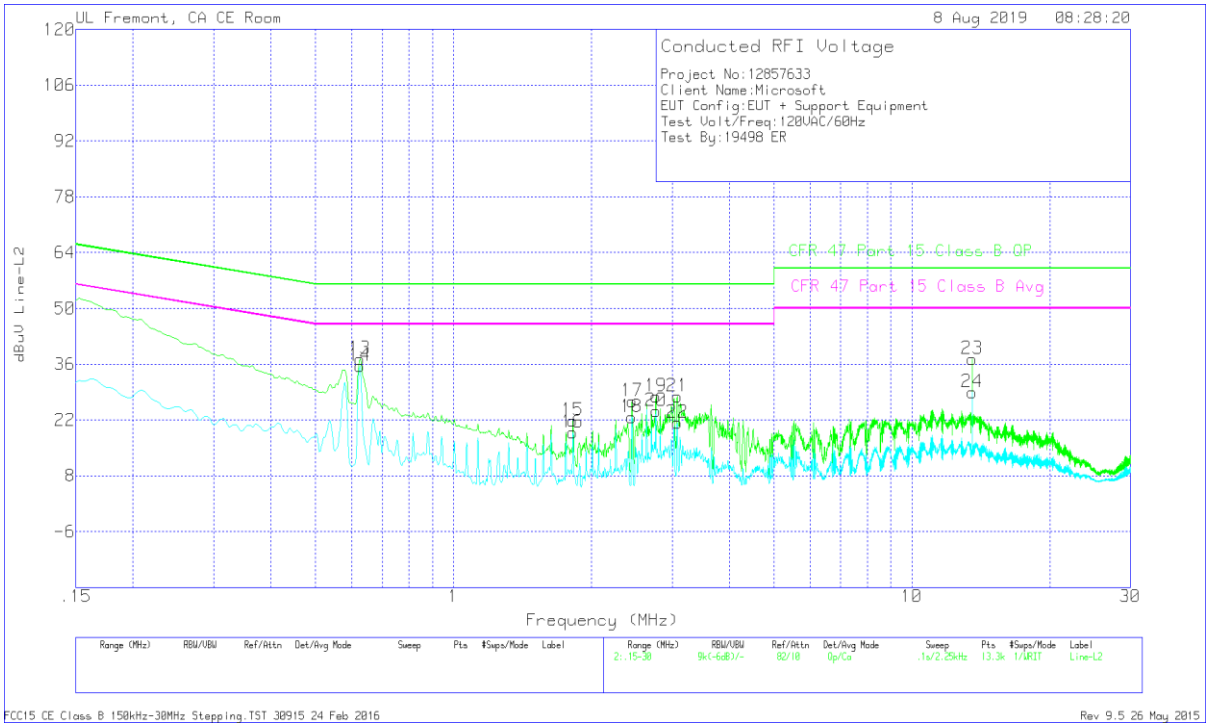
LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.62475	27.25	Qp	0	0	10.1	37.35	56	-18.65	-	-
14	.62475	25.51	Ca	0	0	10.1	35.61	-	-	46	-10.39
15	1.82175	11.56	Qp	0	.1	10.1	21.76	56	-34.24	-	-
16	1.82175	8.65	Ca	0	.1	10.1	18.85	-	-	46	-27.15
17	2.45175	16.5	Qp	0	.1	10.1	26.7	56	-29.3	-	-
18	2.4495	12.53	Ca	0	.1	10.1	22.73	-	-	46	-23.27
19	2.7645	17.72	Qp	0	.1	10.1	27.92	56	-28.08	-	-
20	2.7645	14.14	Ca	0	.1	10.1	24.34	-	-	46	-21.66
21	3.0795	17.68	Qp	0	.1	10.1	27.88	56	-28.12	-	-
22	3.07725	11.06	Ca	0	.1	10.1	21.26	-	-	46	-24.74
23	13.56	26.86	Qp	.1	.2	10.2	37.36	60	-22.64	-	-
24	13.56	18.39	Ca	.1	.2	10.2	28.89	-	-	50	-21.11

Qp - Quasi-Peak detector
Ca - CISPR average detection
NOTE: Markers 23 and 24, 13.56MHz is an external NFC signal unrelated to the EUT.

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