CLASS II PERMISSIVE CHANGE TEST REPORT

Report Number. : 11460738-E1V3

Applicant	:	Microsoft Corporation One Microsoft Way Redmond, WA, 98052, USA
Model	:	1708
FCC ID	:	C3K1708
IC	:	3048A-1708
EUT Description	:	Wireless Input Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS - 247 ISSUE 1

Date Of Issue:
December 16, 2016

Prepared by:
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/06/2016	Initial Issue	---
V2	12/14/2016	Updated section 5.2	Francisco de Anda
V3	12/16/2016	Revised section 5.2	Francisco de Anda

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Wireless Input Device

MODEL: 1708

SERIAL NUMBER: 02600011204642 (Conducted); 02600002414642 (Radiated)

DATE TESTED: November 8th 2016 – December 5th 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS - 247 ISSUE 1	Pass
INDUSTRY CANADA RSS - GEN ISSUE 4	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. 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, or any agency of the U.S. Government.

Approved & Released For
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CONSUMER TECHNOLOGY DIVISION
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Engineer
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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, KDB 558074 D01 v03r05, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, 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
☒ Chamber A (IC:2324B-1)	☐ Chamber D (IC:2324B-4)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:2324B-5)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:2324B-6)
	☐ Chamber G (IC:2324B-7)
	☒ Chamber H (IC:2324B-8)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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

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

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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	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Model 1708 is a wireless input device that contains an 802.11a/g/n and Bluetooth transceiver.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The purpose of this C2PC is to upgrade the device described under section 5.1 of this report to include the following two configuration changes that will be manufactured;

Configuration C

-Removal of RF shield.

Configuration F

-Change of PCB layout due to re-sizing the PCB and consequent relocation of some non-RF relevant components and removal of RF shield

Radiated tests were performed on both configurations and was found configuration C to be worst case. Conducted test are leveraged from the original report, number R11040094-E3V5. Conducted power data included in this report is used to verify the output power.

5.3. MAXIMUM OUTPUT POWER

The measured output power values were verified to be less or equal than the original values. Refer to original report number “R11040094-E1V5” for original output power values and for all antenna port conducted results.

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11g	8.33	6.81
2412 - 2472	802.11n HT20	8.04	6.37

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5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral antenna, with a maximum gain of 0.0 dBi.

5.5. SOFTWARE AND FIRMWARE

The controller firmware used with the EUT during testing was 3.1.703.0 and Radio Firmware was 1.0.107.0.

The test utility software used for conducted testing was Indium QA Tool v0.0.1.63

The HQA UART Tool version used was: Ind_SW_v.1.22

5.6. WORST-CASE CONFIGURATION AND MODE

An investigation on two EUT configurations (C and F, described in section 5.2) was performed, it was determined that configuration C was worst-case. Therefore, all final radiated testing was performed on configuration C.

For below 1GHz radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X/Y/Z, it was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.

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

802.11g mode: 6 Mbps
802.11n HT20mode: MCS0

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5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	X220	R9-EVC3X	DoC
Laptop AC Adapter	Lenovo	42T4434	11S42T4434Z1ZF3K0CV0A3	DoC
Interface Board	Microsoft	X930837-001	None	None
AC/DC Adapter	Samsung	ETA0U61JWE	SC2F422AS/A-E	DoC

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	unshielded	1	
2	DC	1	barrel	unshielded	0.8	
3	AC	1	2 prong	unshielded	1.5	

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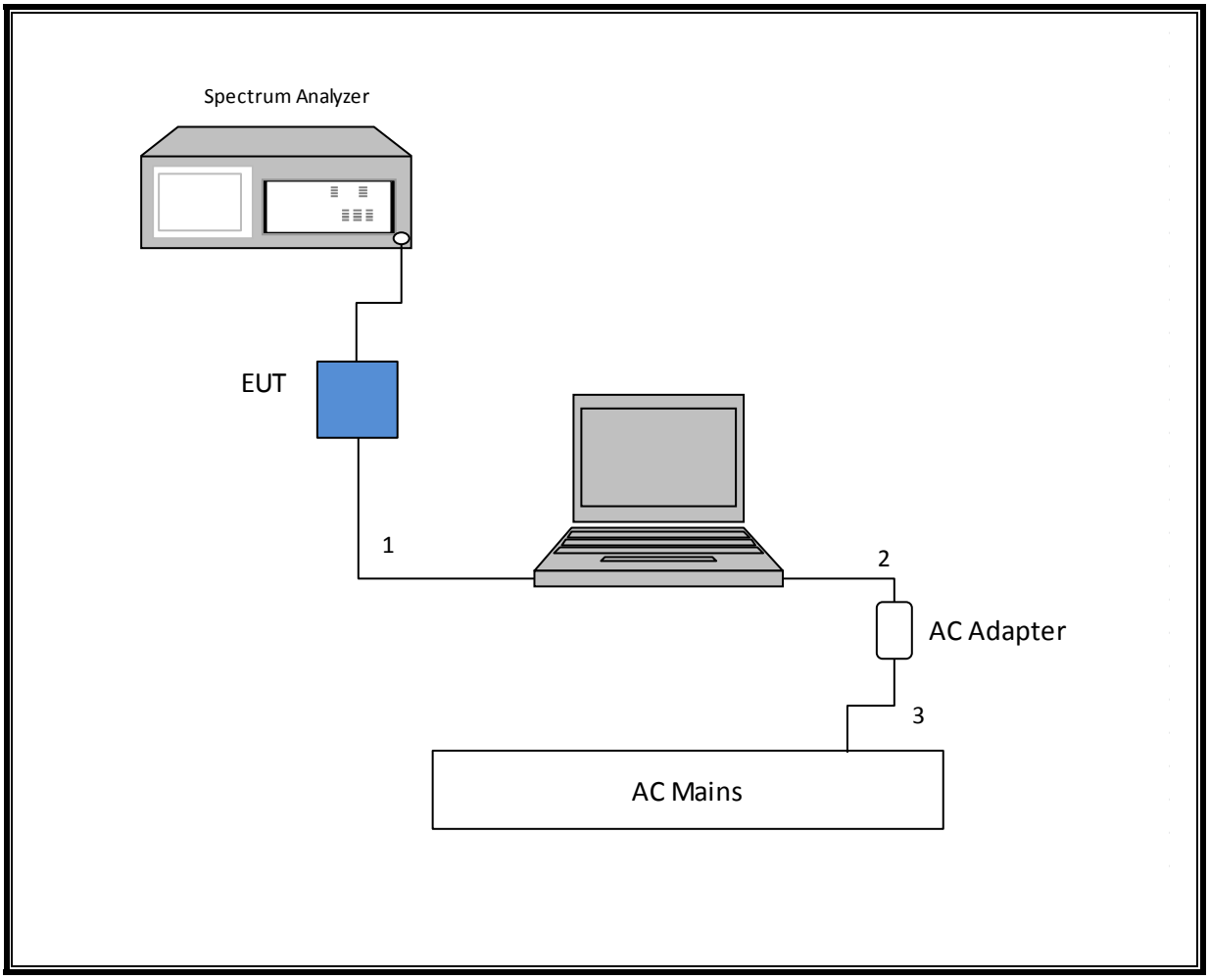
TEST SETUP - CONDUCTED TESTS

The EUT was tested connected to a host Laptop via USB cable adapter and spectrum analyzer to antenna port. Test software exercised the EUT.

SETUP DIAGRAM - CONDUCTED TESTS



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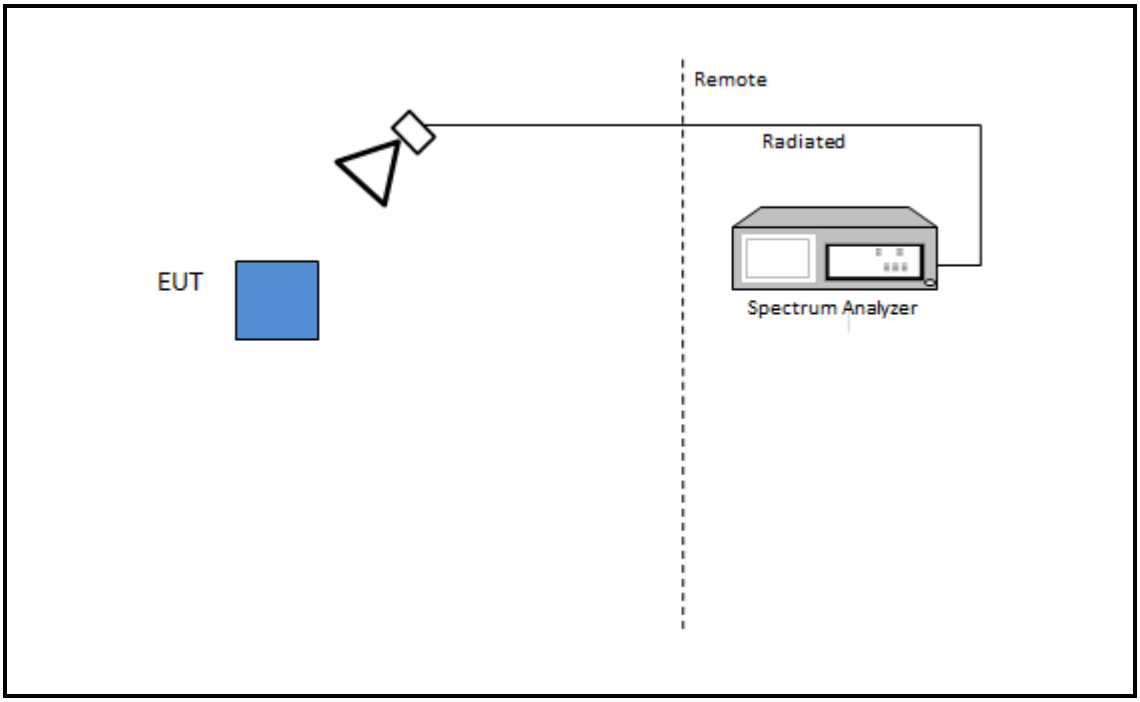
TEST SETUP - RADIATED TESTS

An interface board between EUT and laptop was used to program the EUT. Once programmed the EUT was tested standalone powered by batteries. Test software exercised the EUT.

SETUP DIAGRAM - RADIATED TESTS



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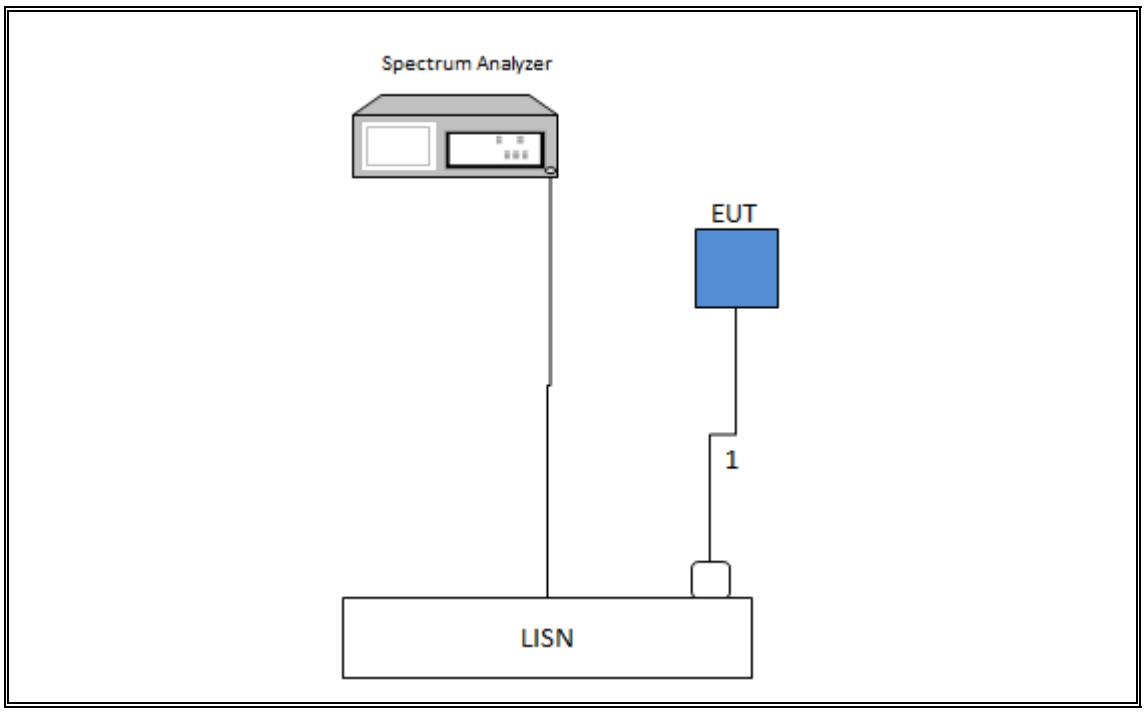
TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER

The EUT was powered by AC/DC adapter via USB cable. Test software exercised the EUT.

SETUP DIAGRAM - AC LINE CONDUCTED: AC/DC ADAPTER



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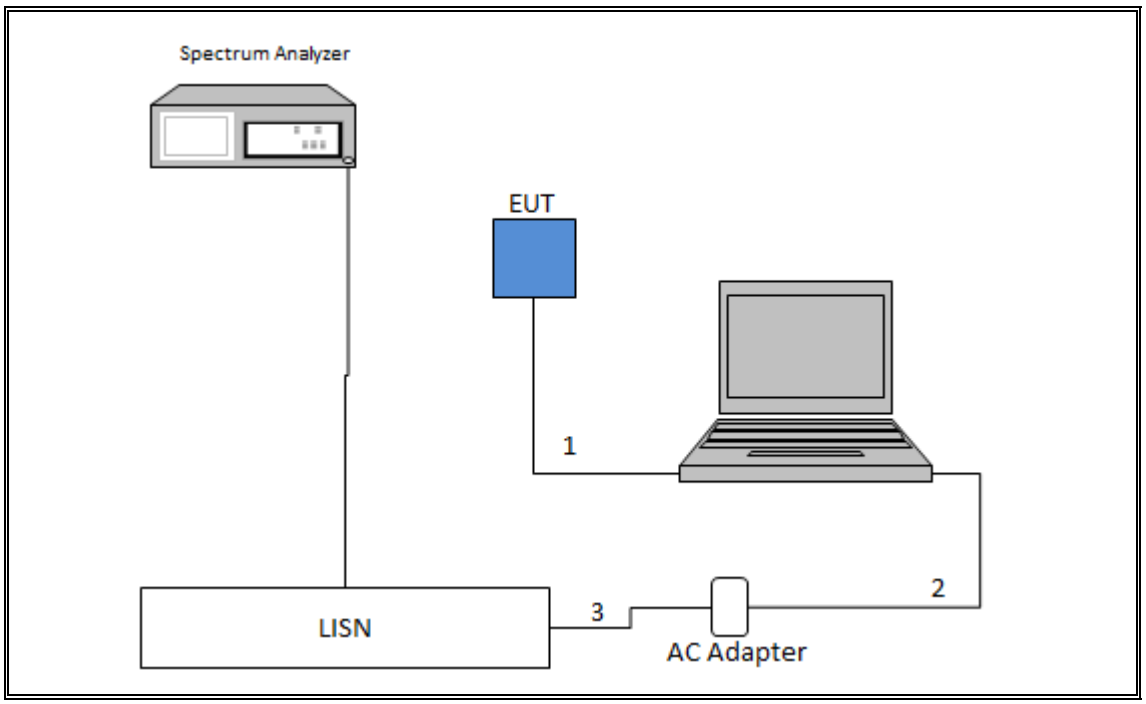
TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION

The EUT was powered by host PC via USB cable. Test software exercised the EUT.

SETUP DIAGRAM – AC LINE CONDUCTED: LAPTOP CONFIGURATION



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6. 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**	**Asset**	**Cal Due**
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T130	09/23/2017
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	02/22/2017
Antenna, Active Loop 9kHz to 30MHz	ETS-Lindgren	6502	T757	05/31/2017
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T1165	08/01/2017
RF Preamplifier, 1 - 7GHz	Amplical	AMP1G6-10-27	T1370	04/15/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T908	04/13/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T906	02/03/2017
High Pass Filter 3GHz	Micro-Tronics	HPM17543	T486	08/01/2017
Antenna, Horn, 18-26 GHz	ARA	MWH-1826/B	T449	05/26/2017
RF Preamplifier, 1 - 26GHz	Agilent	8449B	T404	07/05/2017
Spectrum Analyzer, 40 GHz	HP	8564E	T106	09/07/2017
LISN	Fischer Custom Communication, Inc.	FCC-LISN-50/250-25-2-01-CISPR16	T1310	06/08/2017
EMI Test Receiver, 10 Hz - 7 GHz	Rohde & Schwarz	ESCR 7	T1436	12/19/2016
Transient Limiter	Com-Power	LIT-930	T1457	02/10/2017
Power Meter	Keysight	N1912A	T1244	05/03/2017
Power Sensor	Keysight	N1921A	T1224	03/22/2017
Radiated Software	UL	UL EMC	Rev. 9.5, April 26, 2016	

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7. MEASUREMENT METHODS

Output Power: KDB 558074 D01 v03r05, Section 9.1.2.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.1.

Band-edge: KDB 558074 D01 v03r05, Section 12.1.

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

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)
11g	2.76	2.82	0.978	0.978	0.093	0.362
11n HT20	2.56	2.625	0.975	0.975	0.108	0.39

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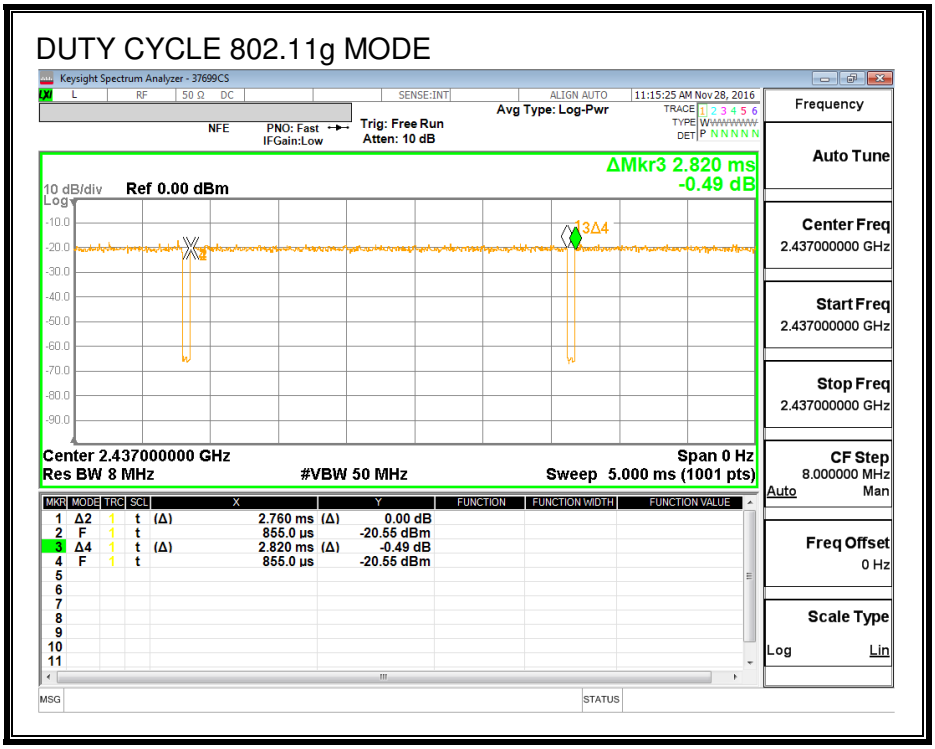
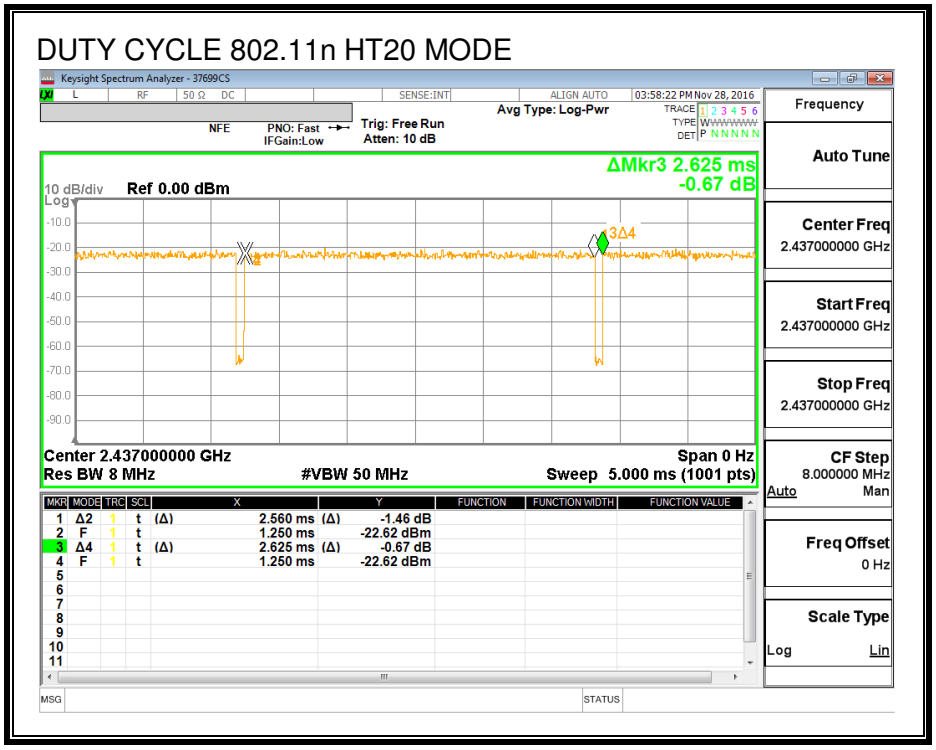
DUTY CYCLE PLOTS





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8.2. 11g MODE IN THE 2.4GHz BAND

8.2.1. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-247 (5.4) (4)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Tested By:	37699 CS	Date:	11/8/16

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	0.00	30.00	30	36	30.00
Mid	2437	0.00	30.00	30	36	30.00
High	2462	0.00	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	7.91	7.91	30.00	-22.09
Mid	2437	8.33	8.33	30.00	-21.67
High	2462	8.02	8.02	30.00	-21.98

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8.3. 11n HT20 MODE IN THE 2.4GHz BAND

8.3.1. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-247 (5.4) (4)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Tested By:	37699 CS	Date:	11/8/16

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	0.00	30.00	30	36	30.00
Mid	2437	0.00	30.00	30	36	30.00
High	2462	0.00	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	7.70	7.70	30.00	-22.30
Mid	2437	8.04	8.04	30.00	-21.96
High	2462	7.76	7.76	30.00	-22.24

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC 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
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 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.

For 2.4 GHz band, the spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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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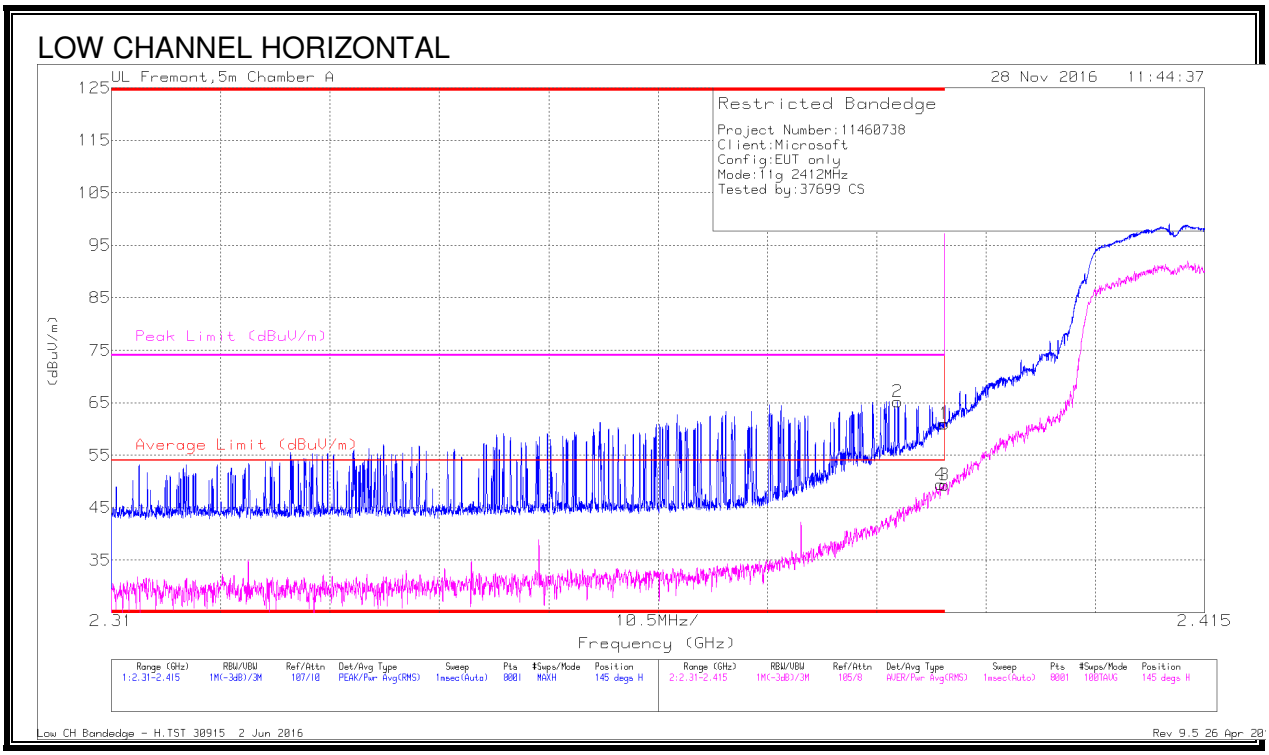
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. 11g MODE IN THE 2.4GHz BAND

AUTHORIZED BANDEDGE (LOW CHANNEL, CH 1)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.39	52.32	Pk	32.3	-23.7	0	60.92	-	-	74	-13.08	145	129	H
2	* 2.386	56.74	Pk	32.2	-23.7	0	65.24	-	-	74	-8.76	145	129	H
3	* 2.39	40.59	RMS	32.3	-23.7	.09	49.28	54	-4.72	-	-	145	129	H
4	* 2.39	40.77	RMS	32.3	-23.7	.09	49.46	54	-4.54	-	-	145	129	H

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

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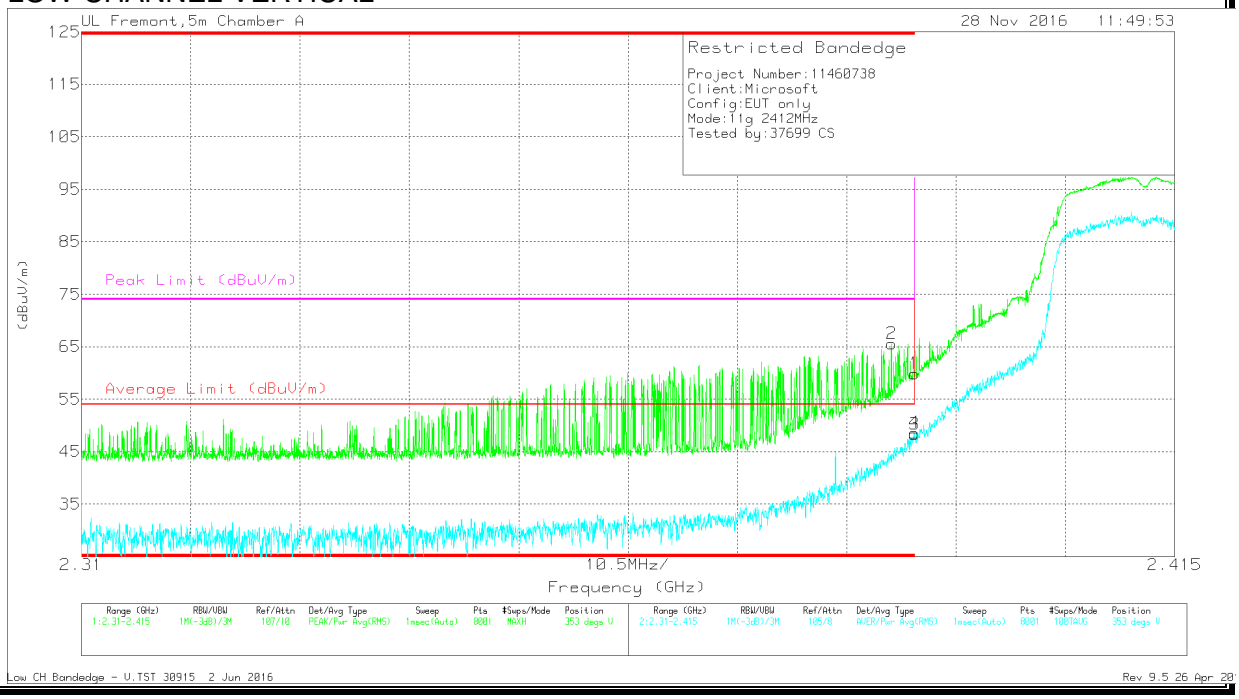
LOW CHANNEL VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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
2	* 2.388	56.93	Pk	32.3	-23.7	0	65.53	-	-	74	-8.47	353	359	V
1	* 2.39	51.29	Pk	32.3	-23.7	0	59.89	-	-	74	-14.11	353	359	V
3	* 2.39	39.64	RMS	32.3	-23.7	.09	48.33	54	-5.67	-	-	353	359	V
4	* 2.39	39.89	RMS	32.3	-23.7	.09	48.58	54	-5.42	-	-	353	359	V

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

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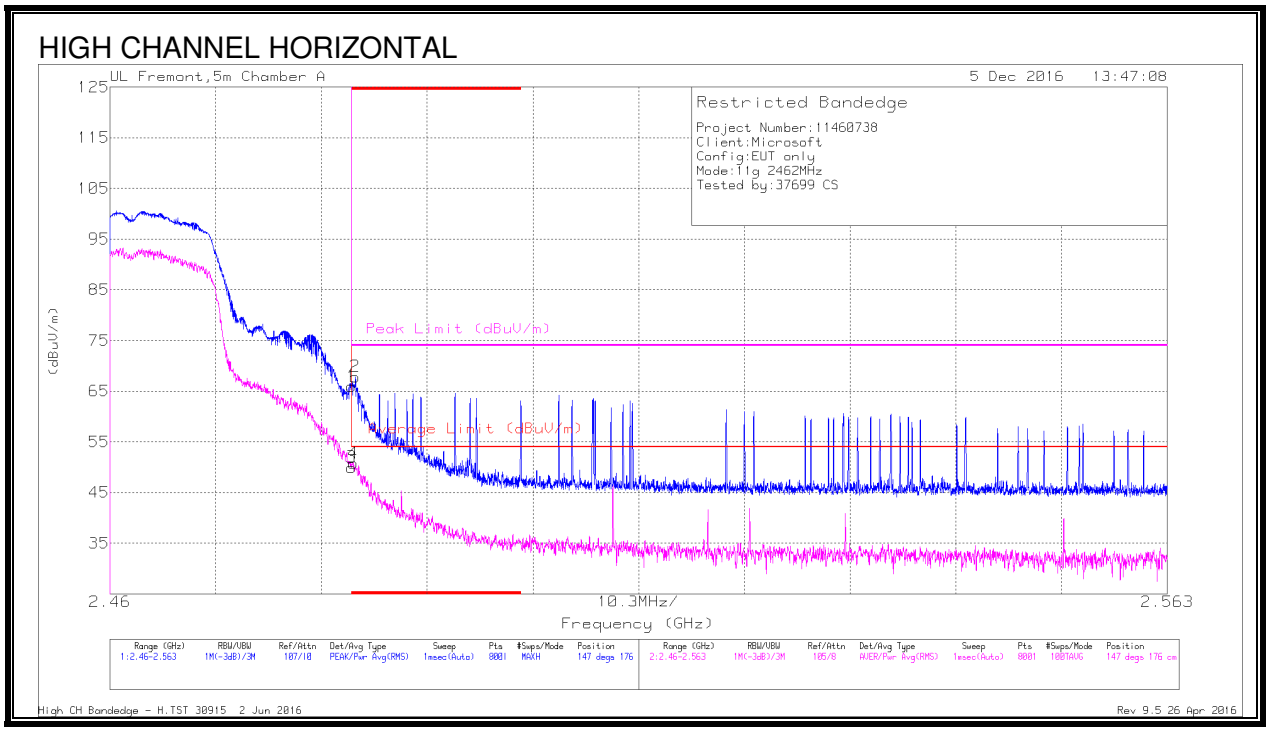
AUTHORIZED BANDEDGE (HIGH CHANNEL, CH 11)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.484	57.12	Pk	32.4	-23.6	0	65.92	-	-	74	-8.08	147	176	H
2	* 2.484	59.06	Pk	32.4	-23.6	0	67.86	-	-	74	-6.14	147	176	H
3	* 2.484	41.18	RMS	32.4	-23.6	.09	50.07	54	-3.93	-	-	147	176	H
4	* 2.484	41.98	RMS	32.4	-23.6	.09	50.87	54	-3.13	-	-	147	176	H

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

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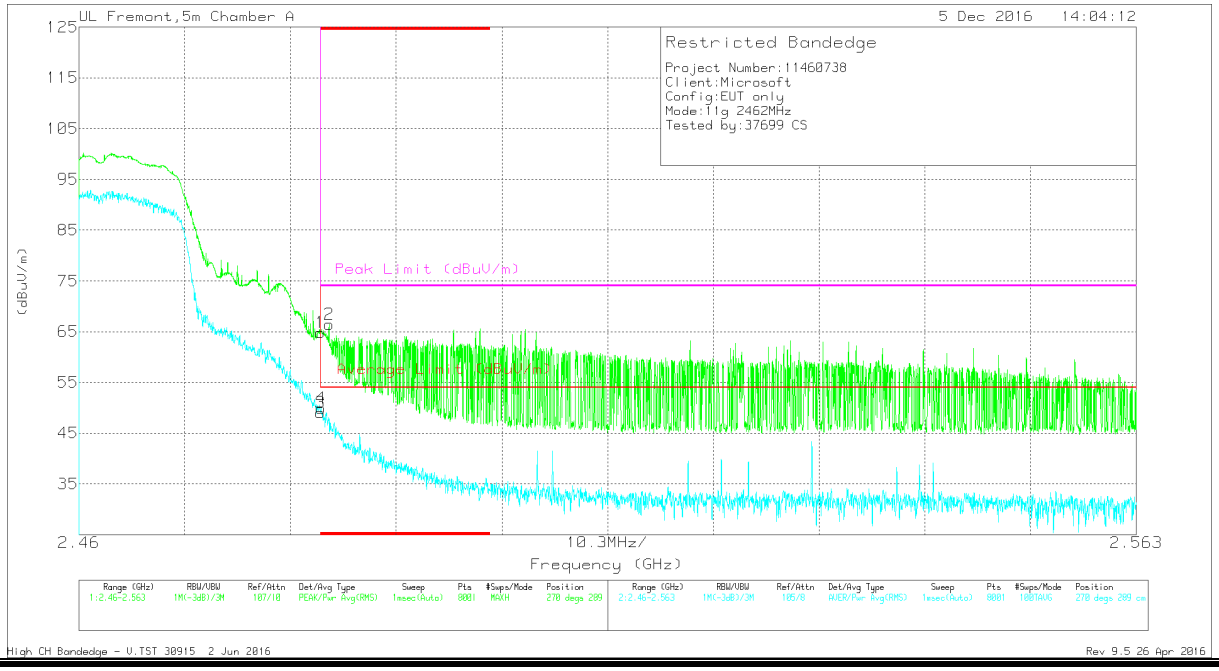
HIGH CHANNEL VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.484	55.99	Pk	32.4	-23.6	0	64.79	-	-	74	-9.21	270	289	V
2	* 2.484	57.58	Pk	32.4	-23.6	0	66.38	-	-	74	-7.62	270	289	V
3	* 2.484	40.18	RMS	32.4	-23.6	.09	49.07	54	-4.93	-	-	270	289	V
4	* 2.484	41.08	RMS	32.4	-23.6	.09	49.97	54	-4.03	-	-	270	289	V

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

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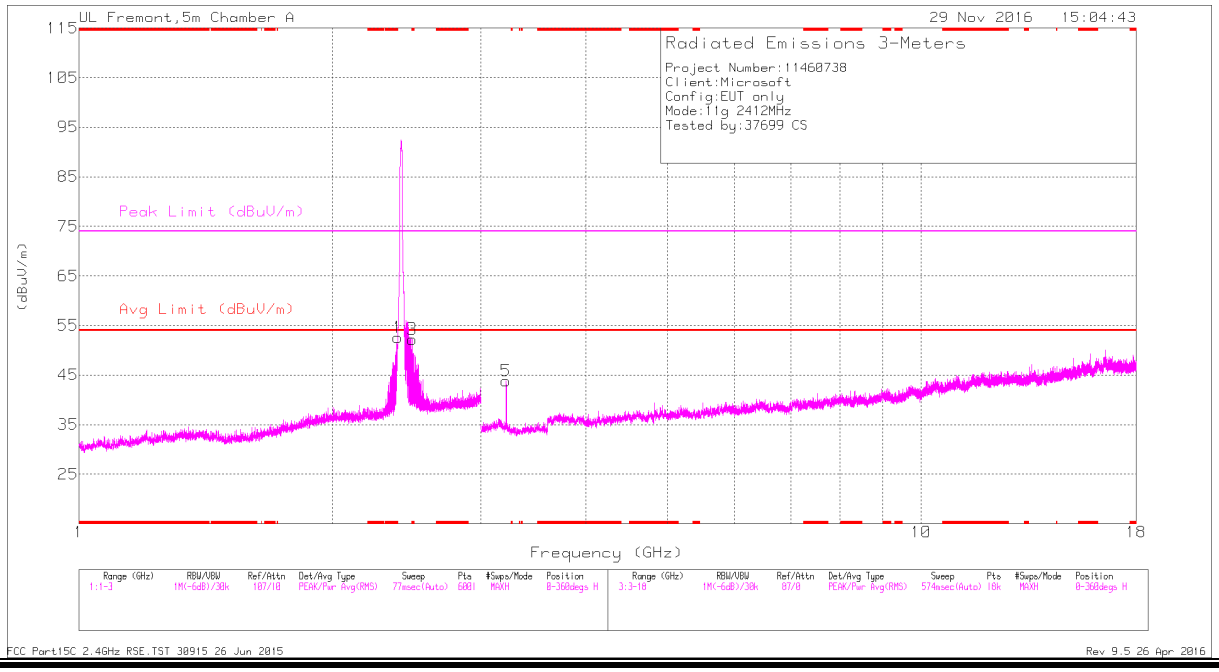
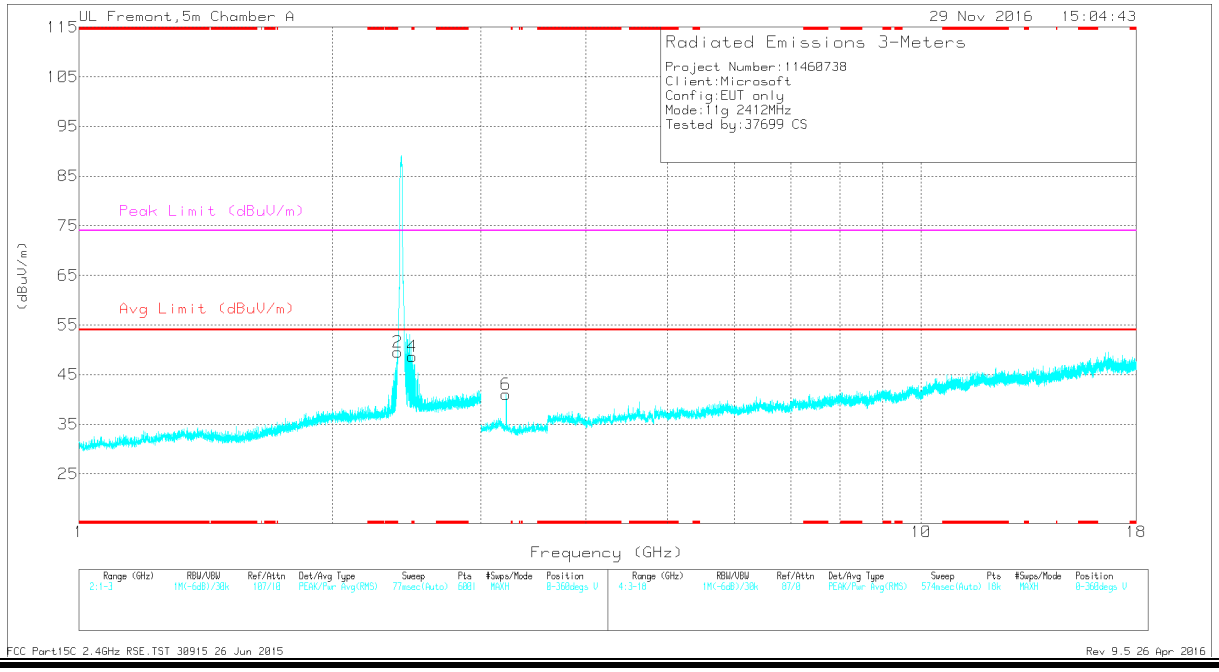
HARMONICS AND SPURIOUS EMISSIONS LOW CHANNEL, CH 1)

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.386	52.61	PK2	32.2	-23.7	0	61.11	-	-	74	-12.89	323	144	H
	* 2.39	37.57	MAv1	32.3	-23.7	.1	46.27	54	-7.73	-	-	323	144	H
3	* 2.485	52.33	PK2	32.4	-23.7	0	61.03	-	-	74	-12.97	95	126	H
	* 2.484	27.61	MAv1	32.4	-23.6	.1	36.51	54	-17.49	-	-	95	126	H
2	* 2.389	52.23	PK2	32.3	-23.7	0	60.83	-	-	74	-13.17	185	278	V
	* 2.39	37.05	MAv1	32.3	-23.7	.1	45.75	54	-8.25	-	-	185	278	V
4	* 2.486	46.62	PK2	32.5	-23.7	0	55.42	-	-	74	-18.58	343	275	V
	* 2.485	22.44	MAv1	32.4	-23.7	.1	31.24	54	-22.76	-	-	343	275	V
5	3.216	44.53	PK2	33.2	-30.3	0	47.43	-	-	-	-	55	184	H
6	3.216	43.1	PK2	33.2	-30.3	0	46	-	-	-	-	52	180	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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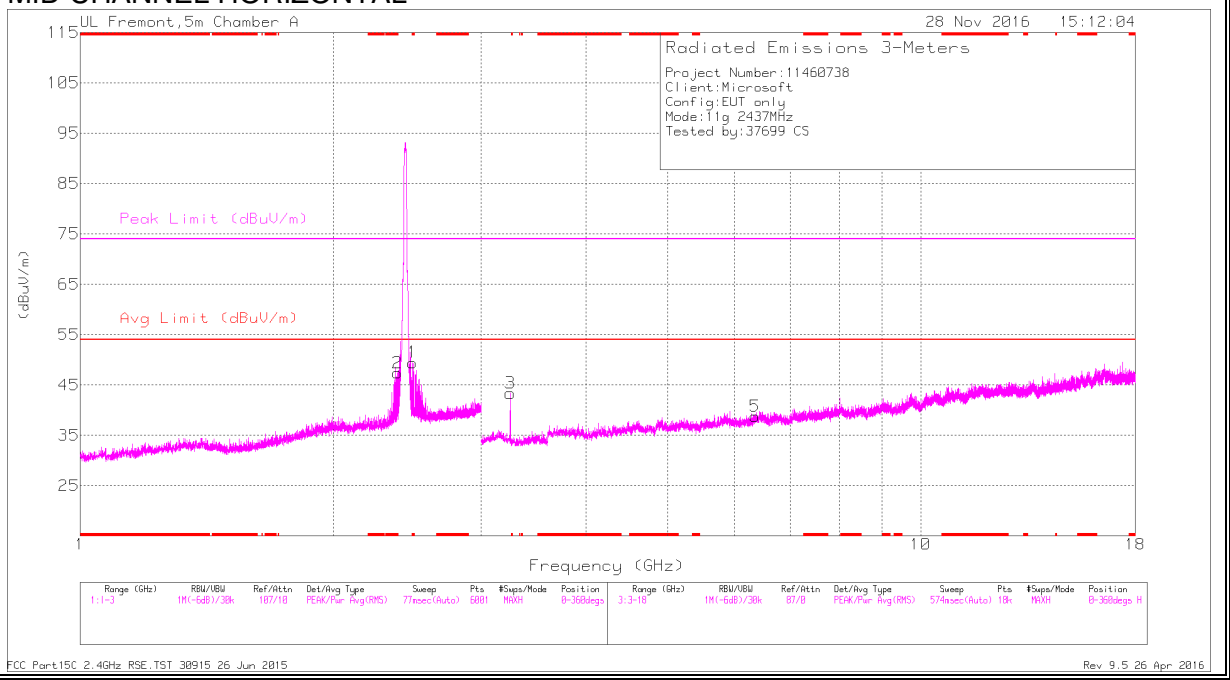
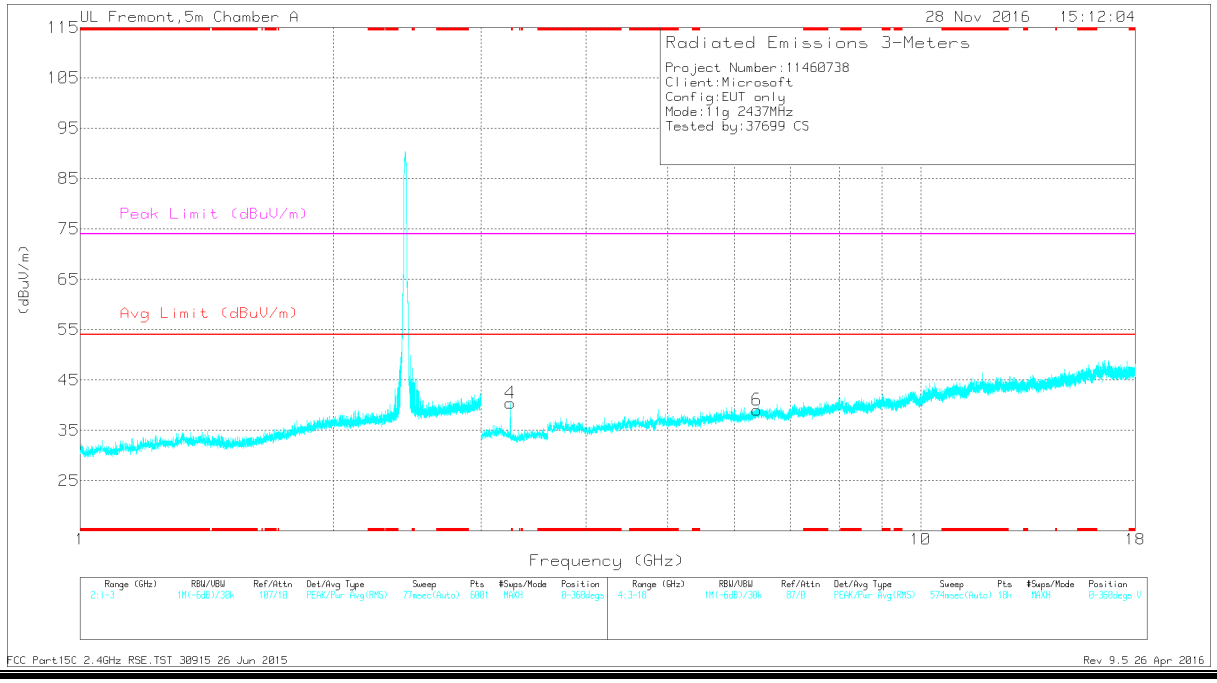
HARMONICS AND SPURIOUS EMISSIONS MID CHANNEL, CH 6)

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.495	53.67	PK2	32.5	-23.7	0	62.47	-	-	74	-11.53	320	225	H
	* 2.488	30.72	MAv1	32.5	-23.6	.09	39.71	54	-14.29	-	-	320	225	H
2	* 2.379	46.77	PK2	32.2	-23.7	0	55.27	-	-	74	-18.73	58	294	H
	* 2.389	23.16	MAv1	32.3	-23.7	.09	31.85	54	-22.15	-	-	58	294	H
3	3.249	41.75	PK2	33	-30.9	0	43.85	-	-	-	-	58	200	H
4	3.249	40.32	PK2	33	-30.9	0	42.42	-	-	-	-	64	210	V
5	6.356	36.48	PK2	35.6	-26.3	0	45.78	-	-	-	-	132	200	H
6	6.382	35.93	PK2	35.6	-26	0	45.53	-	-	-	-	283	102	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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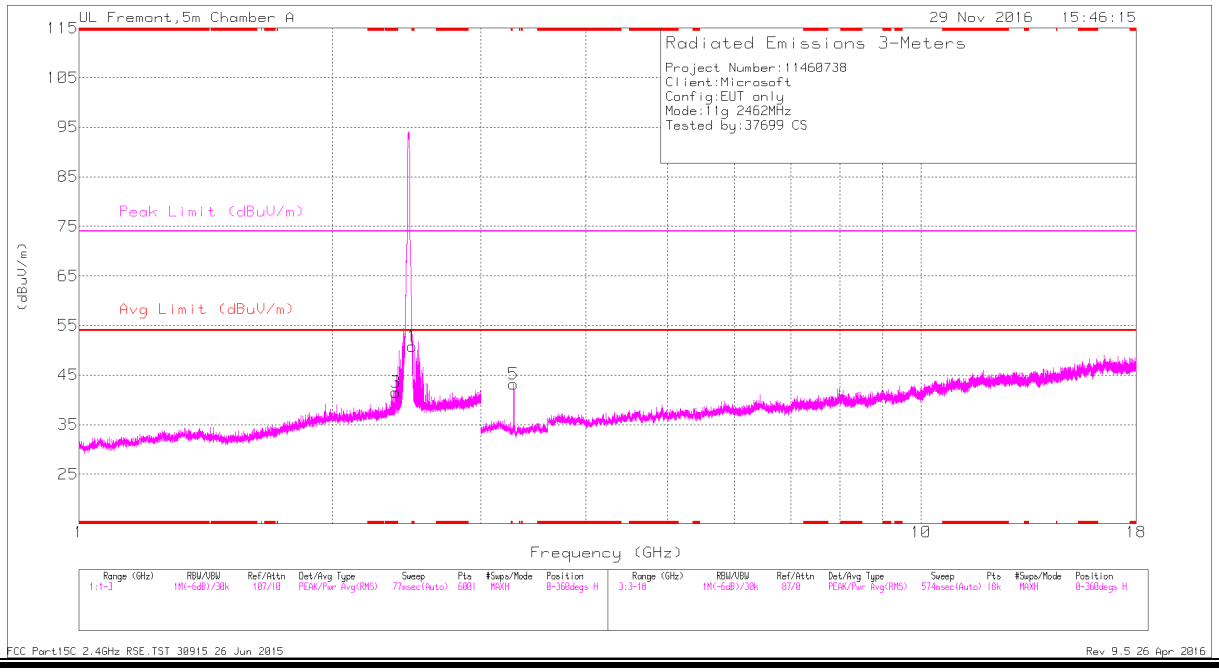
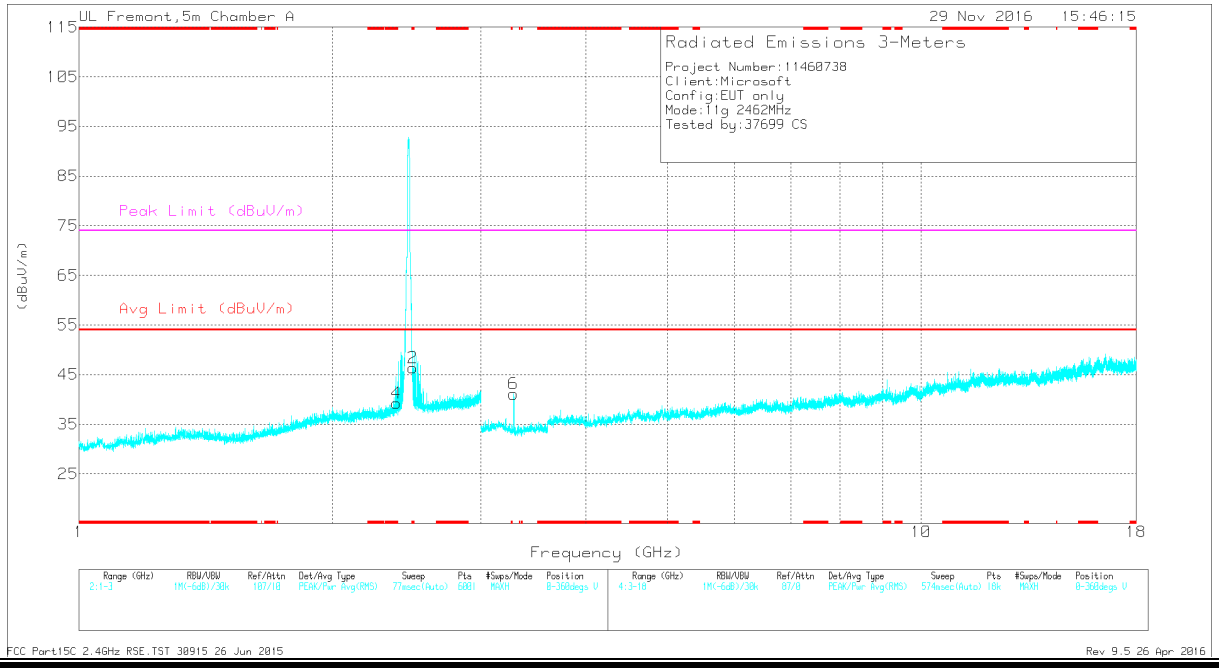
HARMONICS AND SPURIOUS EMISSIONS HIGH CHANNEL, CH 11)

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.488	55.78	PK2	32.5	-23.7	0	64.58	-	-	74	-9.42	47	147	H
	* 2.484	39.8	MAv1	32.4	-23.6	.1	48.7	54	-5.3	-	-	47	147	H
3	* 2.387	45.73	PK2	32.3	-23.7	0	54.33	-	-	74	-19.67	159	244	H
	* 2.389	25.99	MAv1	32.3	-23.7	.1	34.69	54	-19.31	-	-	159	244	H
2	* 2.489	53.34	PK2	32.5	-23.7	0	62.14	-	-	74	-11.86	154	247	V
	* 2.484	37.38	MAv1	32.4	-23.6	.1	46.28	54	-7.72	-	-	154	247	V
4	* 2.385	46.9	PK2	32.2	-23.7	0	55.4	-	-	74	-18.6	154	360	V
	* 2.388	22.47	MAv1	32.3	-23.7	.1	31.17	54	-22.83	-	-	154	360	V
5	3.283	44.94	PK2	32.8	-31	0	46.74	-	-	-	-	47	139	H
6	3.283	43.74	PK2	32.8	-31	0	45.54	-	-	-	-	32	207	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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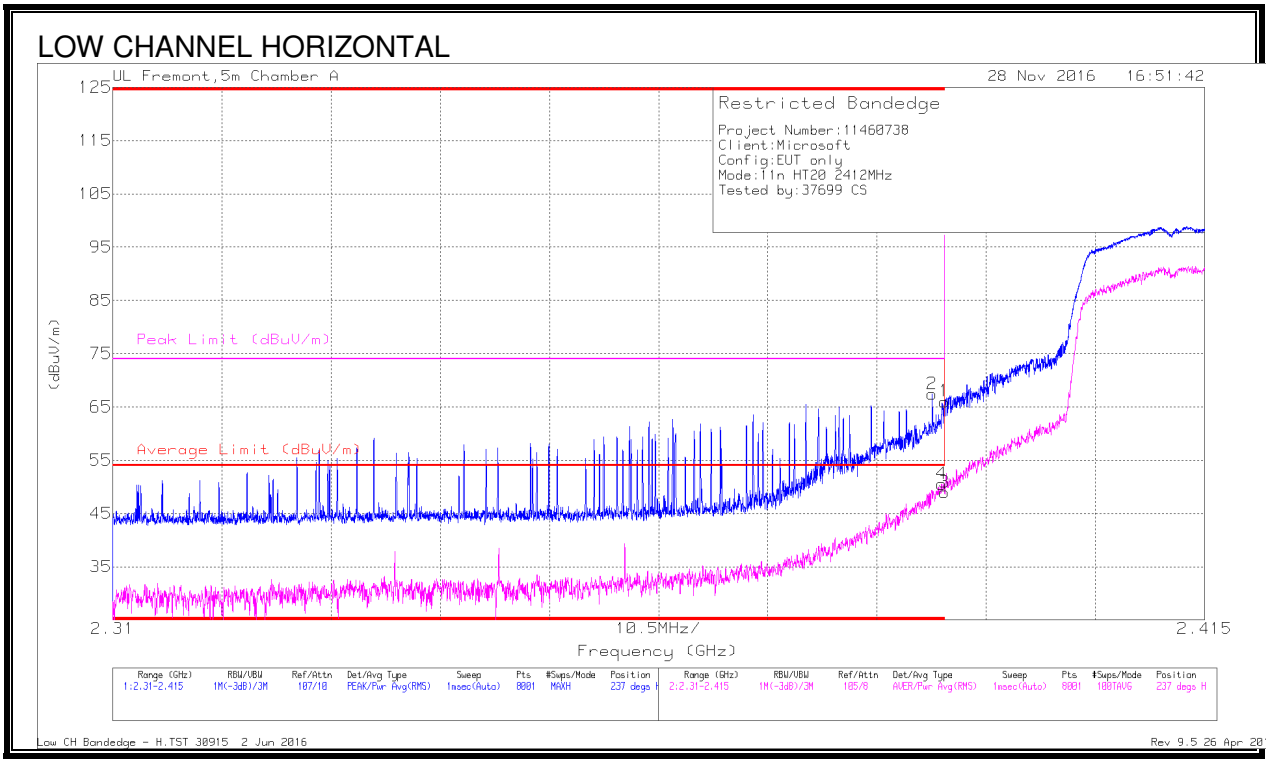
9.2.2. 11n HT20 MODE IN THE 2.4GHz BAND

AUTHORIZED BANDEDGE (LOW CHANNEL, CH 1)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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
2	* 2.389	58.8	Pk	32.3	-23.7	0	67.4	-	-	74	-6.6	237	104	H
1	* 2.39	57.43	Pk	32.3	-23.7	0	66.03	-	-	74	-7.97	237	104	H
3	* 2.39	40.39	RMS	32.3	-23.7	.11	49.1	54	-4.9	-	-	237	104	H
4	* 2.39	41.92	RMS	32.3	-23.7	.11	50.63	54	-3.37	-	-	237	104	H

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

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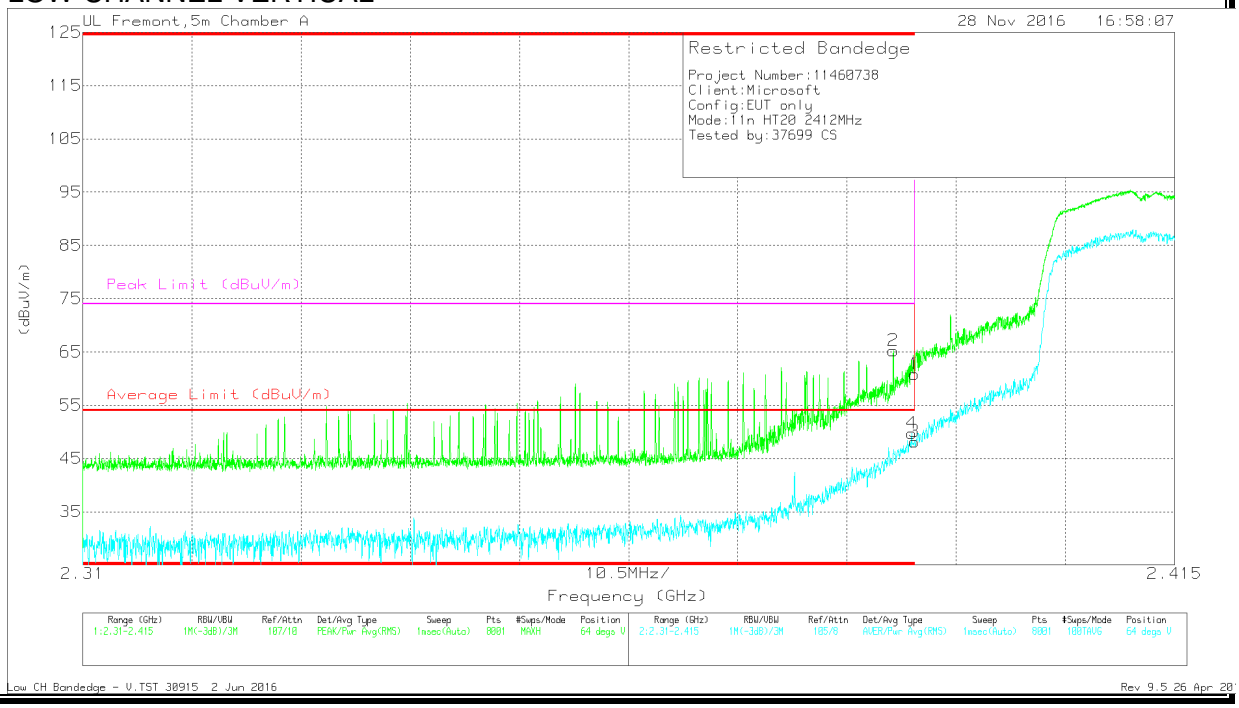
LOW CHANNEL VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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
2	* 2.388	56.6	Pk	32.3	-23.7	0	65.2	-	-	74	-8.8	64	244	V
1	* 2.39	52.23	Pk	32.3	-23.7	0	60.83	-	-	74	-13.17	64	244	V
3	* 2.39	39.44	RMS	32.3	-23.7	.11	48.15	54	-5.85	-	-	64	244	V
4	* 2.39	41.01	RMS	32.3	-23.7	.11	49.72	54	-4.28	-	-	64	244	V

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

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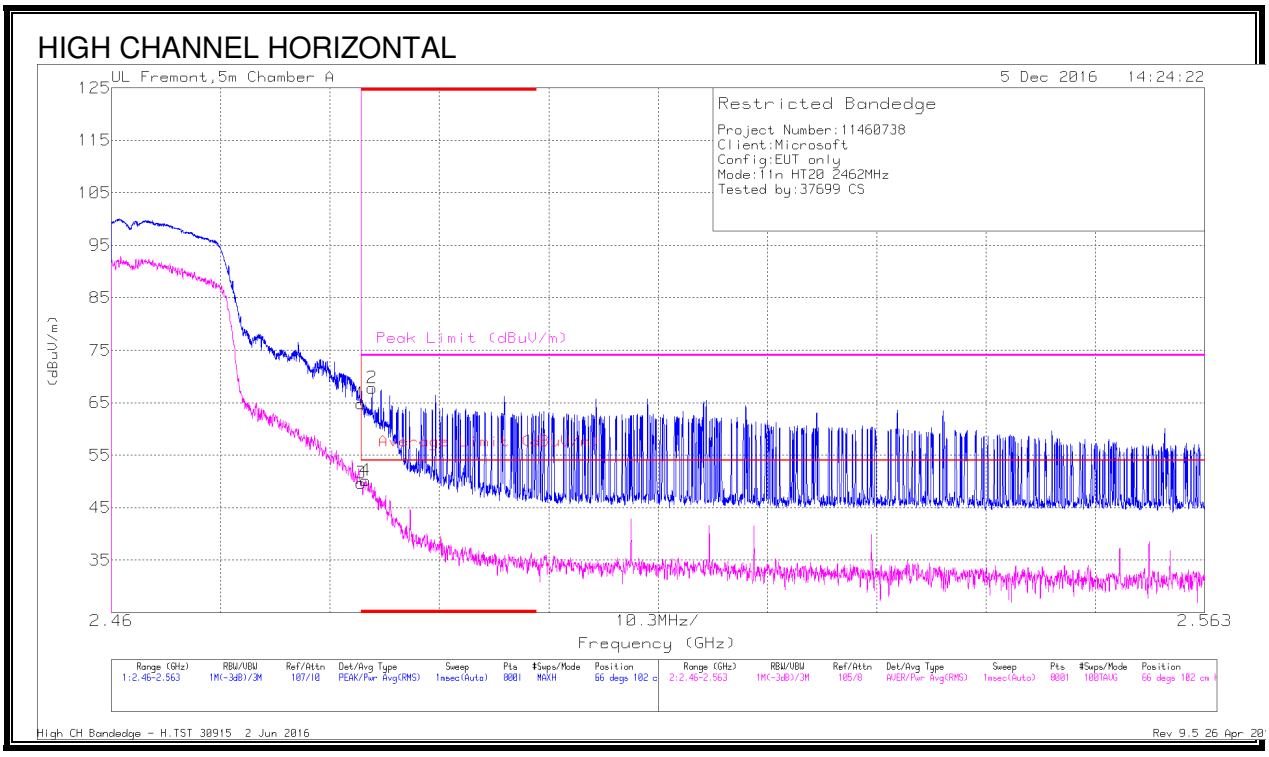
AUTHORIZED BANDEDGE (HIGH CHANNEL, CH 11)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (db/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	55.97	Pk	32.4	-23.6	64.77	-	-	74	-9.23	66	102	H
3	* 2.484	40.88	RMS	32.4	-23.6	49.68	54	-4.32	-	-	66	102	H
4	* 2.484	41.34	RMS	32.4	-23.6	50.14	54	-3.86	-	-	66	102	H
2	* 2.485	59.12	Pk	32.4	-23.7	67.82	-	-	74	-6.18	66	102	H

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

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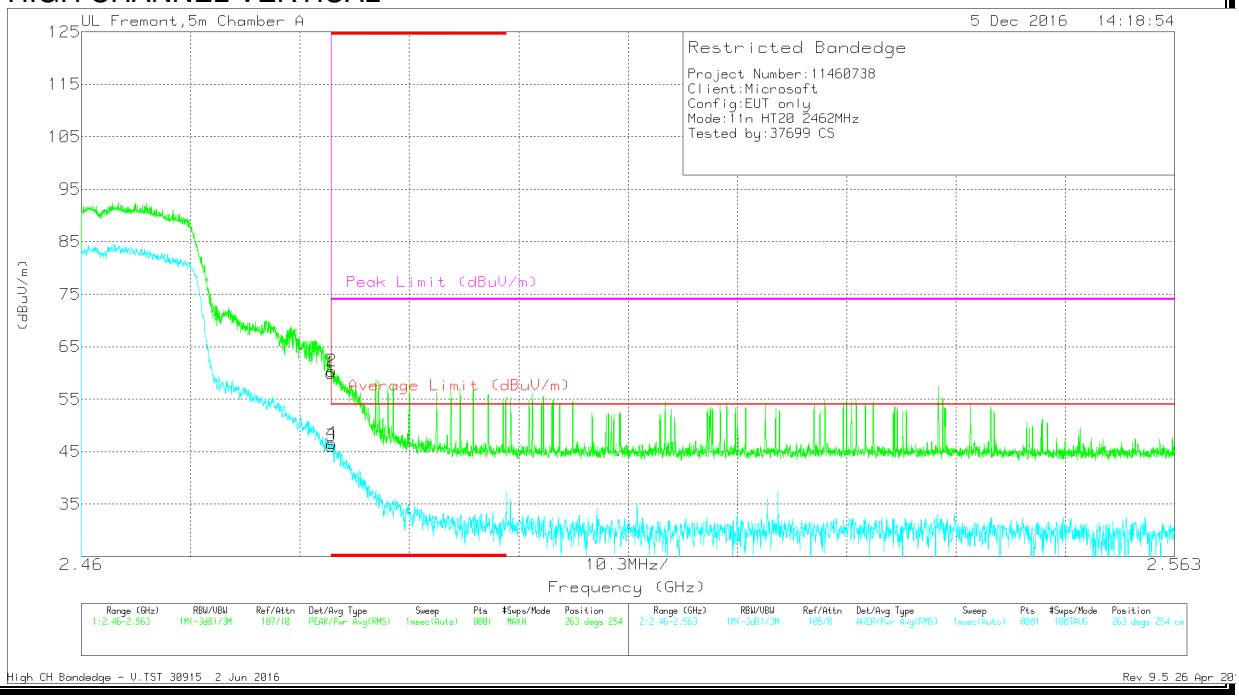
HIGH CHANNEL VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.484	51.19	Pk	32.4	-23.6	0	59.99	-	-	74	-14.01	263	254	V
2	* 2.484	51.52	Pk	32.4	-23.6	0	60.32	-	-	74	-13.68	263	254	V
3	* 2.484	37.2	RMS	32.4	-23.6	.11	46.11	54	-7.89	-	-	263	254	V
4	* 2.484	37.67	RMS	32.4	-23.6	.11	46.58	54	-7.42	-	-	263	254	V

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

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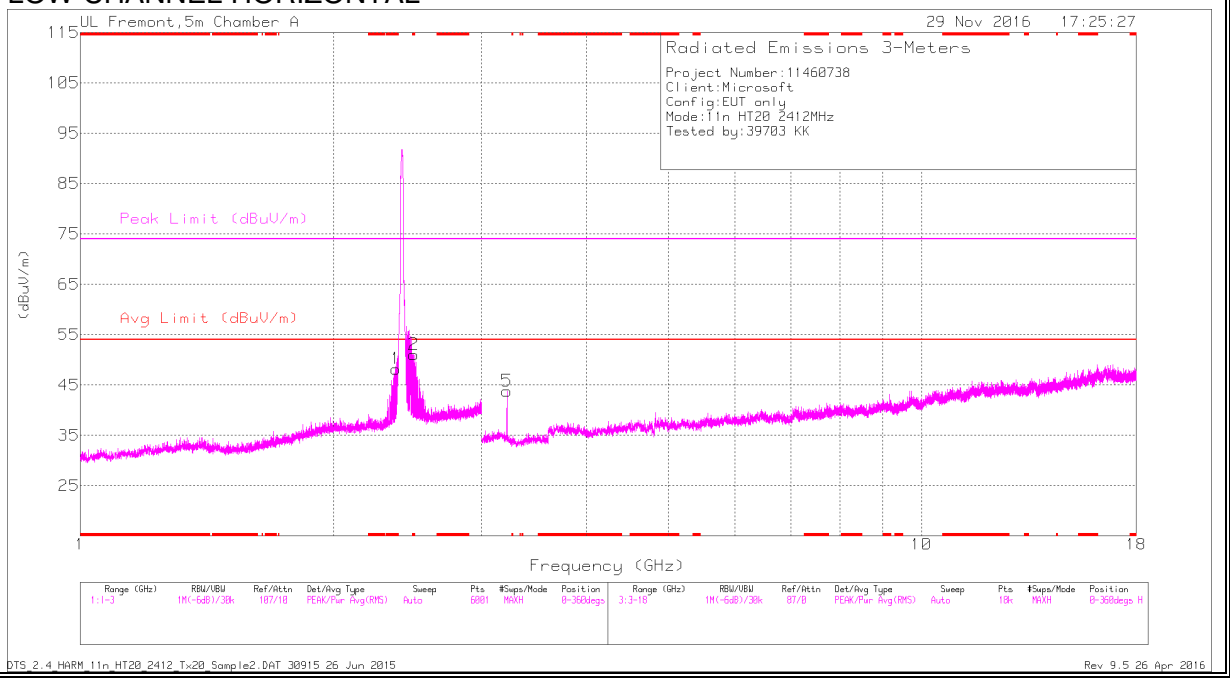
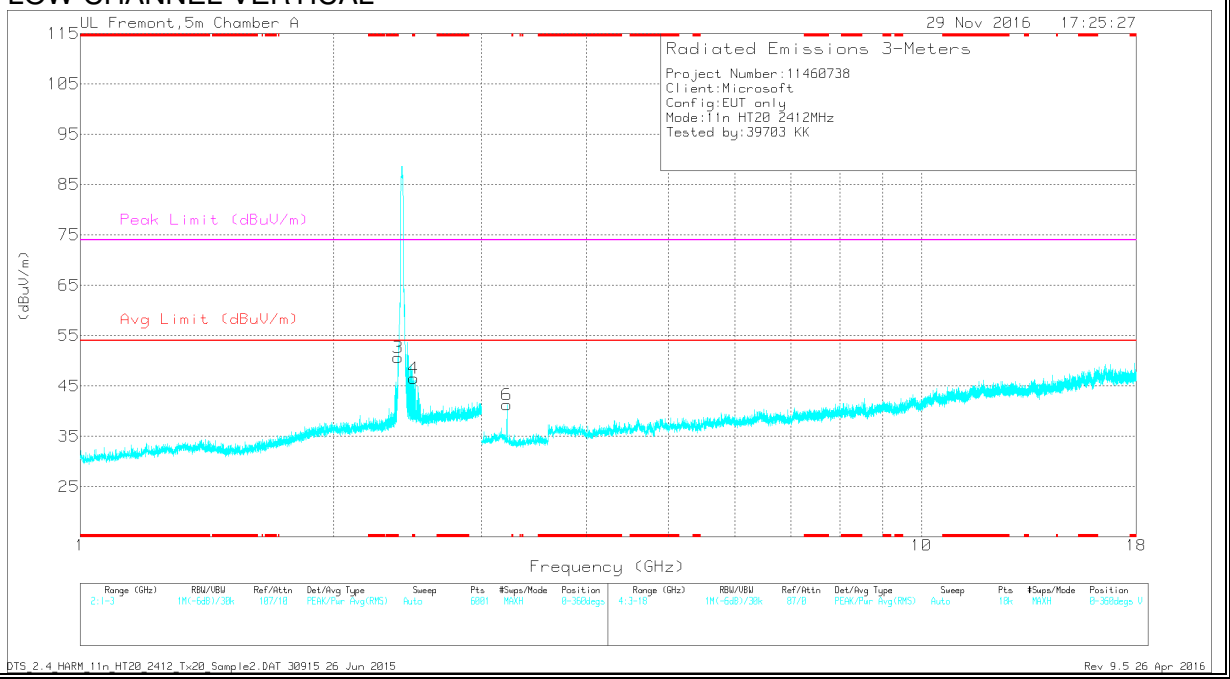
HARMONICS AND SPURIOUS EMISSIONS LOW CHANNEL, CH 1)

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.374	50.36	PK2	32.2	-23.7	0	58.86	-	-	74	-15.14	342	122	H
	* 2.372	30.21	MAv1	32.2	-23.7	.11	38.82	54	-15.18	-	-	342	122	H
2	* 2.491	51.36	PK2	32.5	-23.7	0	60.16	-	-	74	-13.84	337	137	H
	* 2.492	27.8	MAv1	32.5	-23.7	.11	36.71	54	-17.29	-	-	337	137	H
3	* 2.387	51.04	PK2	32.3	-23.7	0	59.64	-	-	74	-14.36	92	311	V
	* 2.389	36.5	MAv1	32.3	-23.7	.11	45.21	54	-8.79	-	-	92	311	V
4	* 2.491	43.83	PK2	32.5	-23.7	0	52.63	-	-	74	-21.37	360	242	V
	* 2.492	22.45	MAv1	32.5	-23.7	.11	31.36	54	-22.64	-	-	360	242	V
5	3.216	44.77	PK2	33.2	-30.3	0	47.67	-	-	-	-	310	185	H
6	3.216	42.7	PK2	33.2	-30.3	0	45.6	-	-	-	-	313	200	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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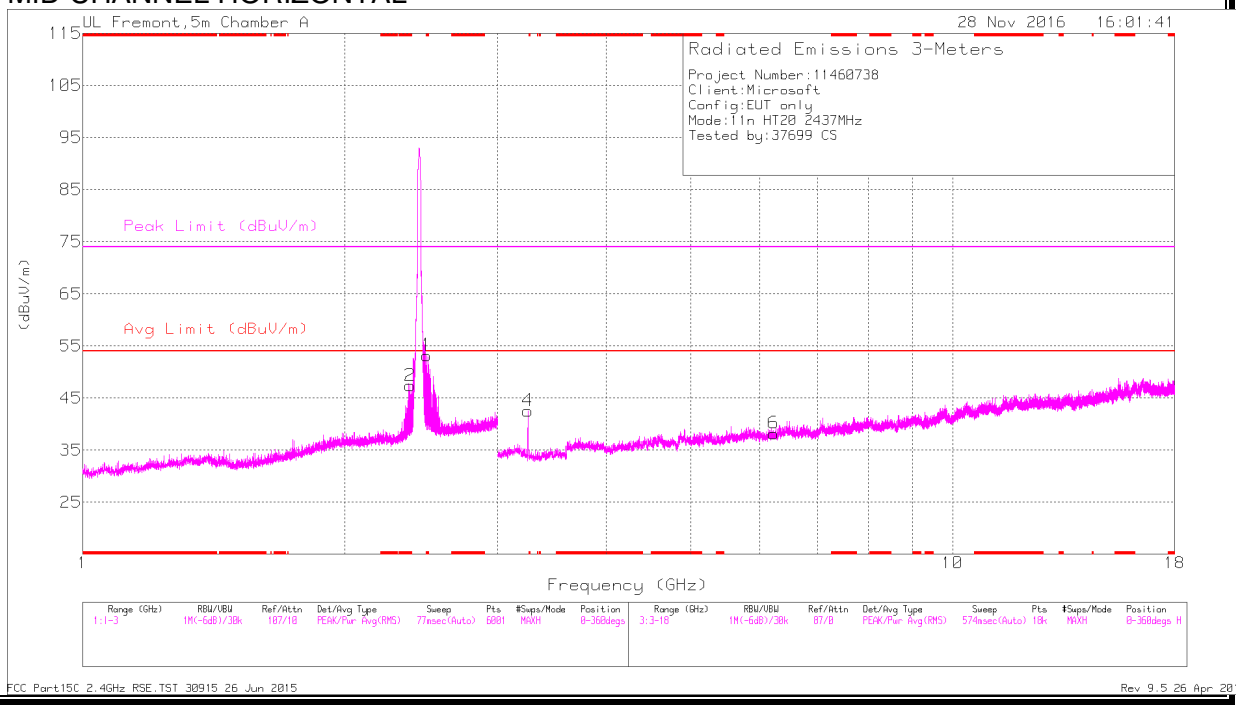
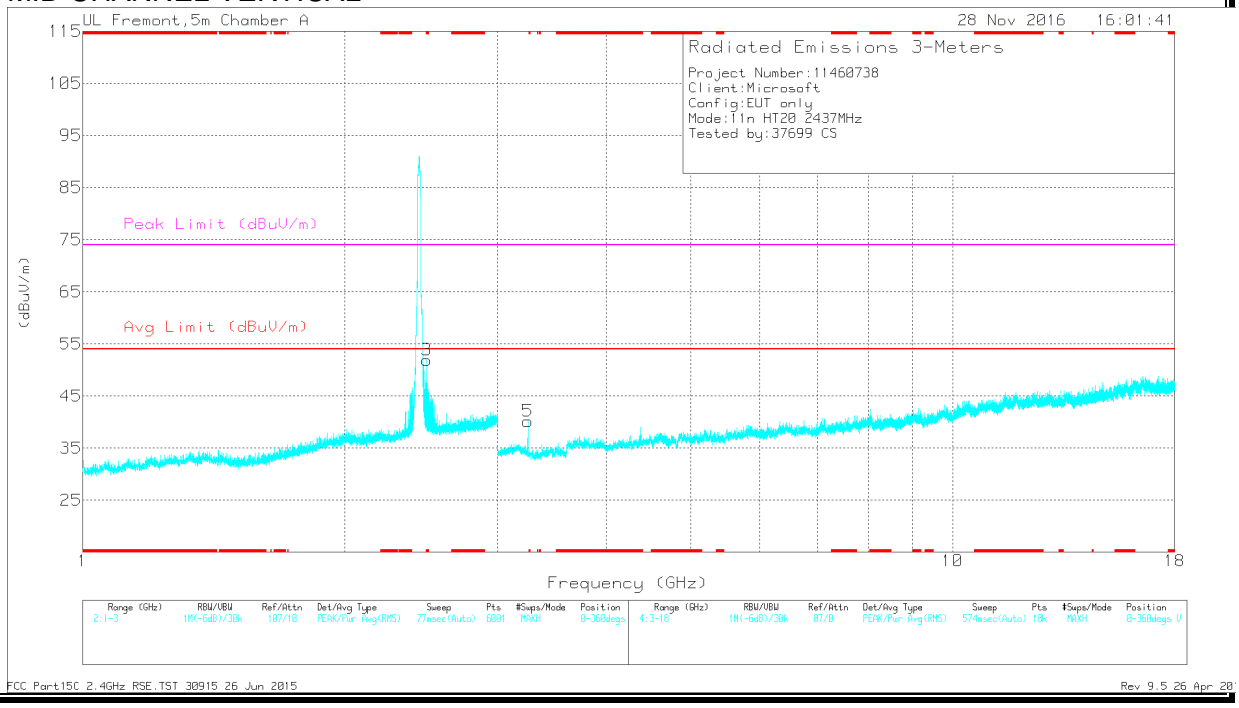
HARMONICS AND SPURIOUS EMISSIONS MID CHANNEL, CH 6)

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.484	53.9	PK2	32.4	-23.6	0	62.7	-	-	74	-11.3	322	370	H
	* 2.496	28.75	MAv1	32.5	-23.7	.11	37.66	54	-16.34	-	-	322	370	H
2	* 2.39	45.5	PK2	32.3	-23.7	0	54.1	-	-	74	-19.9	257	119	H
	* 2.37	23.7	MAv1	32.2	-23.7	.11	32.31	54	-21.69	-	-	257	119	H
3	* 2.484	47.92	PK2	32.4	-23.6	0	56.72	-	-	74	-17.28	16	104	V
	* 2.485	24.72	MAv1	32.4	-23.7	.11	33.53	54	-20.47	-	-	16	104	V
4	3.249	41.62	PK2	33	-30.9	0	43.72	-	-	-	-	0	199	H
5	3.249	38.97	PK2	33	-30.9	0	41.07	-	-	-	-	0	199	V
6	6.231	35.59	PK2	35.5	-26.5	0	44.59	-	-	-	-	0	102	H

* - 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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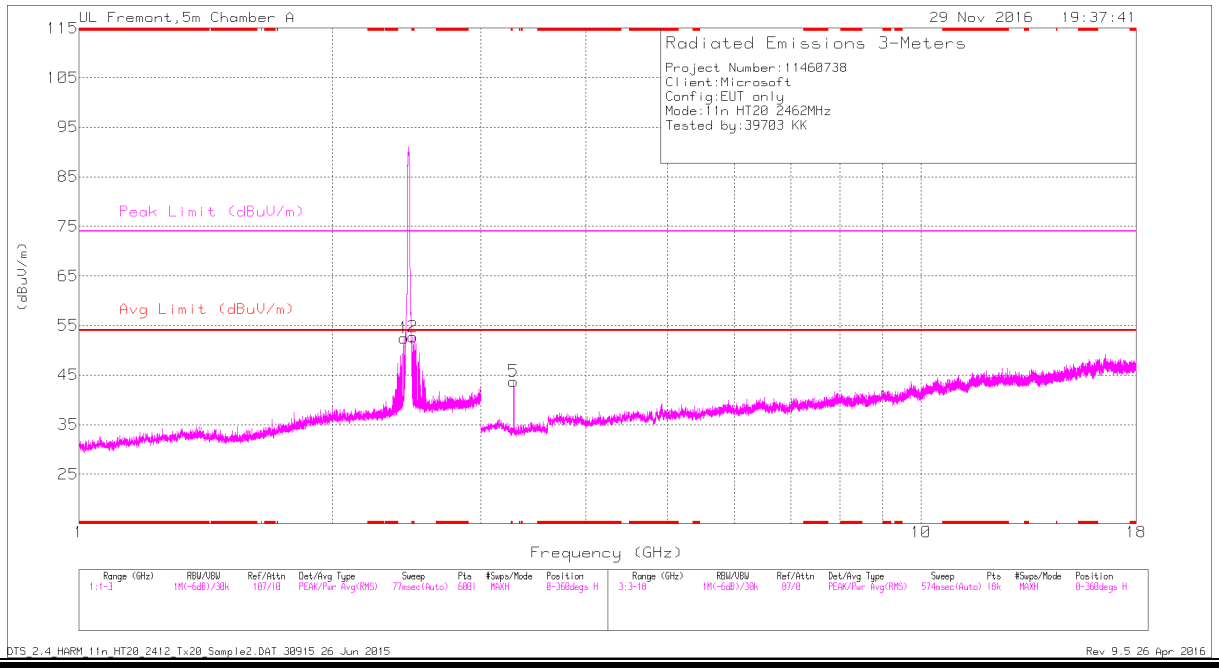
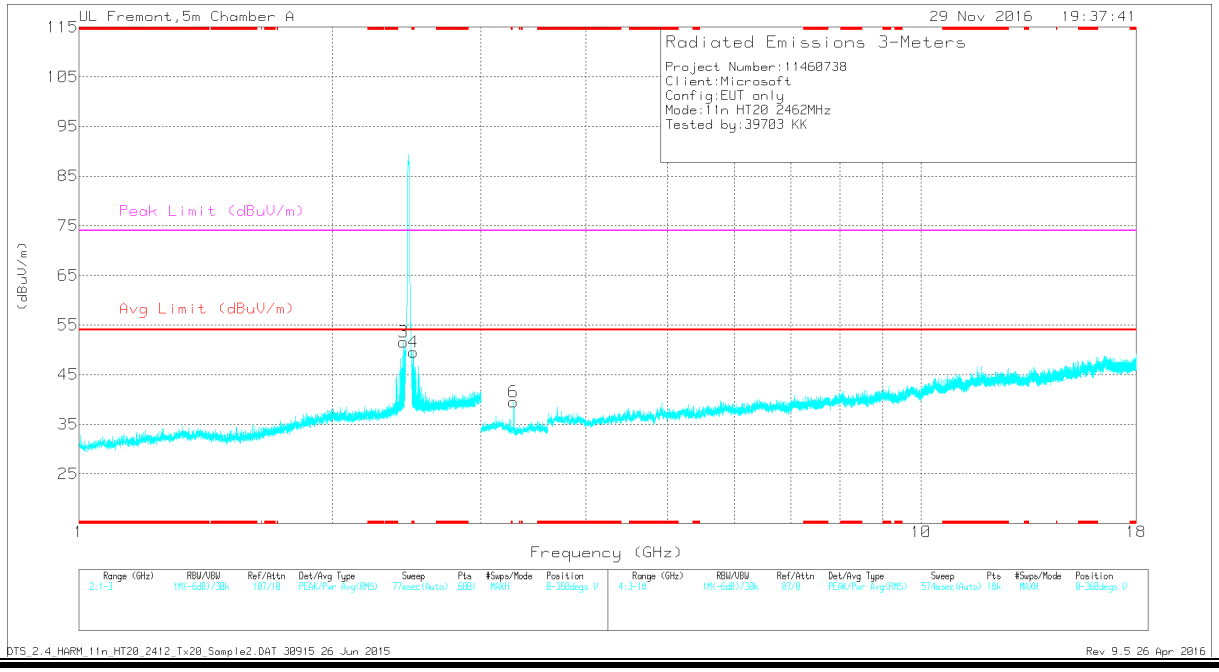
HARMONICS AND SPURIOUS EMISSIONS HIGH CHANNEL, CH 11)

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (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	* 2.491	43.16	PK2	32.5	-23.7	0	51.96	-	-	74	-22.04	360	100	H
	* 2.493	23.41	MAv1	32.5	-23.7	.1	32.31	54	-21.69	-	-	360	100	H
2	* 2.497	51.16	PK2	32.5	-23.7	0	59.96	-	-	74	-14.04	263	165	V
	* 2.494	26.1	MAv1	32.5	-23.7	.1	35	54	-19	-	-	263	165	V
3	2.427	48.09	PK2	32.4	-23.7	0	56.79	-	-	-	-	141	200	V
4	2.435	46.54	PK2	32.4	-23.7	0	55.24	-	-	-	-	360	100	H
5	3.282	28.53	MAv1	32.8	-31	.1	30.43	-	-	-	-	263	199	V
6	3.283	34.26	MAv1	32.8	-31	.1	36.16	-	-	-	-	263	102	H

* - 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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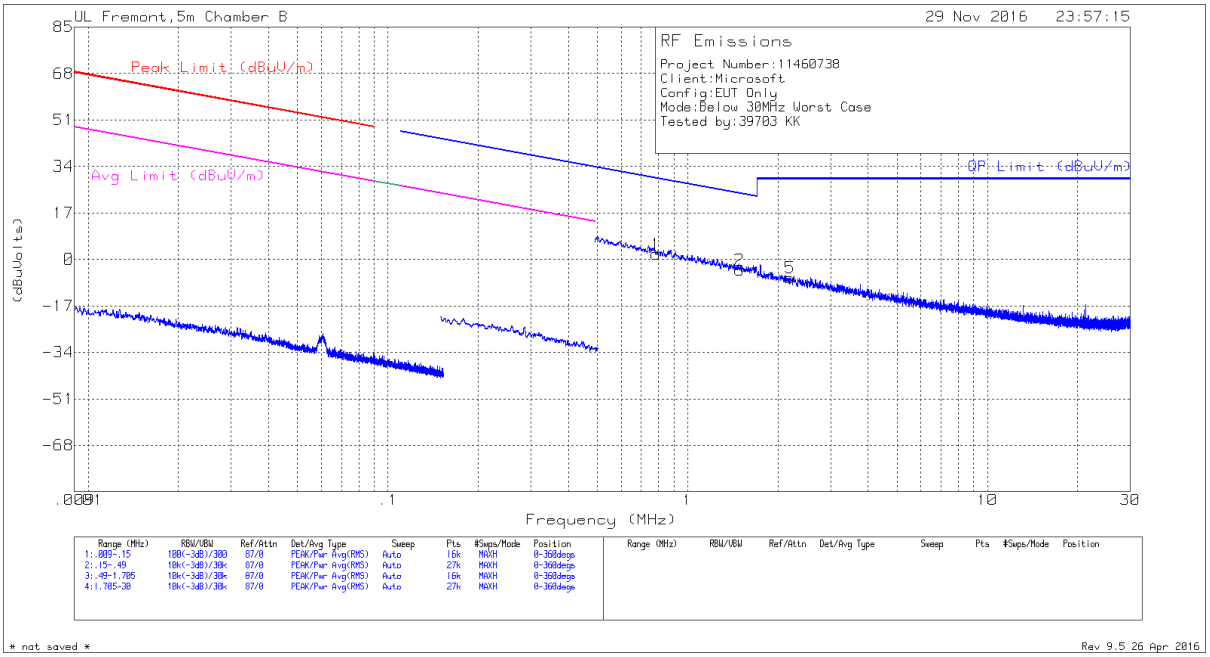
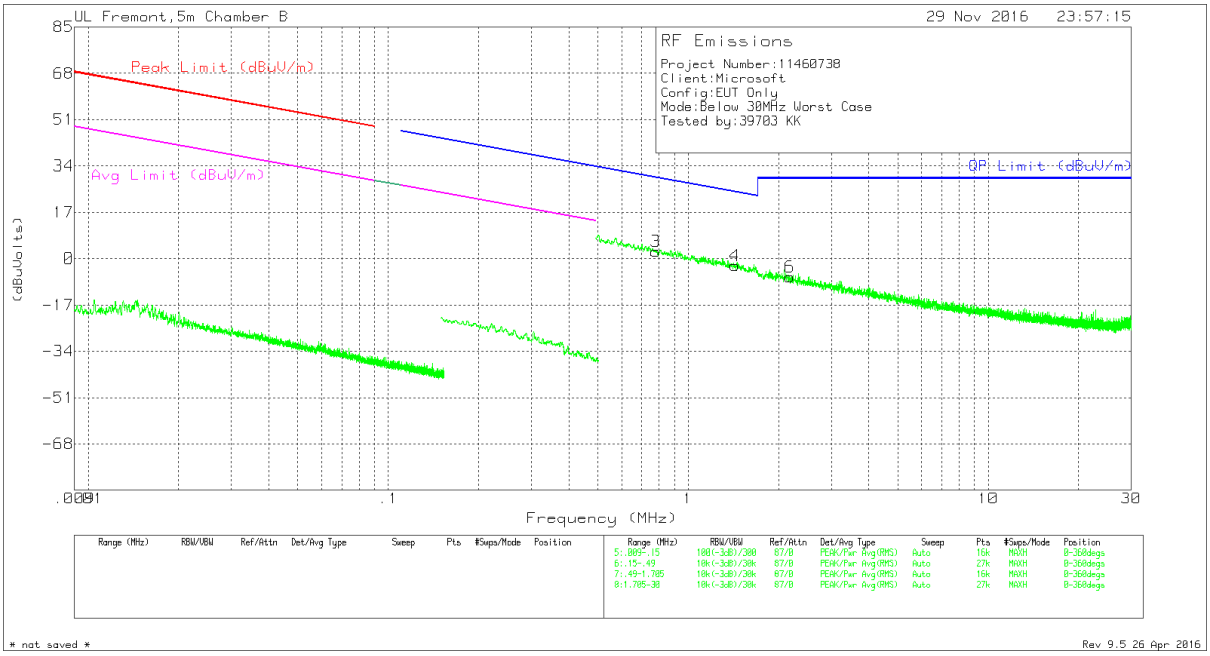
9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 9KHz TO 30 MHz (WORST-CASE CONFIGURATION)

FACE ON PLOT



FACE OFF PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.78051	30.54	Pk	10.6	1.5	-40	2.64	29.77	-27.13	0-360
1	.78427	29.89	Pk	10.6	1.5	-40	1.99	29.73	-27.74	0-360
4	1.43312	25.29	Pk	10.7	1.5	-40	-2.51	24.5	-27.01	0-360
2	1.49164	23.9	Pk	10.7	1.5	-40	-3.9	24.16	-28.06	0-360
6	2.17608	21.08	Pk	10.8	1.5	-40	-6.62	29.5	-36.12	0-360
5	2.19599	20.94	Pk	10.8	1.5	-40	-6.76	29.5	-36.26	0-360

Pk - Peak detector

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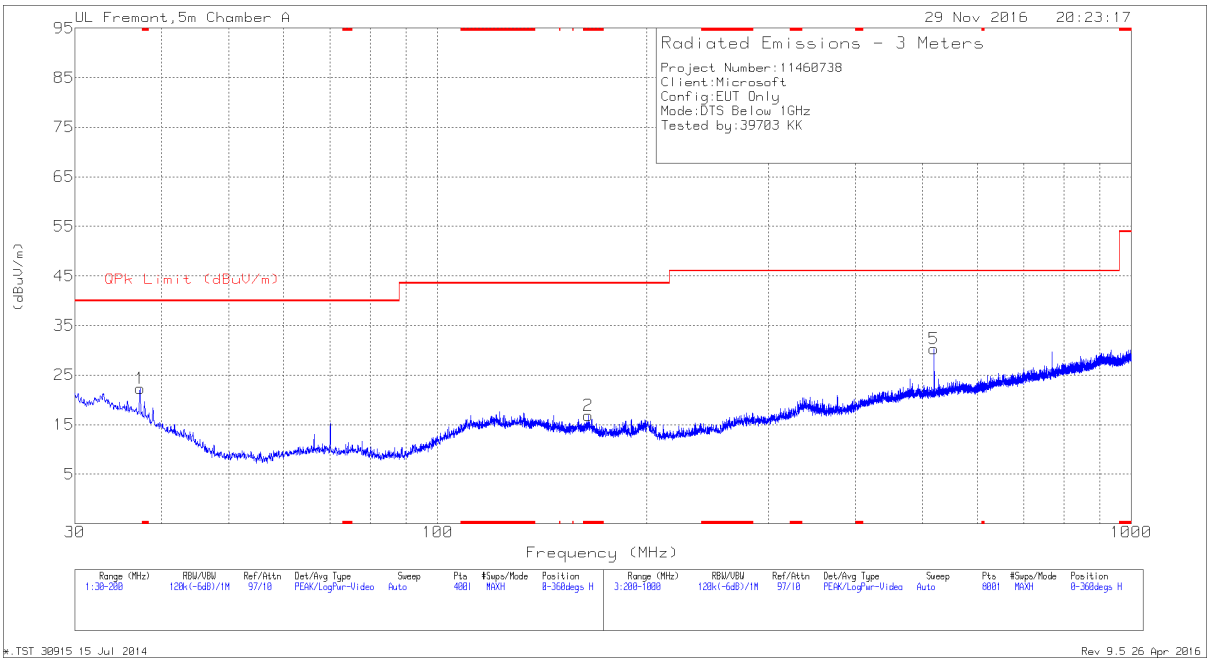
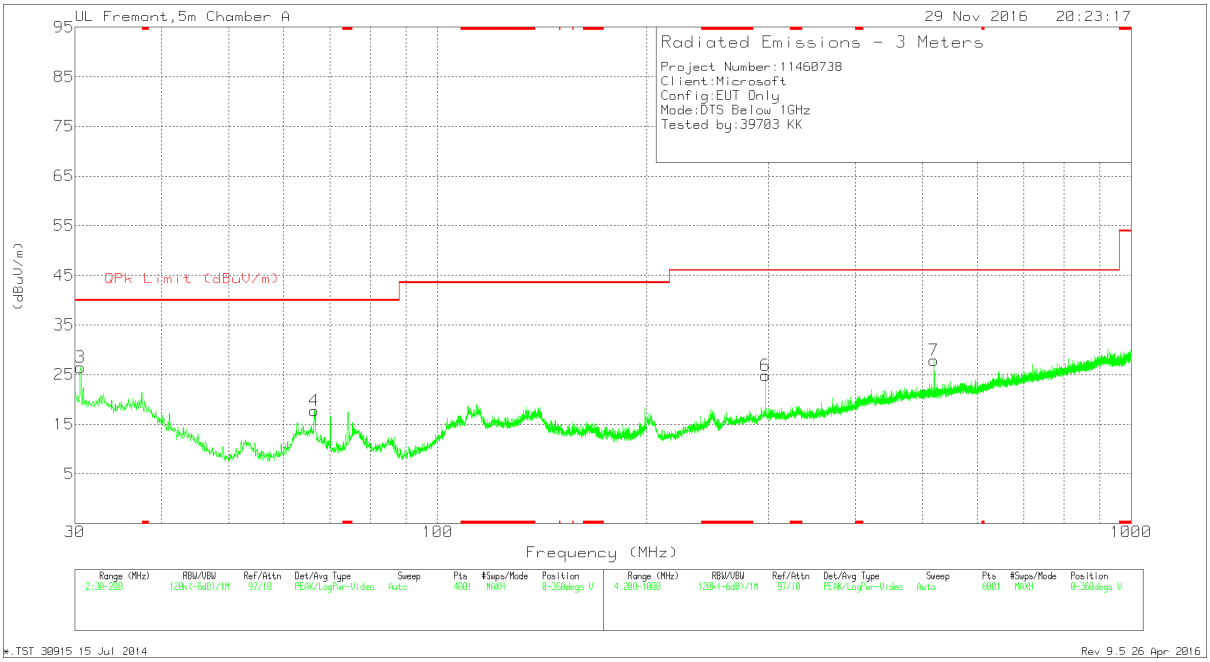
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 164.98	31.09	Pk	16	-30.2	16.89	43.52	-26.63	0-360	100	H
3	30.5525	33.93	Pk	23.7	-31.2	26.43	40	-13.57	0-360	100	V
1	37.225	33.45	Pk	19.9	-31.1	22.25	40	-17.75	0-360	300	H
4	66.38	36.28	Pk	12.4	-30.9	17.78	40	-22.22	0-360	100	V
6	296.9	36.93	Pk	17.3	-29.4	24.83	46.02	-21.19	0-360	400	V
5	519.7	37.06	Pk	21.8	-28.6	30.26	46.02	-15.76	0-360	100	H
7	519.7	34.63	Pk	21.8	-28.6	27.83	46.02	-18.19	0-360	400	V

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

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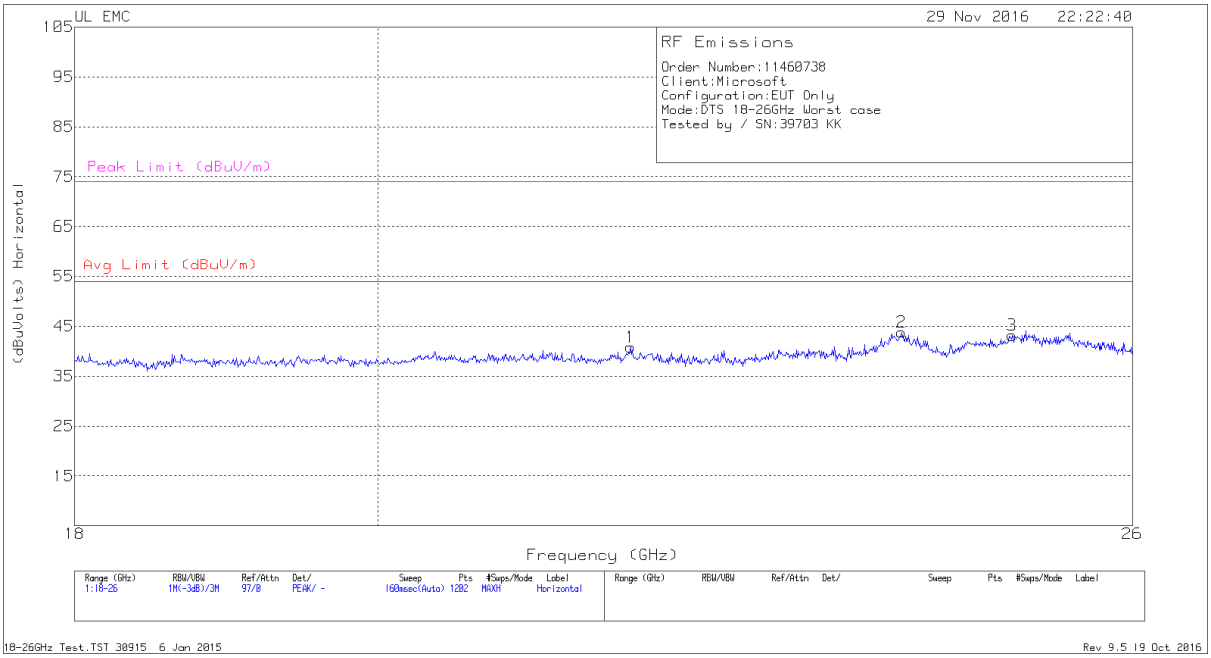
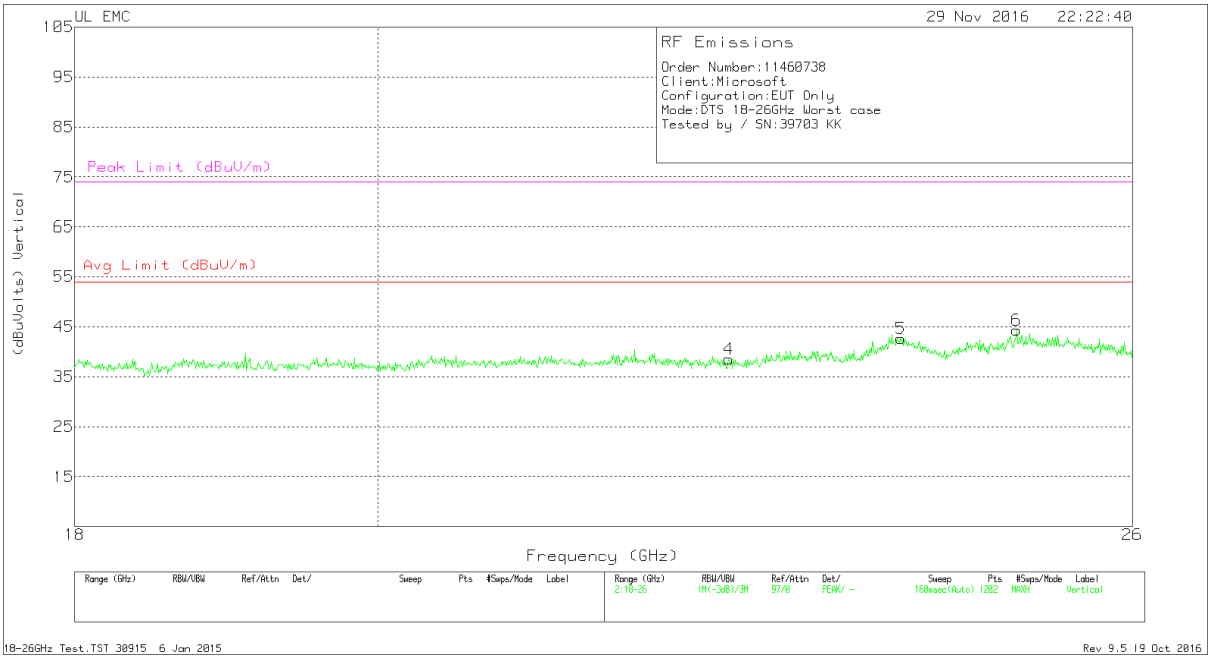
9.4. WORST-CASE 18 to 26 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (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	21.837	41.93	Pk	33.3	-24.9	-9.5	40.83	54	-13.17	74	-33.17
2	23.995	43.73	Pk	34	-24.4	-9.5	43.83	54	-10.17	74	-30.17
3	24.934	42.87	Pk	34.2	-24.4	-9.5	43.17	54	-10.83	74	-30.83
4	22.596	40.1	Pk	33.4	-25.5	-9.5	38.5	54	-15.5	74	-35.5
5	23.988	42.47	Pk	34	-24.3	-9.5	42.67	54	-11.33	74	-31.33
6	24.974	43.83	Pk	34.2	-24.2	-9.5	44.33	54	-9.67	74	-29.67

Pk - 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 (dBμV)	
	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 C63.10.

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.

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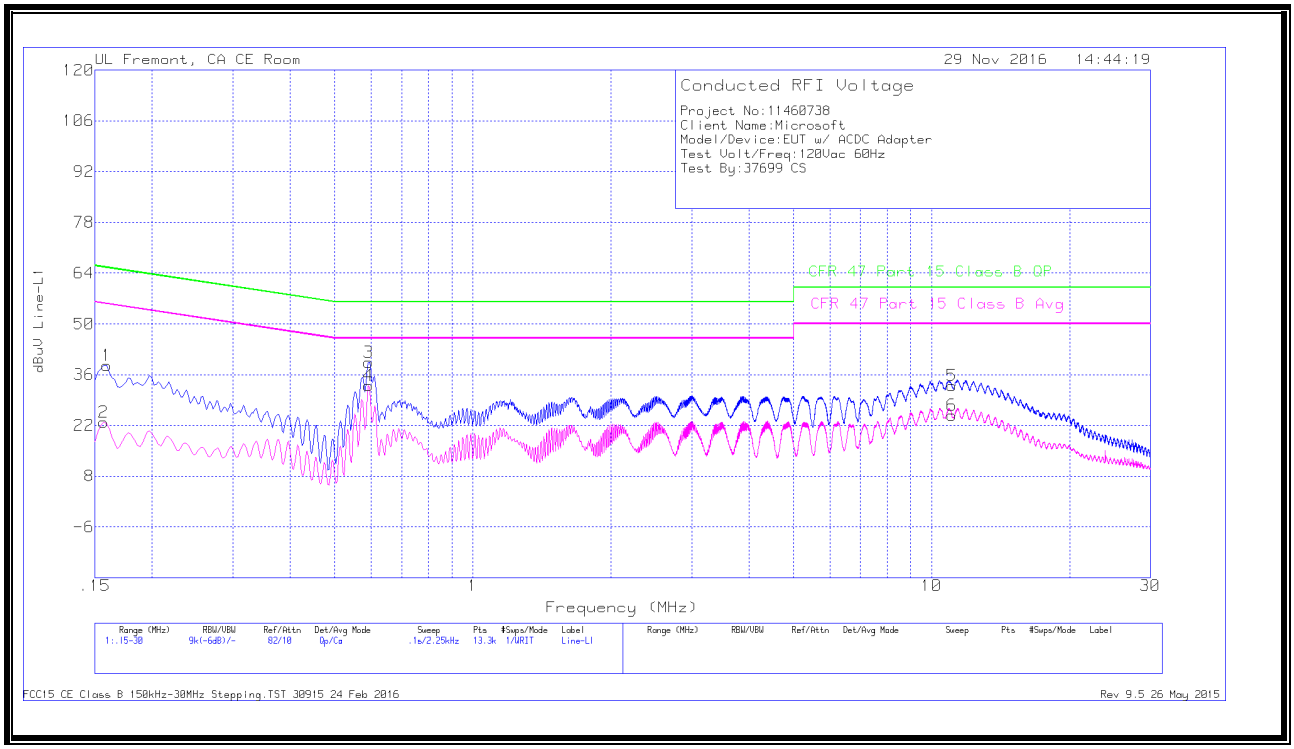
10.1. EUT POWERED BY AC/DC ADAPTER VIA USB CABLE

LINE 1 RESULTS



WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables 1&3	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	.159	28.42	Qp	0	0	10.1	38.52	65.52	-27	-	-
2	.15675	12.77	Ca	0	0	10.1	22.87	-	-	55.63	-32.76
3	.59325	29.26	Qp	0	0	10.1	39.36	56	-16.64	-	-
4	.59325	22.84	Ca	0	0	10.1	32.94	-	-	46	-13.06
5	11.067	22.6	Qp	0	.2	10.2	33	60	-27	-	-
6	11.06475	14.4	Ca	0	.2	10.2	24.8	-	-	50	-25.2

Qp - Quasi-Peak detector
Ca - CISPR average detection

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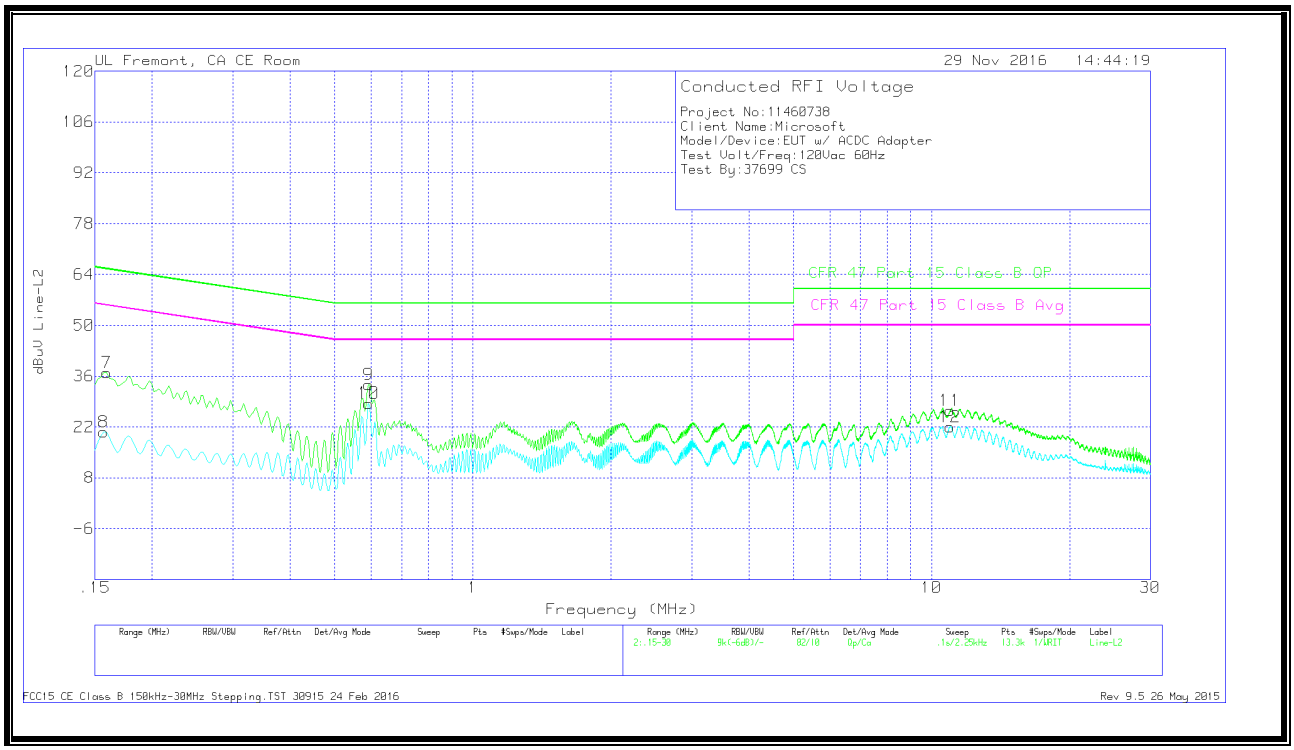
LINE 2 RESULTS



WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables 2&3	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)
7	.159	26.89	Qp	0	0	10.1	36.99	65.52	-28.53	-	-
8	.15675	10.5	Ca	0	0	10.1	20.6	-	-	55.63	-35.03
9	.59325	23.5	Qp	0	0	10.1	33.6	56	-22.4	-	-
10	.59325	18.43	Ca	0	0	10.1	28.53	-	-	46	-17.47
11	10.97925	16.07	Qp	0	.2	10.2	26.47	60	-33.53	-	-
12	10.97475	11.68	Ca	0	.2	10.2	22.08	-	-	50	-27.92

Qp - Quasi-Peak detector
Ca - CISPR average detection

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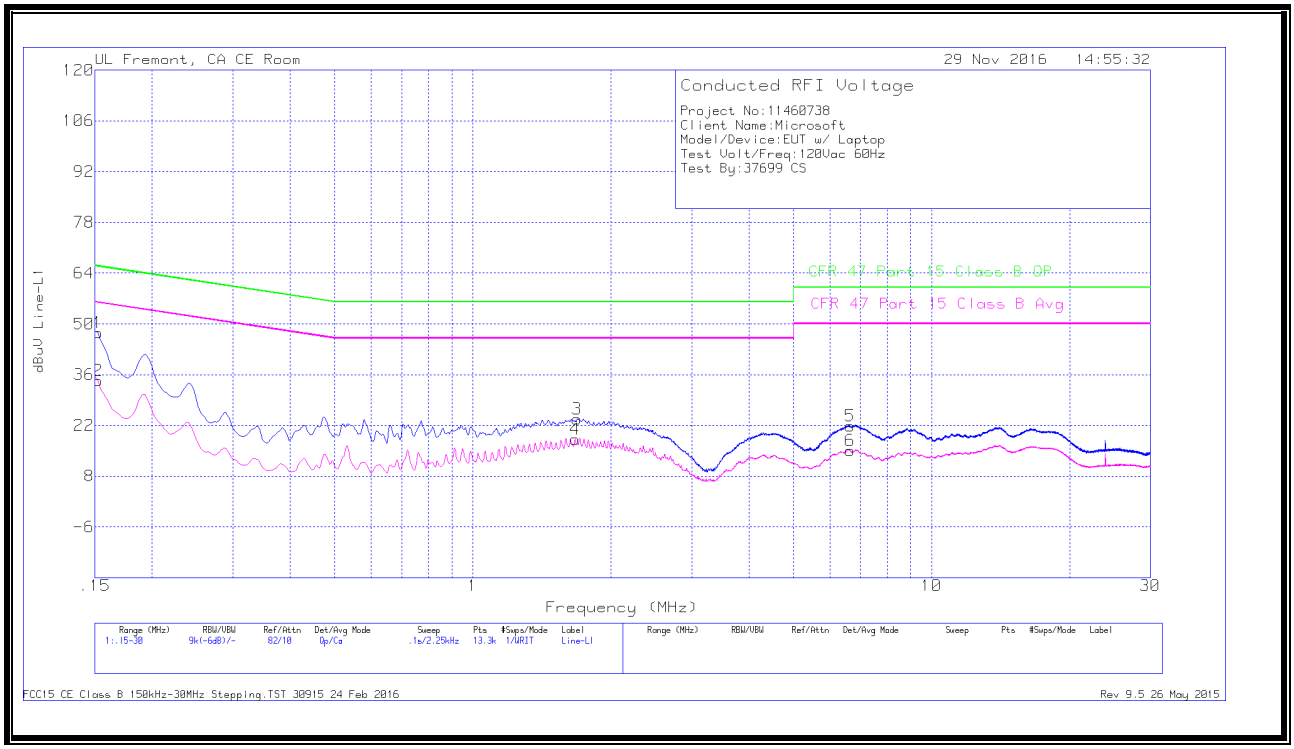
10.2. EUT POWERED BY HOST PC VIA USB CABLE

LINE 1 RESULTS



WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables 1&3	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	.15225	37.31	Qp	.1	0	10.1	47.51	65.88	-18.37	-	-
2	.15225	24.08	Ca	.1	0	10.1	34.28	-	-	55.88	-21.6
3	1.689	13.57	Qp	0	.1	10.1	23.77	56	-32.23	-	-
4	1.671	7.92	Ca	0	.1	10.1	18.12	-	-	46	-27.88
5	6.648	11.48	Qp	0	.1	10.2	21.78	60	-38.22	-	-
6	6.63675	4.75	Ca	0	.1	10.2	15.05	-	-	50	-34.95

Qp - Quasi-Peak detector
Ca - CISPR average detection

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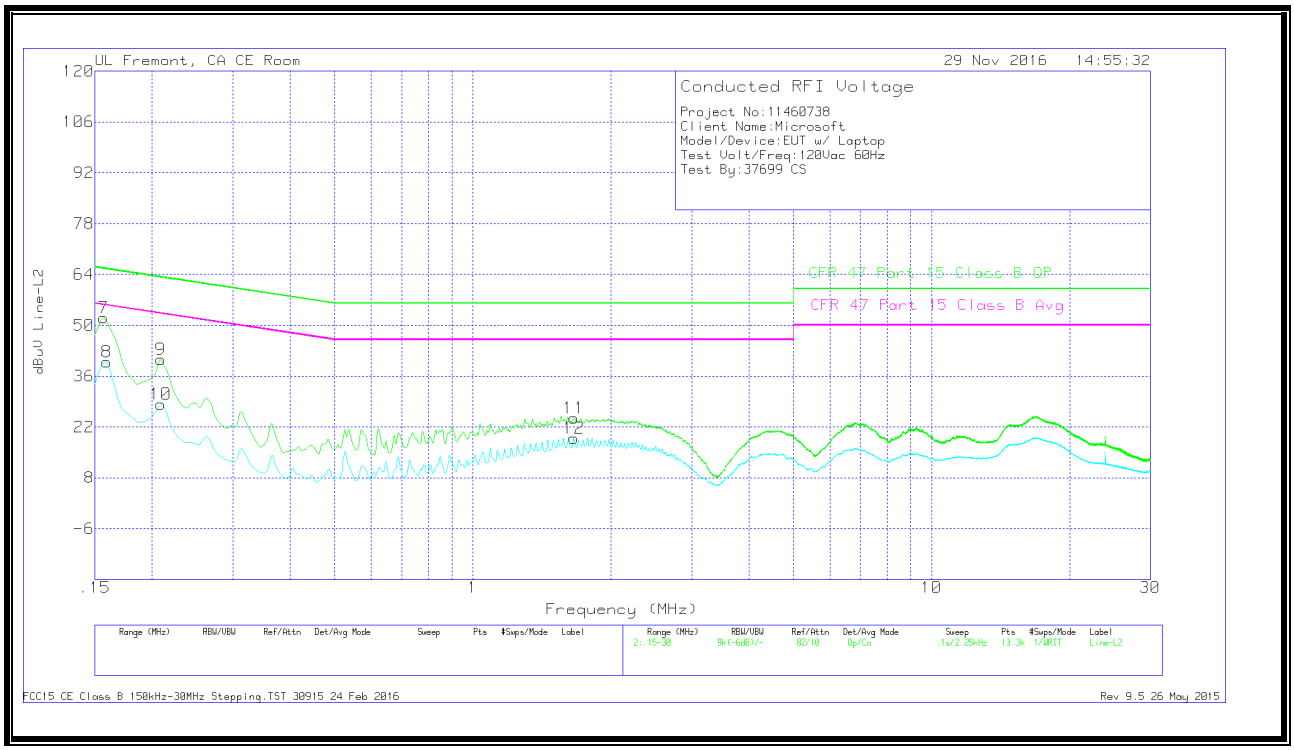
LINE 2 RESULTS



WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables 2&3	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)
7	.15675	42.05	Qp	0	0	10.1	52.15	65.63	-13.48	-	-
8	.159	29.84	Ca	0	0	10.1	39.94	-	-	55.52	-15.58
9	.2085	30.45	Qp	0	0	10.1	40.55	63.26	-22.71	-	-
10	.2085	18.11	Ca	0	0	10.1	28.21	-	-	53.26	-25.05
11	1.662	14.2	Qp	0	.1	10.1	24.4	56	-31.6	-	-
12	1.65975	8.61	Ca	0	.1	10.1	18.81	-	-	46	-27.19

Qp - Quasi-Peak detector
Ca - CISPR average detection

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