



CERTIFICATION TEST REPORT

Report Number. : 11681248-E2V5

Applicant : ENERGOUS CORPORATION
3590 NORTH FIRST STREET
SAN JOSE, CA 95134 USA

Model : NF-130

FCC ID : 2ADNG-NF130

EUT Description : CHARGER PAD

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
October 04, 2017

Prepared by:
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Revision History



NVLAP LAB CODE 200065-0

Rev.	Issue Date	Revisions	Revised By
V1	04/17/17	Initial Issue	C. Vergonio
V2	04/20/17	Updated Section 5.3 and 8.1.	C. Vergonio
V3	04/21/17	Updated Section 5.3 with correct antenna gain. Updated Section 5.6 Support Equipment table.	C. Vergonio
V4	08/24/17	Revised Section 5.1	M. Heckrotte
V5	10/04/17	Removed RSS standard info, revised Section 5.6 and 6	Tina Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Energous Corporation
3590 North First Street
San Jose, CA 95134 USA

EUT DESCRIPTION: CHARGER PAD

MODEL: NF-130

SERIAL NUMBER: MLKI0239 (Transmitter)

DATE TESTED: MARCH 21-22, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:



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UL VERIFICATION SERVICES INC.

Prepared By:



JASON QIAN
WiSE Lab Engineer
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, KDB 558074 D01 v03r05, ANSI C63.10-2013.

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	
<input type="checkbox"/>	Chamber A (IC:2324B-1)	<input type="checkbox"/>	Chamber D (IC:22541-1)
<input type="checkbox"/>	Chamber B (IC:2324B-2)	<input type="checkbox"/>	Chamber E (IC:22541-2)
<input checked="" type="checkbox"/>	Chamber C (IC:2324B-3)	<input type="checkbox"/>	Chamber F (IC:22541-3)
		<input type="checkbox"/>	Chamber G (IC:22541-4)
		<input checked="" type="checkbox"/>	Chamber H (IC:22541-5)

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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

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%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an RF based charging system that provides a wireless solution for small-sized and low powered devices. The EUT also includes a Bluetooth Low Energy radio.

This report documents test results of the Bluetooth Low Energy radio portion of the Charger Pad.

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	-6.47	0.23

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio is tested with a PIFA Chip antenna, with a maximum peak gain of -9.5dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was NF130T.Rev1.0.
The software installed in the EUT during testing was 3.0.3.23.

5.5. WORST-CASE CONFIGURATION AND MODE

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

The EUT is a tabletop device. Therefore, all final radiated testing was performed with the EUT in tabletop (X) orientation.

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

BLE: 1 Mbps.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC Adapter	Zeskit	AD566	N/A	N/A
Laptop	Dell	P61G	N/A	N/A

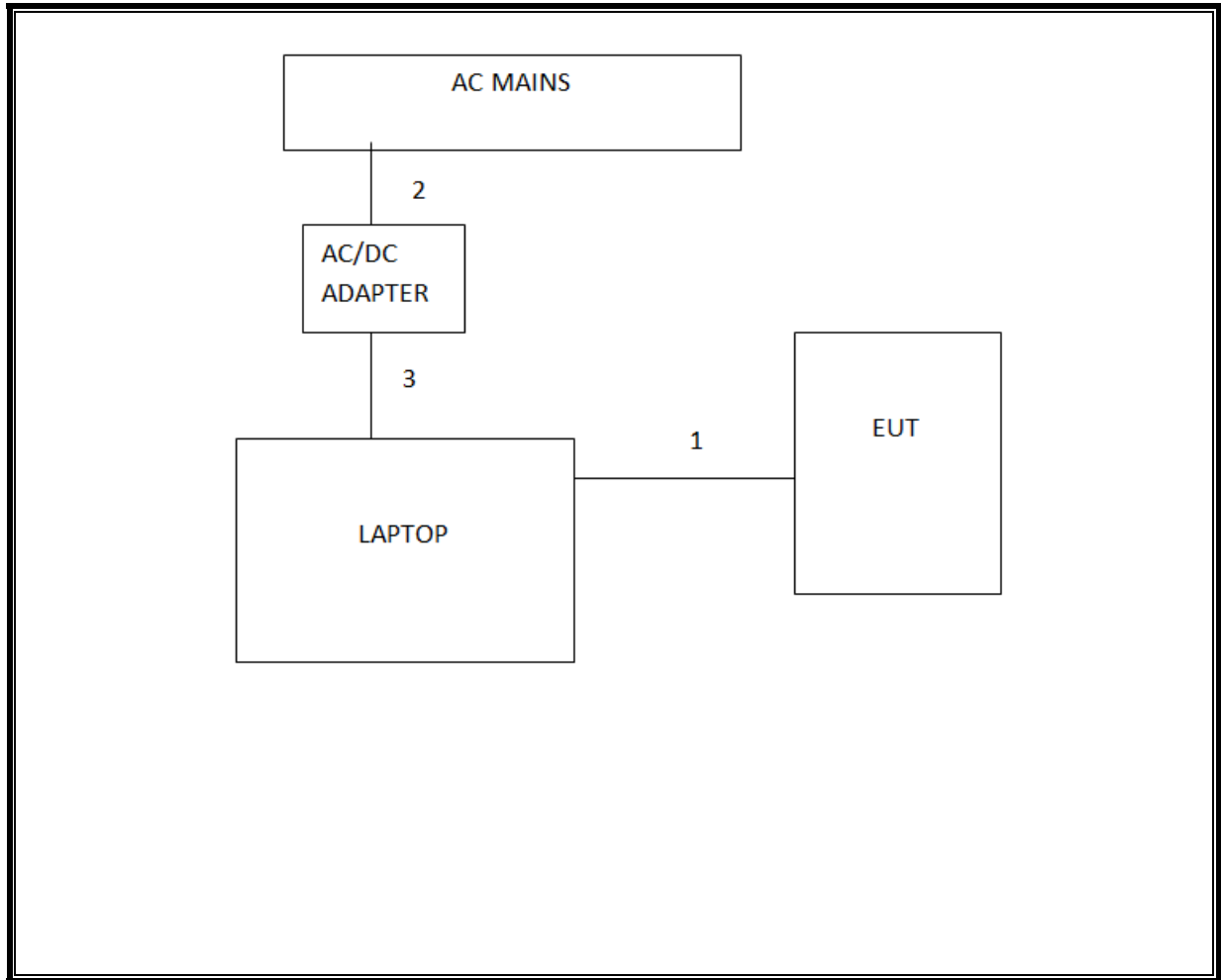
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Unshielded	1	EUT to Laptop
2	AC Power	1	AC	Unshielded	1	
3	DC Power	1	DC	Unshielded	1	

TEST SETUP

The EUT is connected to the test laptop through USB cable. Test software exercised the EUT.

SETUP DIAGRAM



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	T Number	Cal Date	Cal Due
PSA Series Spectrum Analyzer, 3Hz - 26.5GHz	Agilent	E4440A	199	07/22/16	07/22/17
PXA Spectrum Analyzer, 3Hz to 44GHz	Agilent	N9030A	908	04/13/16	04/13/17
Horn Antenna, 18 - 26.5 GHz	ARA	MWH-1826/B	449	05/26/16	05/26/17
Horn Antenna, 1-18GHz	ETS Lindgren	3117	120	04/05/16	04/05/17
Antenna, Biconolog, 30MHz-1GHz	Sunol Sciences	JB3	407	04/04/16	04/04/17
Loop Antenna	EMCO	6502	1616	12/12/16	12/12/17
Amplifier, 1-26.5GHz	Miteq	AFS42-00101800-25-S-42	1165	08/01/16	08/01/17
Amplifier, 1 to 8GHz	Miteq	AMF-4D-01000800-30-29P	1170	04/28/16	04/28/17
Amplifier, 10KHz to 1GHz, 32dB	Keysight	8447D	300	11/10/16	11/10/17
P-Series Power Meter	Keysight	N1911A	1264	07/08/16	07/08/17
Wideband Power Sensor 50MHz - 18GHz	Agilent	N1921A	1224	03/22/16	03/22/17
EMI Receiver	Rohde & Schwarz	ESR-EMI	1436	12/19/16	12/19/17
LISN	FISCHER	FCC-LISN-50/250-25-2-01	1310	06/08/16	06/08/17

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, Apr 26, 2016
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 5.1.1, July 15, 2016

7. ANTENNA PORT TEST RESULTS

7.1. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r05, Section 8.1.

Output Power: KDB 558074 D01 v03r05, Section 9.1.1.

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.0.

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

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

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

7.2. ON TIME, DUTY CYCLE

LIMITS

None; for reporting purposes only.

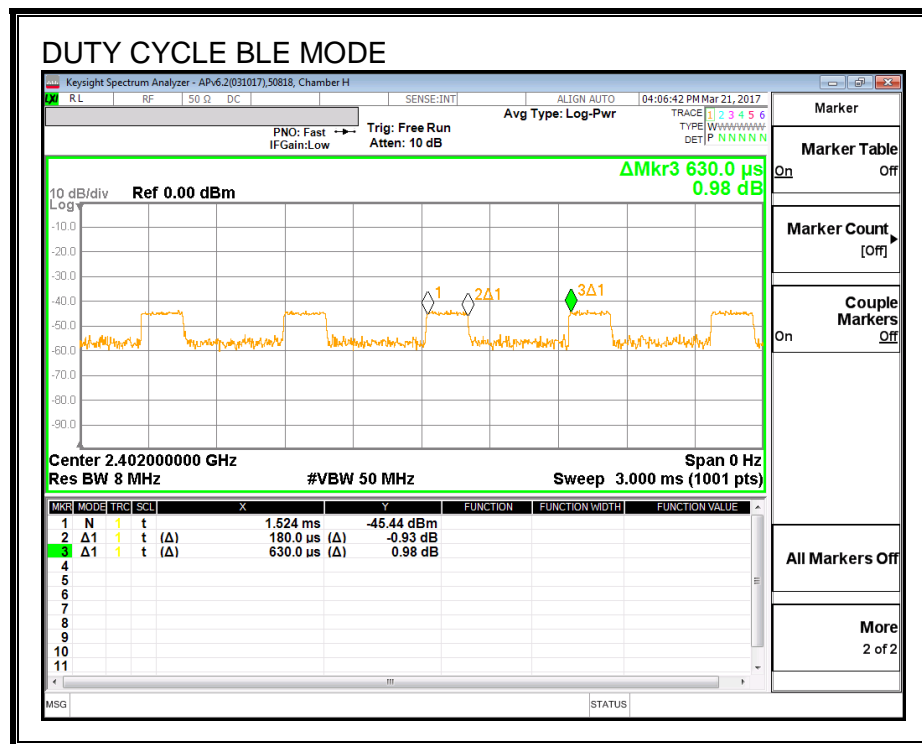
PROCEDURE

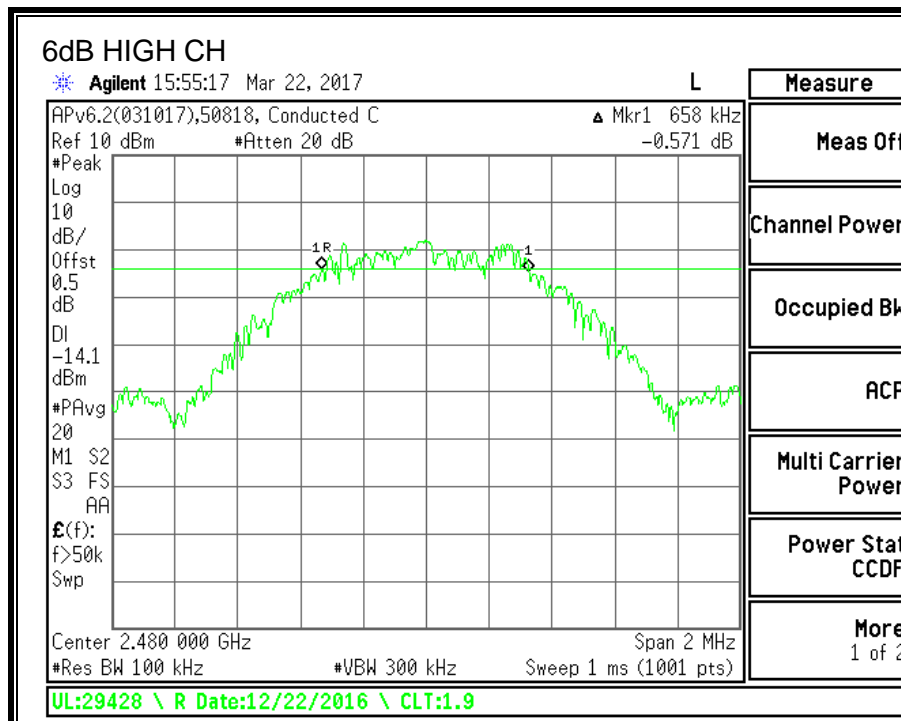
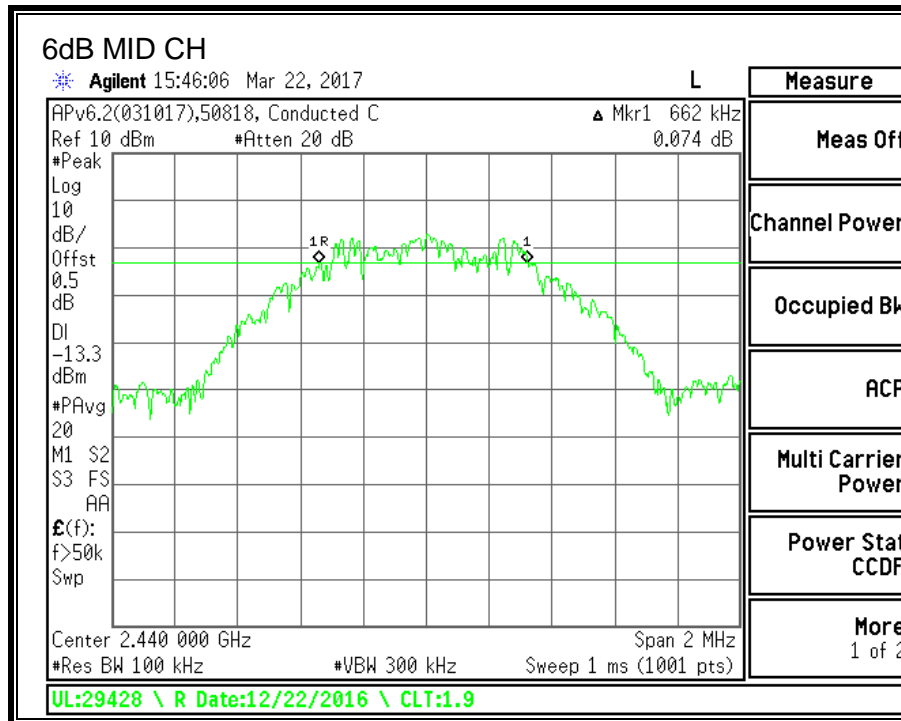
KDB 558074 Zero-Span Spectrum Analyzer Method.

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/T Minimum VBW (khz)
BLE	.180	.630	0.286	28.57	5.44	5.556

DUTY CYCLE PLOTS





7.3.2. 99% BANDWIDTH

LIMITS

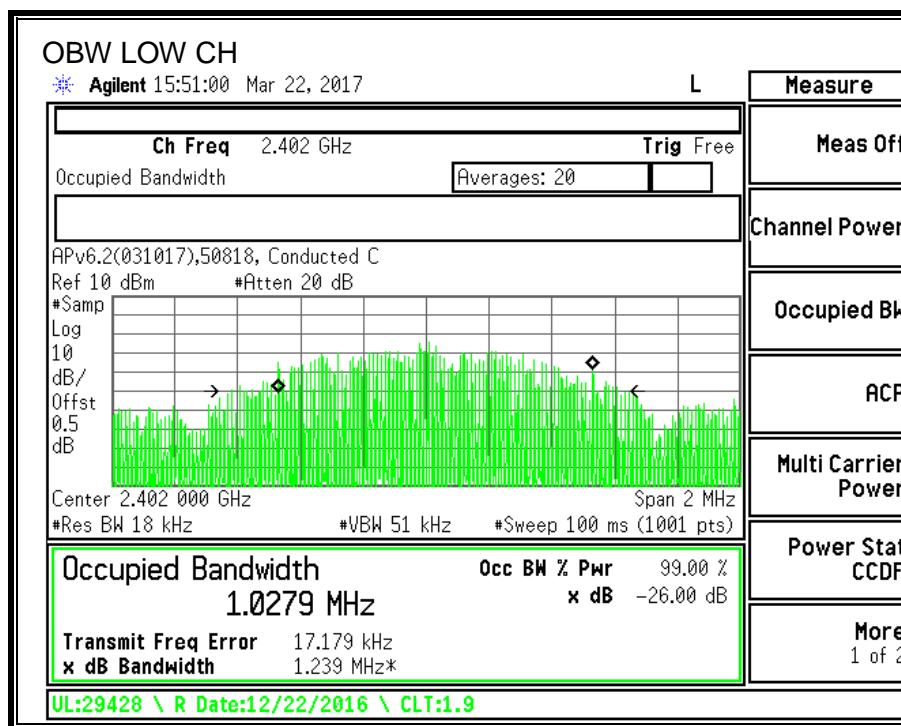
None; for reporting purposes only.

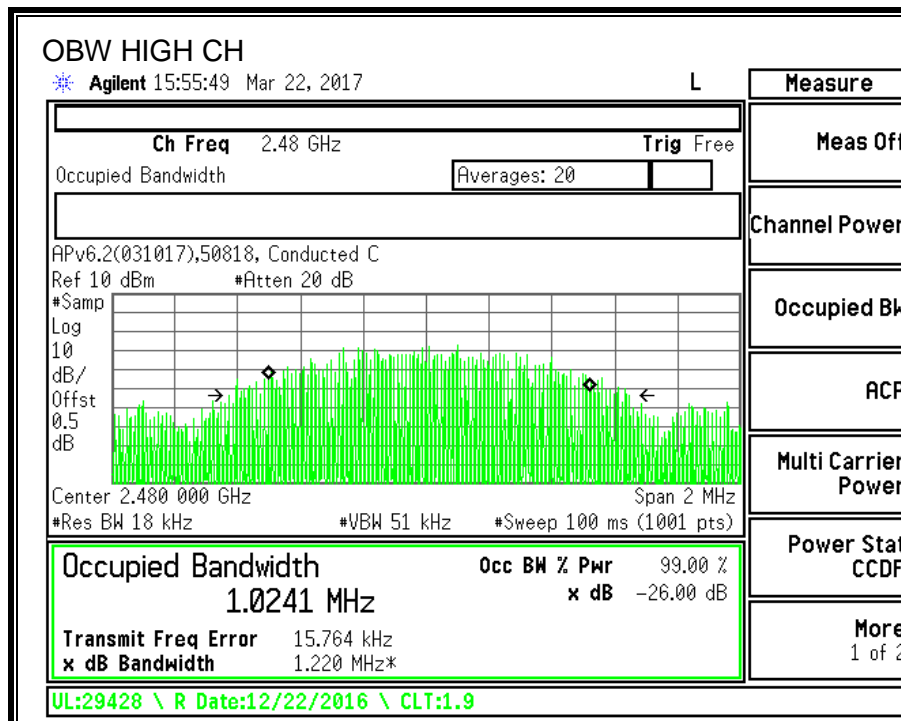
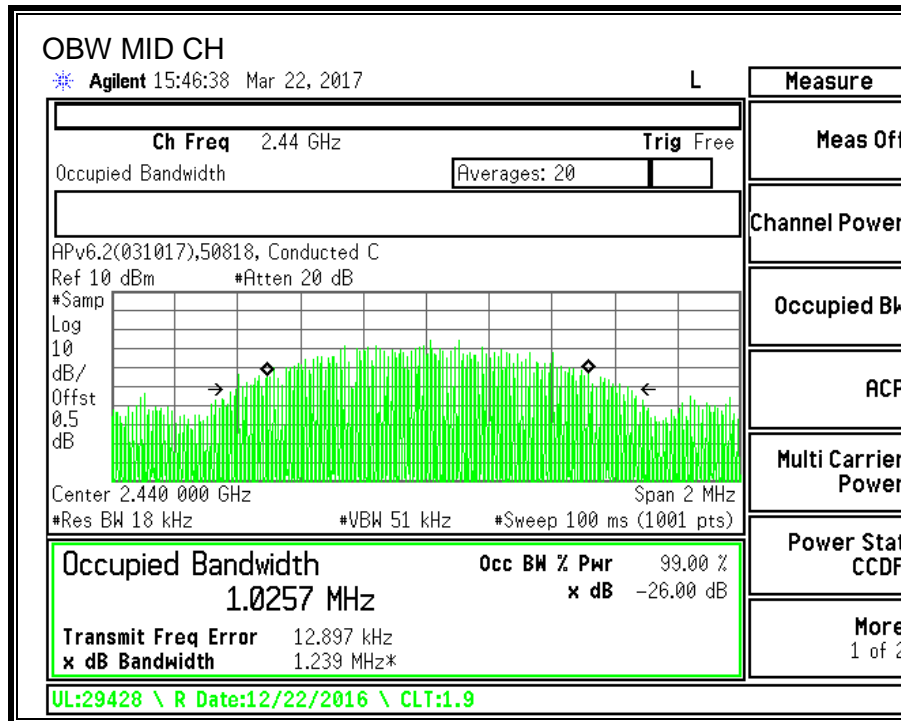
Test Procedure

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0279
Middle	2440	1.0257
High	2480	1.0241





7.3.3. OUTPUT POWER

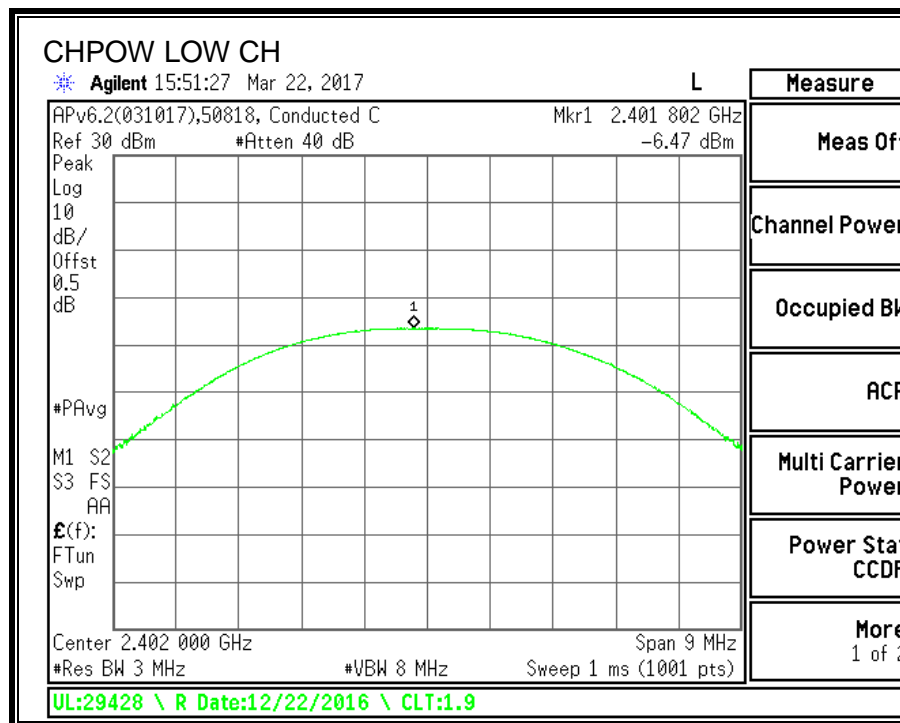
LIMITS

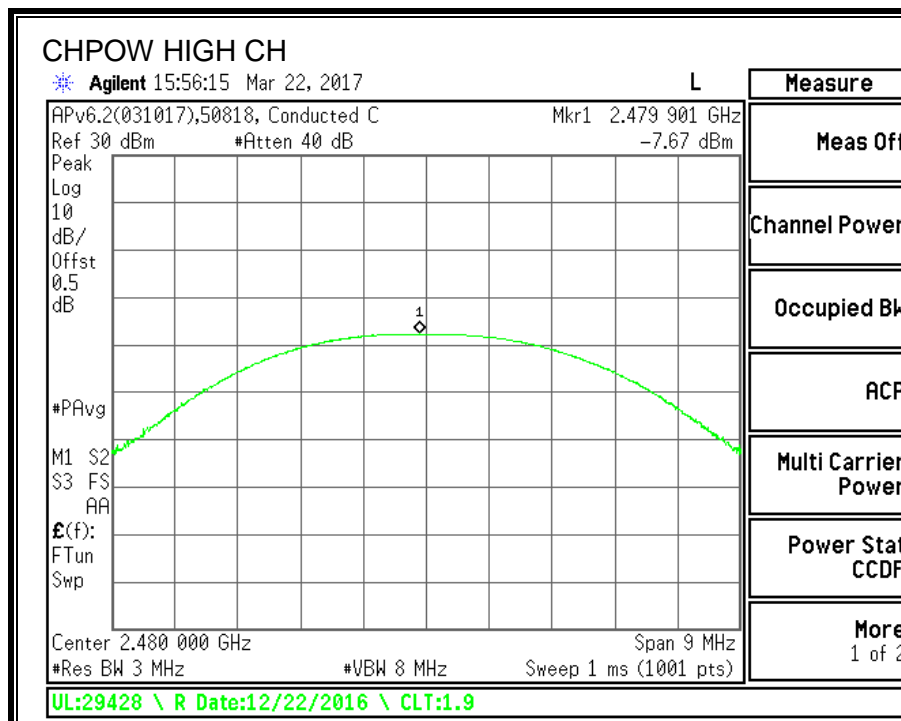
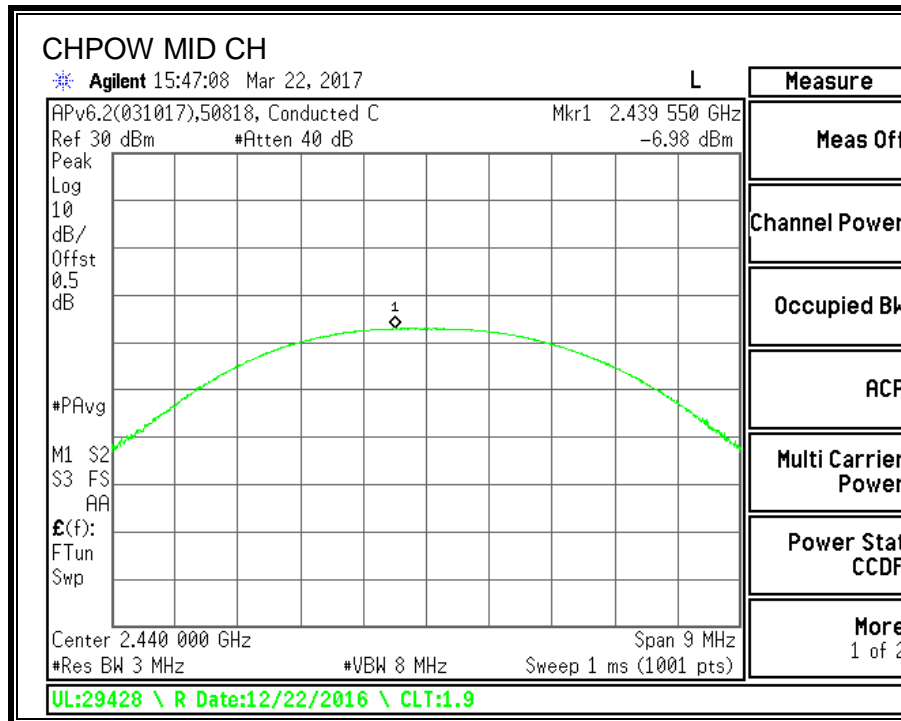
FCC §15.247 (b)

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

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-6.47	30	-36.47
Middle	2440	-6.98	30	-36.98
High	2480	-7.67	30	-37.67





7.3.4. POWER SPECTRAL DENSITY

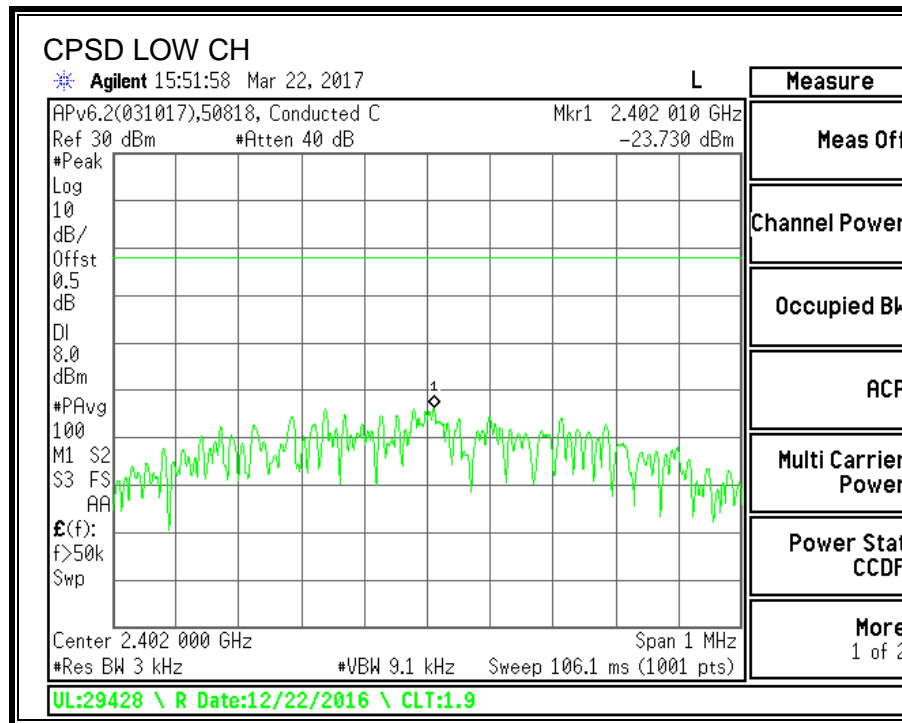
LIMITS

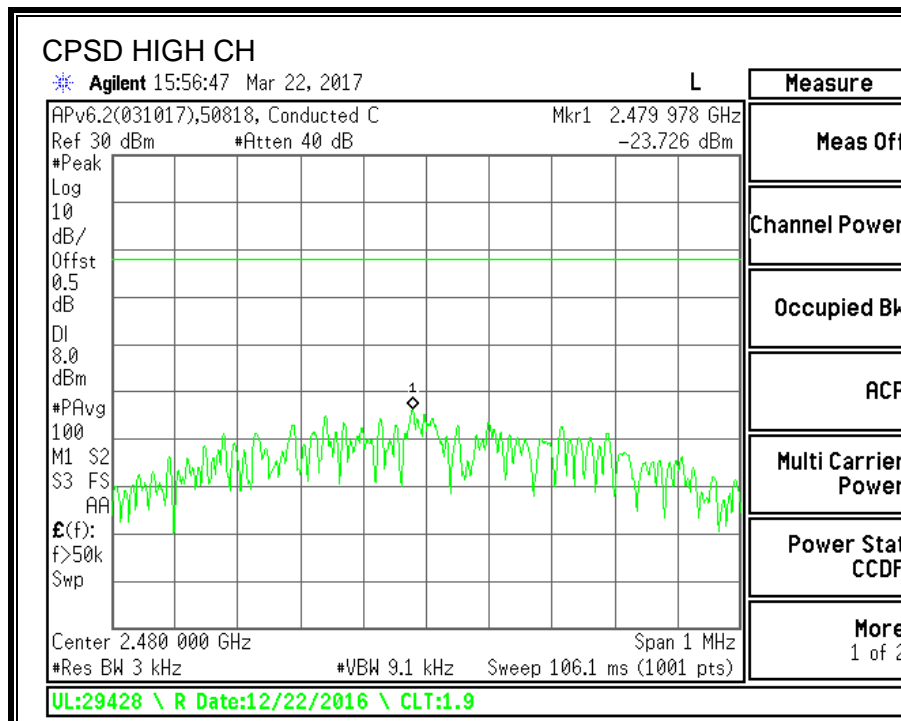
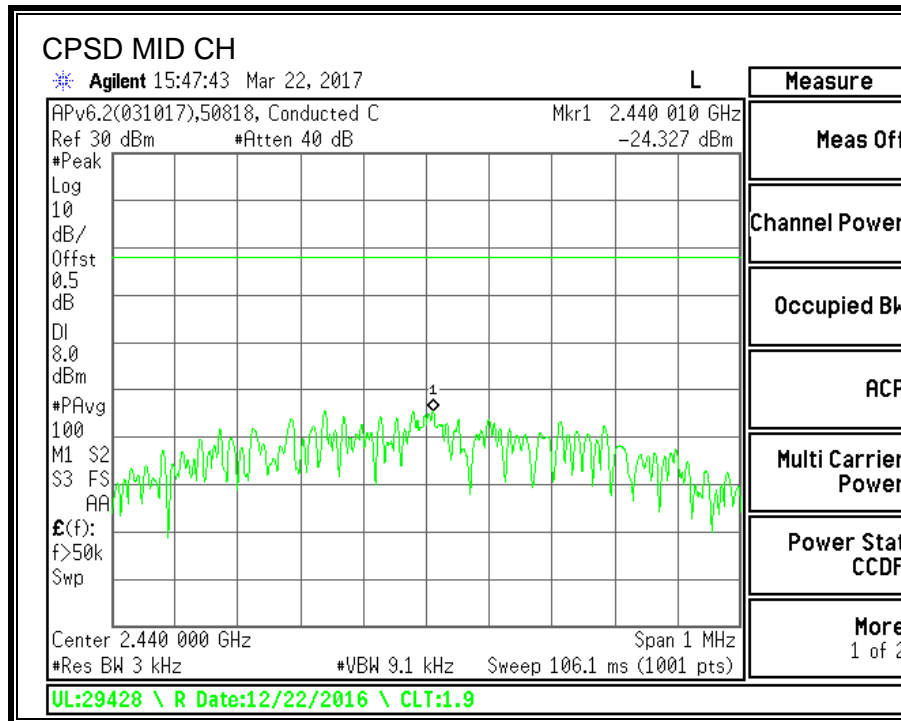
FCC §15.247 (e)

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

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-23.73	8	-31.73
Middle	2440	-24.33	8	-32.33
High	2480	-23.73	8	-31.73





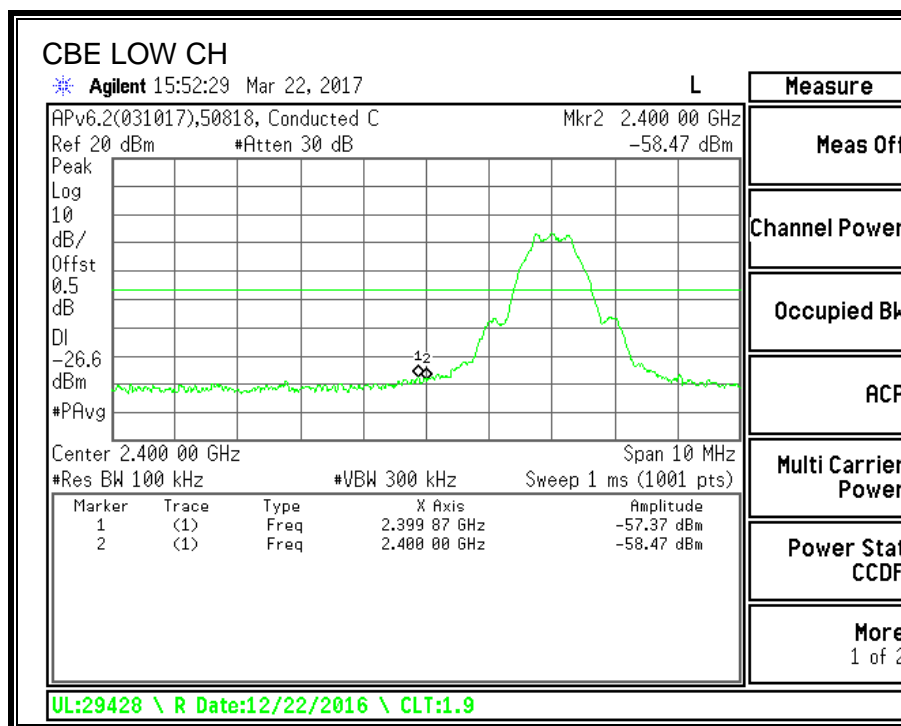
7.3.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

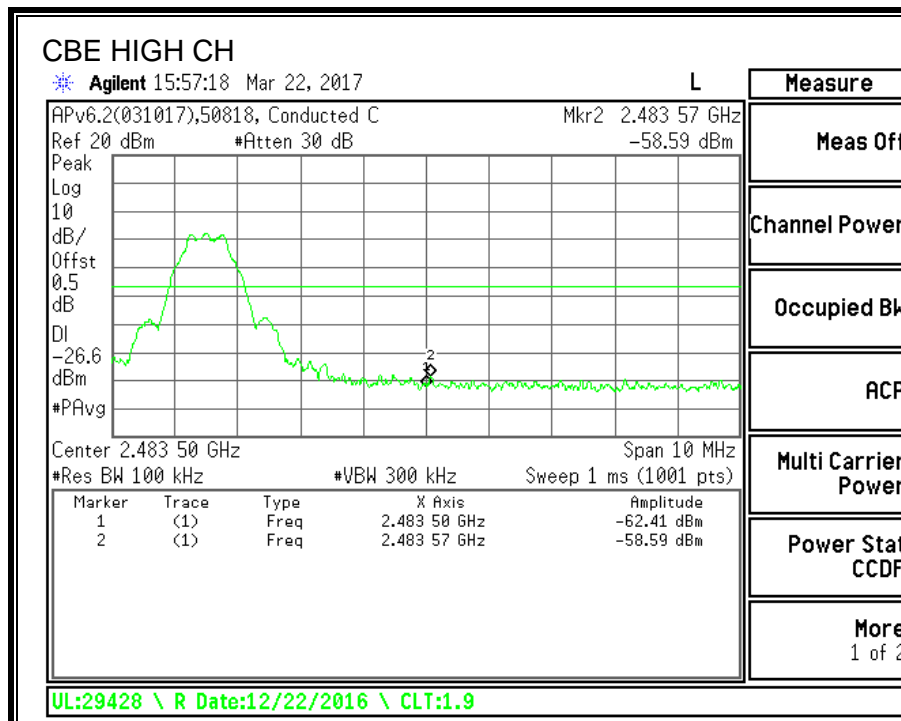
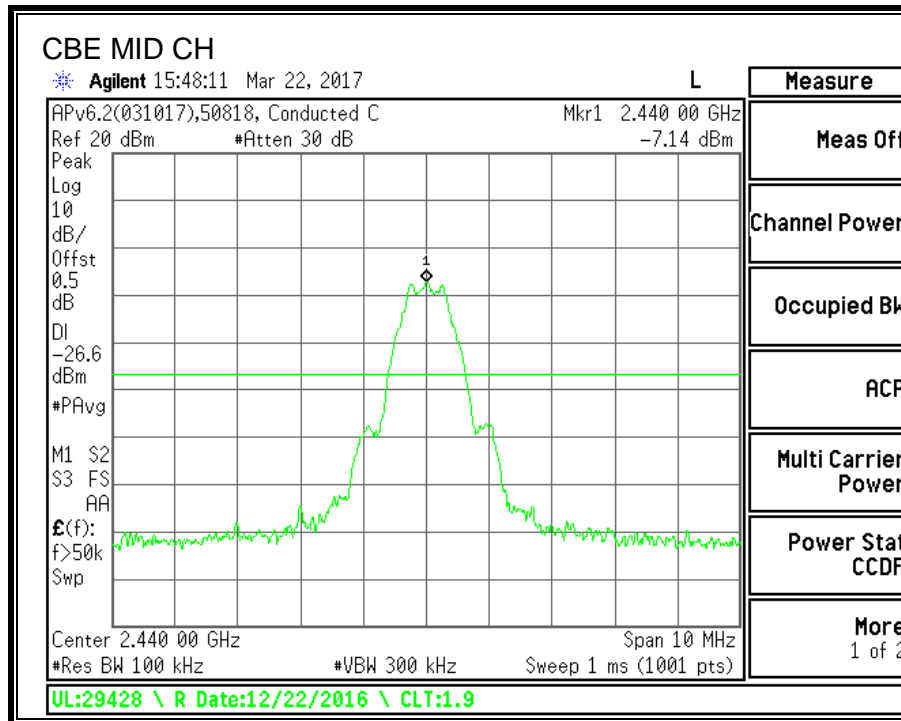
LIMITS

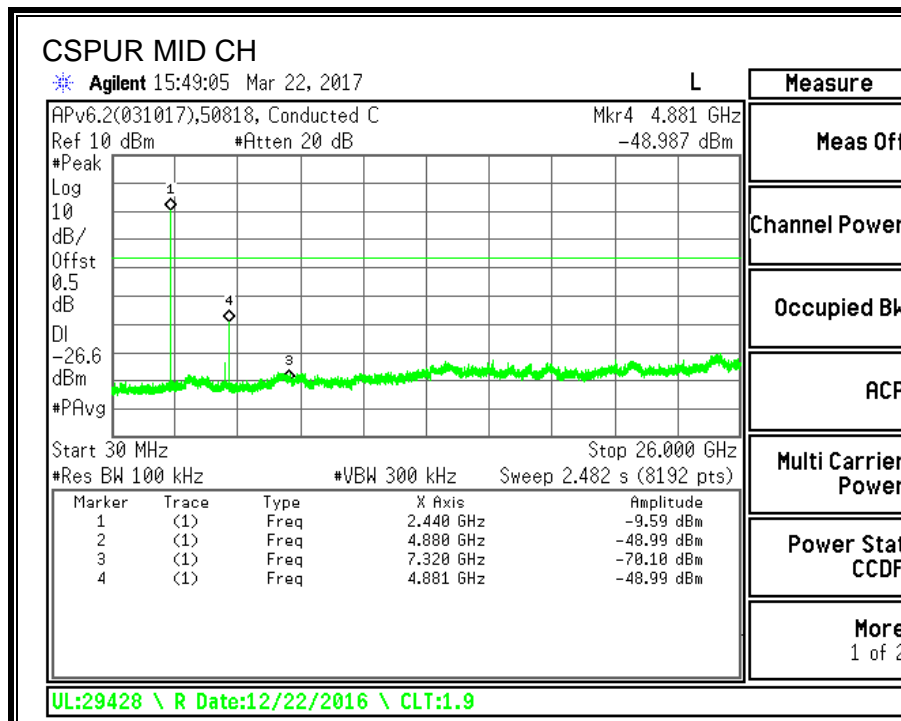
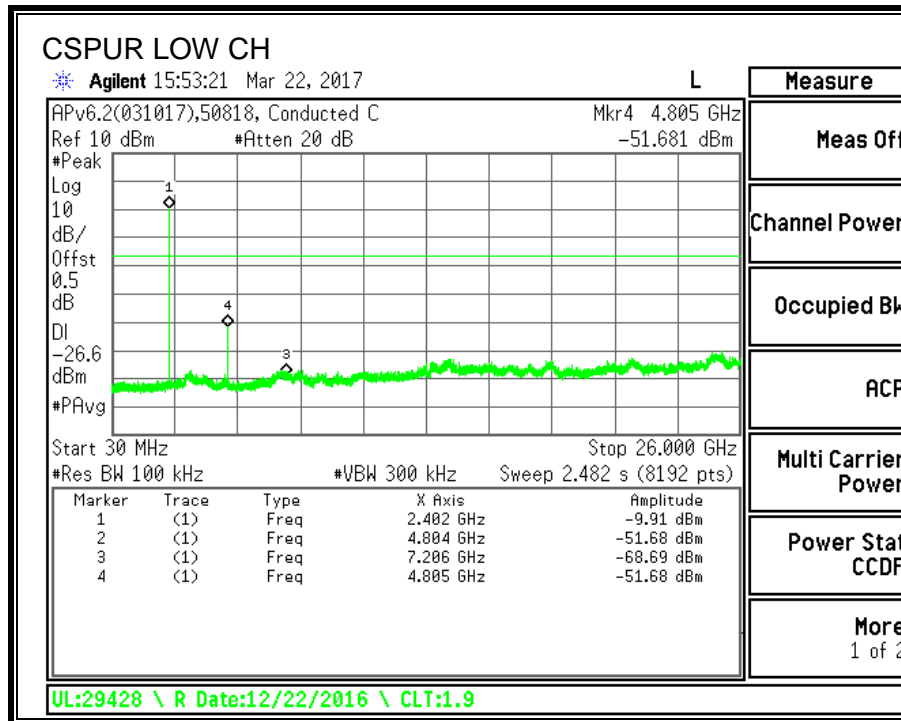
FCC §15.247 (d)

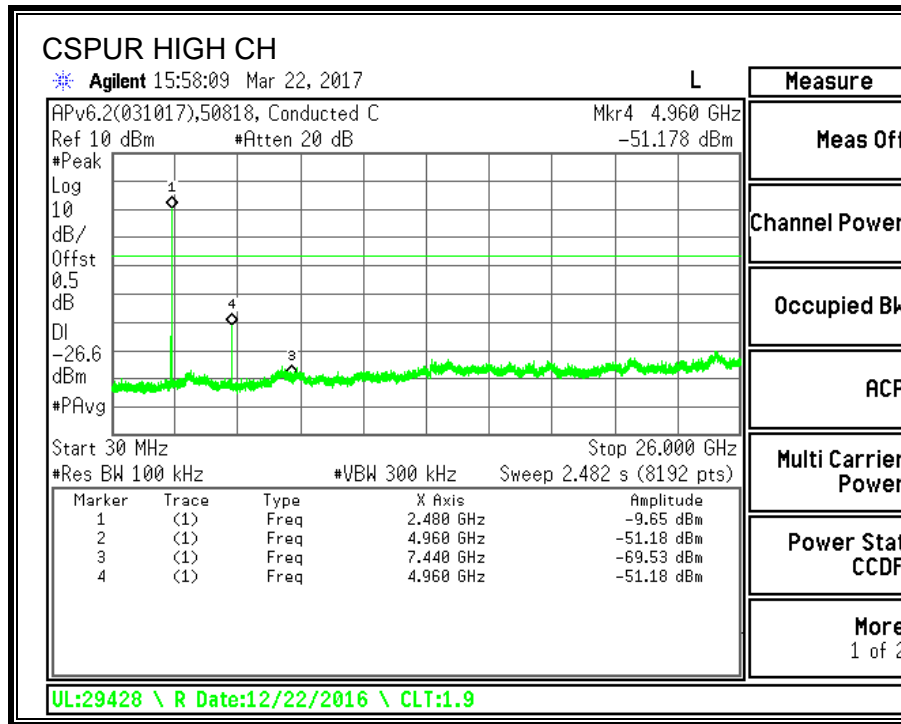
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS









8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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.

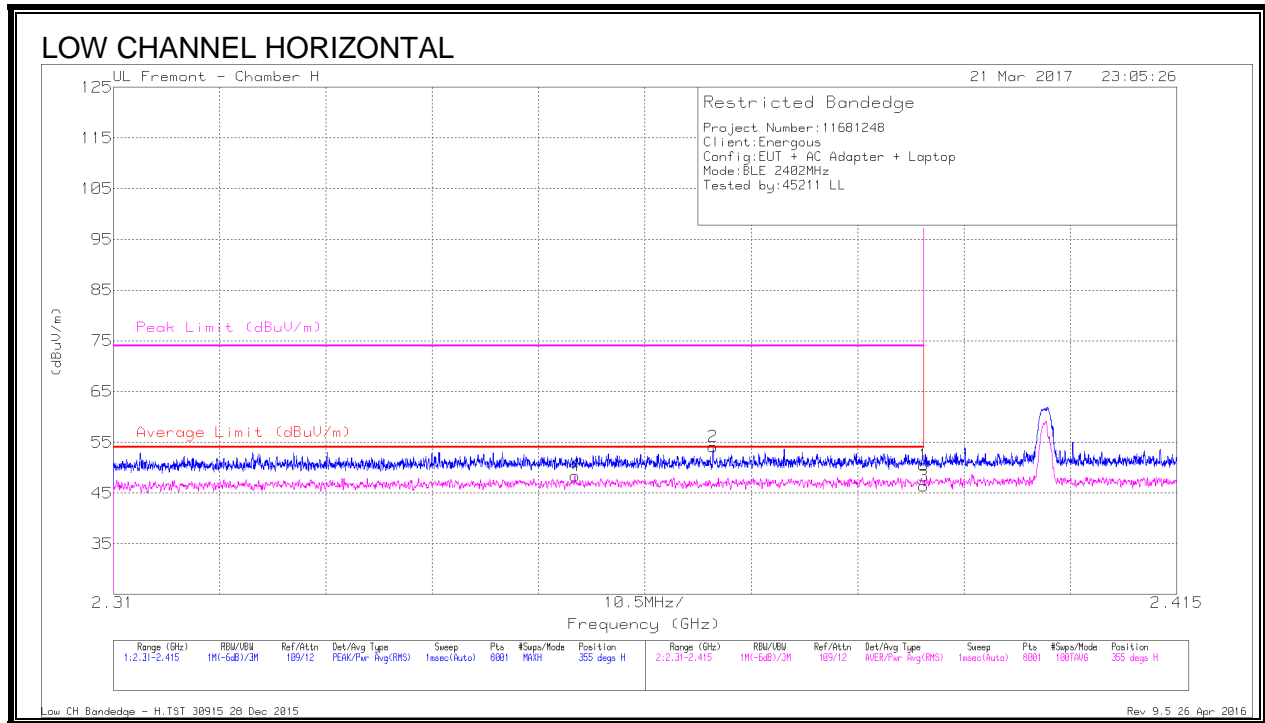
For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

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 1GHz to 18 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.

8.2. RESTRICTED BANDEDGE (LOW CHANNEL)



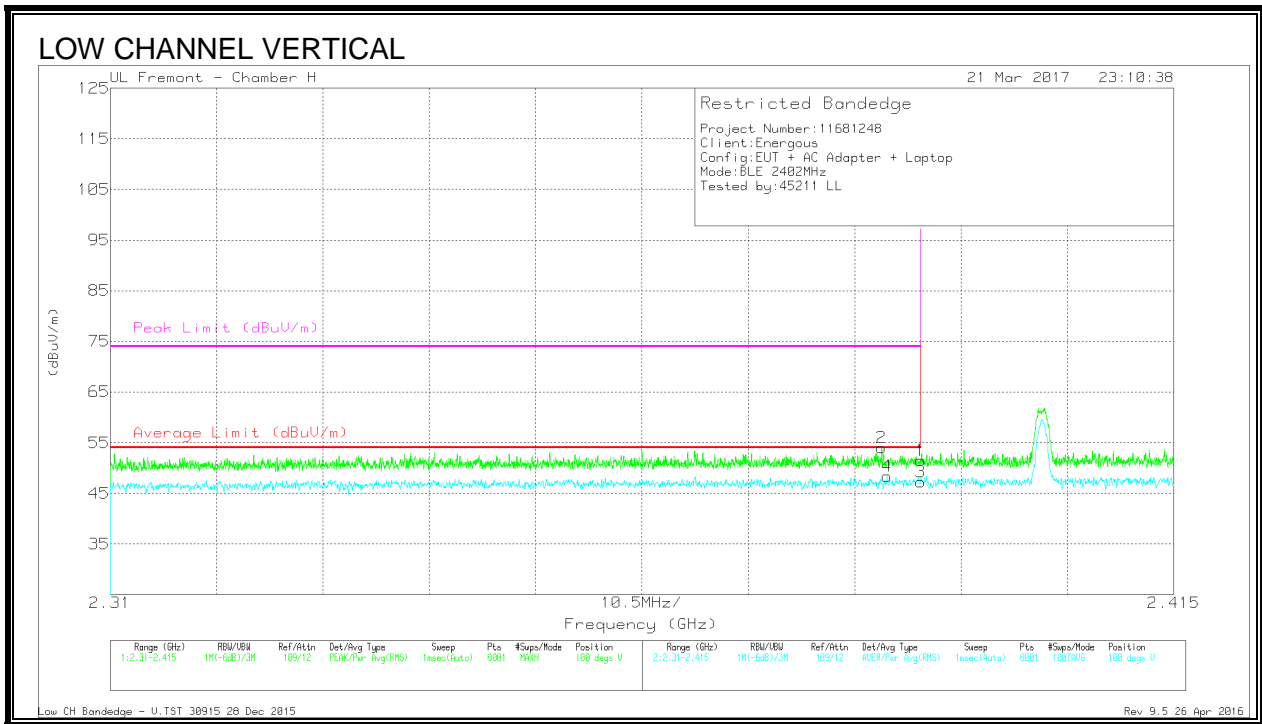
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
4	* 2.356	27.78	RMS	31.8	-16.6	5.44	48.42	54	-5.58	-	-	355	141	H
2	* 2.369	38.89	PK	31.8	-16.6	0	54.09	-	-	74	-19.91	355	141	H
1	* 2.39	35.19	PK	31.9	-16.6	0	50.49	-	-	74	-23.51	355	141	H
3	* 2.39	25.7	RMS	31.9	-16.6	5.44	46.44	54	-7.56	-	-	355	141	H

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

RMS - RMS detection



Trace Markers

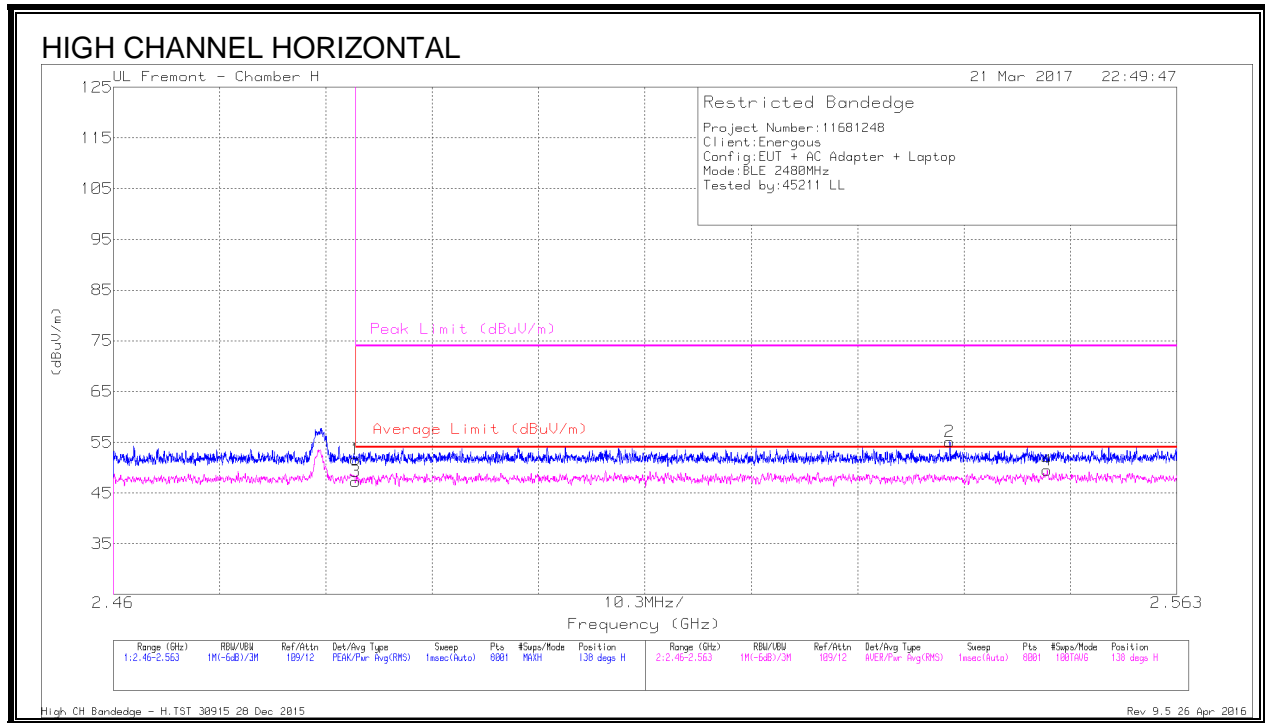
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
2	* 2.386	38.66	Pk	31.9	-16.6	0	53.96	-	-	74	-20.04	100	277	V
4	* 2.387	27.5	RMS	31.9	-16.5	5.44	48.34	54	-5.66	-	-	100	277	V
1	* 2.39	36.26	Pk	31.9	-16.6	0	51.56	-	-	74	-22.44	100	277	V
3	* 2.39	26.53	RMS	31.9	-16.6	5.44	47.27	54	-6.73	-	-	100	277	V

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

RMS - RMS detection

8.3. AUTHORIZED BANDEGE (HIGH CHANNEL)



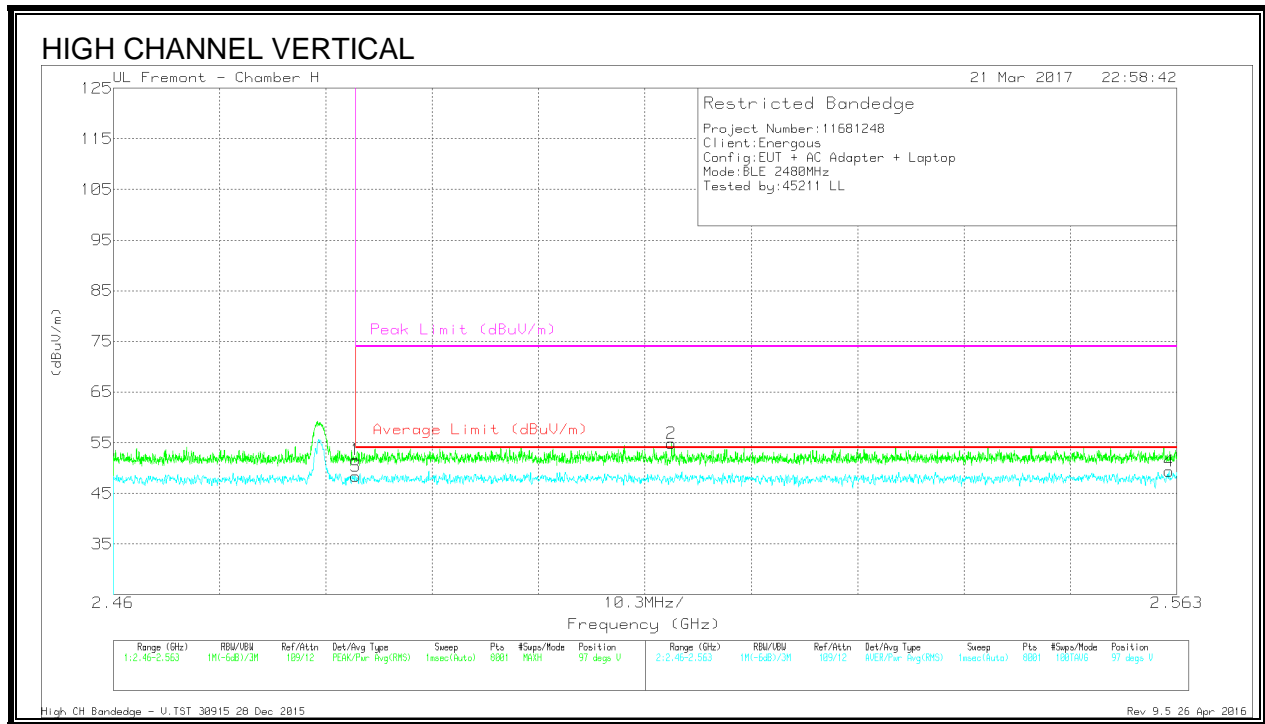
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.484	35.83	Pk	32.2	-16.4	0	51.63	-	-	74	-22.37	138	156	H
3	* 2.484	26.08	RMS	32.2	-16.4	5.44	47.32	54	-6.68	-	-	138	156	H
2	2.541	39.2	Pk	32.2	-16.3	0	55.1	-	-	74	-18.9	138	156	H
4	2.55	28.02	RMS	32.2	-16.2	5.44	49.46	54	-4.54	-	-	138	156	H

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

RMS - RMS detection



Trace Markers

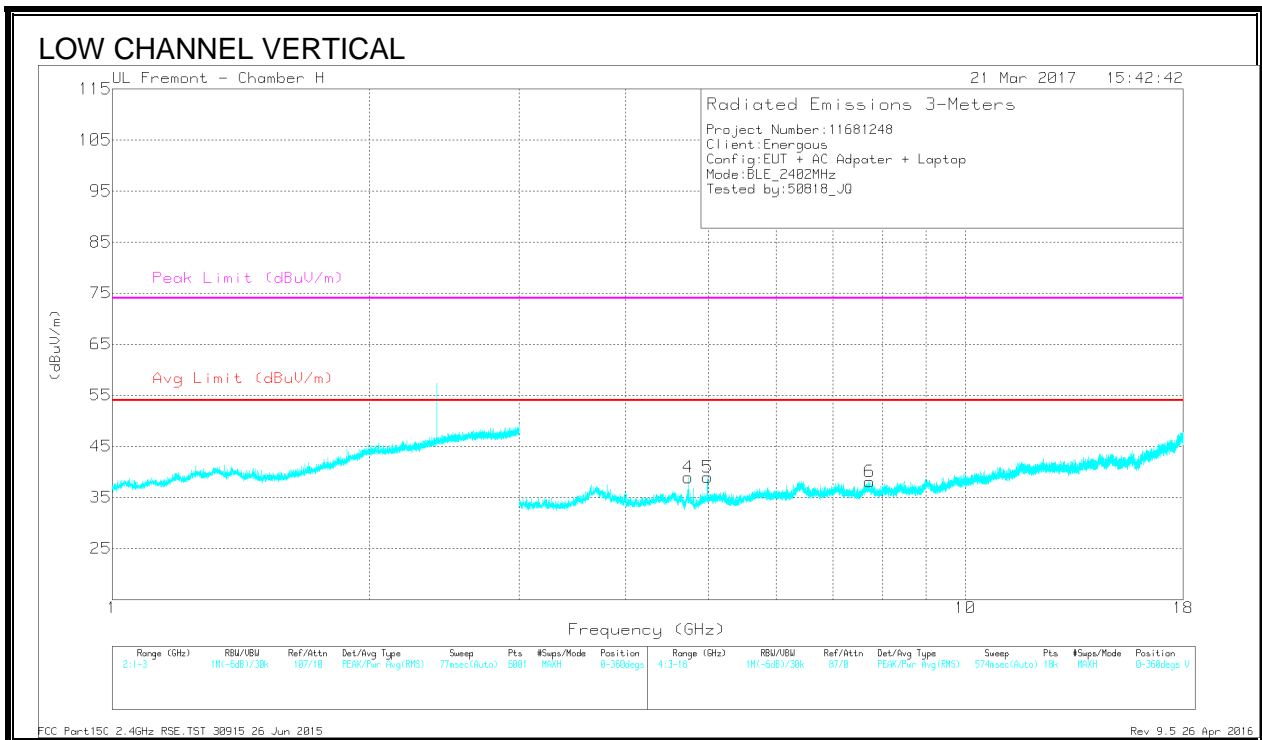
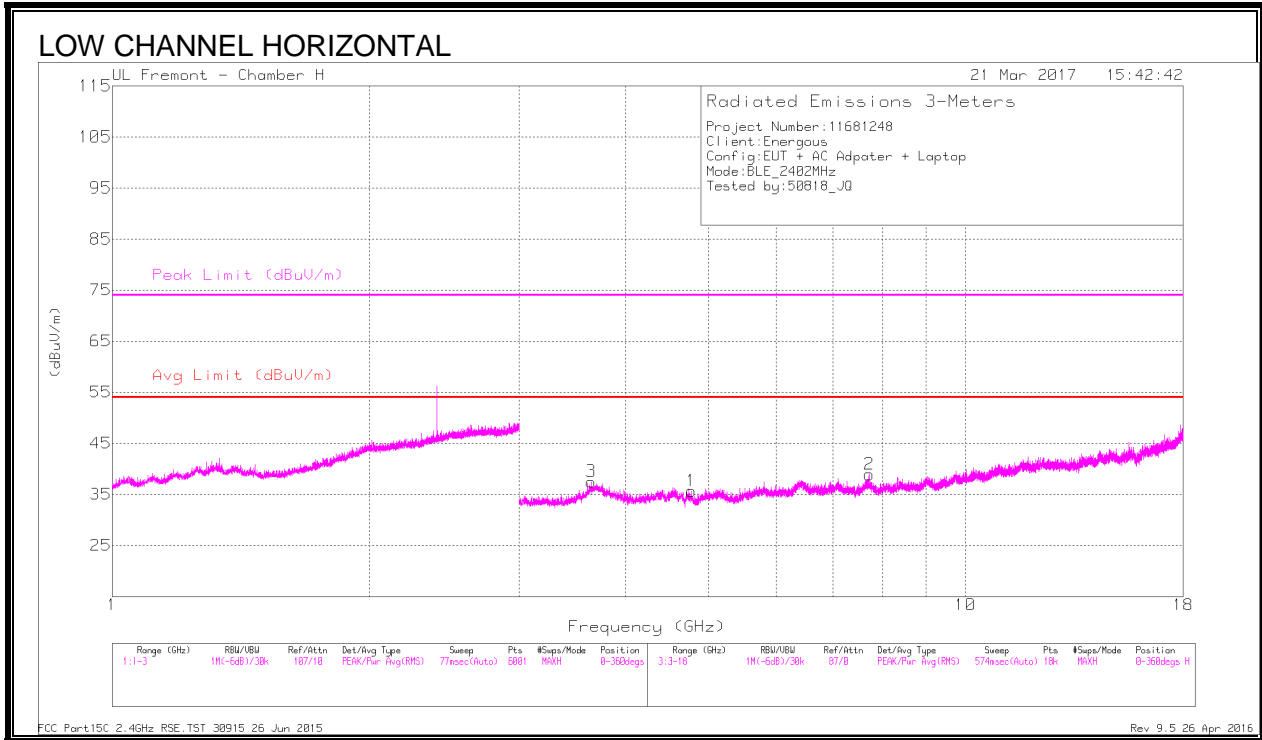
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Ch/Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Altitude (Degs)	Height (cm)	Polarity
1	* 2.484	35.83	Pk	32.2	-16.4	0	51.63	-	-	74	-22.37	97	236	V
3	* 2.484	27.12	RMS	32.2	-16.4	5.44	48.36	54	-5.64	-	-	97	236	V
2	2.514	39.04	Pk	32.2	-16.4	0	54.84	-	-	74	-19.16	97	236	V
4	2.562	27.95	RMS	32.2	-16.2	5.44	49.39	54	-4.61	-	-	97	236	V

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

RMS - RMS detection

8.4. HARMONICS AND SPURIOUS EMISSIONS 1 TO 18 GHz



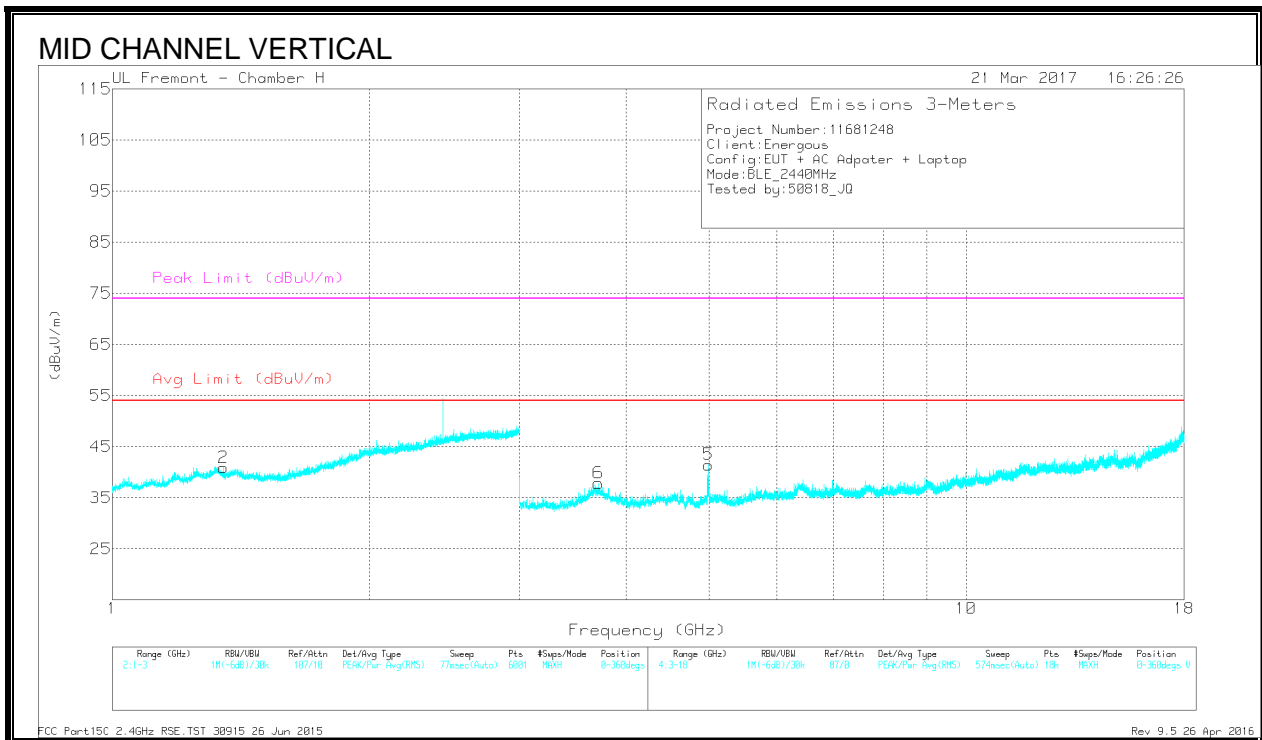
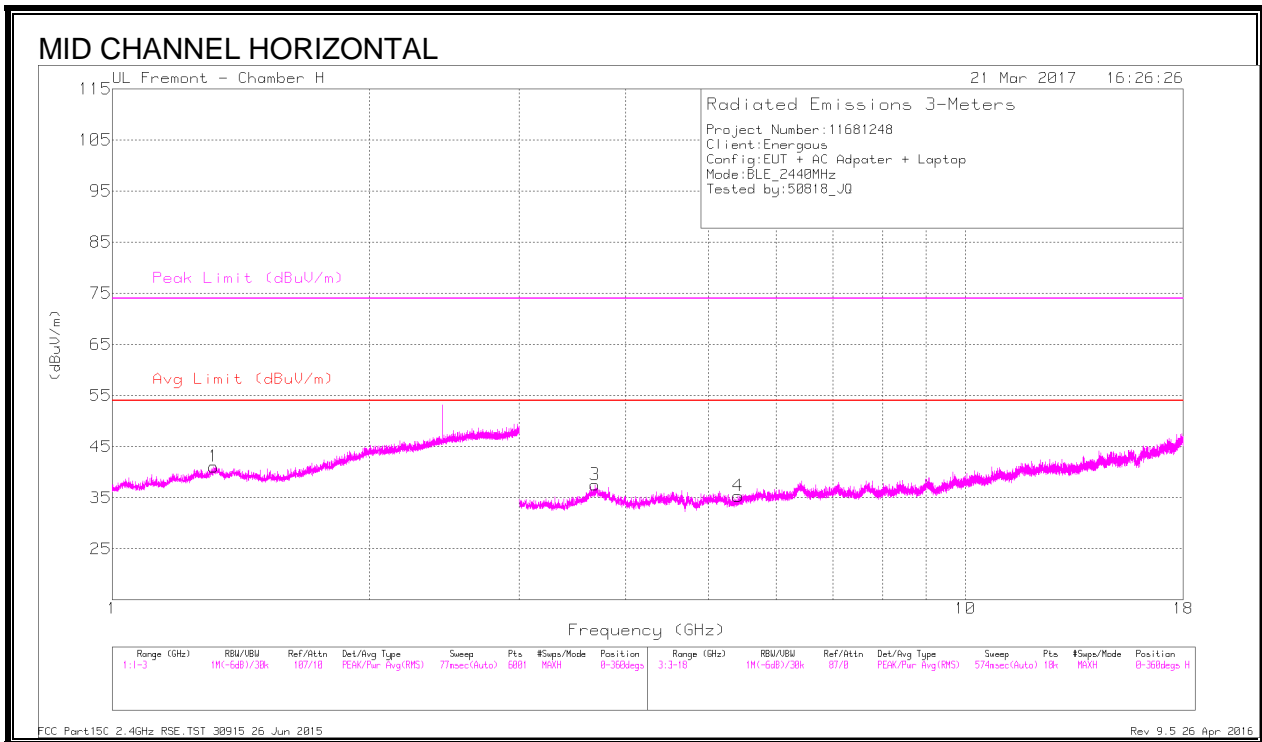
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Ftr/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
* 4.78	41.61	PK2	34	-35	0	40.61	-	-	74	-33.39	260	198	H
* 4.776	30.95	MAv1	34	-35	5.44	35.39	54	-18.61	-	-	260	198	H
	39.35	PK2	35.8	-30.5	0	44.65	-	-	74	-29.35	168	105	H
* 7.711	27.53	MAv1	35.8	-30.7	5.44	38.07	54	-15.93	-	-	168	105	H
* 3.641	43.49	PK2	34.9	-35.8	0	42.59	-	-	74	-31.41	70	320	H
* 3.643	32.9	MAv1	34.9	-35.8	5.44	37.44	54	-16.56	-	-	70	320	H
* 4.732	42.03	PK2	34	-34.5	0	41.53	-	-	74	-32.47	138	170	V
* 4.73	31.38	MAv1	34	-34.5	5.44	36.32	54	-17.68	-	-	138	170	V
* 4.993	48.43	PK2	34.1	-34.3	0	48.23	-	-	74	-25.77	62	238	V
* 4.987	31	MAv1	34.1	-34.2	5.44	36.34	54	-17.66	-	-	62	238	V
* 7.719	38.46	PK2	35.8	-30.6	0	43.66	-	-	74	-30.34	265	288	V
* 7.727	27.3	MAv1	35.8	-30.7	5.44	37.84	54	-16.16	-	-	265	288	V

* - indicates frequency in CFR15.205 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



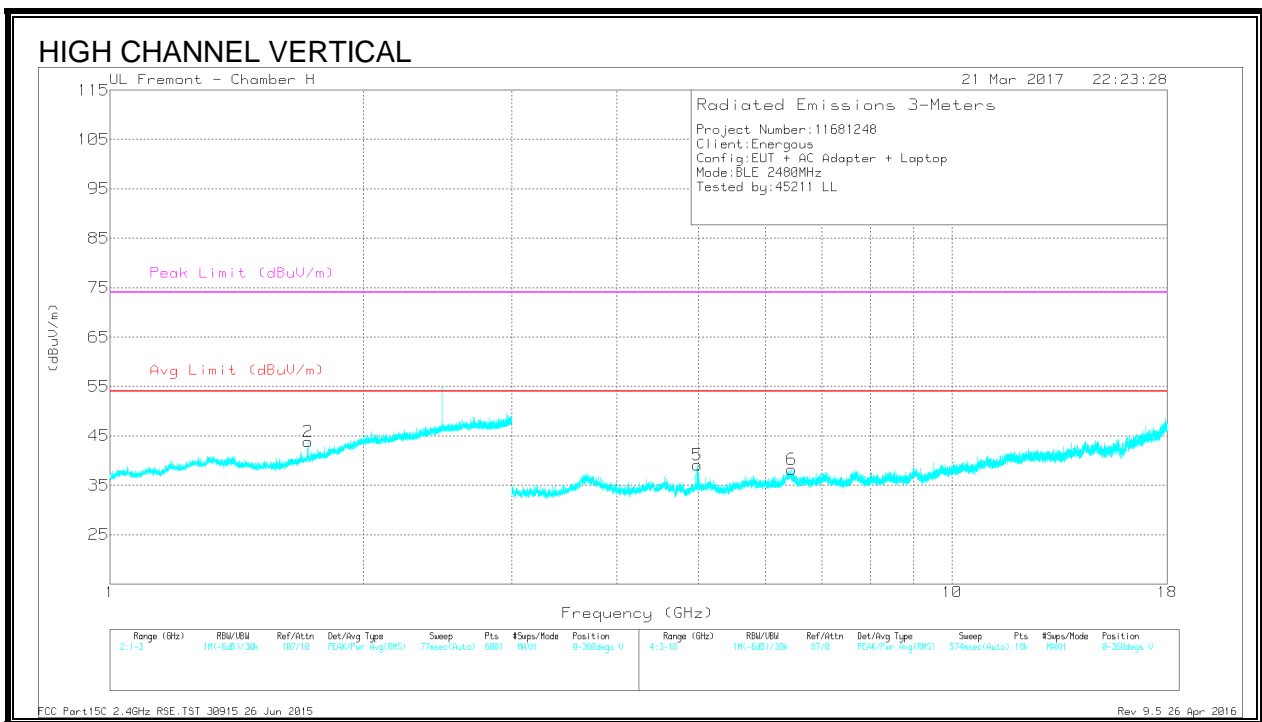
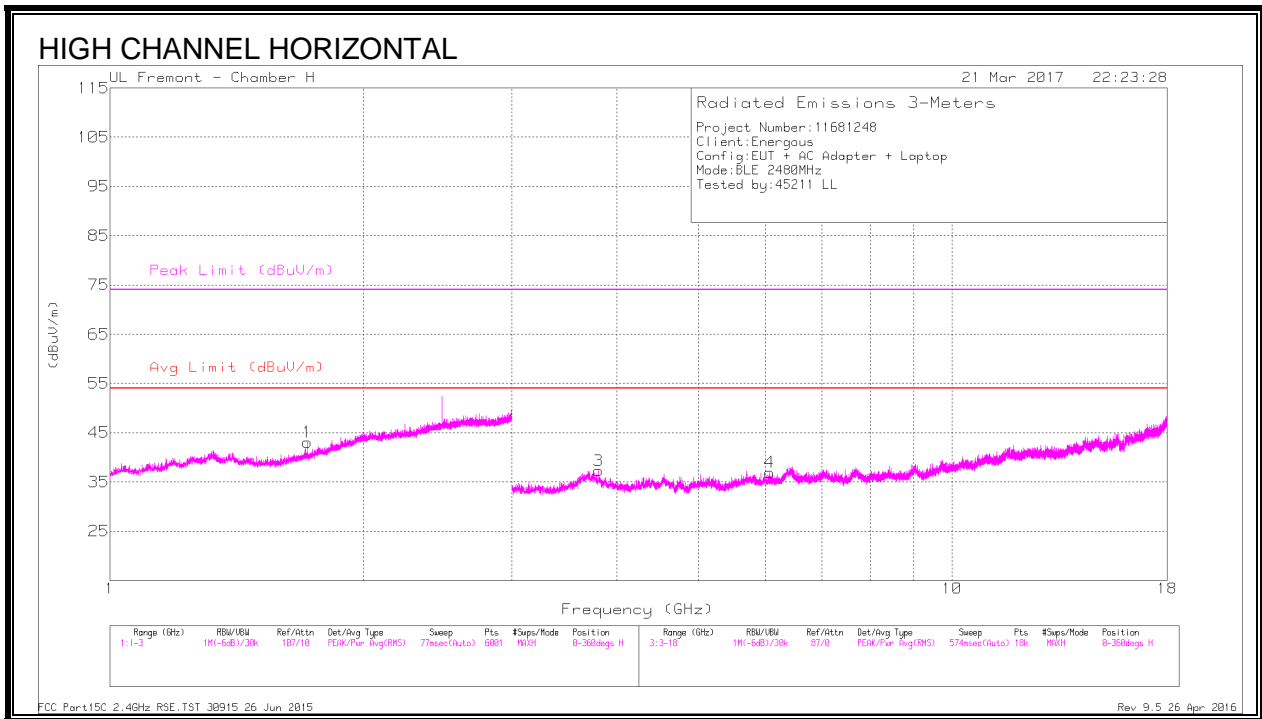
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AFT120 (dB/m)	Amp/Cbl/Ftr/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
* 1.317	36.39	PK2	29.7	-18.7	0	47.39	-	-	74	-26.61	10	140	H
* 1.321	24.47	MAv1	29.7	-18.7	5.44	40.91	54	-13.09	-	-	10	140	H
* 1.348	35.3	PK2	29.5	-18.6	0	46.2	-	-	74	-27.8	307	383	V
* 1.345	24.09	MAv1	29.6	-18.6	5.44	40.53	54	-13.47	-	-	307	383	V
* 3.683	44.52	PK2	34.9	-36	0	43.42	-	-	74	-30.58	299	133	H
* 3.685	32.96	MAv1	34.9	-36	5.44	37.3	54	-16.7	-	-	299	133	H
* 5.42	40.44	PK2	34.6	-34	0	41.04	-	-	74	-32.96	246	324	H
* 5.419	29.17	MAv1	34.6	-34	5.44	35.21	54	-18.79	-	-	246	324	H
* 4.99	49.57	PK2	34.1	-34.1	0	49.57	-	-	74	-24.43	53	235	V
* 4.994	30.78	MAv1	34.1	-34.3	5.44	36.02	54	-17.98	-	-	53	235	V
* 3.713	43.58	PK2	34.8	-35.9	0	42.48	-	-	74	-31.52	352	169	V
* 3.711	32.97	MAv1	34.8	-35.9	5.44	37.31	54	-16.69	-	-	352	169	V

* - indicates frequency in CFR15.205 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/ 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
* 1.72	35.37	PK2	29	-17.7	0	46.67	-	-	74	-27.33	224	107	V
* 1.719	24.81	MAv1	29	-17.7	5.44	41.55	54	-12.45	-	-	224	107	V
* 3.809	43.25	PK2	34	-35.3	0	41.95	-	-	74	-32.05	264	102	H
* 3.807	33.27	MAv1	34	-35.4	5.44	37.31	54	-16.69	-	-	264	102	H
* 4.977	46.4	PK2	34.1	-34.3	0	46.2	-	-	74	-27.8	69	191	V
* 4.985	30.99	MAv1	34.1	-34.3	5.44	36.23	54	-17.77	-	-	69	191	V
1.715	35.91	PK2	28.9	-17.7	0	47.11	-	-	-	-	311	126	H
1.716	25.04	MAv1	28.9	-17.7	5.44	41.68	-	-	-	-	311	126	H
6.071	28.37	MAv1	35.4	-31.9	5.44	37.31	-	-	-	-	158	210	H
6.073	38.4	PK2	35.4	-31.8	0	42	-	-	-	-	158	210	H
6.452	39.52	PK2	35.7	-31.3	0	43.92	-	-	-	-	107	164	V
6.453	29.17	MAv1	35.7	-31.4	5.44	38.91	-	-	-	-	107	164	V

* - indicates frequency in CFR15.205 Restricted Band

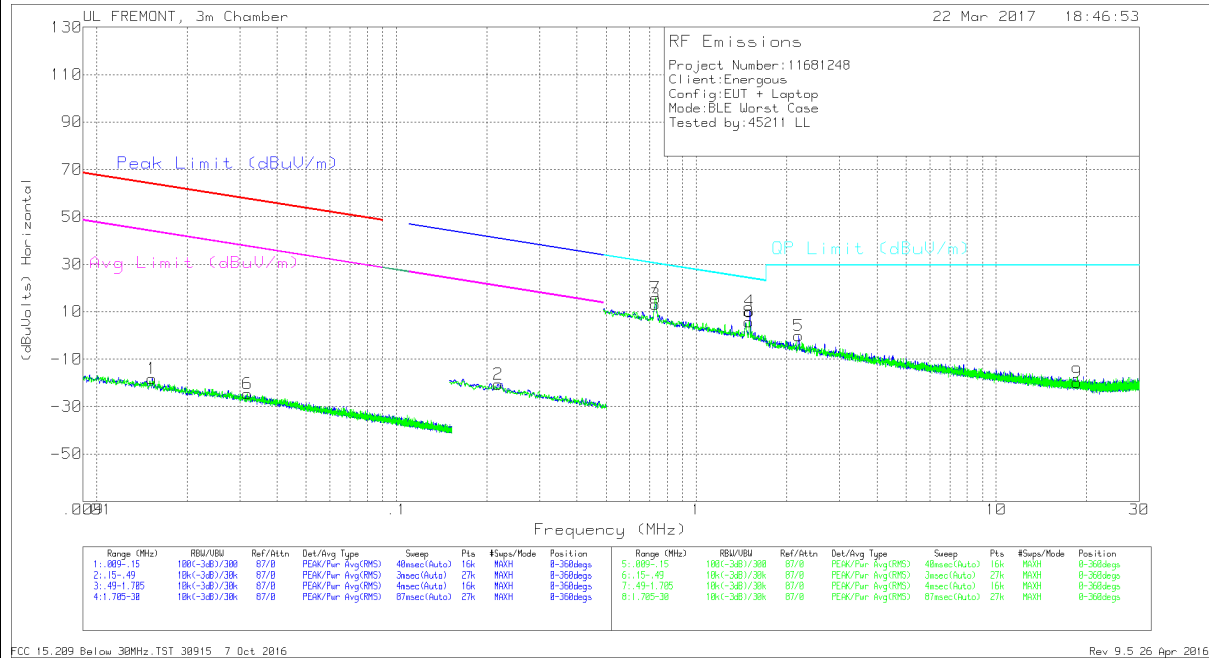
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

8.5. WORST-CASE BELOW 30 MHz

SPURIOUS EMISSIONS BELOW 30MHz (WORST-CASE CONFIGURATION)

HORIZONTAL AND VERTICAL PLOTS



FCC 15.209, Below 30MHz, TST 30915, 7 Oct 2016

Rev 9.5 26 Apr 2016

NOTE: KDB 937606 OATS and Chamber Correlation Justification

- Based 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.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01533	43.82	Pk	16.6	1.4	-80	-18.18	63.88	-82.06	43.88	-62.06	-	-	0-360
6	.03178	40.38	Pk	13.7	1.4	-80	-24.52	57.54	-82.06	37.54	-62.06	-	-	0-360
2	.21817	46.13	Pk	11.7	1.5	-80	-20.67	-	-	-	-	-	-	-

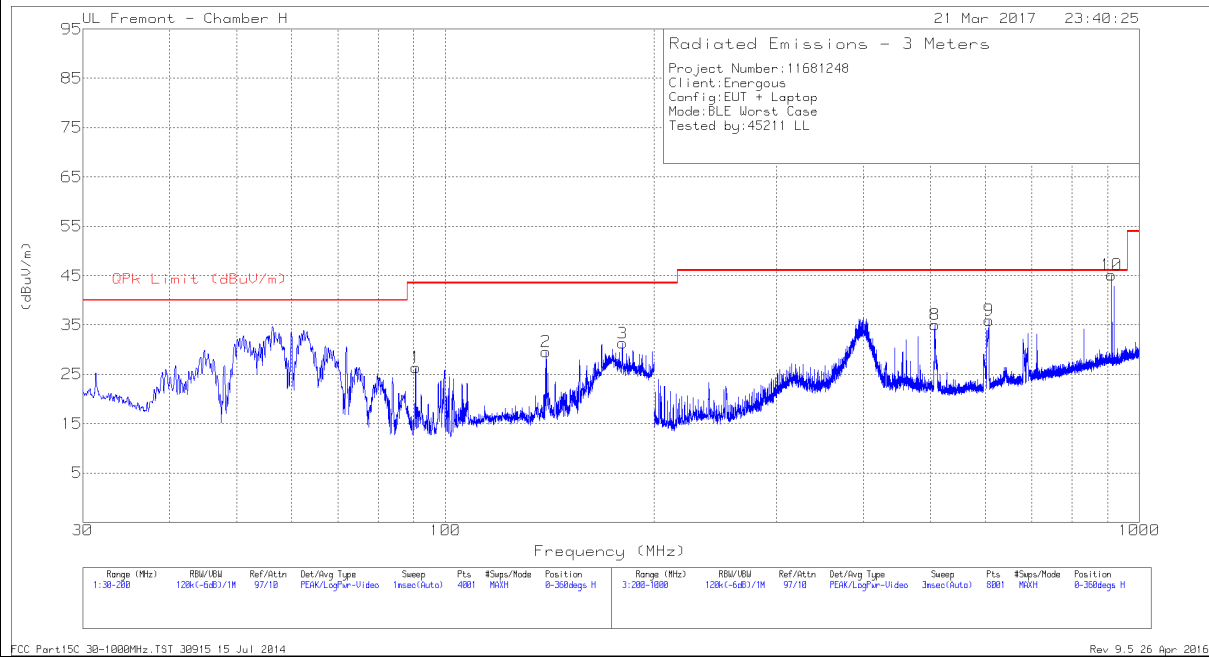
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.73012	39.93	Pk	11.8	1.5	-40	13.23	-	-	-	-	30.35	-17.12	0-360
7	.73145	42.44	Pk	11.8	1.5	-40	15.74	-	-	-	-	30.33	-14.59	0-360
8	1.5008	32.27	Pk	11.9	1.5	-40	5.67	-	-	-	-	24.1	-18.43	0-360
4	1.50768	36.78	Pk	11.9	1.5	-40	10.18	-	-	-	-	24.07	-13.89	0-360
5	2.19494	26.44	Pk	11.9	1.5	-40	-1.16	-	-	-	-	29.5	-29.66	0-360
9	18.58304	8.66	Pk	10	1.6	-40	-19.74	-	-	-	-	29.5	-49.24	0-360

Pk - Peak detector

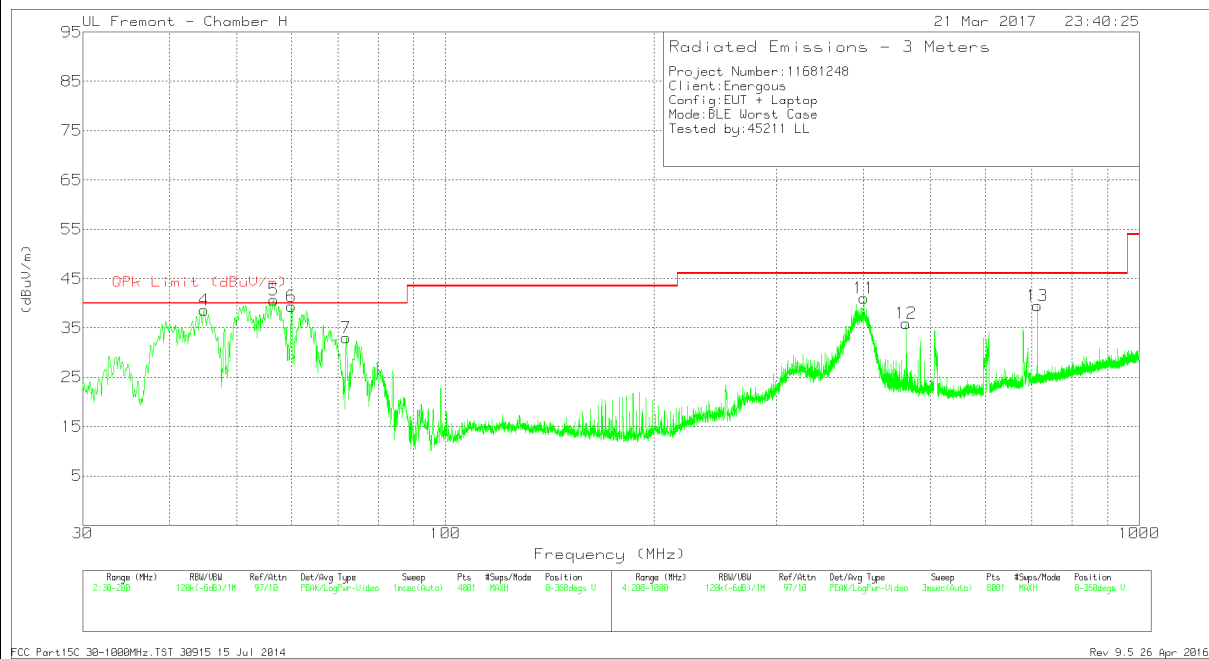
8.6. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
11	* 401	50.07	Pk	19.6	-28.6	41.07	46.02	-4.95	0-360	201	V
4	44.875	55.28	Pk	14.4	-31.1	38.58	40	-1.42	0-360	100	V
5	56.5625	60.38	Pk	11.2	-30.9	40.68	40	.68	0-360	100	V
6	60.005	58.95	Pk	11.4	-30.9	39.45	40	-.55	0-360	100	V
7	71.99	51.66	Pk	12.1	-30.8	32.96	40	-7.04	0-360	100	V
1	90.605	45.12	Pk	11.8	-30.6	26.32	43.52	-17.2	0-360	201	H
2	139.65	42.88	Pk	16.8	-30.1	29.58	43.52	-13.94	0-360	201	H
3	179.94	46.19	Pk	15	-29.9	31.29	43.52	-12.23	0-360	201	H
12	461.5	43.38	Pk	21	-28.4	35.98	46.02	-10.04	0-360	301	V
8	507.3	41.77	Pk	21.5	-28.2	35.07	46.02	-10.95	0-360	98	H
9	607.7	41.46	Pk	22.6	-28.1	35.96	46.02	-10.06	0-360	199	H
13	712.6	42.77	Pk	24.4	-27.7	39.47	46.02	-6.55	0-360	201	V
10	912.8	45.38	Pk	26.2	-26.4	45.18	46.02	-.84	0-360	399	H

* - indicates frequency in CFR47 Pt 15 Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 400.8363	41.36	Qp	19.6	-28.7	32.26	46.02	-13.76	188	209	V
44.8923	49.96	Qp	14.4	-31.1	33.26	40	-6.74	244	108	V
56.4406	49.12	Qp	11.1	-30.9	29.32	40	-10.68	157	378	V
60.0069	48.47	Qp	11.4	-30.9	28.97	40	-11.03	105	299	V
912.5869	23.1	Qp	26.2	-26.4	22.9	46.02	-23.12	343	164	H

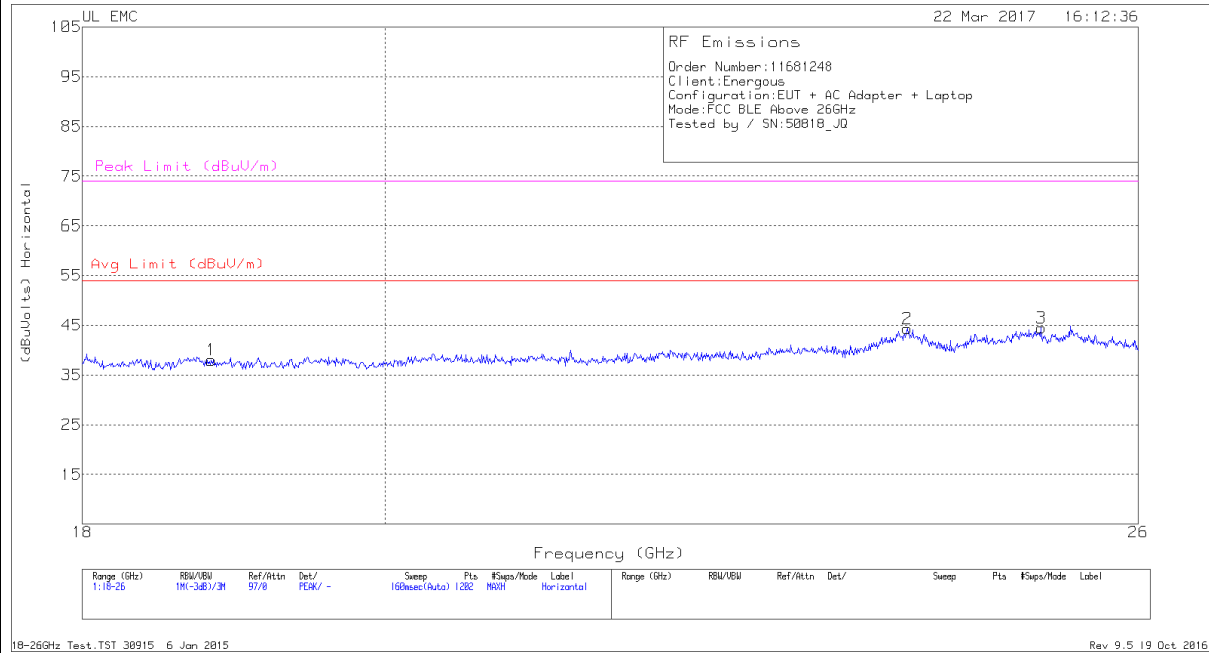
* - indicates frequency in CFR47 Pt 15 Restricted Band

Qp - Quasi-Peak detector

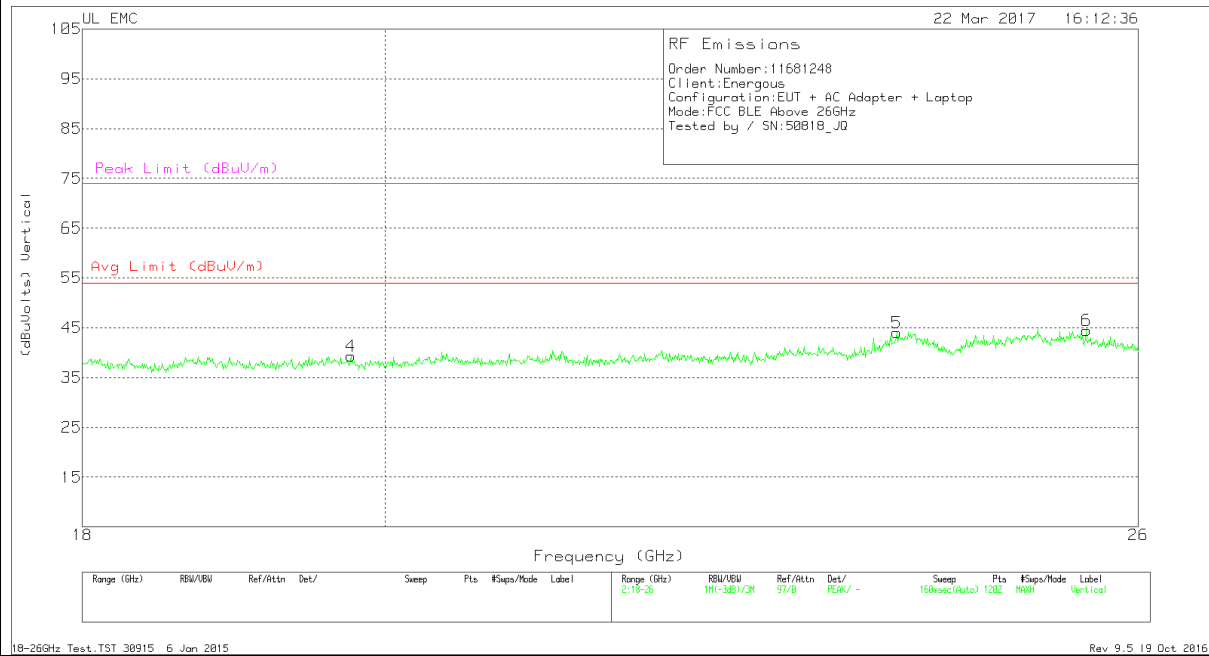
8.7. WORST-CASE ABOVE 18 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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	18.826	40	Pk	32.5	-25	-9.5	38	54	-16	74	-36
2	23.988	44.13	Pk	34	-24.3	-9.5	44.33	54	-9.67	74	-29.67
3	25.134	44.4	Pk	34.3	-24.7	-9.5	44.5	54	-9.5	74	-29.5
4	19.765	40.93	Pk	32.7	-24.8	-9.5	39.33	54	-14.67	74	-34.67
5	23.902	43.4	Pk	34	-23.9	-9.5	44	54	-10	74	-30
6	25.534	44.7	Pk	34.4	-25.1	-9.5	44.5	54	-9.5	74	-29.5

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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.

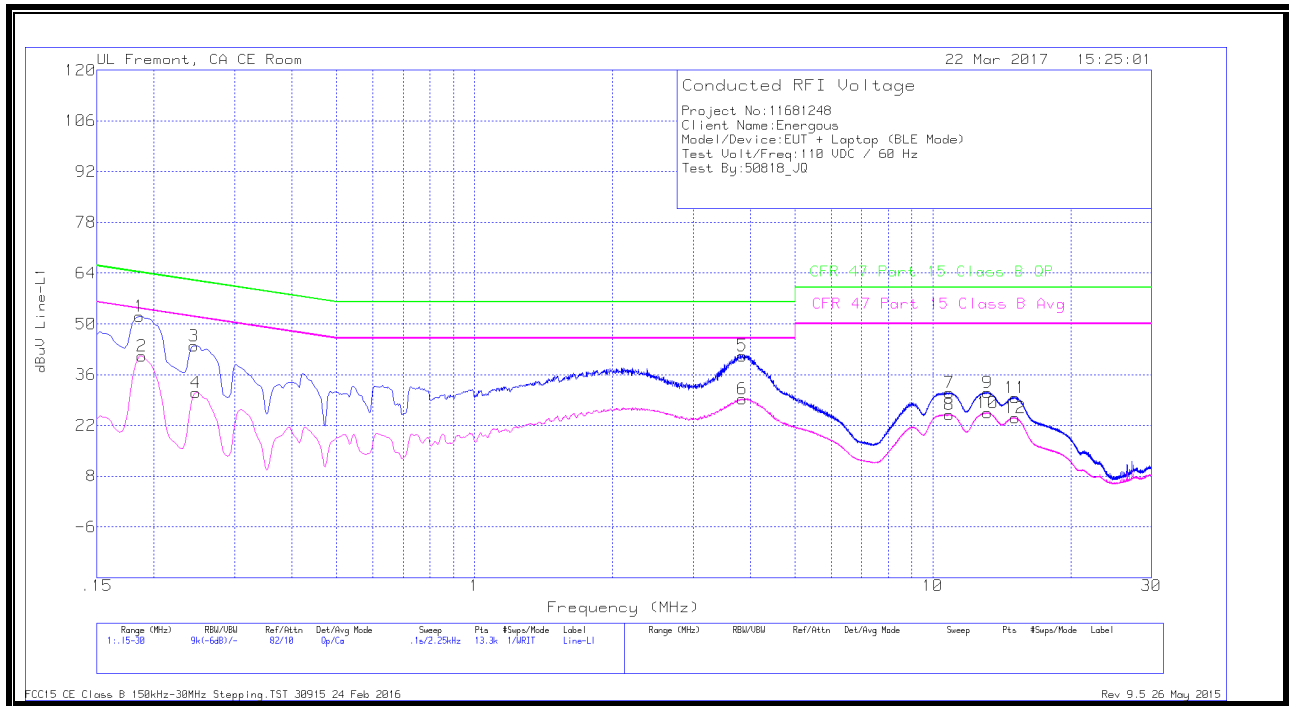
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

9.1. EUT POWERED BY HOST PC VIA USB CABLE

LINE 1 RESULTS



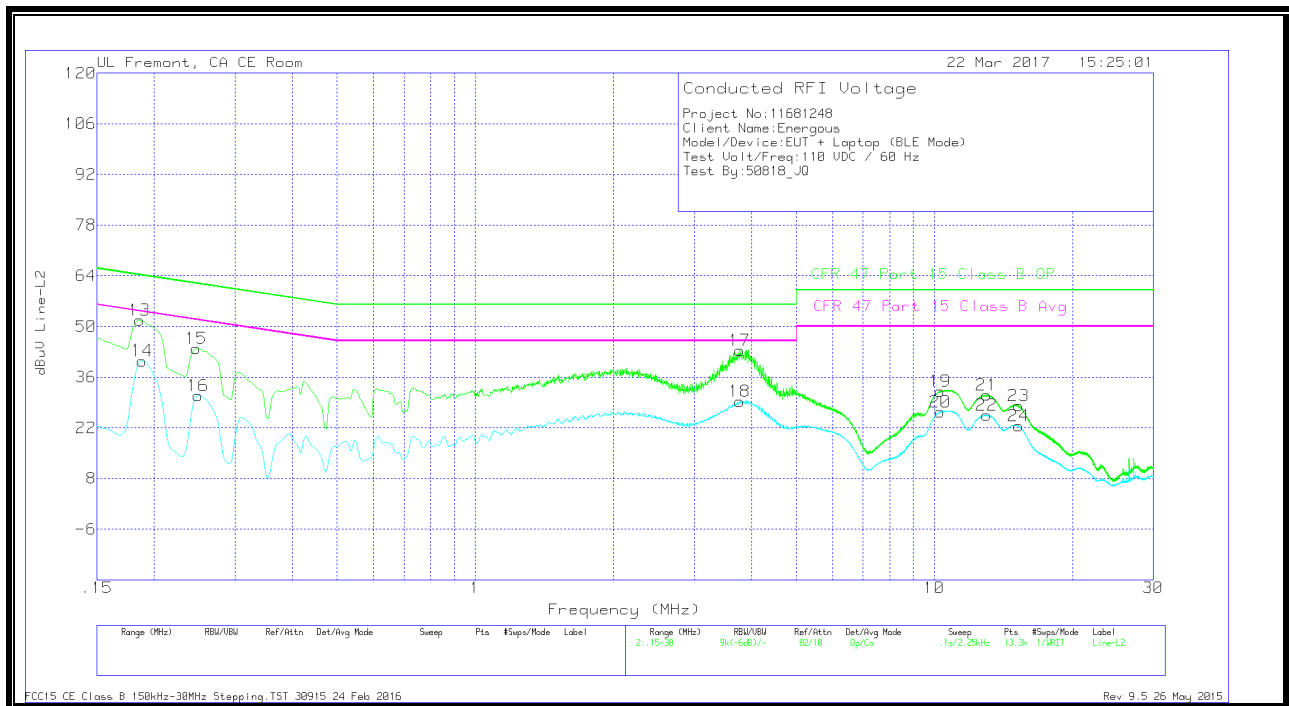
WORST EMISSIONS

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	.186	41.95	Qp	0	.1	10.1	52.15	64.21	-12.06	-	-
2	.18825	30.94	Ca	0	.1	10.1	41.14	-	-	54.11	-12.97
3	.2445	33.74	Qp	0	.1	10.1	43.94	61.94	-18	-	-
4	.24675	20.93	Ca	0	.1	10.1	31.13	-	-	51.87	-20.74
5	3.83775	31.02	Qp	0	.1	10.1	41.22	56	-14.78	-	-
6	3.83775	19.09	Ca	0	.1	10.1	29.29	-	-	46	-16.71
7	10.86	20.67	Qp	0	.2	10.2	31.07	60	-28.93	-	-
8	10.88025	14.63	Ca	0	.2	10.2	25.03	-	-	50	-24.97
9	13.15838	20.56	Qp	.1	.2	10.2	31.06	60	-28.94	-	-
10	13.1775	14.93	Ca	.1	.2	10.2	25.43	-	-	50	-24.57
11	15.1305	19.31	Qp	0	.2	10.2	29.71	60	-30.29	-	-
12	15.12375	13.69	Ca	0	.2	10.2	24.09	-	-	50	-25.91

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

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	.186	41.51	Qp	0	.1	10.1	51.71	64.21	-12.5	-	-
14	.18825	30.32	Ca	0	.1	10.1	40.52	-	-	54.11	-13.59
15	.24675	33.75	Qp	0	.1	10.1	43.95	61.87	-17.92	-	-
16	.249	20.71	Ca	0	.1	10.1	30.91	-	-	51.79	-20.88
17	3.768	33.16	Qp	0	.1	10.1	43.36	56	-12.64	-	-
18	3.76575	19.05	Ca	0	.1	10.1	29.25	-	-	46	-16.75
19	10.31325	21.68	Qp	0	.2	10.2	32.08	60	-27.92	-	-
20	10.31325	15.88	Ca	0	.2	10.2	26.28	-	-	50	-23.72
21	12.9975	20.49	Qp	.1	.2	10.2	30.99	60	-29.01	-	-
22	13.002	15.01	Ca	.1	.2	10.2	25.51	-	-	50	-24.49
23	15.26775	17.64	Qp	0	.2	10.2	28.04	60	-31.96	-	-
24	15.26325	12.06	Ca	0	.2	10.2	22.46	-	-	50	-27.54

Qp - Quasi-Peak detector

Ca - CISPR average detection