



**FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

APPLE WATCH

MODEL NUMBER: A1554 &1638

FCC ID: BCG-E2871

IC: 579C-E2871

REPORT NUMBER: 14U19371-E2, REVISION C

ISSUE DATE: MARCH 03, 2015

Prepared for

APPLE, INC.

1 INFINITE LOOP

CUPERTINO, CA 95014, U.S.A.

Prepared by

UL VERIFICATION SERVICES INC.

47173 BENICIA STREET

FREMONT, CA 94538, U.S.A.

TEL: (510) 771-1000

FAX: (510) 661-0888



NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	02/20/15	Initial Issue	C. Pang
B	02/27/15	Revised report to address TCB's questions	T. Chu
C	03/03/15	Revised report to address TCB's questions	T. Chu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	6
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	6
4.2. <i>SAMPLE CALCULATION</i>	6
4.3. <i>MEASUREMENT UNCERTAINTY</i>	6
5. EQUIPMENT UNDER TEST	7
5.1. <i>DESCRIPTION OF EUT</i>	7
5.2. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	7
5.3. <i>SOFTWARE AND FIRMWARE</i>	7
5.4. <i>WORST-CASE CONFIGURATION AND MODE</i>	8
5.5. <i>DESCRIPTION OF TEST SETUP</i>	9
6. TEST AND MEASUREMENT EQUIPMENT	12
7. MEASUREMENT METHODS	13
8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	14
8.1. <i>ON TIME AND DUTY CYCLE RESULTS</i>	14
9. ANTENNA PORT TEST RESULTS	16
10. RADIATED TEST RESULTS	17
10.1. <i>LIMITS AND PROCEDURE</i>	17
10.2. <i>TRANSMITTER ON A1554 ANTENNA 1</i>	18
10.2.1. <i>EMISSIONS ABOVE 1 GHz AND BELOW 18GHz</i>	18
10.3. <i>TRANSMITTER ON A1554 ANTENNA 2</i>	28
10.3.1. <i>EMISSIONS ABOVE 1 GHz AND BELOW 18GHz</i>	28
10.4. <i>TRANSMITTER ON A1638</i>	38
10.4.1. <i>EMISSIONS ABOVE 1 GHz AND BELOW 18GHz</i>	38
10.5. <i>WORST-CASE BELOW 1 GHz</i>	48
10.6. <i>WORST-CASE ABOVE 18 GHz</i>	54
11. AC POWER LINE CONDUCTED EMISSIONS	57
11.1. <i>AC POWER LINE CONDUCTED EMISSIONS A1554 ANTENNA 1</i>	58
11.2. <i>AC POWER LINE CONDUCTED EMISSIONS A1638</i>	61
12. SETUP PHOTOS	64

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: APPLE WATCH

MODEL: A1554 & A1638

SERIAL NUMBER: FG7NQ0JJFY2H (ANTENNA 1 A1554 RADIATED)
FH7P304AG9JC (ANTENNA 2 A1554 RADIATED)
F4KNV01DG6KM (ANTENNA 1 A1638 RADIATED)

DATE TESTED: DECEMBER 2, 2014 – FEBRUARY 09, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	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 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 and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services 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:



CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:



ROY ZHENG
LAB TECHNICIAN
UL VERIFICATION SERVICES INC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 8.

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	<input checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

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
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an Apple Watch with WLAN, Bluetooth and NFC support.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Planar Inverted-F Antenna (PIFA) with a maximum gain as below table:

Frequency Band (GHz)	Model	Antenna 1 Gain (dBi)	Antenna 2 Gain(dBi)
2.4	A1554	-11.1	-11.1
	A1638	-11.1	

The EUT has two models, A1554 and A1638. Both models have one WiFi/BT antenna port. The antenna used in any given unit can be either antenna 1 or antenna 2 in case of Model A1554. On the other hand Model A1638 has Antenna 1 only.

5.3. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 12.3.1051.1701

The software used in the EUT during Bluetooth FHSS testing was version 12.3.748.1192

5.4. WORST-CASE CONFIGURATION AND MODE

EUT has 3 types of enclosures and various kinds of metallic and non-metallic wristbands. There are 2 types of metallic bands; Metal Links, and Metal Mesh. Worst case configuration was investigated; and it was found that the stainless steel enclosure and metal mesh wristband was the worst case. All testing are performed on the worst case.

The following configurations were investigated and EUT powered by AC/DC adapter was the worst-case scenario. AC power line and below 1G radiated tests were conducted on configuration 1.

Configuration	Descriptions
1	EUT powered by AC/DC adapter via USB cable with wireless charger
2	EUT powered by host PC via USB cable with wireless charger

Investigation was performed on these 2 metallic bands and the worse-case is Stainless Steel watch-case + Metal Mesh Band. All testing are performed on this worst case.

Radiated emission, 30-1000MHz and 18-26GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

All testing was performed with the EUT in three orthogonal orientations X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait). It was found that Y-orientation (landscape) was the worst-case.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop AC/DC adapter	Lenovo	92P1160	11S92P1160Z1ZBGH798B12	N/A
Laptop	Lenovo	7659	L3-AL664 08/03	N/A
Wireless Charger	Apple	A1570	DLC451508N5FTPG3K	BCGA1570
AC/DC adapter	Apple	A1265	1X3276SZZ08QZ	N/A

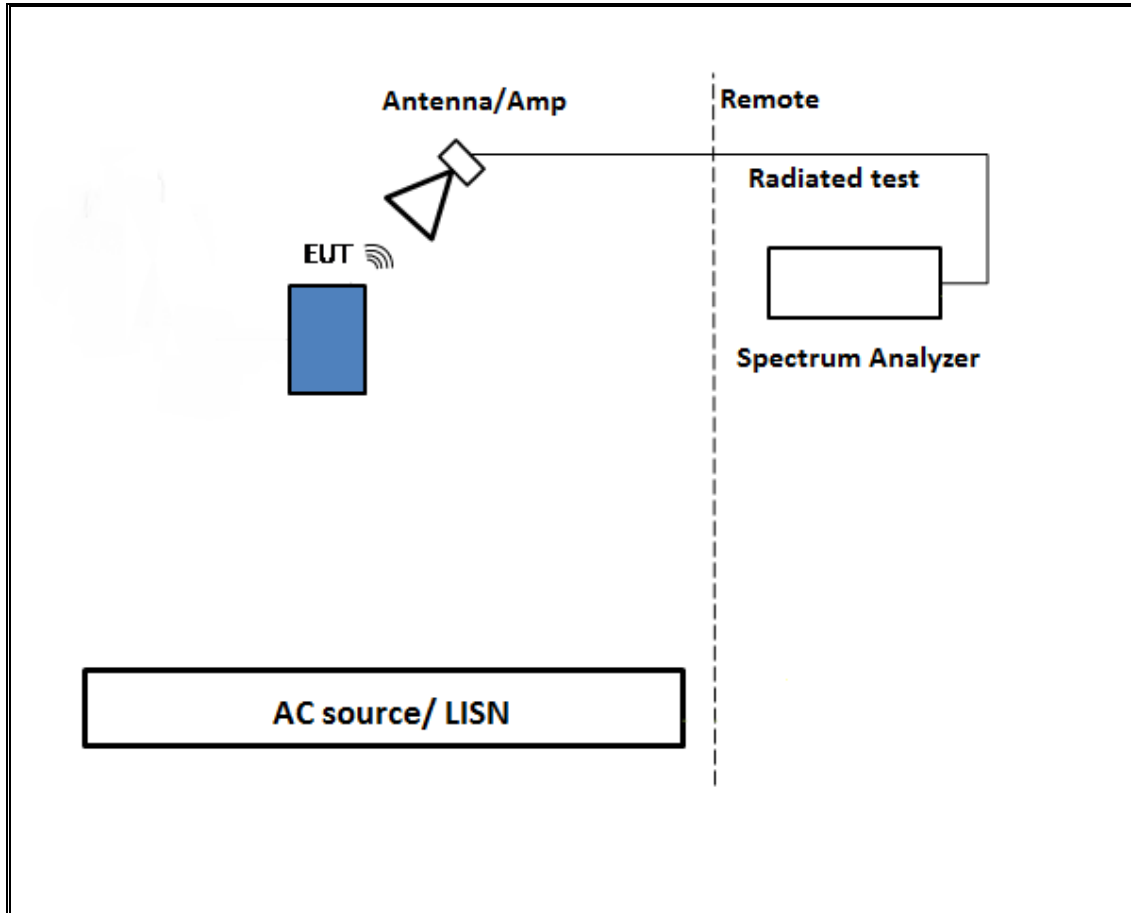
I/O CABLES (BELOW 1G RADIATED AND AC POWERLINE CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Un-Shielded	2	To AC/DC adapter

TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was tested battery powered. Test software exercised the EUT.

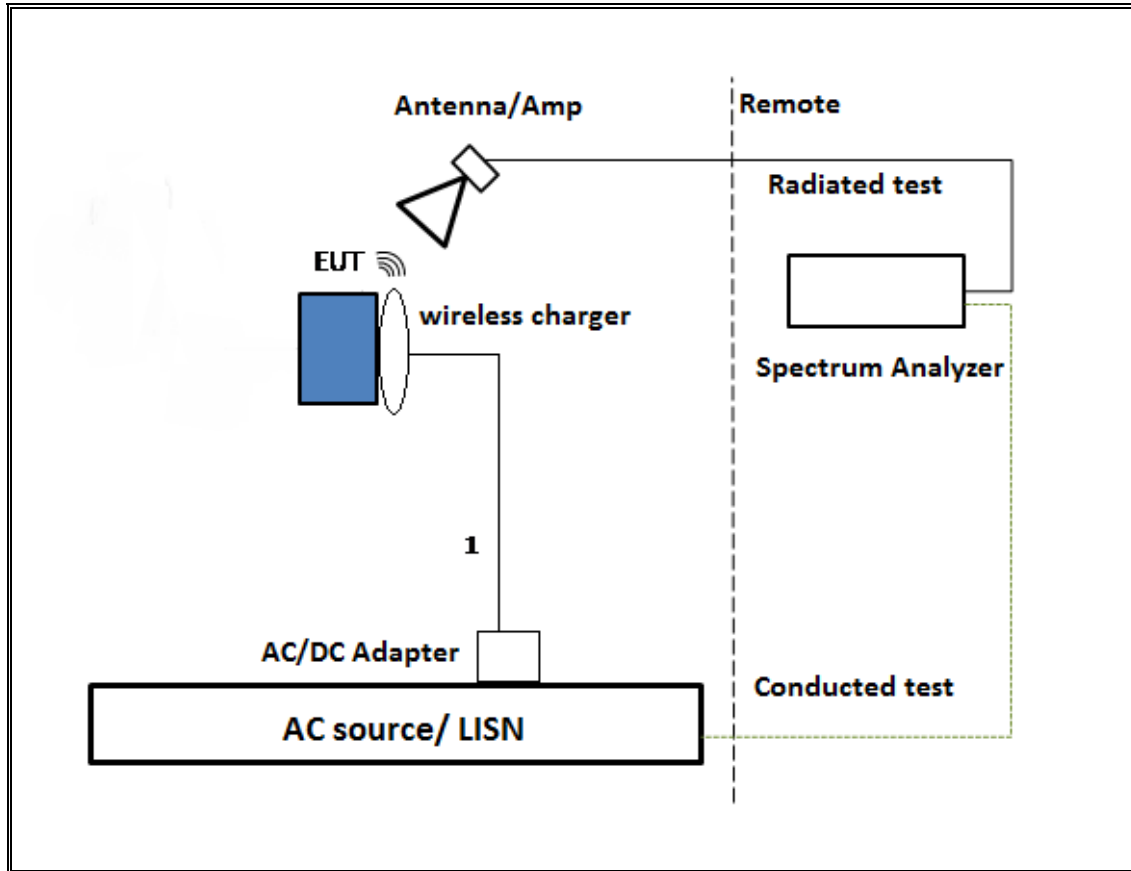
SETUP DIAGRAM



TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was powered by wireless charger. 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	Asset	Cal Due
PXA Signal Analyzer	Agilent	N9030A	T342	06/25/15
Power Meter	Agilent	N1911A	T382	04/09/15
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	01/15/16
Antenna, Hybrid 30MHz to 2GHz	Sunol Sciences	JB3	T407	05/05/15
Amplifier, 10KHz to 1GHz	Sonoma	310N	T286	04/23/15
Amplifier, 1 to 18GHz	Miteq	AFS42-00101	T740	01/26/16
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	T284	09/16/15
LISN, 30 MHz	FCC	LISN-50/250-25-2	T24	01/16/16
Amplifier, 1 to 26.5 Ghz	Agilent	8449B	T404	03/25/15
Antenna, Horn 18 to 26.5GHz	ARA	SWH-28	T125	05/09/15
Spectrum Analyzer	Agilent	8564E	T106	08/06/15

7. MEASUREMENT METHODS

Out-of-band emissions in non-restricted bands: KDB 558074 D01.

Out-of-band emissions in restricted bands: KDB 558074 D01.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

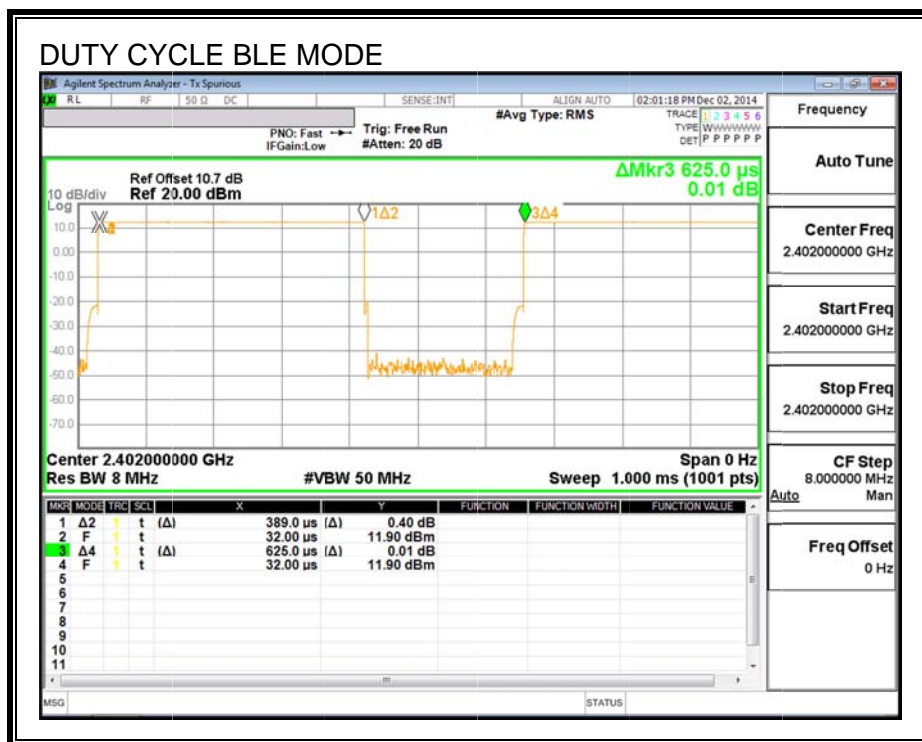
PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

8.1. 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)
BLE	0.389	0.625	0.622	62.2%	2.059	2.571

DUTY CYCLE PLOTS



Note: Additional offset: Duty Cycle Applied for Average Bandedge data.

ON Time / Period = Duty Cycle (dB)

$0.931 / 0.959 = 0.970802$

$=IF(\text{Duty Cycle} < 0.98, 10 * \text{LOG}(1 / \text{Duty Cycle}), 0)$

$=(10 * \text{LOG}(1 / 0.970802), 0)$

Duty Cycle Correction Factor = 0.12869337 dB

Adding Duty Cycle Offset:

Bandedge Reading + Duty Cycle Correction Factor = Final Bandedge Reading

9. ANTENNA PORT TEST RESULTS

Model A1554 and model A1638 are using identical electrical design as A1553. For all antenna port results, refer the BLE test report that has done by UL Verification Services Inc. The report and FCC ID numbers are 14U19383-E2C and BCG-E2870 respectively.

10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

IC RSS-GEN, Section 7 (Receiver)

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. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. 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, then the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

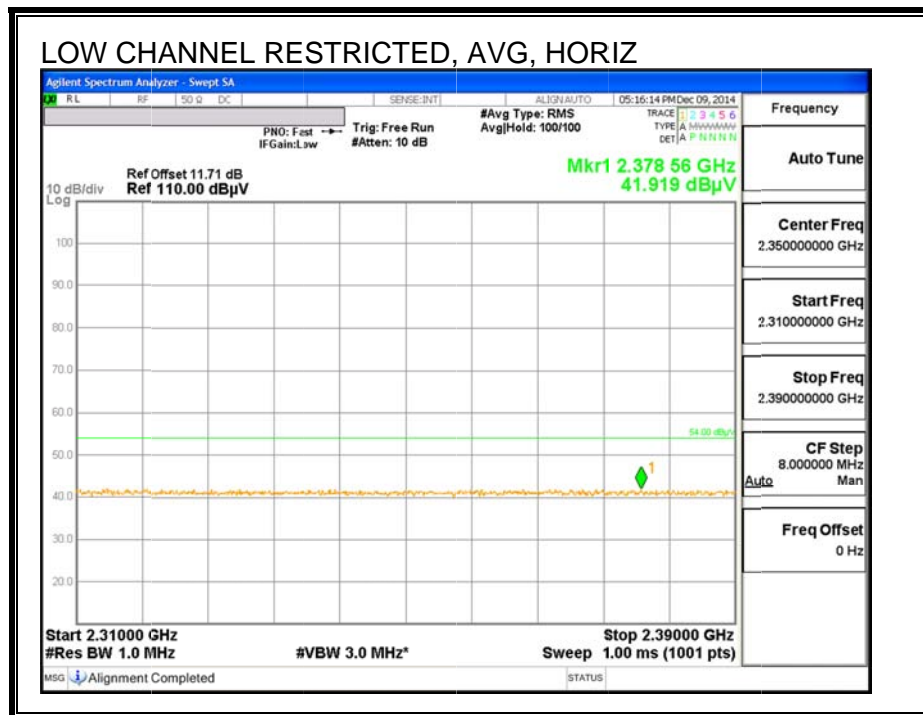
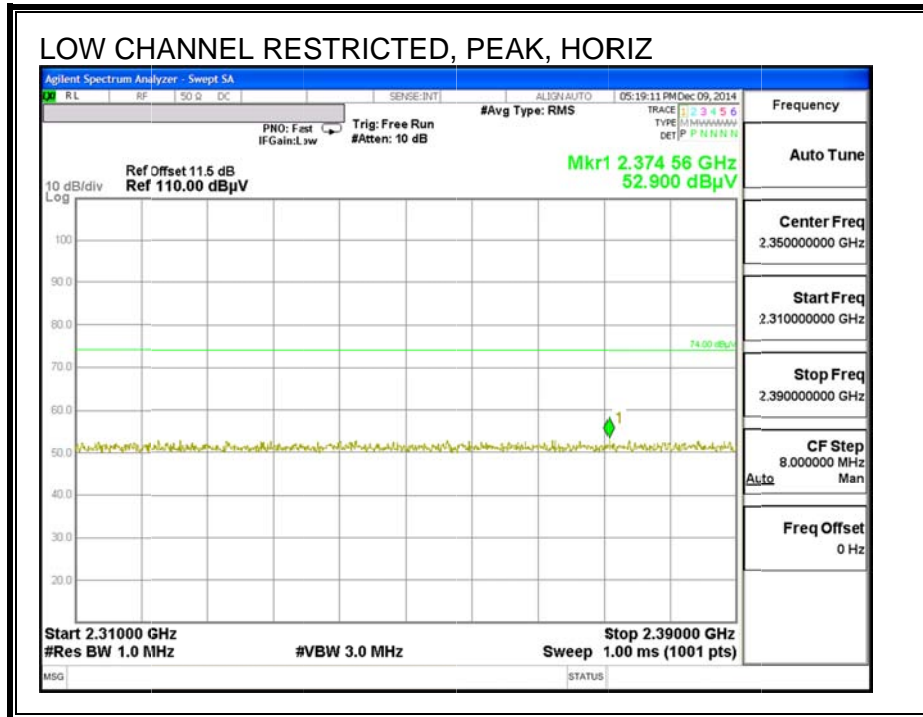
For 2.4 GHz band, the spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

10.2. TRANSMITTER ON A1554 ANTENNA 1

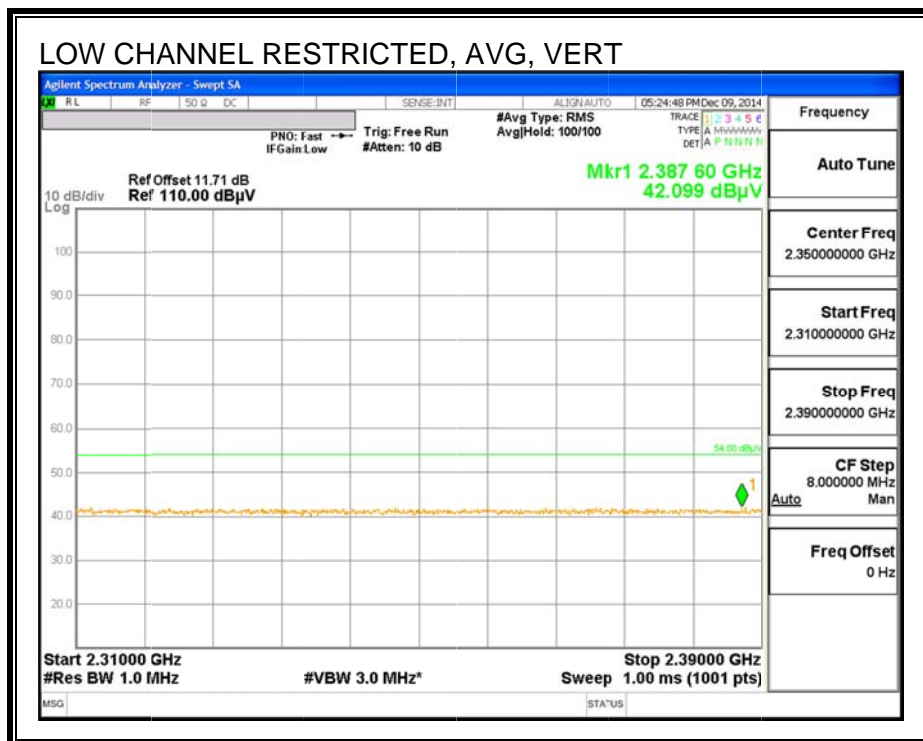
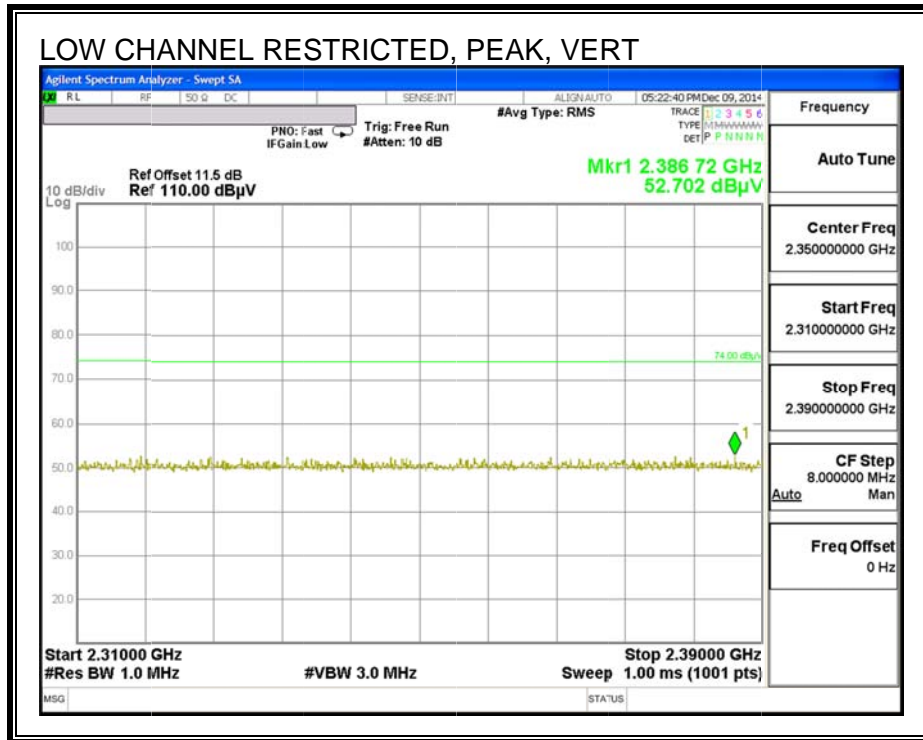
10.2.1. EMISSIONS ABOVE 1 GHz AND BELOW 18GHz

RESTRICTED BANDEDGE, (LOW CHANNEL, HORIZONTAL)



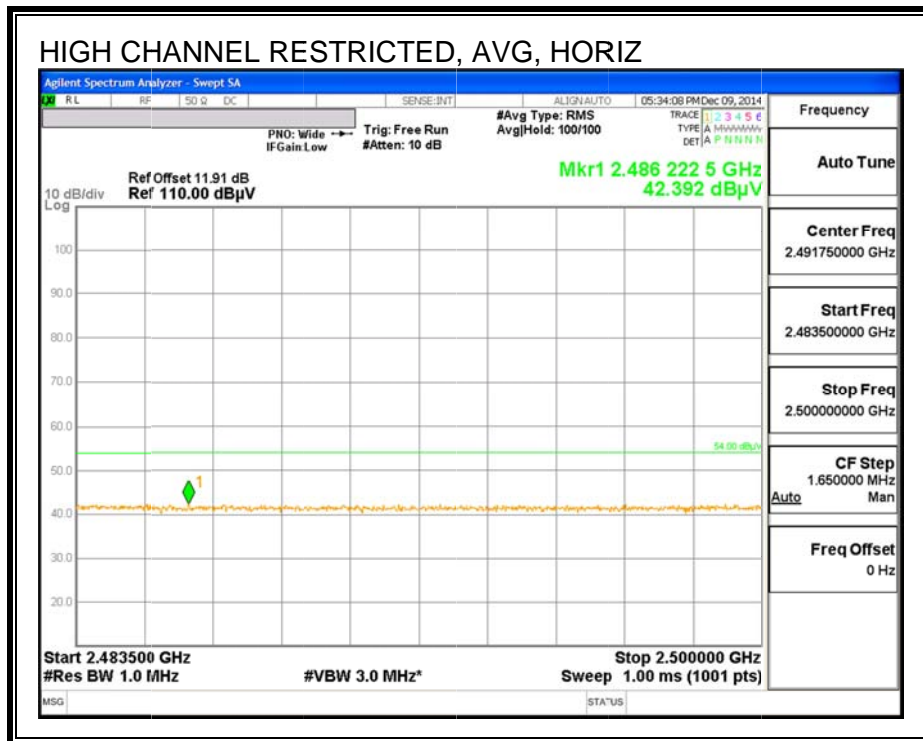
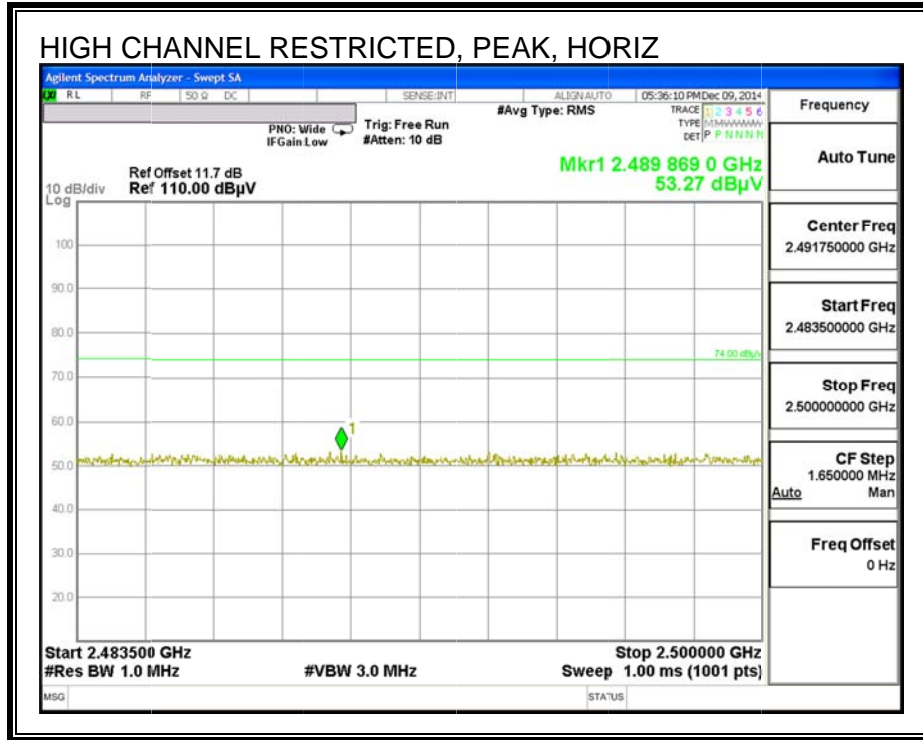
After duty cycle correction = 43.768

RESTRICTED BANDEDGE, (LOW CHANNEL, VERTICAL)



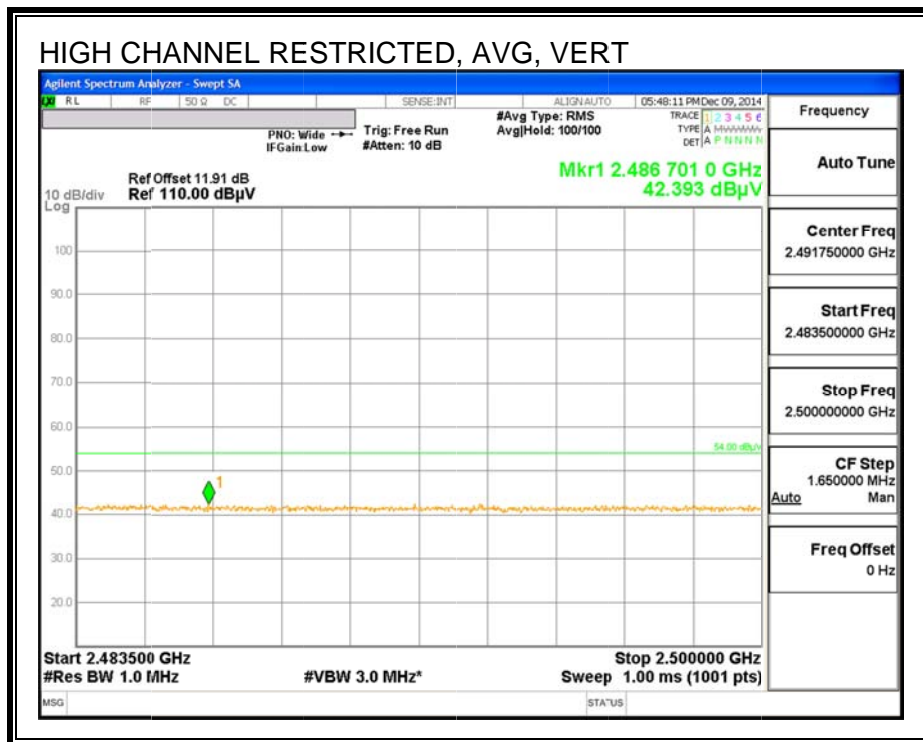
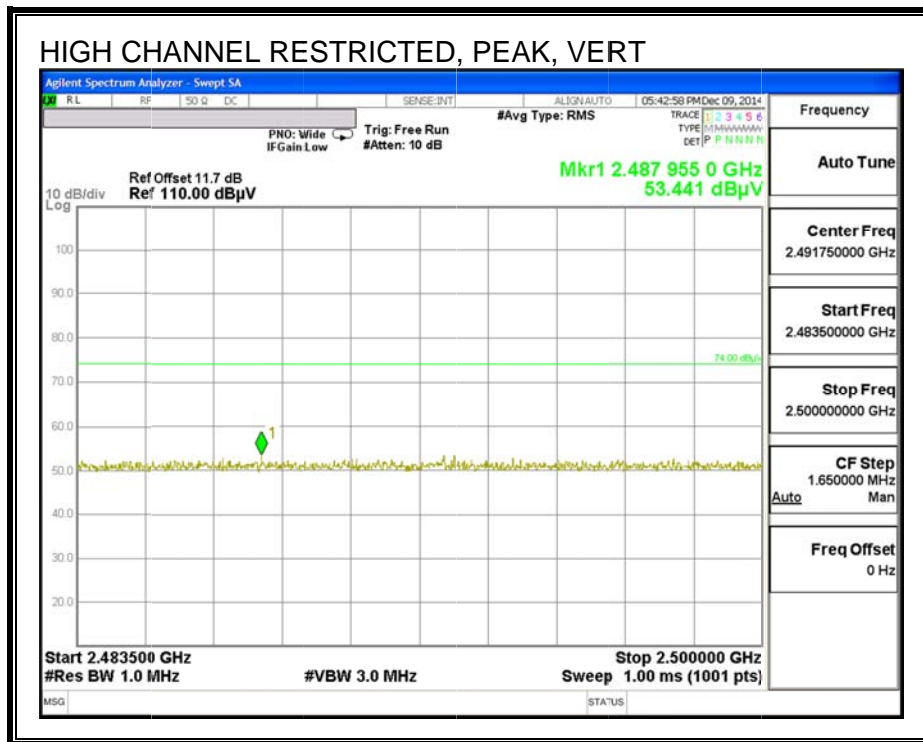
After duty cycle correction = 43.948

RESTRICTED BANDEDGE, (HIGH CHANNEL, HORIZONTAL)



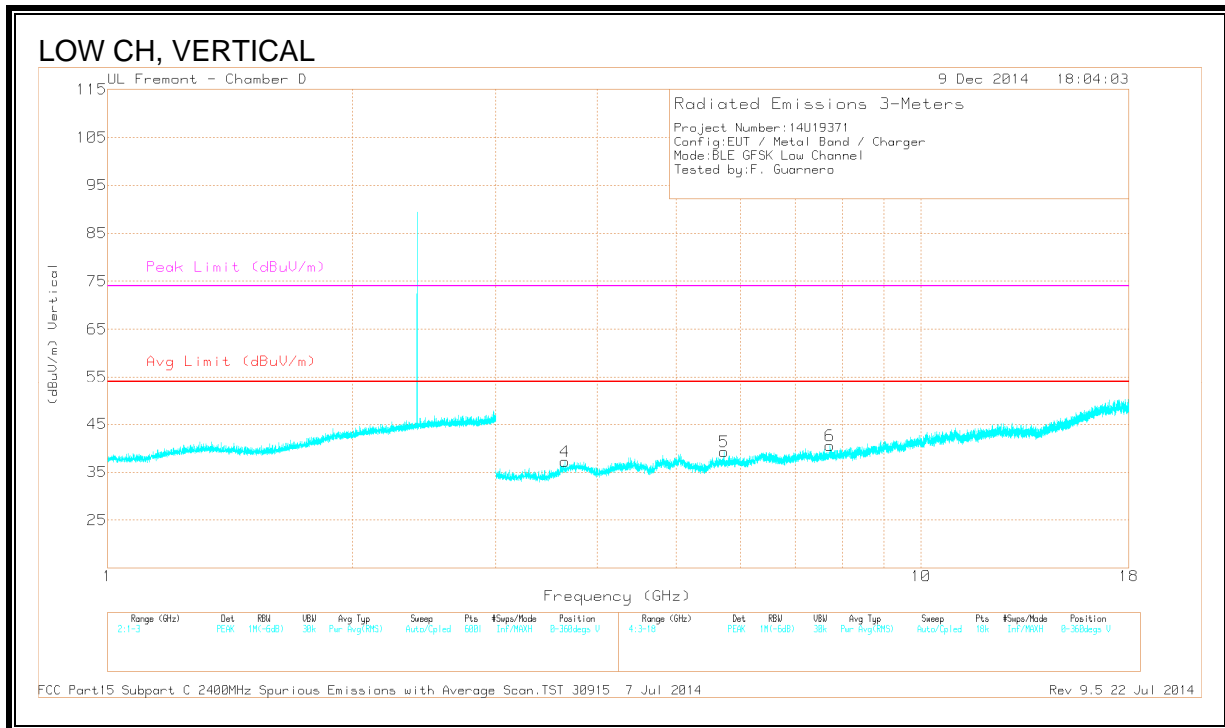
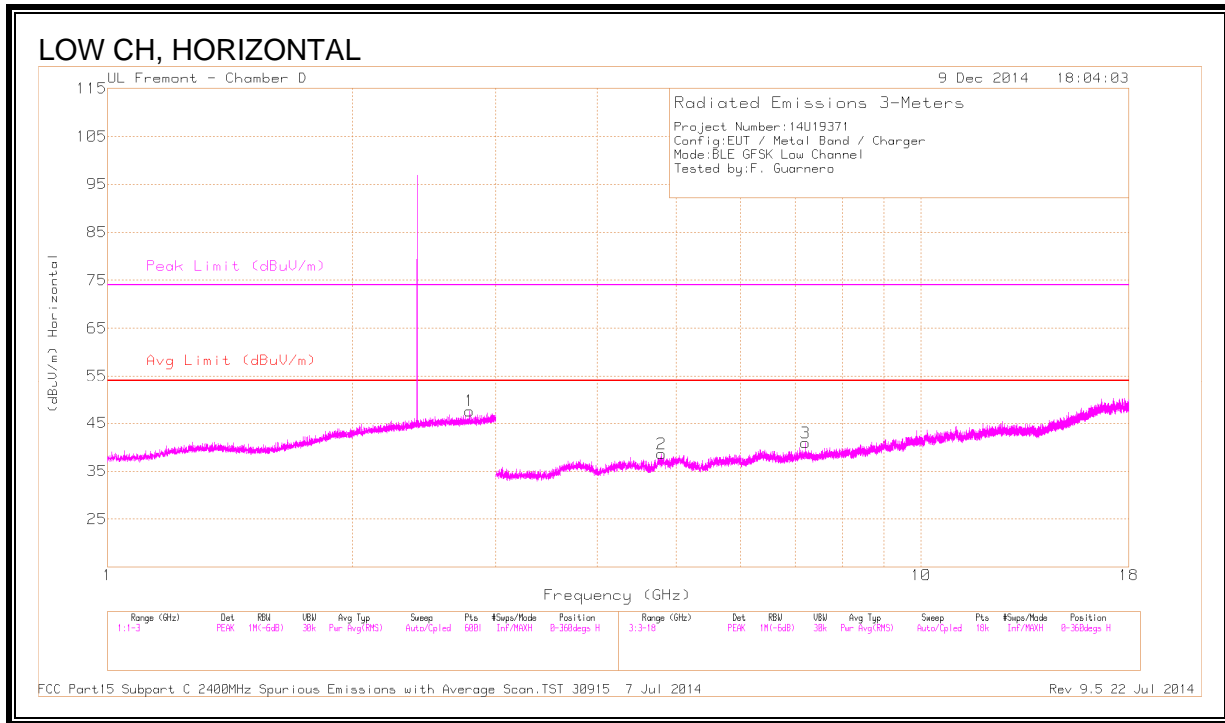
After duty cycle correction = 44.241

RESTRICTED BANDEDGE, (HIGH CHANNEL, VERTICAL)



After duty cycle correction = 44.242

LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

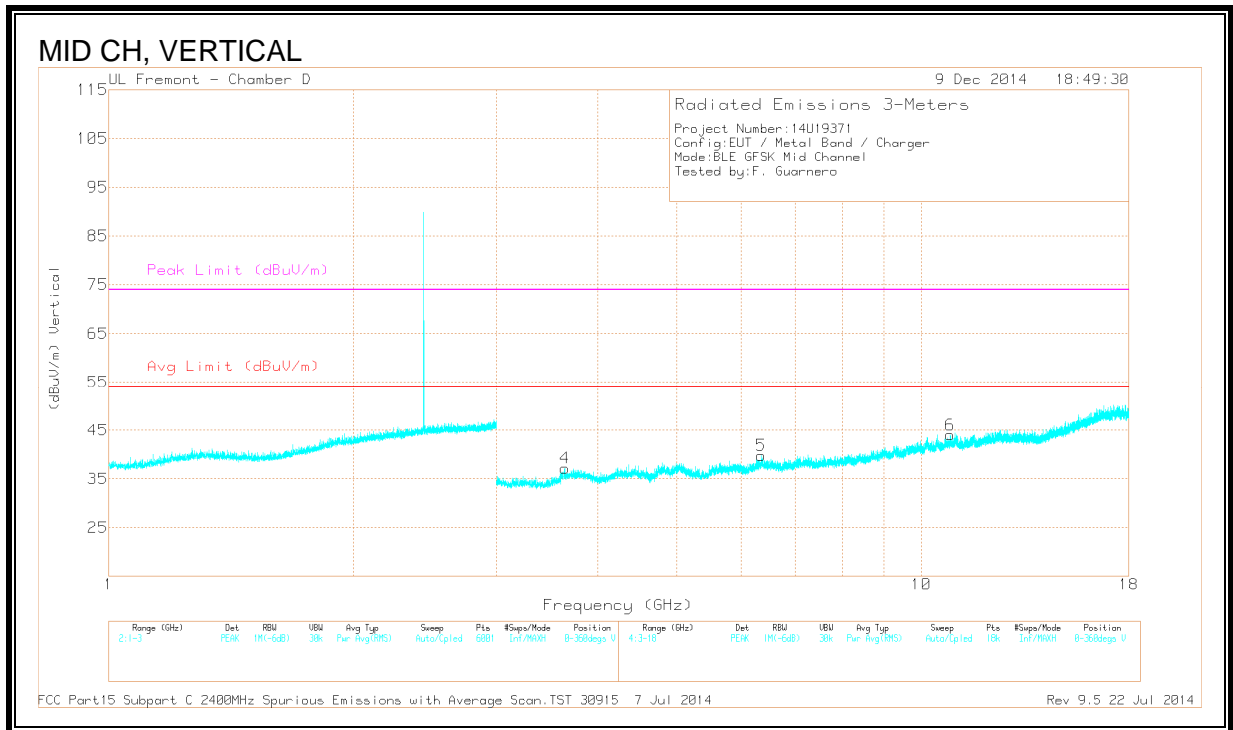
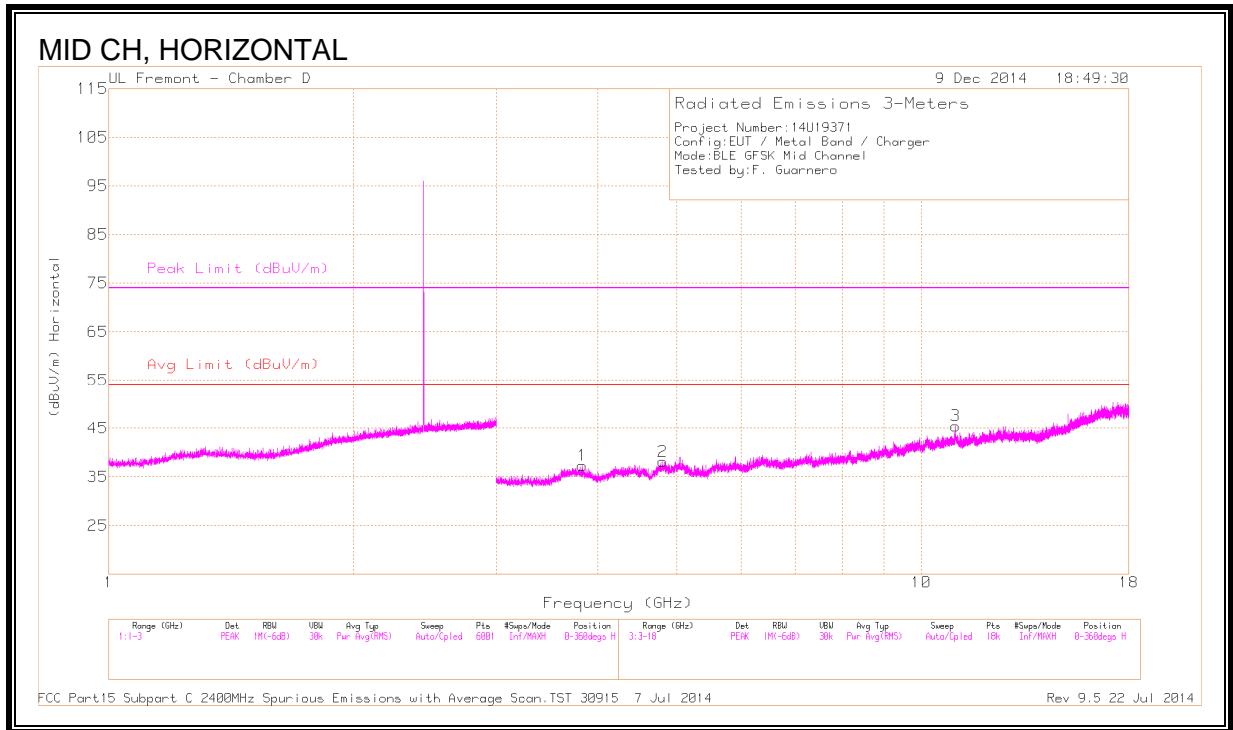
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.788	41.97	PK2	32.5	-20.2	0	54.27	-	-	74	-19.73	351	180	H
	* 2.786	30.41	MAv1	32.5	-20.2	2.06	44.76	54	-9.54	-	-	351	180	H
2	* 4.794	37.65	PK2	34.2	-26.8	0	45.05	-	-	74	-28.95	352	188	H
	* 4.793	26.86	MAv1	34.2	-26.8	2.06	36.32	54	-17.68	-	-	352	188	H
3	7.205	37.58	PK2	35.7	-24.8	0	48.48	-	-	-	-	346	159	H
4	* 3.649	38.58	PK2	33.4	-28.8	0	43.18	-	-	74	-30.82	289	324	V
	* 3.652	27.82	MAv1	33.4	-28.9	2.06	33.76	54	-20.24	-	-	289	324	V
6	* 7.722	35.51	PK2	35.8	-24.6	0	46.71	-	-	74	-27.29	290	325	V
	* 7.721	25.23	MAv1	35.8	-24.6	2.06	38.49	54	-15.51	-	-	290	325	V
5	5.722	37.20	PK2	34.7	-26.7	0	45.20	-	-	-	-	296	305	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

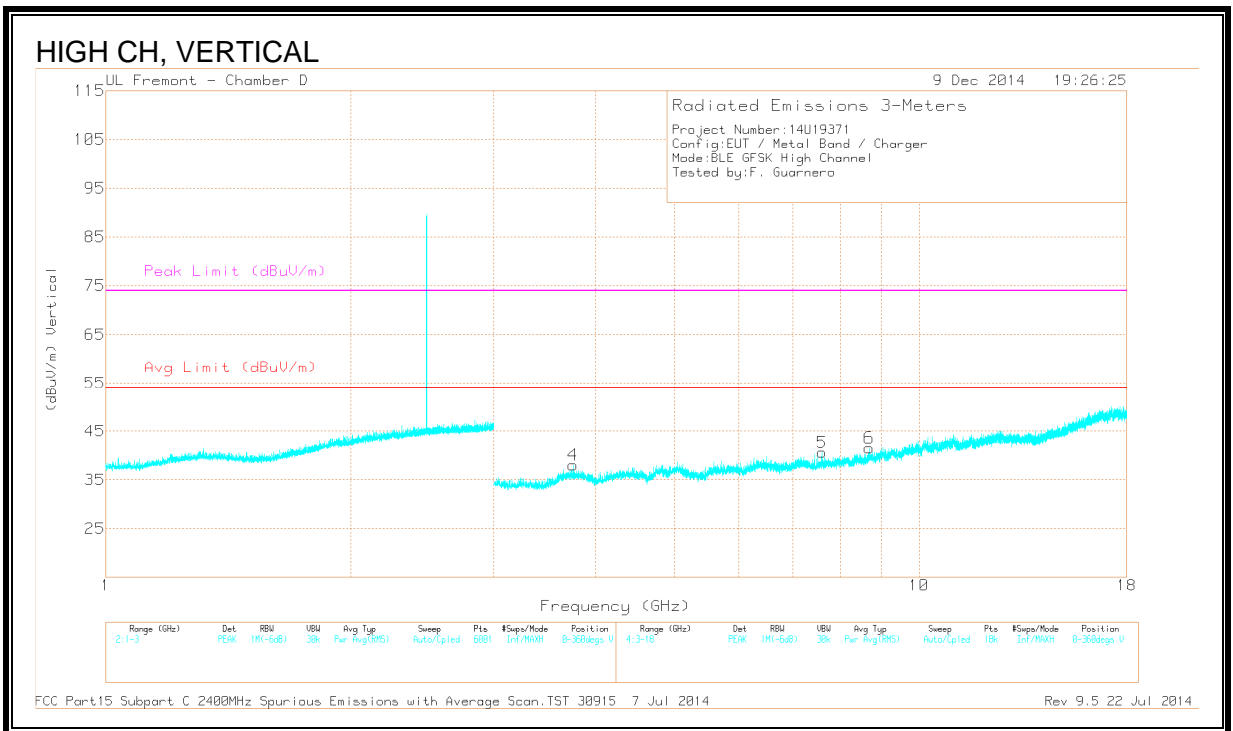
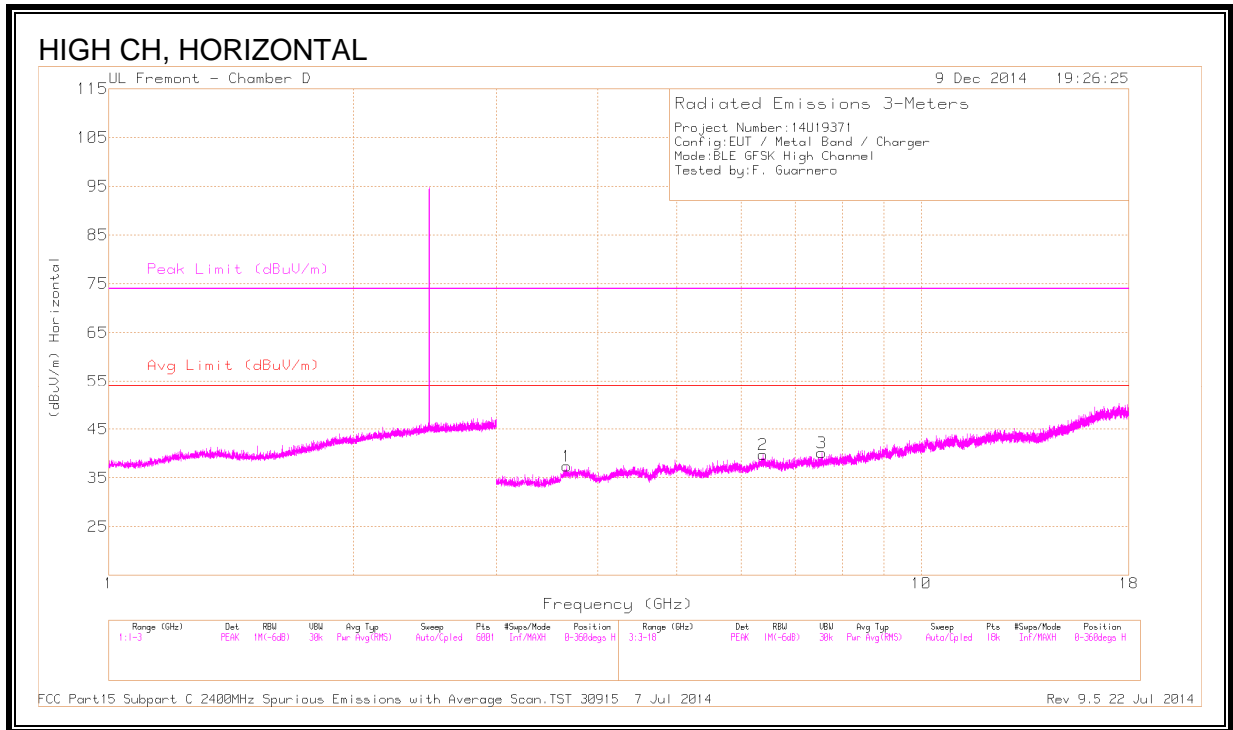
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.826	39.44	PK2	33.4	-28.3	0	44.54	-	-	74	-29.46	274	187	H
	* 3.826	27.62	MAv1	33.4	-28.3	2.06	34.78	54	-19.22	-	-	274	187	H
2	* 4.810	37.58	PK2	34.2	-26.9	0	44.88	-	-	74	-29.12	247	182	H
	* 4.811	26.58	MAv1	34.2	-26.9	2.06	35.94	54	-18.06	-	-	247	182	H
3	* 11.022	33.47	PK2	38.1	-20.3	0	51.27	-	-	74	-22.73	257	144	H
	* 11.023	22.40	MAv1	38.1	-20.3	2.06	42.26	54	-11.74	-	-	257	144	H
4	* 3.644	38.65	PK2	33.4	-28.8	0	43.25	-	-	74	-30.75	360	338	V
	* 3.643	27.46	MAv1	33.4	-28.8	2.06	34.12	54	-19.88	-	-	360	338	V
5	6.351	37.04	PK2	35.6	-25.8	0	46.84	-	-	-	-	354	332	V
6	* 10.856	35.02	PK2	38.1	-21.0	0	52.12	-	-	74	-21.88	357	339	V
	* 10.857	22.98	MAv1	38.1	-21.0	2.06	42.14	54	-11.86	-	-	357	339	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 3.663	38.41	PK2	33.3	-28.9	0	42.81	-	-	74	-31.19	292	159	H
	* 3.664	27.61	MAv1	33.3	-28.9	2.06	34.07	54	-19.93	-	-	292	159	H
2	6.381	37.47	PK2	35.6	-26.0	0	47.07	-	-	-	-	319	173	H
3	* 7.538	35.77	PK2	35.7	-24.7	0	46.77	-	-	74	-27.23	317	166	H
	* 7.541	24.78	MAv1	35.7	-24.7	2.06	37.84	54	-16.16	-	-	317	166	H
4	* 3.756	38.05	PK2	33.3	-28.3	0	43.05	-	-	74	-30.95	198	241	V
	* 3.756	26.59	MAv1	33.3	-28.3	2.06	33.65	54	-20.35	-	-	198	241	V
5	* 7.594	36.68	PK2	35.7	-25.1	0	47.28	-	-	74	-26.72	62	215	V
	* 7.596	24.46	MAv1	35.7	-25.1	2.06	37.12	54	-16.88	-	-	62	215	V
6	8.683	34.34	PK2	36.0	-22.1	0	48.24	-	-	-	-	202	268	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

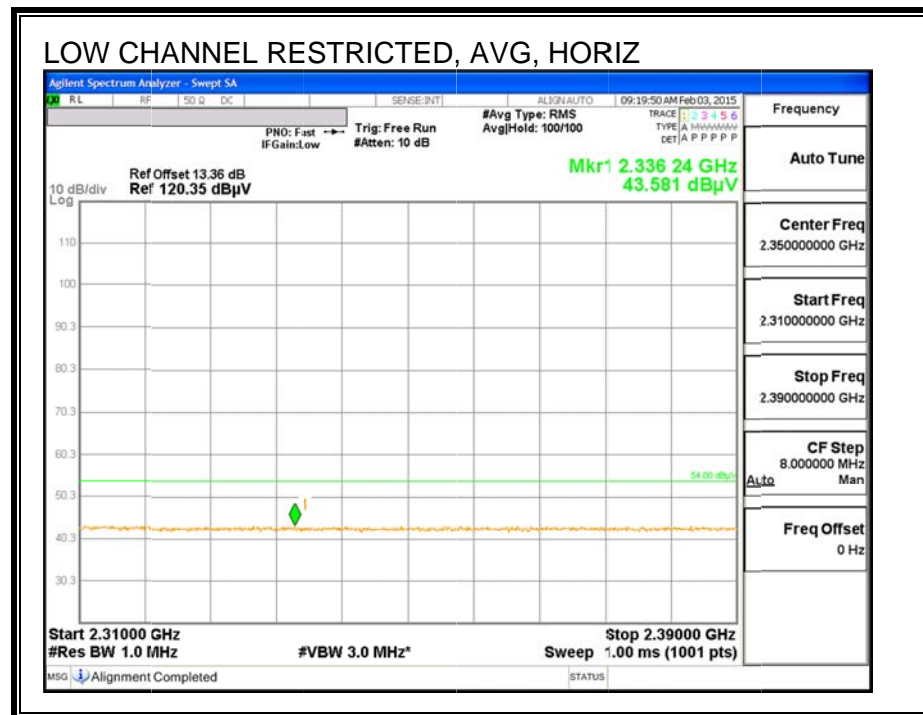
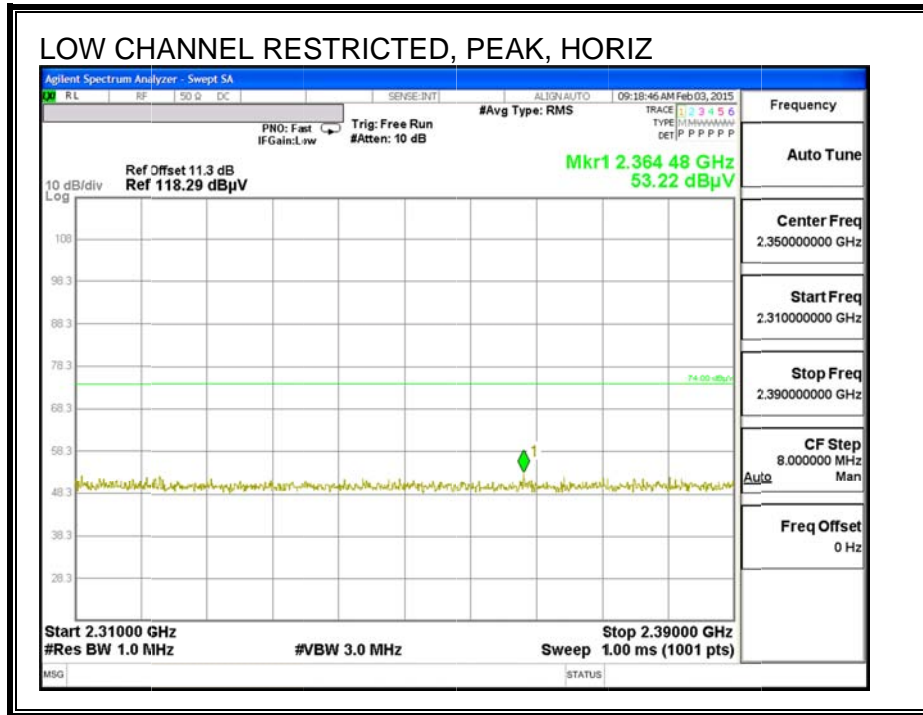
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

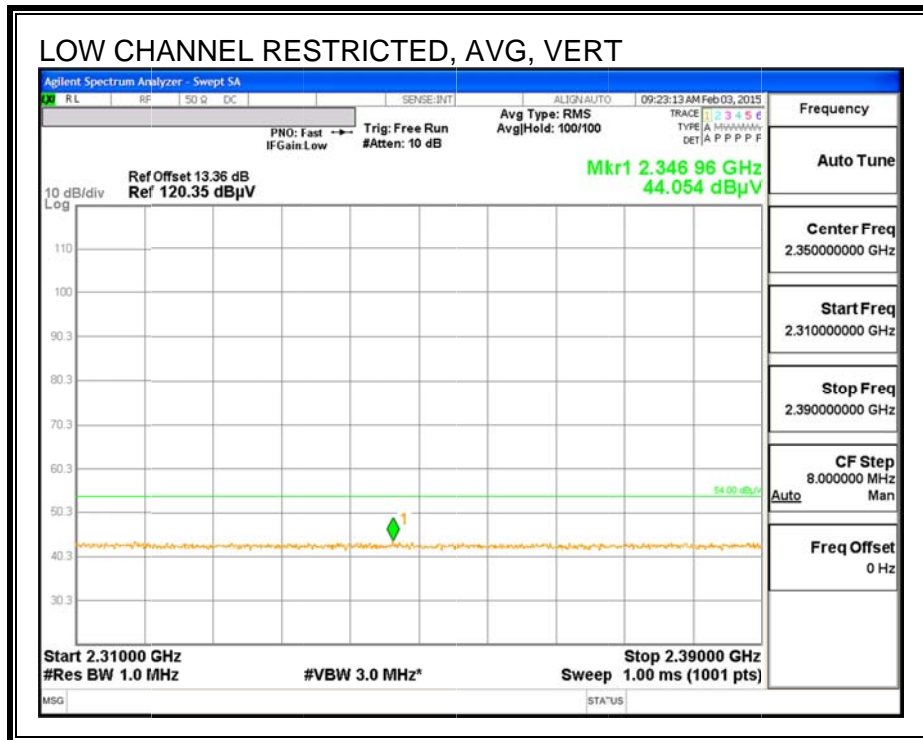
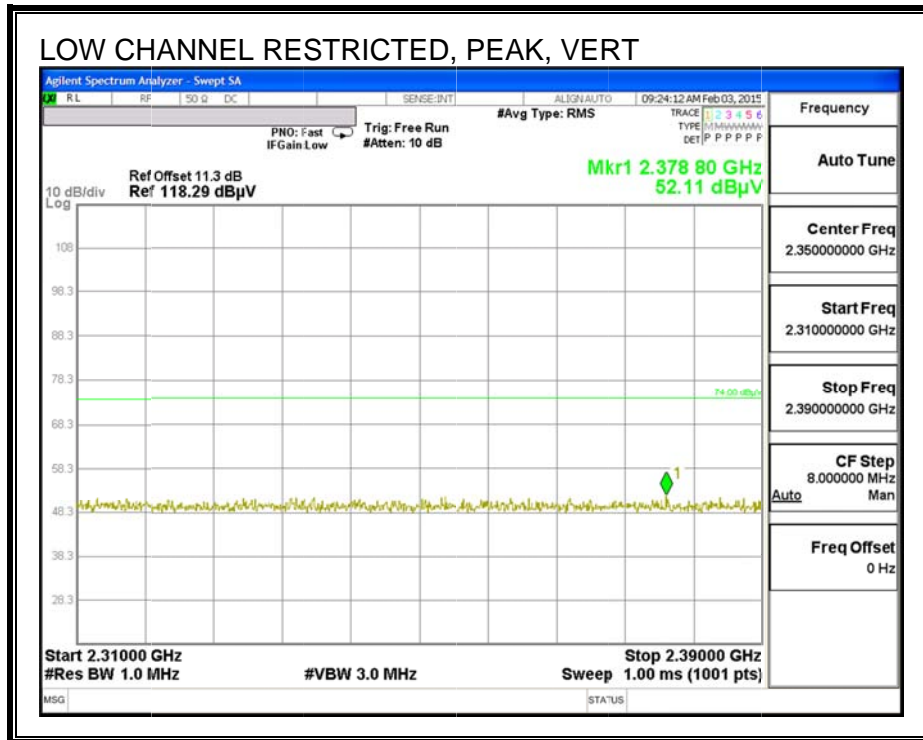
10.3. TRANSMITTER ON A1554 ANTENNA 2

10.3.1. EMISSIONS ABOVE 1 GHz AND BELOW 18GHz

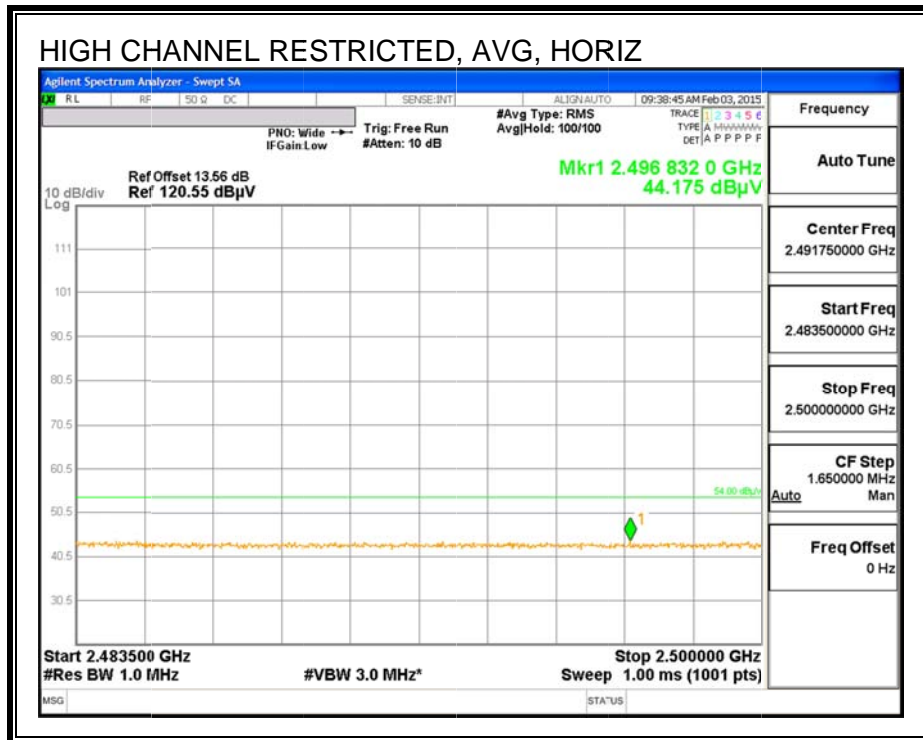
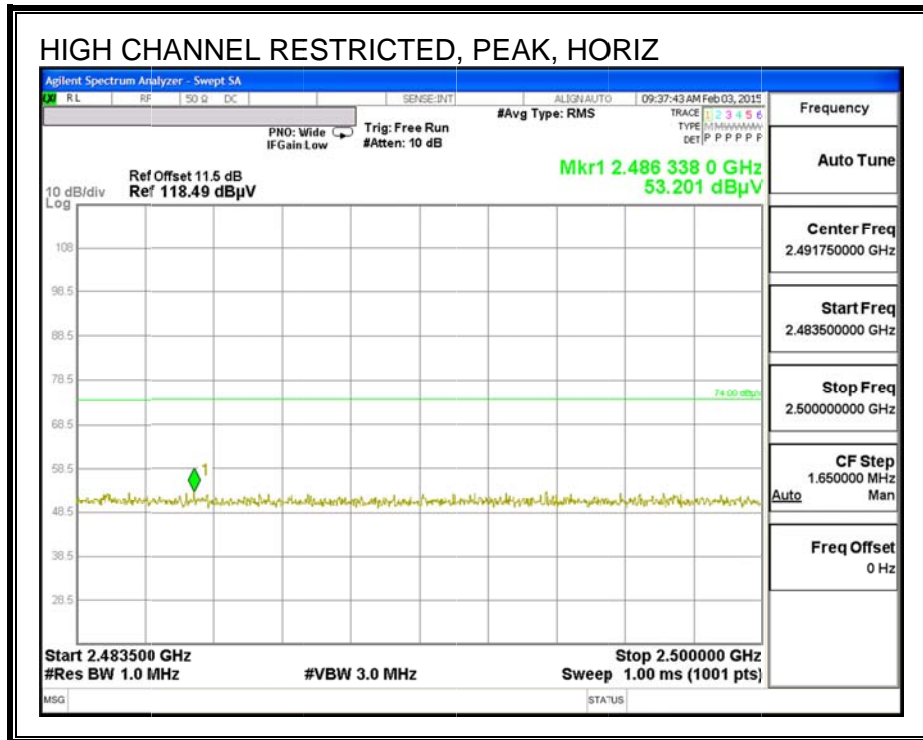
RESTRICTED BANDEDGE, (LOW CHANNEL, HORIZONTAL)



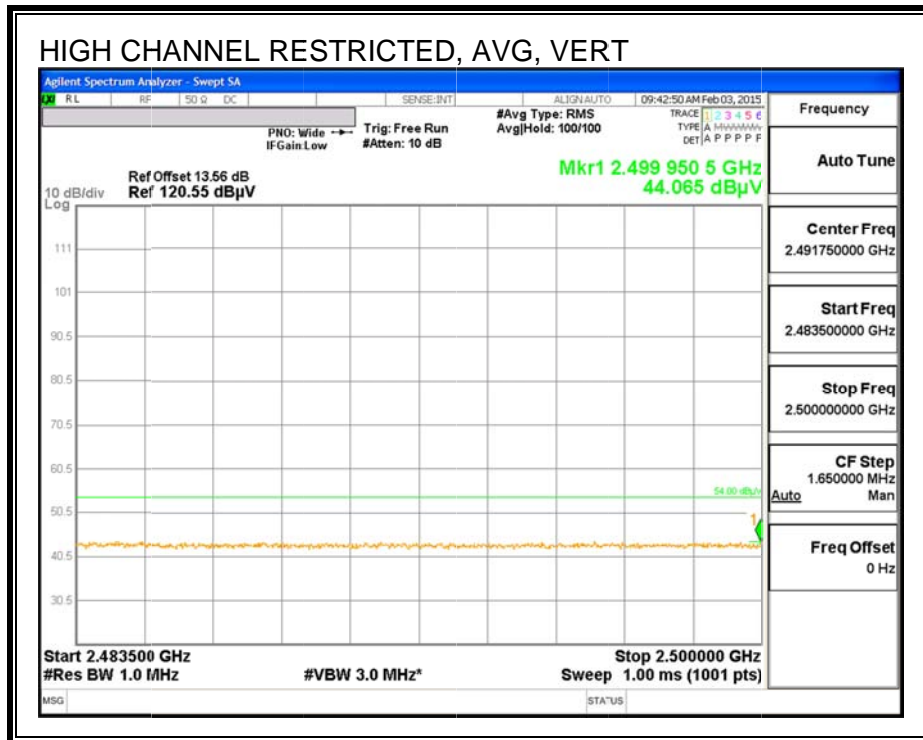
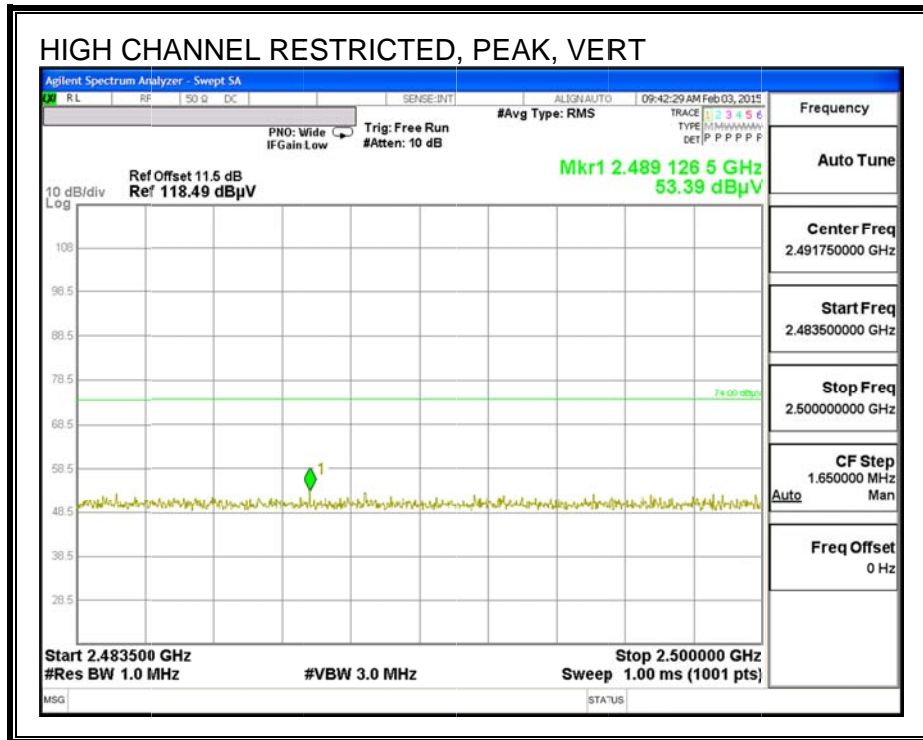
RESTRICTED BANDEDGE, (LOW CHANNEL, VERTICAL)



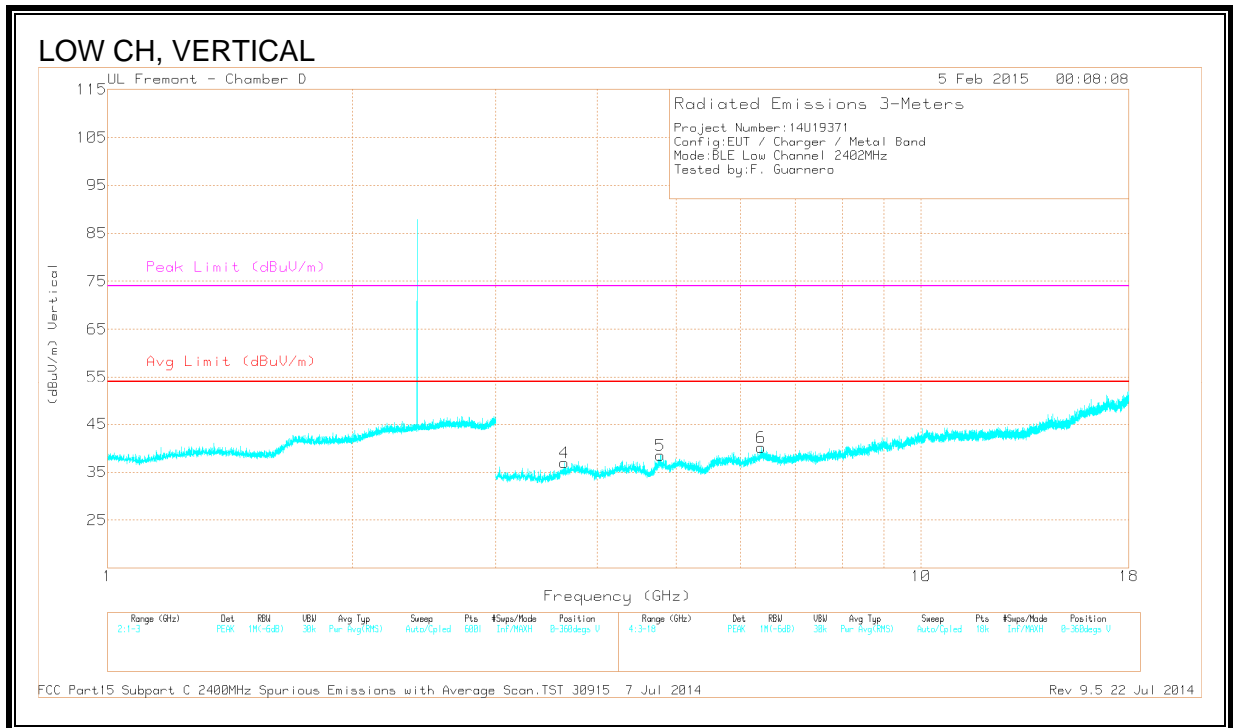
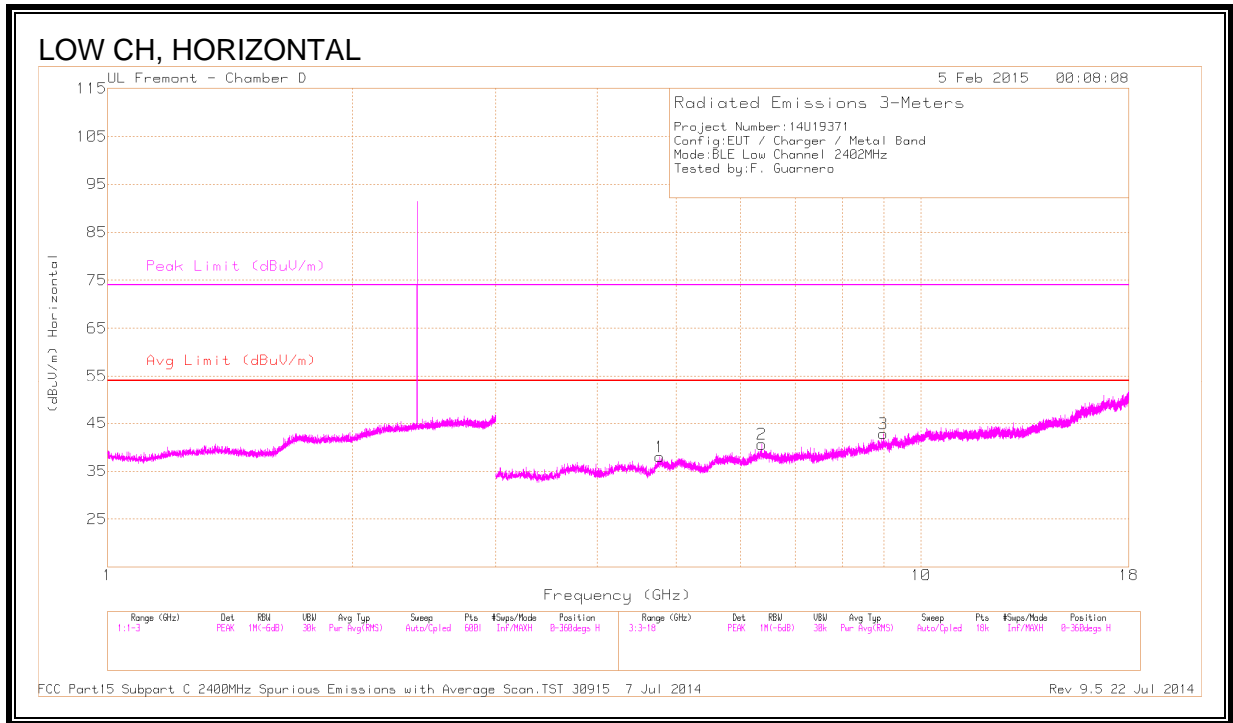
RESTRICTED BANDEDGE, (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE, (HIGH CHANNEL, VERTICAL)



LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

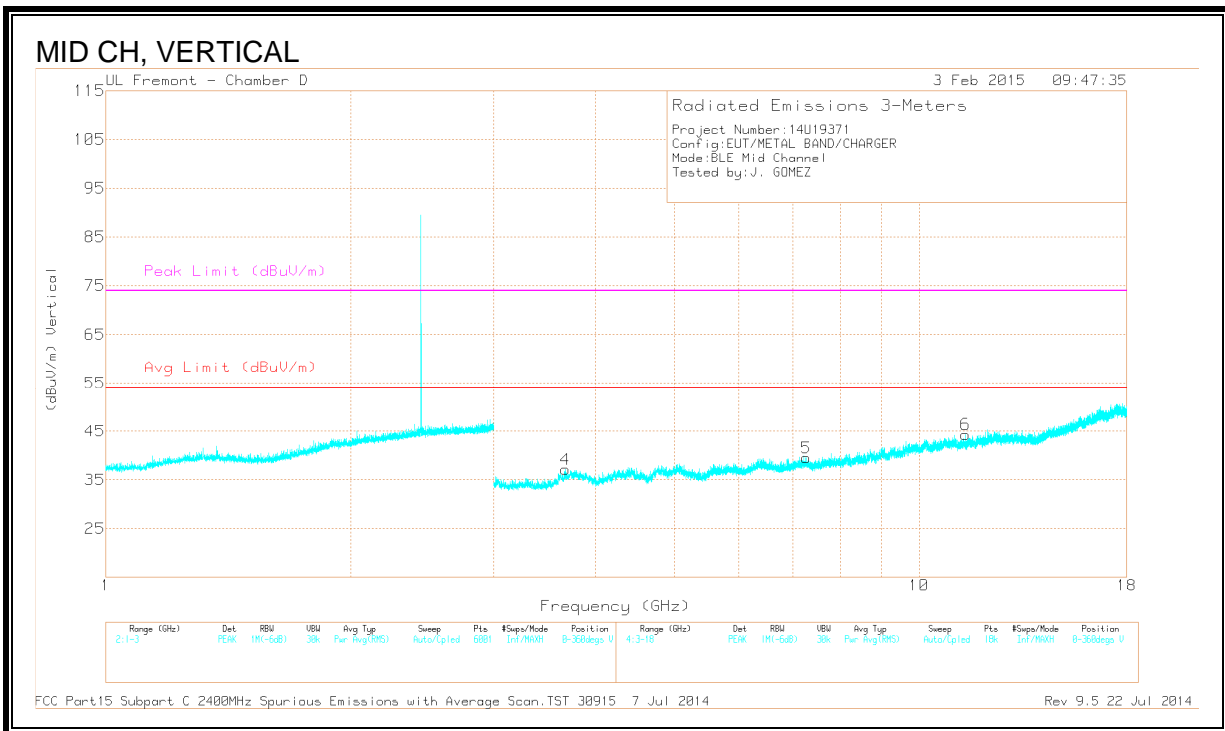
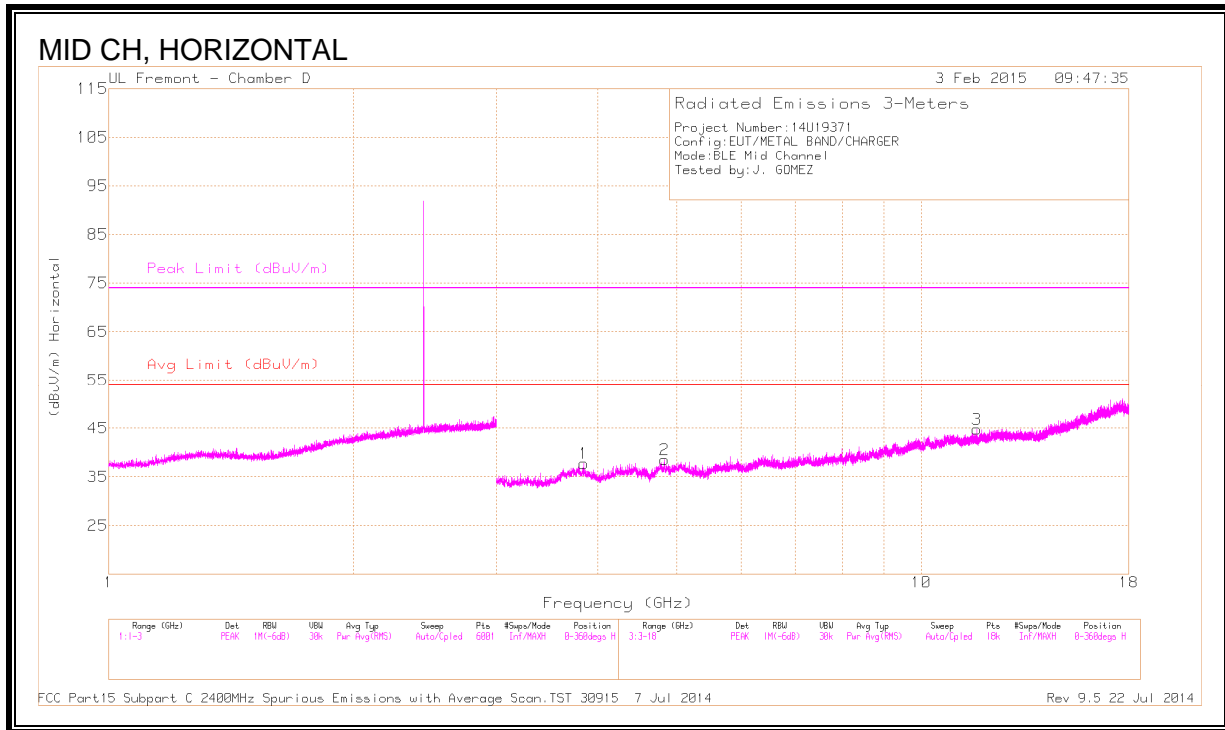
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.773	37.34	PK2	33.9	-26.6	0	44.64	-	-	74	-29.36	102	312	H
	* 4.775	25.83	MAv1	33.9	-26.6	2.06	35.19	54	-18.81	-	-	102	312	H
2	6.374	36.81	PK2	36.0	-26.3	0	46.51	-	-	-	-	62	103	H
3	8.979	34.67	PK2	36.6	-22.6	0	48.67	-	-	-	-	293	112	H
4	* 3.642	39.37	PK2	33.1	-28.9	0	43.57	-	-	74	-30.43	26	309	V
	* 3.643	26.99	MAv1	33.1	-29.0	2.06	33.15	54	-20.85	-	-	26	309	V
5	* 4.780	37.65	PK2	34.0	-26.6	0	45.05	-	-	74	-28.95	173	112	V
	* 4.779	26.23	MAv1	34.0	-26.6	2.06	35.69	54	-18.31	-	-	173	112	V
6	6.363	36.80	PK2	36.0	-26.3	0	46.50	-	-	-	-	85	273	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

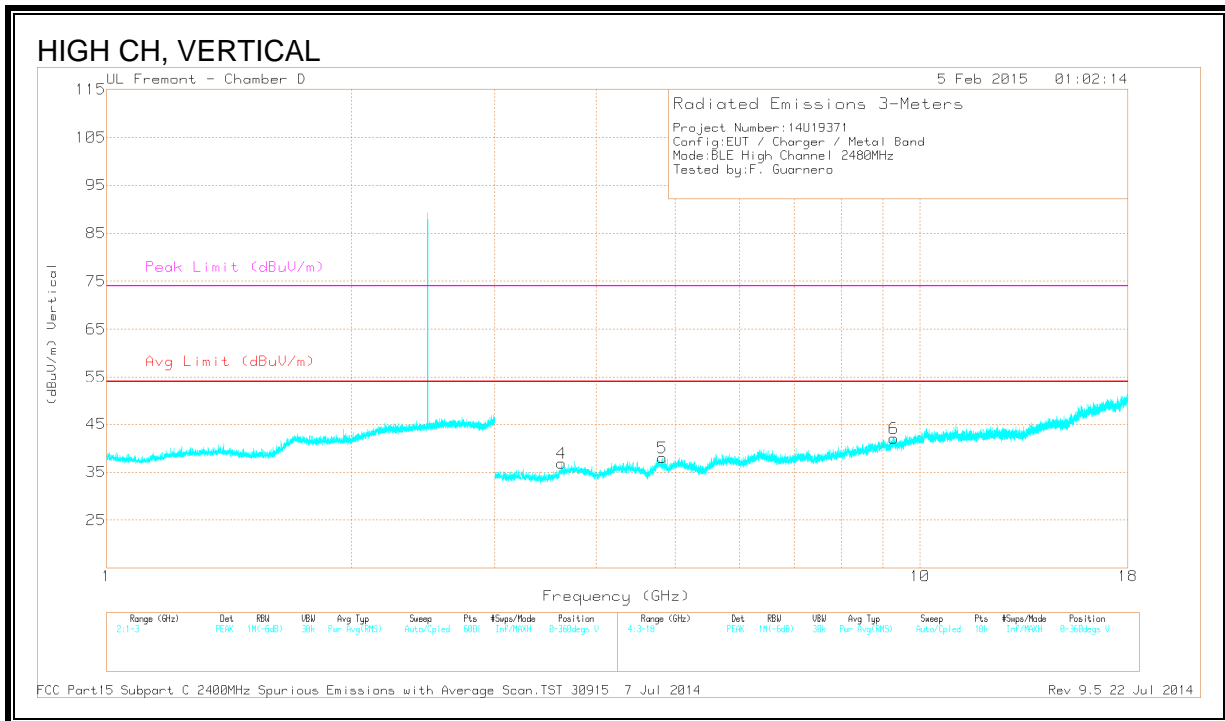
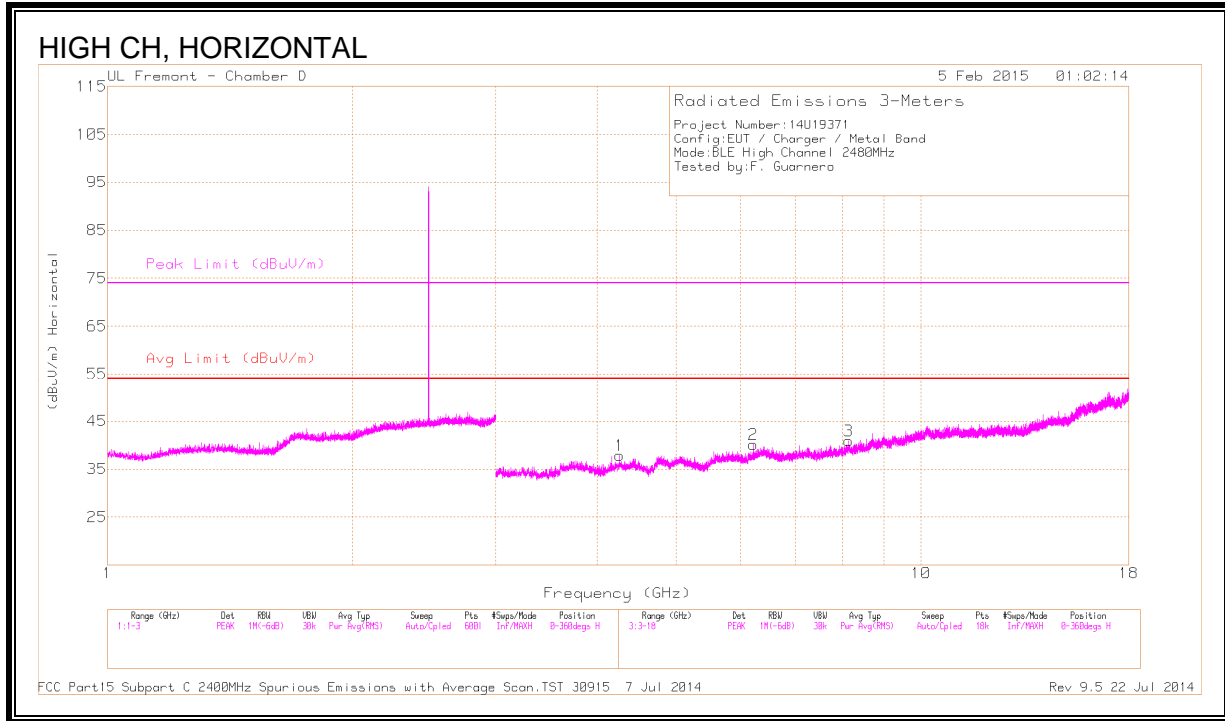
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.842	38.93	PK2	33.4	-28.7	0	43.63	-	-	74	-30.37	103	354	H
	* 3.843	27.36	MAv1	33.4	-28.7	2.06	34.12	54	-19.88	-	-	103	354	H
2	* 4.832	38.72	PK2	34.2	-27.6	0	45.32	-	-	74	-28.68	0	292	H
	* 4.831	26.62	MAv1	34.2	-27.5	2.06	35.38	54	-18.62	-	-	0	292	H
3	* 11.705	33.90	PK2	38.3	-21.6	0	50.6	-	-	74	-23.4	72	155	H
	* 11.704	22.78	MAv1	38.3	-21.6	2.06	41.54	54	-12.46	-	-	72	155	H
4	* 3.673	39.10	PK2	33.3	-29.1	0	43.3	-	-	74	-30.7	93	220	V
	* 3.672	27.76	MAv1	33.3	-29.1	2.06	34.02	54	-19.98	-	-	93	220	V
5	* 7.266	36.76	PK2	35.7	-25.2	0	47.26	-	-	74	-26.74	239	153	V
	* 7.267	25.53	MAv1	35.7	-25.2	2.06	38.09	54	-15.91	-	-	239	153	V
6	* 11.407	34.96	PK2	38.1	-21.6	0	51.46	-	-	74	-22.54	224	290	V
	* 11.406	23.66	MAv1	38.1	-21.6	2.06	42.22	54	-11.78	-	-	224	290	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 4.257	38.60	PK2	33.4	-27.9	0	44.10	-	-	74	-29.9	7	125	H
	* 4.258	26.30	MAv1	33.4	-27.9	2.06	33.86	54	-20.14	-	-	7	125	H
2	6.215	37.12	PK2	36.0	-26.8	0	46.32	-	-	-	-	29	282	H
3	* 8.152	34.89	PK2	36.1	-22.9	0	48.09	-	-	74	-25.91	62	223	H
	* 8.152	23.58	MAv1	36.1	-22.9	2.06	38.84	54	-15.16	-	-	62	223	H
4	* 3.623	38.78	PK2	33.1	-28.6	0	43.28	-	-	74	-30.72	56	212	V
	* 3.624	26.98	MAv1	33.1	-28.6	2.06	33.54	54	-20.46	-	-	56	212	V
5	* 4.816	36.98	PK2	34.0	-27.3	0	43.68	-	-	74	-30.32	65	195	V
	* 4.820	26.57	MAv1	33.9	-27.3	2.06	35.23	54	-18.77	-	-	65	195	V
6	9.285	33.47	PK2	36.8	-20.7	0	49.57	-	-	-	-	99	213	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

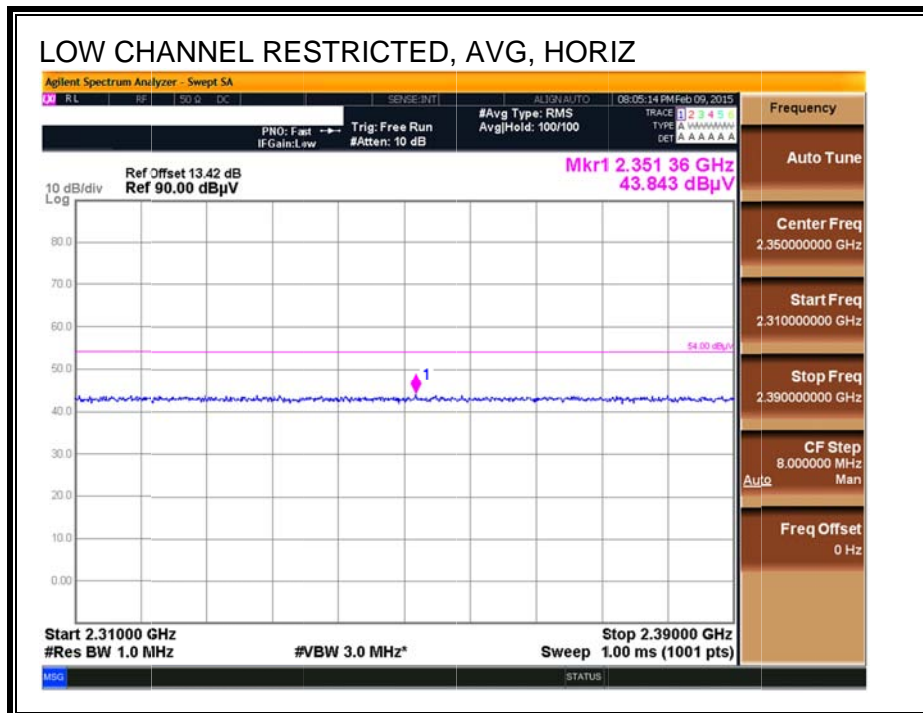
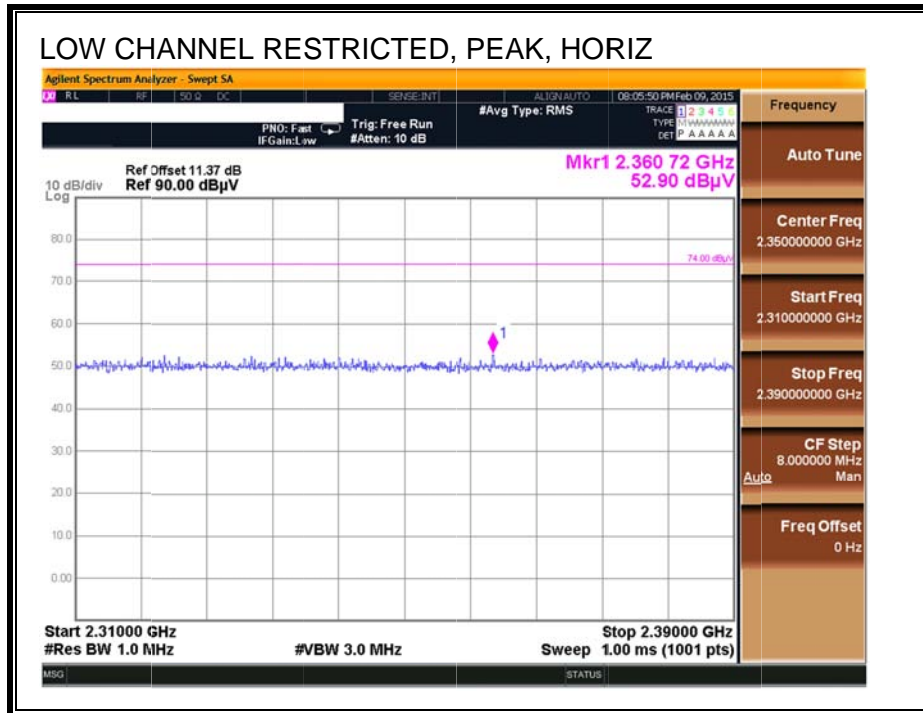
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

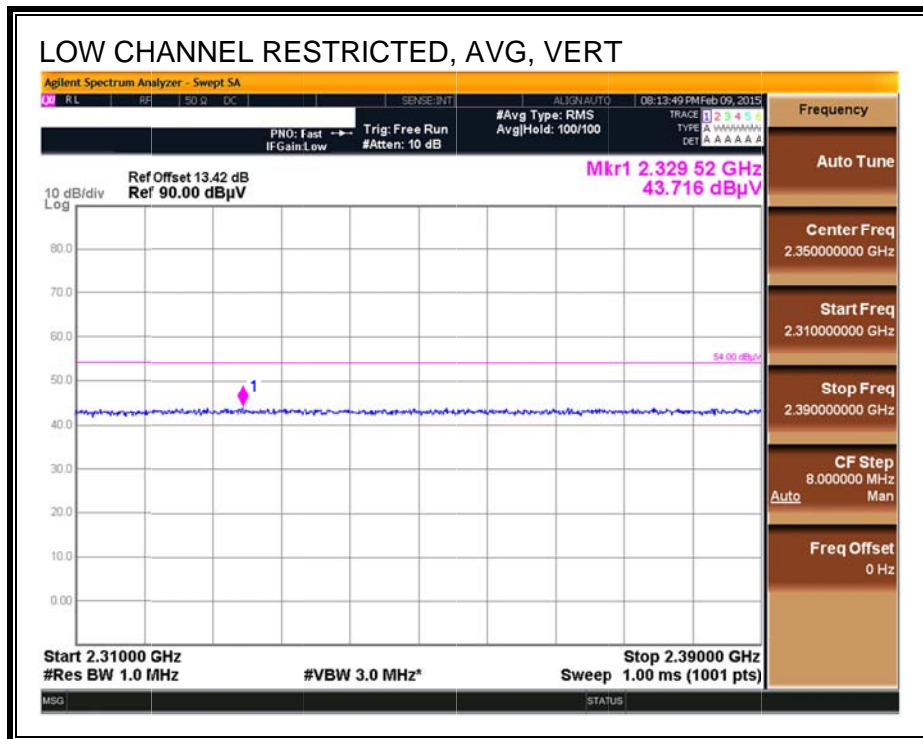
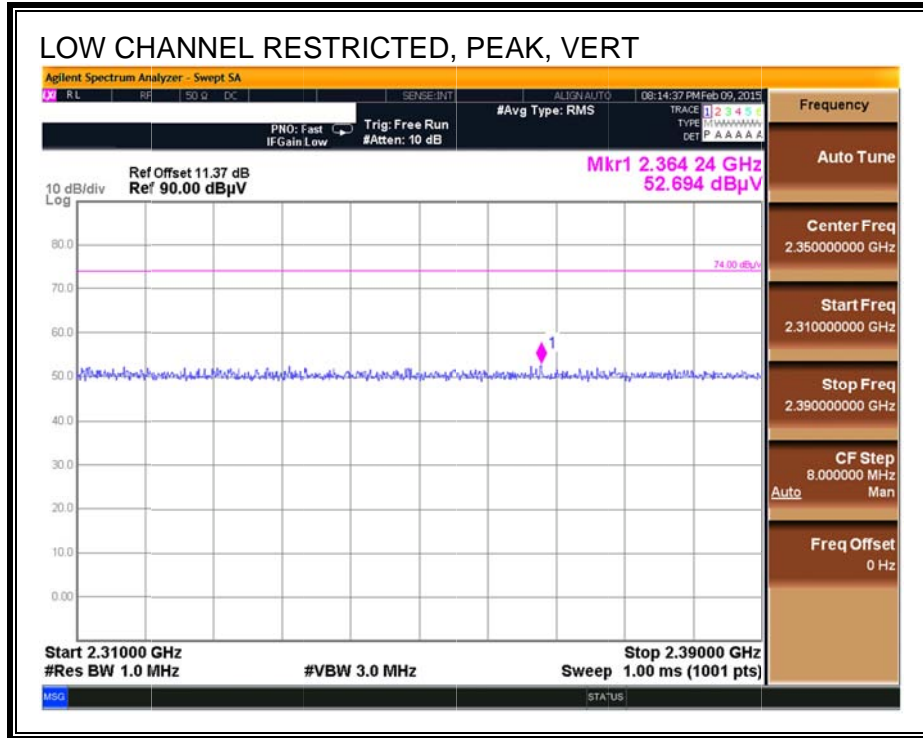
10.4. TRANSMITTER ON A1638

10.4.1. EMISSIONS ABOVE 1 GHz AND BELOW 18GHz

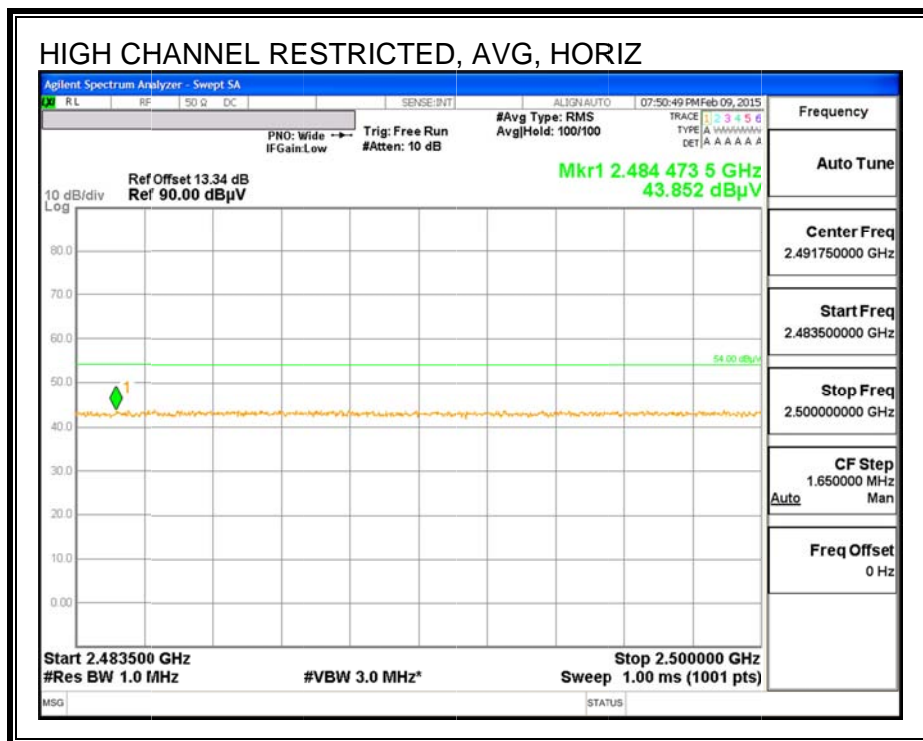
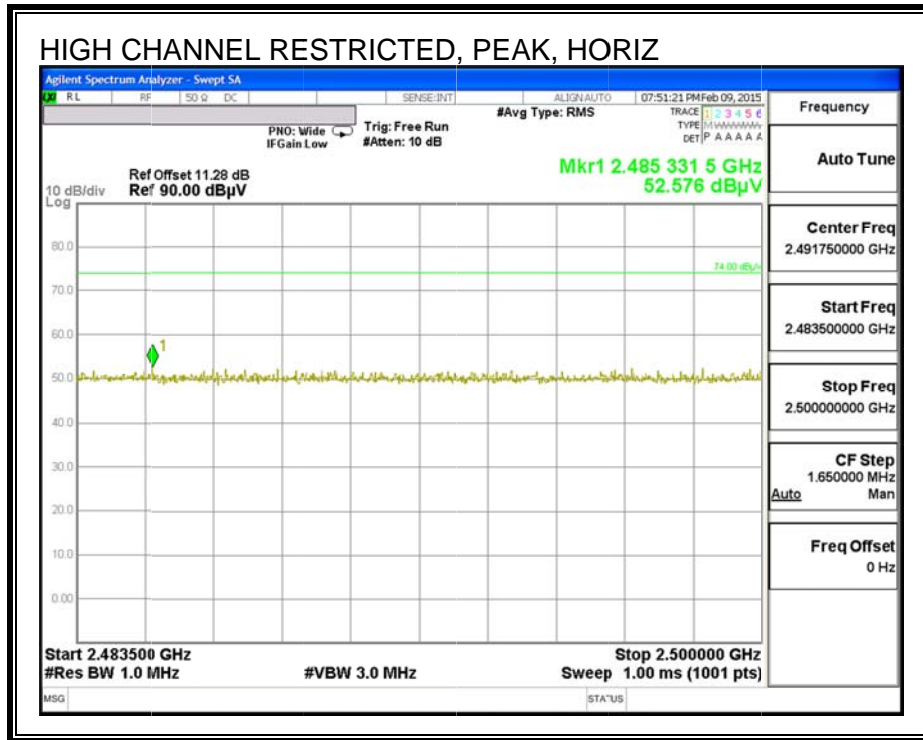
RESTRICTED BANDEDGE, (LOW CHANNEL, HORIZONTAL)



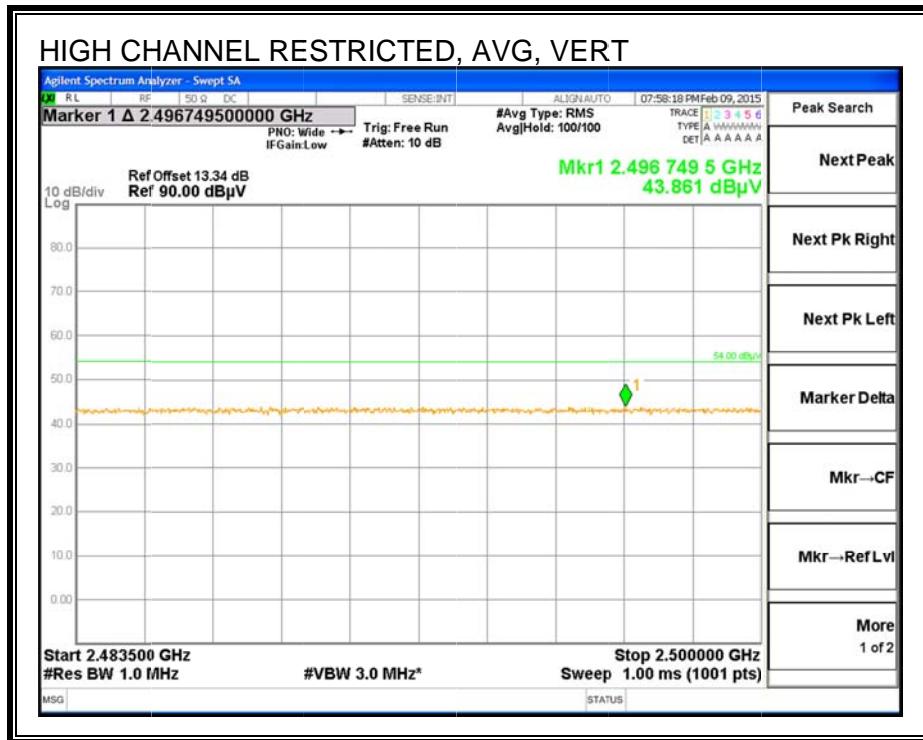
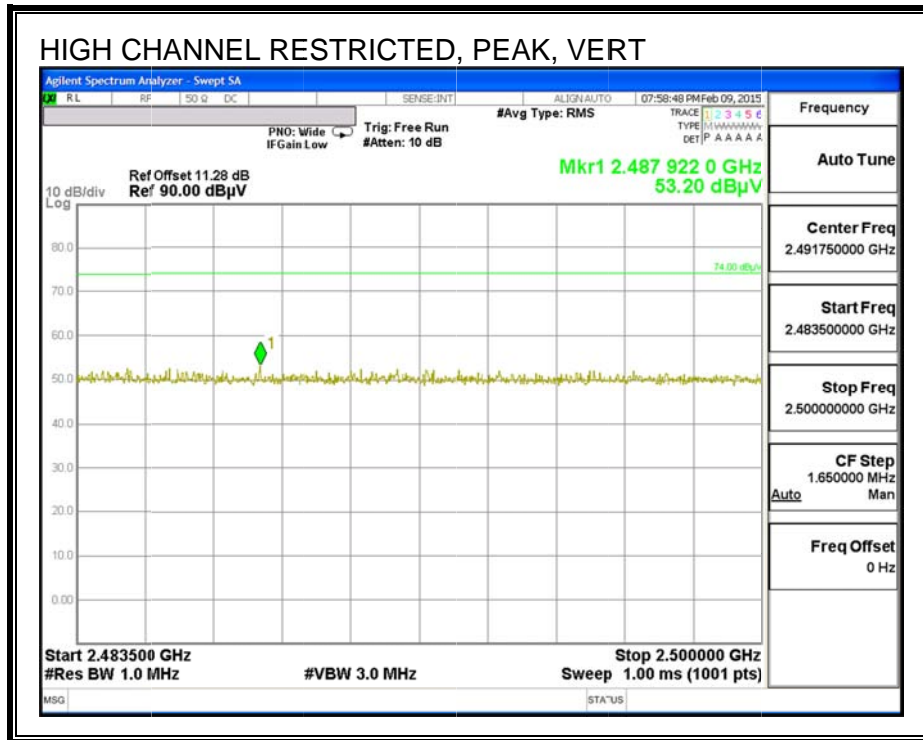
RESTRICTED BANDEDGE, (LOW CHANNEL, VERTICAL)



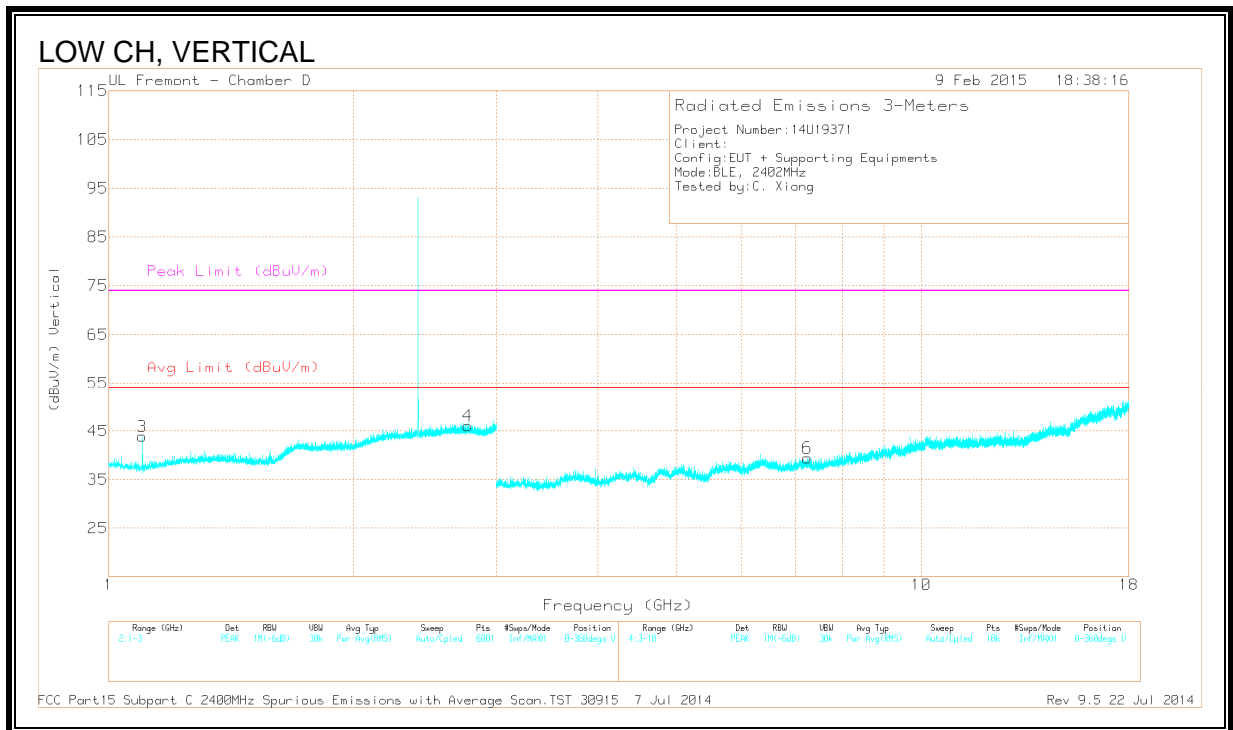
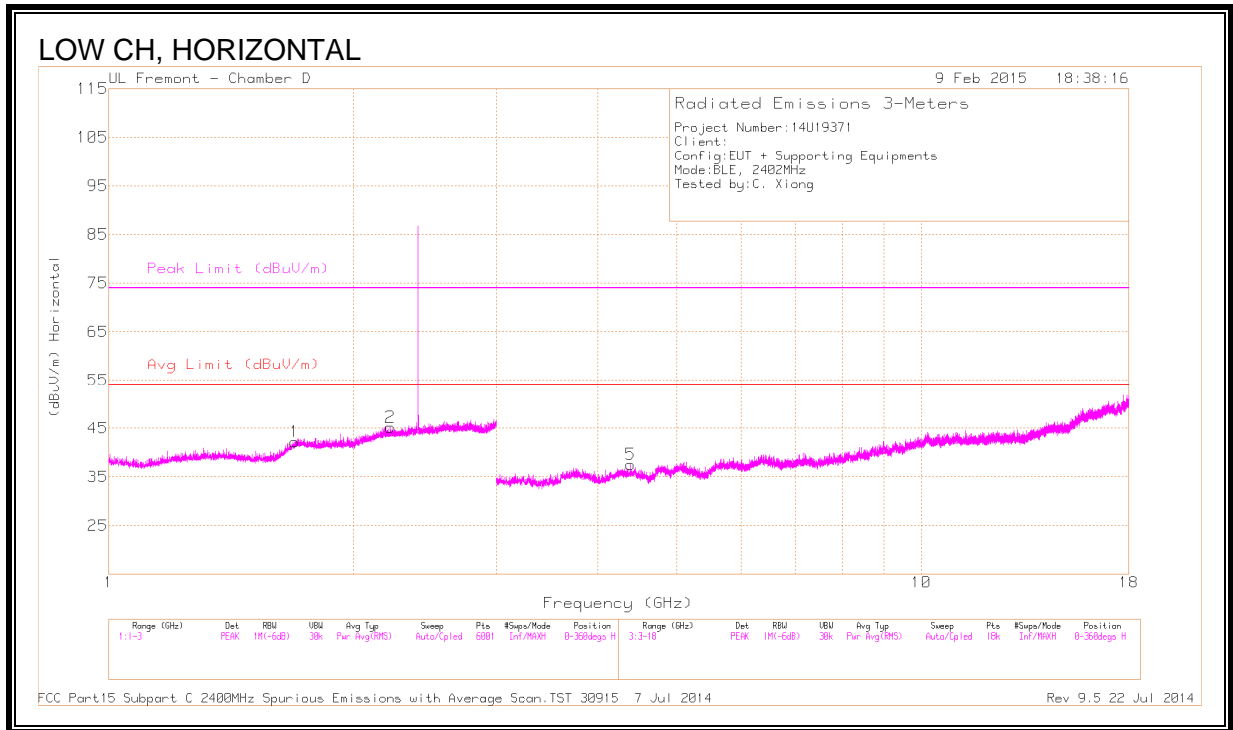
RESTRICTED BANDEDGE, (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE, (HIGH CHANNEL, VERTICAL)



LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

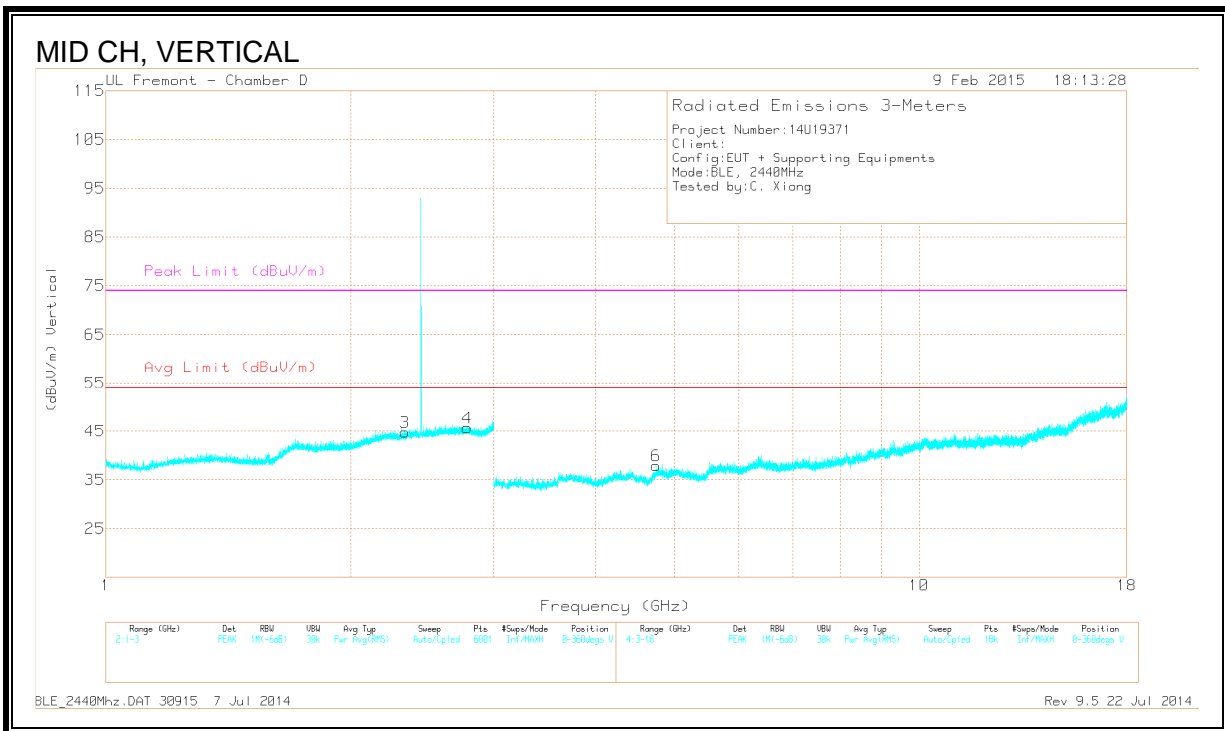
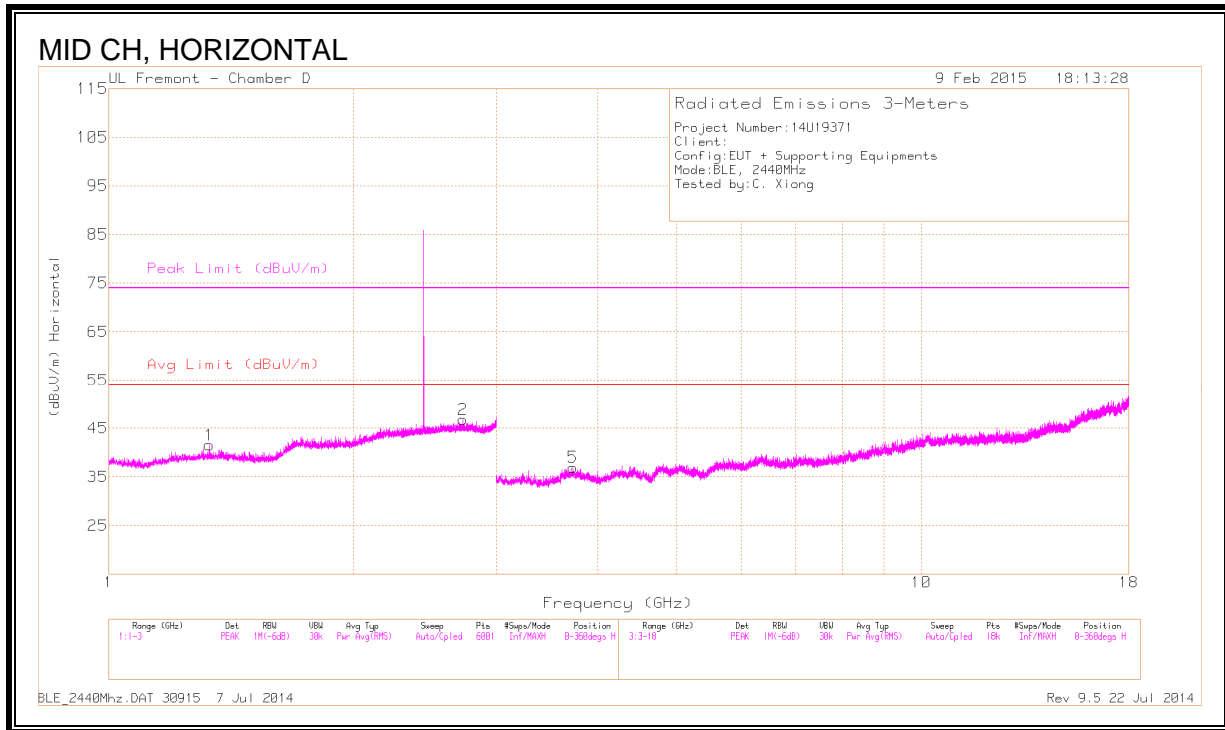
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.694	41.33	PK2	30.5	-21.7	0	50.13	-	-	74	-23.87	48	138	H
	* 1.695	30.12	MAv1	30.5	-21.7	2.06	40.98	54	-13.02	-	-	48	138	H
2	* 2.221	41.31	PK2	32.0	-21.0	0	52.31	-	-	74	-21.69	53	151	H
	* 2.222	30.17	MAv1	32.0	-21.0	2.06	43.23	54	-10.77	-	-	53	151	H
3	* 1.099	41.40	PK2	26.9	-22.5	0	45.80	-	-	74	-28.20	104	186	V
	* 1.100	30.39	MAv1	26.8	-22.5	2.06	36.75	54	-17.25	-	-	104	186	V
4	* 2.767	42.11	PK2	32.4	-20.4	0	54.11	-	-	74	-19.89	159	201	V
	* 2.768	30.14	MAv1	32.4	-20.4	2.06	44.20	54	-9.80	-	-	159	201	V
5	* 4.386	37.65	PK2	33.5	-28.2	0	42.95	-	-	74	-31.05	123	237	H
	* 4.385	27.02	MAv1	33.5	-28.2	2.06	34.38	54	-19.62	-	-	123	237	H
6	7.240	36.55	PK2	35.6	-24.9	0	47.25	-	-	-	-	186	178	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

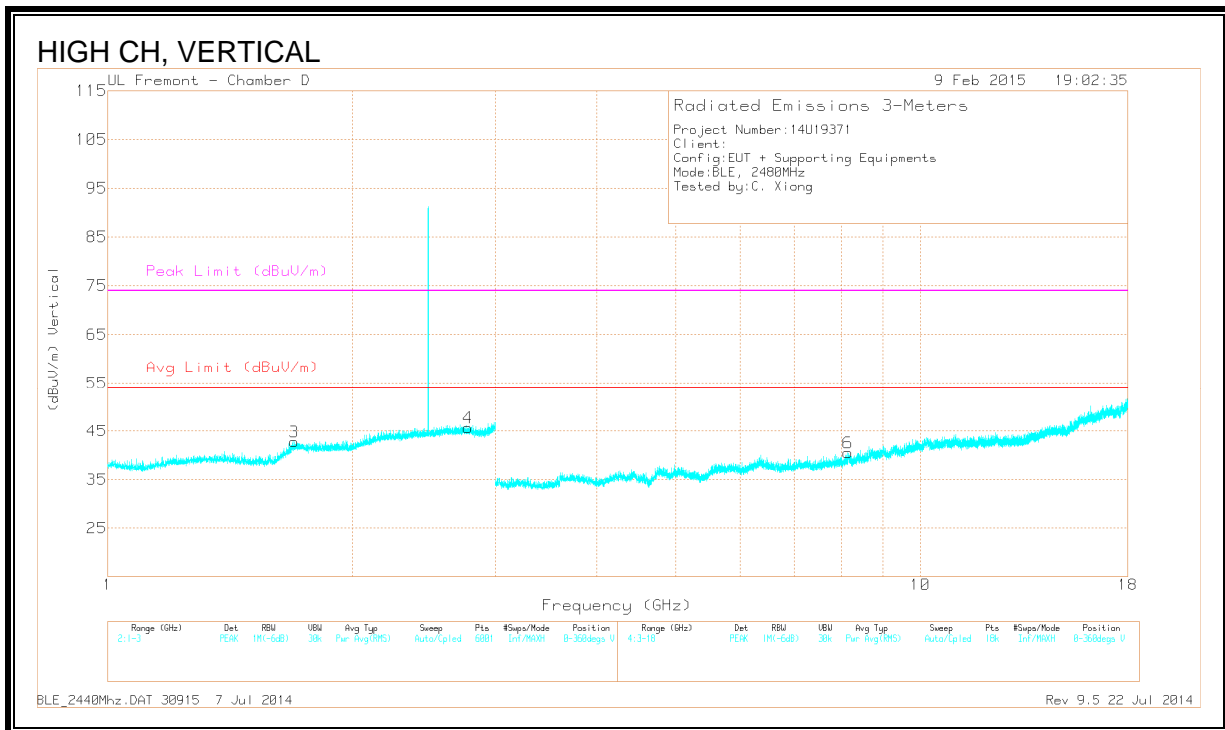
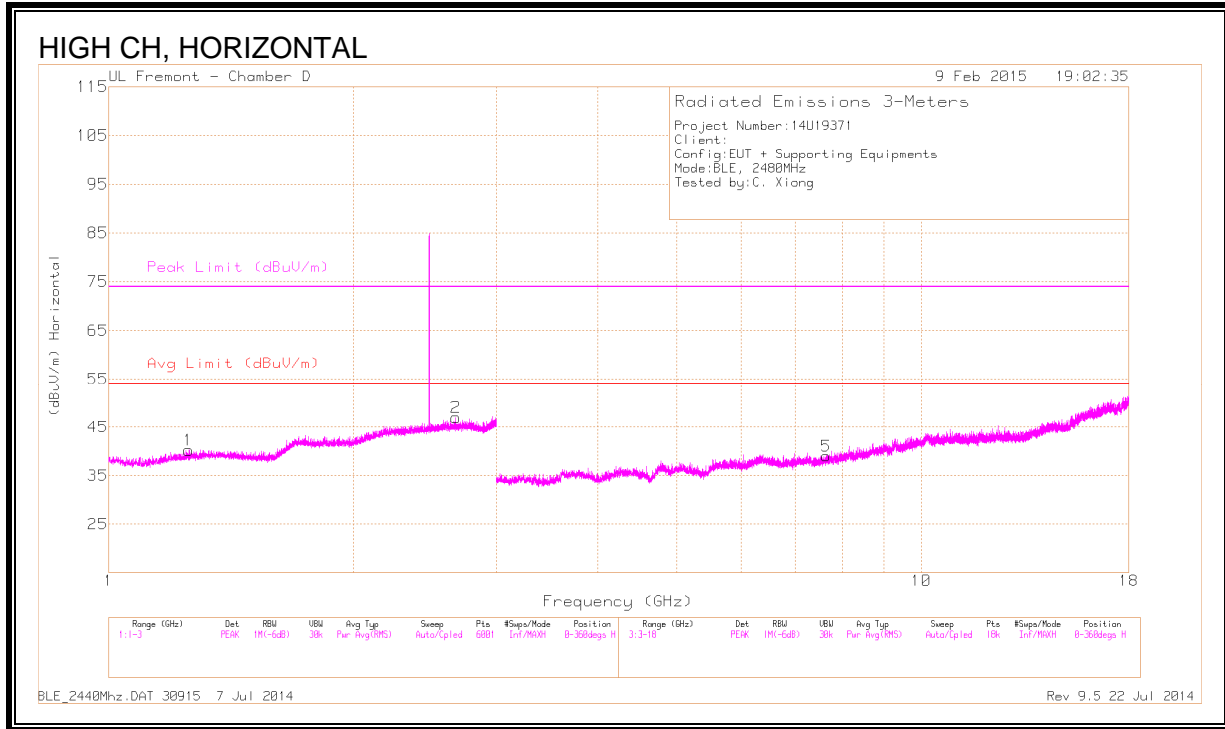
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.331	41.91	PK2	28.4	-22.2	0	48.11	-	-	74	-25.89	121	155	H
	* 1.331	30.57	MAv1	28.4	-22.2	2.06	38.83	54	-15.17	-	-	121	155	H
2	* 2.726	41.70	PK2	32.4	-20.5	0	53.60	-	-	74	-20.40	113	133	H
	* 2.728	30.28	MAv1	32.4	-20.5	2.06	44.24	54	-9.76	-	-	113	133	H
3	* 2.335	41.25	PK2	32	-21.0	0	52.25	-	-	74	-21.75	92	178	V
	* 2.335	30.14	MAv1	32	-21.0	2.06	43.20	54	-10.80	-	-	92	178	V
4	* 2.782	41.37	PK2	32.4	-20.4	0	53.37	-	-	74	-20.63	203	215	V
	* 2.785	30.17	MAv1	32.4	-20.4	2.06	44.23	54	-9.77	-	-	203	215	V
5	* 3.724	38.63	PK2	32.9	-28.7	0	42.83	-	-	74	-31.17	148	197	H
	* 3.725	27.8	MAv1	32.9	-28.7	2.06	34.06	54	-19.94	-	-	148	197	H
6	* 4.753	37.95	PK2	33.9	-26.9	0	44.95	-	-	74	-29.05	103	162	V
	* 4.753	27.10	MAv1	33.9	-26.9	2.06	36.16	54	-17.84	-	-	103	162	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 1.253	42.16	PK2	28.2	-22.3	0	48.06	-	-	74	-25.94	121	178	H
	* 1.255	30.54	MAv1	28.2	-22.3	2.06	38.450	54	-15.50	-	-	121	178	H
2	* 2.674	41.48	PK2	32.4	-20.6	0	53.28	-	-	74	-20.72	212	144	H
	* 2.675	30.49	MAv1	32.4	-20.6	2.06	44.35	54	-9.65	-	-	212	144	H
3	* 1.698	41.40	PK2	30.6	-21.7	0	50.30	-	-	74	-23.7	92	190	V
	* 1.699	30.21	MAv1	30.7	-21.7	2.06	41.27	54	-12.73	-	-	92	190	V
4	* 2.773	41.84	PK2	32.4	-20.4	0	53.84	-	-	74	-20.16	146	148	V
	* 2.777	30.16	MAv1	32.4	-20.4	2.06	44.22	54	-9.78	-	-	146	148	V
5	* 7.637	36.27	PK2	35.7	-24.9	0	47.07	-	-	74	-26.93	128	217	H
	* 7.637	24.94	MAv1	35.7	-24.9	2.06	37.80	54	-16.20	-	-	128	217	H
6	* 8.145	34.83	PK2	36.1	-23	0	47.93	-	-	74	-26.07	154	206	V
	* 8.146	24.16	MAv1	36.1	-23	2.06	39.32	54	-14.68	-	-	154	206	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

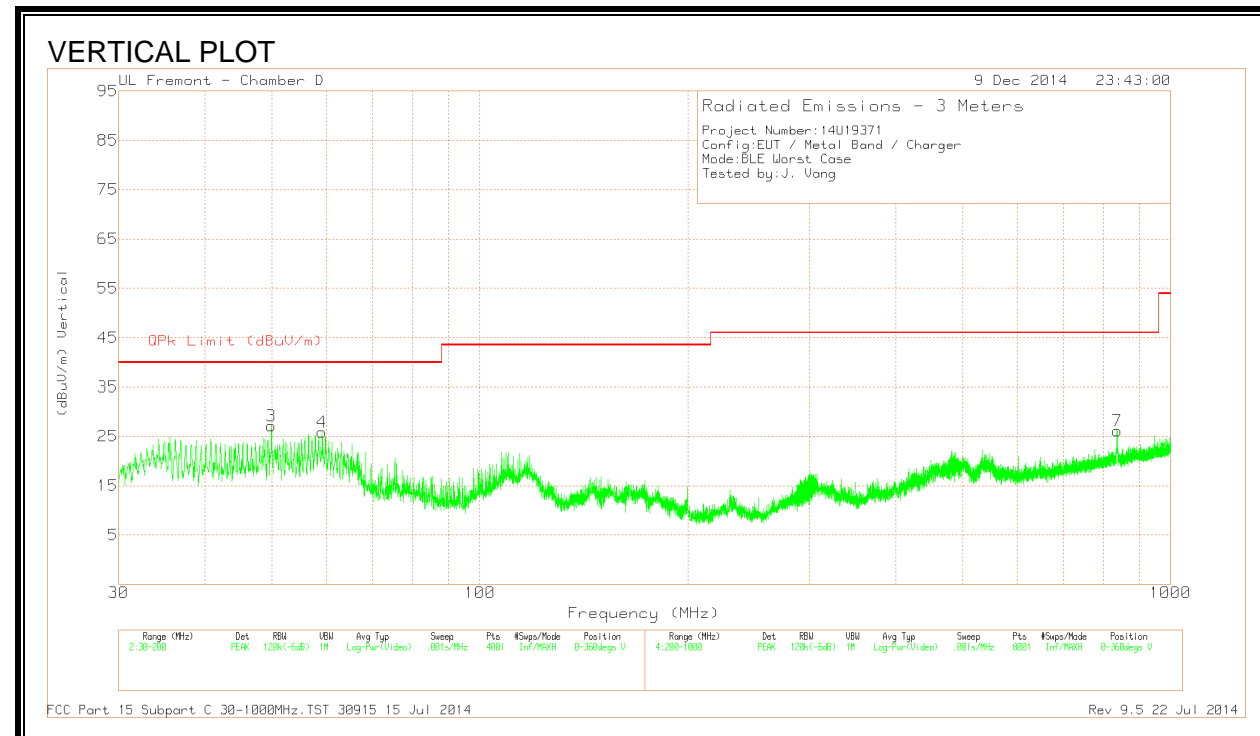
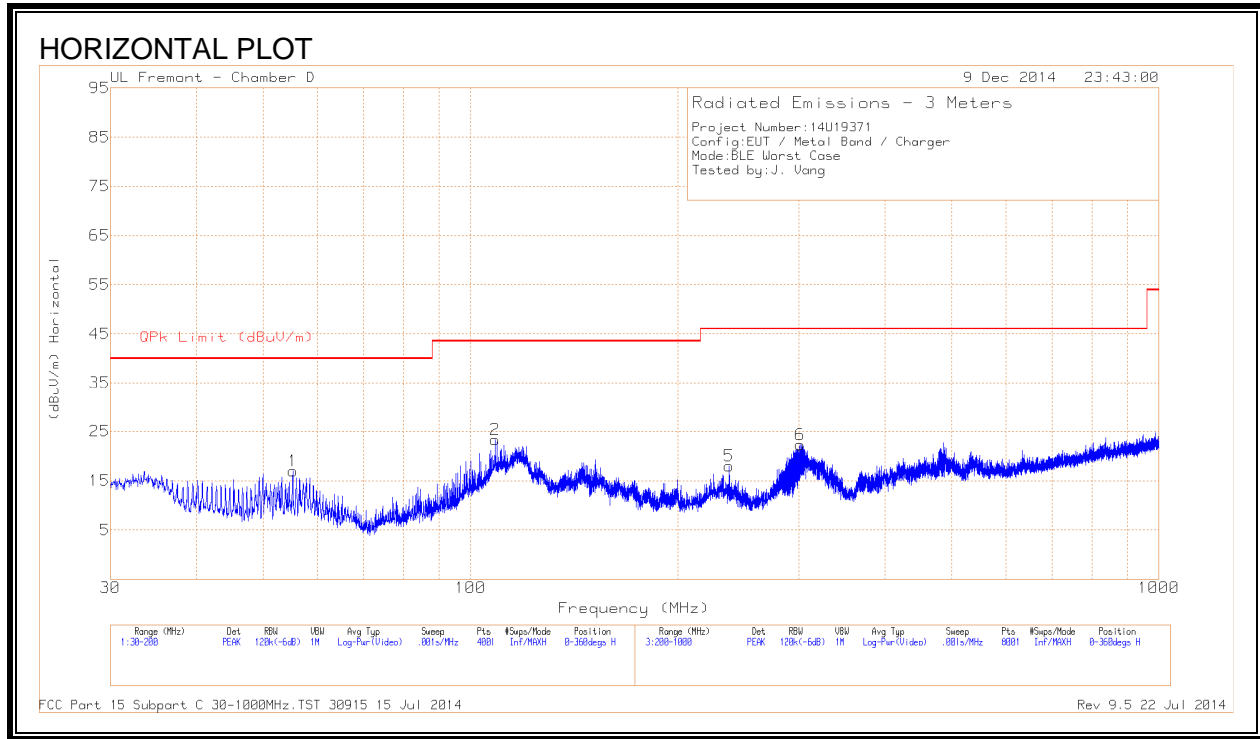
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

10.5. WORST-CASE BELOW 1 GHz

A1554 ANTENNA 1

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



DATA

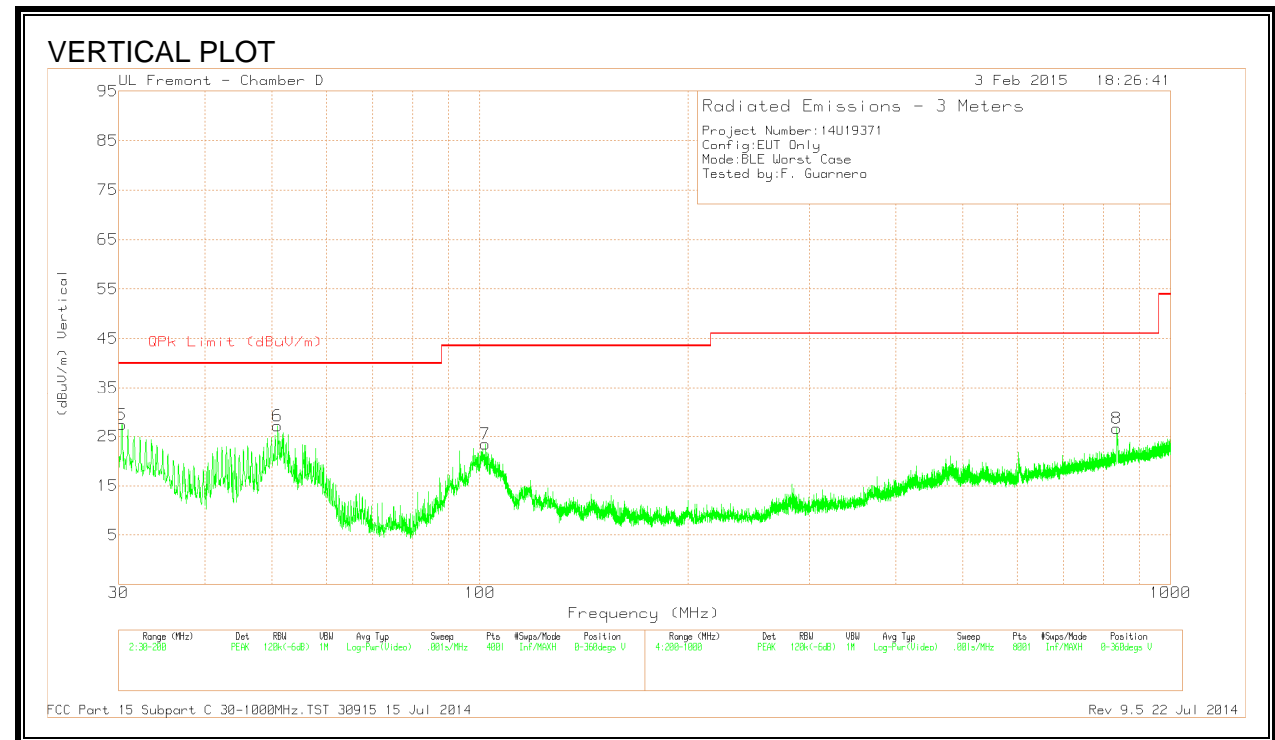
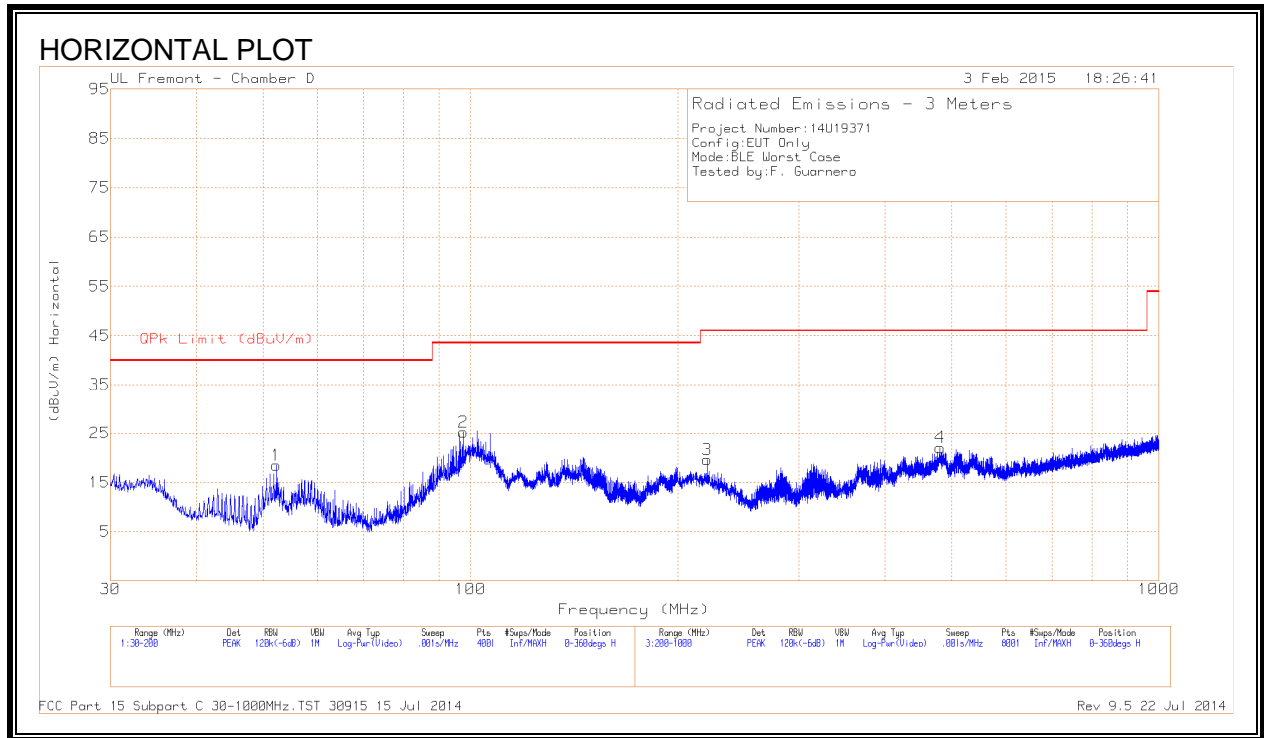
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	55.245	41.32	PK	7.3	-31.7	16.92	40.00	-23.08	0-360	201	H
2	* 108.71	42.20	PK	12.4	-31.3	23.30	43.52	-20.22	0-360	301	H
3	49.9325	50.87	PK	7.9	-31.7	27.07	40.00	-12.93	0-360	100	V
4	59.1125	49.81	PK	7.6	-31.6	25.81	40.00	-14.19	0-360	100	V
5	237.700	37.23	PK	11.5	-30.7	18.03	46.02	-27.99	0-360	100	H
6	301.400	39.28	PK	13.4	-30.4	22.28	46.02	-23.74	0-360	100	H
7	837.500	33.10	PK	21.8	-28.8	26.1	46.02	-19.92	0-360	100	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK - Peak detector

A1554 ANTENNA 2

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



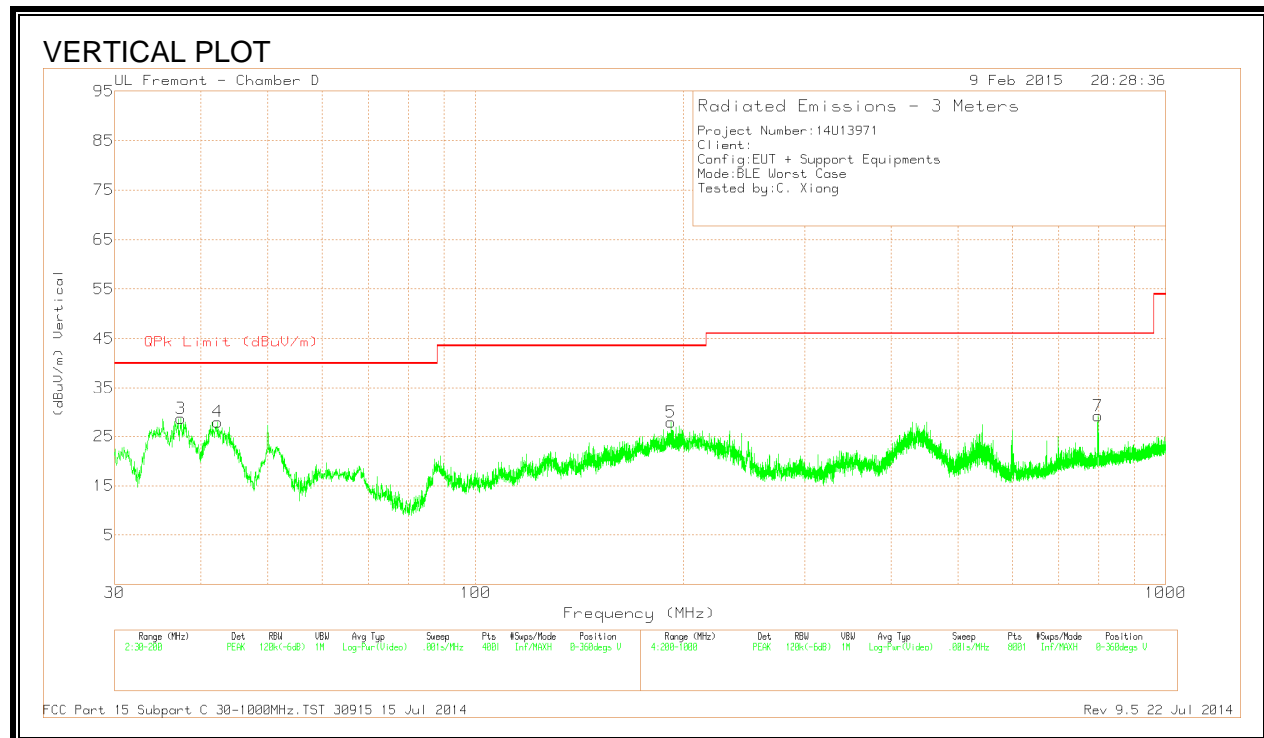
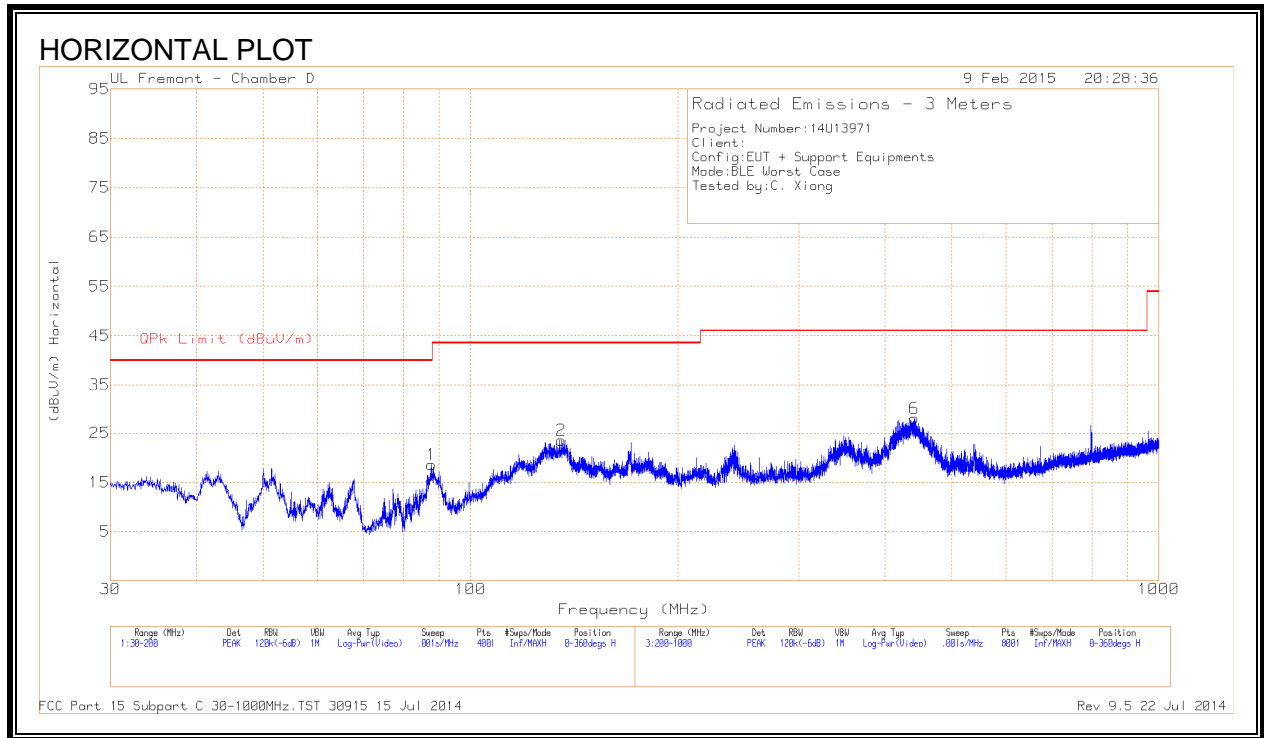
DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	52.270	42.70	PK	7.4	-31.6	18.50	40.00	-21.50	0-360	401	H
2	97.7025	47.03	PK	9.7	-31.5	25.23	43.52	-18.29	0-360	301	H
3	220.800	39.60	PK	10.7	-30.7	19.60	46.02	-26.42	0-360	100	H
4	481.200	34.21	PK	17.7	-29.8	22.11	46.02	-23.91	0-360	201	H
5	30.2975	37.98	PK	21.3	-31.9	27.38	40.00	-12.62	0-360	100	V
6	50.995	51.20	PK	7.6	-31.7	27.10	40.00	-12.90	0-360	100	V
7	101.910	43.91	PK	10.9	-31.4	23.41	43.52	-20.11	0-360	100	V
8	835.000	33.59	PK	21.8	-28.8	26.59	46.02	-19.43	0-360	100	V

PK - Peak detector

A1638

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



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	87.800	42.51	PK	7.5	-31.4	18.61	40.00	-21.39	0-360	202	H
2	* 135.4425	41.42	PK	13.3	-31.2	23.52	43.52	-20.00	0-360	202	H
3	37.4375	44.48	PK	16.0	-31.8	28.68	40.00	-11.32	0-360	100	V
4	42.325	47.45	PK	12.3	-31.8	27.95	40.00	-12.05	0-360	100	V
5	191.925	47.44	PK	11.3	-30.9	27.84	43.52	-15.68	0-360	100	V
6	441.100	41.32	PK	16.6	-29.9	28.02	46.02	-18.00	0-360	100	H
7	798.800	36.86	PK	21.3	-29.0	29.16	46.02	-16.86	0-360	99	V

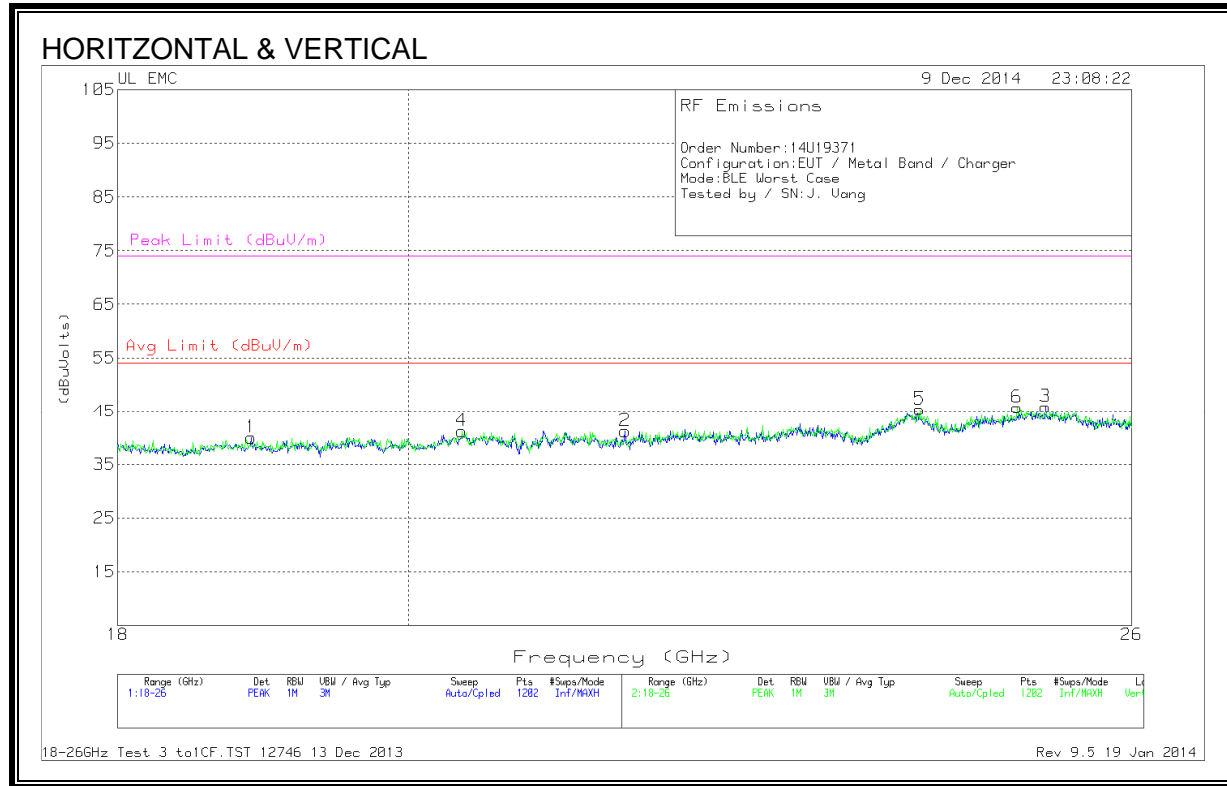
* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK - Peak detector

10.6. WORST-CASE ABOVE 18 GHz

A1554 ANTENNA 1

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



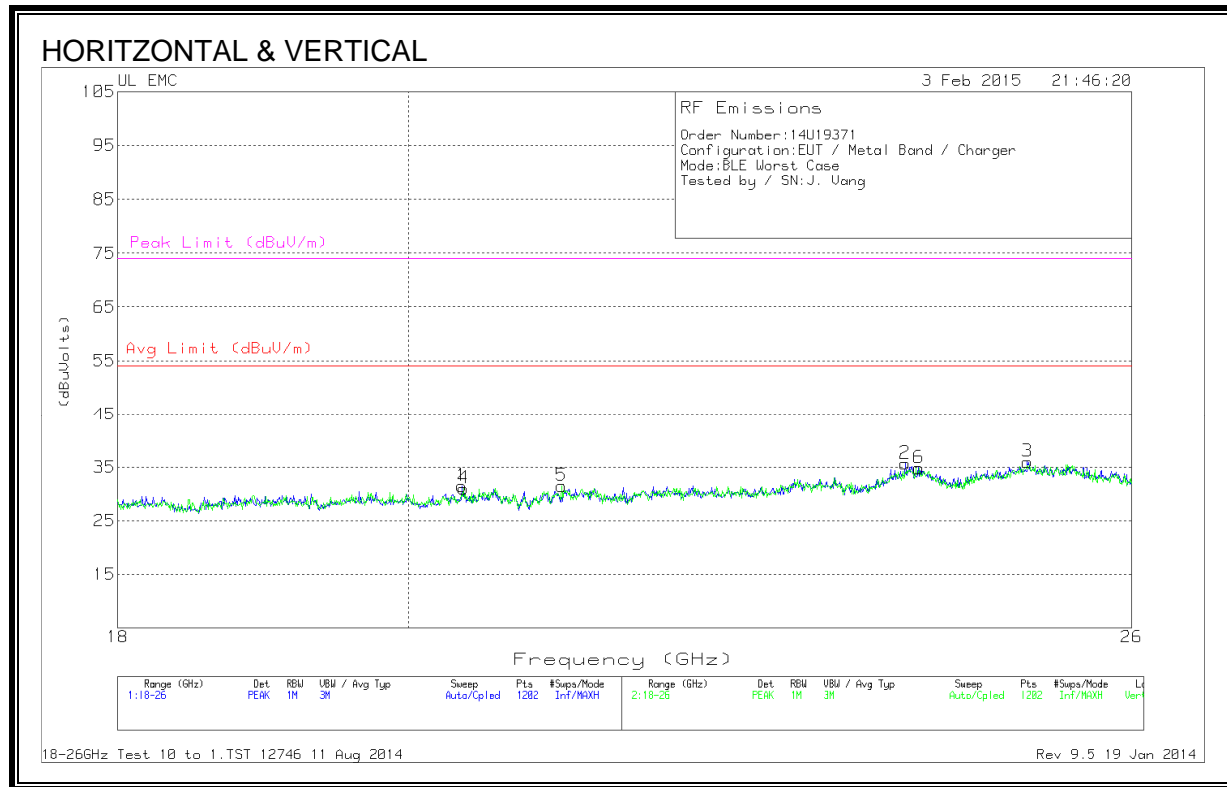
HORIZONTAL & VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T125 (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	18.893	41.40	PK	32.6	-24.5	-9.5	40.00	54	-14.00	74	-34
2	21.637	40.97	PK	33.2	-23.5	-9.5	41.16	54	-12.83	74	-32.83
3	25.201	44.03	PK	34.2	-22.9	-9.5	45.83	54	-8.16	74	-28.16
4	20.391	41.47	PK	33	-23.8	-9.5	41.16	54	-12.83	74	-32.83
5	24.075	43.63	PK	33.9	-22.7	-9.5	45.33	54	-8.66	74	-28.66
6	24.941	43.67	PK	34.1	-22.6	-9.5	45.66	54	-8.33	74	-28.33

PK - Peak detector

A1554 ANTENNA 2

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



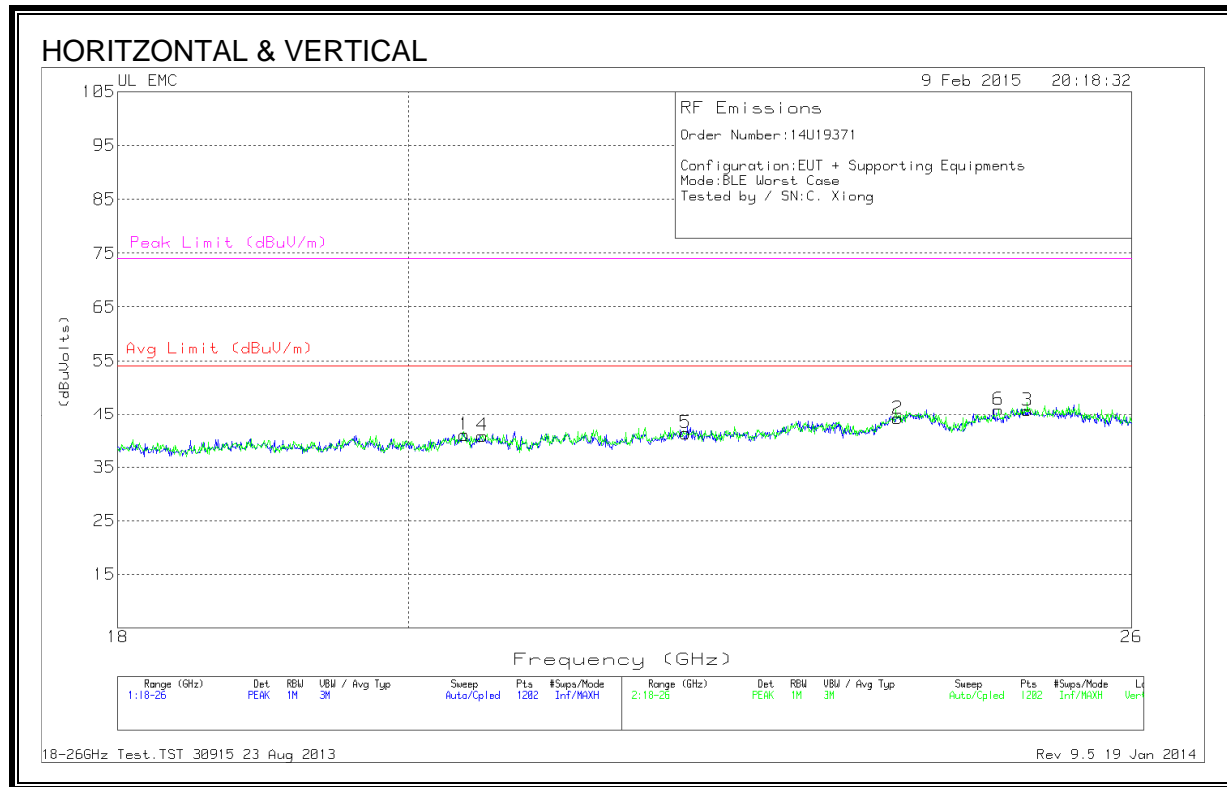
HORIZONTAL & VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	20.391	42.40	PK	32.9	-23.8	-20	31.50	54	-22.50	74	-42.50
2	23.948	44.27	PK	34.2	-22.8	-20	35.66	54	-18.33	74	-38.33
3	25.034	44.30	PK	34.5	-22.8	-20	36.00	54	-18.00	74	-38.00
4	20.405	41.70	PK	32.9	-23.6	-20	31.00	54	-23.00	74	-43.00
5	21.144	42.60	PK	33.3	-24.4	-20	31.50	54	-22.50	74	-42.50
6	24.068	43.23	PK	34.2	-22.6	-20	34.83	54	-19.16	74	-39.16

PK - Peak detector

A1638

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



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	20.411	41.20	PK	32.9	-23.6	-9.5	41.00	54	-13.00	74	-33.00
2	23.885	42.17	PK	34.2	-22.7	-9.5	44.16	54	-9.83	74	-29.83
3	25.034	43.47	PK	34.5	-22.8	-9.5	45.66	54	-8.33	74	-28.33
4	20.545	41.13	PK	33.0	-23.8	-9.5	40.83	54	-13.16	74	-33.16
5	22.117	40.73	PK	33.7	-23.6	-9.5	41.33	54	-12.66	74	-32.66
6	24.774	43.53	PK	34.5	-22.7	-9.5	45.83	54	-8.166	74	-28.16

PK - Peak detector

11. 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

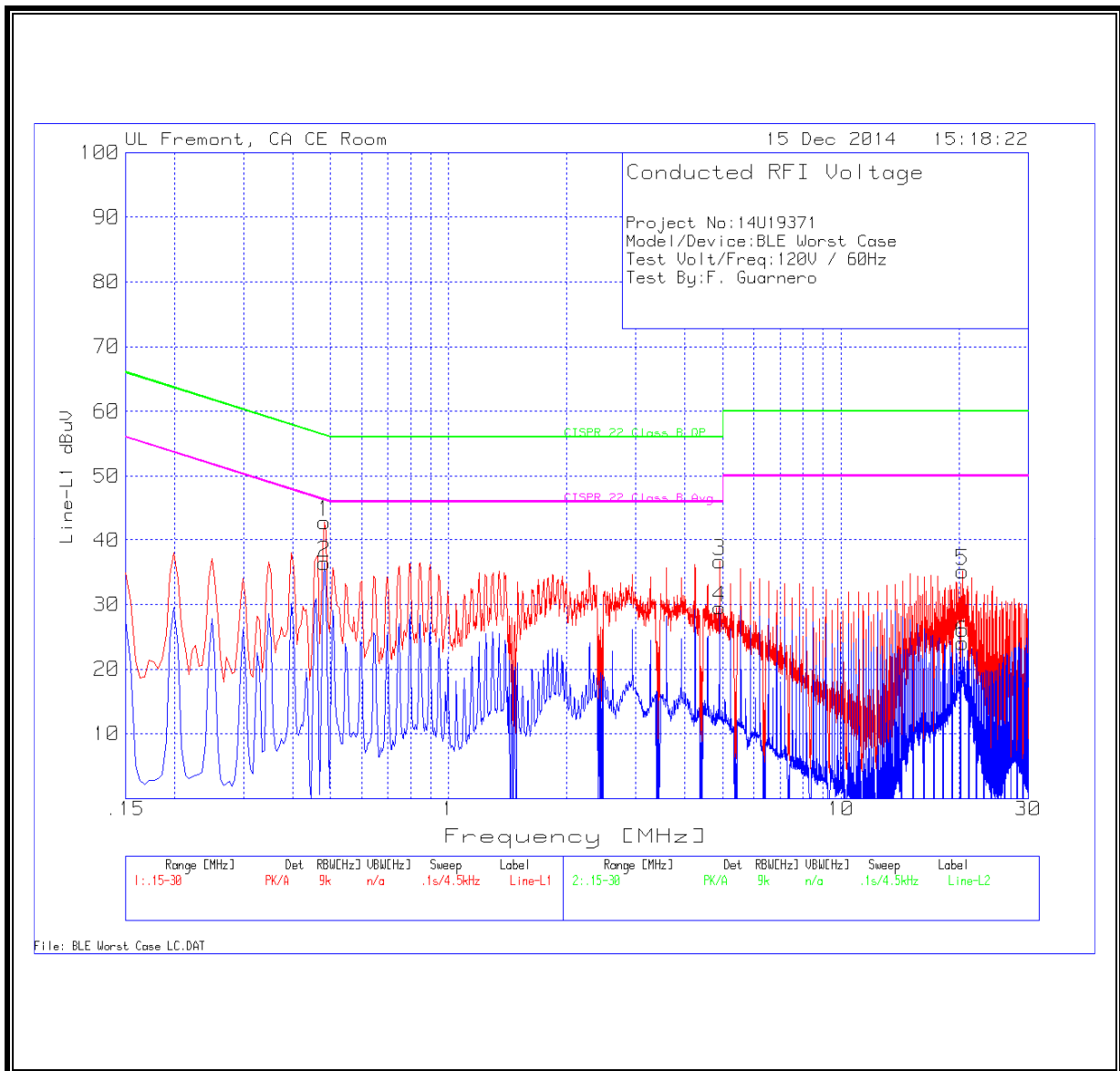
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4-2009

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

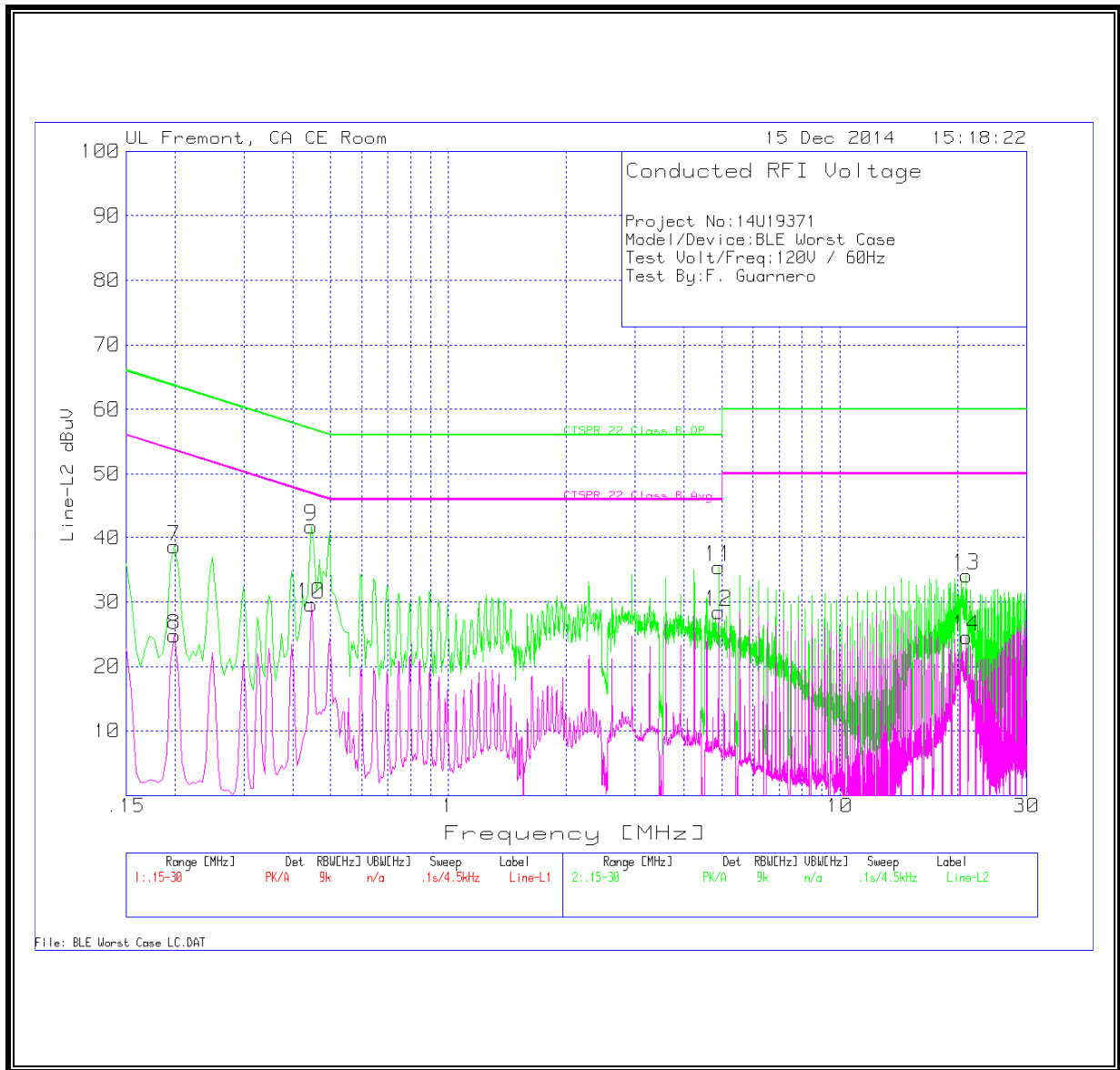
Line conducted data is recorded for both NEUTRAL and HOT lines.

11.1. AC POWER LINE CONDUCTED EMISSIONS A1554 ANTENNA 1

LINE 1 PLOT



LINE 2 PLOT



WORST EMISSIONS DATA

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.483	42.54	PK	.4	0	42.94	56.3	-13.36	-	-
2	.483	36.06	Av	.4	0	36.46	-	-	46.3	-9.84
3	4.8975	36.42	PK	.2	.1	36.72	56	-19.28	-	-
4	4.8975	29.24	Av	.2	.1	29.54	-	-	46	-16.46
5	20.409	34.63	PK	.3	.2	35.13	60	-24.87	-	-
6	20.409	23.52	Av	.3	.2	24.02	-	-	50	-25.98

Line-L2 .15 - 30MHz

Trace Markers

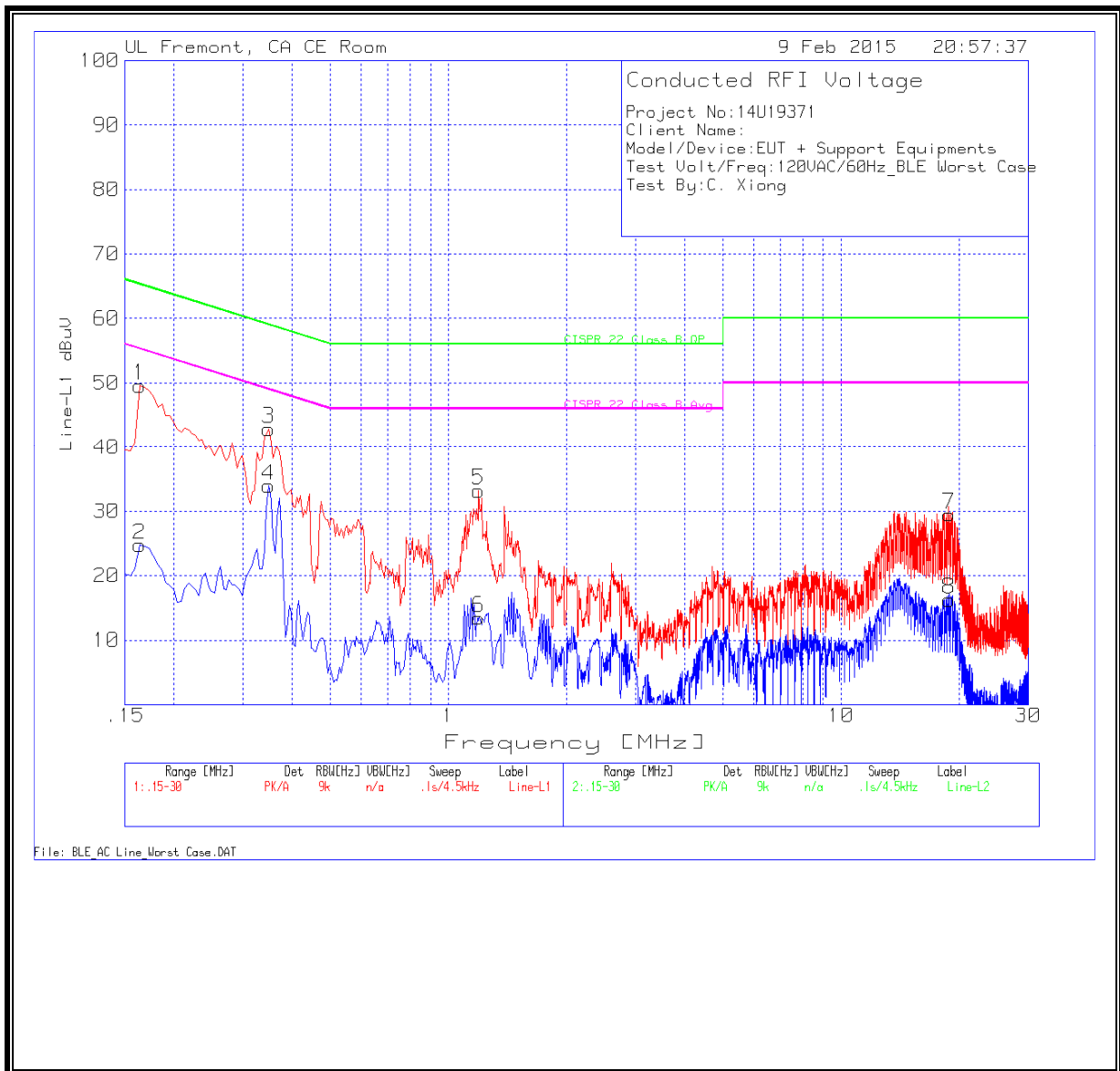
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	.1995	37.64	PK	1	0	38.64	63.6	-24.96	-	-
8	.1995	23.78	Av	1	0	24.78	-	-	53.6	-28.82
9	.447	41.48	PK	.4	0	41.88	56.9	-15.02	-	-
10	.447	29.17	Av	.4	0	29.57	-	-	46.9	-17.33
11	4.8975	35.08	PK	.2	.1	35.38	56	-20.62	-	-
12	4.8975	28.16	Av	.2	.1	28.46	-	-	46	-17.54
13	21.0615	33.61	PK	.3	.2	34.11	60	-25.89	-	-
14	21.0615	24.1	Av	.3	.2	24.6	-	-	50	-25.4

PK - Peak detector

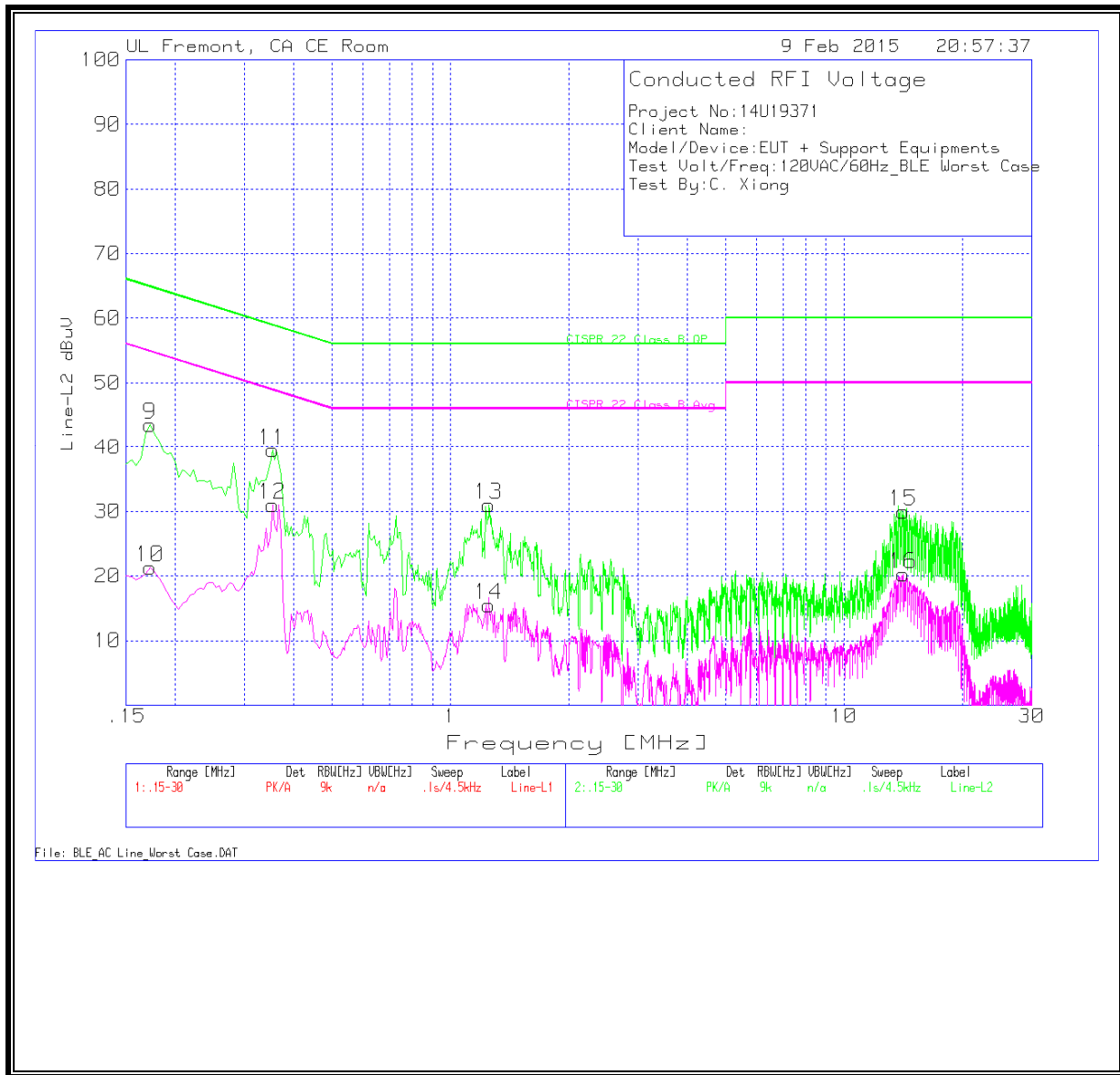
Av - average detection

11.2. AC POWER LINE CONDUCTED EMISSIONS A1638

LINE 1 PLOT



LINE 2 PLOT



WORST EMISSIONS DATA

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.1635	48.4	PK	1.2	0	49.6	65.3	-15.7	-	-
2	.1635	23.54	Av	1.2	0	24.74	-	-	55.3	-30.56
3	.348	42.38	PK	.5	0	42.88	59	-16.12	-	-
4	.348	33.41	Av	.5	0	33.91	-	-	49	-15.09
5	1.194	32.9	PK	.2	.1	33.2	56	-22.8	-	-
6	1.194	13.19	Av	.2	.1	13.49	-	-	46	-32.51
7	18.879	29.01	PK	.3	.2	29.51	60	-30.49	-	-
8	18.879	15.79	Av	.3	.2	16.29	-	-	50	-33.71

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
9	.1725	42.37	PK	1.2	0	43.57	64.8	-21.23	-	-
10	.1725	20.14	Av	1.2	0	21.34	-	-	54.8	-33.46
11	.3525	39.02	PK	.5	0	39.52	58.9	-19.38	-	-
12	.3525	30.48	Av	.5	0	30.98	-	-	48.9	-17.92
13	1.2525	30.8	PK	.2	0	31	56	-25	-	-
14	1.2525	15.29	Av	.2	0	15.49	-	-	46	-30.51
15	14.1495	29.57	PK	.2	.2	29.97	60	-30.03	-	-
16	14.1495	19.83	Av	.2	.2	20.23	-	-	50	-29.77

PK - Peak detector

Av - average detection