FCC 47 CFR 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-E1, 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

Rev.	Issue Date	Revisions	Revised By
--	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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TABLE OF CONTENTS

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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**Error! Reference source not found.**

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

DATE TESTED: NOVEMBER 24 – 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 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:

CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:

MONA HUA
EMC ENGINEER
UL VERIFICATION SERVICES INC.

This report shall not be reproduced except in full, without the written approval of 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
☐ Chamber A	☒ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☐ Chamber F
	☐ Chamber G
	☐ 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:

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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%.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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

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.

Worst-case data rates were:

GFSK mode: DH5
8PSK mode: 3-DH5

DQPSK mode has been verified to have the lowest power.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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

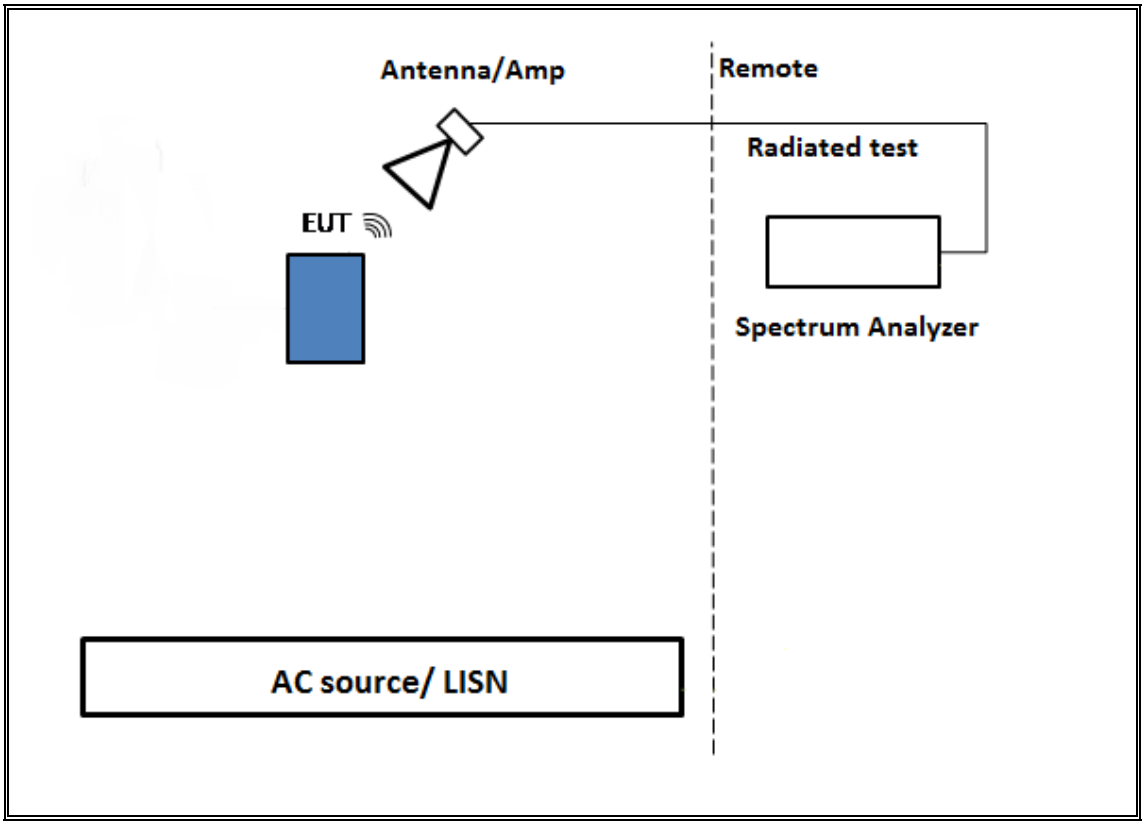
I/O CABLES (BELOW 1G RADIATED AND AC POWERLINE CONDUCTED TEST)

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TEST SETUP- RADIATED ABOVE 1 GHz

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

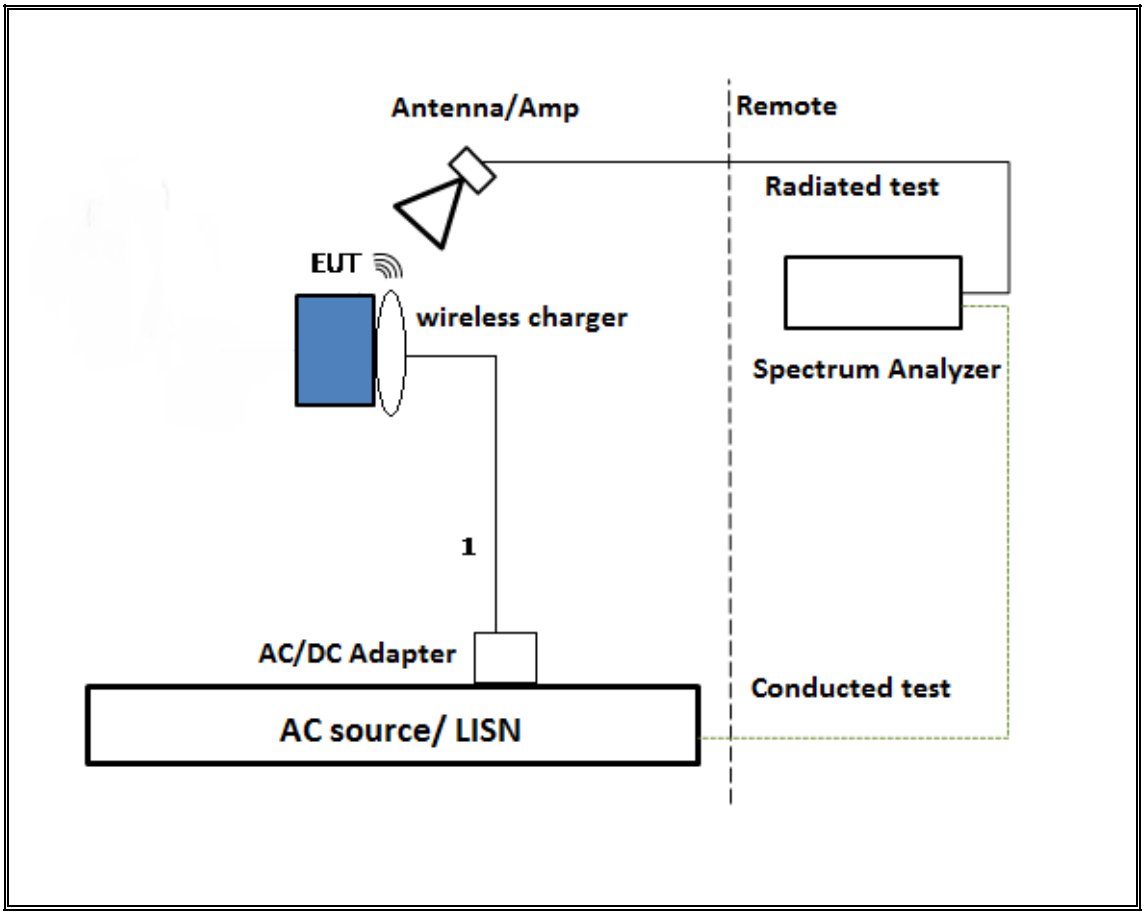


This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

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

SETUP DIAGRAM



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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 Numbe**	**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
PXA Signal Analyzer 3Hz to 44GHz	Agilent	N9030A	T340	03/11/15
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-50/250-2	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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

7. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

DUTY CYCLE DATA A1554 ANTENNA 1

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
Bluetooth GFSK	1.000	1.000	1.000	100.00%	0.00	0.010
Bluetooth 8PSK	1.000	1.000	1.000	100.00%	0.00	0.010

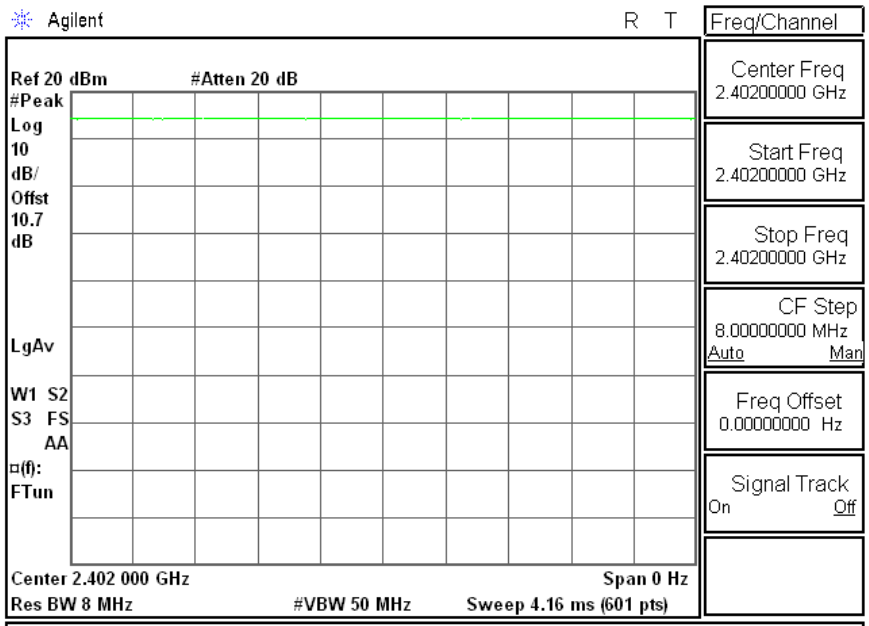
DUTY CYCLE DATA A1638 ANTENNA 1

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF with A1489)						
Bluetooth GFSK	2.888	3.752	0.770	76.97%	1.14	0.346
Bluetooth 8PSK	2.890	3.750	0.771	77.07%	1.13	0.346

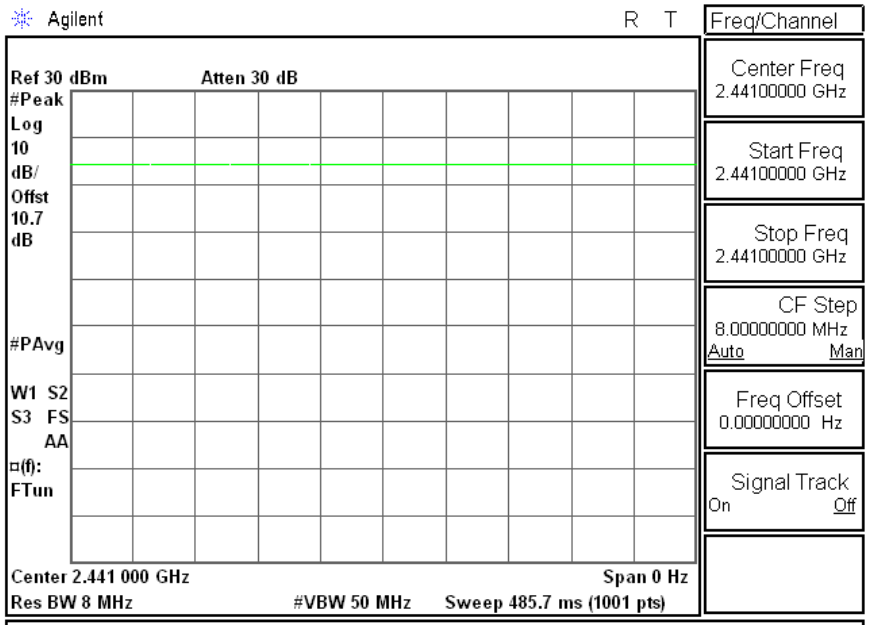
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DUTY CYCLE PLOTS A1554 ANTENNA 1

DUTY CYCLE GFSK MODE



DUTY CYCLE 8PSK MODE

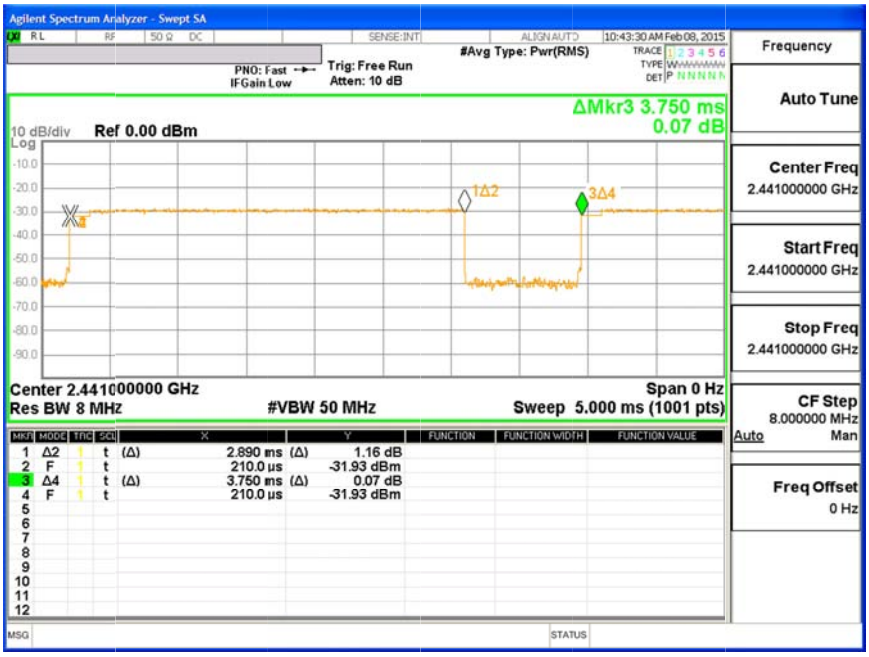


This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DUTY CYCLE PLOTS A1638 ANTENNA 1

DUTY CYCLE GFSK MODE

DUTY CYCLE 8PSK MODE



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8. ANTENNA PORT TEST RESULTS

Model A1554 and model A1638 are using identical electrical design as A1553. For all antenna port results, refer the Bluetooth test report that has done by UL Verification Services Inc. The report and FCC ID numbers are 14U19383-E1C and BCG-E2870 respectively.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9. RADIATED TEST RESULTS

9.1. LIMITS

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 10 Hz for average measurements.

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.

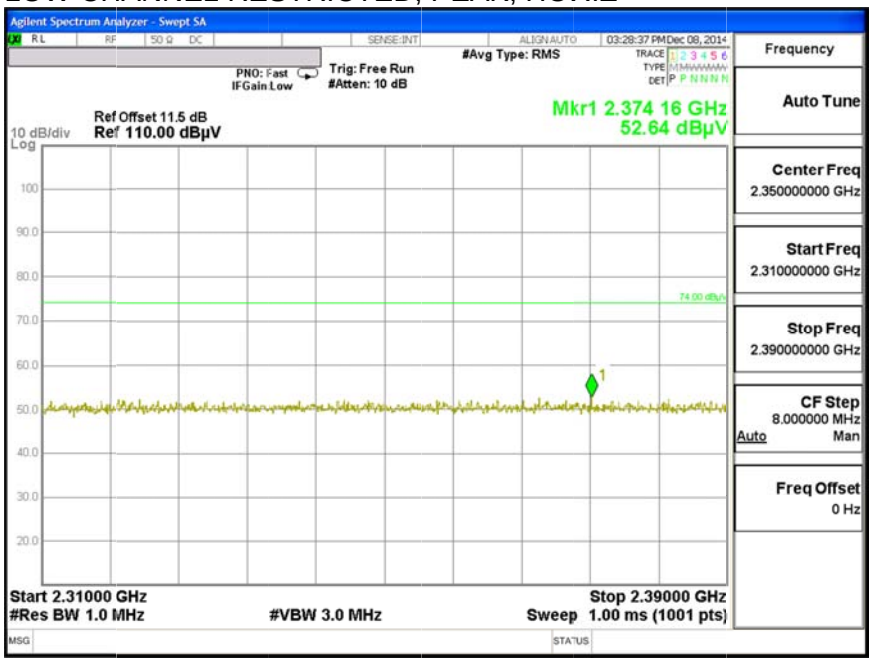
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.2. TRANSMITTER ABOVE 1 GHz A1554 ANTENNA 1

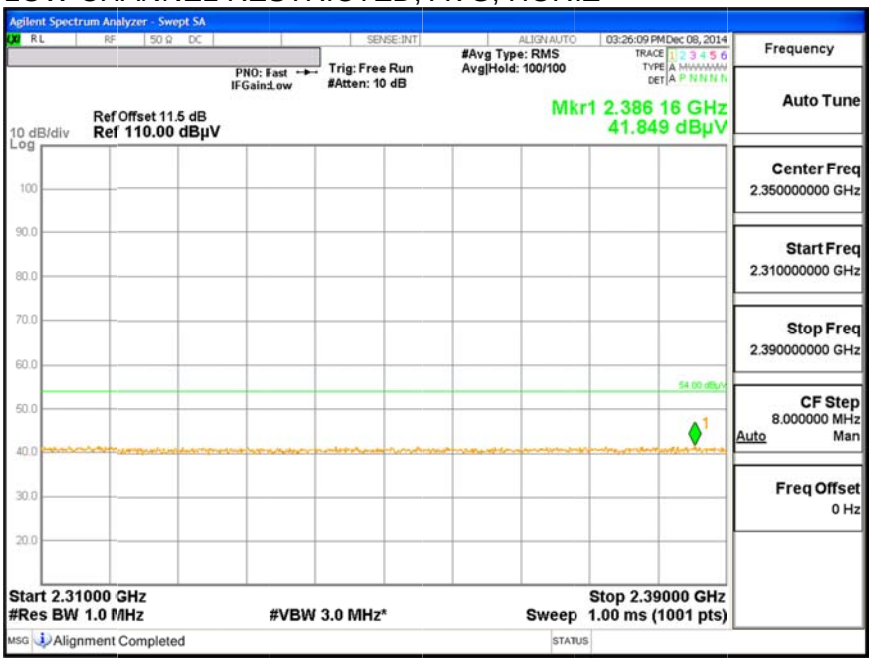
9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ



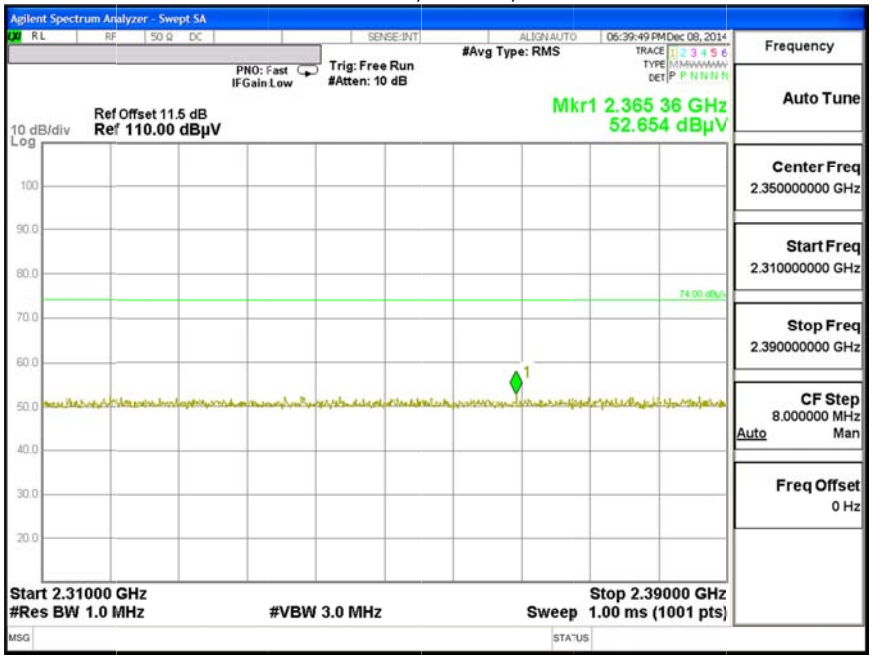
LOW CHANNEL RESTRICTED, AVG, HORIZ



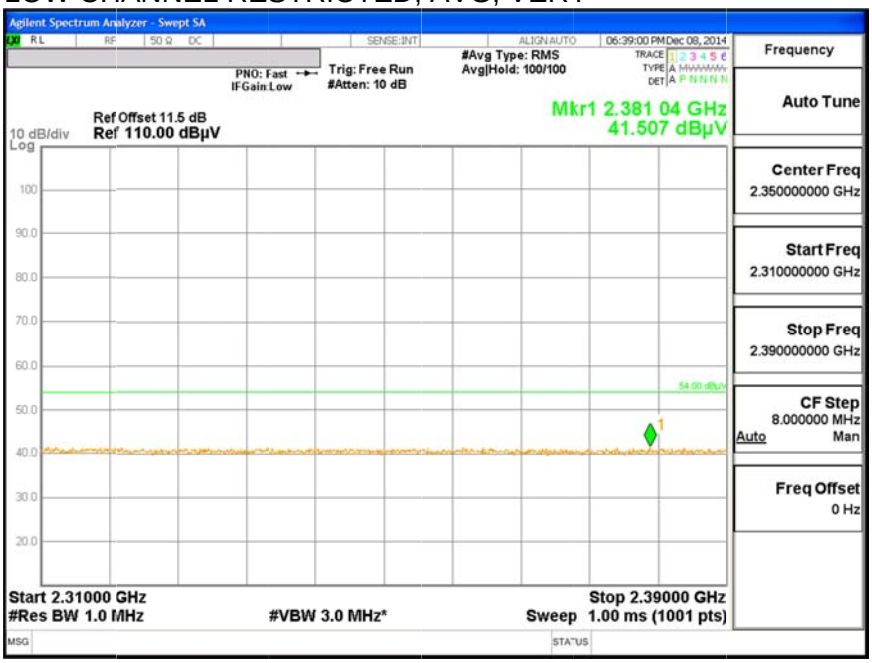
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



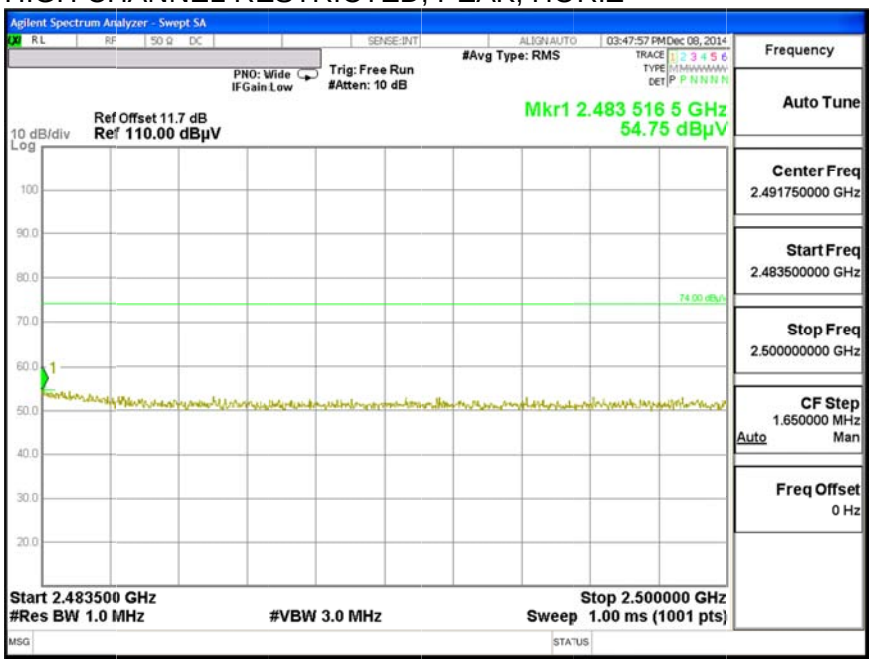
LOW CHANNEL RESTRICTED, AVG, VERT



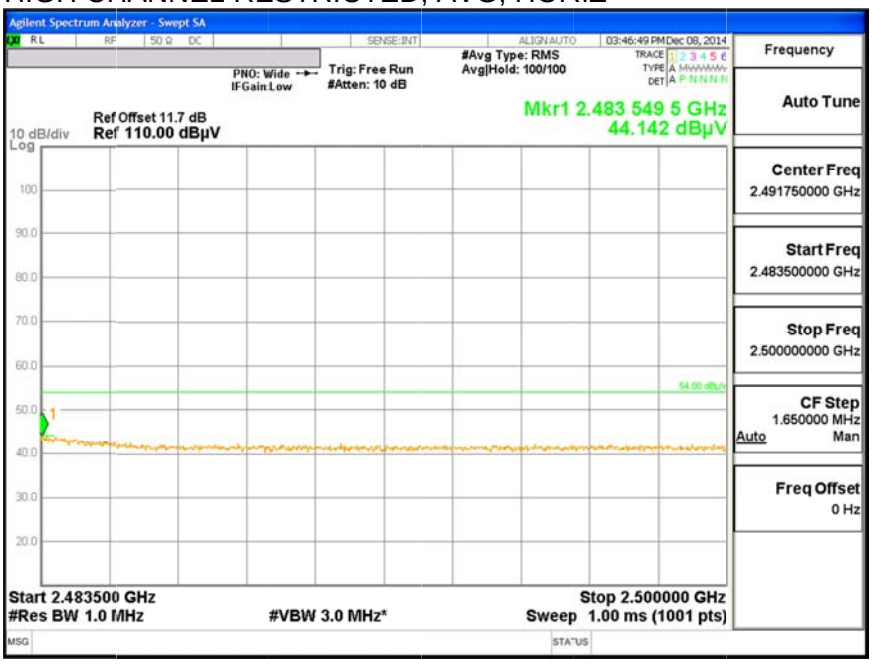
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



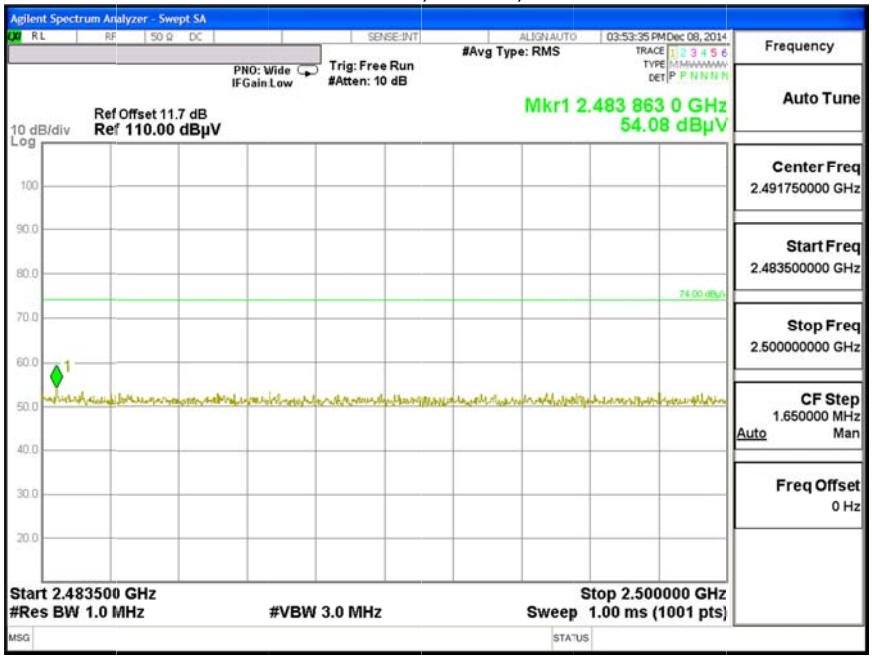
HIGH CHANNEL RESTRICTED, AVG, HORIZ



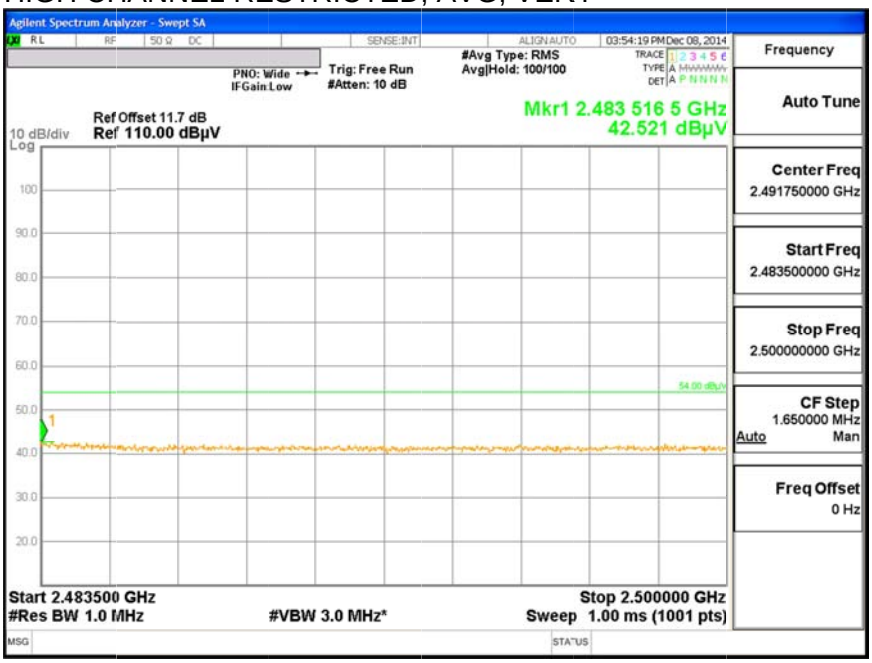
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



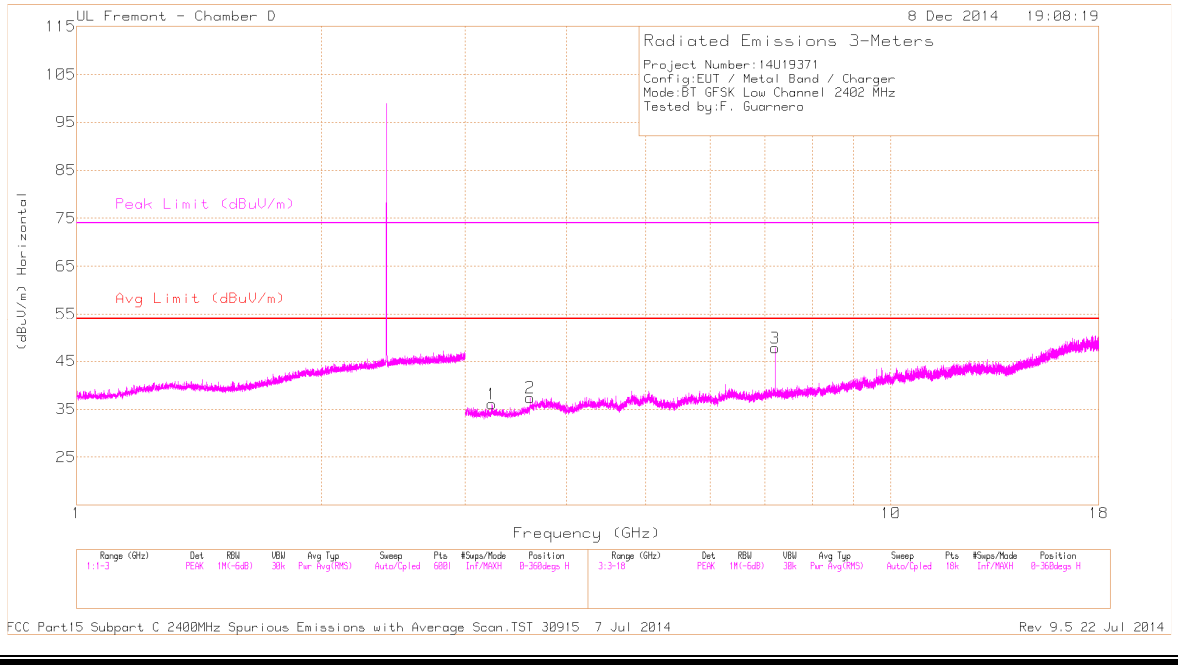
HIGH CHANNEL RESTRICTED, AVG, VERT



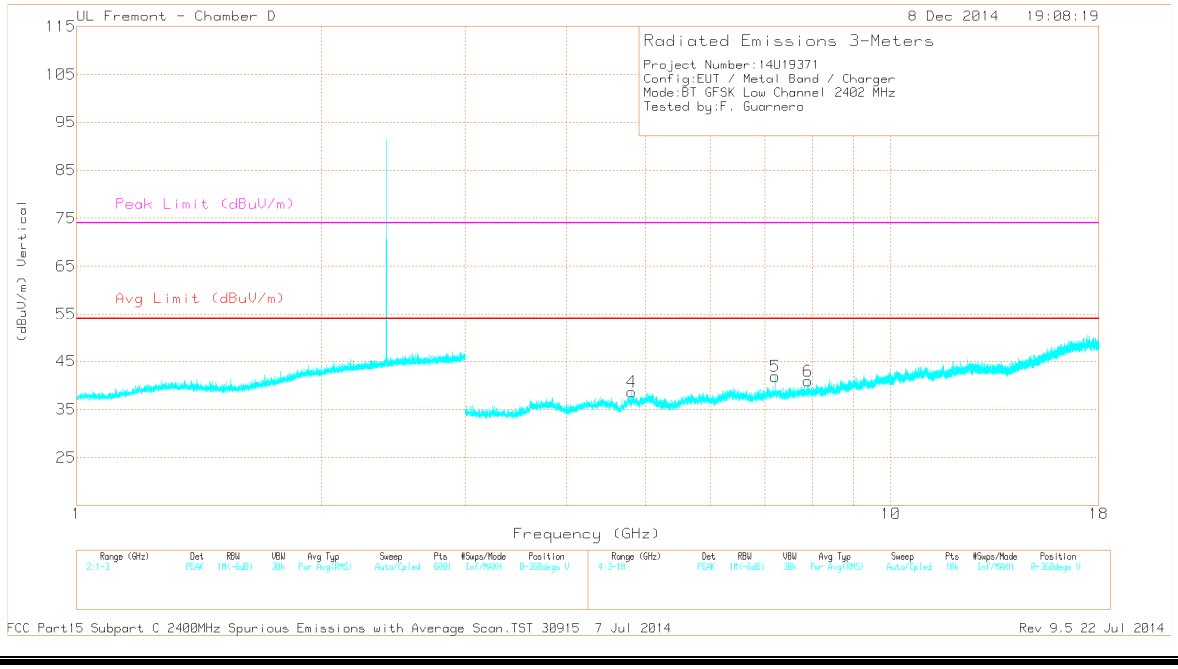
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.235	38.59	PK3	32.7	-28.4	42.89	-	-	-	-	95	180	H
2	* 3.603	37.7	PK3	33.5	-28.3	42.90	-	-	74	-31.10	20	202	H
	* 3.603	25.48	VB10	33.5	-28.3	30.68	54	-23.32	-	-	20	202	H
3	7.205	41.65	PK3	35.7	-24.8	52.55	-	-	-	-	337	159	H
4	* 4.804	39.39	PK3	34.2	-26.9	46.69	-	-	74	-27.31	98	308	V
	* 4.804	29.07	VB10	34.2	-26.9	36.37	54	-17.63	-	-	98	308	V
5	7.206	38.76	PK3	35.7	-24.8	49.66	-	-	-	-	124	260	V
6	7.908	35.85	PK3	35.8	-24.2	47.45	-	-	-	-	84	218	V

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

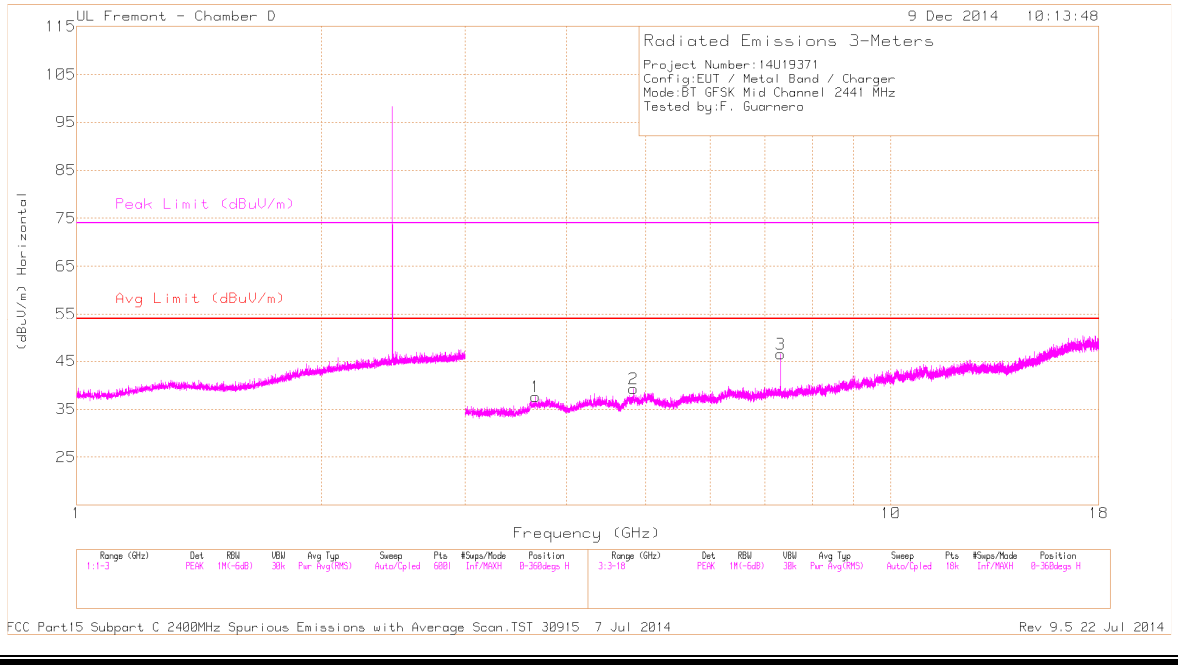
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

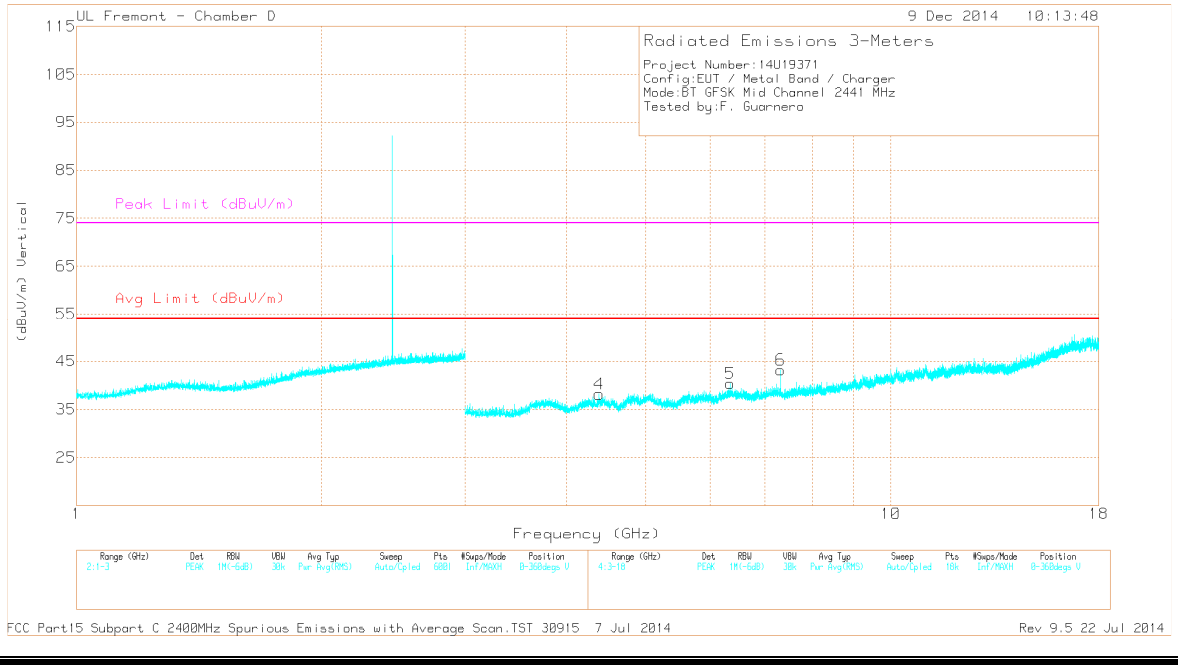
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.658	38.75	PK3	33.3	-28.9	43.15	-	-	74	-30.85	360	167	H
	* 3.661	25.87	VB10	33.3	-28.9	30.27	54	-23.73	-	-	360	167	H
2	* 4.833	38.32	PK3	34.2	-27.3	45.22	-	-	74	-28.78	115	251	H
	* 4.832	25.32	VB10	34.2	-27.3	32.22	54	-21.78	-	-	115	251	H
3	* 7.323	41.35	PK3	35.7	-24.9	52.15	-	-	74	-21.85	345	168	H
	* 7.323	35.19	VB10	35.7	-24.9	45.99	54	-8.01	-	-	345	168	H
4	* 4.383	38.20	PK3	33.9	-28.2	43.90	-	-	74	-30.10	142	290	V
	* 4.384	25.40	VB10	33.9	-28.2	31.10	54	-22.90	-	-	142	290	V
5	6.351	36.62	PK3	35.6	-25.8	46.42	-	-	-	-	138	302	V
6	* 7.323	40.67	PK3	35.7	-24.9	51.47	-	-	74	-22.53	133	291	V
	* 7.323	32.02	VB10	35.7	-24.9	42.82	54	-11.18	-	-	133	291	V

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

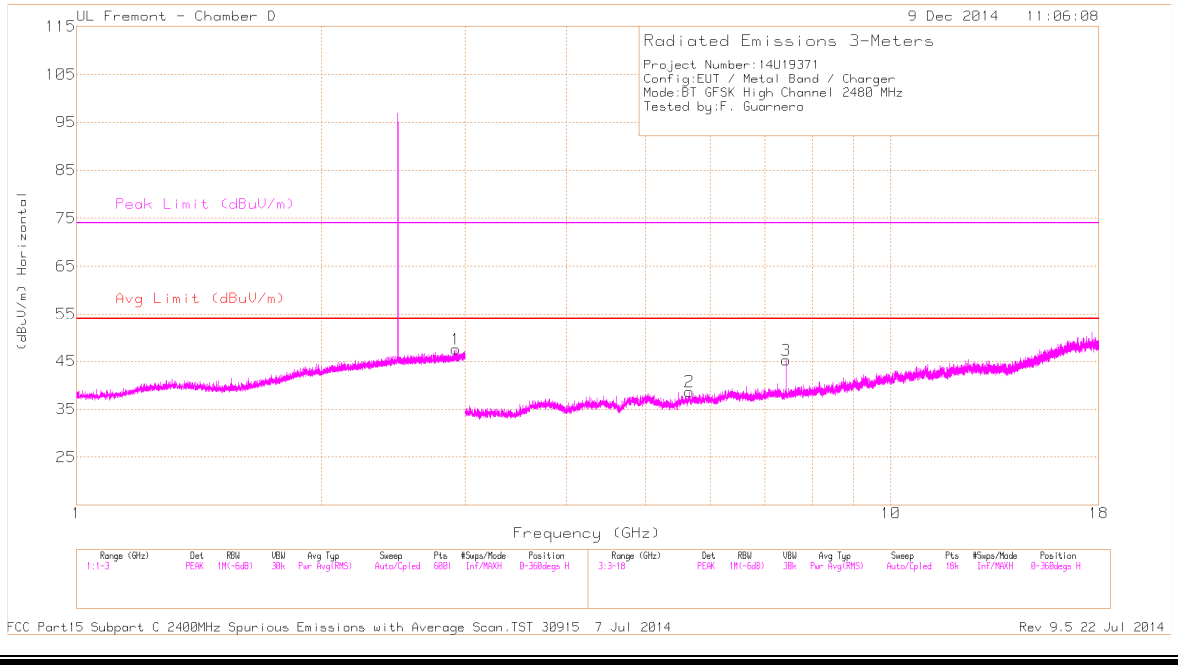
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

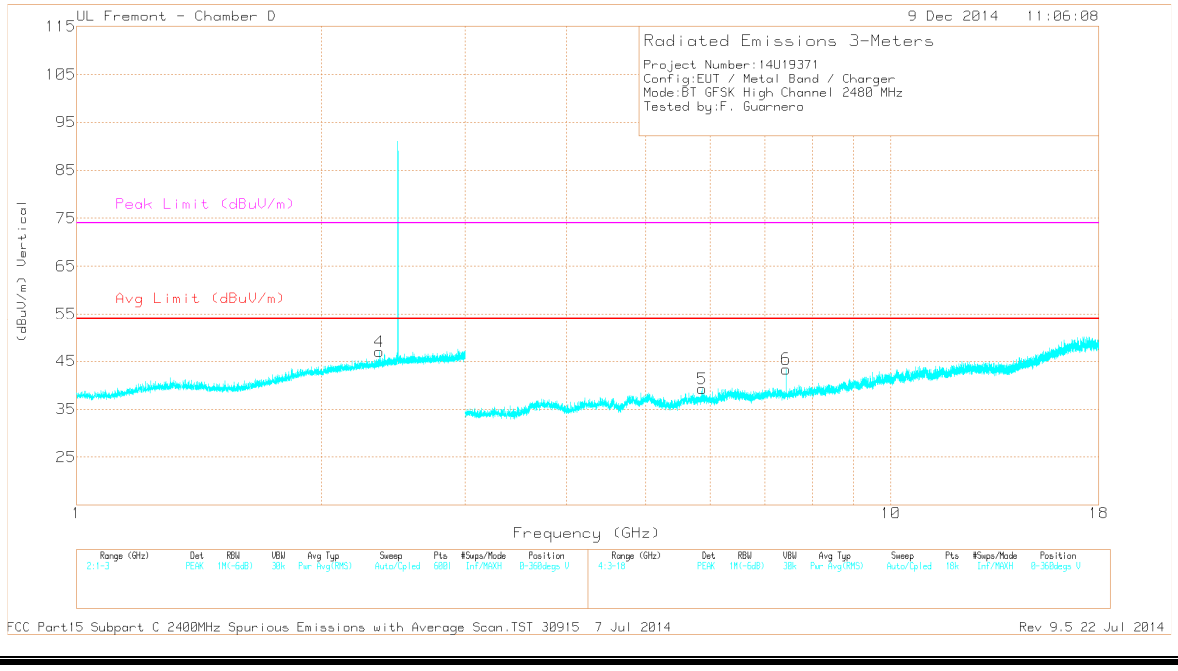
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.925	42.34	PK3	32.6	-20.1	54.84	-	-	-	-	279	203	H
2	5.659	37.58	PK3	34.6	-26.4	45.78	-	-	-	-	278	201	H
3	* 7.439	40.21	PK3	35.6	-24.8	51.01	-	-	74	-22.99	289	203	H
	* 7.440	33.41	VB10	35.6	-24.8	44.21	54	-9.79	-	-	289	203	H
4	* 2.353	41.99	PK3	32.0	-20.7	53.29	-	-	74	-20.71	290	318	V
	* 2.353	28.45	VB10	32.0	-20.7	39.75	54	-14.25	-	-	290	318	V
5	5.862	38.11	PK3	35.0	-26.9	46.21	-	-	-	-	291	320	V
6	* 7.440	39.47	PK3	35.6	-24.8	50.27	-	-	74	-23.73	277	323	V
	* 7.440	32.01	VB10	35.6	-24.8	42.81	54	-11.19	-	-	277	323	V

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

PK3 - FHSS Method: Maximum Peak

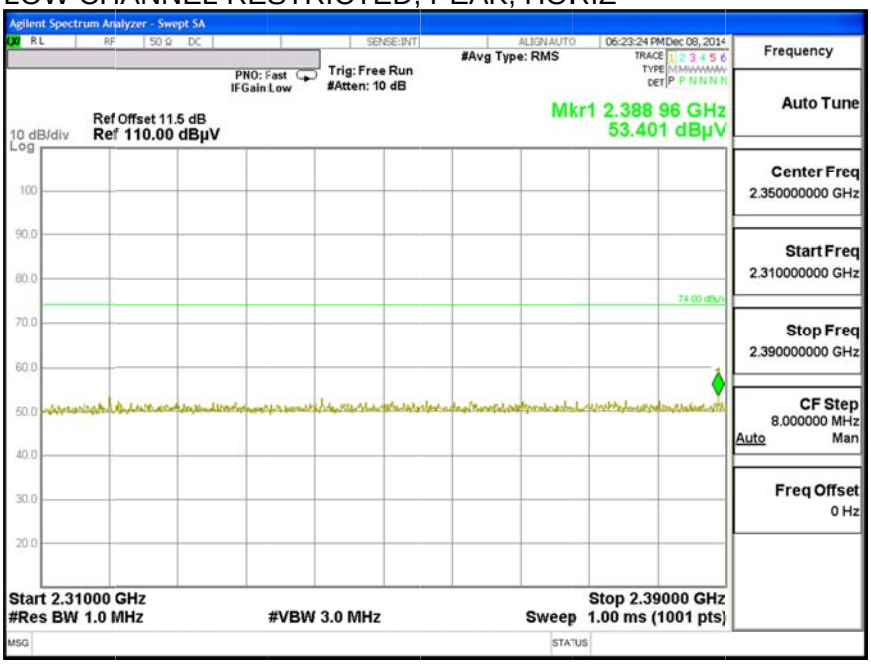
VB10Hz - FHSS Method: 10Hz Video Bandwidth

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

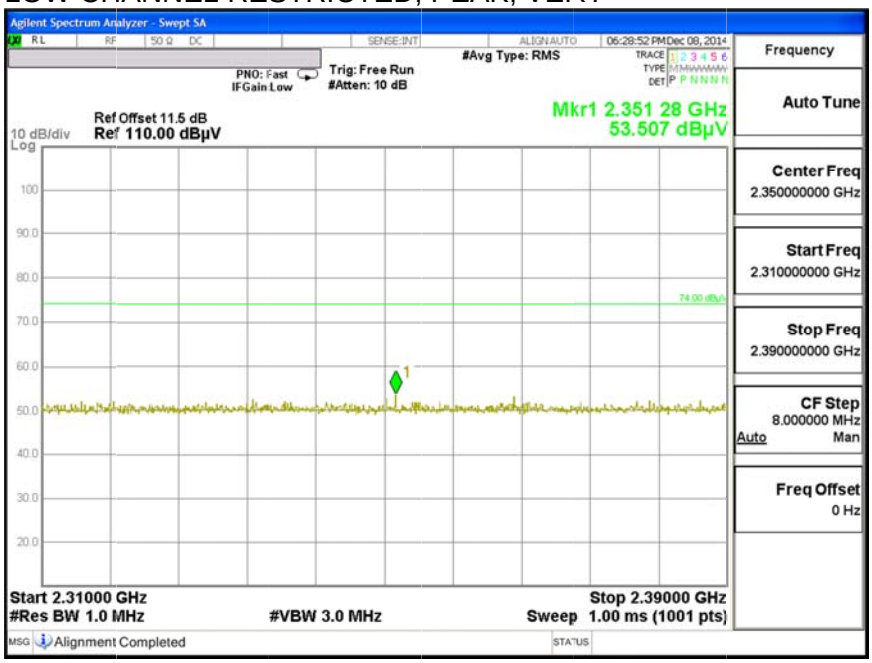


LOW CHANNEL RESTRICTED, AVG, HORIZ

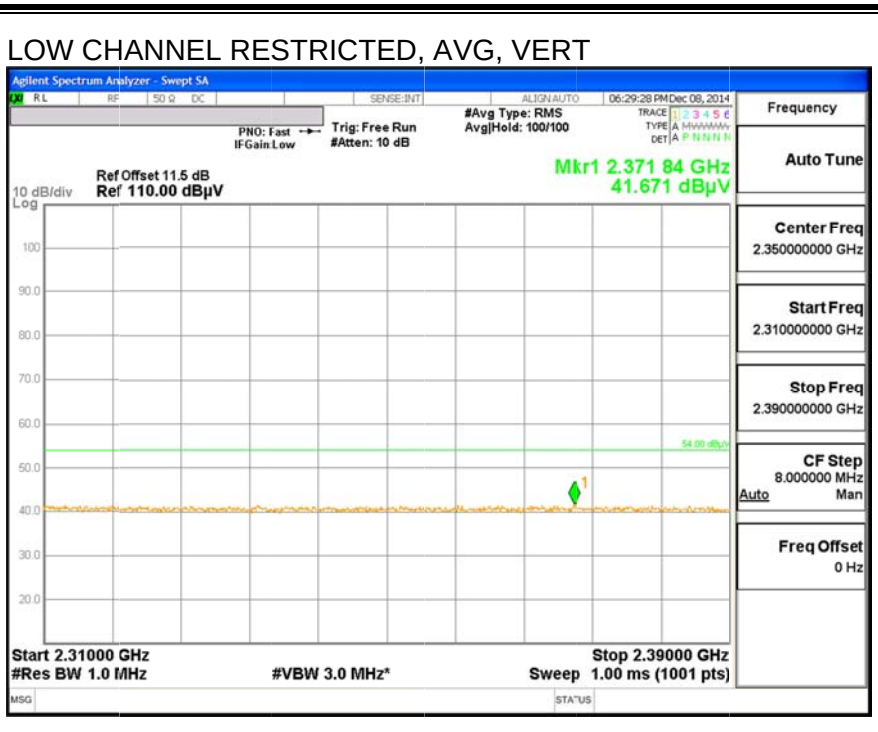
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



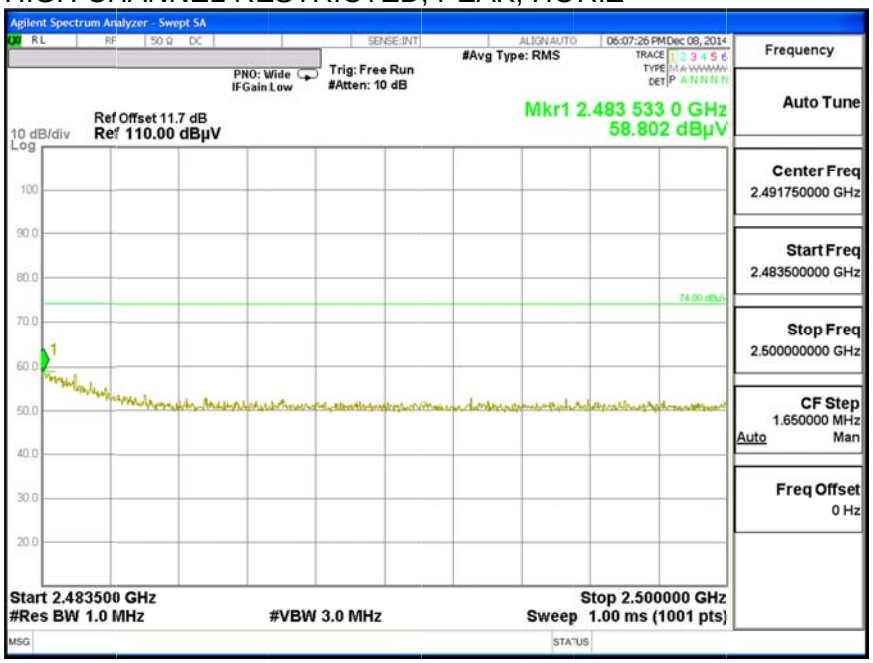
LOW CHANNEL RESTRICTED, AVG, VERT



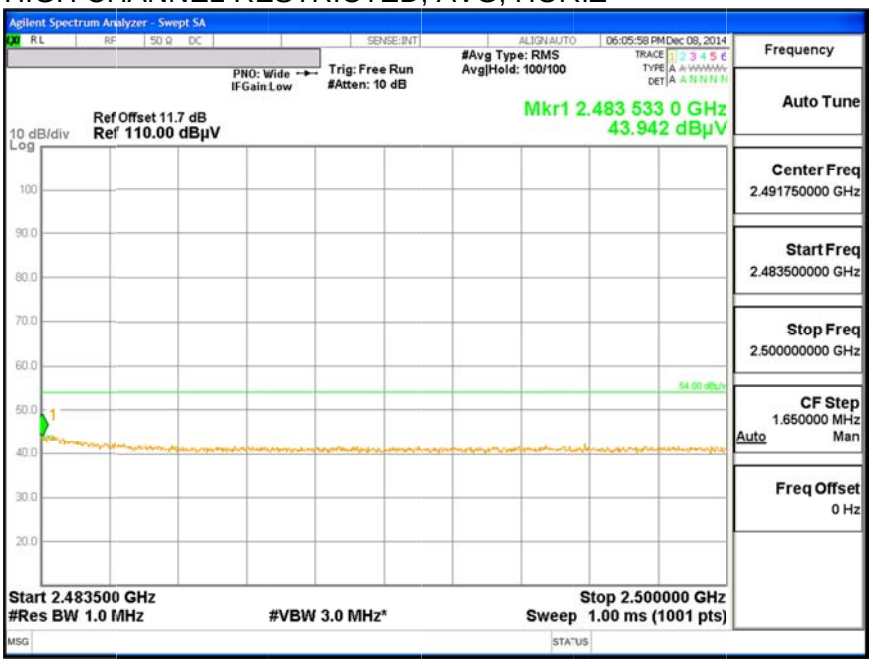
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



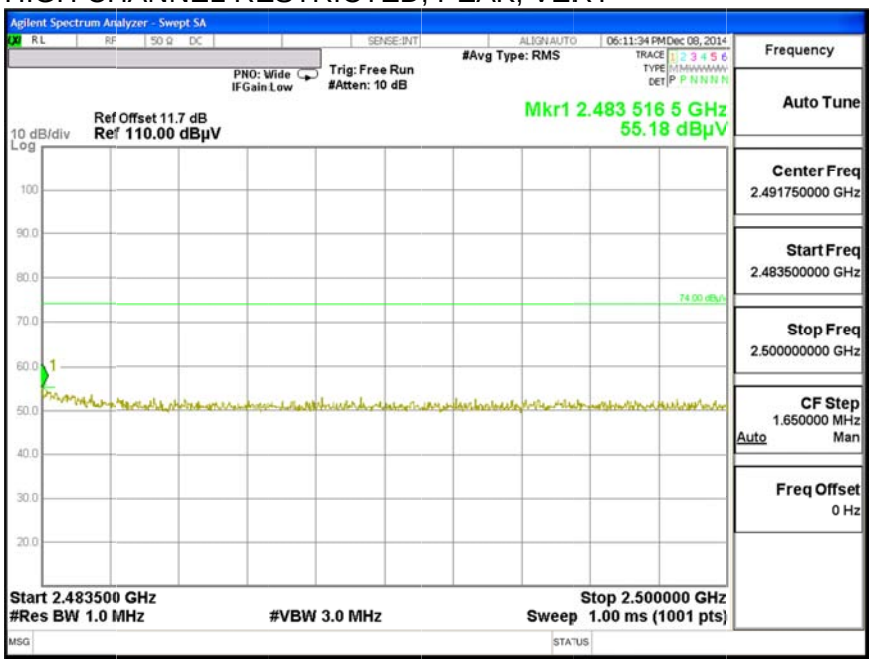
HIGH CHANNEL RESTRICTED, AVG, HORIZ



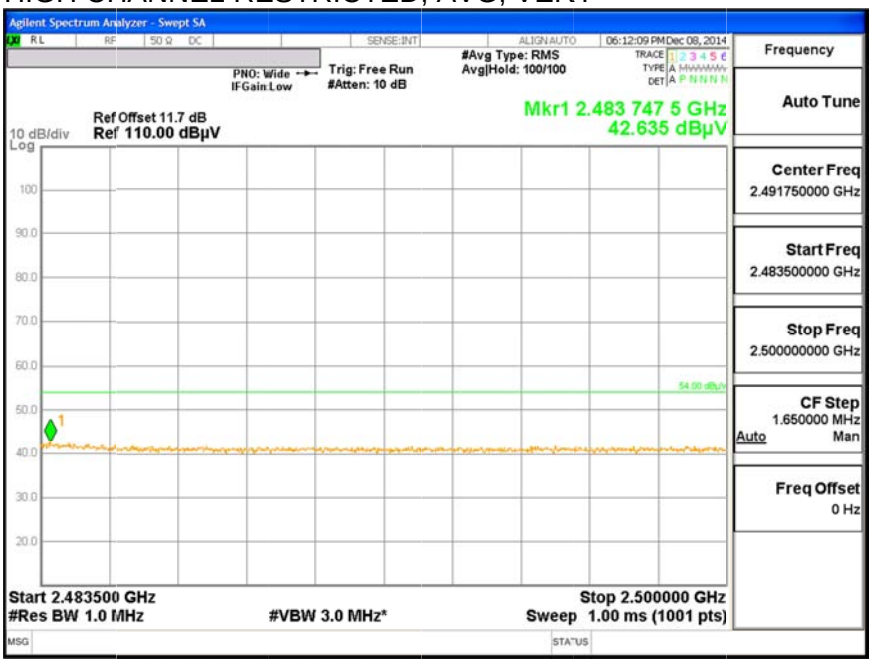
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



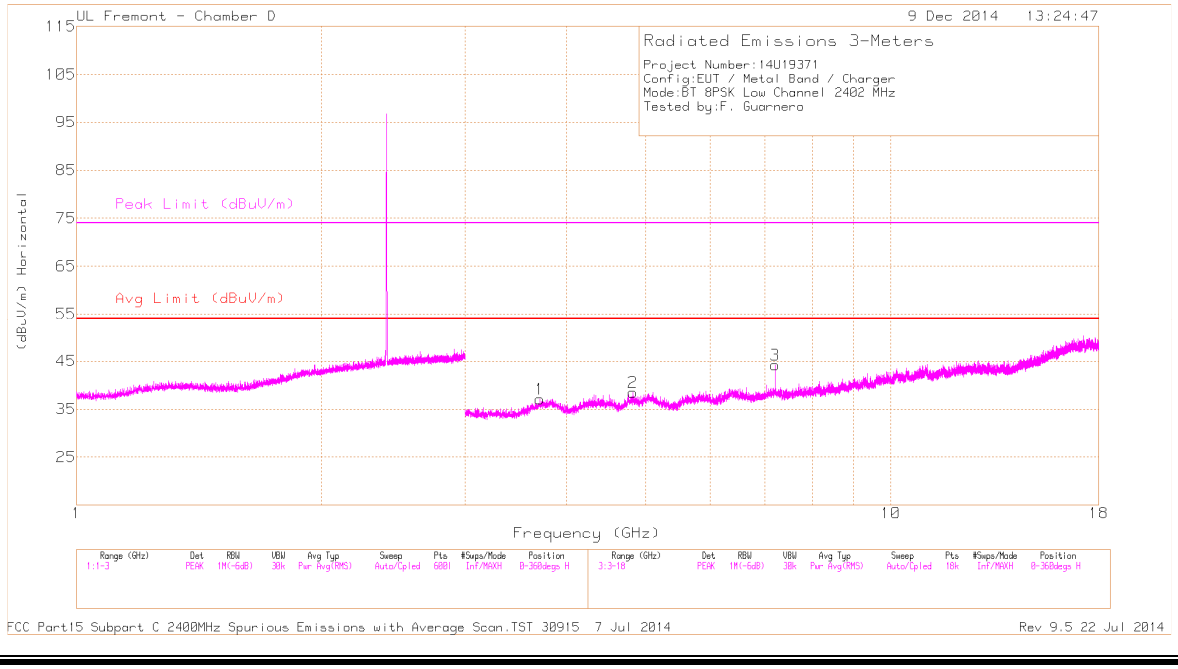
HIGH CHANNEL RESTRICTED, AVG, VERT



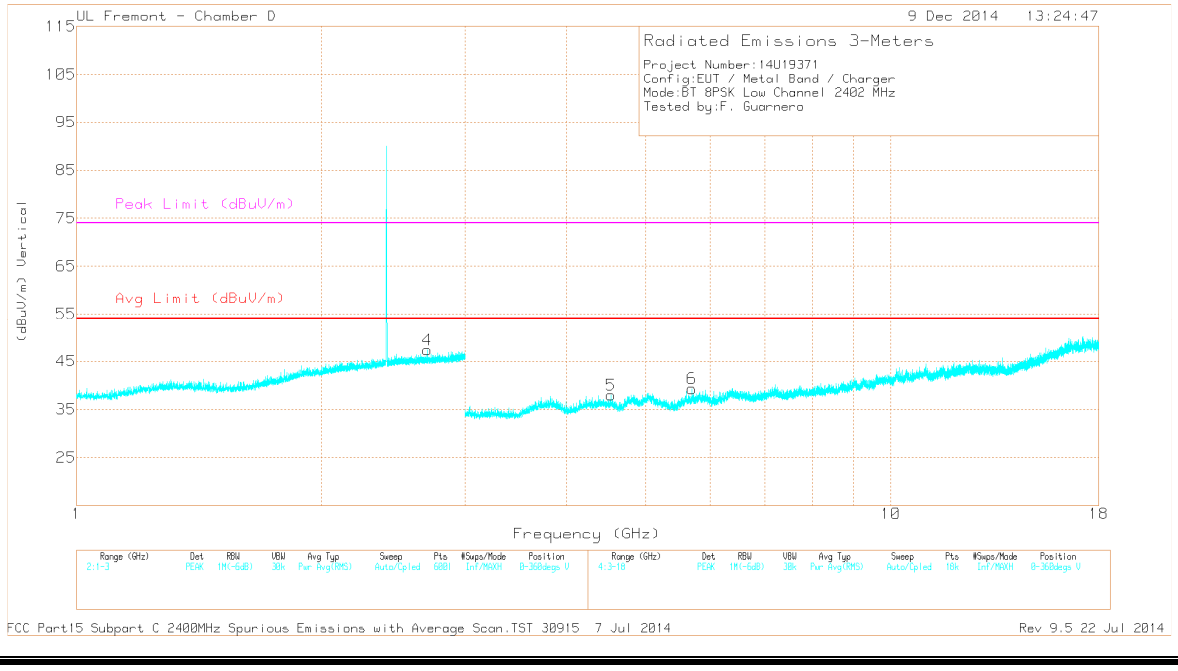
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.707	38.21	PK3	33.2	-28.7	42.71	-	-	74	-31.29	324	170	H
	* 3.706	25.67	VB10	33.2	-28.7	30.17	54	-23.83	-	-	324	170	H
2	* 4.826	37.89	PK3	34.2	-27.2	44.89	-	-	74	-29.11	333	165	H
	* 4.823	24.86	VB10	34.2	-27.1	31.96	54	-22.04	-	-	333	165	H
3	7.206	40.72	PK3	35.7	-24.8	51.62	-	-	-	-	352	175	H
4	* 2.696	41.56	PK3	32.4	-20.3	53.66	-	-	74	-20.34	40	207	V
	* 2.693	28.49	VB10	32.4	-20.3	40.59	54	-13.41	-	-	40	207	V
5	* 4.535	37.77	PK3	34	-27.5	44.27	-	-	74	-29.73	152	202	V
	* 4.535	24.90	VB10	34	-27.5	31.40	54	-22.60	-	-	152	202	V
6	5.693	36.89	PK3	34.7	-26.5	45.09	-	-	-	-	0	218	V

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

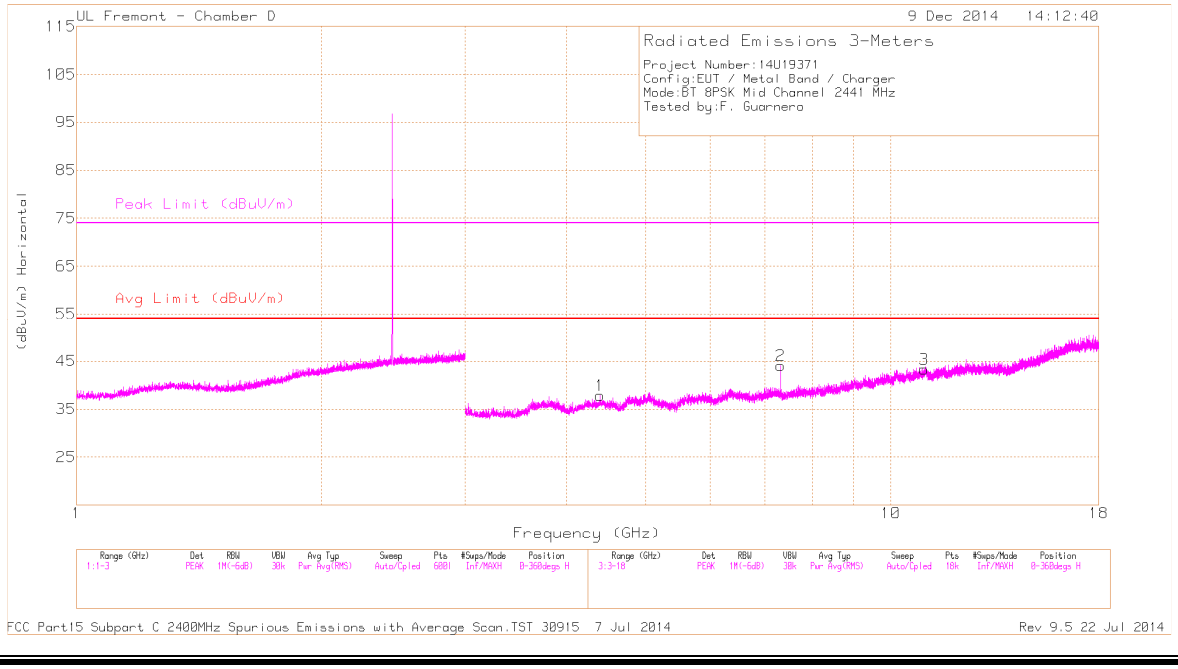
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

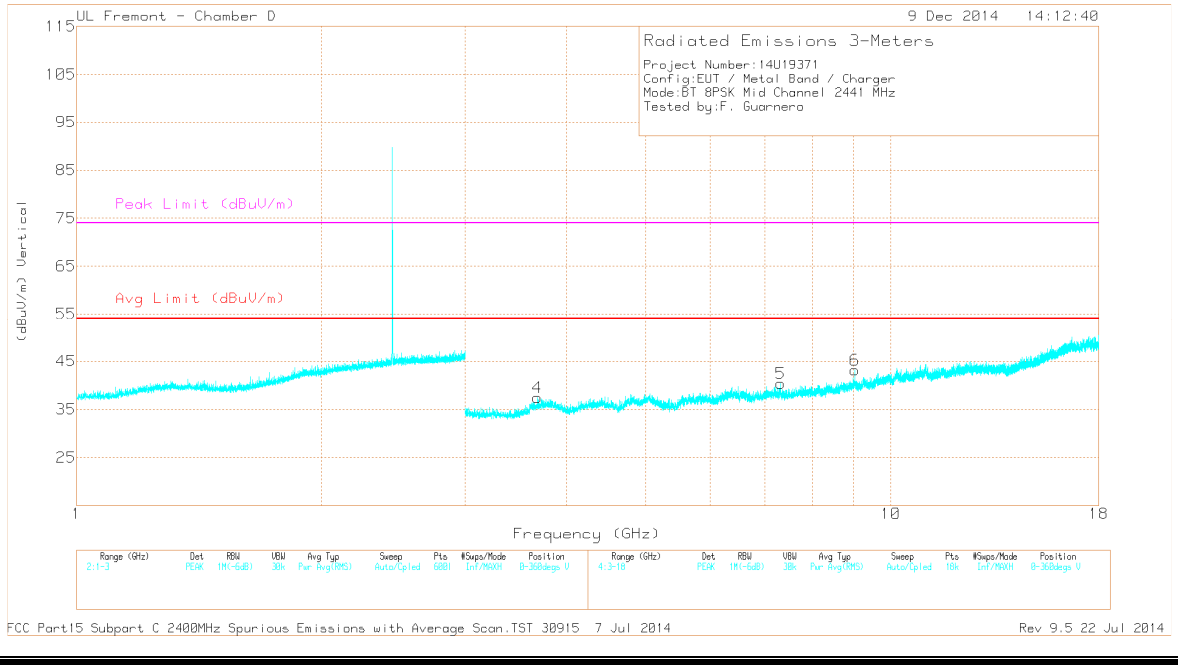
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.396	38.72	PK3	33.9	-28.1	44.52	-	-	74	-29.48	337	170	H
	* 4.396	25.19	VB10	33.9	-28.1	30.99	54	-23.01	-	-	337	170	H
2	* 7.323	40.66	PK3	35.7	-24.9	51.46	-	-	74	-22.54	346	169	H
	* 7.323	30.85	VB10	35.7	-24.9	41.65	54	-12.35	-	-	346	169	H
3	* 10.994	33.65	PK3	38.1	-21.1	50.65	-	-	74	-23.35	339	171	H
	* 10.994	21.22	VB10	38.1	-21.1	38.22	54	-15.78	-	-	339	171	H
4	* 3.683	38.87	PK3	33.3	-28.8	43.37	-	-	74	-30.63	153	328	V
	* 3.683	25.92	VB10	33.3	-28.8	30.42	54	-23.58	-	-	153	328	V
5	* 7.323	38.82	PK3	35.7	-24.9	49.62	-	-	74	-24.38	138	272	V
	* 7.323	28.16	VB10	35.7	-24.9	38.96	54	-15.04	-	-	138	272	V
6	* 9.021	34.55	PK3	36.2	-21.6	49.15	-	-	74	-24.85	96	213	V
	* 9.016	21.69	VB10	36.2	-21.9	35.99	54	-18.01	-	-	96	213	V

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

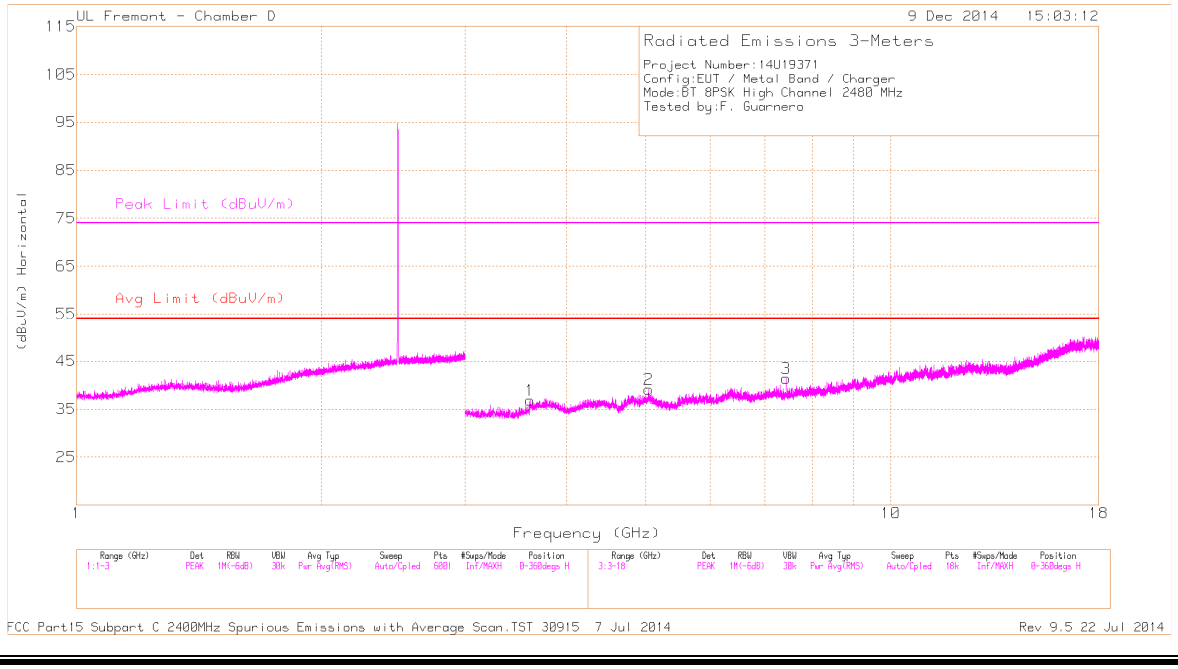
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

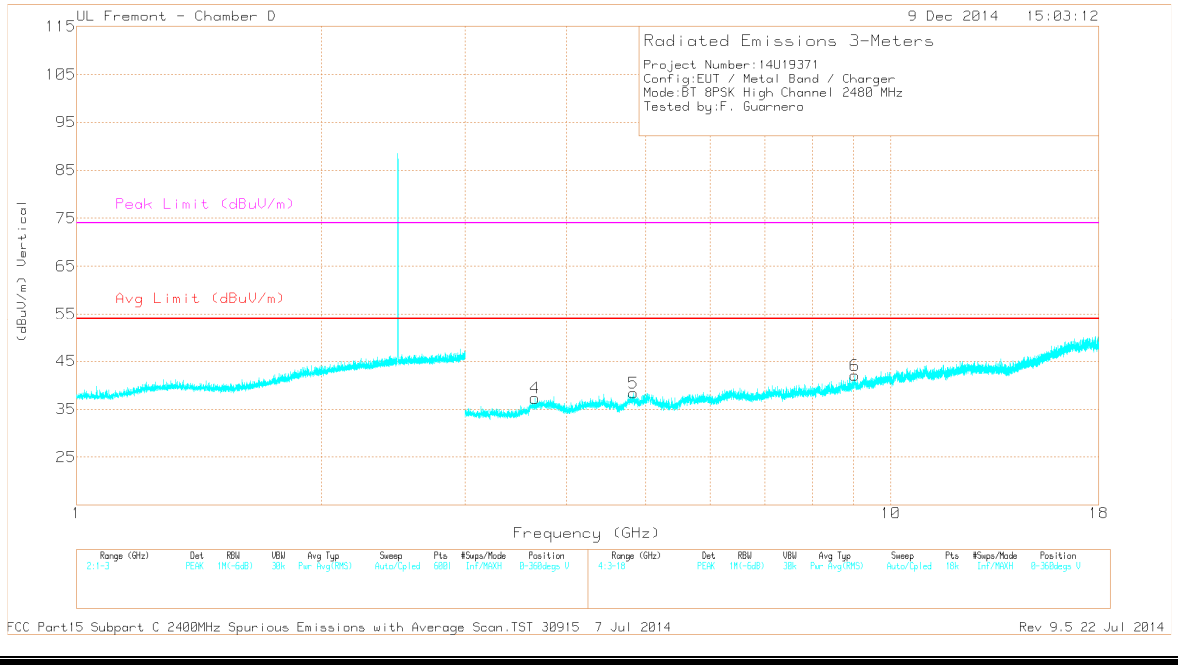
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.605	38.18	PK3	33.5	-28.3	43.38	-	-	74	-30.62	346	170	H
	* 3.605	25.39	VB10	33.5	-28.3	30.59	54	-23.41	-	-	346	170	H
2	* 5.042	37.67	PK3	34.3	-26.2	45.77	-	-	74	-28.23	342	202	H
	* 5.044	24.61	VB10	34.3	-26.2	32.71	54	-21.29	-	-	342	202	H
3	* 7.440	38.36	PK3	35.6	-24.8	49.16	-	-	74	-24.84	33	148	H
	* 7.440	27.08	VB10	35.6	-24.8	37.88	54	-16.12	-	-	33	148	H
4	* 3.653	38.34	PK3	33.4	-28.9	42.84	-	-	74	-31.16	292	328	V
	* 3.655	25.73	VB10	33.4	-28.9	30.23	54	-23.77	-	-	292	328	V
5	* 4.831	37.53	PK3	34.2	-27.3	44.43	-	-	74	-29.57	313	322	V
	* 4.831	25.05	VB10	34.2	-27.3	31.95	54	-22.05	-	-	313	322	V
6	* 9.030	34.16	PK3	36.2	-21.6	48.76	-	-	74	-25.24	297	316	V
	* 9.029	21.60	VB10	36.2	-21.6	36.20	54	-17.80	-	-	297	316	V

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

PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

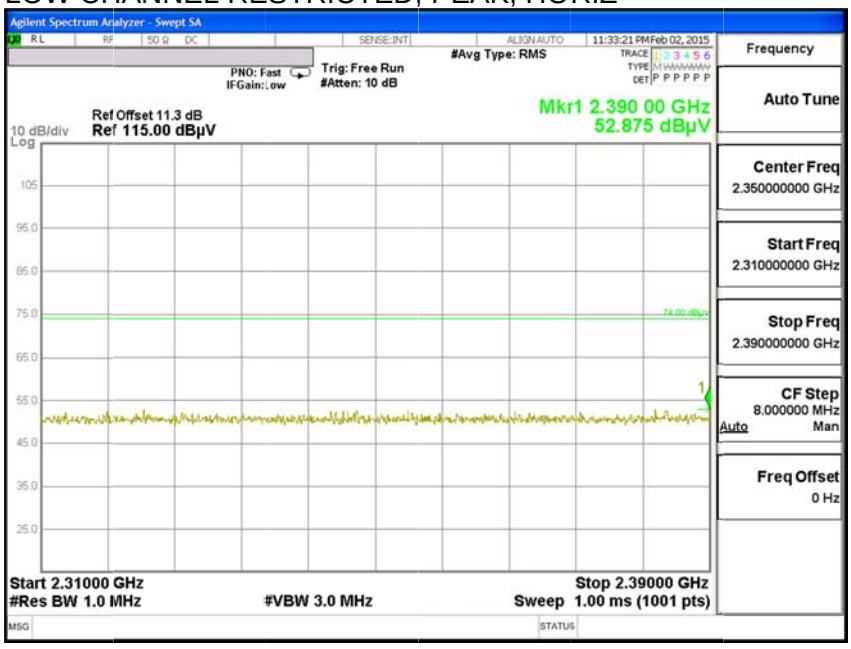
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.3. TRANSMITTER ABOVE 1 GHz A1554 ANTENNA 2

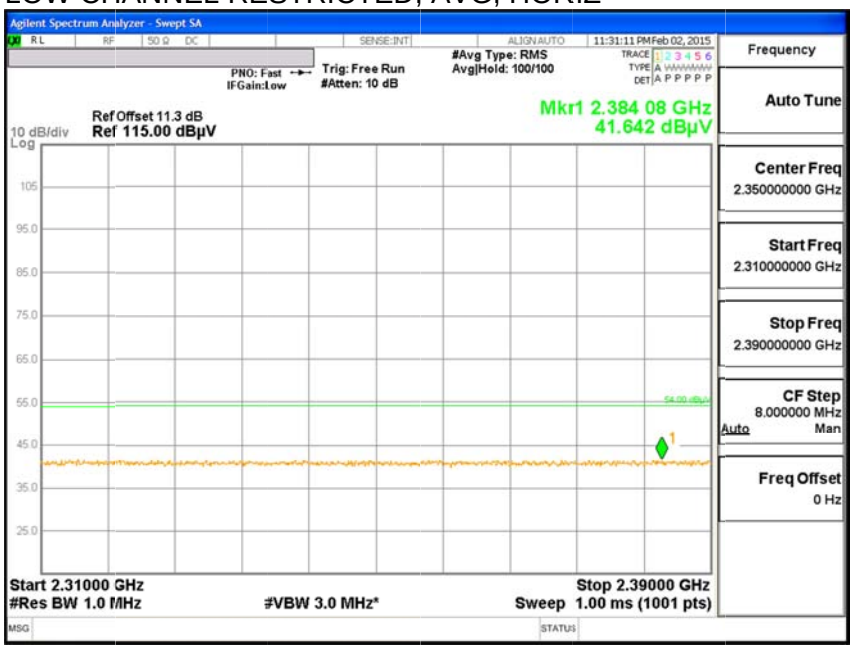
9.3.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ



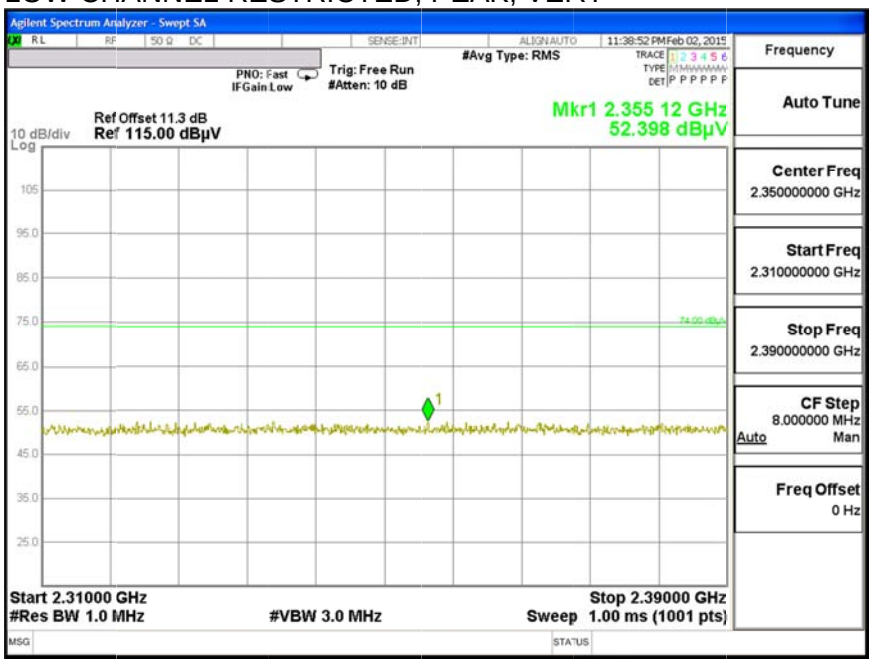
LOW CHANNEL RESTRICTED, AVG, HORIZ



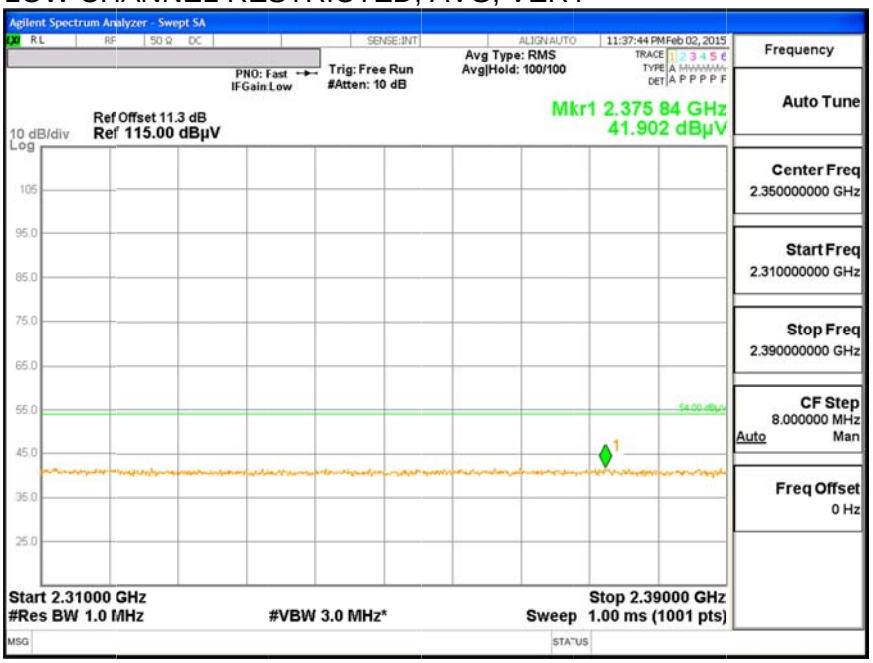
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



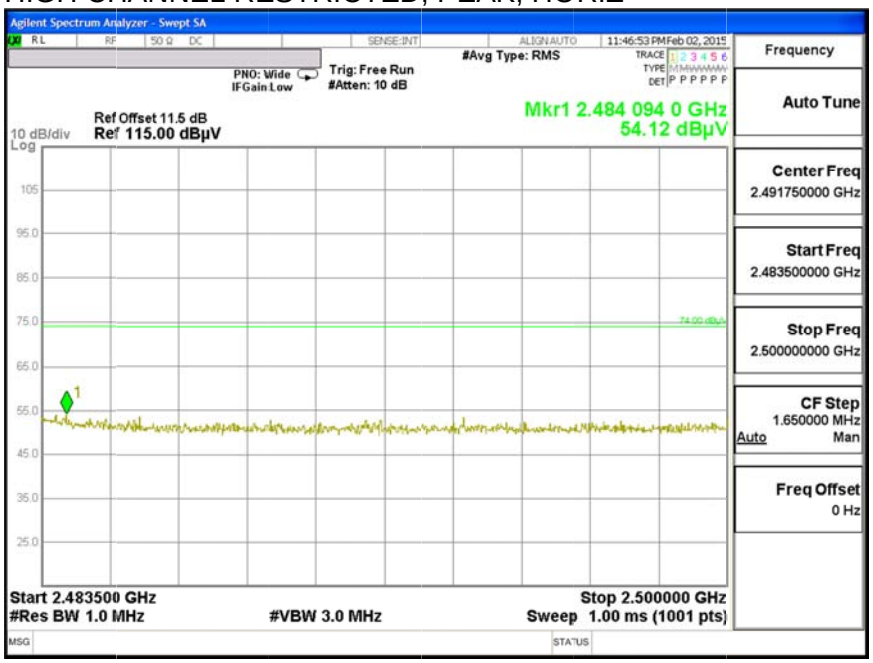
LOW CHANNEL RESTRICTED, AVG, VERT



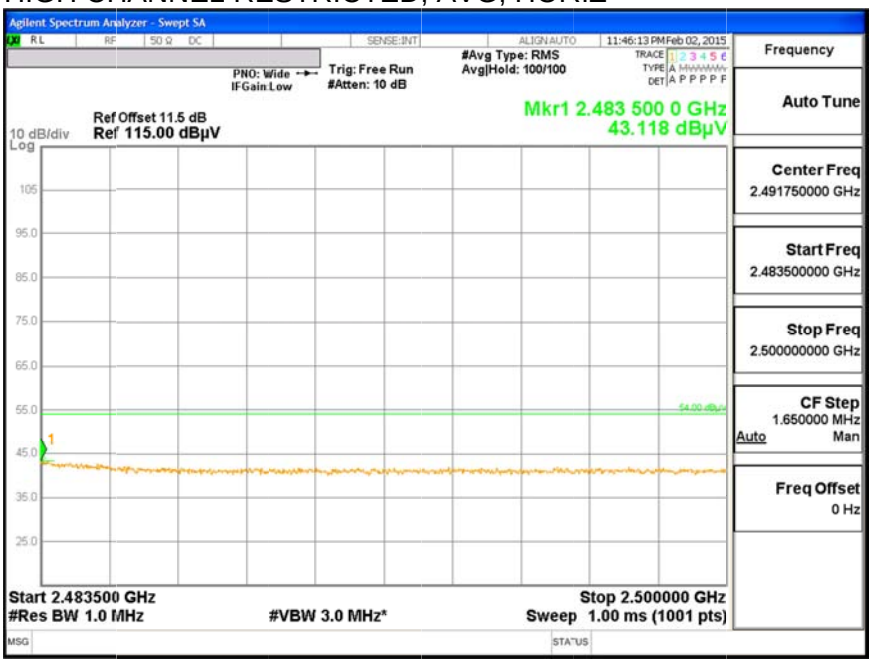
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



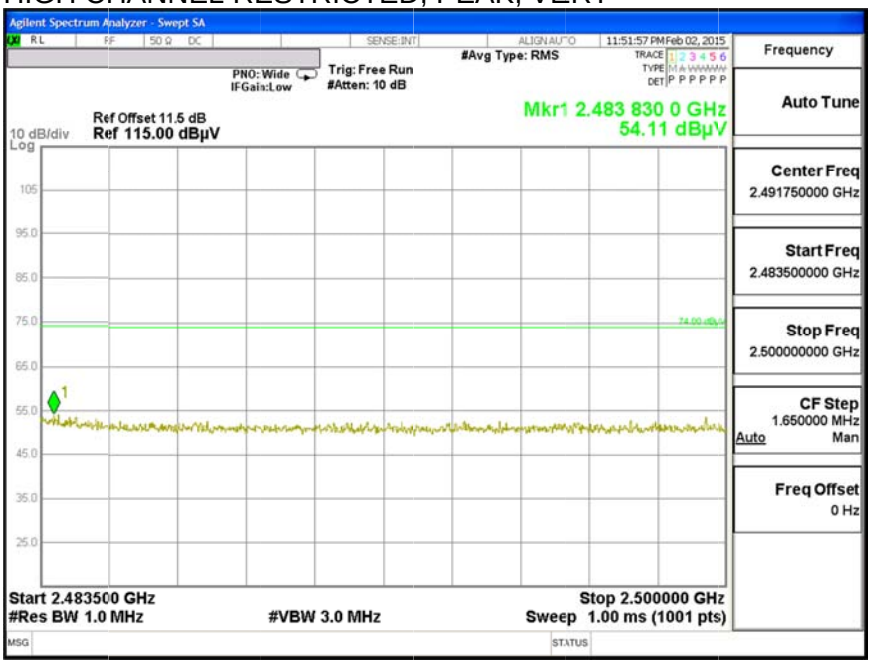
HIGH CHANNEL RESTRICTED, AVG, HORIZ



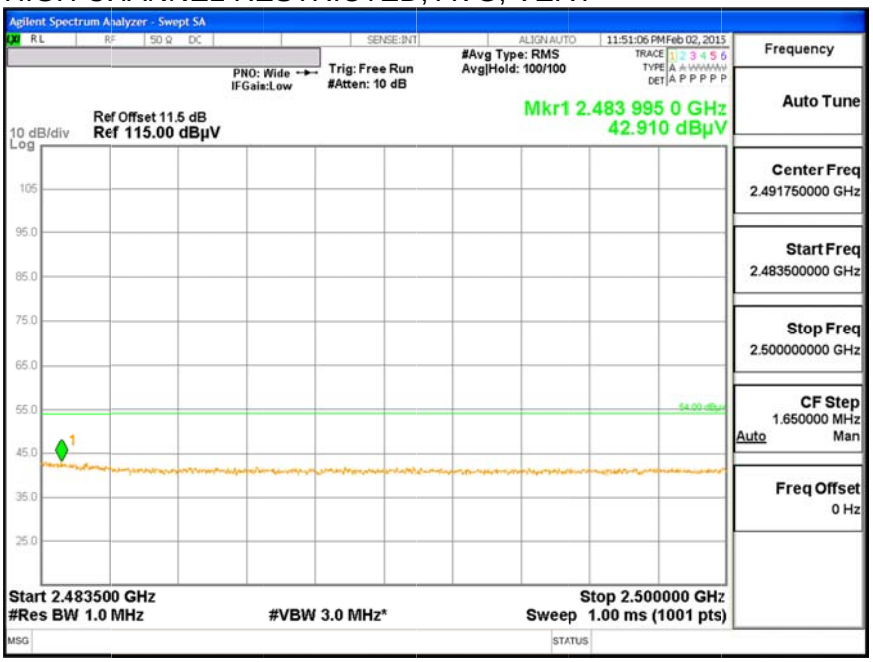
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



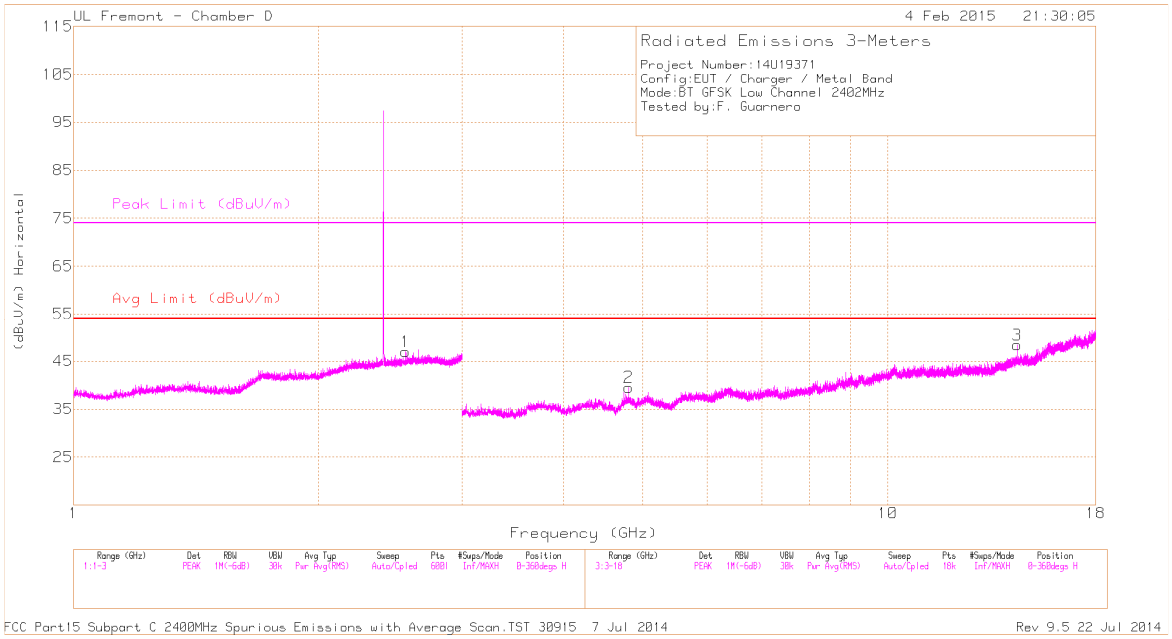
HIGH CHANNEL RESTRICTED, AVG, VERT



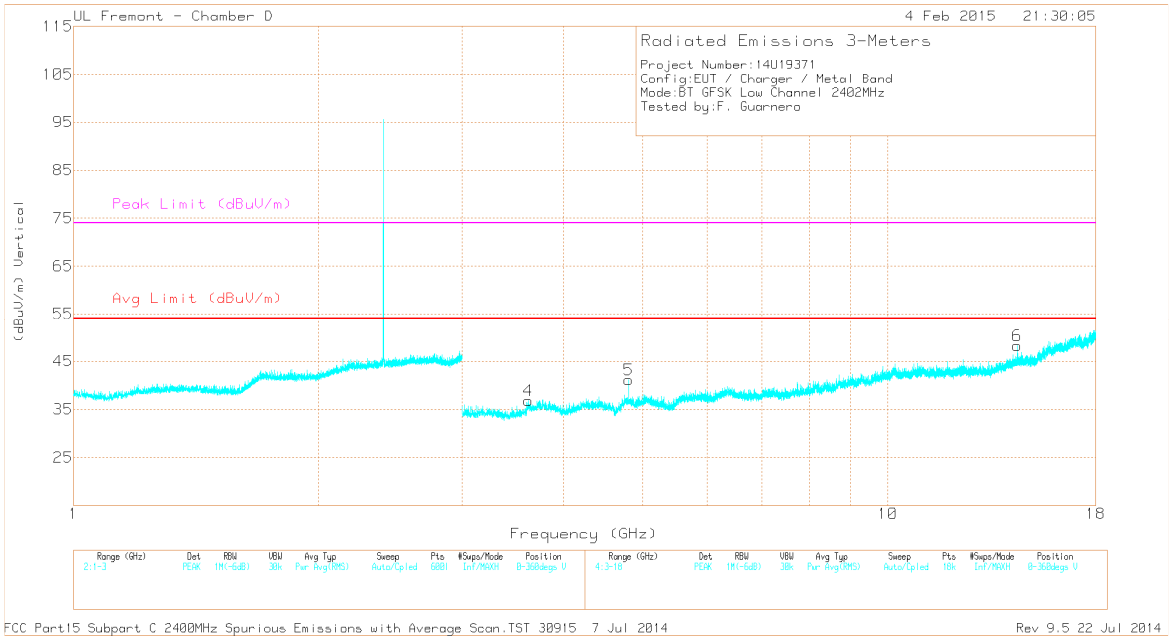
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.558	42.09	PK3	32.2	-20.7	53.59	-	-	-	-	202	253	H
2	* 4.804	39.15	PK3	34.0	-27.0	46.15	-	-	74	-27.85	95	218	H
	* 4.804	27.81	VB10	34.0	-27.0	34.81	54	-19.19	-	-	95	218	H
3	14.411	39.10	PK3	39.9	-22.4	56.60	-	-	-	-	328	134	H
4	* 3.616	39.07	PK3	33.2	-28.5	43.77	-	-	74	-30.23	257	193	V
	* 3.616	25.65	VB10	33.2	-28.5	30.35	54	-23.65	-	-	257	193	V
5	* 4.804	39.93	PK3	34.0	-27.0	46.93	-	-	74	-27.07	351	183	V
	* 4.804	31.04	VB10	34.0	-27.0	38.04	54	-15.96	-	-	351	183	V
6	14.413	37.66	PK3	39.9	-22.4	55.16	-	-	-	-	342	232	V

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

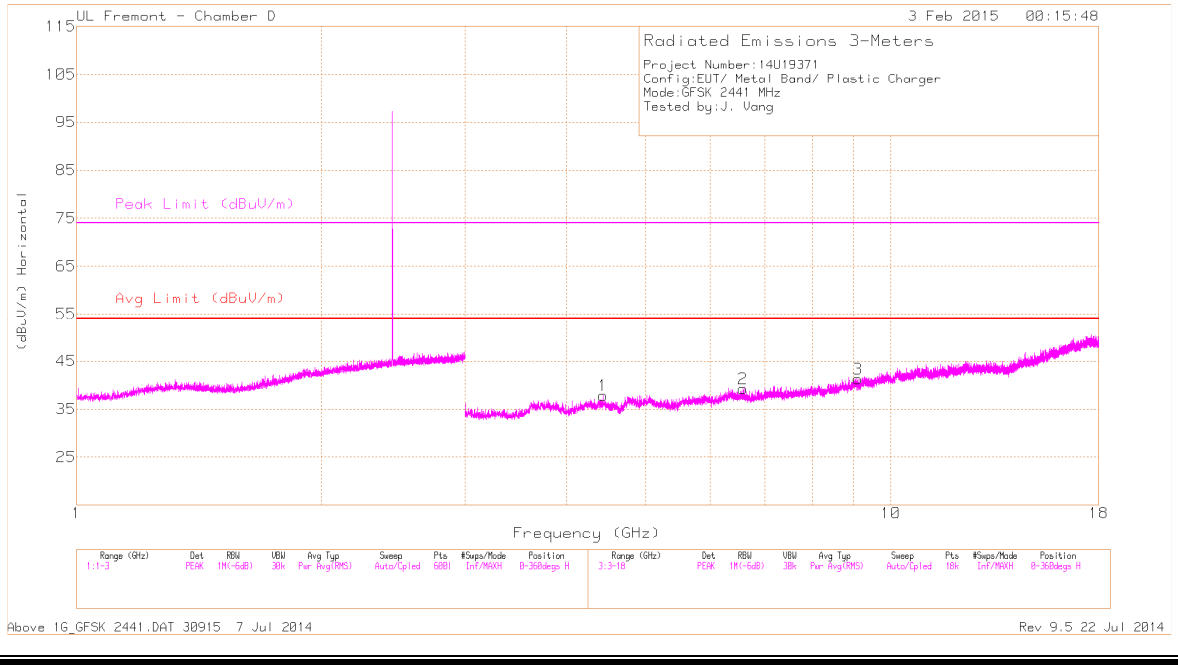
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

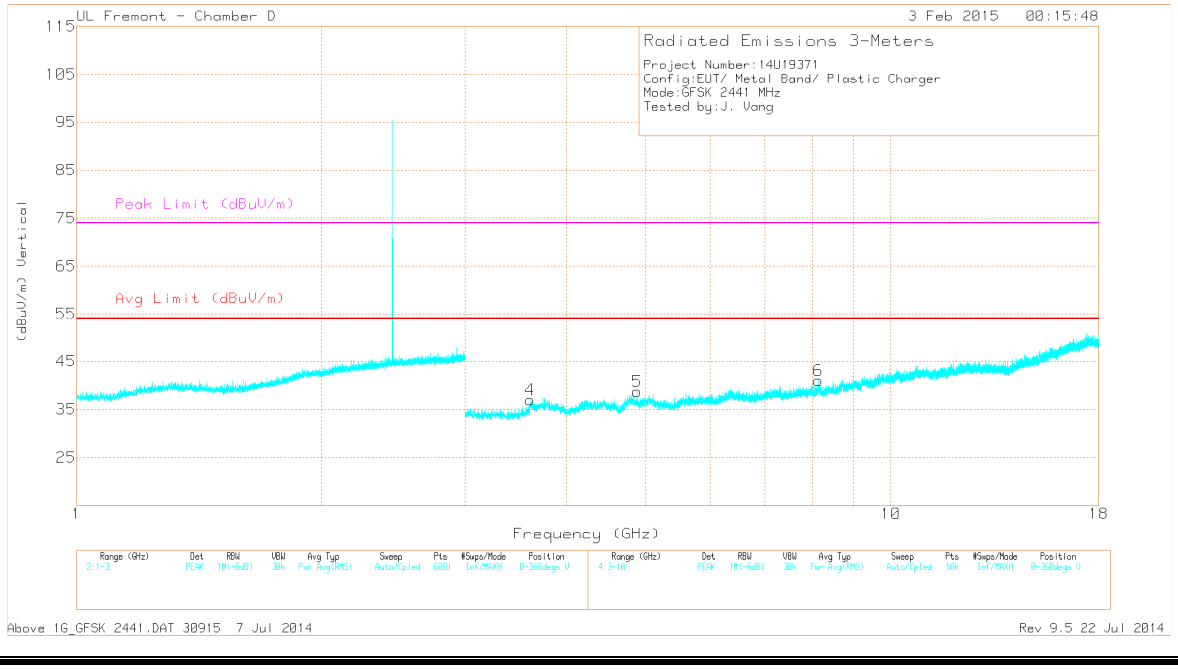
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	4.432	37.95	PK3	33.9	-27.6	44.25	-	-	-	-	190	202	H
2	6.582	37.05	PK3	35.6	-25.8	46.85	-	-	-	-	203	206	H
3	* 9.116	35.42	PK3	36.3	-22.7	49.02	-	-	74	-24.98	169	109	H
	* 9.114	22.2	VB10	36.3	-22.6	35.90	54	-18.10	-	-	169	109	H
4	* 3.608	38.69	PK3	33.5	-28.4	43.79	-	-	74	-30.21	58	202	V
	* 3.608	25.77	VB10	33.5	-28.4	30.87	54	-23.13	-	-	58	202	V
5	* 4.881	38.46	PK3	34.2	-28.2	44.46	-	-	74	-29.54	49	207	V
	* 4.882	27.73	VB10	34.2	-28.2	33.73	54	-20.27	-	-	49	207	V
6	* 8.140	34.79	PK3	35.8	-23.1	47.49	-	-	74	-26.51	50	211	V
	* 8.141	22.50	VB10	35.8	-23.1	35.20	54	-18.80	-	-	50	211	V

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

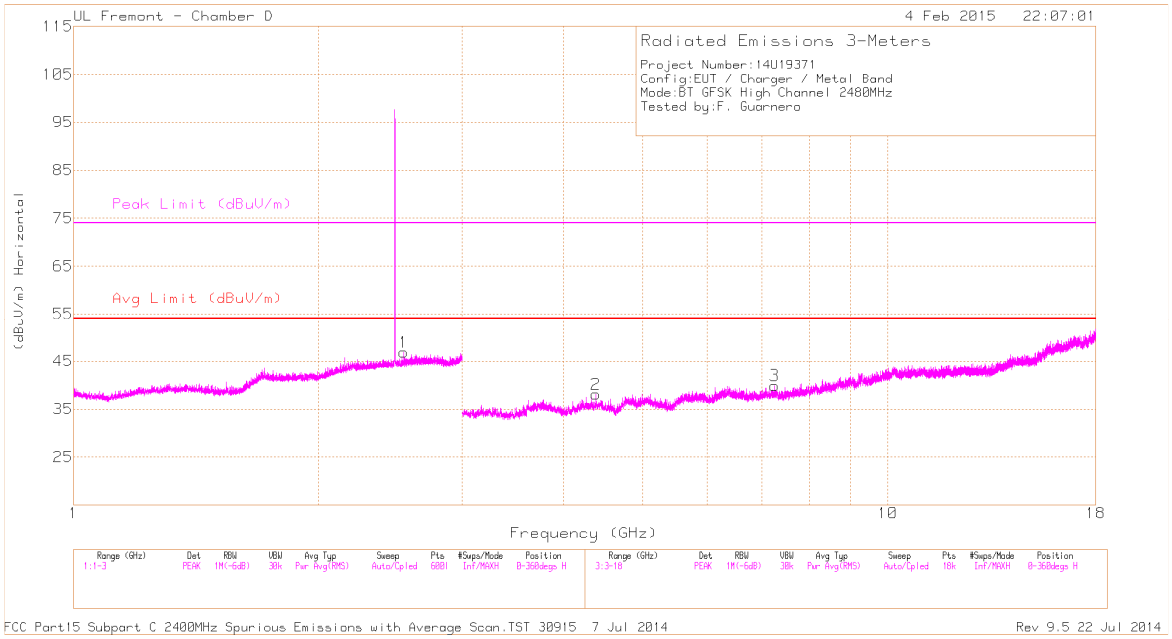
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

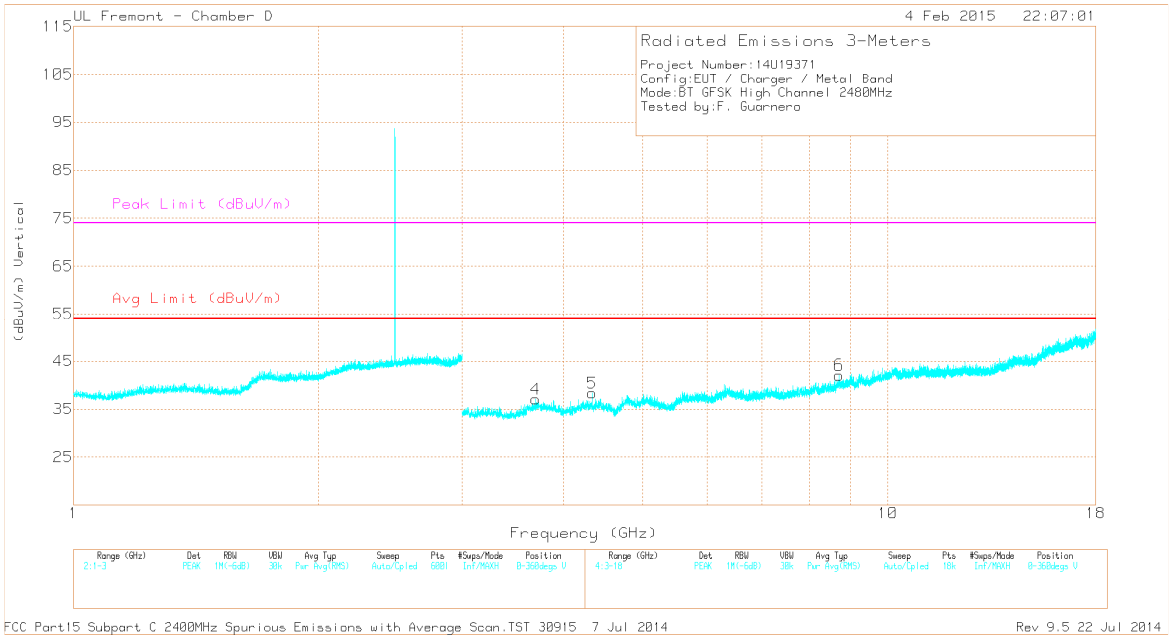
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.546	41.46	PK3	32.2	-20.7	52.96	-	-	-	-	59	251	H
2	* 4.377	38.38	PK3	33.5	-28.3	43.58	-	-	74	-30.42	251	315	H
	* 4.378	25.60	VB10	33.5	-28.3	30.80	54	-23.20	-	-	251	315	H
3	* 7.255	36.87	PK3	35.6	-25.0	47.47	-	-	74	-26.53	52	102	H
	* 7.256	23.68	VB10	35.6	-25.1	34.18	54	-19.82	-	-	52	102	H
4	* 3.694	39.44	PK3	32.9	-29.1	43.24	-	-	74	-30.76	101	314	V
	* 3.696	26.01	VB10	32.9	-29.1	29.81	54	-24.19	-	-	101	314	V
5	* 4.333	38.04	PK3	33.5	-28.7	42.84	-	-	74	-31.16	221	205	V
	* 4.334	25.70	VB10	33.5	-28.7	30.50	54	-23.50	-	-	221	205	V
6	8.715	34.25	PK3	36.5	-21.9	48.85	-	-	-	-	187	359	V

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

PK3 - FHSS Method: Maximum Peak

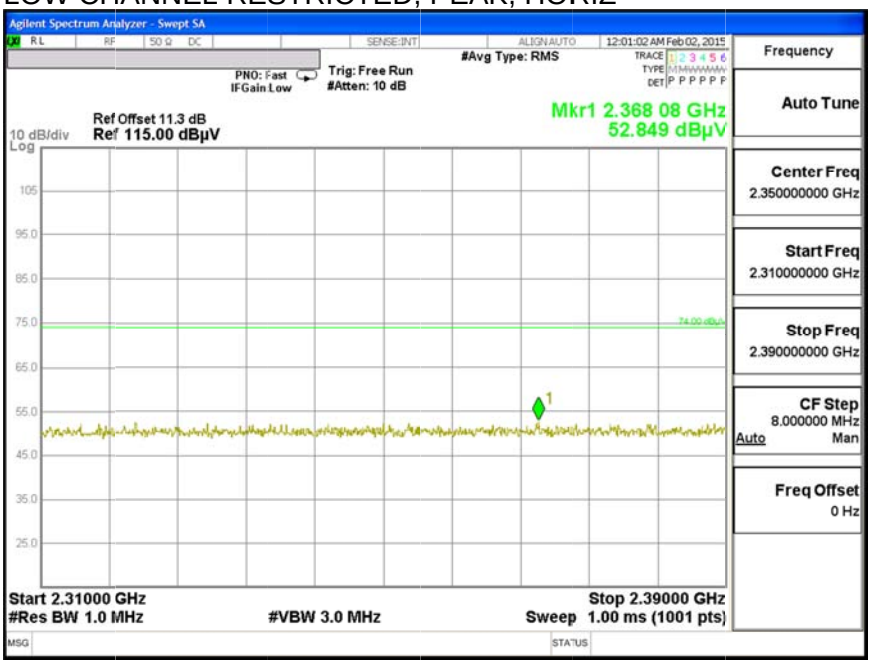
VB10Hz - FHSS Method: 10Hz Video Bandwidth

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

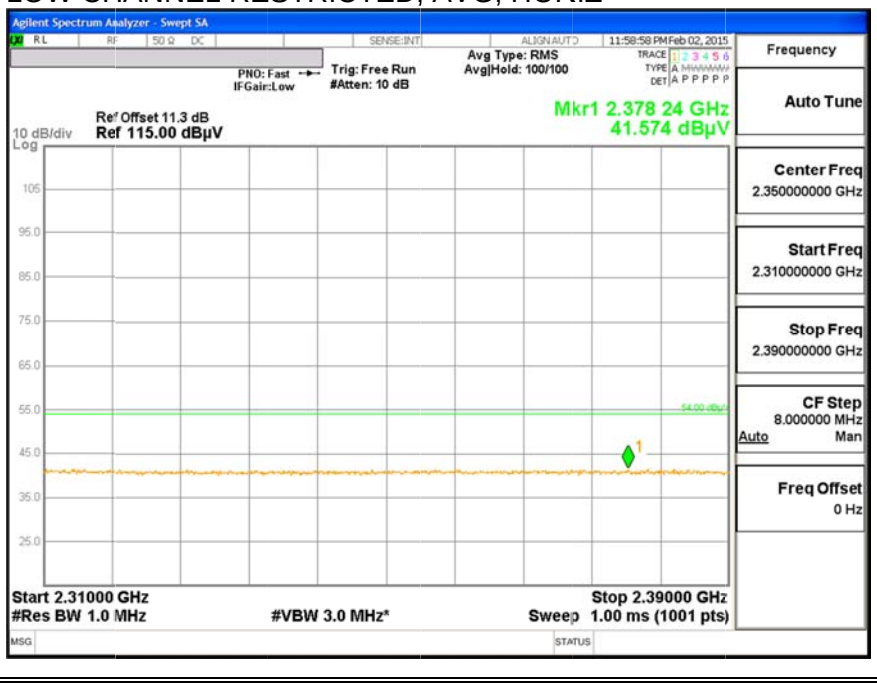
9.3.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ



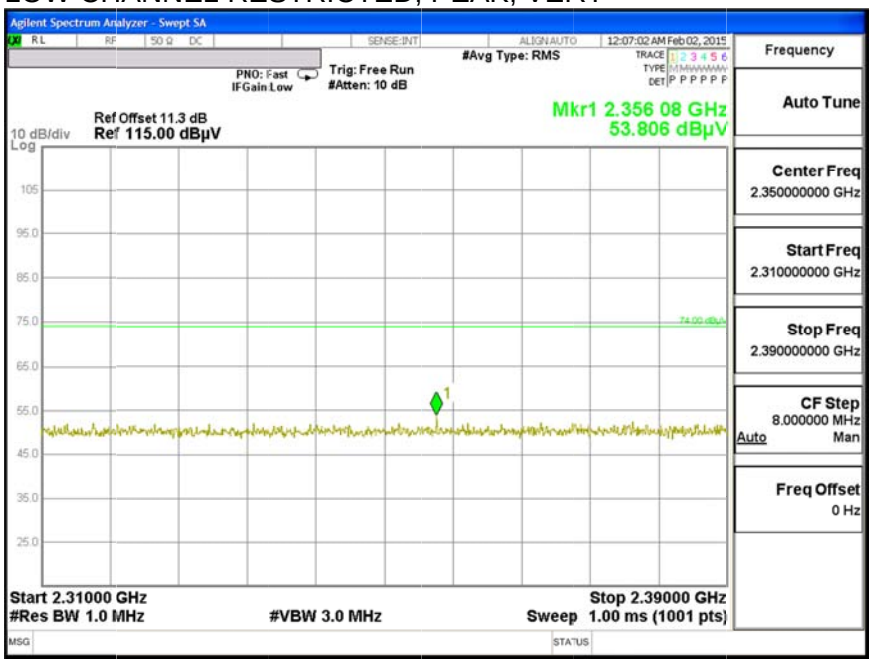
LOW CHANNEL RESTRICTED, AVG, HORIZ



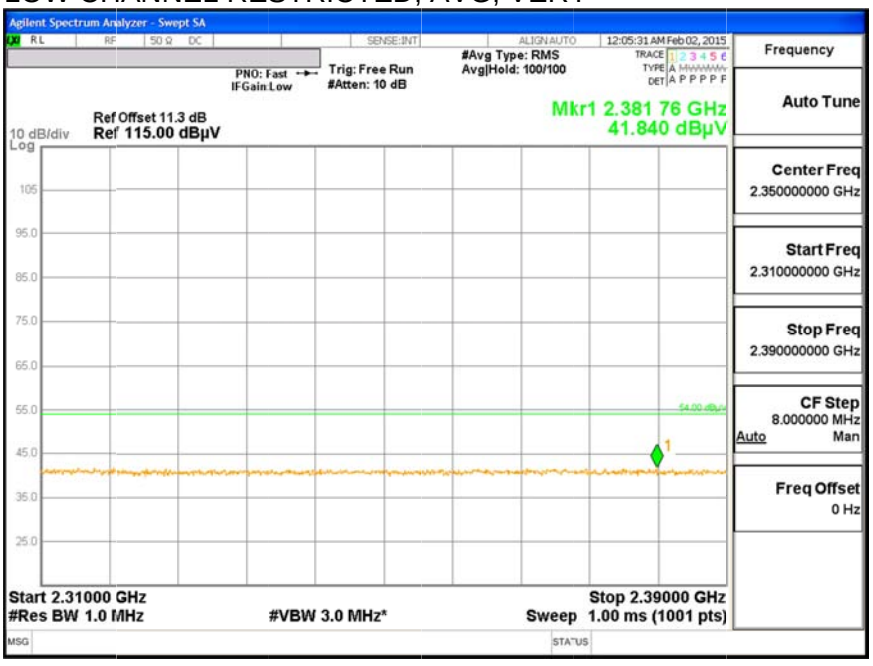
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



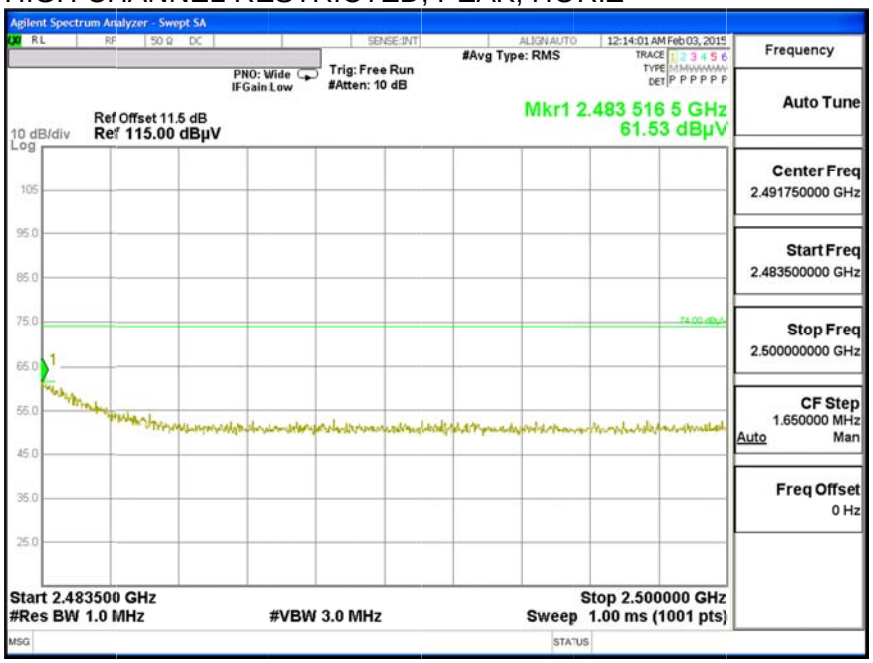
LOW CHANNEL RESTRICTED, AVG, VERT



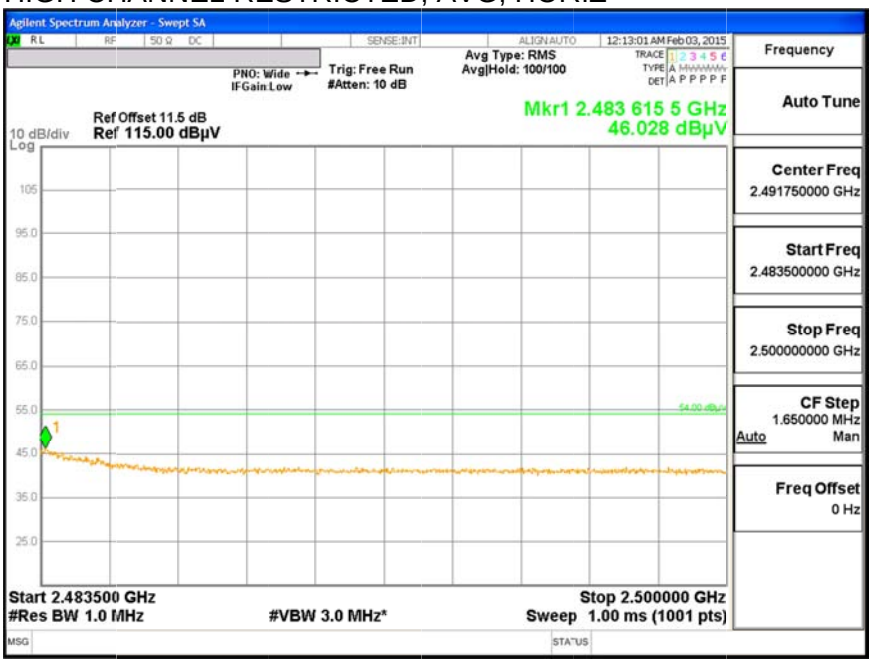
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



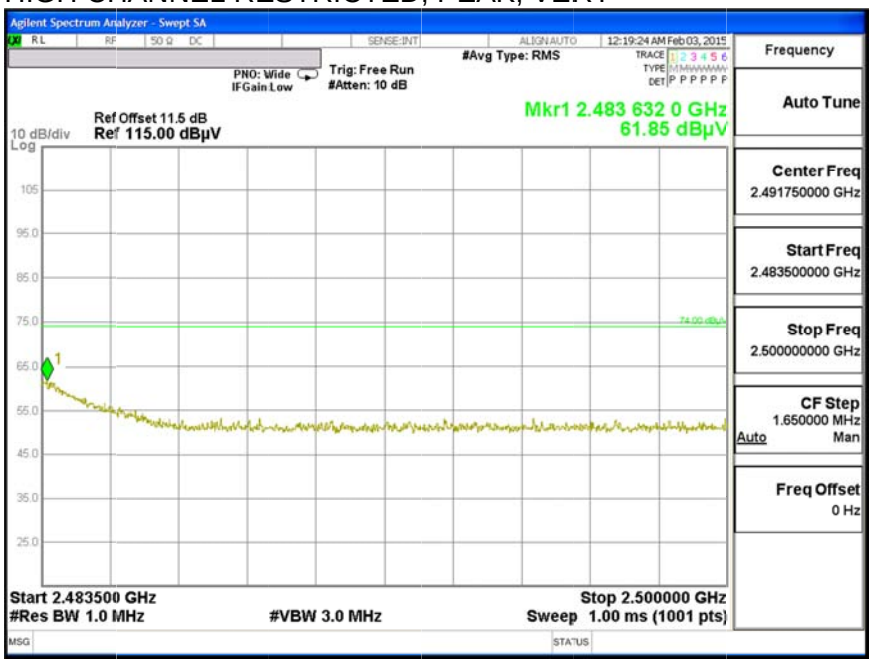
HIGH CHANNEL RESTRICTED, AVG, HORIZ



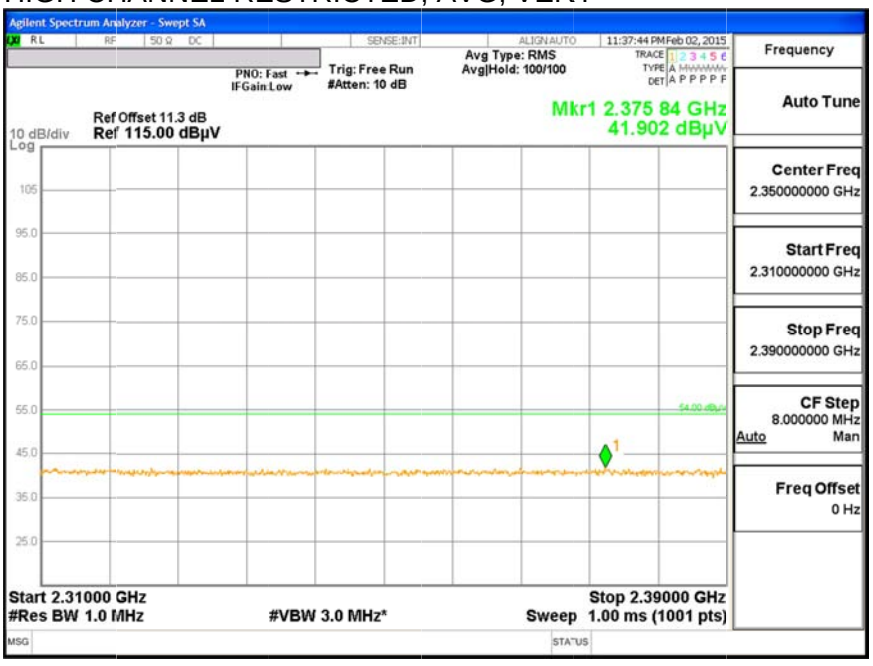
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



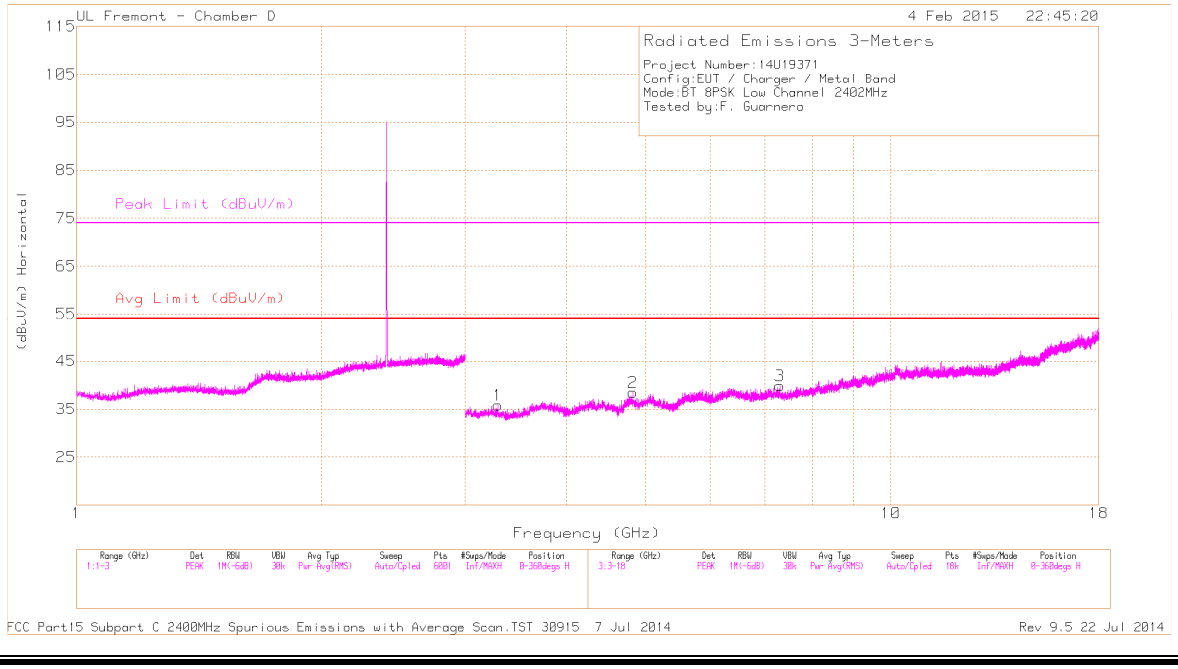
HIGH CHANNEL RESTRICTED, AVG, VERT



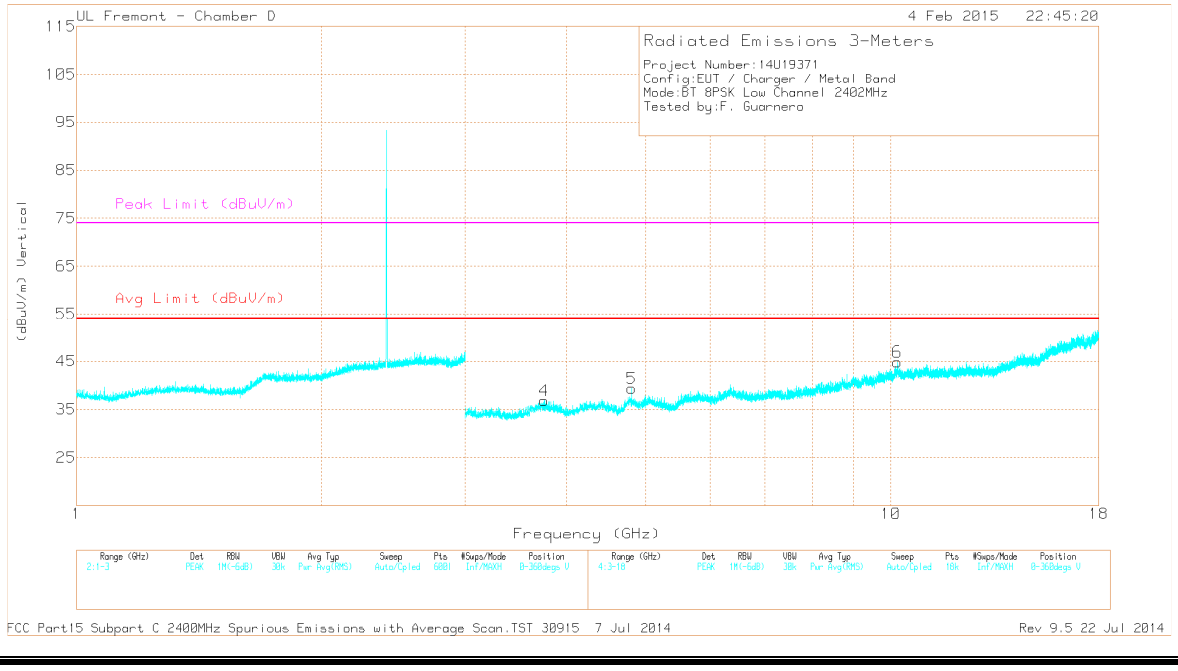
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.290	38.43	PK3	32.8	-28.0	43.23	-	-	-	-	262	202	H
2	* 4.825	38.10	PK3	33.9	-27.4	44.60	-	-	74	-29.40	330	384	H
	* 4.823	24.92	VB10	33.9	-27.4	31.42	54	-22.58	-	-	330	384	H
3	* 7.302	36.64	PK3	35.6	-24.7	47.54	-	-	74	-26.46	4	365	H
	* 7.304	23.48	VB10	35.6	-24.7	34.38	54	-19.62	-	-	4	365	H
4	* 3.749	38.05	PK3	32.9	-28.5	42.45	-	-	74	-31.55	349	149	V
	* 3.750	25.52	VB10	32.9	-28.4	30.02	54	-23.98	-	-	349	149	V
5	* 4.804	39.43	PK3	34.0	-27.0	46.43	-	-	74	-27.57	349	160	V
	* 4.804	29.02	VB10	34.0	-27.0	36.02	54	-17.98	-	-	349	160	V
6	10.193	33.26	PK3	37.8	-20	51.06	-	-	-	-	350	125	V

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

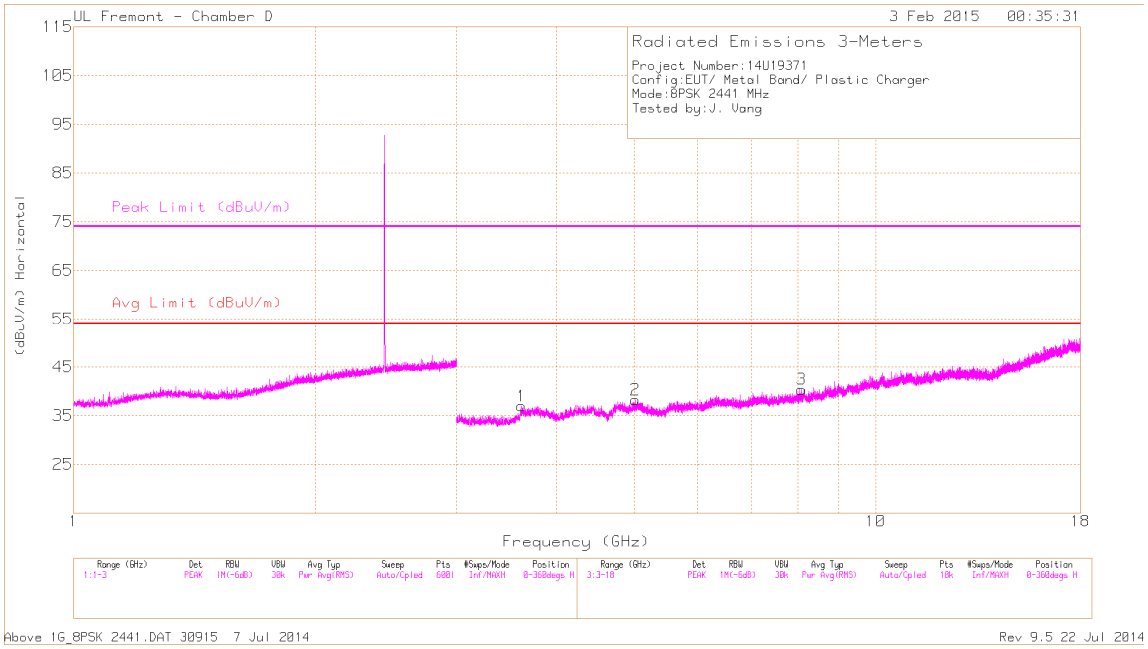
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

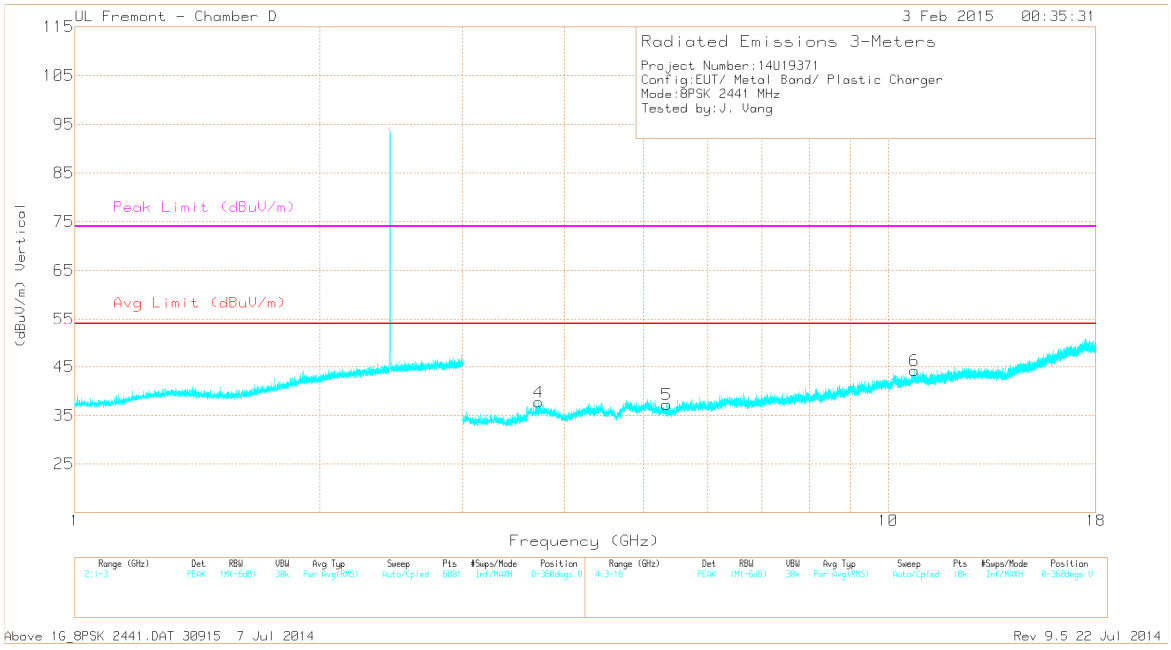
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.617	37.98	PK3	33.5	-28.6	42.88	-	-	74	-31.12	168	170	H
	* 3.618	25.62	VB10	33.5	-28.6	30.52	54	-23.48	-	-	168	170	H
2	* 5.020	36.98	PK3	34.2	-26.8	44.38	-	-	74	-29.62	179	115	H
	* 5.020	24.54	VB10	34.2	-26.8	31.94	54	-22.06	-	-	179	115	H
3	* 8.090	35.11	PK3	35.7	-23.8	47.01	-	-	74	-26.99	207	180	H
	* 8.092	22.75	VB10	35.7	-23.8	34.65	54	-19.35	-	-	207	180	H
4	* 3.717	38.56	PK3	33.2	-28.8	42.96	-	-	74	-31.04	77	208	V
	* 3.717	25.99	VB10	33.2	-28.9	30.29	54	-23.71	-	-	77	208	V
5	5.341	37.21	PK3	34.5	-27.4	44.31	-	-	-	-	60	215	V
6	* 10.770	33.63	PK3	38.1	-20.4	51.33	-	-	74	-22.67	77	201	V
	* 10.769	20.90	VB10	38.1	-20.4	38.60	54	-15.40	-	-	77	201	V

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

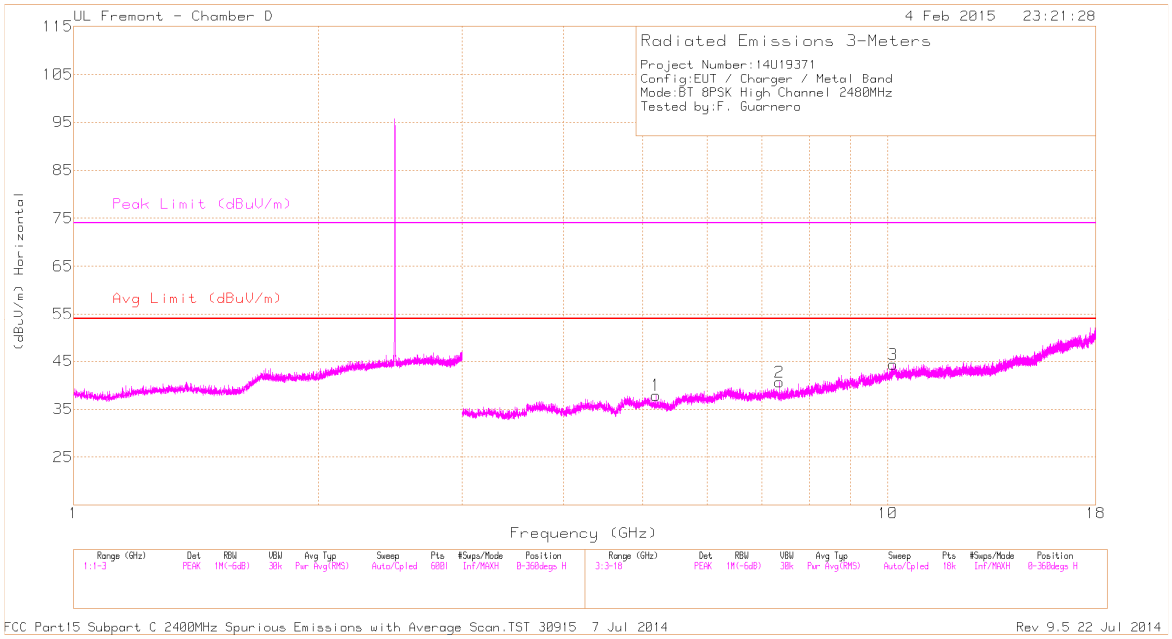
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

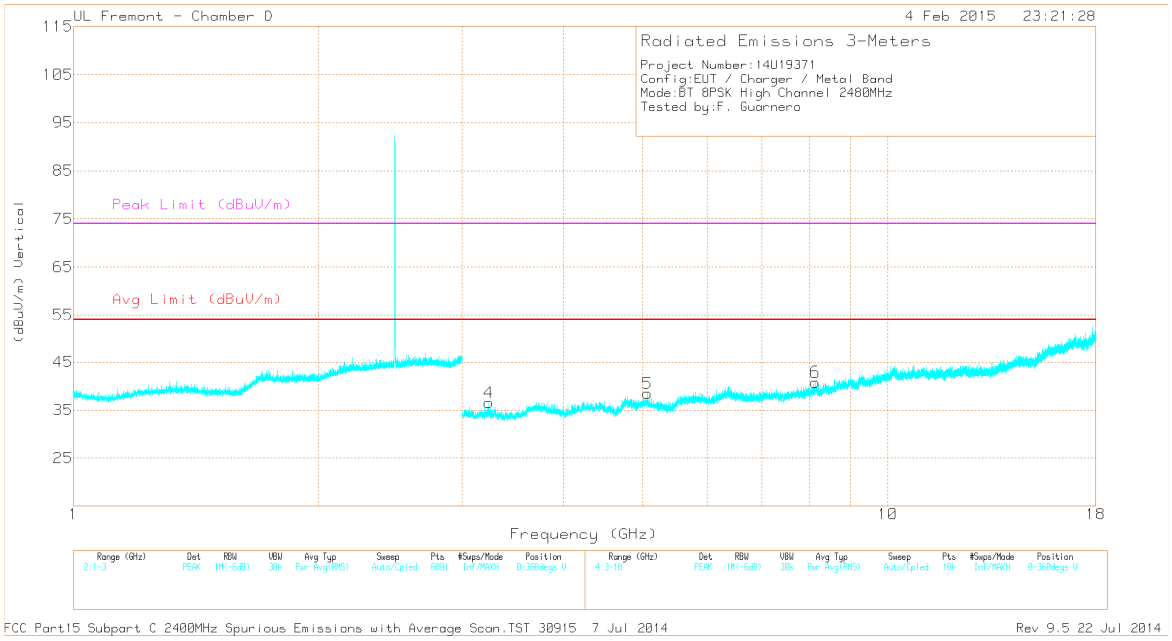
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.187	38.93	PK3	34.3	-28.2	45.03	-	-	-	-	89	354	H
2	* 7.361	36.22	PK3	35.6	-25.2	46.62	-	-	74	-27.38	109	329	H
	* 7.363	23.30	VB10	35.6	-25.2	33.70	54	-20.3	-	-	109	329	H
3	10.152	33.31	PK3	37.9	-20.3	50.91	-	-	-	-	20	295	H
4	3.235	39.14	PK3	33.0	-28.6	43.54	-	-	-	-	218	337	V
5	* 5.070	37.32	PK3	34.1	-26.7	44.72	-	-	74	-29.28	273	369	V
	* 5.068	24.81	VB10	34.1	-26.7	32.21	54	-21.79	-	-	273	369	V
6	* 8.152	34.84	PK3	36.1	-22.9	48.04	-	-	74	-25.96	73	228	V
	* 8.153	22.34	VB10	36.1	-23.0	35.44	54	-18.56	-	-	73	228	V

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

PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

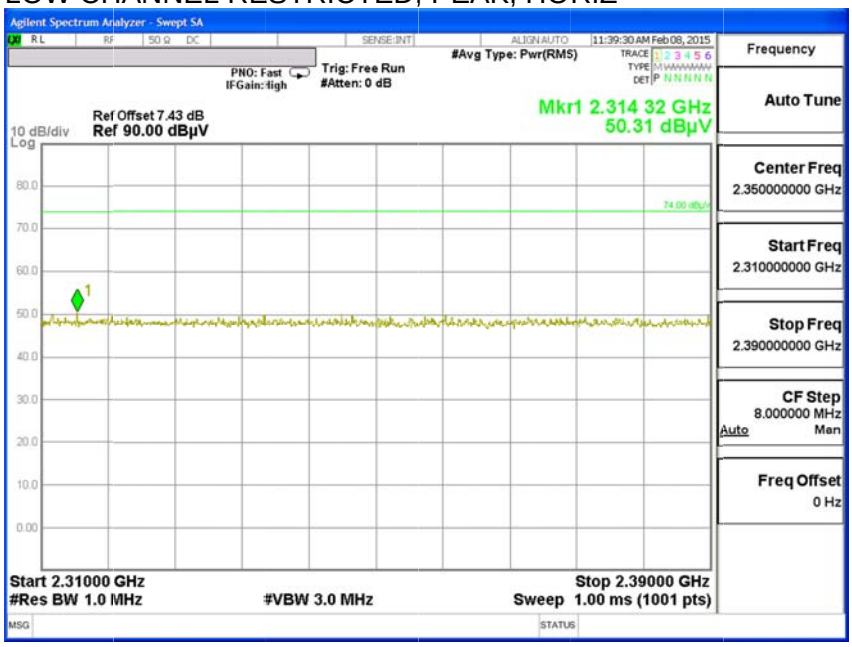
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.4. TRANSMITTER ABOVE 1 GHz A1638

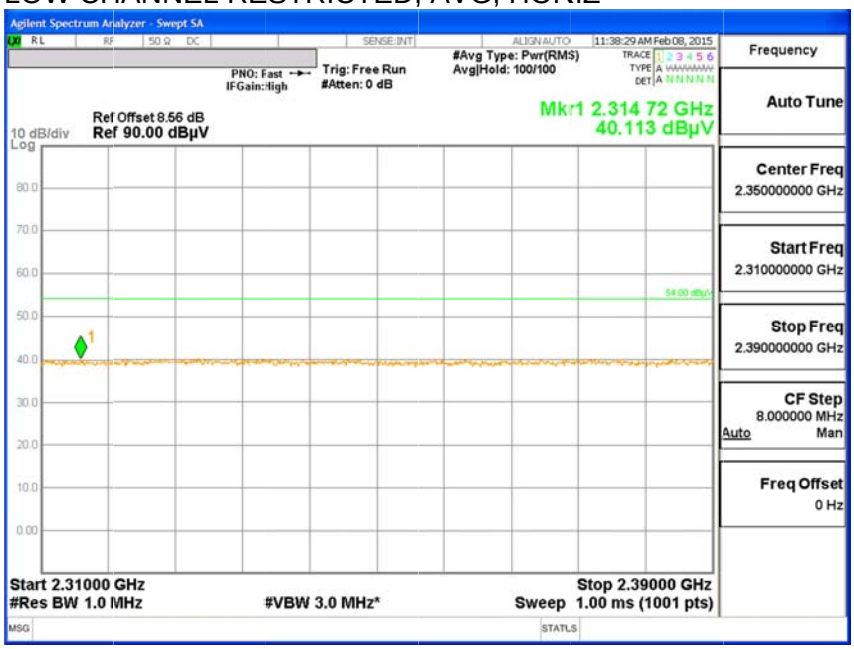
9.4.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ



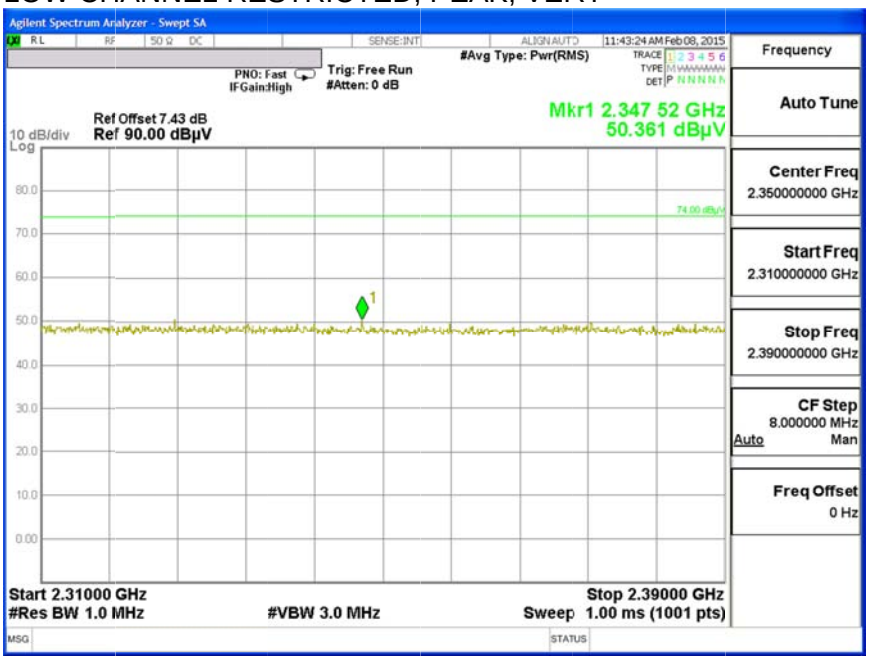
LOW CHANNEL RESTRICTED, AVG, HORIZ



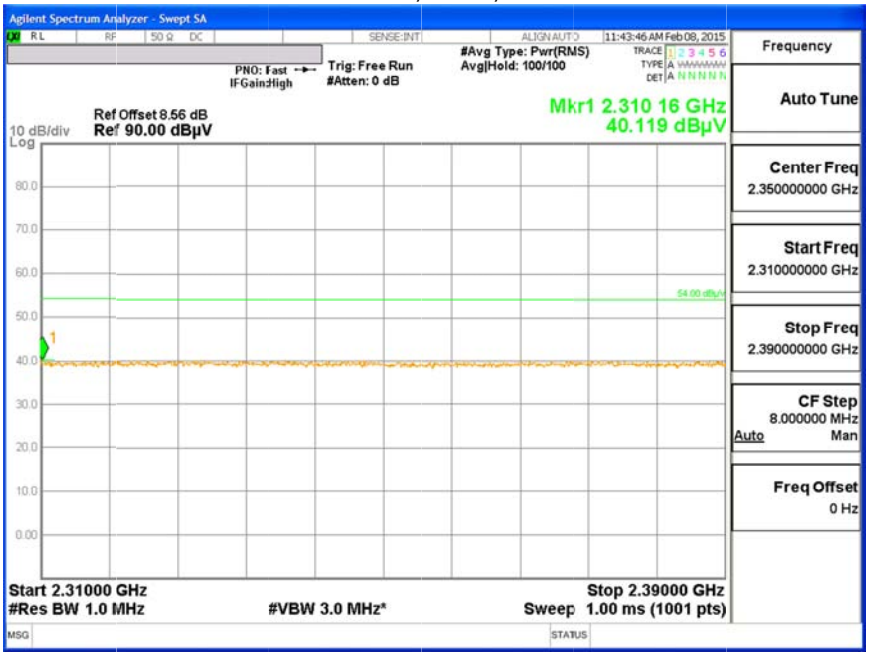
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



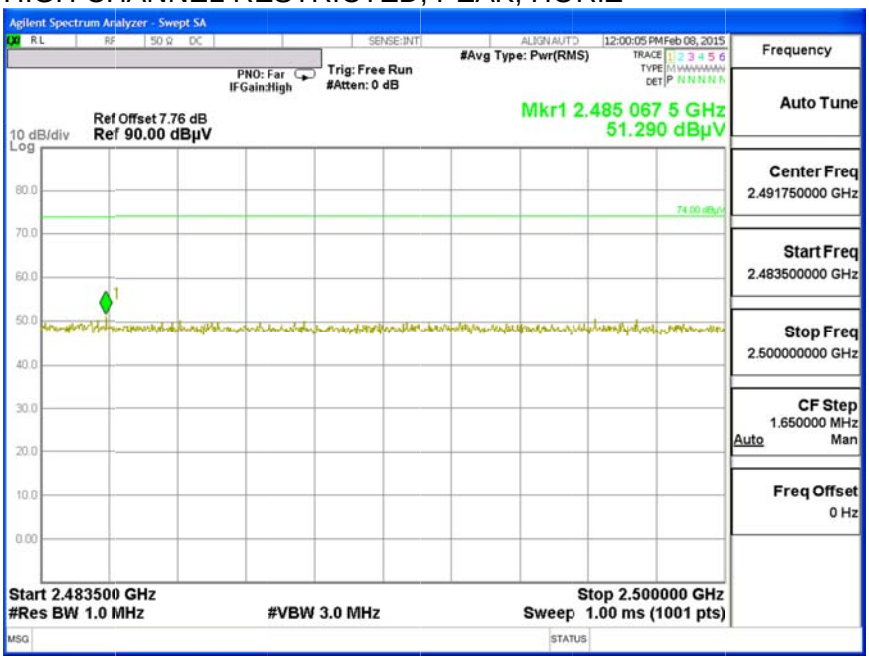
LOW CHANNEL RESTRICTED, AVG, VERT



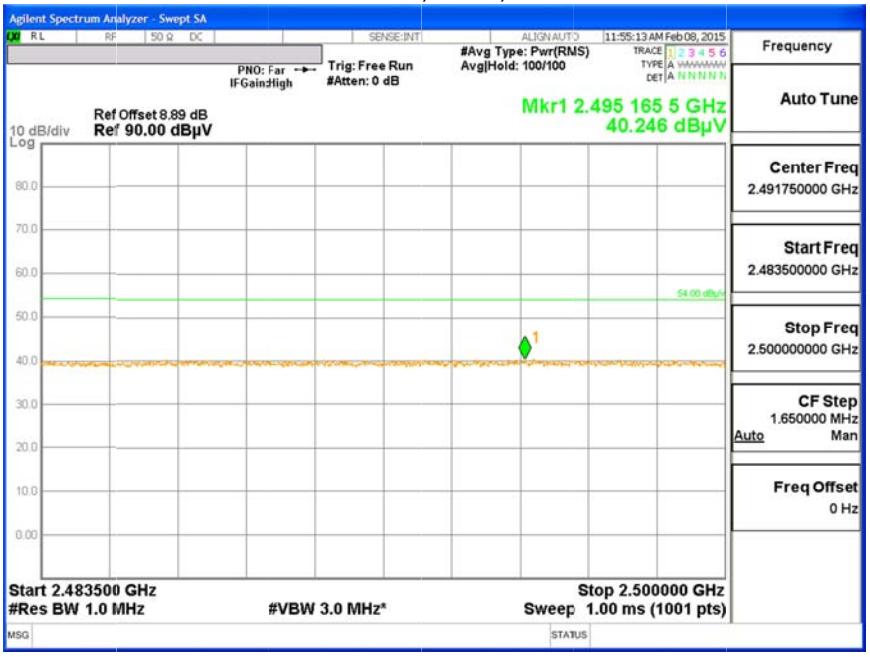
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



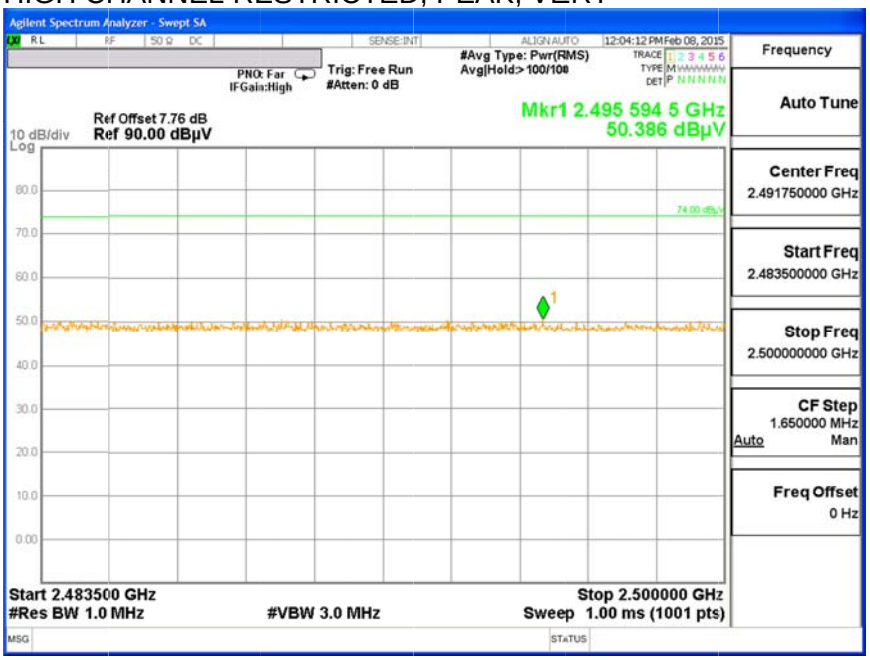
HIGH CHANNEL RESTRICTED, AVG, HORIZ



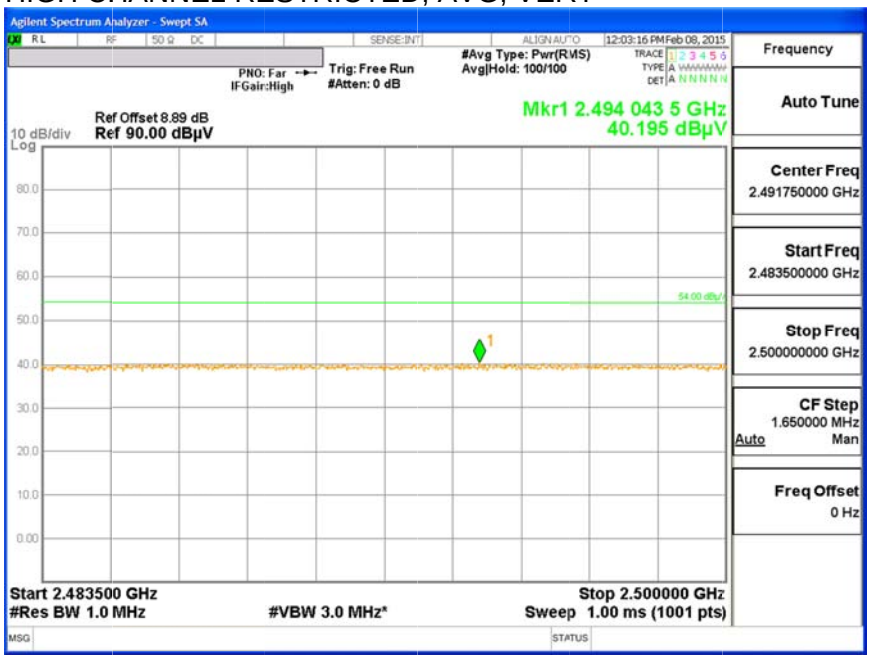
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



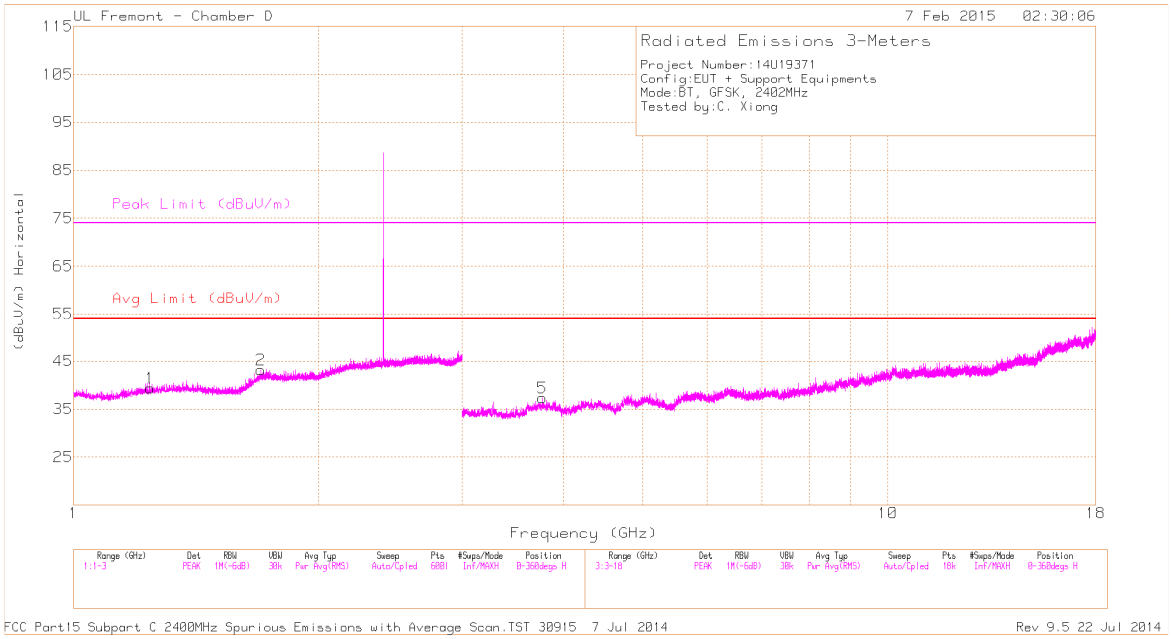
HIGH CHANNEL RESTRICTED, AVG, VERT



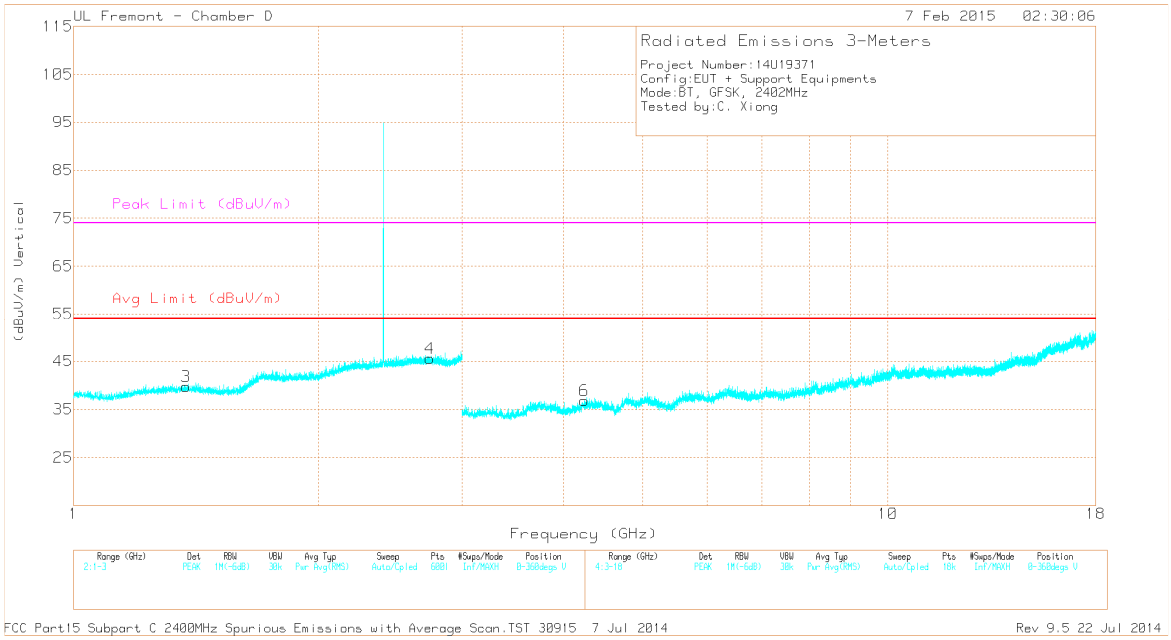
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 1.242	41.89	PK3	28.1	-22.4	0	47.59	-	-	74	-26.41	90	118	H
	* 1.241	28.83	VB1T	28.1	-22.4	1.14	35.67	54	-18.33	-	-	90	118	H
2	* 1.699	41.37	PK3	30.7	-21.7	0	50.37	-	-	74	-23.63	102	146	H
	* 1.698	28.52	VB1T	30.6	-21.7	1.14	38.56	54	-15.44	-	-	102	146	H
3	* 1.374	41.99	PK3	28.4	-22.2	0	48.19	-	-	74	-25.81	70	133	V
	* 1.376	28.80	VB1T	28.4	-22.2	1.14	36.14	54	-17.86	-	-	70	133	V
4	* 2.738	41.34	PK3	32.4	-20.5	0	53.24	-	-	74	-20.76	199	195	V
	* 2.738	28.60	VB1T	32.4	-20.5	1.14	41.64	54	-12.36	-	-	199	195	V
5	* 3.764	38.50	PK3	32.9	-28.3	0	43.10	-	-	74	-30.90	241	242	H
	* 3.765	25.47	VB1T	32.9	-28.3	1.14	31.21	54	-22.79	-	-	241	242	H
6	* 4.237	37.94	PK3	33.4	-27.6	0	43.74	-	-	74	-30.26	182	178	V
	* 4.238	24.89	VB1T	33.4	-27.6	1.14	31.83	54	-22.17	-	-	182	178	V

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

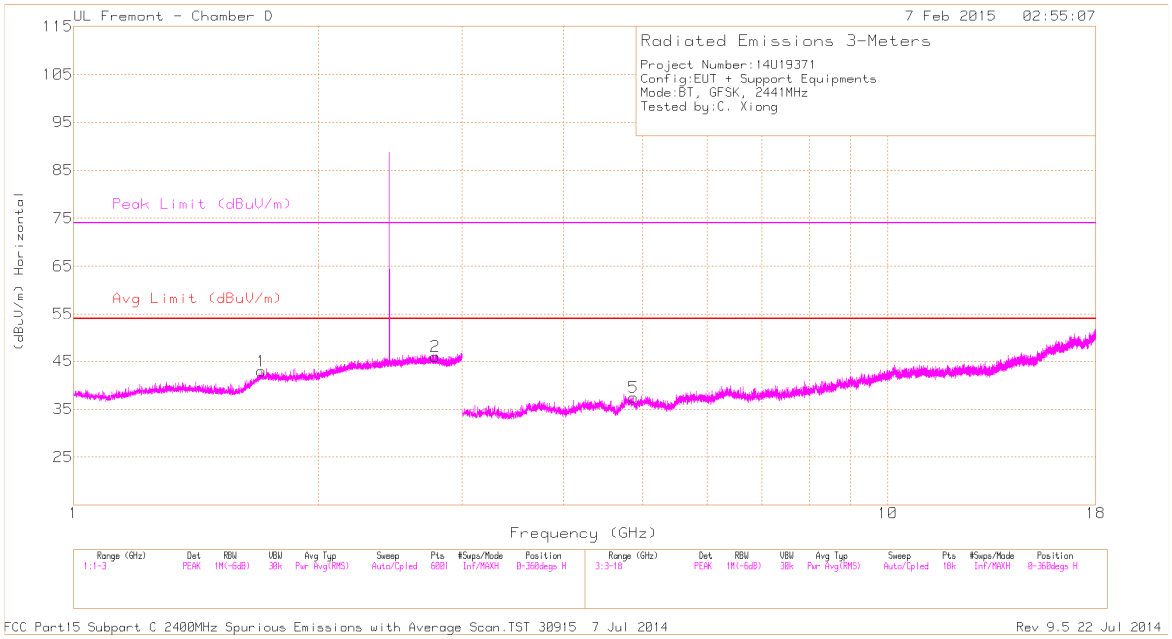
PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

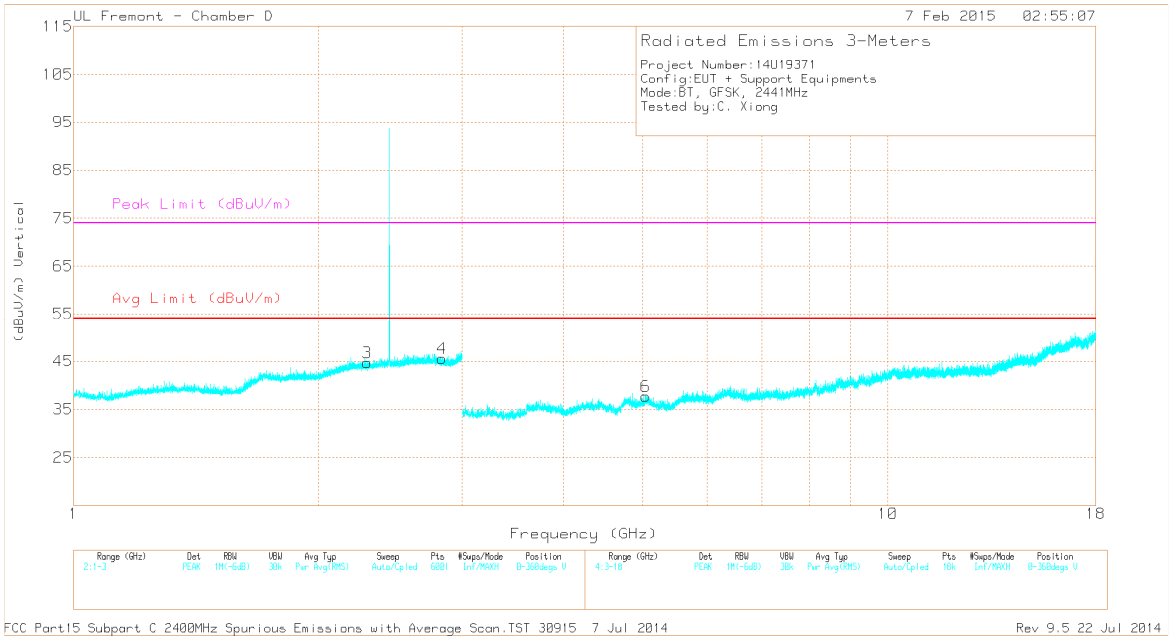
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 1.701	41.59	PK3	30.7	-21.7	0	50.59	-	-	74	-23.41	195	202	H
	* 1.699	28.49	VB1T	30.7	-21.7	1.14	38.63	54	-15.37	-	-	195	202	H
2	* 2.780	42.64	PK3	32.4	-20.4	0	54.64	-	-	74	-19.36	184	164	H
	* 2.781	28.47	VB1T	32.4	-20.4	1.14	41.61	54	-12.39	-	-	184	164	H
3	* 2.296	42.06	PK3	31.9	-21.0	0	52.96	-	-	74	-21.04	145	189	V
	* 2.296	28.50	VB1T	31.9	-21.0	1.14	40.54	54	-13.46	-	-	145	189	V
4	* 2.835	41.74	PK3	32.2	-20.3	0	53.64	-	-	74	-20.36	82	143	V
	* 2.836	28.29	VB1T	32.2	-20.3	1.14	41.33	54	-12.67	-	-	82	143	V
5	* 4.872	38.06	PK3	33.9	-28.1	0	43.86	-	-	74	-30.14	125	160	H
	* 4.869	25.12	VB1T	33.9	-28.1	1.14	32.06	54	-21.94	-	-	125	160	H
6	* 5.037	37.07	PK3	34.0	-26.8	0	44.27	-	-	74	-29.73	222	228	V
	* 5.040	24.75	VB1T	34.0	-26.7	1.14	33.19	54	-20.81	-	-	222	228	V

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

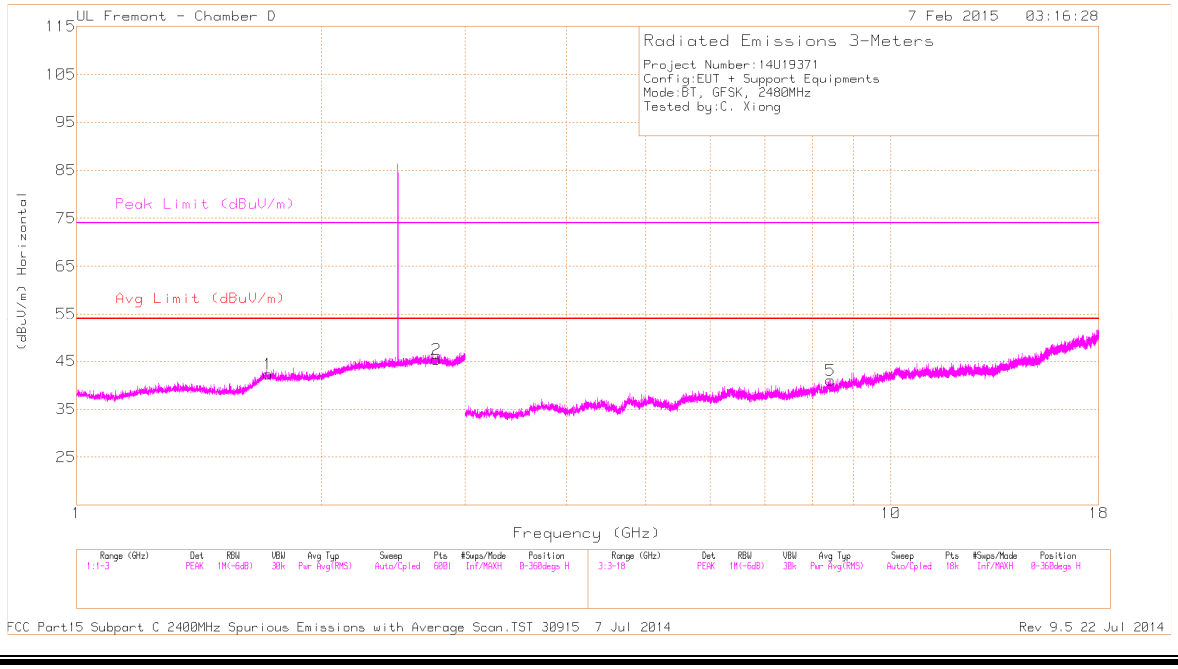
PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

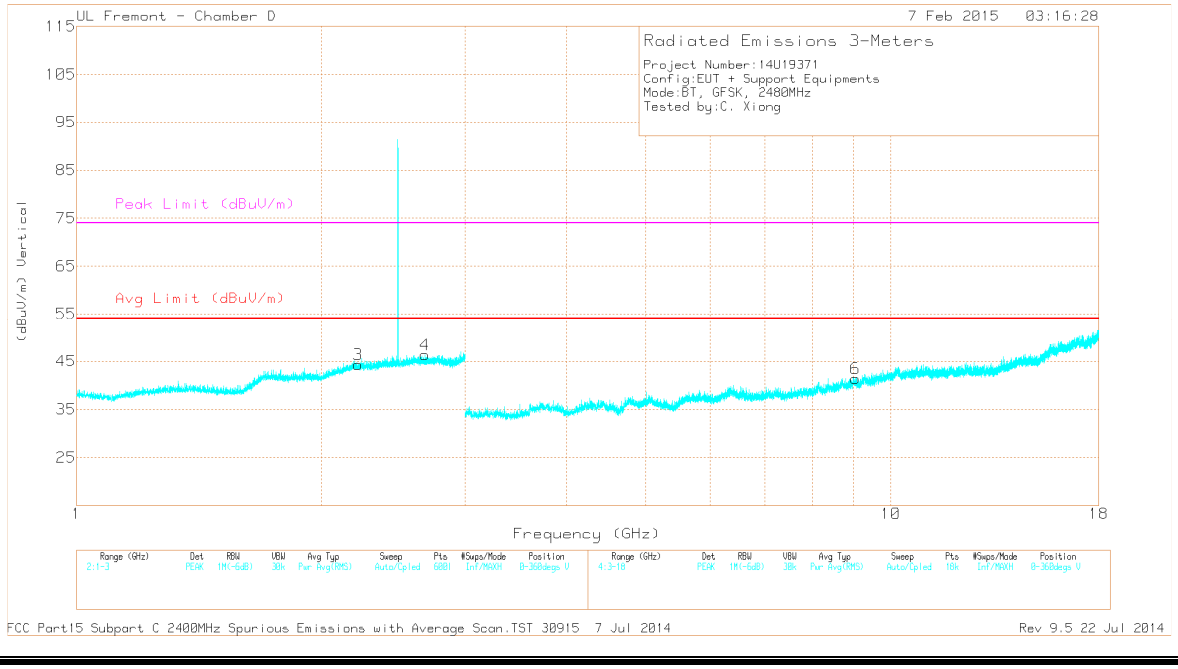
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 1.719	41.65	PK3	30.6	-21.6	0	50.65	-	-	74	-23.35	254	144	H
	* 1.719	28.44	VB1T	30.6	-21.6	1.14	38.58	54	-15.42	-	-	254	144	H
2	* 2.767	41.42	PK3	32.4	-20.4	0	53.42	-	-	74	-20.58	202	188	H
	* 2.767	28.49	VB1T	32.4	-20.4	1.14	41.63	54	-12.37	-	-	202	188	H
3	* 2.220	41.84	PK3	32.0	-21.0	0	52.84	-	-	74	-21.16	184	174	V
	* 2.219	28.45	VB1T	32.0	-21.0	1.14	40.59	54	-13.41	-	-	184	174	V
4	* 2.676	41.83	PK3	32.4	-20.6	0	53.63	-	-	74	-20.37	156	232	V
	* 2.679	28.60	VB1T	32.4	-20.6	1.14	41.54	54	-12.46	-	-	156	232	V
5	* 8.426	35.60	PK3	36.1	-23.4	0	48.30	-	-	74	-25.70	97	211	H
	* 8.426	22.48	VB1T	36.1	-23.4	1.14	36.32	54	-17.68	-	-	97	211	H
6	* 9.050	34.29	PK3	36.6	-21.8	0	49.09	-	-	74	-24.91	118	168	V
	* 9.050	21.64	VB1T	36.6	-21.8	1.14	37.58	54	-16.42	-	-	118	168	V

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

PK3 - FHSS Method: Maximum Peak

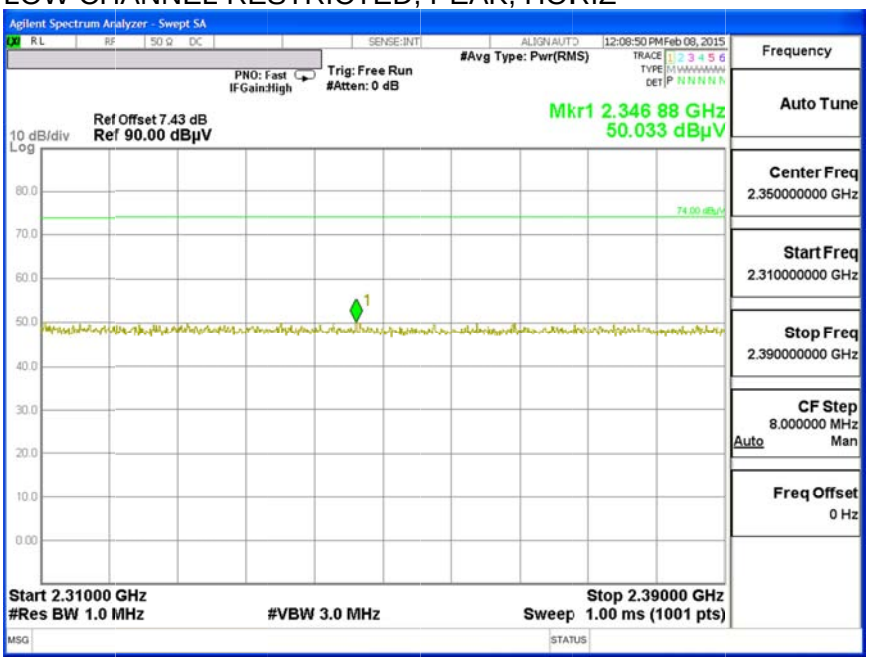
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.4.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

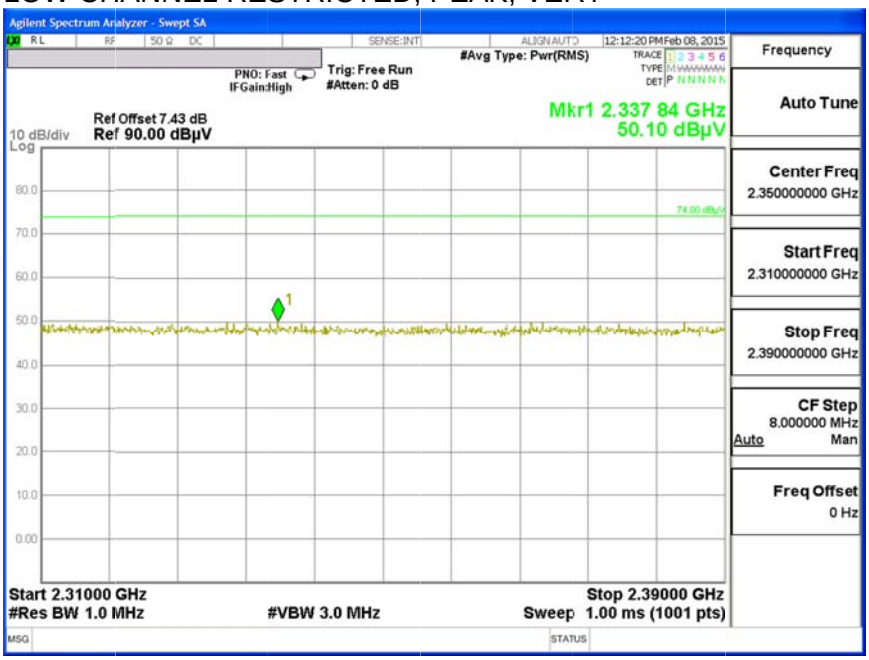


LOW CHANNEL RESTRICTED, AVG, HORIZ

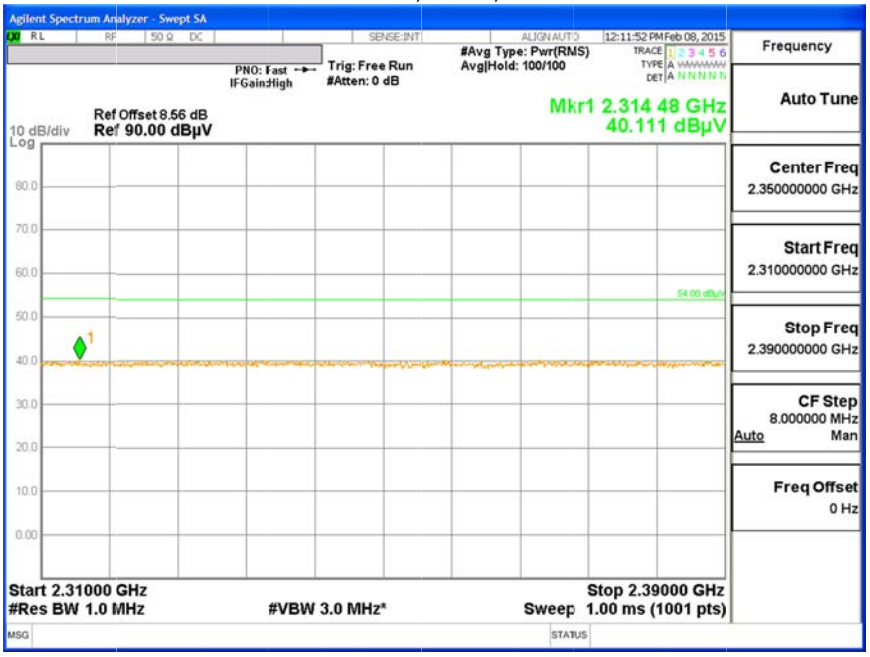
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



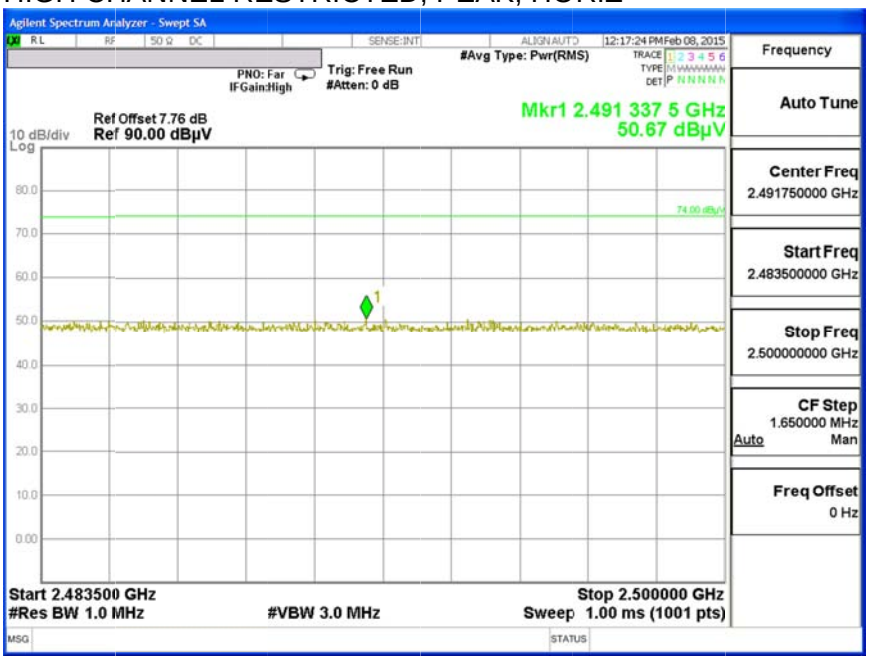
LOW CHANNEL RESTRICTED, AVG, VERT



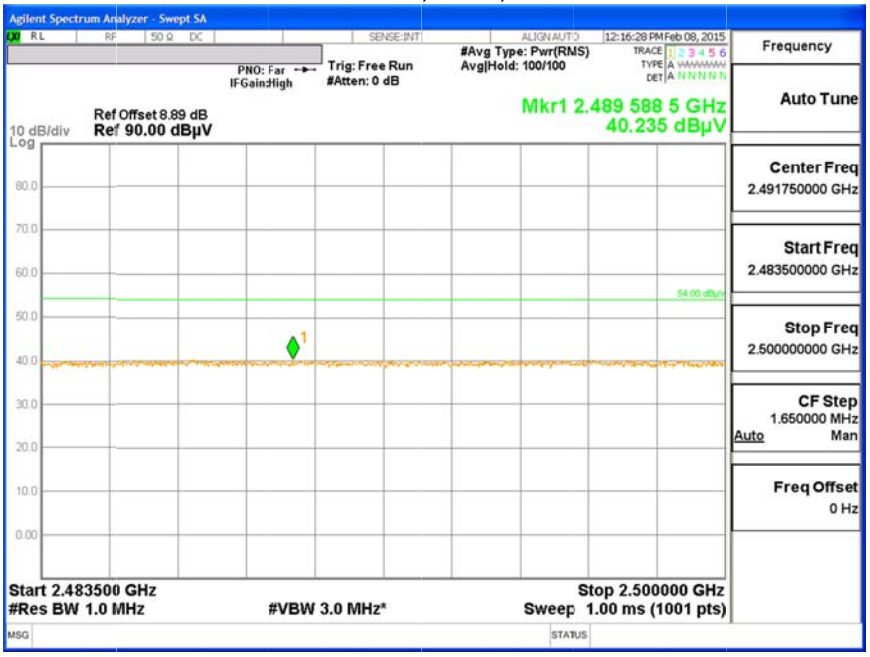
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ



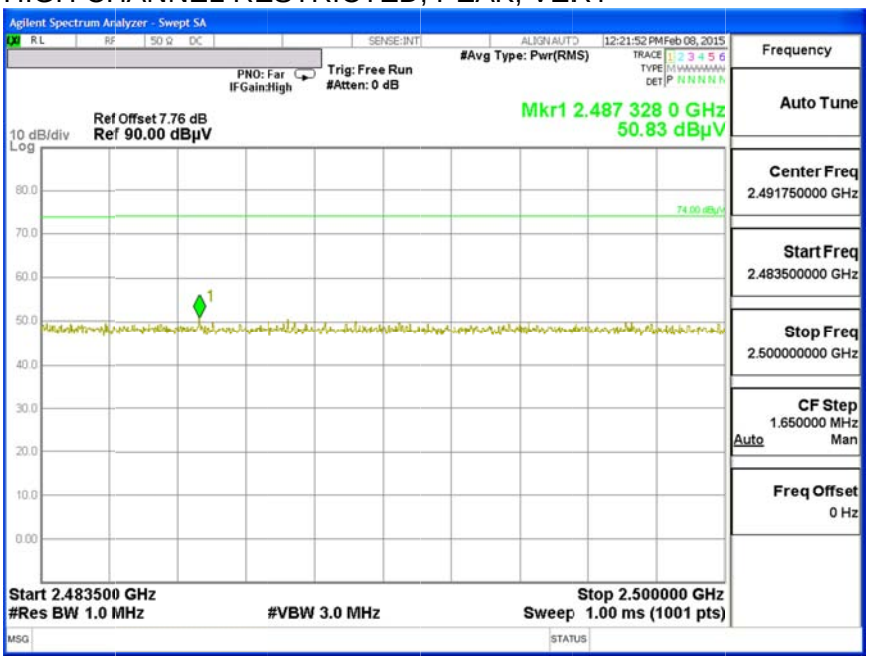
HIGH CHANNEL RESTRICTED, AVG, HORIZ



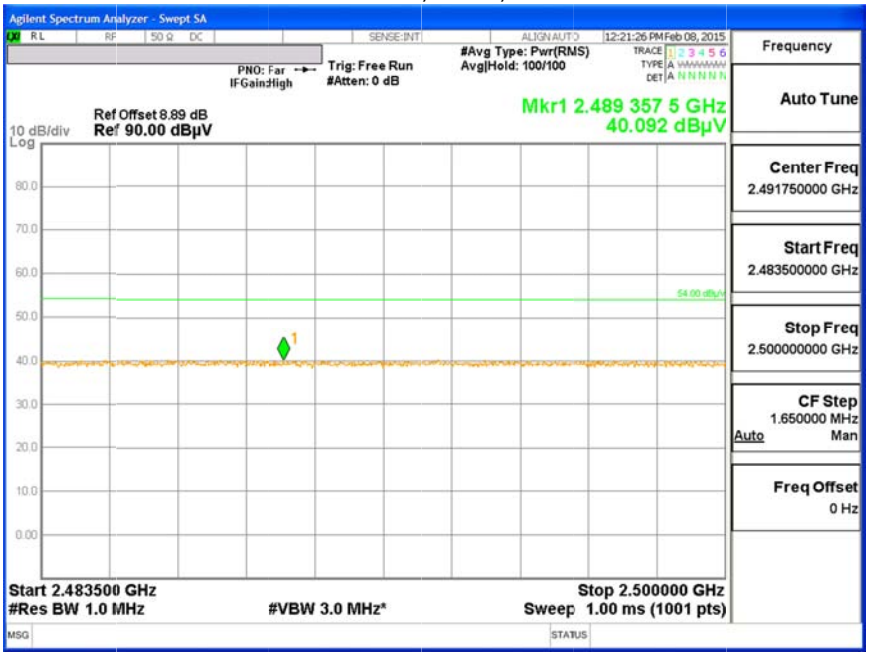
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



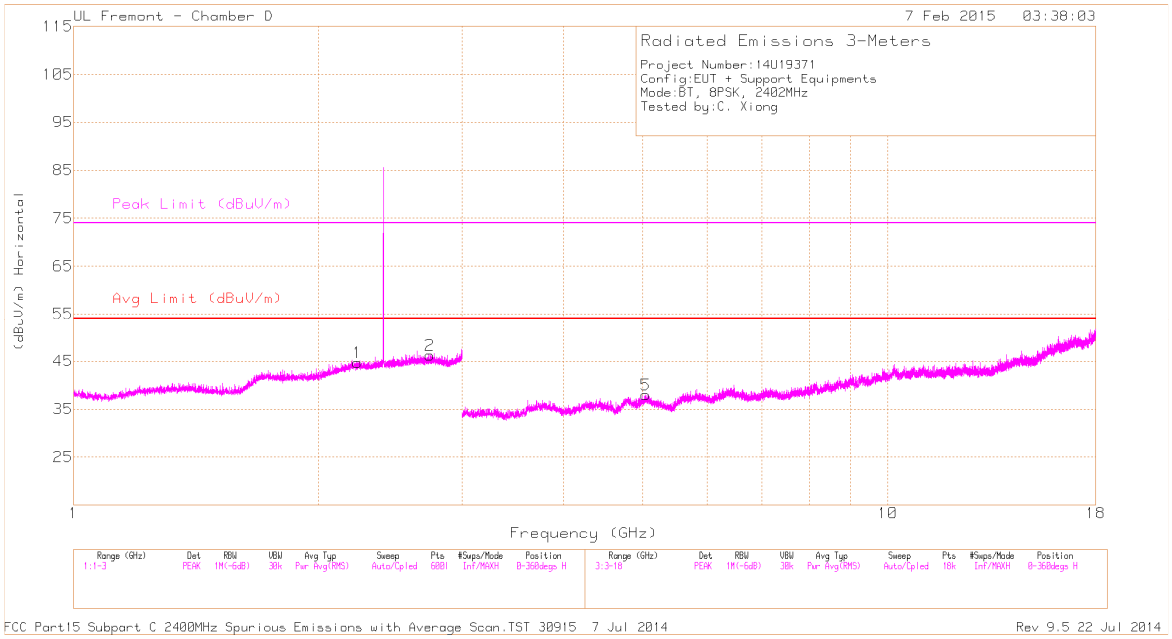
HIGH CHANNEL RESTRICTED, AVG, VERT



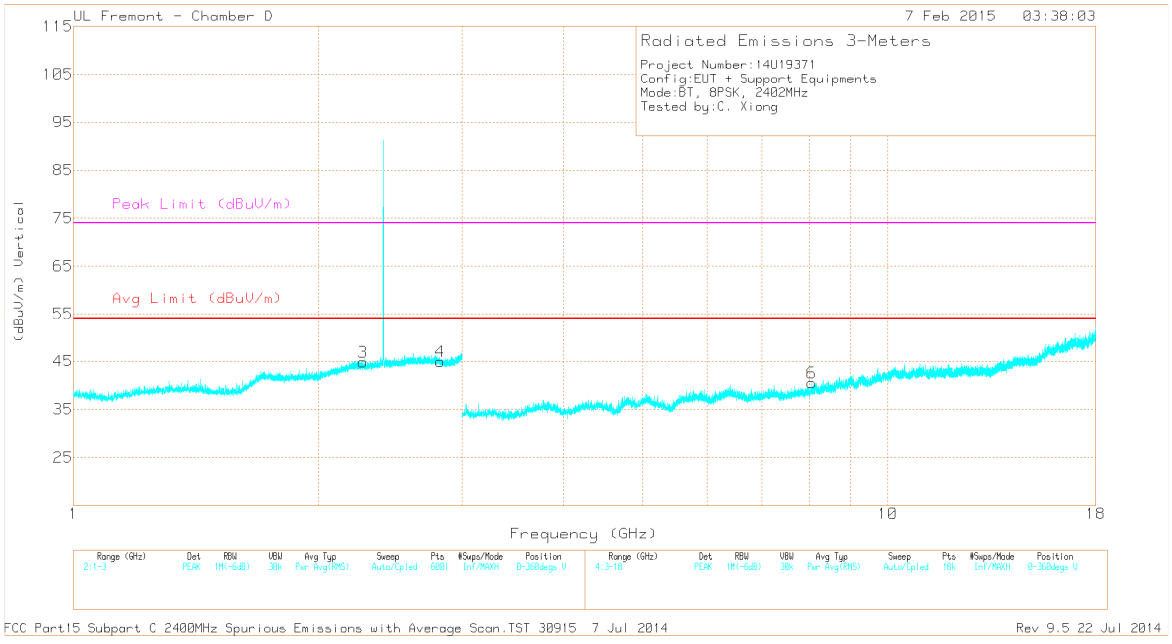
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (LOW)

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 2.232	41.57	PK3	32.0	-21.0	0	52.57	-	-	74	-21.43	33	115	H
	* 2.233	28.48	VB1T	32.0	-21.0	1.13	40.31	54	-13.69	-	-	33	115	H
2	* 2.738	41.71	PK3	32.4	-20.5	0	53.61	-	-	74	-20.39	78	139	H
	* 2.736	28.56	VB1T	32.4	-20.5	1.13	41.59	54	-12.41	-	-	78	139	H
3	* 2.266	41.96	PK3	31.9	-20.9	0	52.96	-	-	74	-21.04	109	178	V
	* 2.269	28.50	VB1T	31.9	-20.9	1.13	40.63	54	-13.37	-	-	109	178	V
4	* 2.822	41.20	PK3	32.3	-20.3	0	53.20	-	-	74	-20.80	161	315	V
	* 2.822	28.28	VB1T	32.3	-20.3	1.13	41.41	54	-12.59	-	-	161	315	V
5	* 5.038	37.28	PK3	34.0	-26.7	0	44.58	-	-	74	-29.42	135	289	H
	* 5.042	24.75	VB1T	34.0	-26.7	1.13	33.18	54	-20.82	-	-	135	289	H
6	* 8.067	36.05	PK3	36.0	-24.5	0	47.55	-	-	74	-26.45	86	253	V
	* 8.064	23.04	VB1T	36.0	-24.5	1.13	35.67	54	-18.33	-	-	86	253	V

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

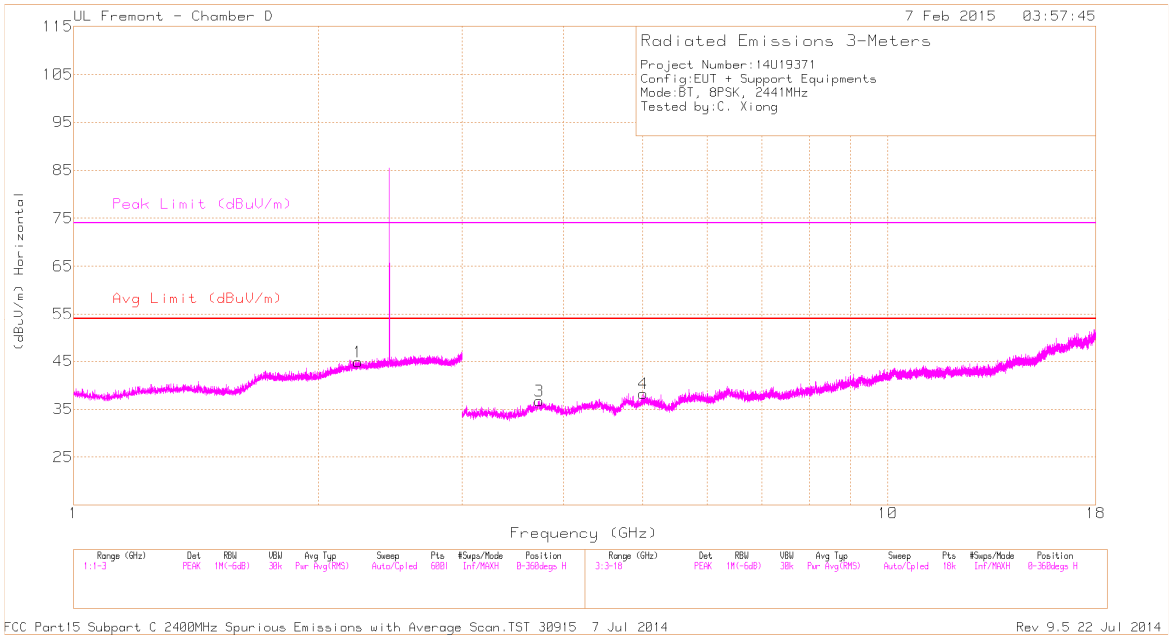
PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

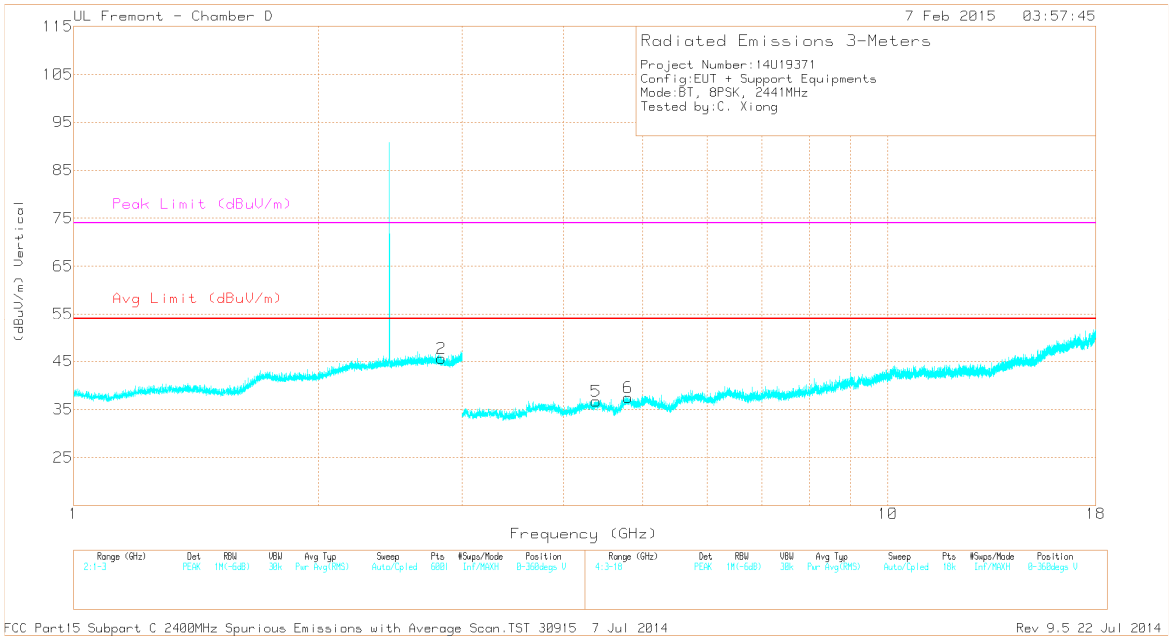
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (MID)

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 2.235	42.48	PK3	32.0	-21.0	0	53.48	-	-	74	-20.52	49	215	H
	* 2.238	28.50	VB1T	32.0	-21.0	1.13	40.63	54	-13.37	-	-	49	215	H
2	* 2.831	42.13	PK3	32.2	-20.3	0	54.03	-	-	74	-19.97	71	179	V
	* 2.827	28.26	VB1T	32.2	-20.3	1.13	41.29	54	-12.71	-	-	71	179	V
3	* 3.730	39.07	PK3	32.9	-28.6	0	43.37	-	-	74	-30.63	101	183	H
	* 3.730	25.78	VB1T	32.9	-28.6	1.13	31.21	54	-22.79	-	-	101	183	H
4	* 5.011	38.37	PK3	34.0	-26.9	0	45.47	-	-	74	-28.53	130	148	H
	* 5.012	24.54	VB1T	34.0	-26.9	1.13	32.77	54	-21.23	-	-	130	148	H
5	* 4.383	37.84	PK3	33.5	-28.2	0	43.14	-	-	74	-30.86	176	178	V
	* 4.384	25.38	VB1T	33.5	-28.2	1.13	31.81	54	-22.19	-	-	176	178	V
6	* 4.795	36.73	PK3	34.0	-26.8	0	43.93	-	-	74	-30.07	37	212	V
	* 4.795	24.43	VB1T	34.0	-26.8	1.13	32.76	54	-21.24	-	-	37	212	V

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

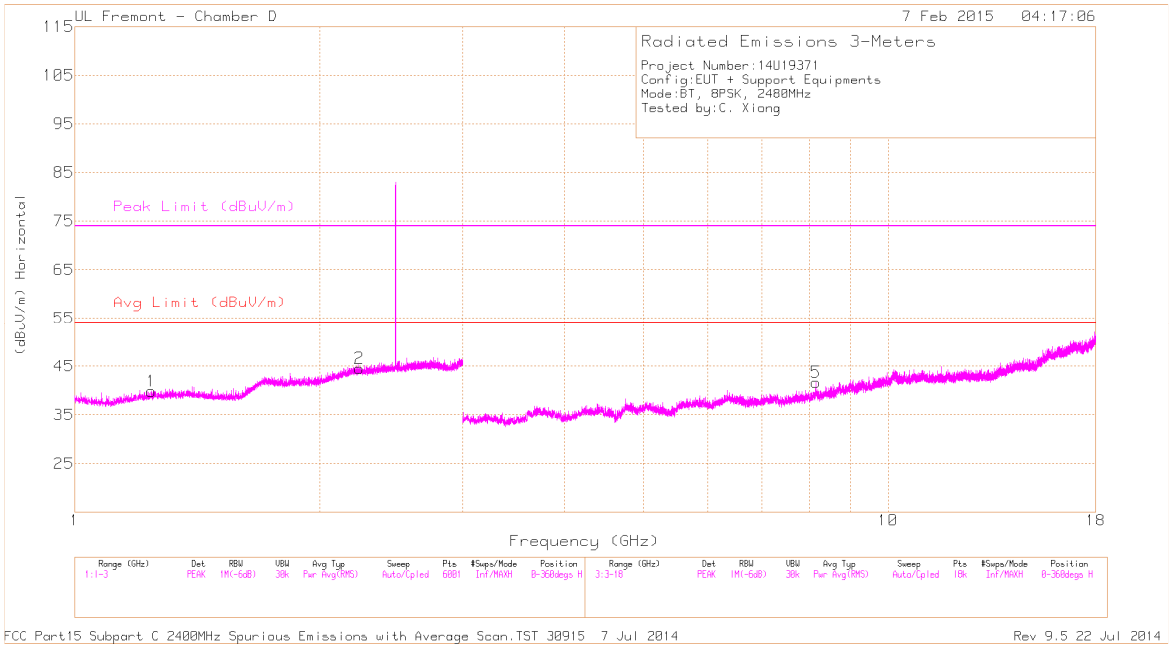
PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

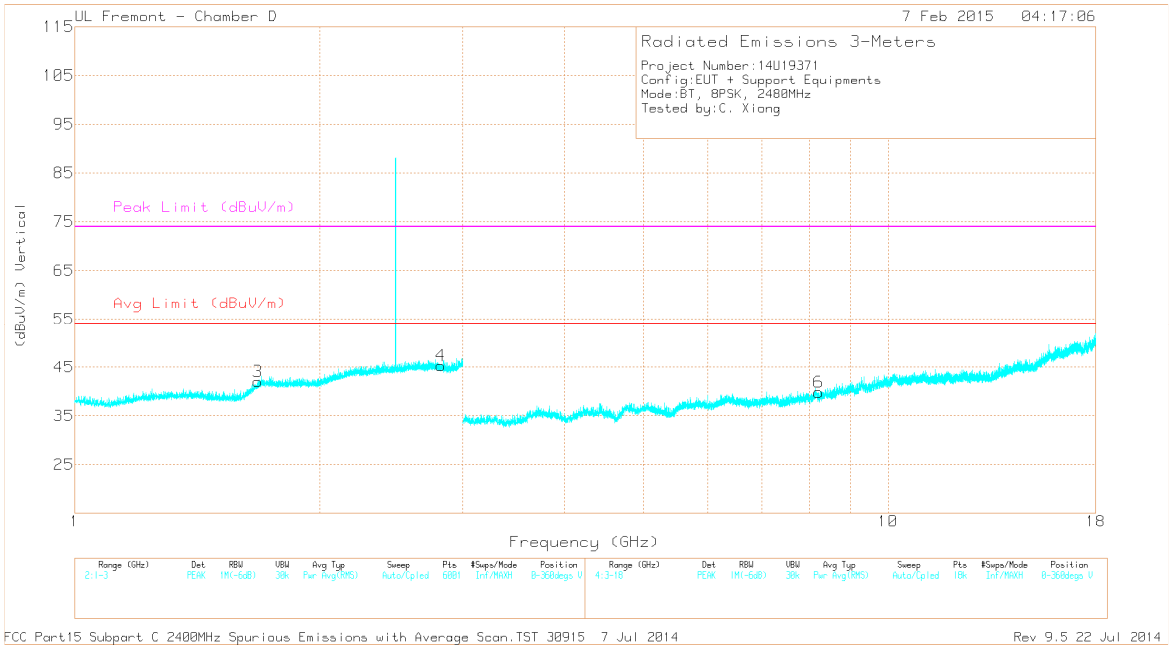
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HARMONICS AND SPURIOUS EMISSIONS (HIGH)

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (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	* 1.241	42.00	PK3	28.1	-22.4	0	47.70	-	-	74	-26.30	38	315	H
	* 1.243	28.77	VB1T	28.1	-22.4	1.13	35.6	54	-18.4	-	-	38	315	H
2	* 2.236	41.78	PK3	32.0	-21.0	0	52.78	-	-	74	-21.22	183	277	H
	* 2.237	28.51	VB1T	32.0	-21.0	1.13	40.64	54	-13.36	-	-	183	277	H
3	* 1.680	41.38	PK3	30.1	-21.7	0	49.78	-	-	74	-24.22	170	219	V
	* 1.681	28.54	VB1T	30.1	-21.7	1.13	38.07	54	-15.93	-	-	170	219	V
4	* 2.821	41.15	PK3	32.3	-20.3	0	53.15	-	-	74	-20.85	156	172	V
	* 2.823	28.30	VB1T	32.2	-20.3	1.13	41.33	54	-12.67	-	-	156	172	V
5	* 8.159	35.17	PK3	36.1	-23.2	0	48.07	-	-	74	-25.93	89	112	H
	* 8.158	22.52	VB1T	36.1	-23.2	1.13	36.55	54	-17.45	-	-	89	112	H
6	* 8.214	36.29	PK3	36.1	-23.9	0	48.49	-	-	74	-25.51	118	138	V
	* 8.214	22.68	VB1T	36.1	-23.9	1.13	36.01	54	-17.99	-	-	118	138	V

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

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

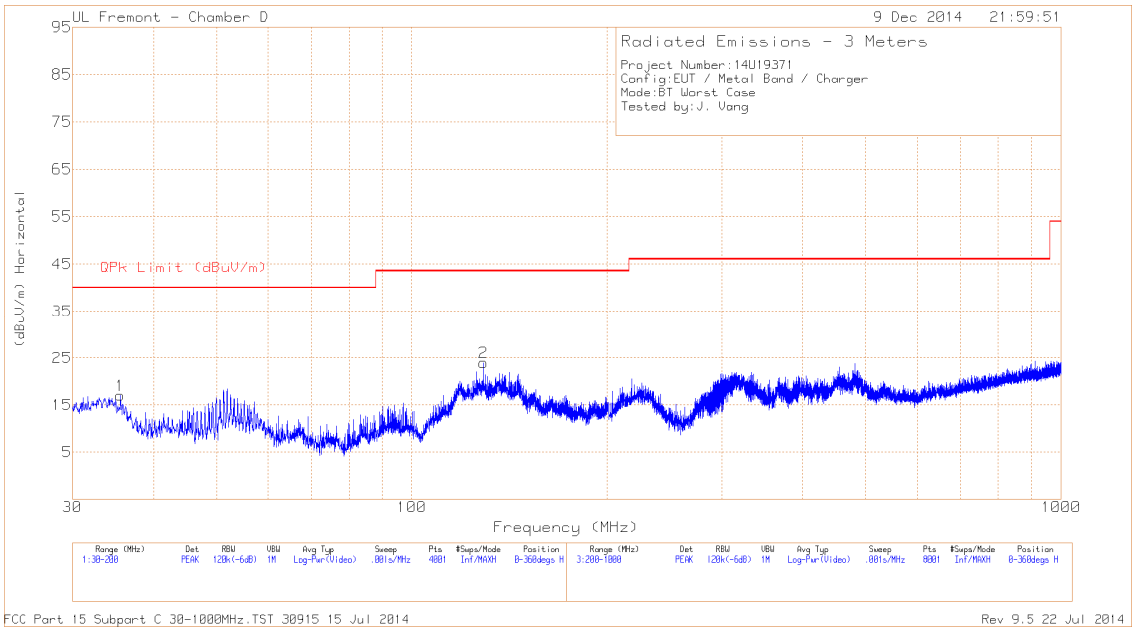
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.5. WORST-CASE BELOW 1 GHz

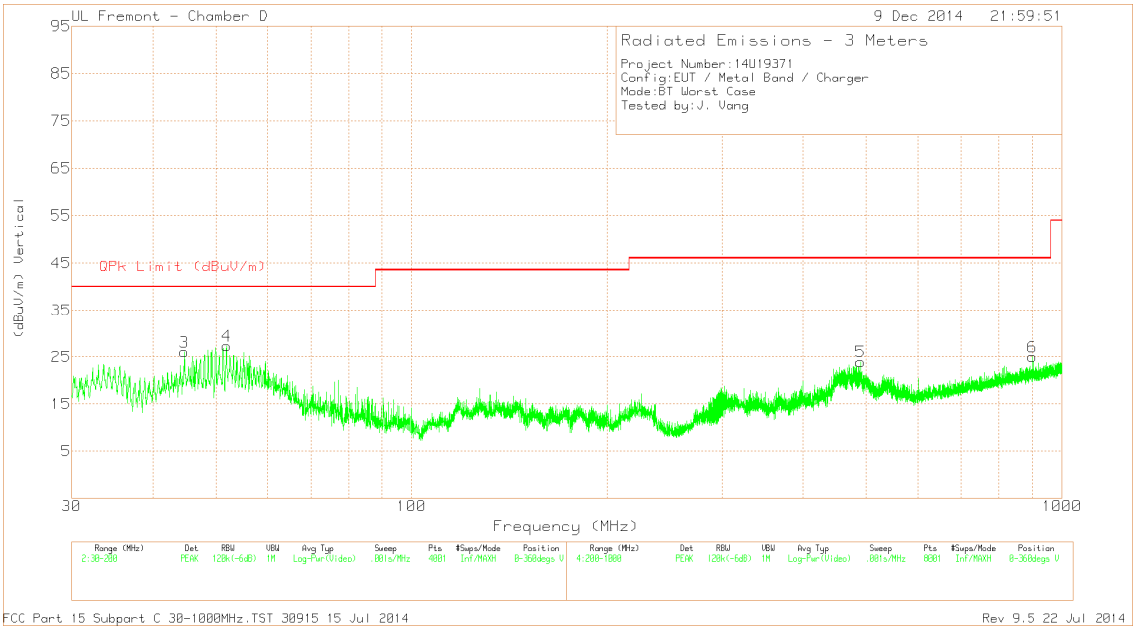
A1554 ANTENNA 1

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

HORIZONTAL PLOT



VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HORIZONTAL AND VERTICAL 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	35.5675	31.52	PK	17.3	-31.8	17.02	40.00	-22.98	0-360	301	H
2	* 128.8975	41.57	PK	13.6	-31.2	23.97	43.52	-19.55	0-360	201	H
3	44.7475	47.21	PK	10.6	-31.8	26.01	40.00	-13.99	0-360	100	V
4	51.930	51.62	PK	7.5	-31.8	27.32	40.00	-12.68	0-360	100	V
5	490.100	35.96	PK	17.8	-29.8	23.96	46.02	-22.06	0-360	98	V
6	900.100	31.23	PK	22.3	-28.5	25.03	46.02	-20.99	0-360	201	V

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

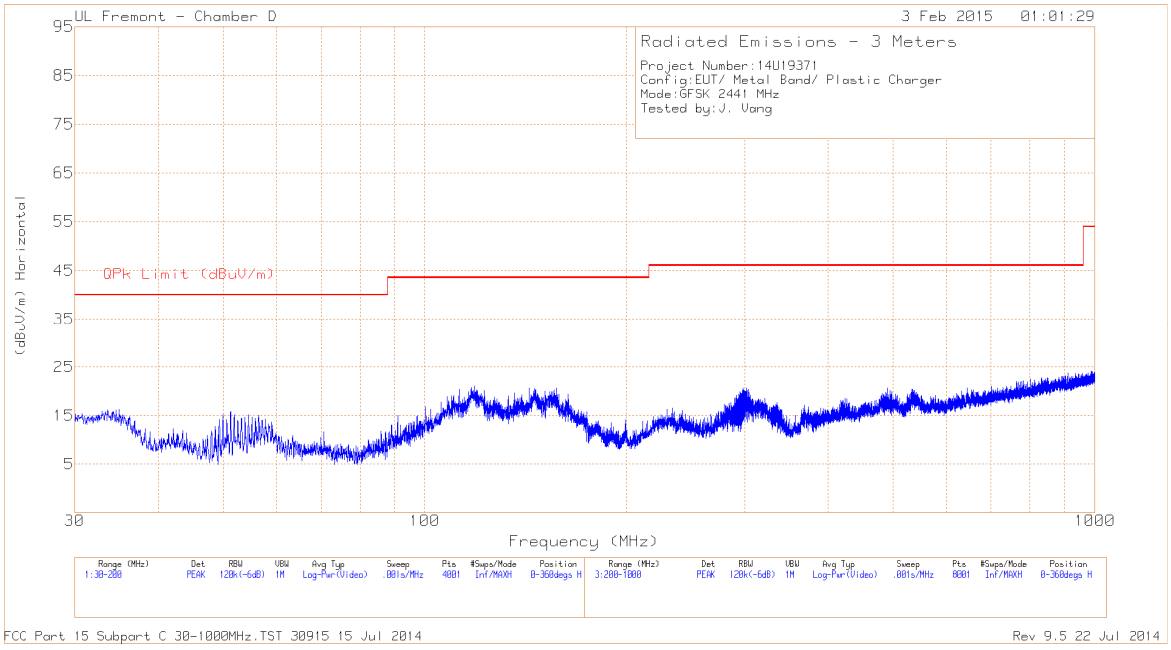
PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

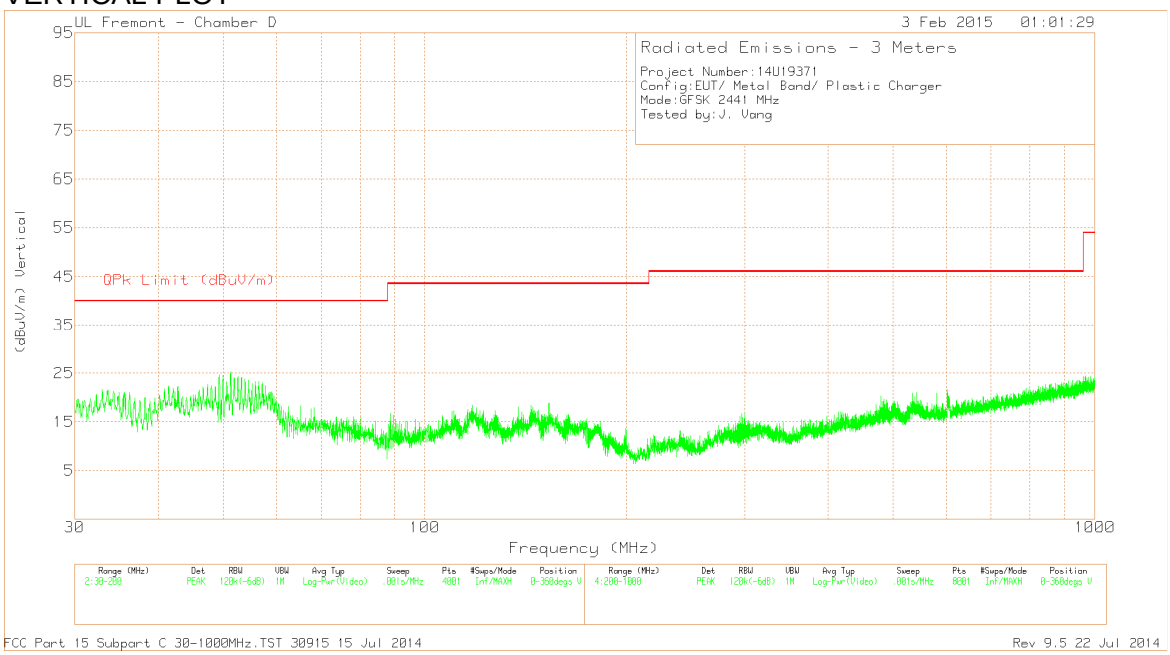
A1554 ANTENNA 2

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

HORIZONTAL PLOT



VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HORIZONTAL AND VERTICAL 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	34.9725	30.43	PK	17.7	-31.8	16.33	40.00	-23.67	0-360	98	H
2	* 117.8475	37.40	PK	13.7	-31.2	19.90	43.52	-23.62	0-360	301	H
3	304.000	37.20	PK	13.5	-30.3	20.40	46.02	-25.62	0-360	100	H
4	51.2925	49.44	PK	7.6	-31.7	25.34	40.00	-14.66	0-360	100	V
5	153.165	37.57	PK	12.4	-31.1	18.87	43.52	-24.65	0-360	100	V
6	602.300	32.8	PK	18.4	-29.5	21.70	46.02	-24.32	0-360	201	V

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

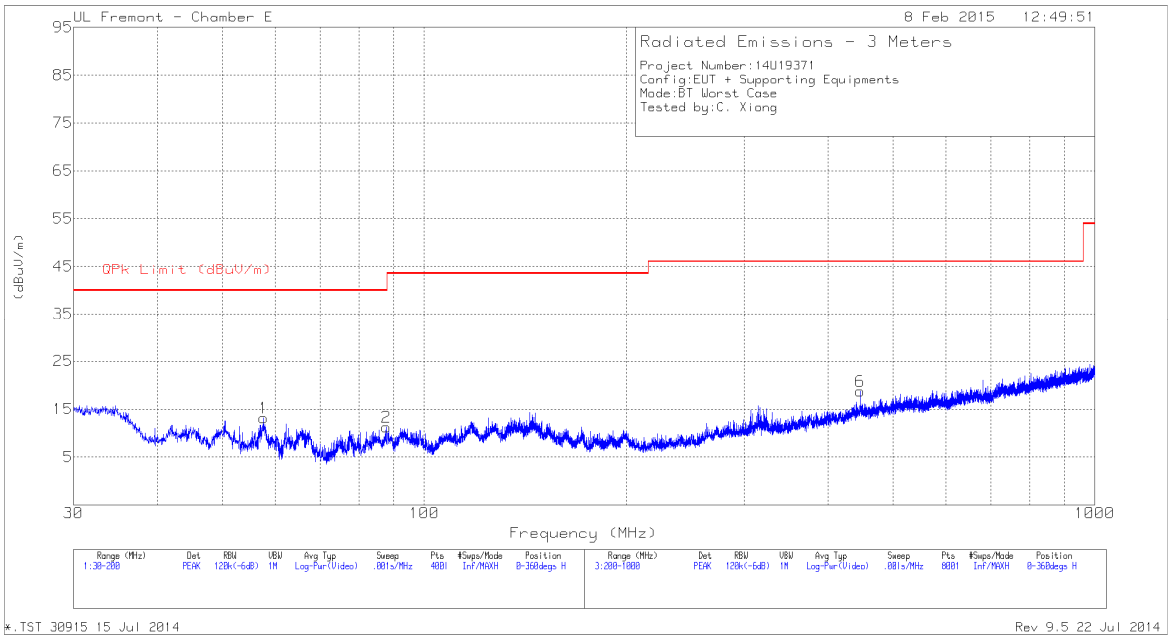
PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

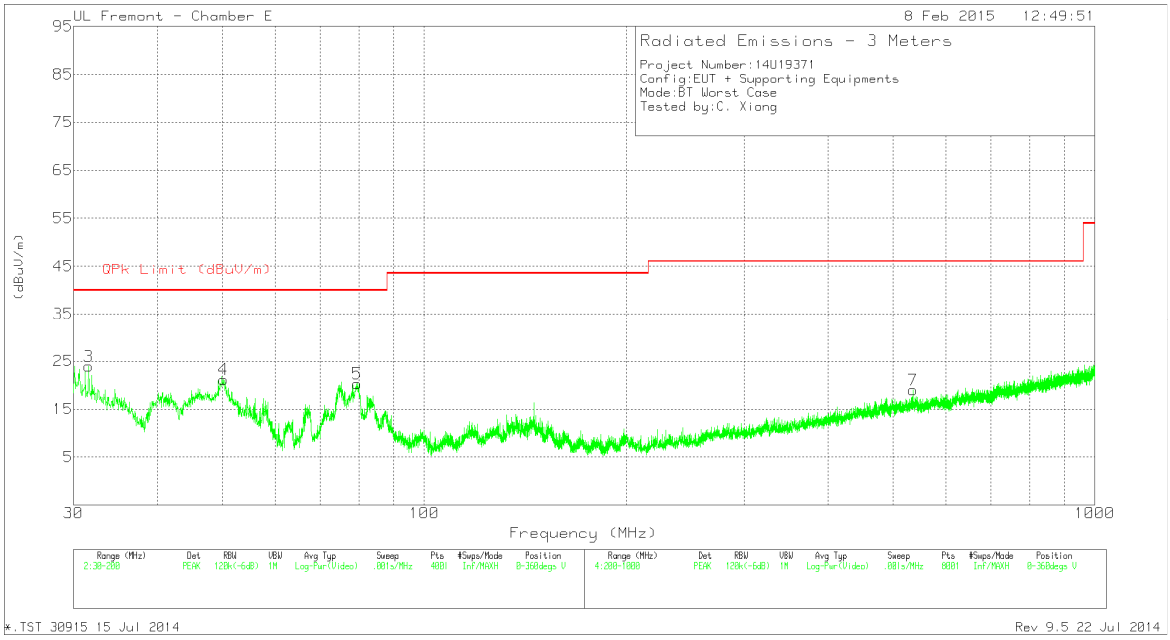
A1638

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

HORIZONTAL PLOT



VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

HORIZONTAL AND VERTICAL DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T408 (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	57.625	37.32	PK	7.5	-31.7	0	13.12	40.00	-26.88	0-360	401	H
2	87.8425	34.73	PK	7.8	-31.3	0	11.23	40.00	-28.77	0-360	201	H
3	31.5725	35.35	PK	20.4	-31.8	0	23.95	40.00	-16.05	0-360	100	V
4	50.1875	44.82	PK	8.0	-31.6	0	21.22	40.00	-18.78	0-360	100	V
5	79.385	43.73	PK	8.1	-31.5	0	20.33	40.00	-19.67	0-360	100	V
6	447.100	31.51	PK	16.9	-29.7	0	18.71	46.02	-27.31	0-360	201	H
7	535.300	30.21	PK	18.3	-29.5	0	19.01	46.02	-27.01	0-360	301	V

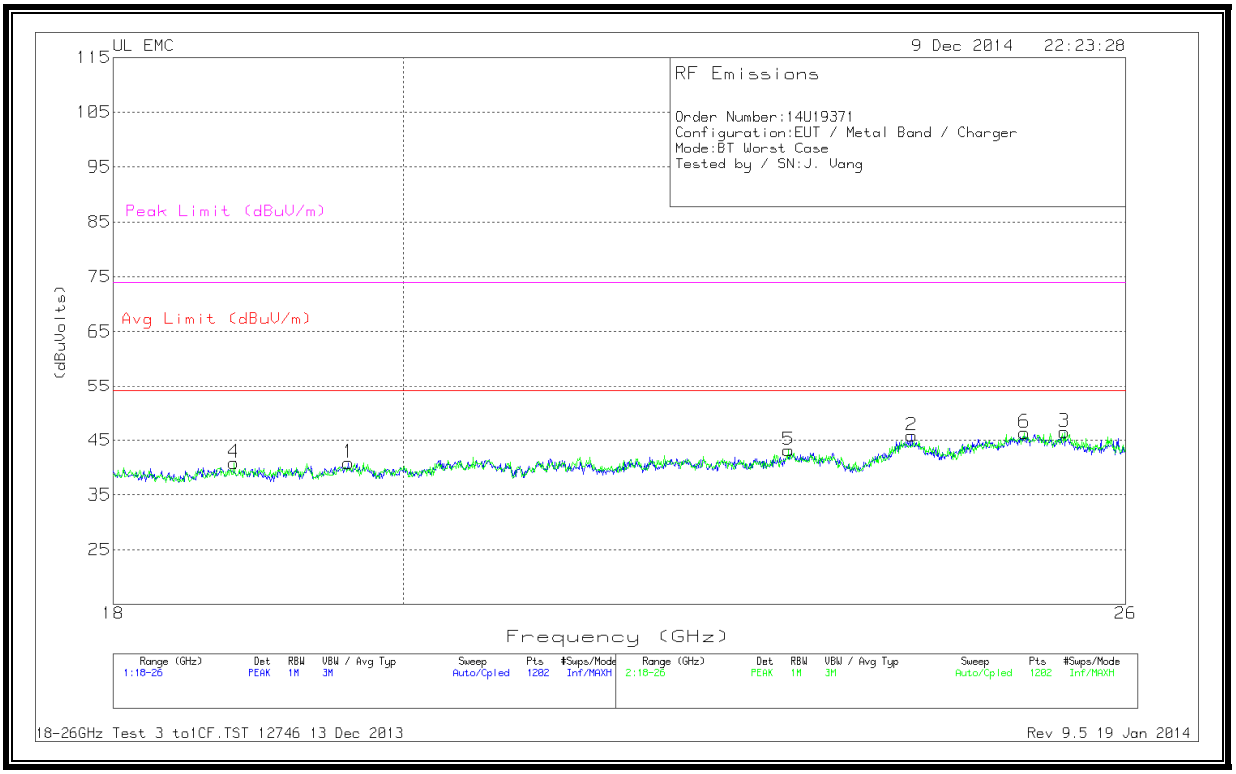
PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.6. WORST-CASE ABOVE 18 GHz

A1554 ANTENNA 1

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



HORIZONTAL & VERTICAL DATA

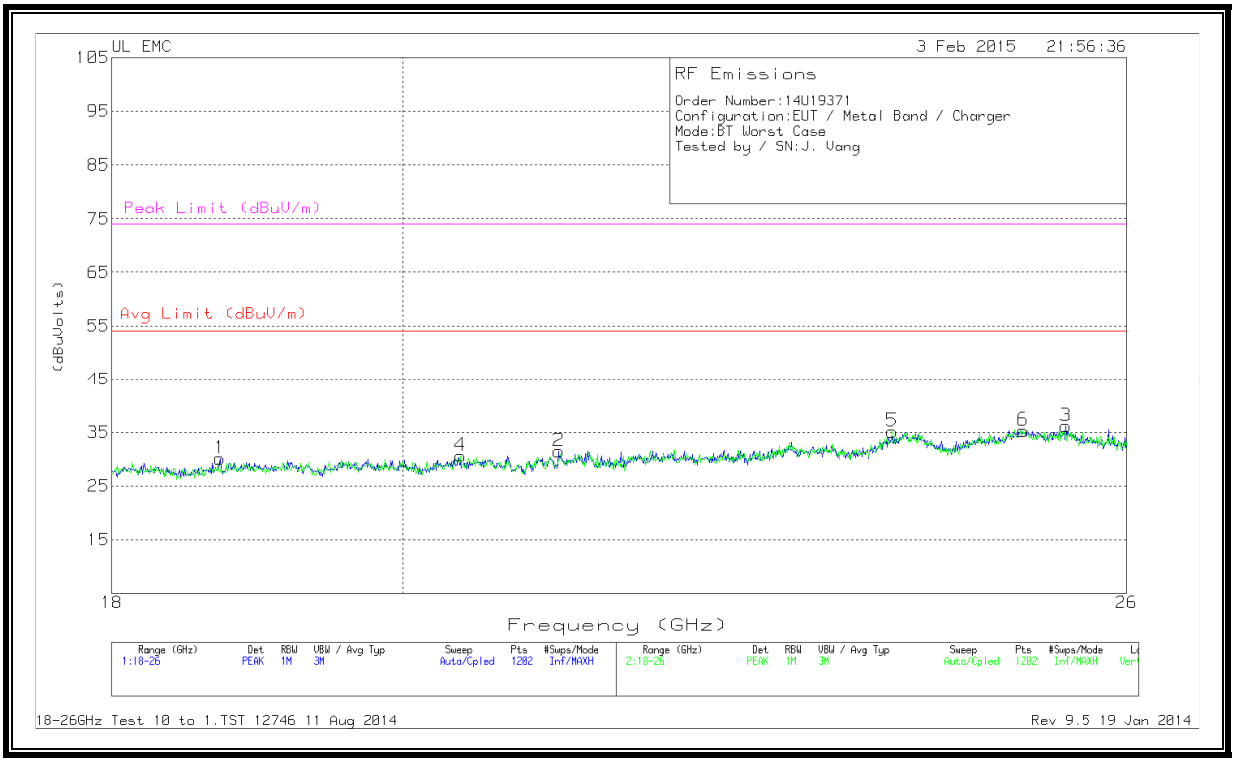
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T125 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.605	41.43	PK	32.8	-23.9	-9.5	40.83	54	-13.16	74	-33.16
2	24.055	44.13	PK	33.9	-22.7	-9.5	45.83	54	-8.16	74	-28.16
3	25.427	45.00	PK	34.1	-23.1	-9.5	46.50	54	-7.50	74	-27.50
4	18.806	42.23	PK	32.5	-24.4	-9.5	40.83	54	-13.16	74	-33.16
5	23.002	42.37	PK	33.5	-23.2	-9.5	43.16	54	-10.83	74	-30.83
6	25.061	44.33	PK	34.1	-22.6	-9.5	46.33	54	-7.66	74	-27.66

PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

A1554 ANTENNA 2

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



HORIZONTAL & VERTICAL DATA

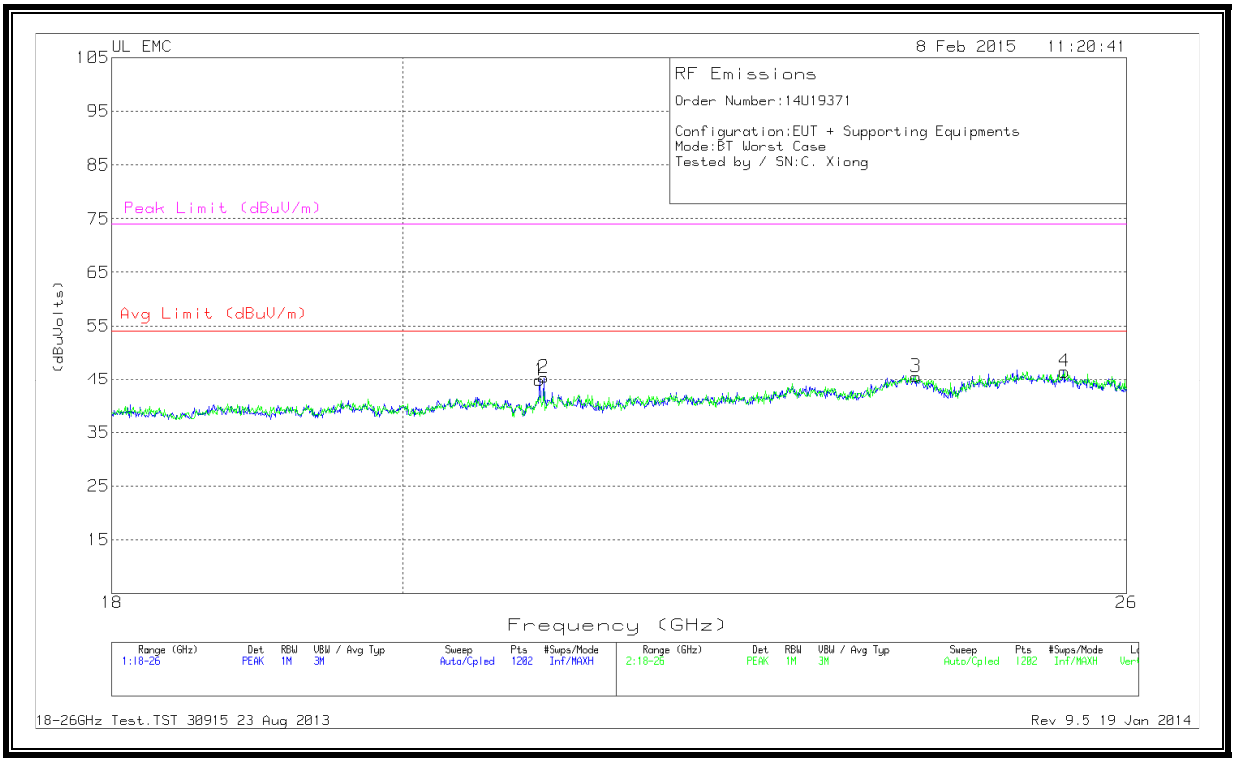
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.719	41.57	PK	32.7	-24.1	-20	30.16	54	-23.83	74	-43.83
2	21.164	42.10	PK	33.3	-23.9	-20	31.50	54	-22.50	74	-42.5
3	25.434	44.67	PK	34.6	-23.1	-20	36.16	54	-17.83	74	-37.83
4	20.425	41.57	PK	33	-23.9	-20	30.66	54	-23.33	74	-43.33
5	23.882	43.67	PK	34.2	-22.7	-20	35.16	54	-18.83	74	-38.83
6	25.041	43.43	PK	34.5	-22.6	-20	35.33	54	-18.66	74	-38.66

PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

A1638

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



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	21.017	44.73	PK	33.3	-23.7	-9.5	44.83	54	-9.16	74	-29.16
2	21.051	46.43	PK	33.3	-24.9	-9.5	45.33	54	-8.66	74	-28.66
3	24.088	43.80	PK	34.2	-23.0	-9.5	45.50	54	-8.50	74	-28.50
4	25.420	44.40	PK	34.6	-23.0	-9.5	46.50	54	-7.50	74	-27.50

PK - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

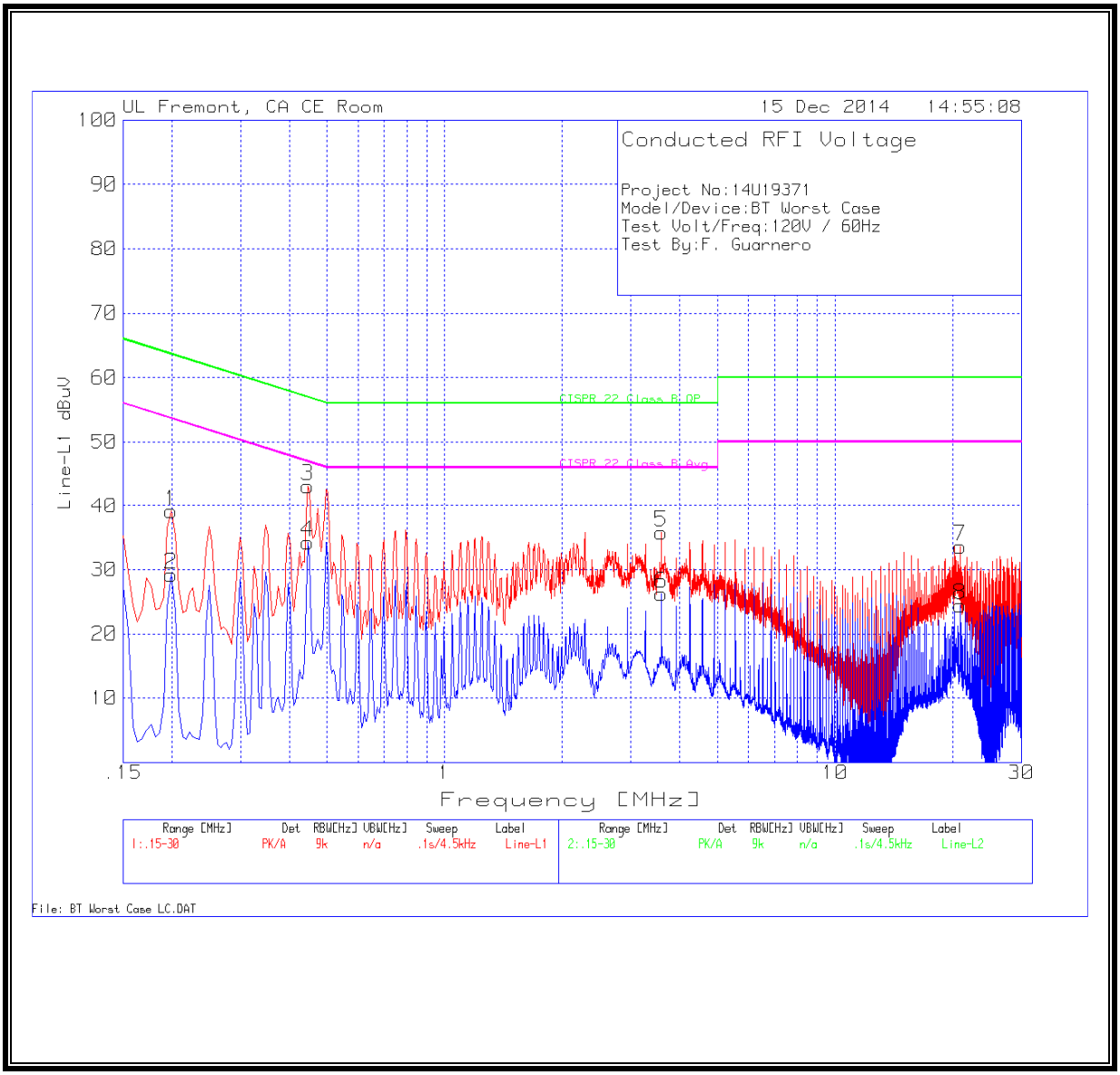
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

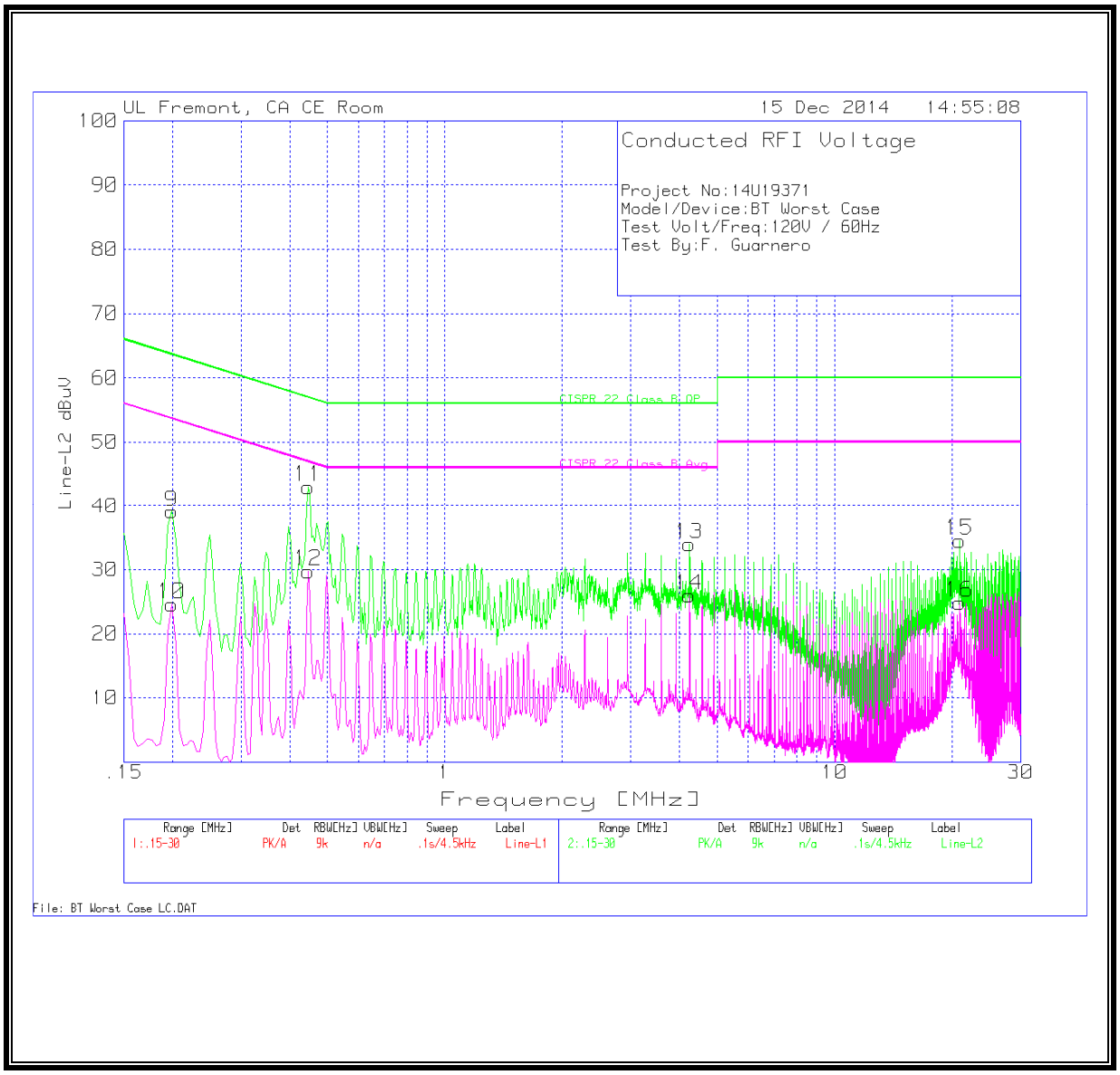
10.1. AC POWER LINE CONDUCTED EMISSIONS A1554 ANTENNA 1

LINE 1 PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LINE 2 PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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	.1995	38.27	PK	.9	0	39.17	63.6	-24.43	-	-
2	.1995	28.33	Av	.9	0	29.23	-	-	53.6	-24.37
3	.4470	42.75	PK	.4	0	43.15	56.9	-13.75	-	-
4	.4470	33.86	Av	.4	0	34.26	-	-	46.9	-12.64
5	3.5925	35.53	PK	.2	.1	35.83	56	-20.17	-	-
6	3.5925	25.94	Av	.2	.1	26.24	-	-	46.0	-19.76
7	20.8995	33.15	PK	.3	.2	33.65	60	-26.35	-	-
8	20.8995	23.96	Av	.3	.2	24.46	-	-	50.0	-25.54

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	.1995	38.08	PK	1	0	39.08	63.6	-24.52	-	-
10	.1995	23.56	Av	1	0	24.56	-	-	53.6	-29.04
11	.4470	42.61	PK	.4	0	43.01	56.9	-13.89	-	-
12	.4470	29.39	Av	.4	0	29.79	-	-	46.9	-17.11
13	4.245	33.63	PK	.2	.1	33.93	56.0	-22.07	-	-
14	4.245	25.64	Av	.2	.1	25.94	-	-	46.0	-20.06
15	20.8995	34.06	PK	.3	.2	34.56	60.0	-25.44	-	-
16	20.8995	24.37	Av	.3	.2	24.87	-	-	50.0	-25.13

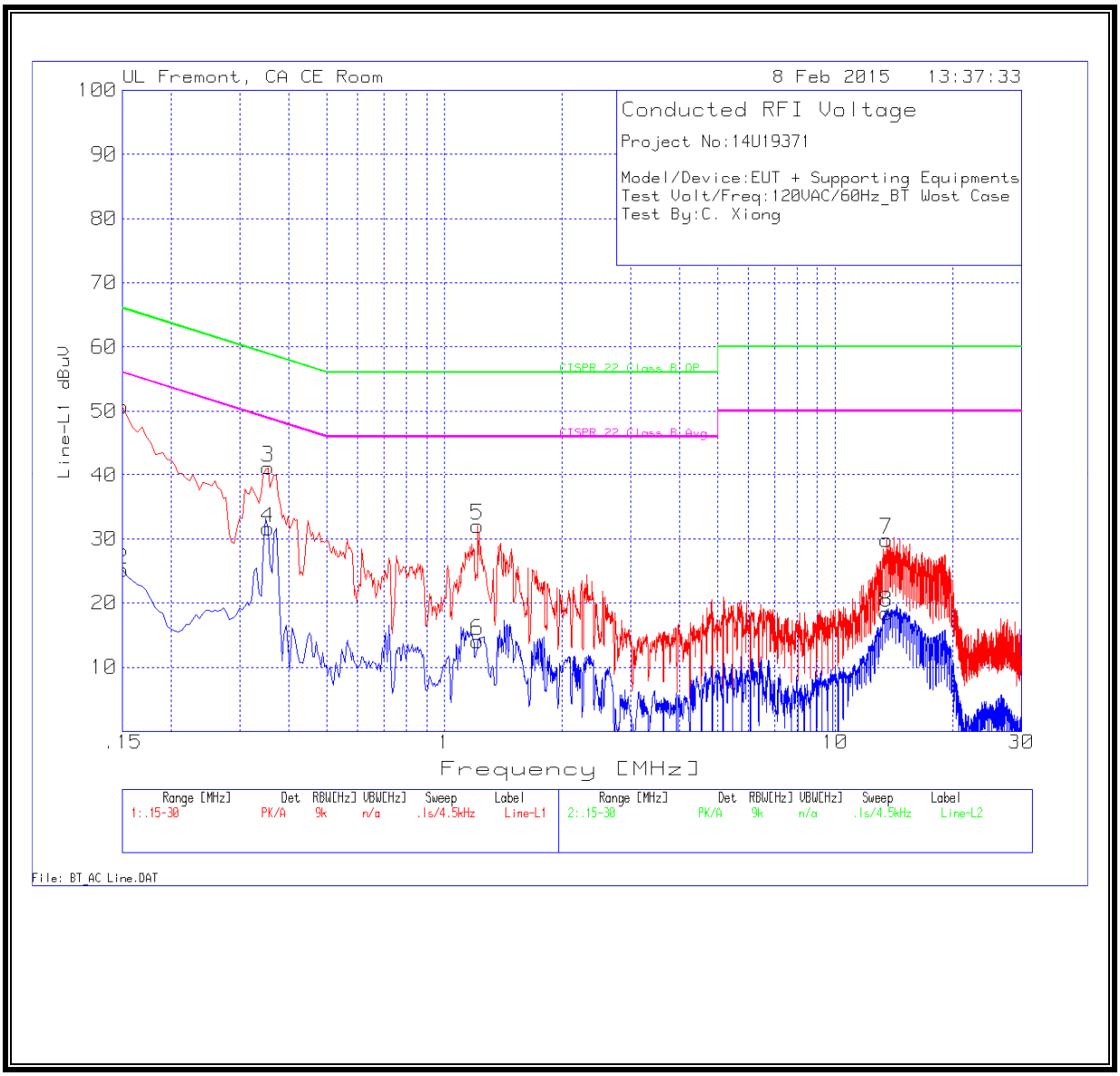
PK - Peak detector

Av - average detection

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

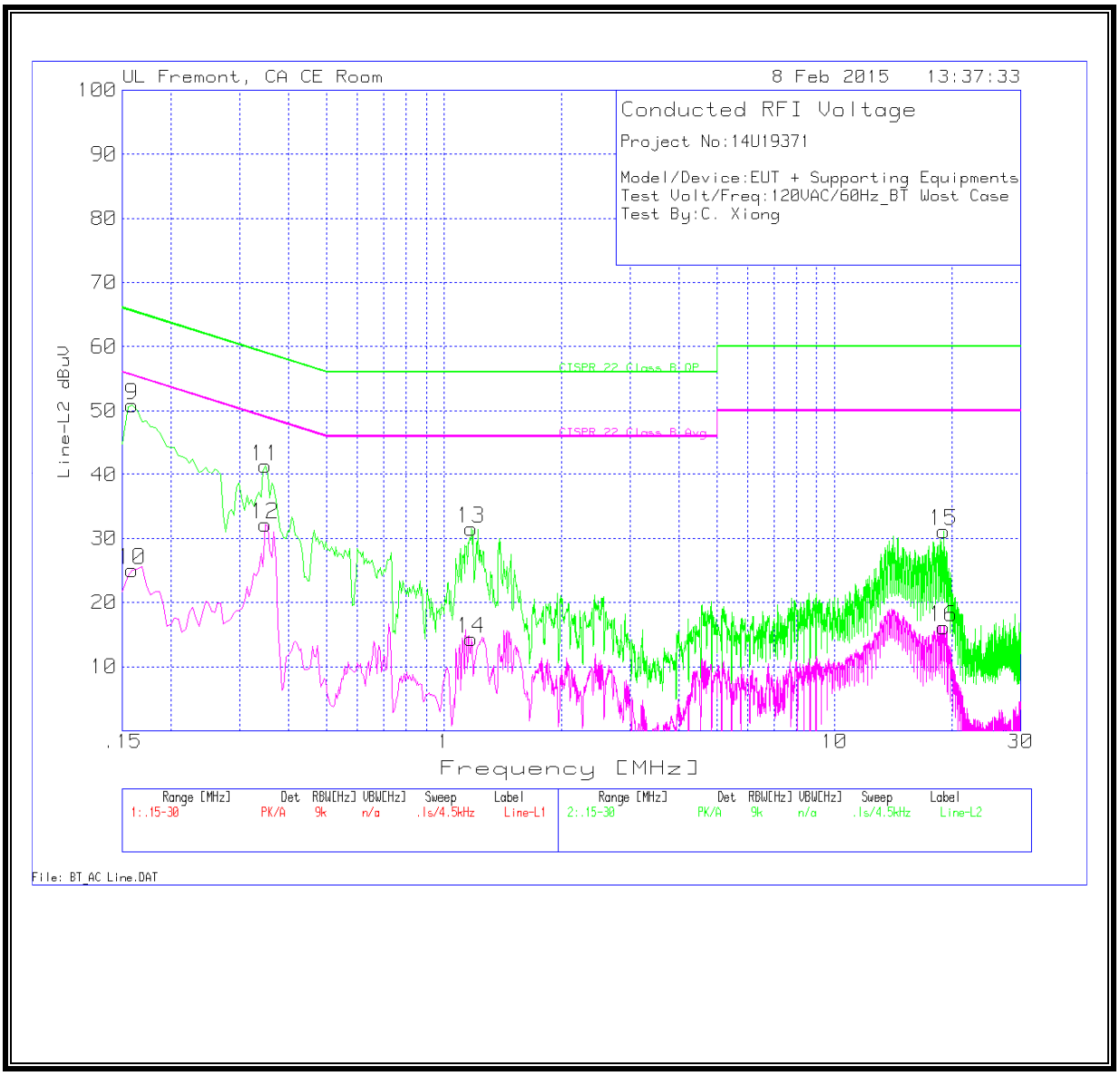
10.2. AC POWER LINE CONDUCTED EMISSIONS A1638

LINE 1 PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

LINE 2 PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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	.1500	49.30	PK	1.4	0	50.70	66.0	-15.30	-	-
2	.1500	23.73	Av	1.4	0	25.13	-	-	56.0	-30.87
3	.3525	40.69	PK	.5	0	41.19	58.9	-17.71	-	-
4	.3525	31.09	Av	.5	0	31.59	-	-	48.9	-17.31
5	1.2165	31.75	PK	.2	.1	32.05	56.0	-23.95	-	-
6	1.2165	13.81	Av	.2	.1	14.11	-	-	46.0	-31.89
7	13.5195	29.48	PK	.2	.2	29.88	60.0	-30.12	-	-
8	13.5195	18.12	Av	.2	.2	18.52	-	-	50.0	-31.48

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	.1590	49.54	PK	1.4	0	50.94	65.5	-14.56	-	-
10	.1590	23.61	Av	1.4	0	25.01	-	-	55.5	-30.49
11	.3480	40.90	PK	.5	0	41.40	59.0	-17.60	-	-
12	.3480	31.66	Av	.5	0	32.16	-	-	49.0	-16.84
13	1.176	31.23	PK	.3	0	31.53	56.0	-24.47	-	-
14	1.176	14.06	Av	.3	0	14.36	-	-	46.0	-31.64
15	19.059	30.59	PK	.3	.2	31.09	60.0	-28.91	-	-
16	19.059	15.70	Av	.3	.2	16.20	-	-	50.0	-33.80

PK - Peak detector

Av - average detection

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.