



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1**

CERTIFICATION TEST REPORT

FOR

eTap System, Firmware Updated Dongle

MODEL NUMBER: 12701

**FCC ID: C90-LINKED
IC: 10161A-LINKED**

REPORT NUMBER: 15U21449-E1V4

ISSUE DATE: OCTOBER 16, 2015

Prepared for

SRAM LLC

**1000 W FULTON MARKET 4TH FLOOR
CHICAGO, IL 60607, 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>
V1	09/24/15	Initial Issue	C.S.OOI
V2	10/07/15	Add notes and setup photo for emission below 30MHz. Add notes and setup photo for horizontal orientation. Revised radiated emission notes	C.S.OOI
V3	10/09/15	Revised radiated emission below 30MHz.data	C.S.OOI
V4	10/16/15	Revised calibration date of test equipment	C.S.OOI

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	<i>5</i>
4.2. <i>SAMPLE CALCULATION</i>	<i>5</i>
4.3. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>6</i>
5. EQUIPMENT UNDER TEST	7
5.1. <i>DESCRIPTION OF EUT</i>	<i>7</i>
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	<i>7</i>
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	<i>7</i>
5.4. <i>SOFTWARE AND FIRMWARE.....</i>	<i>7</i>
5.5. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	<i>8</i>
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>9</i>
6. TEST AND MEASUREMENT EQUIPMENT	11
7. MEASUREMENT METHODS	12
8. ANTENNA PORT TEST RESULTS	13
8.1. <i>802.15.4 SRAMLink MODE IN THE 2.4 GHz BAND</i>	<i>13</i>
8.1.1. <i>ON TIME AND DUTY CYCLE</i>	<i>13</i>
8.1.2. <i>DUTY CYCLE PLOT.....</i>	<i>13</i>
8.1.3. <i>6 dB BANDWIDTH.....</i>	<i>14</i>
8.1.4. <i>99% BANDWIDTH.....</i>	<i>18</i>
8.1.5. <i>AVERAGE POWER</i>	<i>22</i>
8.1.6. <i>POWER SPECTRAL DENSITY</i>	<i>23</i>
8.1.7. <i>CONDUCTED SPURIOUS EMISSIONS.....</i>	<i>27</i>
9. RADIATED TEST RESULTS.....	32
9.1. <i>LIMITS AND PROCEDURE</i>	<i>32</i>
9.2. <i>TRANSMITTER ABOVE 1 GHz.....</i>	<i>33</i>
9.2.1. <i>TX ABOVE 1 GHz FOR 802.15.4 MODE IN THE 2.4 GHz BAND.....</i>	<i>33</i>
9.3. <i>WORST-CASE BELOW 1 GHz.....</i>	<i>43</i>
9.4. <i>RADIATED EMISSION BELOW 30MHz</i>	<i>45</i>
10. AC POWER LINE CONDUCTED EMISSIONS	47
11. SETUP PHOTOS	50

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SRAM LLC
EUT DESCRIPTION: eTap System, Firmware Update Dongle
MODEL: 12701
SERIAL NUMBER: Radiated: 19T58910093; Conducted: 4032500062
DATE TESTED: SEPTEMBER 8 – OCT 9, 2015

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

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

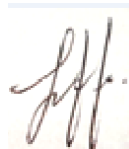
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:



CHOON SIAN OOI
PROJECT LEAD
UL Verification Services Inc.

Tested By:



JEFFREY WU
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input checked="" type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

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 eTap System, Firmware Updated Dongle with 802.15.4 SRAMLink technology

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2405 - 2480	802.15.4 SRAMLink	-2.45	0.57

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a ceramic antenna (P/N 2450AT42A100) by Johanson Technology, with a maximum gain of 0 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 1.0.0.

The test utility software used during testing was Bootloader, Rev. 0.7.0.0; Bootstick, Rev. 0.7.0.0

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The EUT was plug into the laptop's USB port (Horizontal position), and tested at the same time. The fundamental of the EUT was investigated in horizontal and vertical orientations, it was determined that horizontal orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in horizontal orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T410S	R8-0BWT6	N/A
AC Adapter	Lenovo	45N0054	N/A	N/A

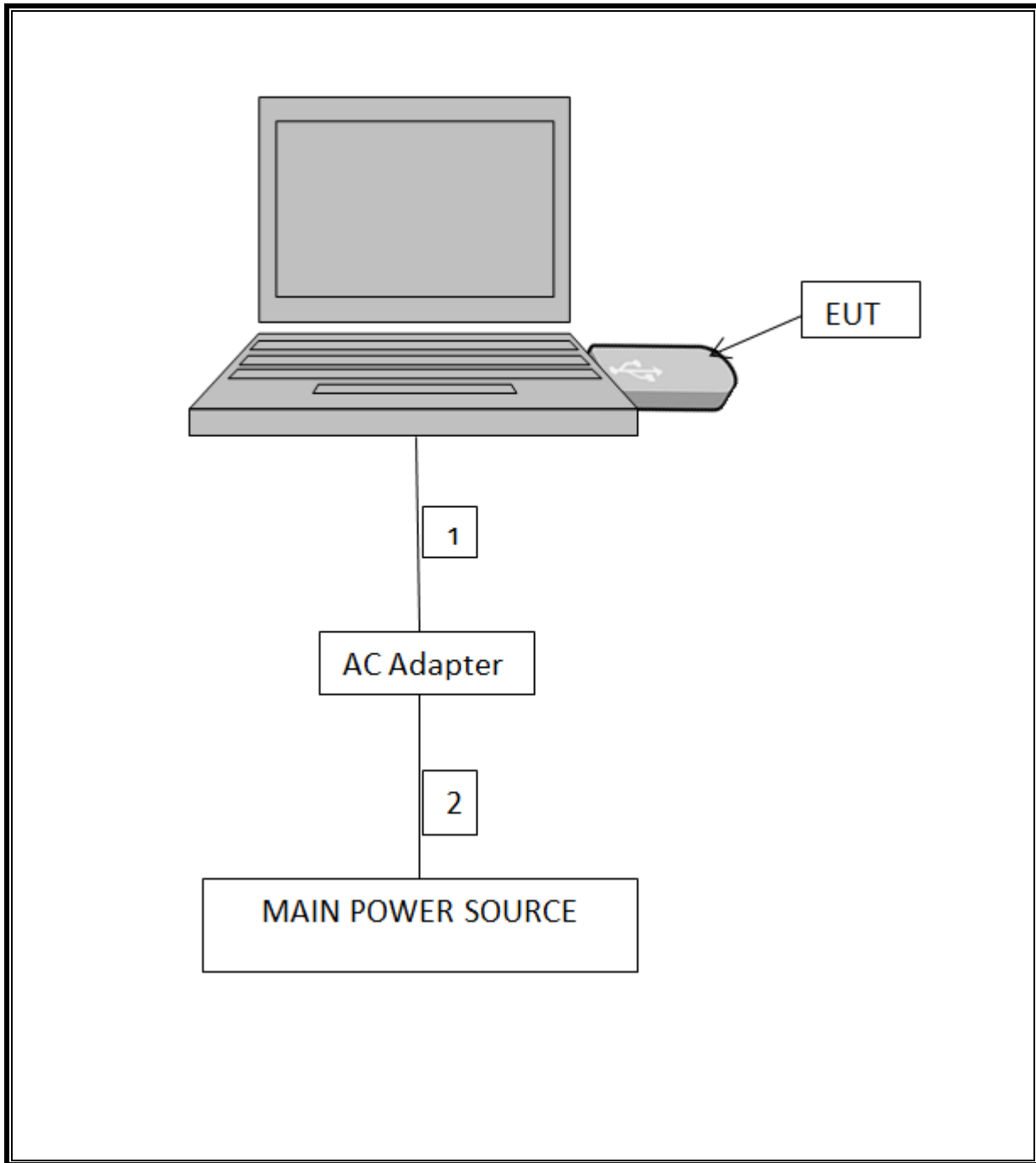
IO CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	20 Vdc	Un-Shielded	0.8	Ferrite on Laptop End
2	AC	1	US115V	Un-Shielded	1	NA

TEST SETUP

The EUT is a stand-alone unit during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



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 No.	Cal Date	Cal Due
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		
Bilog Antenna 30-1000MHz	Sunol	JB1	477	06/10/15	06/10/16
Bilog Antenna 30-1000MHz	Sunol	JB1	185	02/18/15	02/18/16
Horn Antenna 1-18GHz	ETS	3117	119	01/15/15	01/15/16
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	39	01/29/15	01/29/16
Horn Antenna 1-18GHz	ETS	3117	136	03/03/15	03/03/16
Preamp 10kHz-1000MHz	Sonoma	310	300	11/01/14	11/18/15
Preamp 1-8GHz	Miteq	AMF-4D-01000800-30-29P	782	11/18/14	11/17/15
Preamp 1-18GHz	Miteq	AFS42-00101800-25-2-42	493	01/16/15	01/16/16
Preamp 1-26.5GHz	Agilent	8449B	404	04/06/15	05/26/16
Coaxial Switchbox	Agilent	SP6T	927	03/03/15	03/03/16
Spectrum Analyzer 3Hz to 44GHz	Agilent	E4446A	99	06/10/15	06/10/16
3GHz HPF	Micro-Tronics	HPM17543	486	11/18/14	11/18/15
5GHz LPF	Micro-Tronics	LPS17541	481	11/18/14	11/18/15
6GHz HPF	Micro-Tronics	HPS17542	484	11/18/14	09/16/16
EMI Test Receiver	Rohde & Schwarz	ECSI 7	284	09/16/15	11/01/16
Power Meter	Agilent	N1911A	1264	11/01/15	03/09/16
Power Sensor	Agilent	E9327A	117	03/09/15	01/16/16
LISN for Conducted Emissions	FCC	50/250-25-2	24	01/16/15	01/16/16
Antenna, Loop, 30 MHz	EMCO	6502	C00593	02/20/15	02/21/16

7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v03r03, Section 6.0.

6 dB BW: KDB 558074 D01 v03r03, Section 8.1.

99% BW: ANSI C63.10-2013, Section 6.9.3.

Output Power: KDB 558074 D01 v03r03, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v03r03, Section 10.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r03, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r03, Section 12.1.

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

8. ANTENNA PORT TEST RESULTS

8.1. 802.15.4 SRAMLink MODE IN THE 2.4 GHz BAND

8.1.1. ON TIME AND DUTY CYCLE

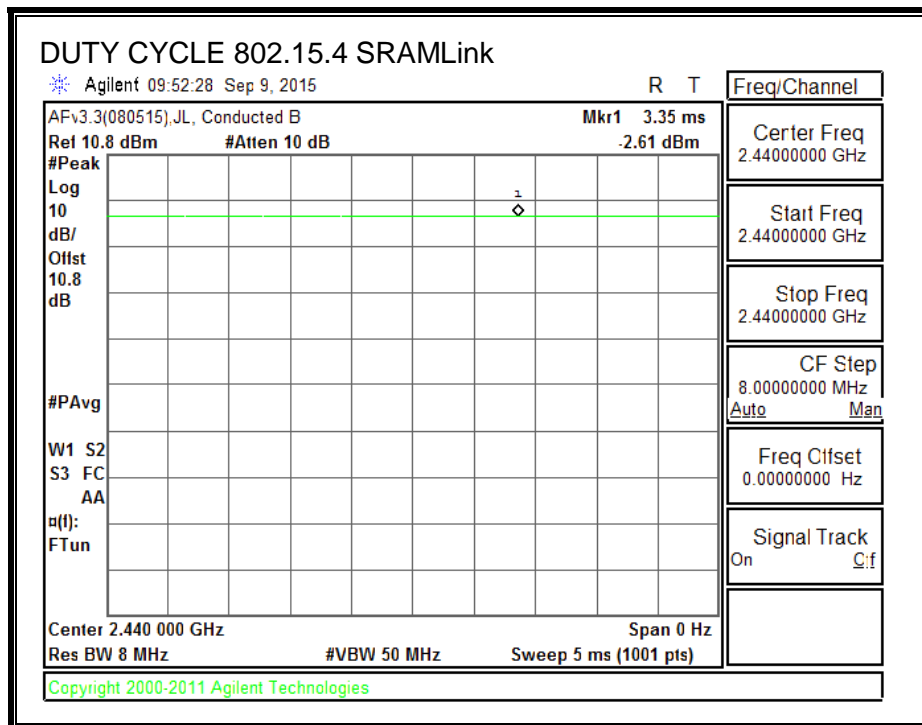
LIMITS

None; for reporting purposes only.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.15.4 Zigbee	10.000	10.000	1.000	100.00%	0.00	0.010

8.1.2. DUTY CYCLE PLOT



8.1.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 Clause 5.2.1

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

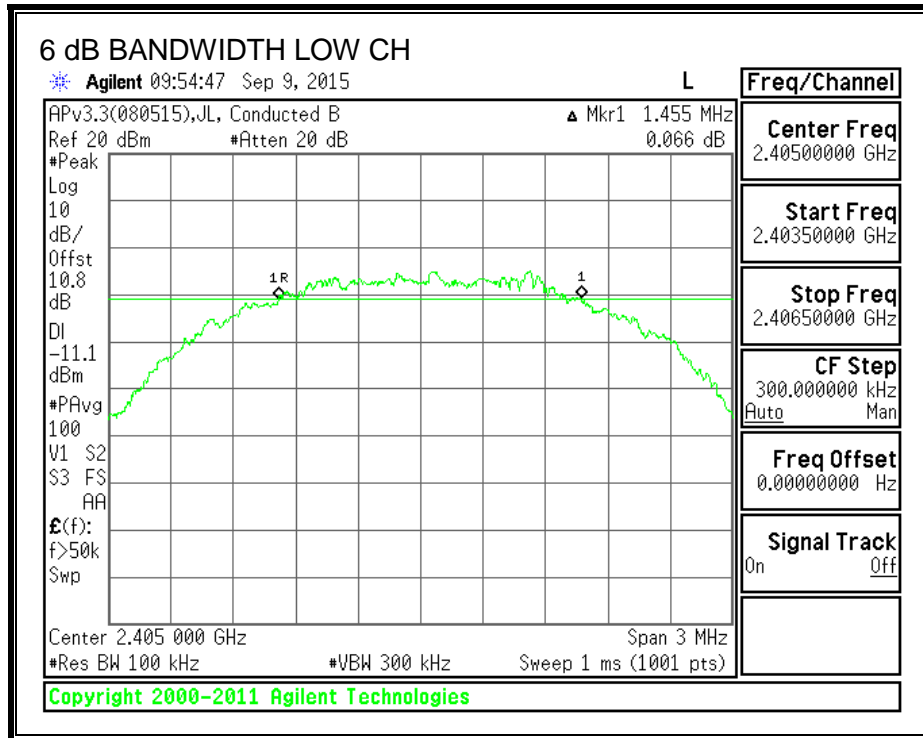
TEST PROCEDURE

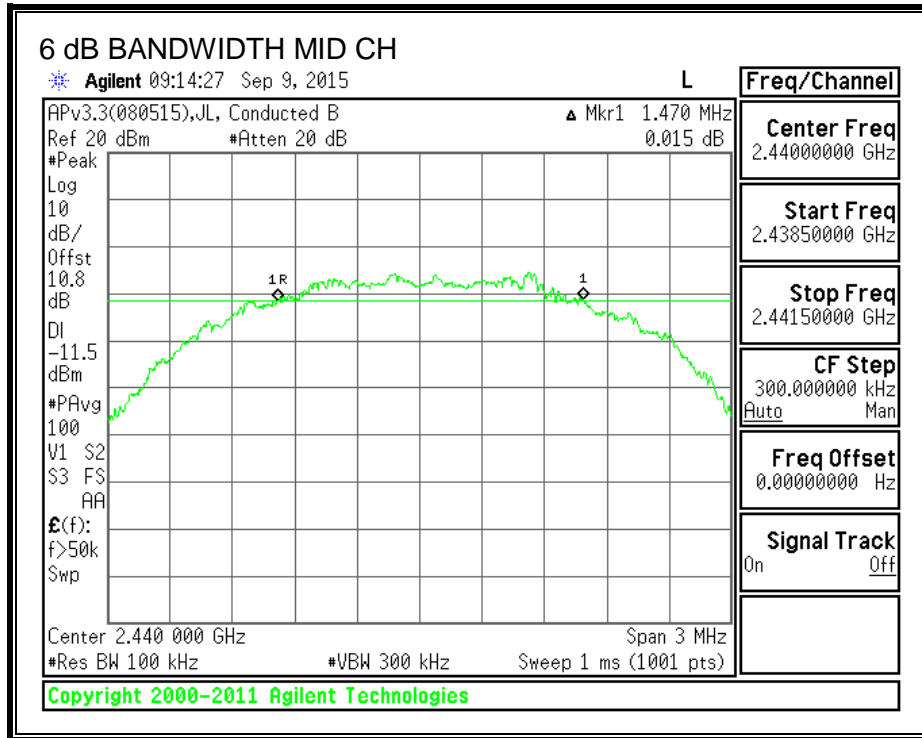
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

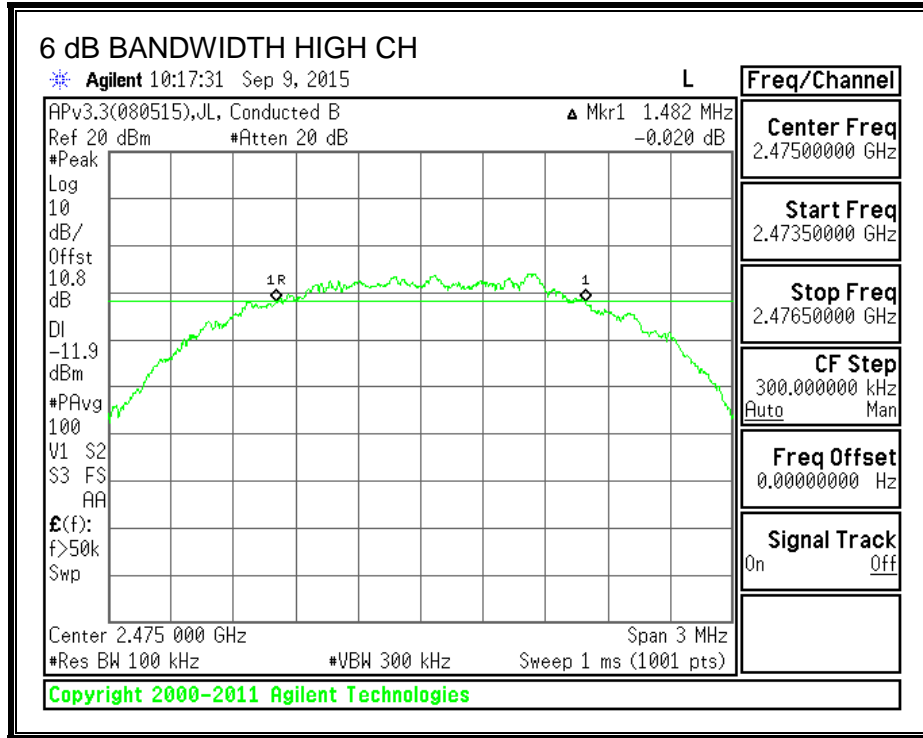
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.455	0.5
Middle	2440	1.47	0.5
High	2480	1.482	0.5

6 dB BANDWIDTH







8.1.4. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

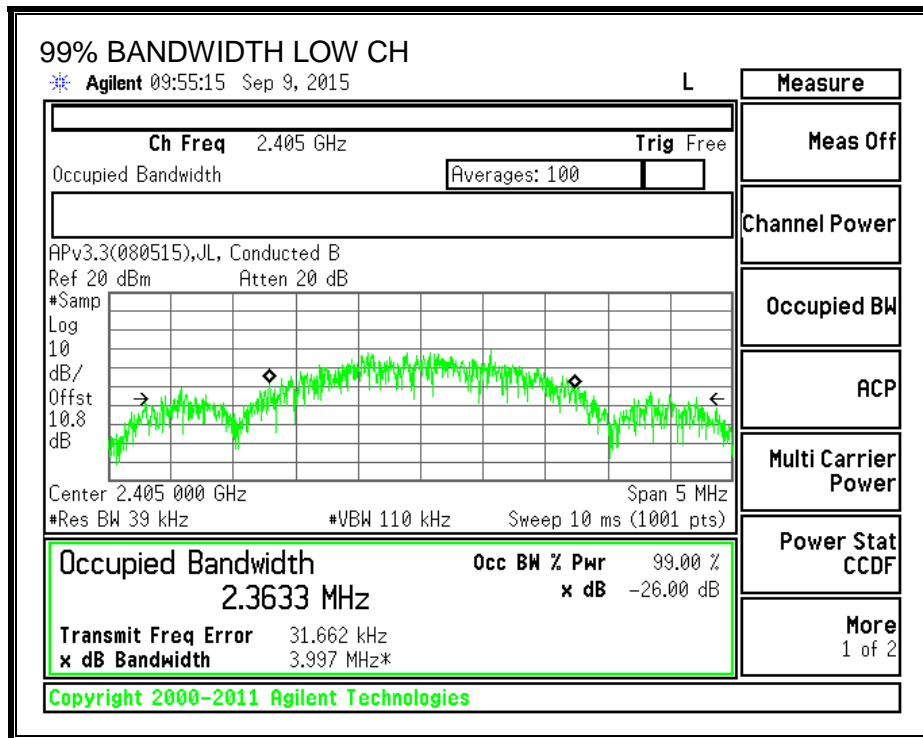
TEST PROCEDURE

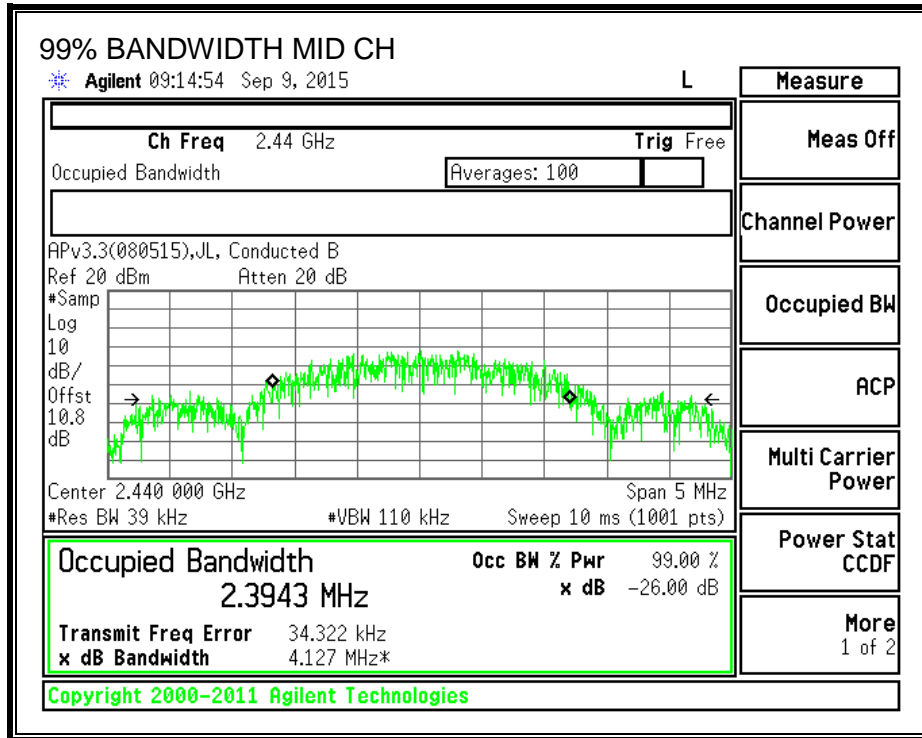
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

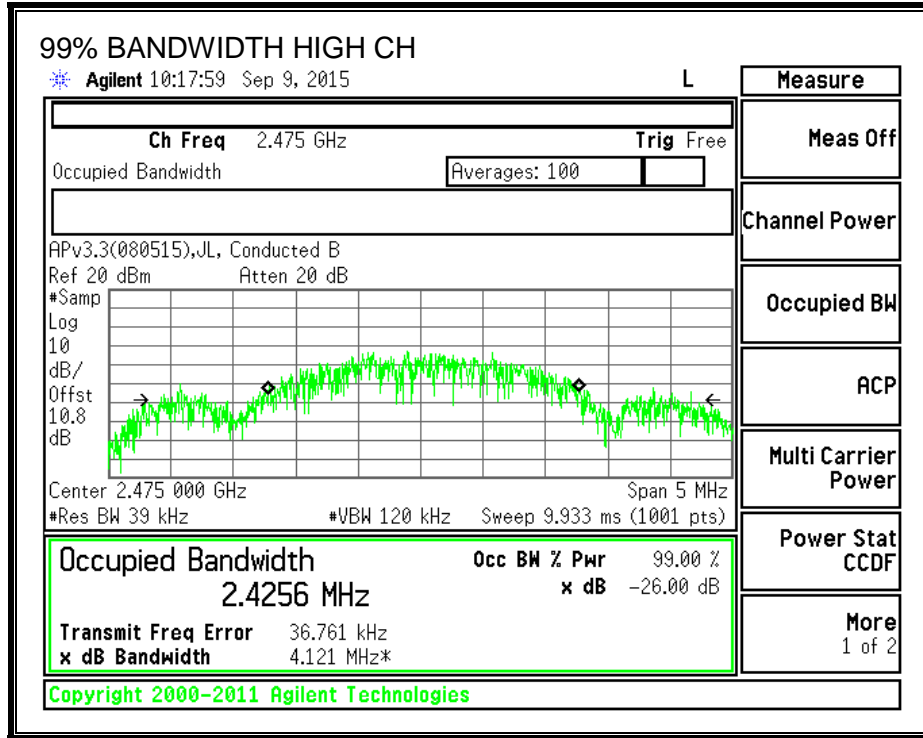
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.3633
Middle	2440	2.3943
High	2480	2.4256

99% BANDWIDTH







8.1.5. AVERAGE POWER

LIMITS

FCC §15.247

IC RSS-247 Clause 5.4(4)

For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section 5.4 (5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	2405	-2.45
Middle	2440	-2.85
High	2480	-2.97

8.1.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

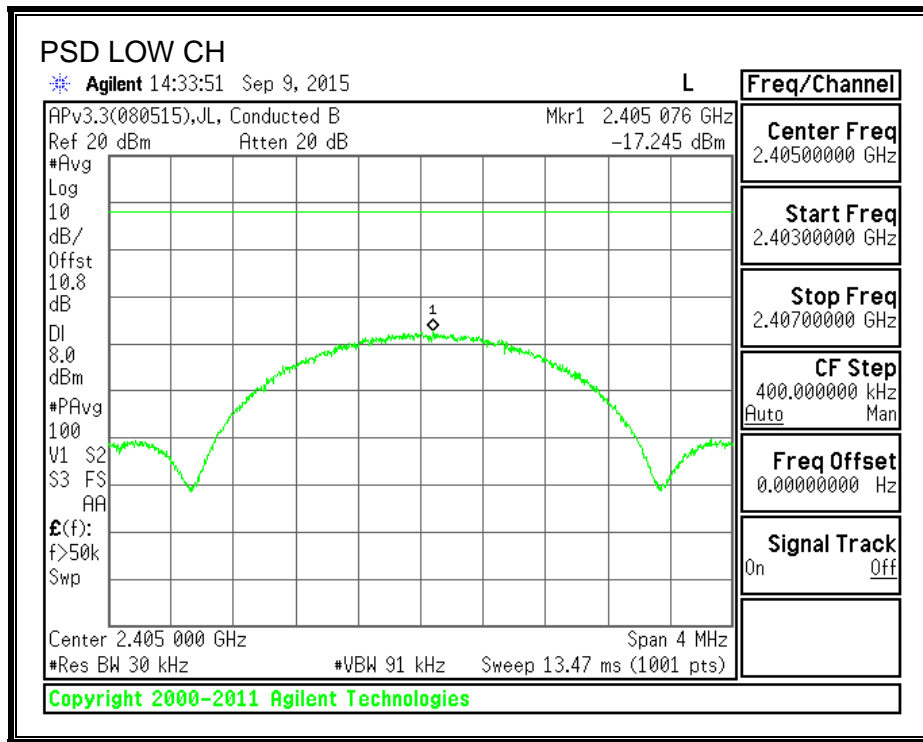
IC RSS-247 Clause 5.2.2

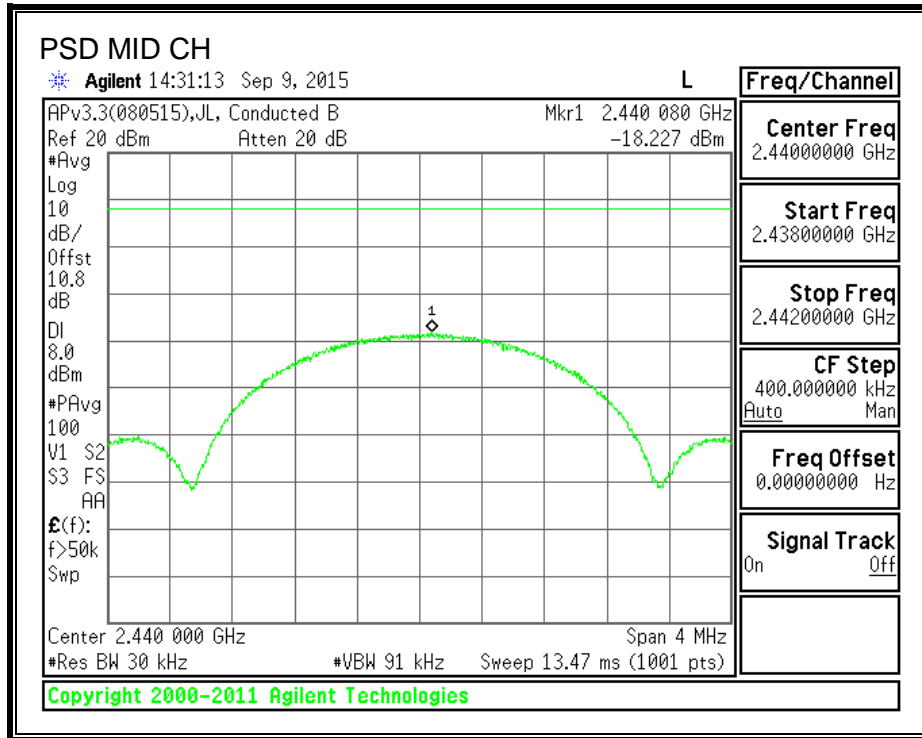
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

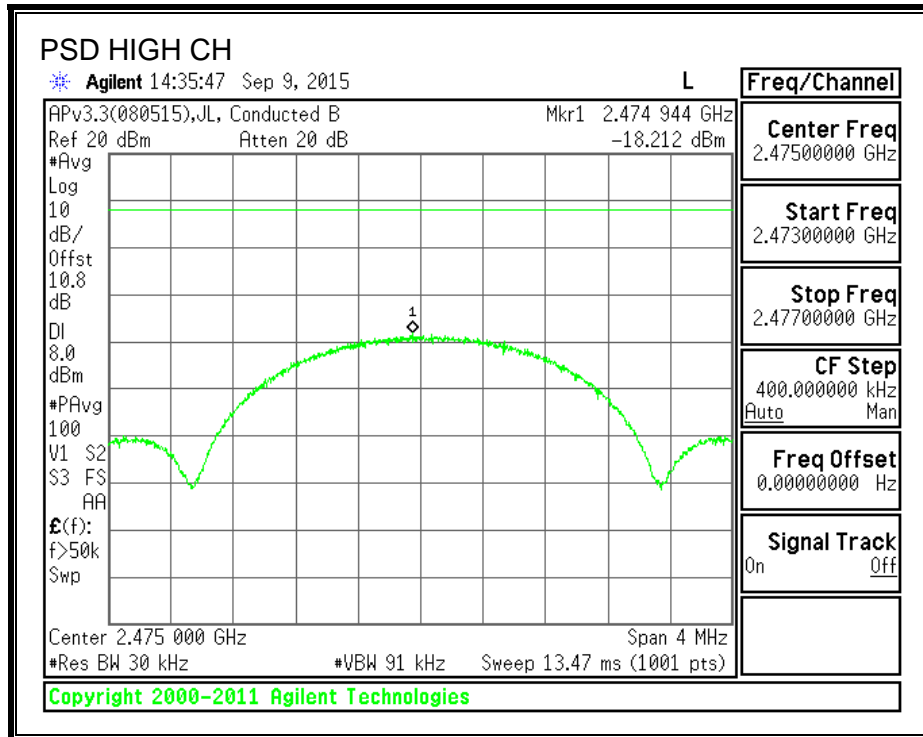
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-17.25	8	-25.25
Middle	2440	-18.23	8	-26.23
High	2480	-18.21	8	-26.21

POWER SPECTRAL DENSITY





\



8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

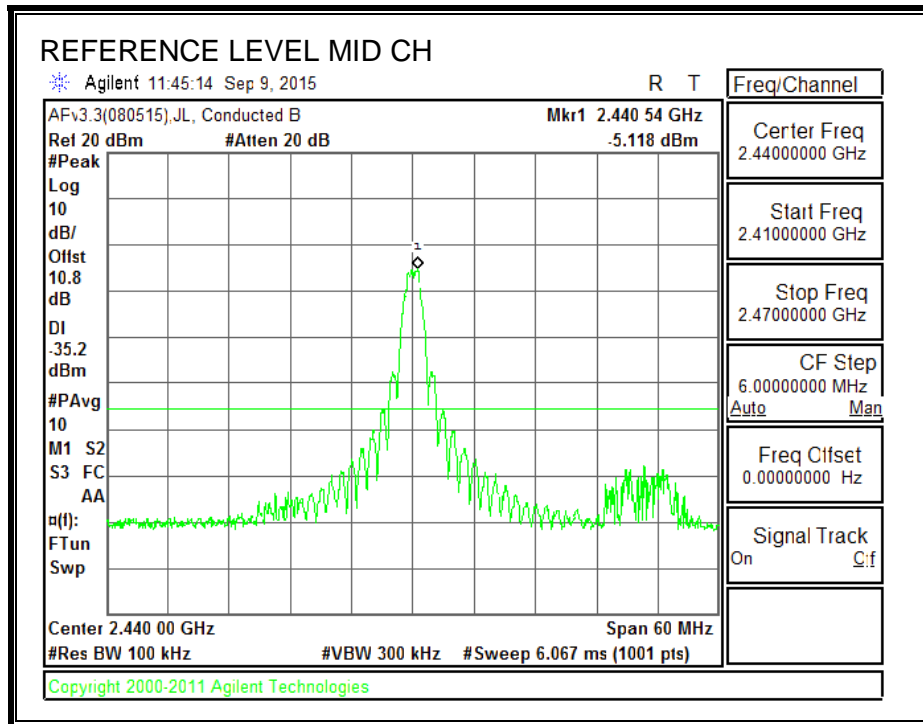
FCC §15.247 (d)

IC RSS-247 Clause 5.5

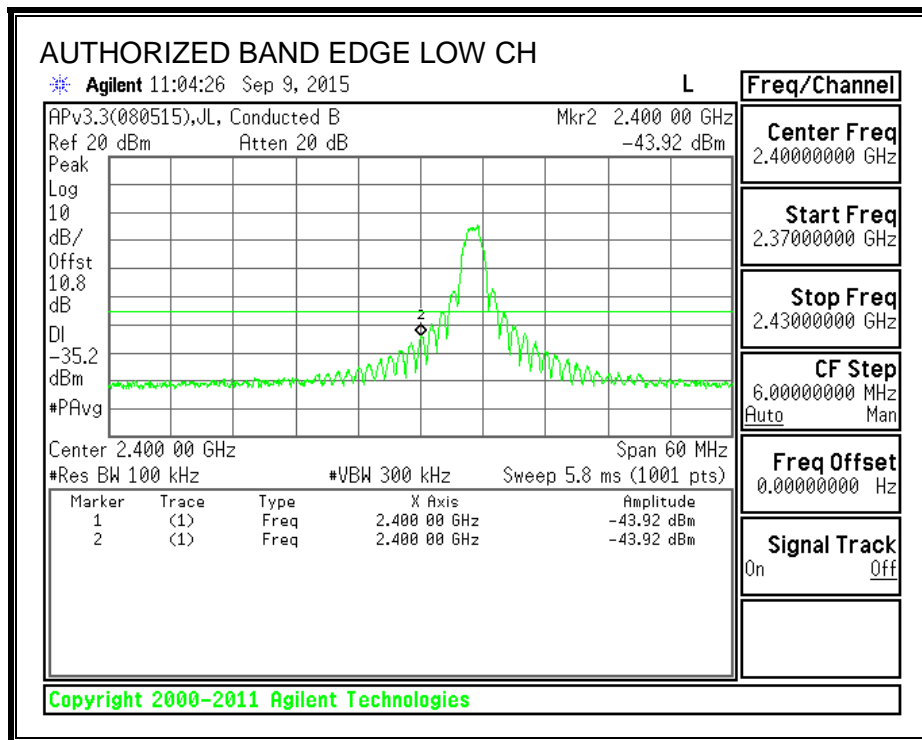
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

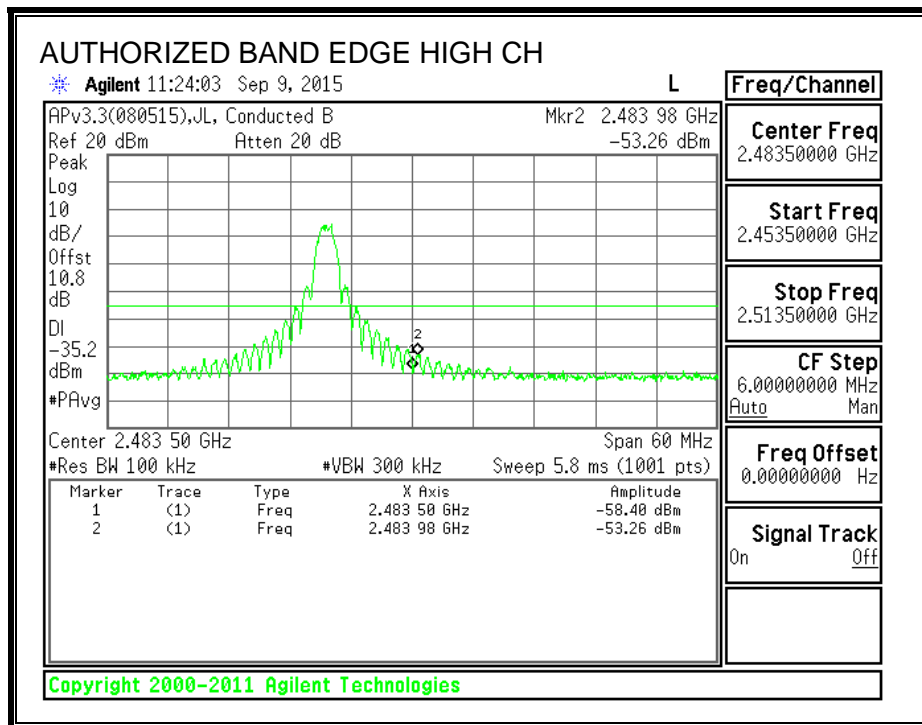
IN-BAND REFERENCE LEVEL



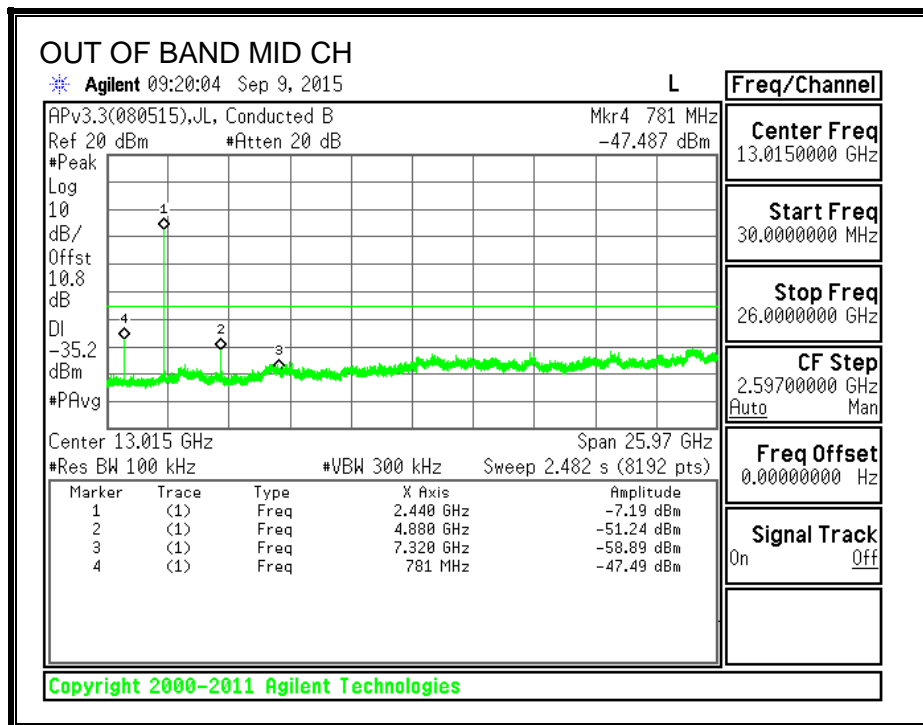
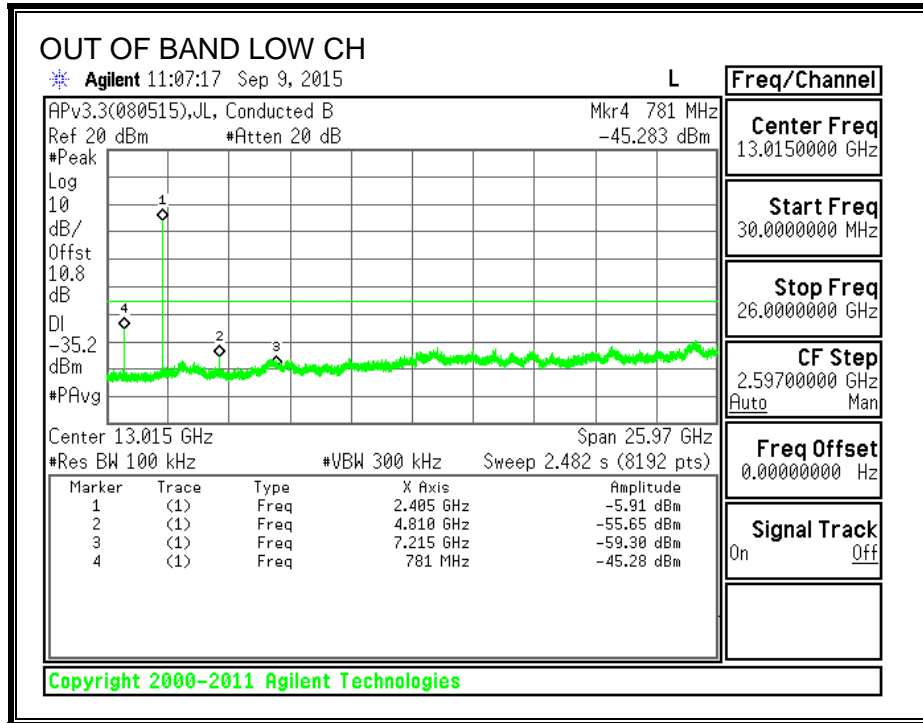
LOW CHANNEL BANDEGE

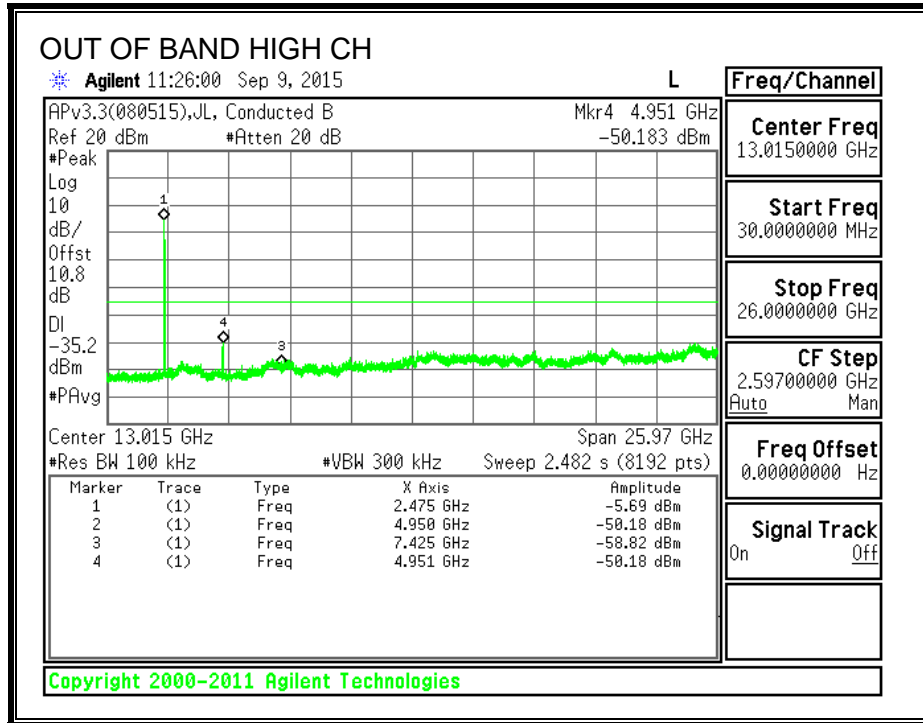


HIGH CHANNEL BANDEGE



OUT-OF-BAND EMISSIONS





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

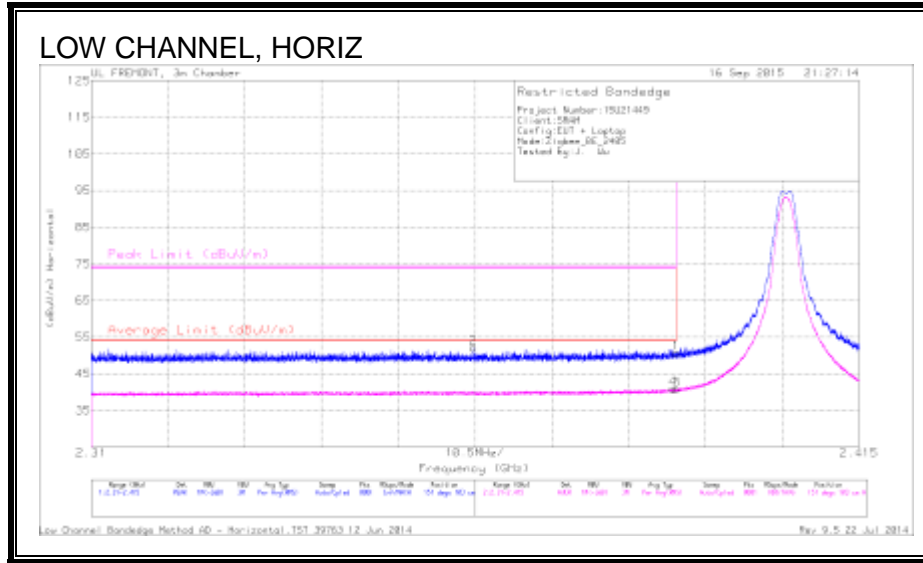
IC RSS-210 Clause 8.9 (Transmitter)

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

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. TX ABOVE 1 GHz FOR 802.15.4 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



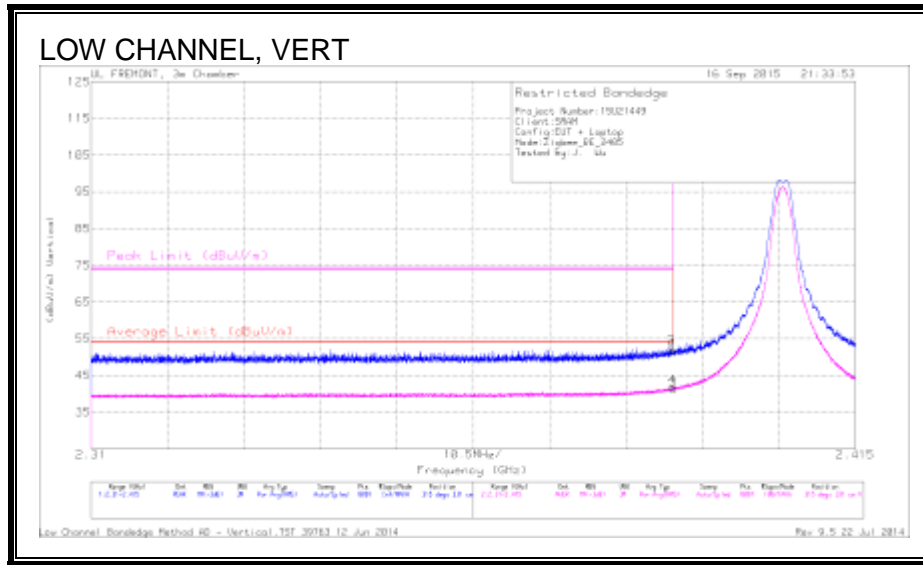
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Filter/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	2.362	42.72	PK	31.9	-22.5	0	52.12	-	-	74	-21.88	151	103	H
1	2.39	41.01	PK	32	-22.4	0	50.61	-	-	74	-23.39	151	103	H
3	2.39	31.16	RMS	32	-22.4	0	40.76	54	-13.24	-	-	151	103	H
4	2.39	31.4	RMS	32	-22.4	0	41	54	-13	-	-	151	103	H

PK - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



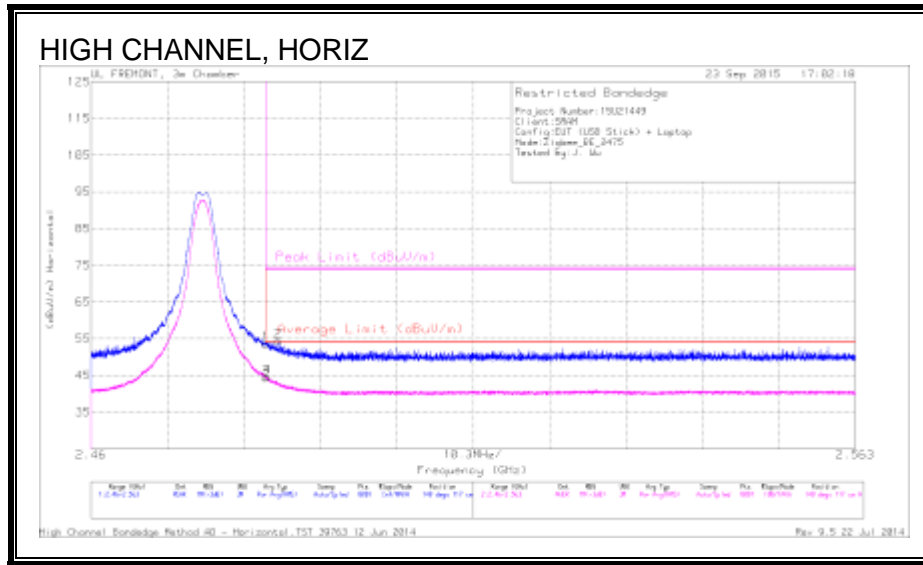
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Fitter/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39	42.11	PK	32	-22.4	0	51.71	-	-	74	-22.29	315	331	V
2	2.39	43.1	PK	32	-22.4	0	52.7	-	-	74	-21.3	315	331	V
3	2.39	31.66	RMS	32	-22.4	0	41.26	54	-12.74	-	-	315	331	V
4	2.39	32.25	RMS	32	-22.4	0	41.85	54	-12.15	-	-	315	331	V

PK - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



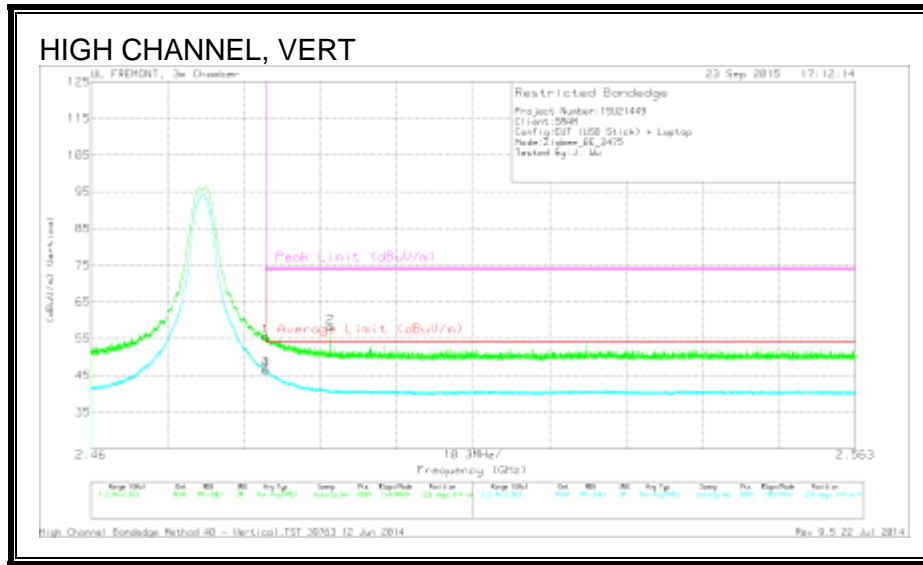
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	43.42	PK	32.3	-22.1	0	53.62	-	-	74	-20.38	148	117	H
3	2.484	34.28	RMS	32.3	-22.1	0	44.48	54	-9.52	-	-	148	117	H
4	2.484	34.4	RMS	32.3	-22.1	0	44.6	54	-9.4	-	-	148	117	H
2	2.485	44.21	PK	32.3	-22.1	0	54.41	-	-	74	-19.59	148	117	H

PK - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Trace Markers

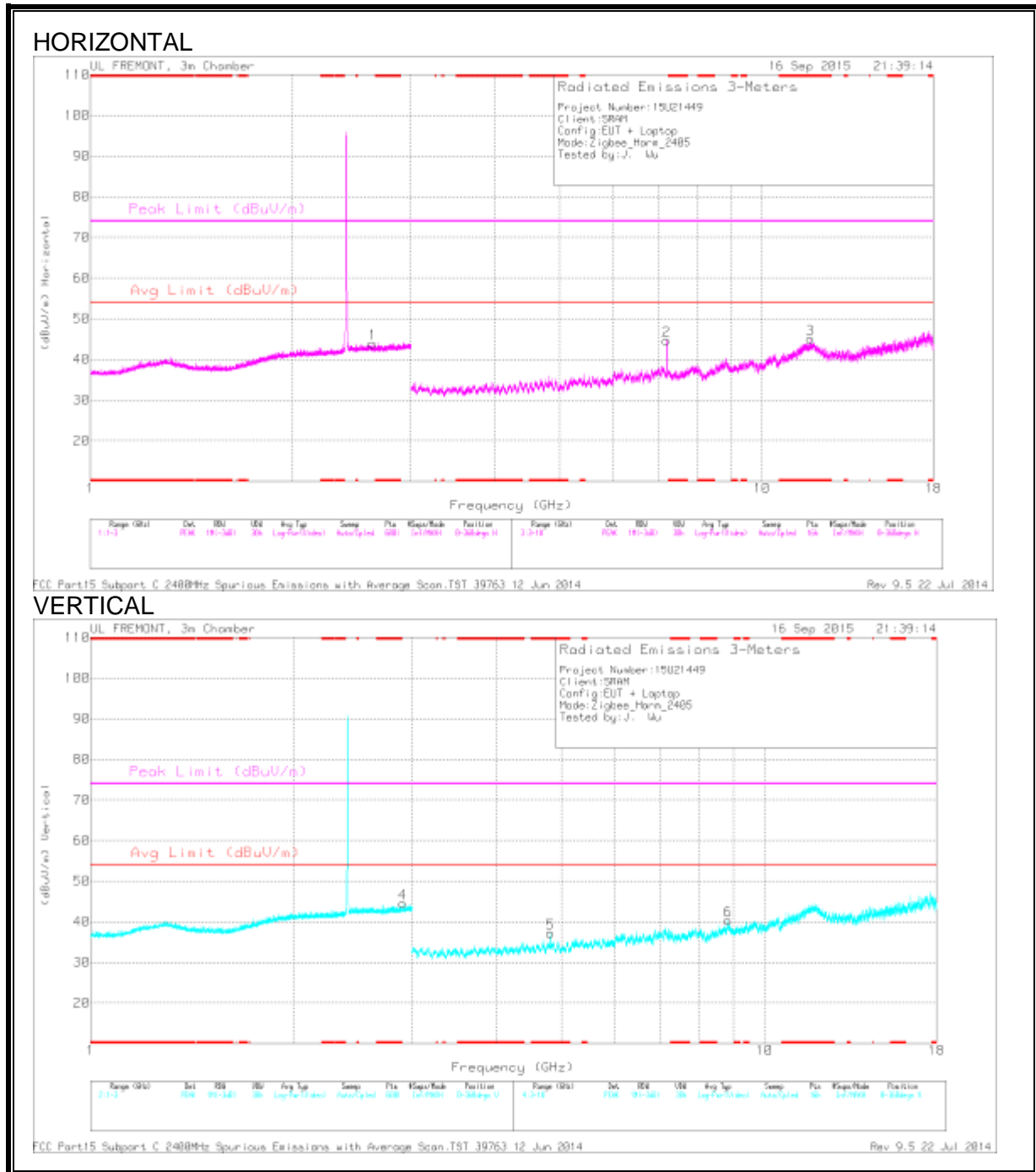
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Fit r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	45.37	PK	32.3	-22.1	0	55.57	-	-	74	-18.43	226	314	V
3	2.484	36.48	RMS	32.3	-22.1	0	46.68	54	-7.32	-	-	226	314	V
4	2.484	36.29	RMS	32.3	-22.1	0	46.49	54	-7.51	-	-	226	314	V
2	2.492	48.09	PK	32.3	-22.2	0	58.19	-	-	74	-15.81	226	314	V

PK - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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
3	* 11.804	37.69	PK2	39	-22.5	0	54.19	-	-	74	-19.81	71	179	H
	* 11.803	25.52	MAv1	39	-22.5	0	42.02	54	-11.98	-	-	71	179	H
5	* 4.811	42.96	PK2	34	-29.5	0	47.46	-	-	74	-26.54	285	245	V
	* 4.811	33.55	MAv1	34	-29.4	0	38.15	54	-15.85	-	-	285	245	V
1	2.63	33.56	PK	32.4	-22	0	43.96	-	-	-	-	0-360	200	H
4	2.907	33.99	PK	32.6	-22	0	44.59	-	-	-	-	0-360	100	V
2	7.214	37.71	PK	35.6	-28.6	0	44.71	-	-	-	-	0-360	100	H
6	8.828	29.7	PK	35.9	-25.2	0	40.4	-	-	-	-	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

-Compliance for emissions in non-restricted bands is shown in conducted out of band testing

PK - Peak detector

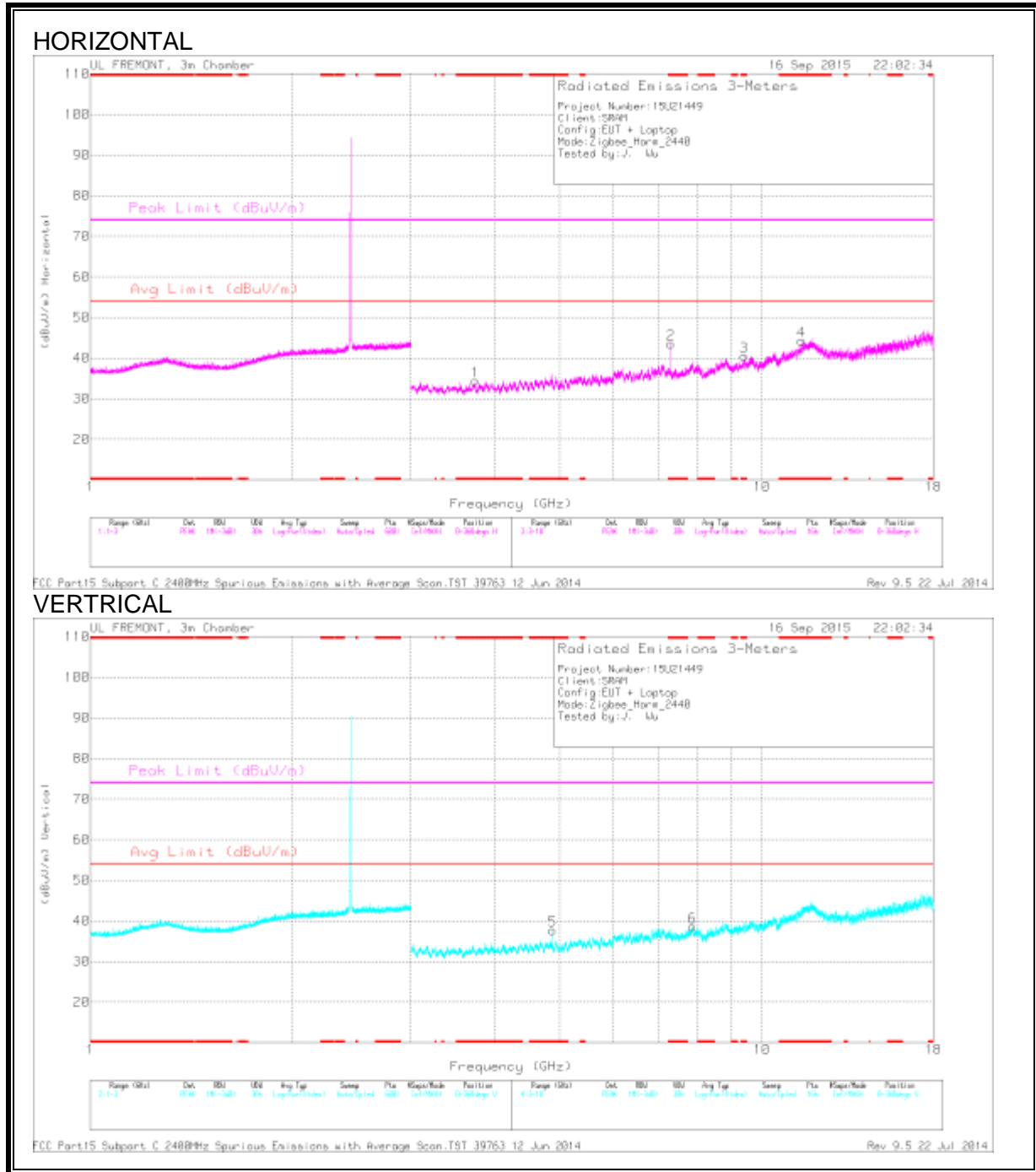
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/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	* 3.74	39.75	PK2	33	-30.3	0	42.45	-	-	74	-31.55	99	164	H
	* 3.74	28.07	MAv1	33	-30.3	0	30.77	54	-23.23	-	-	99	164	H
2	* 7.318	41.93	PK2	35.6	-27.2	0	50.33	-	-	74	-23.67	86	112	H
	* 7.319	33.68	MAv1	35.6	-27.2	0	42.08	54	-11.92	-	-	86	112	H
3	* 9.407	38.03	PK2	36.4	-24.1	0	50.33	-	-	74	-23.67	331	103	H
	* 9.409	24.89	MAv1	36.4	-24.1	0	37.19	54	-16.81	-	-	331	103	H
4	* 11.46	36.83	PK2	38.3	-21.9	0	53.23	-	-	74	-20.77	89	110	H
	* 11.46	24.67	MAv1	38.3	-21.9	0	41.07	54	-12.93	-	-	89	110	H
5	* 4.881	43.26	PK2	34	-29.1	0	48.16	-	-	74	-25.84	260	241	V
	* 4.879	34.21	MAv1	34	-29.1	0	39.11	54	-14.89	-	-	260	241	V
6	7.882	28.92	PK	35.8	-26.1	0	38.62	-	-	-	-	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

-Compliance for emissions in non-restricted bands is shown in conducted out of band testing

PK - Peak detector

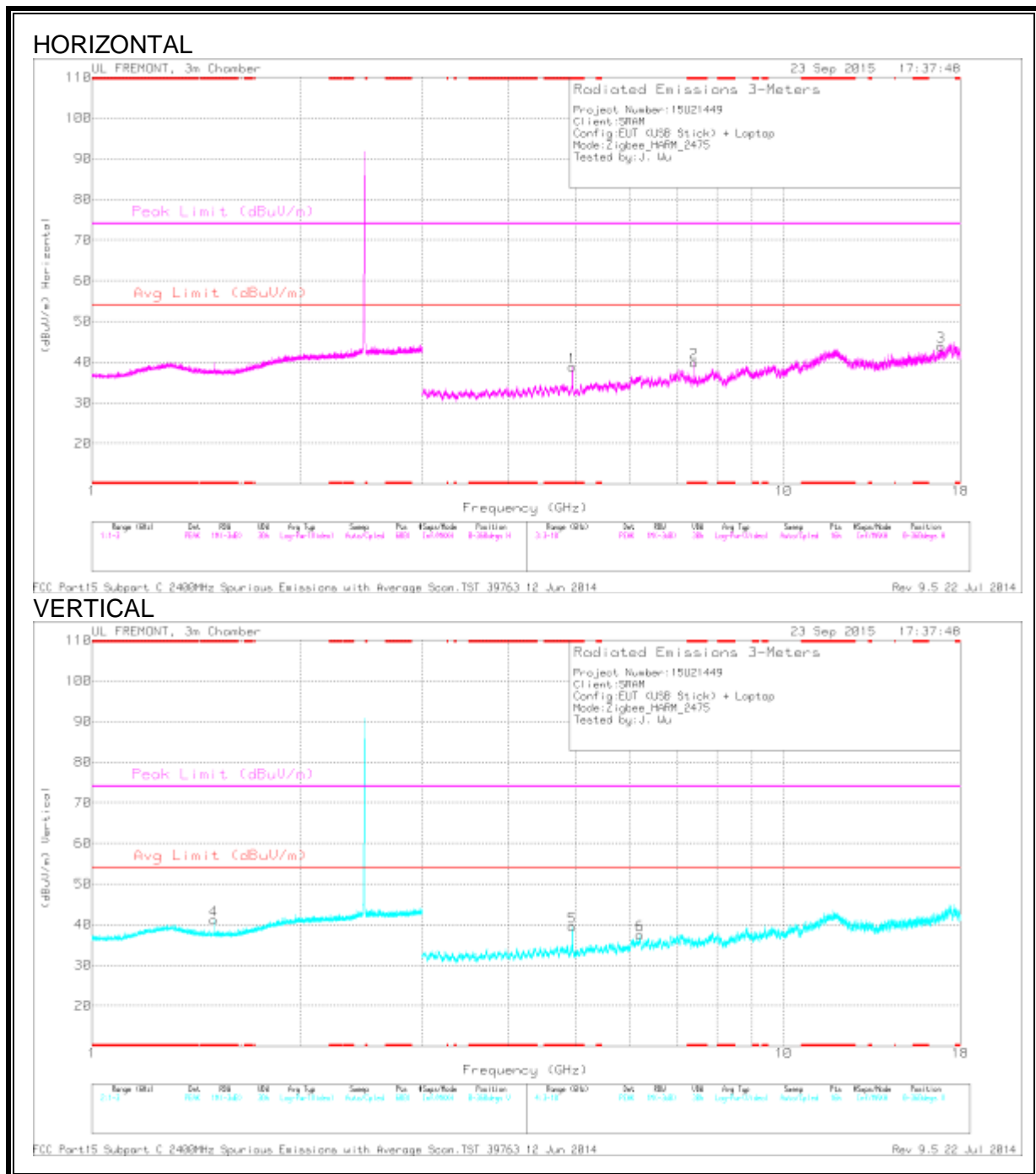
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

Note: Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 1.5	43.05	PK2	28.1	-22.9	48.25	-	-	74	-25.75	161	100	V
	* 1.5	31.67	MAv1	28.1	-22.9	36.87	54	-17.13	-	-	161	100	V
1	* 4.949	44.11	PK2	34	-30.1	48.01	-	-	74	-25.99	48	243	H
	* 4.949	35.75	MAv1	34	-30.1	39.65	54	-14.35	-	-	48	243	H
5	* 4.951	46.69	PK2	34	-30.2	50.49	-	-	74	-23.51	274	250	V
	* 4.951	38.57	MAv1	34	-30.2	42.37	54	-11.63	-	-	274	250	V
2	* 7.427	42.3	PK2	35.7	-27.7	50.3	-	-	74	-23.7	88	115	H
	* 7.427	32.87	MAv1	35.7	-27.7	40.87	54	-13.13	-	-	88	115	H
3	16.881	25.75	PK	41.1	-22.9	43.95	-	-	-	-	0-360	100	H
6	6.196	31.69	PK	35.3	-29.5	37.49	-	-	-	-	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

-Compliance for emissions in non-restricted bands is shown in conducted out of band testing

PK - Peak detector

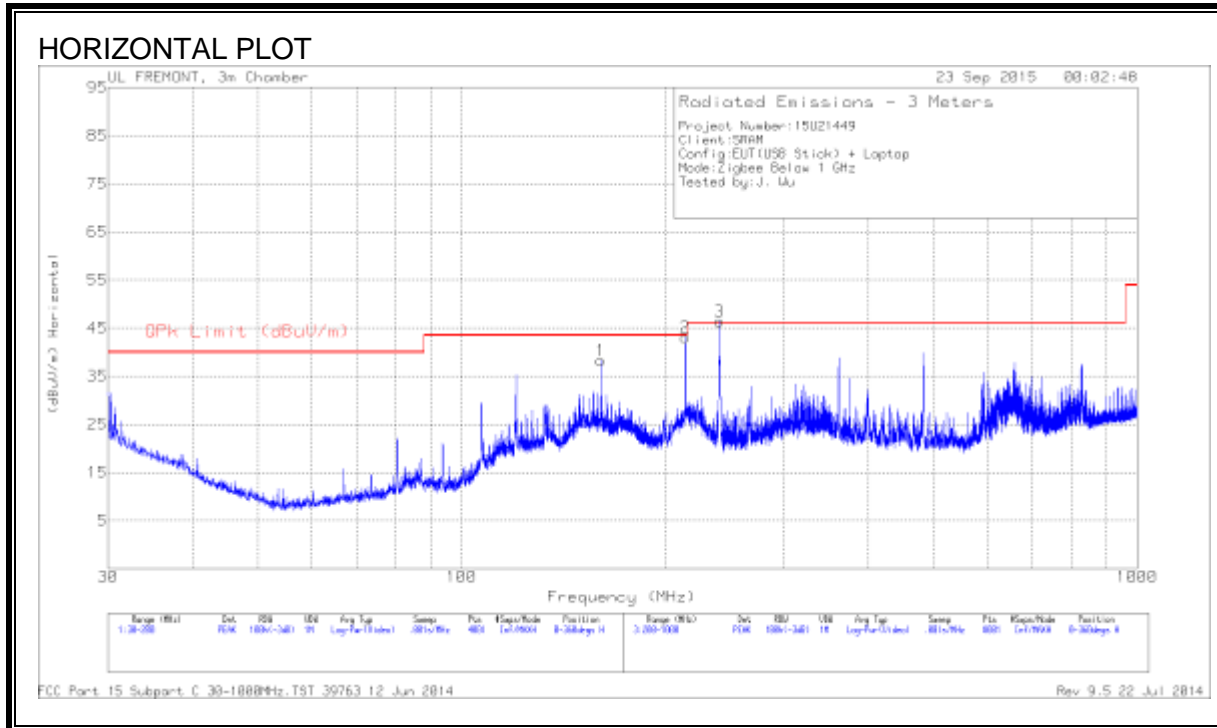
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

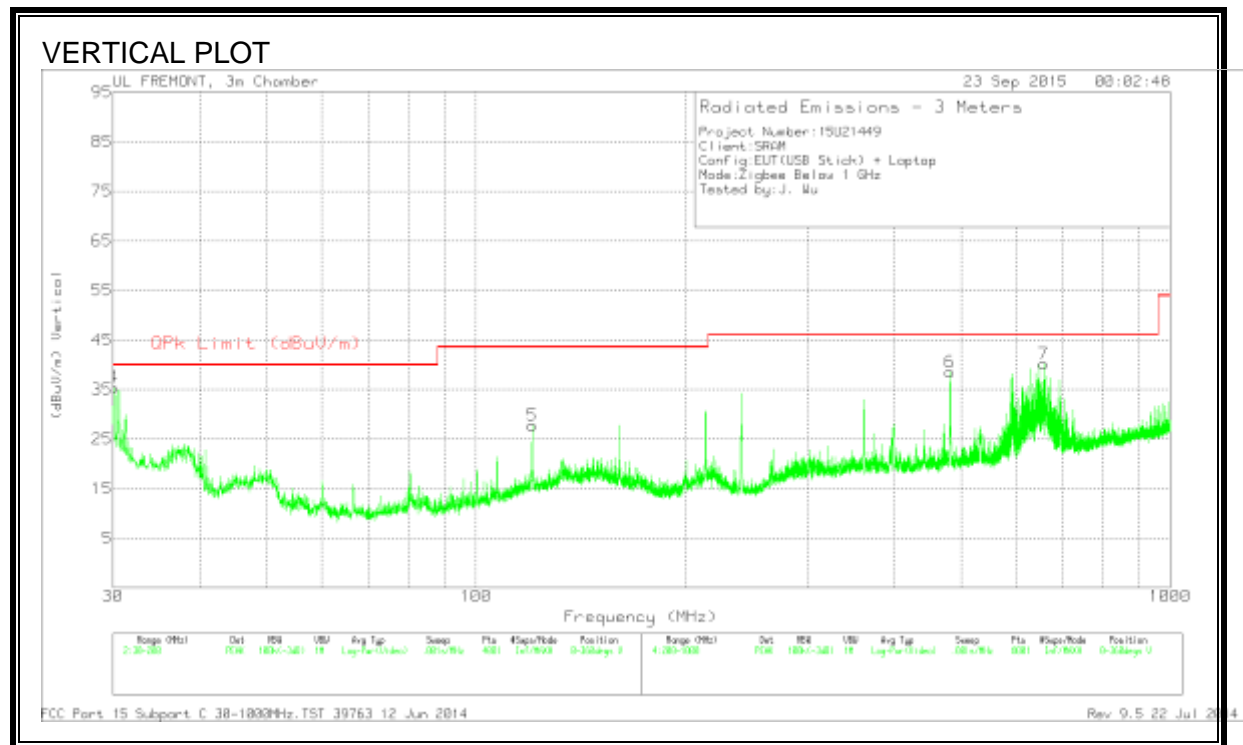
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

9.3. WORST-CASE BELOW 1 GHz

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



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



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	30.8305	27.67	QP	21.1	-27.2	21.57	40	-18.43	121	328	V
5	120.5675	40.04	PK	13.8	-26.1	27.74	43.52	-15.78	0-360	100	V
1	161.388	40.61	QP	12	-25.6	27.01	43.52	-16.51	122	189	H
2	215.374	38.93	QP	10.4	-25	24.33	43.52	-19.19	112	118	H
3	240.019	37.12	QP	11.5	-24.7	23.92	46.02	-22.1	59	127	H
6	482.1	45.9	PK	17.6	-25	38.5	46.02	-7.52	0-360	200	V
7	638.42	25.49	QP	19.3	-24.5	20.29	46.02	-25.73	61	234	V

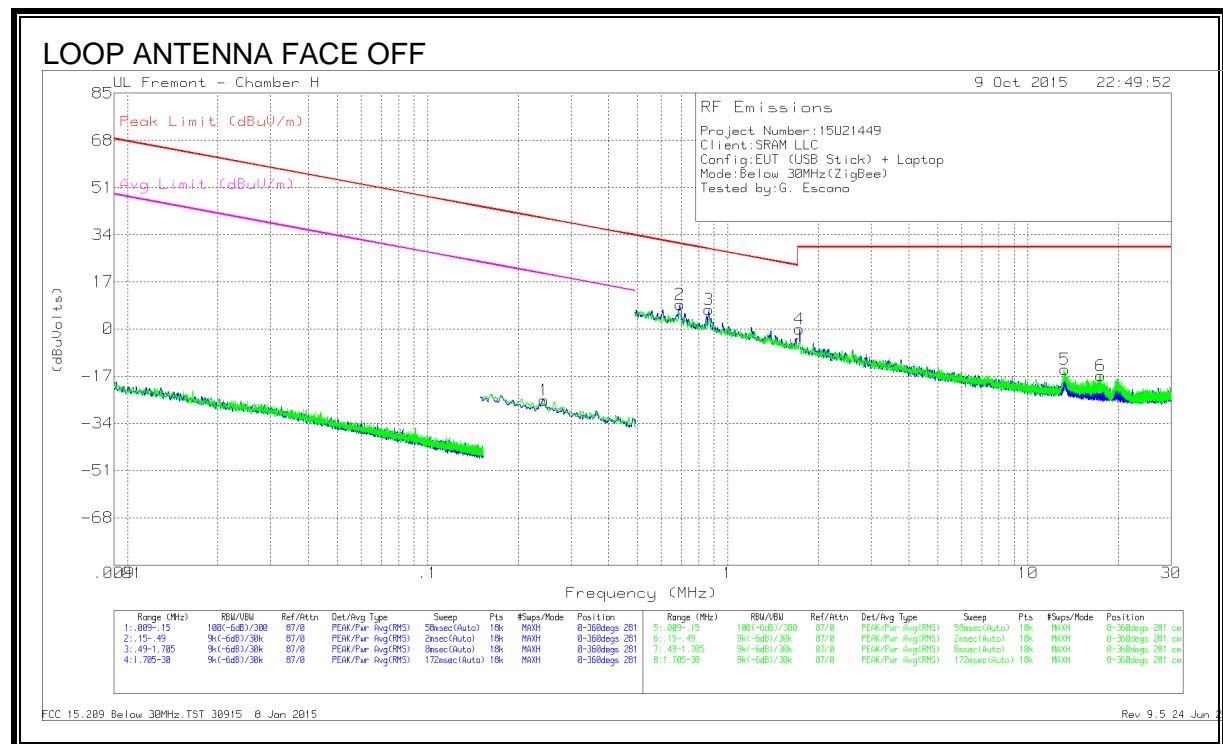
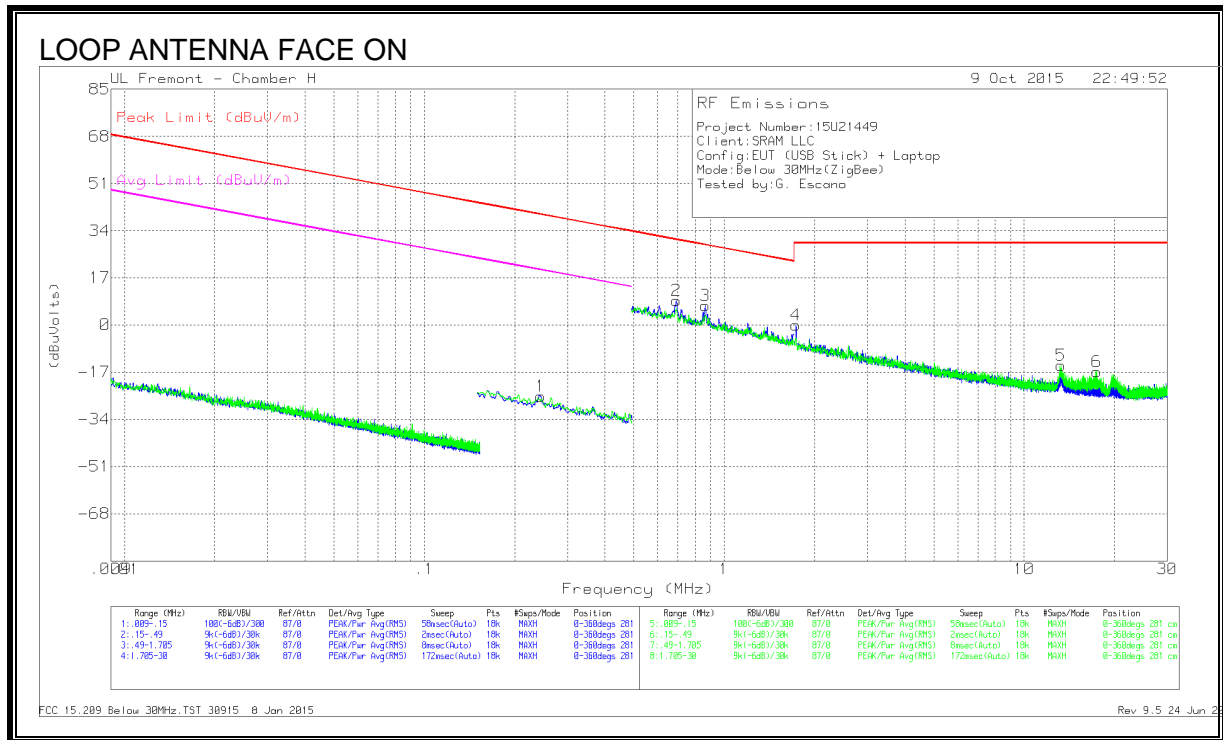
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

**NOTE: Emission from supporting equipment, the laptop.

9.4. RADIATED EMISSION BELOW 30MHz



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.24425	43.83	Pk	10.4	.1	-80	-25.67	39.85	-65.52	19.85	-45.52	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.69244	38.59	Pk	10.2	.1	-40	8.89	30.8	-21.91	-	-	0-360
3	.86463	36.63	Pk	10.2	.1	-40	6.93	28.87	-21.94	-	-	0-360
4	1.7333	29.41	Pk	10.4	.2	-40	.01	29.54	-29.53	-	-	0-360
5	13.2875	14.52	Pk	10.4	.6	-40	-14.48	29.54	-44.02	-	-	0-360
6	17.49574	12.49	Pk	10.1	.6	-40	-16.81	29.54	-46.35	-	-	0-360

Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 8 Jan 2015
 Rev 9.5 24 Jun 2015

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen Clause 8.8

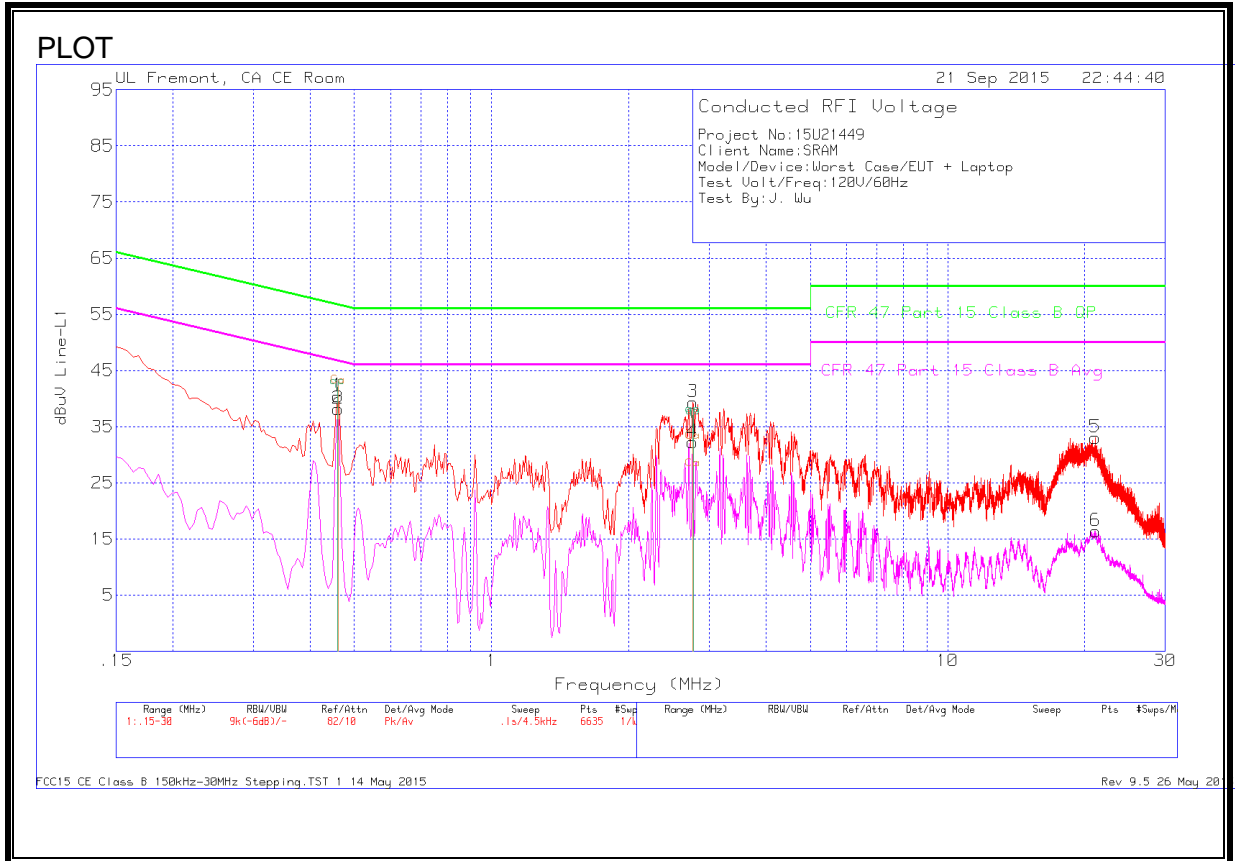
Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

RESULTS

6 WORST EMISSIONS

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz

Marker	Frequenc y (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.4605	40.02	Pk	.4	0	40.42	56.68	-16.26	46.68	-6.26
2	.4605	37.79	Av	.4	0	38.19	-	-	46.68	-8.49
3	2.7645	39.05	Pk	.2	.1	39.35	56	-16.65	46	-6.65
4	2.76	31.93	Av	.2	.1	32.23	-	-	46	-13.77
5	21.1065	32.57	Pk	.3	.2	33.07	60	-26.93	50	-16.93
6	21.1155	15.89	Av	.3	.2	16.39	-	-	50	-33.61

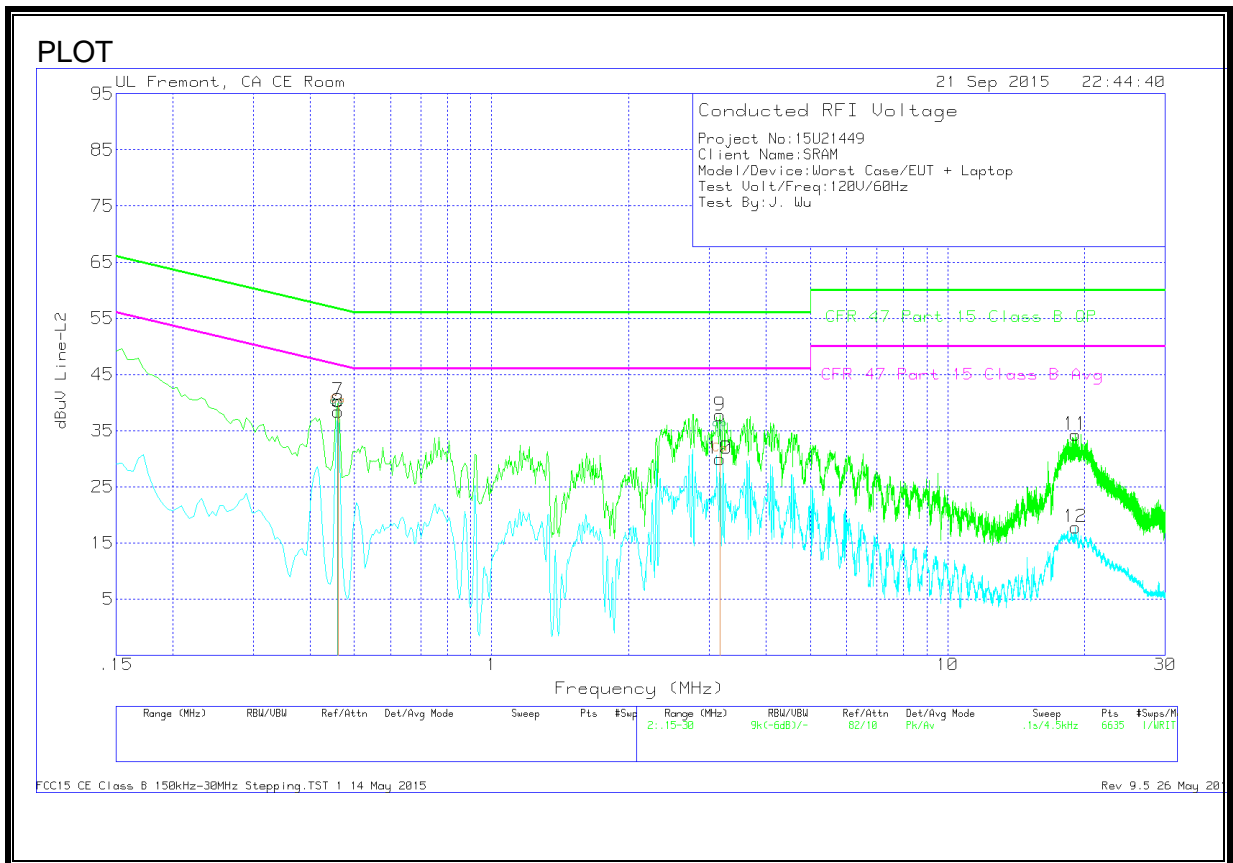
Pk - Peak detector

Av - Average detection

Range 1: Line-L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
.45938	41.67	Qp	.4	0	42.07	56.7	-14.63	-	-
2.76563	36.34	Qp	.2	.1	36.64	56	-19.36	-	-
2.76113	36.74	Qp	.2	.1	37.04	56	-18.96	-	-

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
7	.4605	39.86	Pk	.4	0	40.26	56.68	-16.42	46.68	-6.42
8	.4605	37.99	Av	.4	0	38.39	-	-	46.68	-8.29
9	3.1695	37.44	Pk	.2	.1	37.74	56	-18.26	46	-8.26
10	3.1695	29.68	Av	.2	.1	29.98	-	-	46	-16.02
11	19.077	33.77	Pk	.3	.2	34.27	60	-25.73	50	-15.73
12	19.077	17.32	Av	.3	.2	17.82	-	-	50	-32.18

Pk - Peak detector

Av - Average detection

Range 2: Line-L2 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
.45938	38.85	Qp	.4	0	39.25	56.7	-17.45	-	-
3.16838	34.96	Qp	.2	.1	35.26	56	-20.74	-	-

Qp - Quasi-Peak detector