



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

**BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT**

FOR

APPLE WATCH

MODEL NUMBER: A1802

**FCC ID: BCG-E3102
IC: 579C-E3102**

REPORT NUMBER: 16U23780-E2V2

ISSUE DATE: AUGUST 26, 2016

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
V1	08/15/2016	Initial Issue	Mengistu Mekuria
V2	08/26/2016	Revised report to address TCB's questions	Tina Chu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. SAMPLE CALCULATION	7
4.3. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. SOFTWARE AND FIRMWARE.....	8
5.5. WORST-CASE CONFIGURATION AND MODE.....	9
5.6. DESCRIPTION OF TEST SETUP.....	10
6. TEST AND MEASUREMENT EQUIPMENT	13
7. ANTENNA PORT TEST RESULTS	14
7.1. MEASUREMENT METHODS	14
7.2. HIGH POWER ANTENNA	17
7.2.1. 6 dB BANDWIDTH.....	17
7.2.2. 99% BANDWIDTH.....	20
7.2.3. AVERAGE POWER.....	23
7.2.4. OUTPUT POWER	24
7.2.5. POWER SPECTRAL DENSITY	25
7.2.6. CONDUCTED SPURIOUS EMISSIONS.....	28
7.3. LOW POWER ANTENNA	32
7.3.1. 6 dB BANDWIDTH.....	32
7.3.2. 99% BANDWIDTH.....	35
7.3.3. AVERAGE POWER.....	38
7.3.4. OUTPUT POWER	39
7.3.5. POWER SPECTRAL DENSITY	40
7.3.6. CONDUCTED SPURIOUS EMISSIONS.....	43
8. RADIATED TEST RESULTS.....	47
8.1. LIMITS AND PROCEDURE	47
8.2. TRANSMITTER ABOVE 1 GHz.....	48
8.2.1. HIGH POWER ANTENNA RESTRICTED BANDEDGE	48
8.2.2. HIGH POWER ANTENNA HARMONICS AND SPURIOUS EMISSIONS	52
8.2.3. LOW POWER ANTENNA RESTRICTED BANDEDGE.....	58

8.2.4.	LOW POWER ANTENNA HARMONICS AND SPURIOUS EMISSIONS	62
8.3.	WORST-CASE BELOW 1 GHz.....	68
8.4.	WORST-CASE 18 to 26 GHz.....	70
9.	AC POWER LINE CONDUCTED EMISSIONS	72
10.	SETUP PHOTOS	73

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: APPLE WATCH

MODEL: A1802

SERIAL NUMBER: FH7RM045H91M

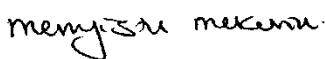
DATE TESTED: JULY 01- AUGST 22, 2016

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

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

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

Approved & Released For
UL Verification Services Inc. By:



MENGISTU MENKURIA
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Prepared By:



TRI PHAM
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, KDB 558074 D01 v03r05, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☒ Chamber F
	☒ Chamber G
	☒ 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, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	18.27	67.14

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	-10.50

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 14S310.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT has 1 type of enclosure and various kinds of metallic and non-metallic wristbands. There are 2 types of metallic bands; Metal Links, and Metal Mesh. The worst-case configuration was investigated within these combinations charging with/without wireless charger by AC/DC adapter and it was determined that EUT with wristband charging with wireless charger by AC/DC adapter was the worst-case; therefore, all final radiated testing was performed with this configuration. There is no significant difference among various kinds of wristbands.

Radiated emission below 1G was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

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

BLE: 1 Mbps.

5.6. 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	A1768	DLC616200ZYHE1Y835	BCGA1768
AC/DC adapter	Apple	A1385	D293154U2DTDHLHCW	N/A
Test jig	Apple	-	OYOOH217	N/A

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB to mini USB	Shielded	1	To laptop and fixture

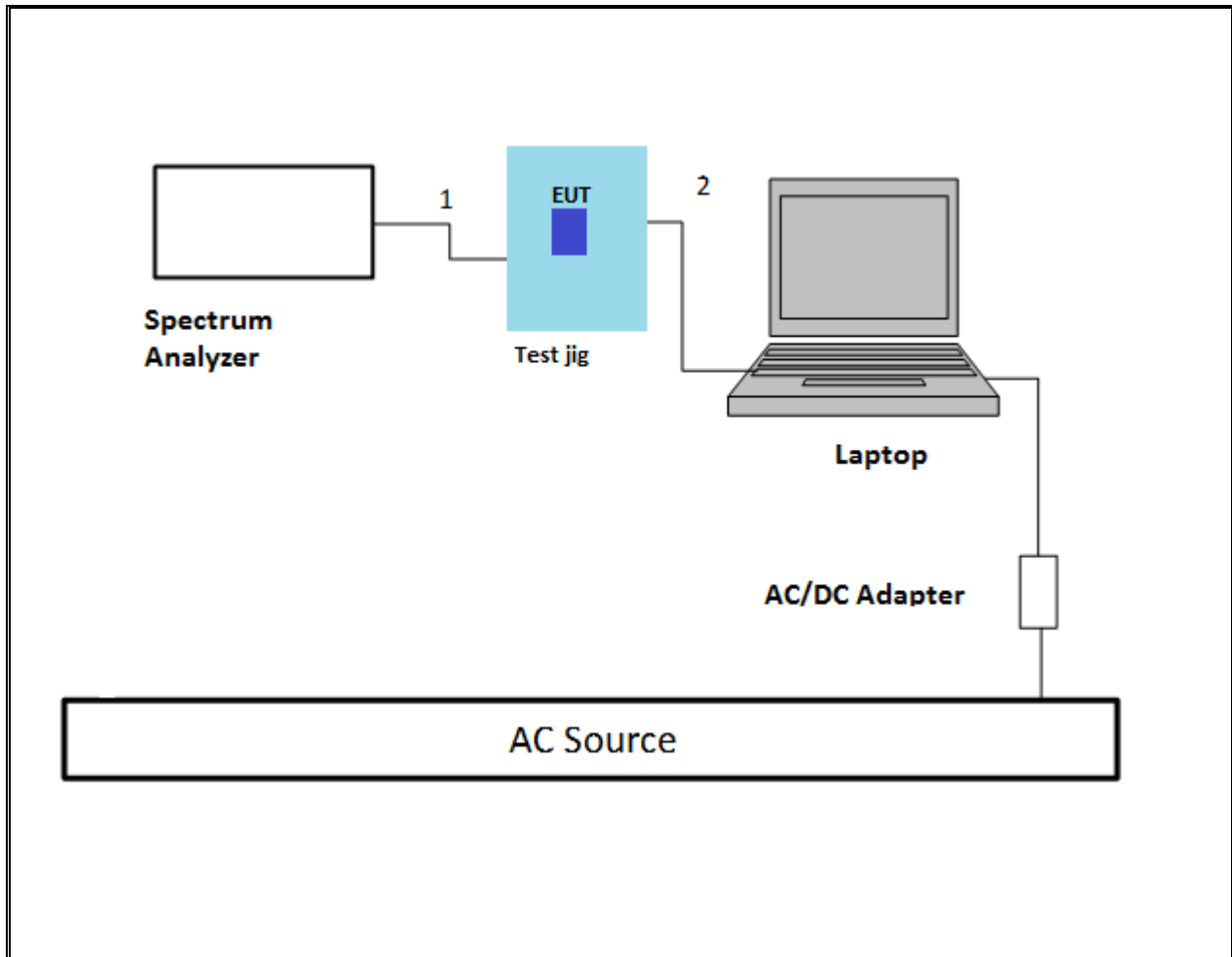
I/O CABLES (BELOW AND ABOVE 1G RADIATED TEST)

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

TEST SETUP- CONDUCTED PORT

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

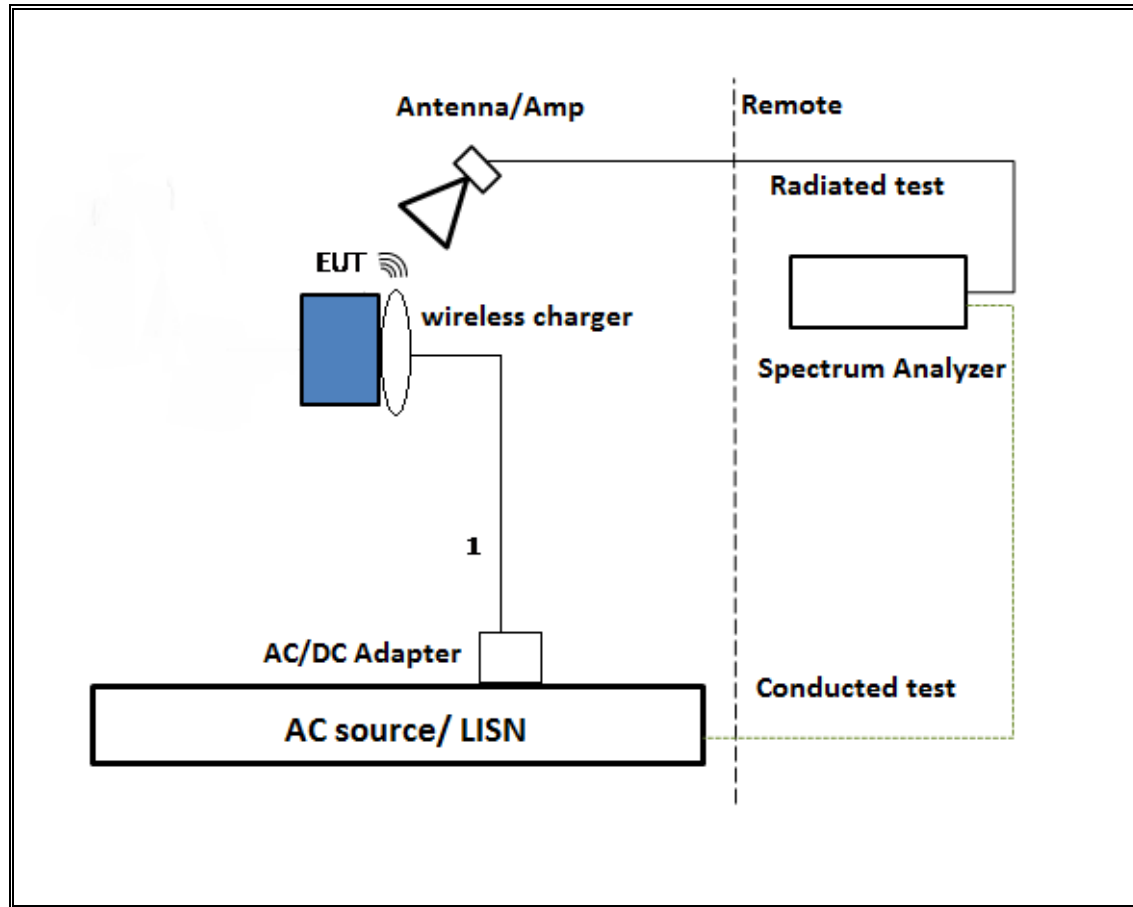
SETUP DIAGRAM



TEST SETUP- BELOW AND ABOVE 1GHZ TESTS

EUT was powered by battery and charged by AC/DC adapter via USB cable with wireless charger. Test software exercised the EUT.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	T Number	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T120	4/5/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T122	1/29/2017
Amplifier, 10KHz to 1GHz,	Sonoma	310N	T173	6/17/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	T341	10/14/2016
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	4/18/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T899	5/26/2017
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T491	5/31/2017
Amplifier, 10KHz to 1GHz,	Sonoma	310N	T834	6/17/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	T905	6/21/2017
Power Meter, P-series single channel	Agilent	N1911A	T1271	7/8/2017
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	T1228	6/20/2017
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	T447	6/16/2017
**Spectrum Analyzer, 40 GHz	Agilent	8564E	T106	8/13/2016
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	T402	7/5/2017
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015	
* Conducted Software	UL	UL EMC	Ver 4.0, January 11, 2016	

Note: * indicates automation software version used in the compliance certification testing

** Test equipment was used before equipment calibration due date.

7. ANTENNA PORT TEST RESULTS

7.1. MEASUREMENT METHODS

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

Output Power: KDB 558074 D01 v03r05, Section 9.1.2.

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

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

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

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

ON TIME, DUTY CYCLE

LIMITS

None; for reporting purposes only.

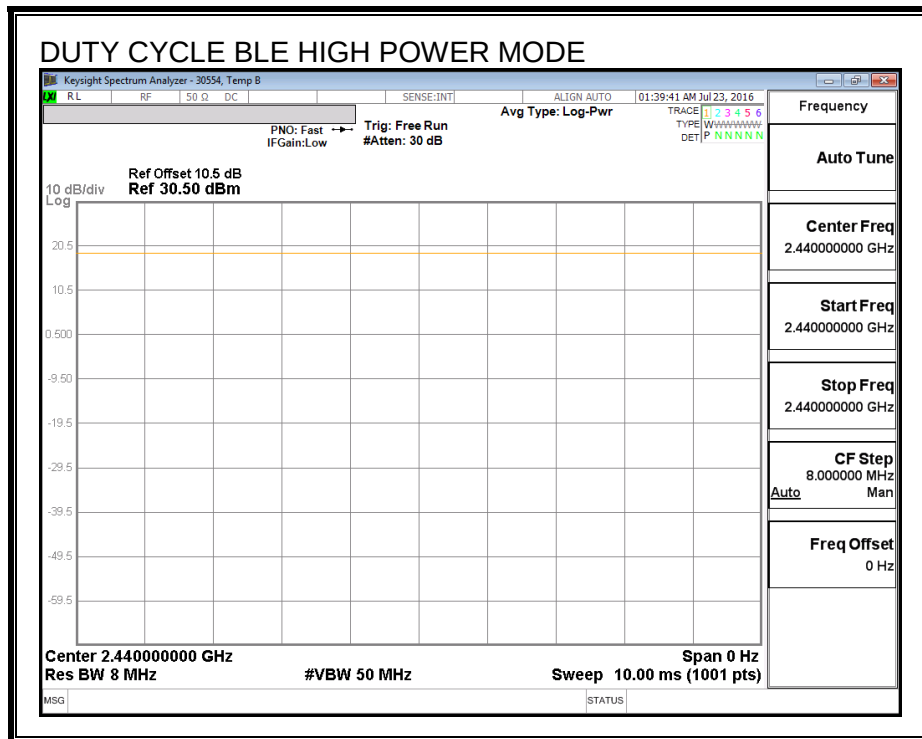
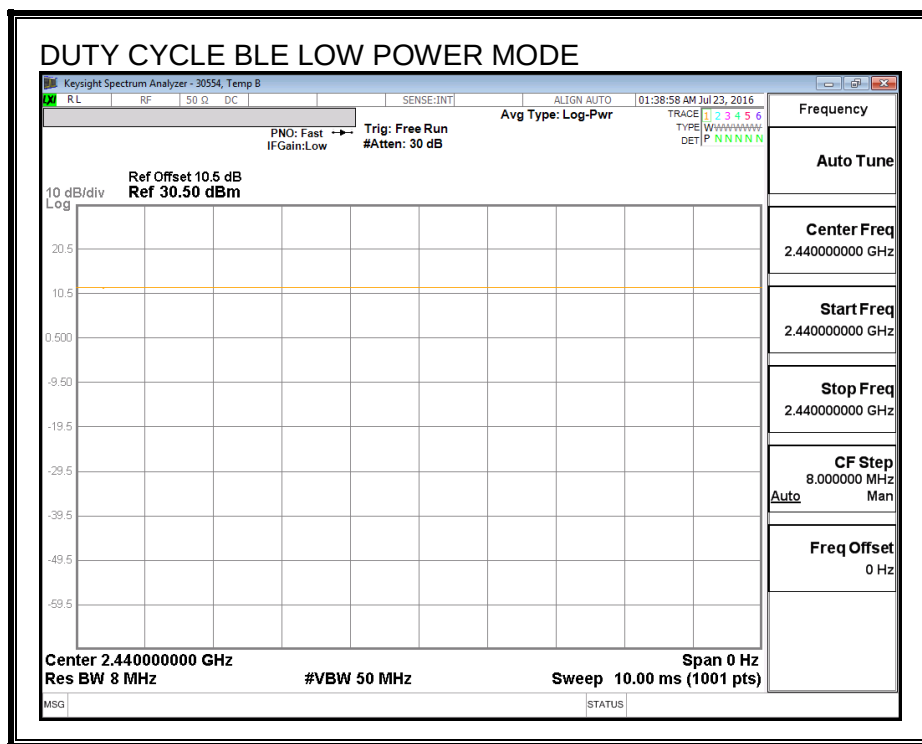
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
BLE LOW POWER	10.000	10.000	1.000	100.00%	0.00	0.010
BLE HIGH POWER	10.000	10.000	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOTS



7.2. HIGH POWER ANTENNA

7.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

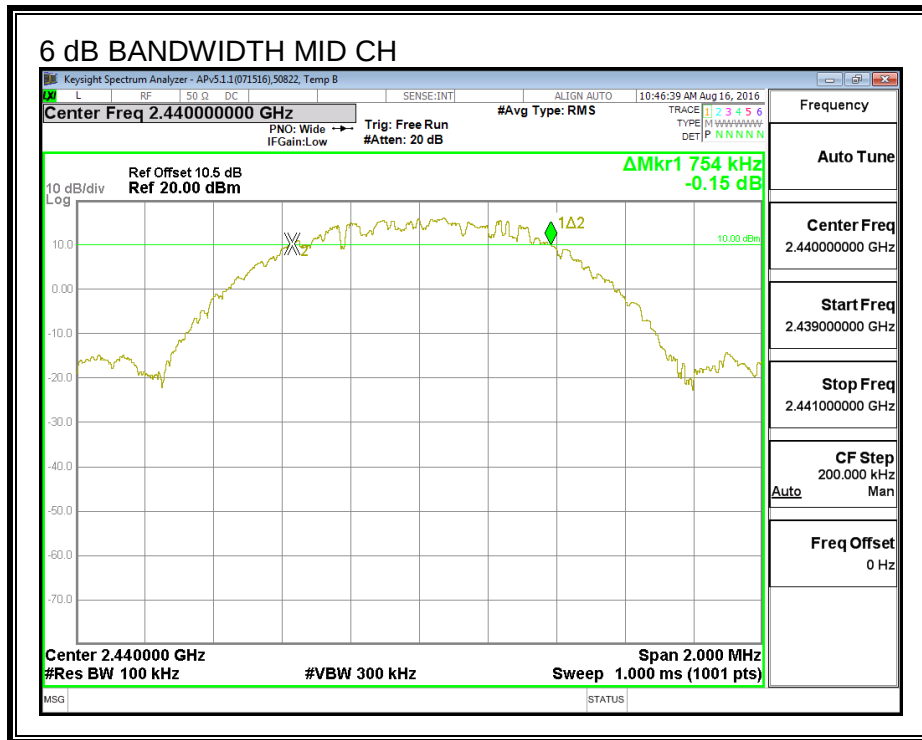
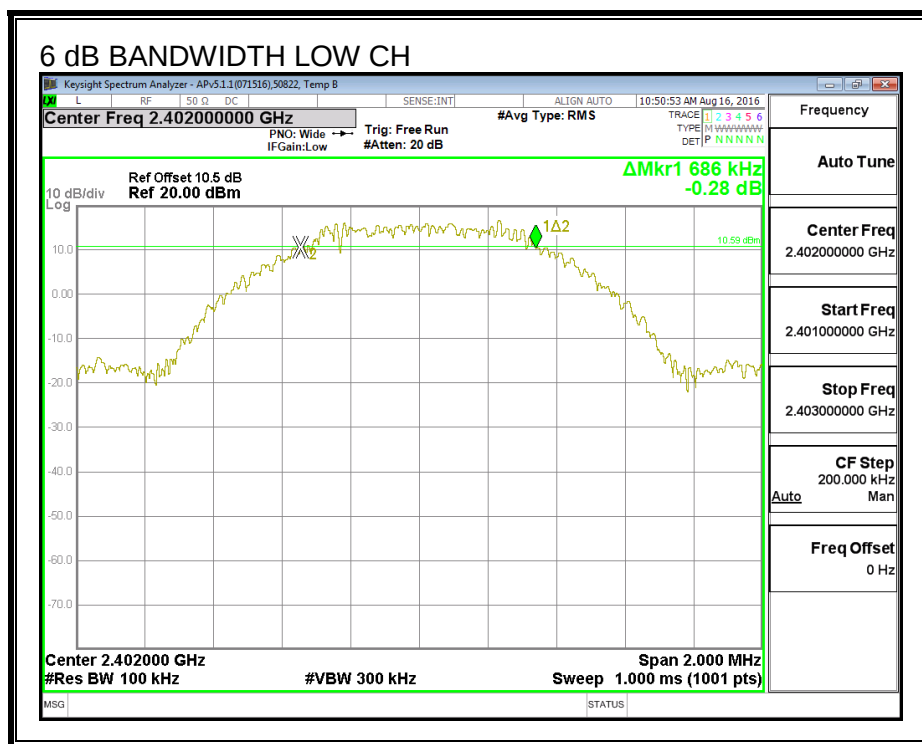
IC RSS-247 (5.2) (1)

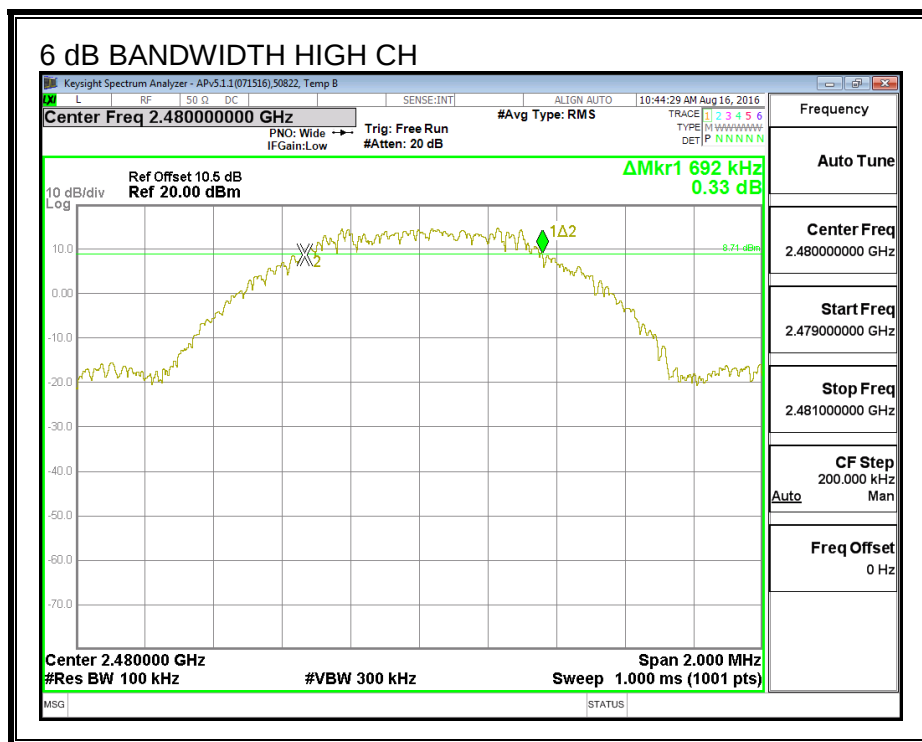
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.686	0.5
Middle	2440	0.754	0.5
High	2480	0.692	0.5

6 dB BANDWIDTH





7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

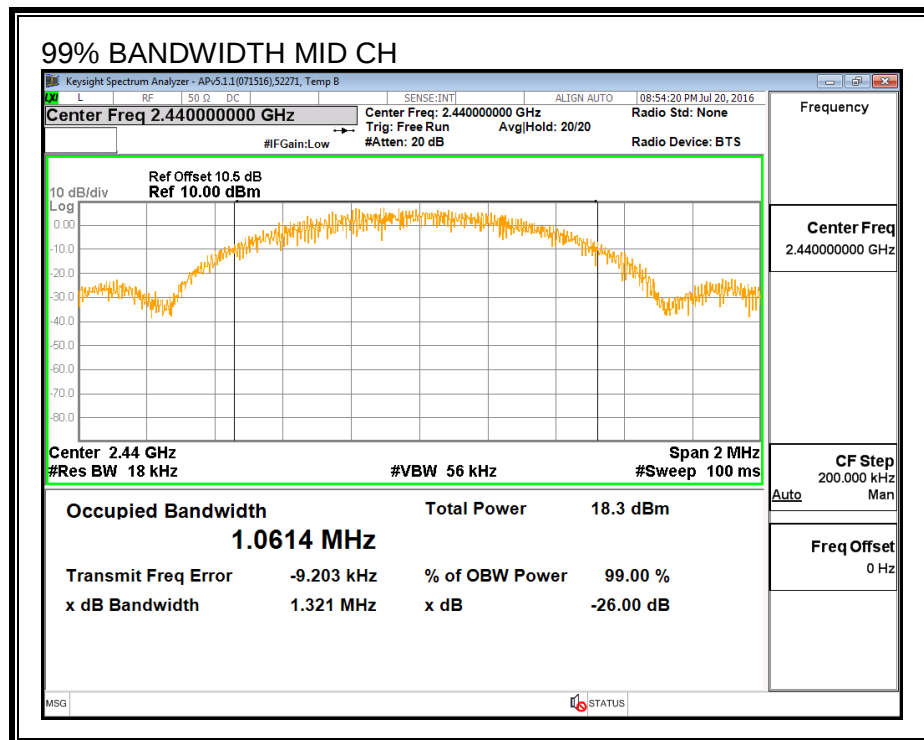
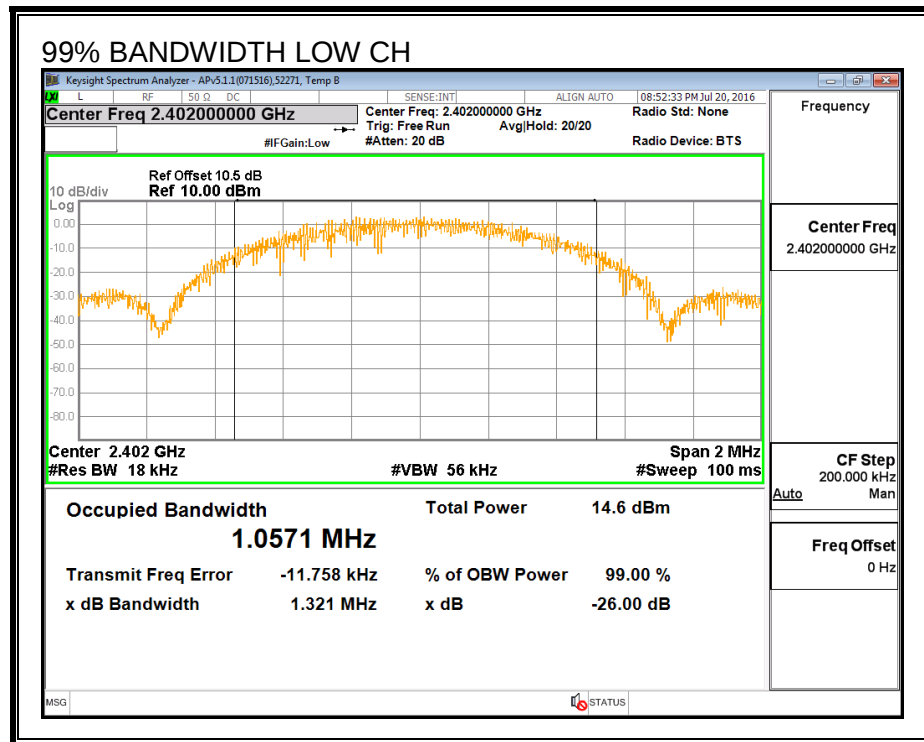
TEST PROCEDURE

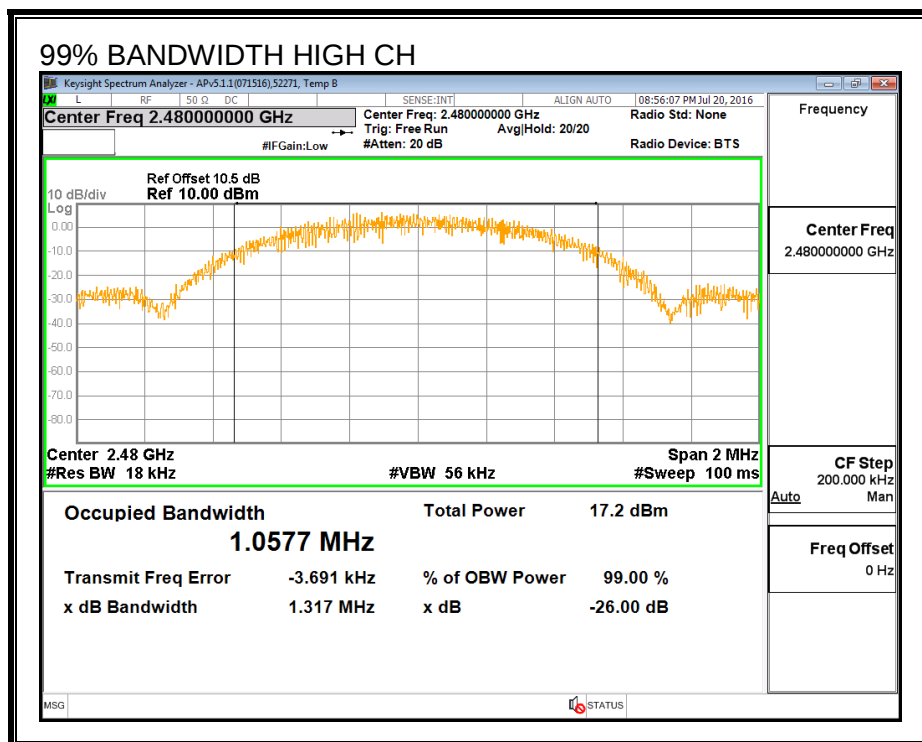
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth or to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Frequency (MHz)	99% Bandwidth (MHz)
2402	1.0571
2440	1.0614
2480	1.0577

99% BANDWIDTH





7.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

ID:	44353	Date:	8/11/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	17.25
Middle	2440	17.26
High	2480	17.30

7.2.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 (5.4) (4)

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

RESULTS

ID:	44353	Date:	8/11/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	18.20	30	-11.800
Middle	2440	18.21	30	-11.790
High	2480	18.27	30	-11.730

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

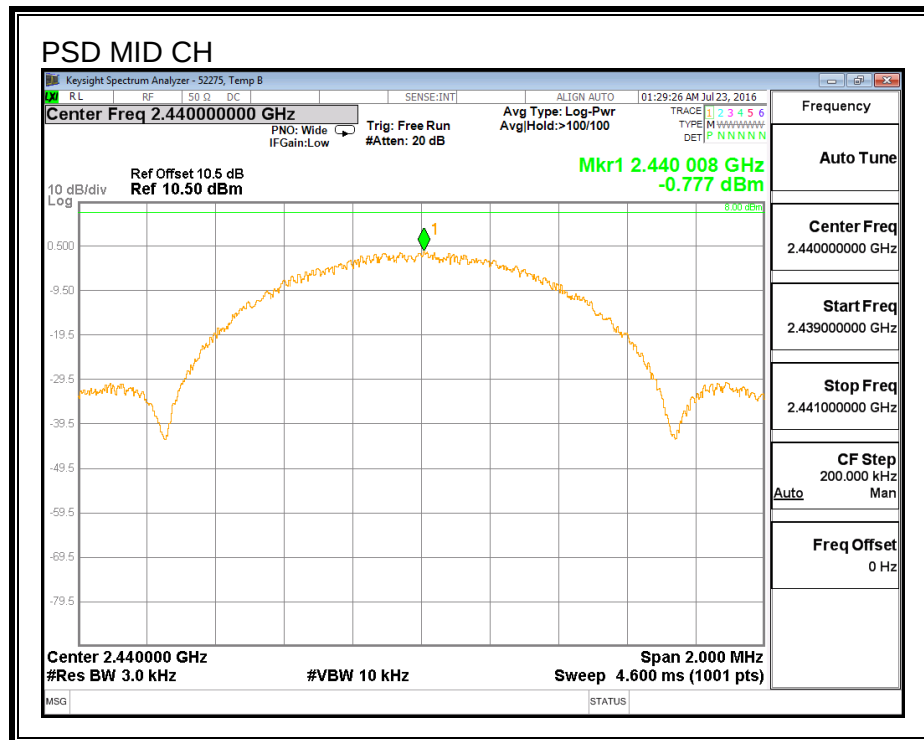
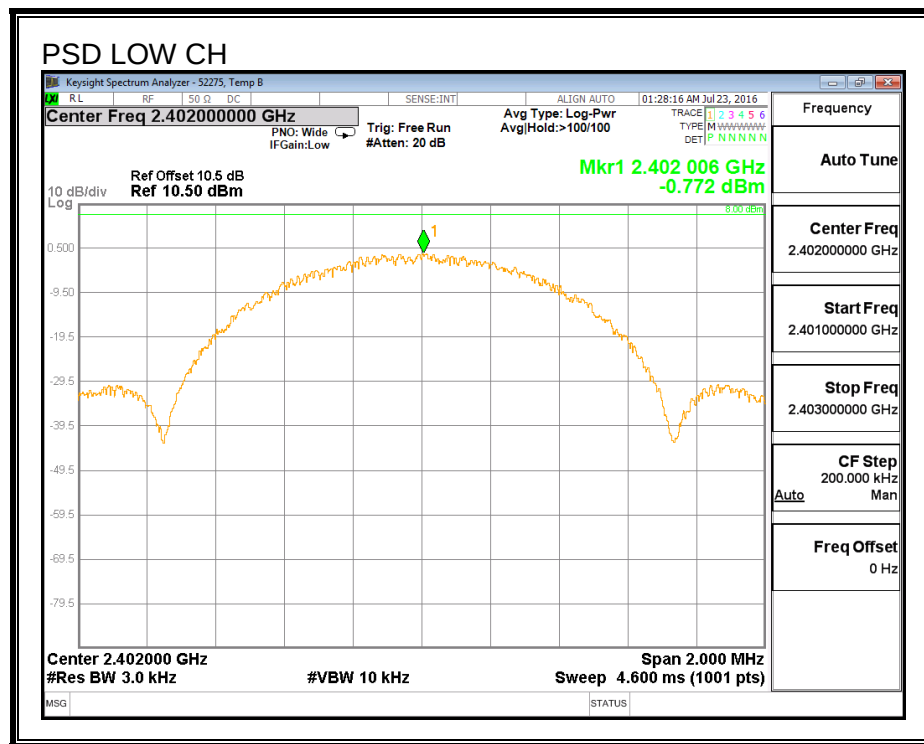
IC RSS-247 (5.2) (2)

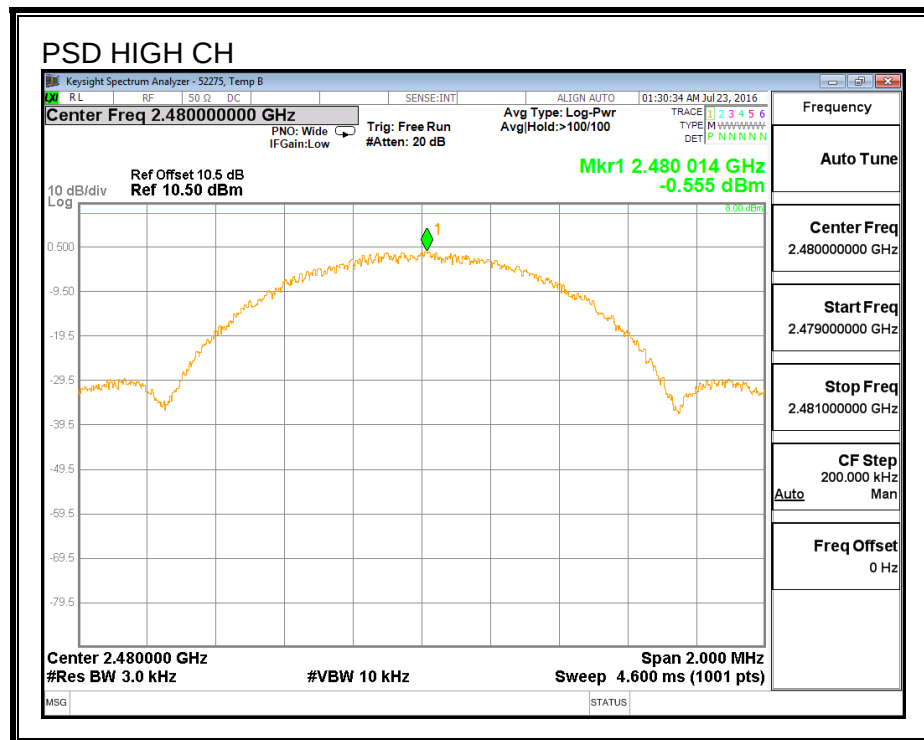
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-0.77	8	-8.77
Middle	2440	-0.78	8	-8.78
High	2480	-0.56	8	-8.56

POWER SPECTRAL DENSITY





7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

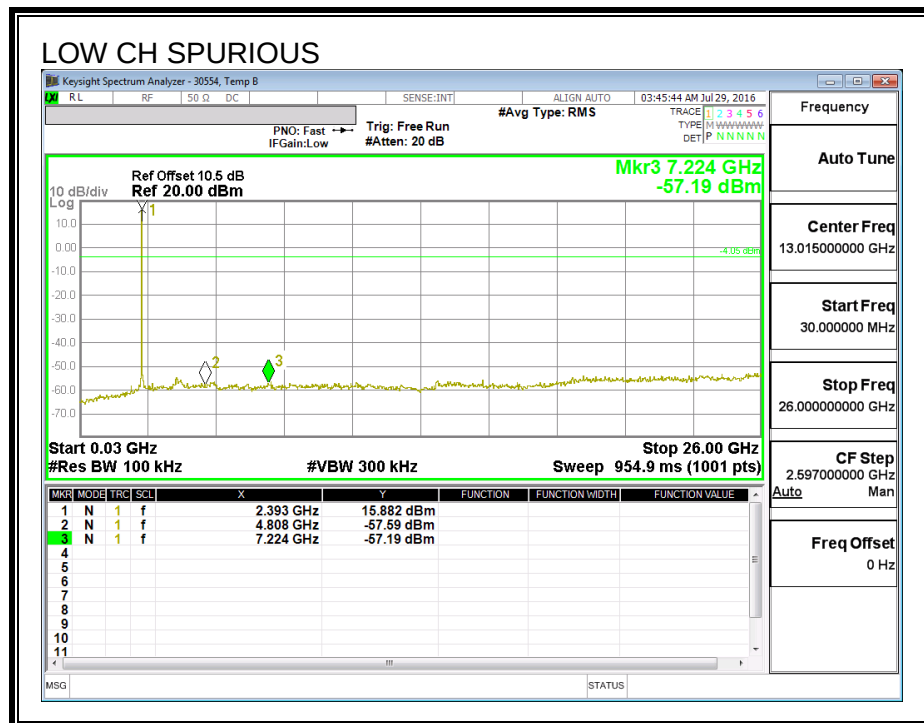
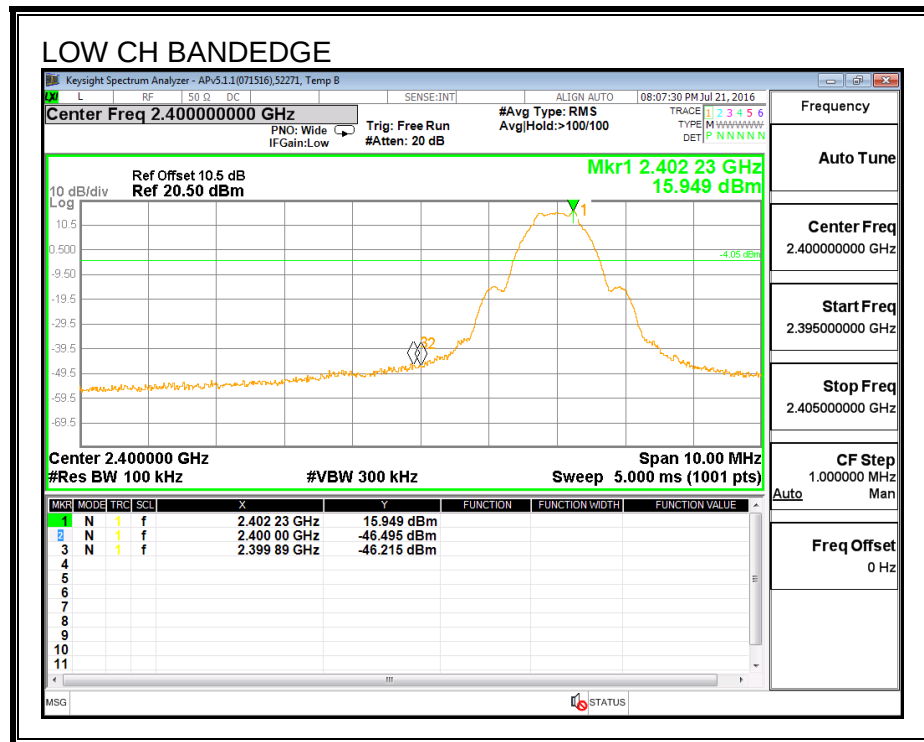
FCC §15.247 (d)

IC RSS-247 (5.5)

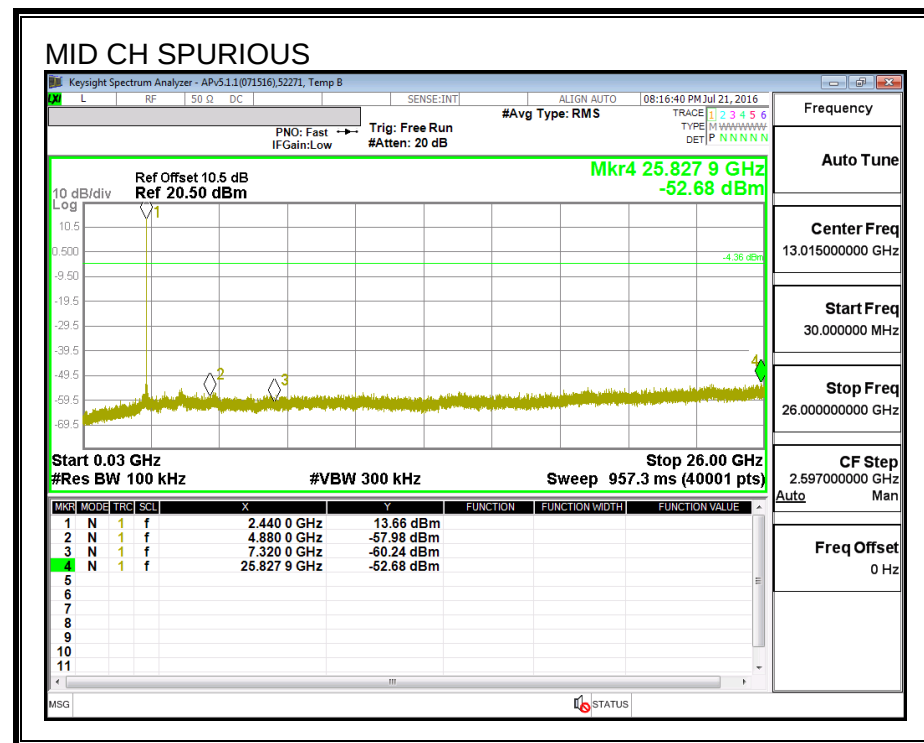
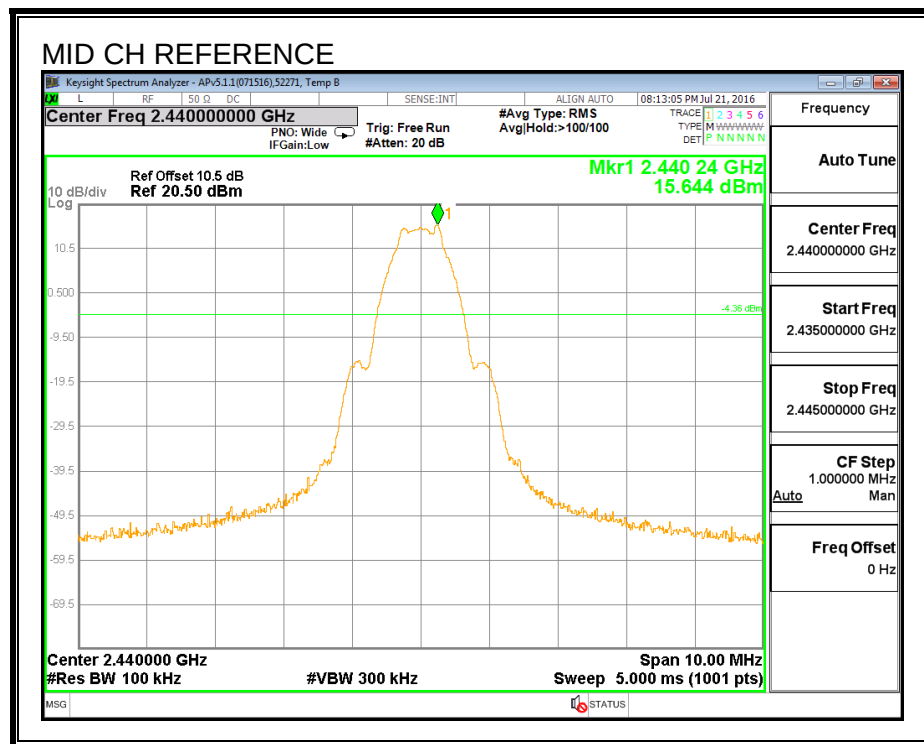
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

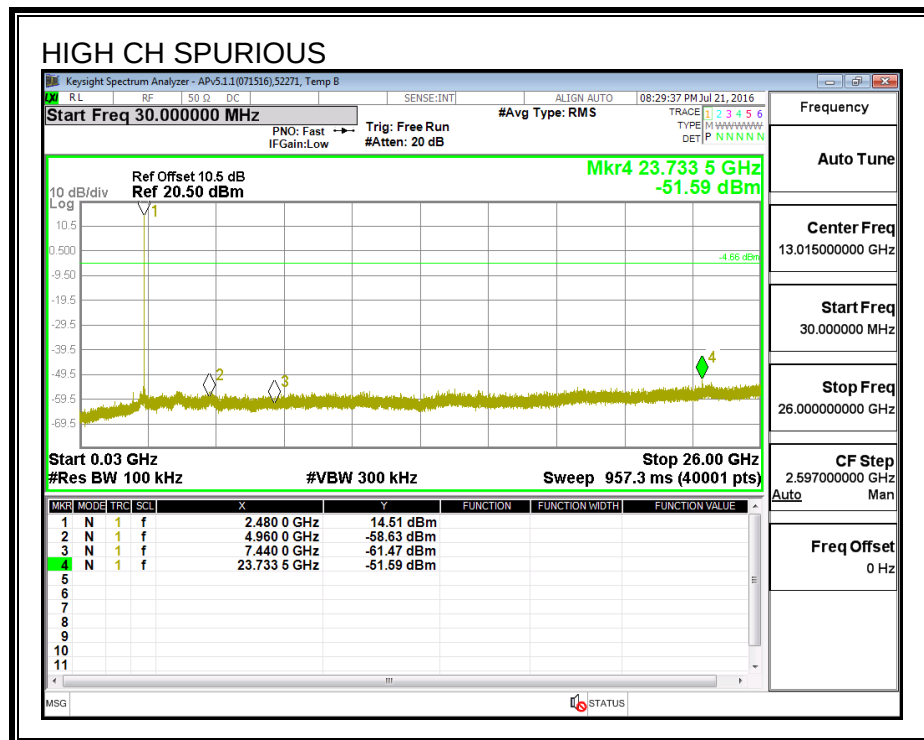
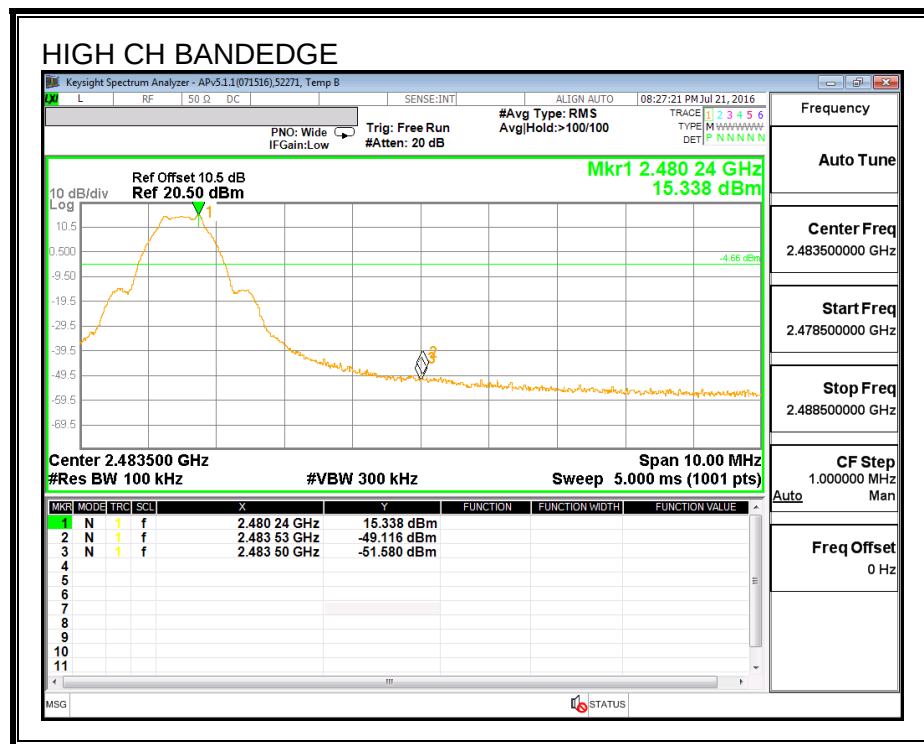
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



7.3. LOW POWER ANTENNA

7.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

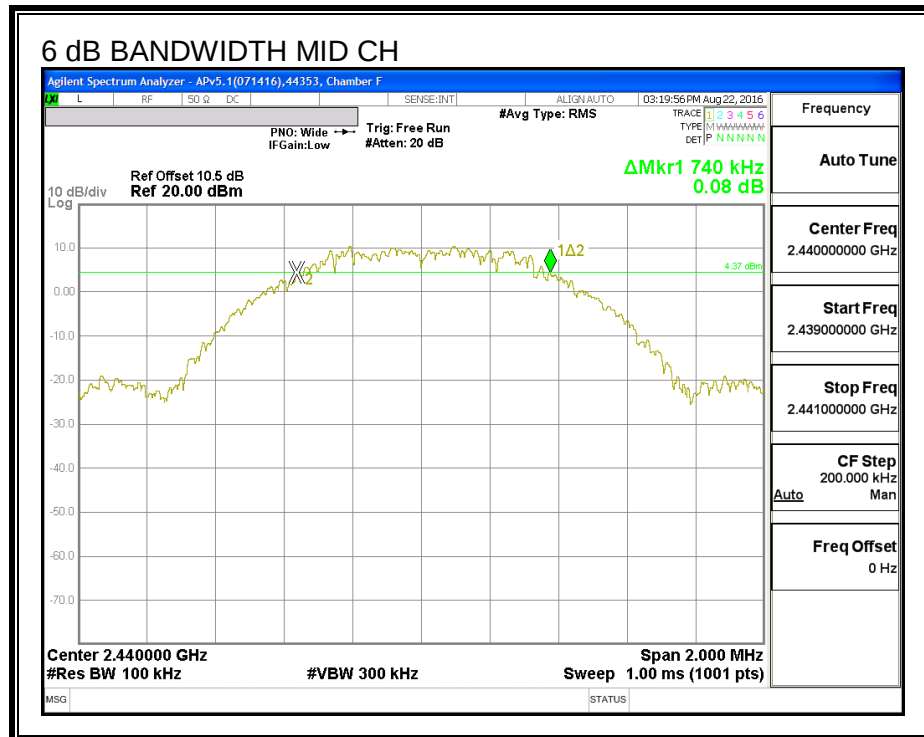
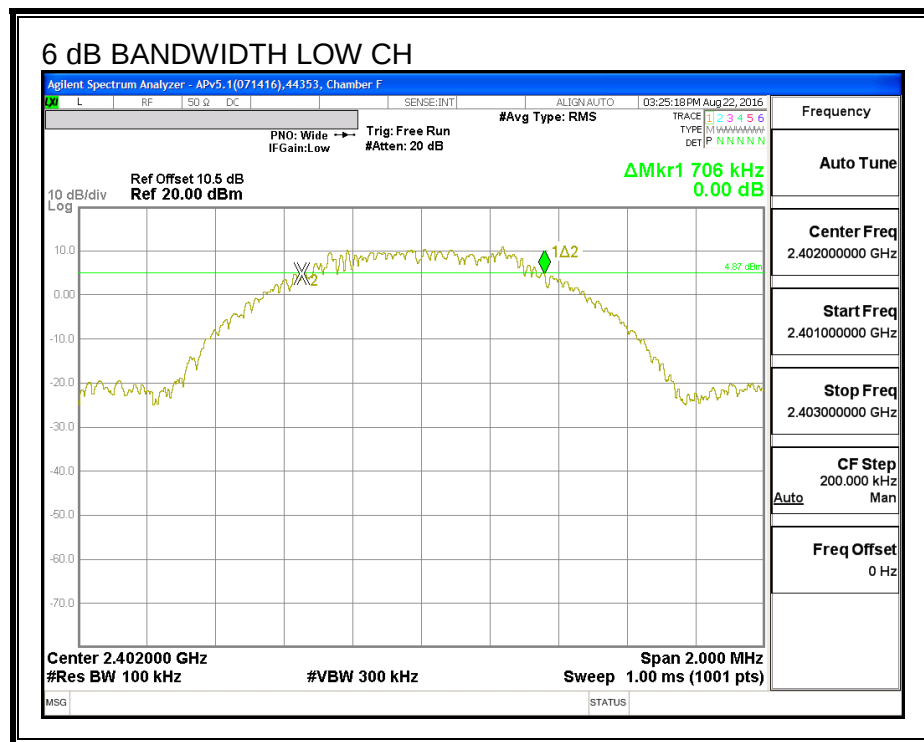
IC RSS-247 (5.2) (1)

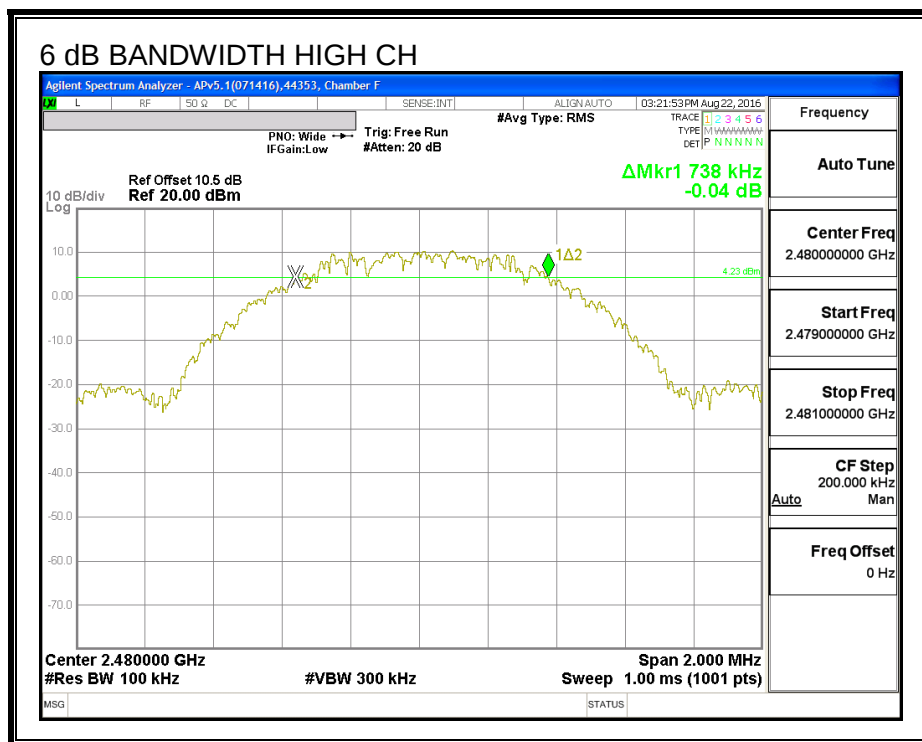
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.706	0.5
Middle	2440	0.740	0.5
High	2480	0.738	0.5

6 dB BANDWIDTH





7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

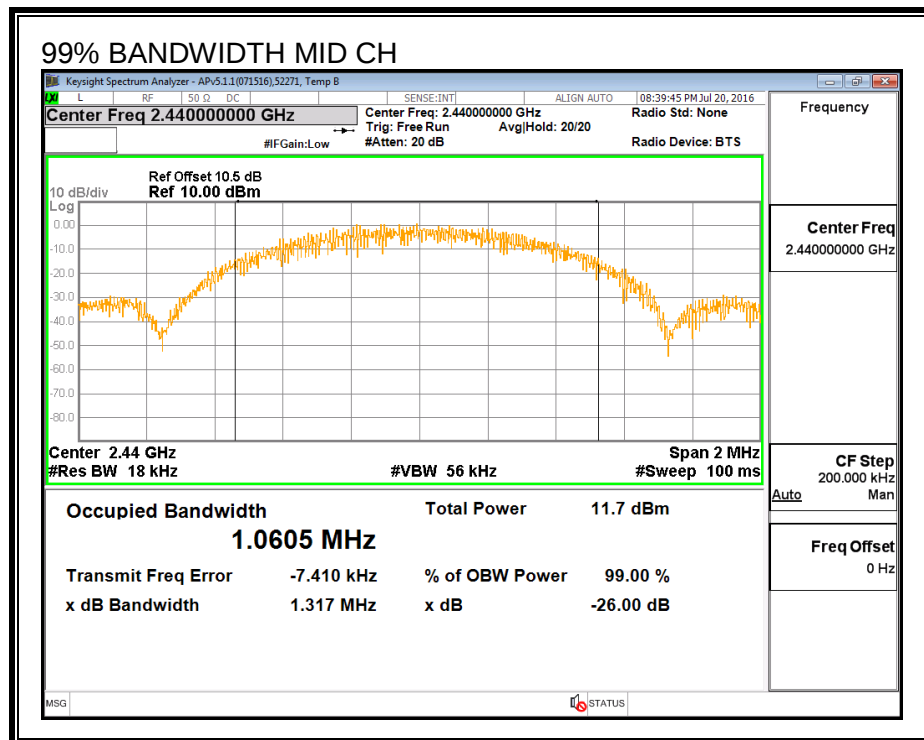
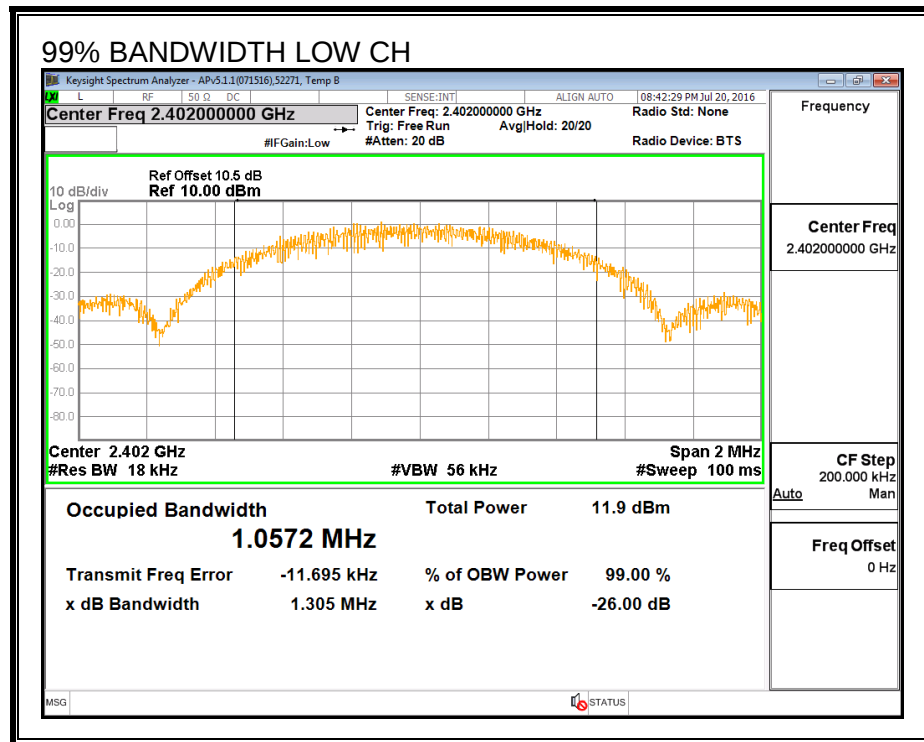
TEST PROCEDURE

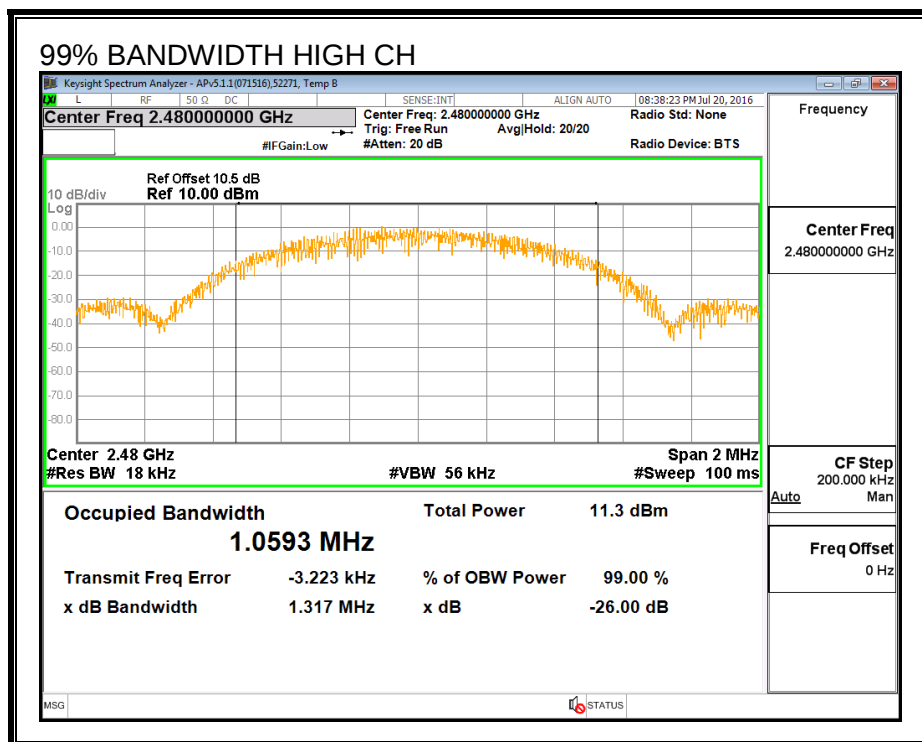
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0572
Middle	2440	1.0605
High	2480	1.0593

99% BANDWIDTH





7.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

ID:	52275	Date:	7/23/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	9.9
Middle	2440	10.0
High	2480	10.0

7.3.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 (5.4) (4)

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

RESULTS

ID:	52275	Date:	7/23/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.45	30	-19.550
Middle	2440	10.60	30	-19.400
High	2480	10.62	30	-19.380

7.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

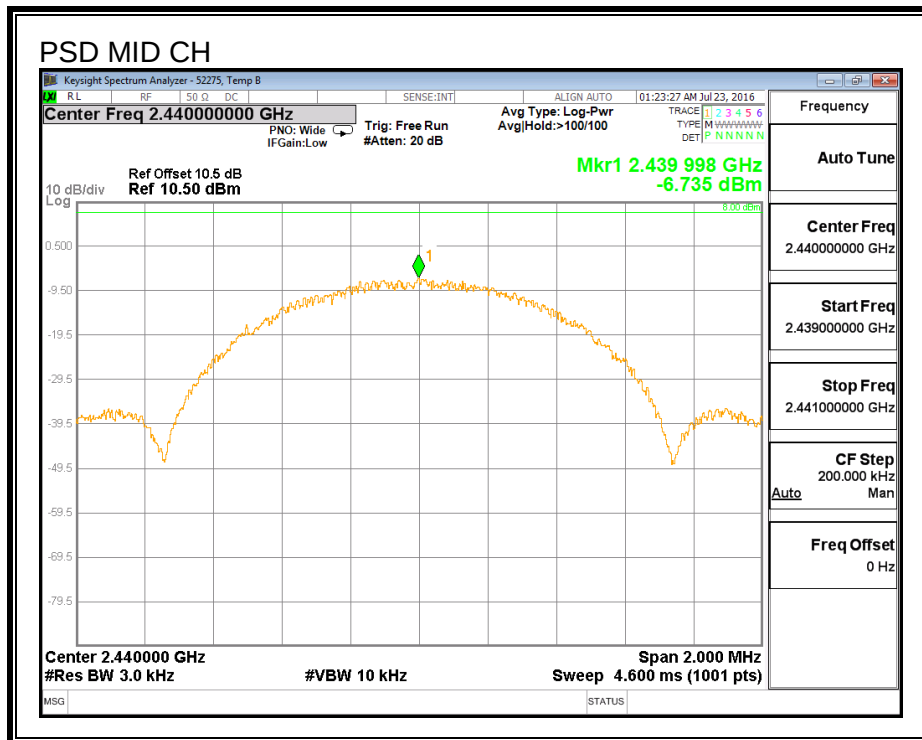
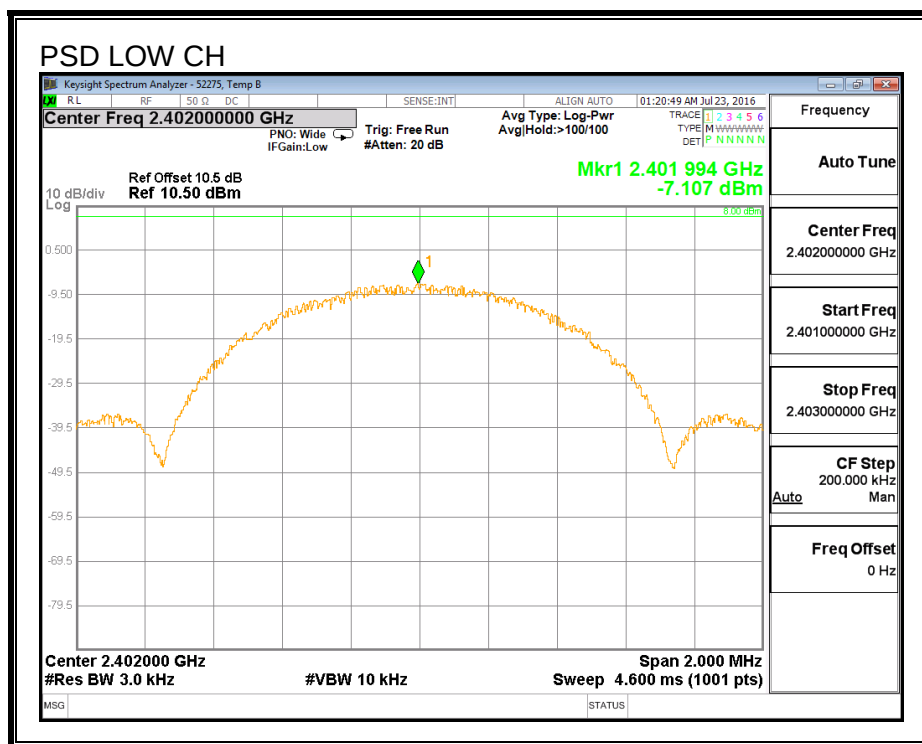
IC RSS-247 (5.2) (2)

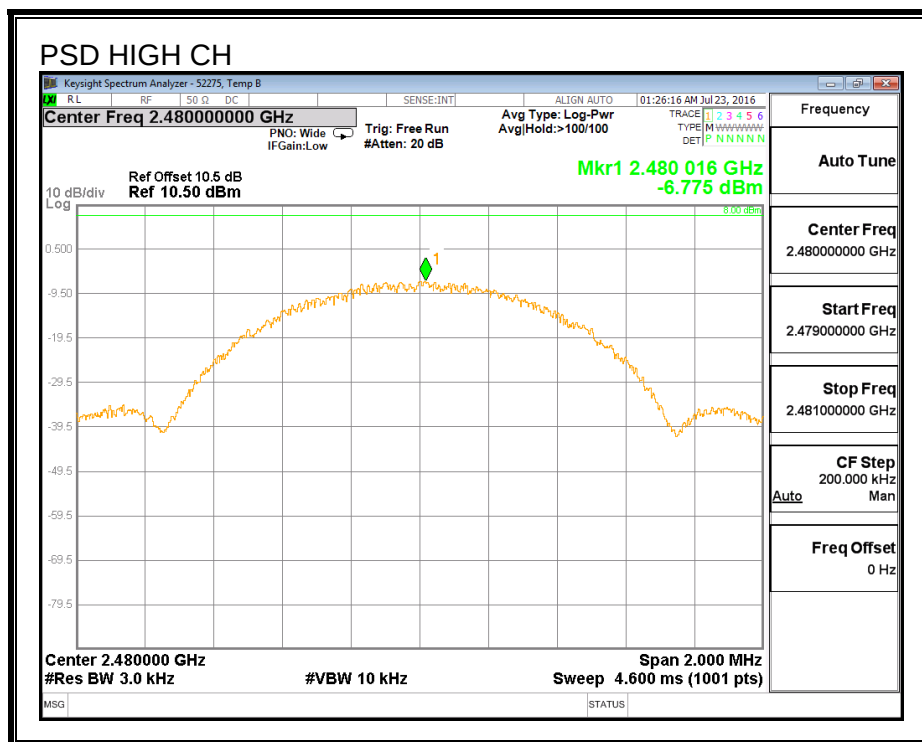
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-7.11	8	-15.11
Middle	2440	-6.74	8	-14.74
High	2480	-6.78	8	-14.78

POWER SPECTRAL DENSITY





7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

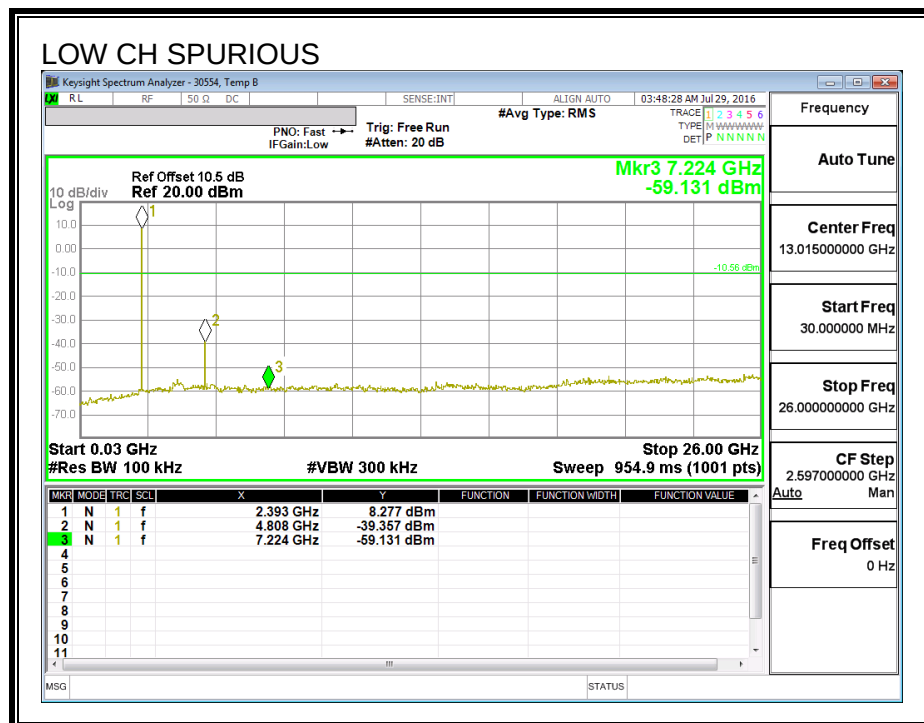
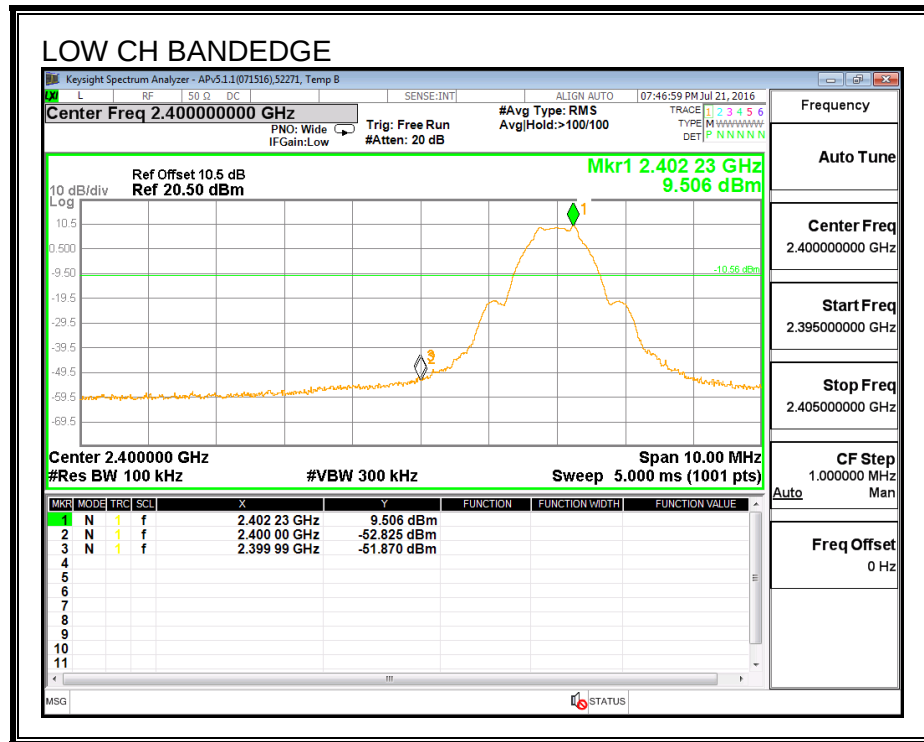
FCC §15.247 (d)

IC RSS-247 (5.5)

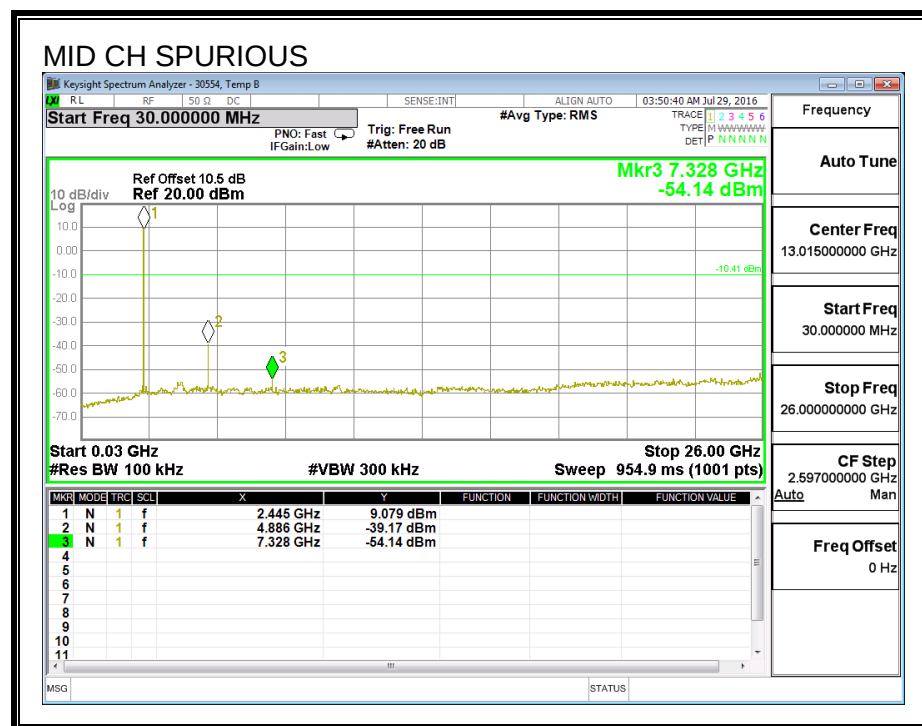
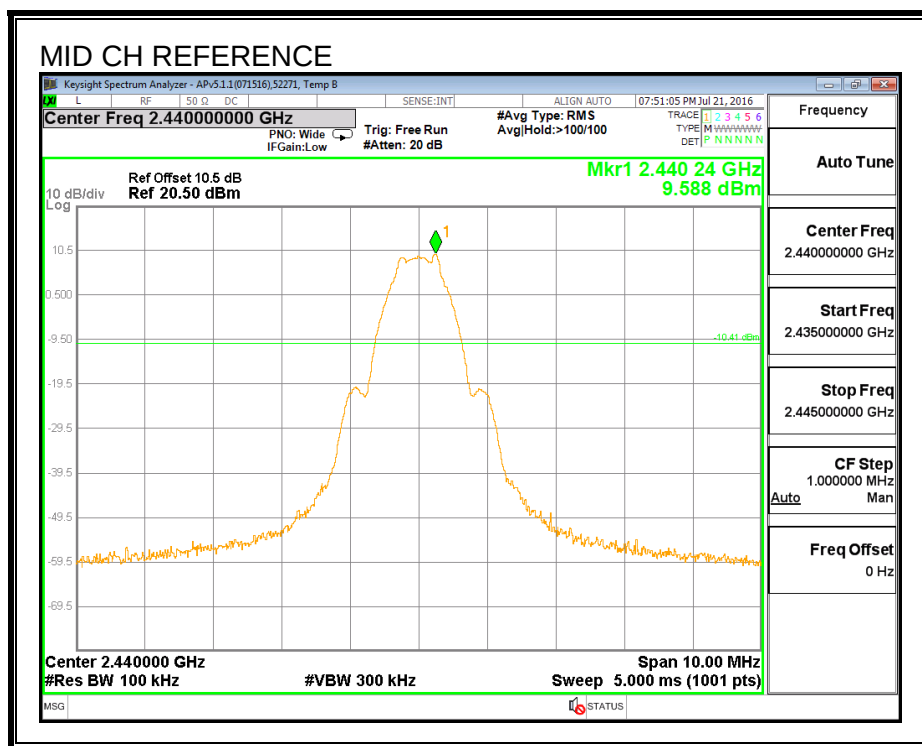
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

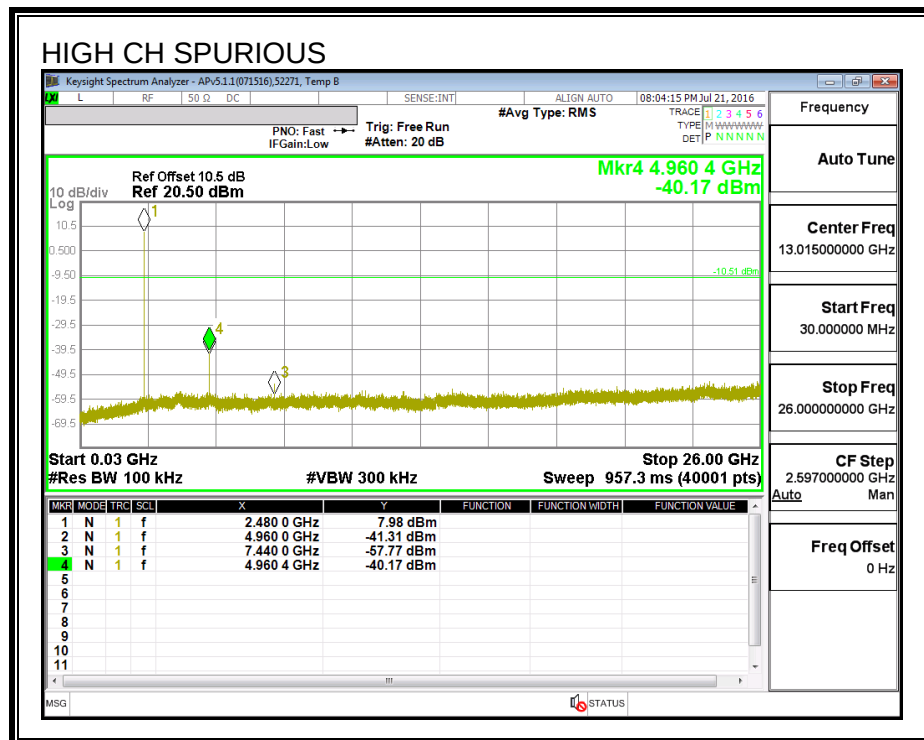
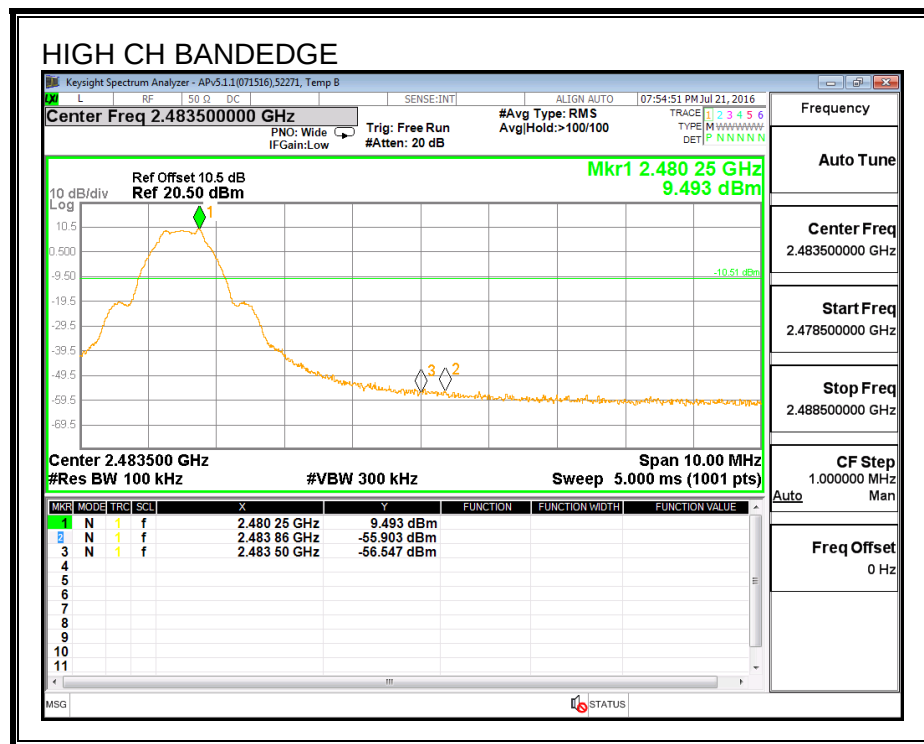
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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

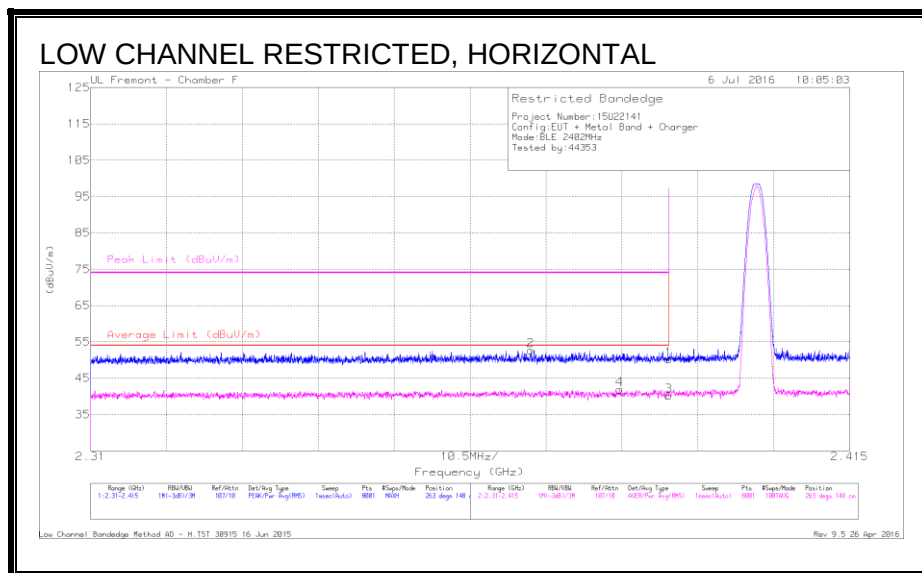
For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 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.

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. HIGH POWER ANTENNA RESTRICTED BANDEGE



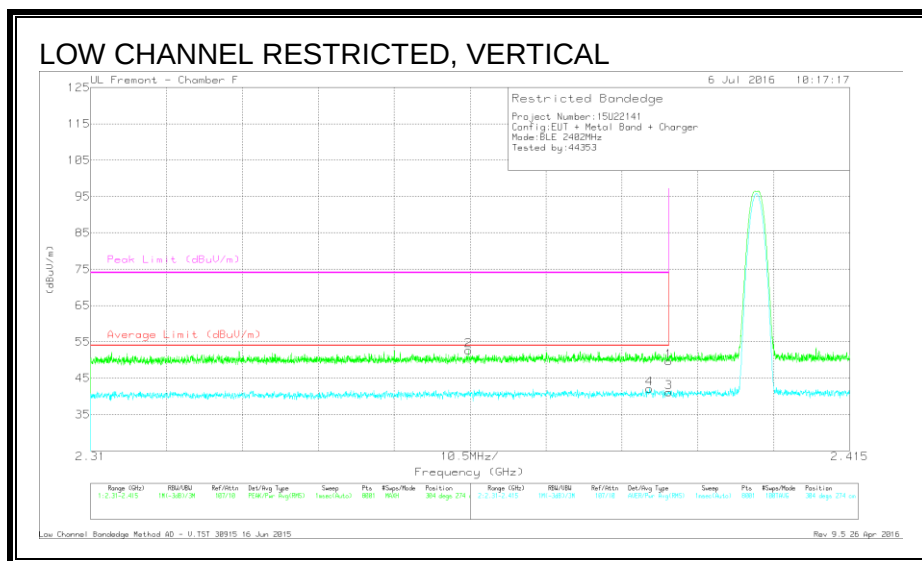
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.96	Pk	32.1	-20.9	50.16	-	-	74	-23.84	263	148	H
2	* 2.371	41.56	Pk	32	-20.9	52.66	-	-	74	-21.34	263	148	H
3	* 2.39	28.89	RMS	32.1	-20.9	40.09	54	-13.91	-	-	263	148	H
4	* 2.383	30.71	RMS	32.1	-20.9	41.91	54	-12.09	-	-	263	148	H

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

Pk - Peak detector

RMS - RMS detection



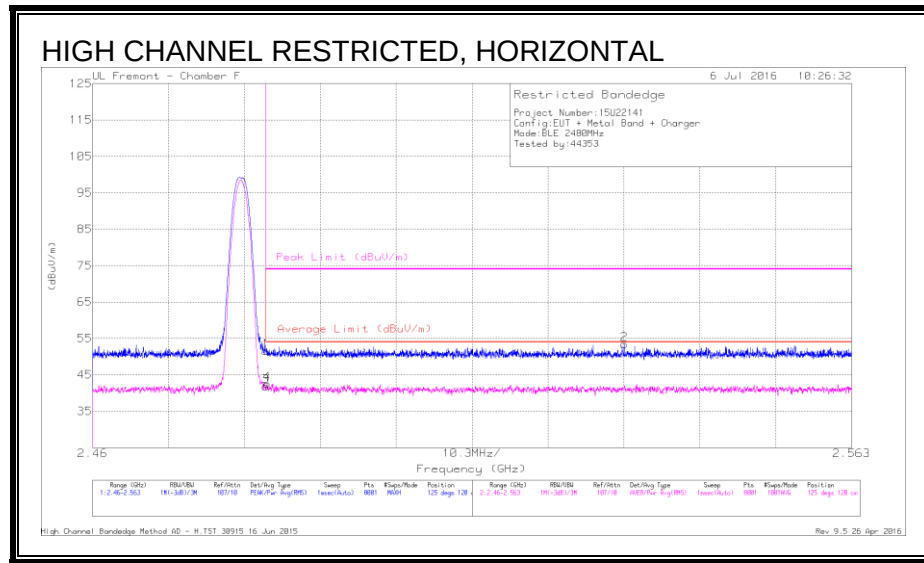
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.52	Pk	32.1	-20.9	49.72	-	-	74	-24.28	304	274	V
2	* 2.362	41.52	Pk	32	-20.9	52.62	-	-	74	-21.38	304	274	V
3	* 2.39	29.92	RMS	32.1	-20.9	41.12	54	-12.88	-	-	304	274	V
4	* 2.387	30.9	RMS	32.1	-20.9	42.1	54	-11.9	-	-	304	274	V

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

Pk - Peak detector

RMS - RMS detection



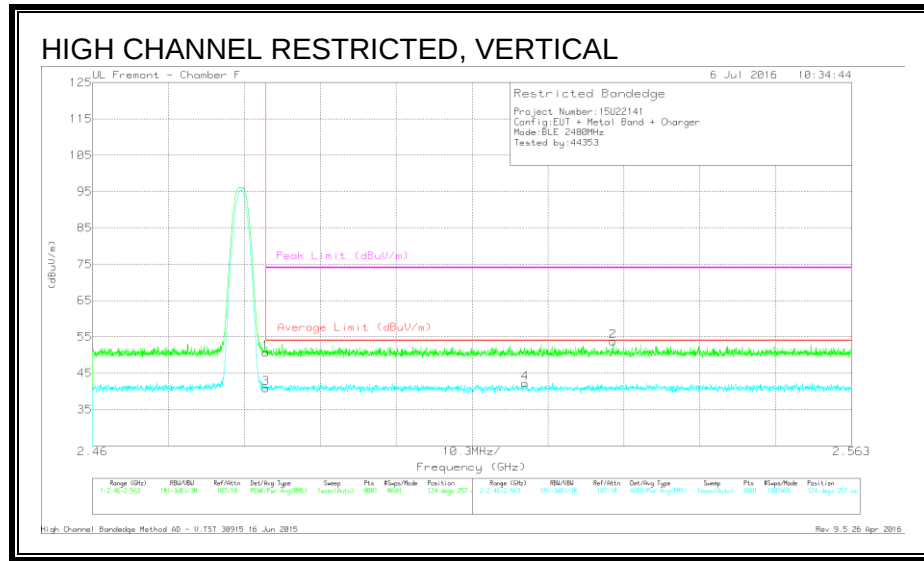
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.2	Pk	32.3	-21	51.5	-	-	74	-22.5	125	120	H
2	2.532	41.95	Pk	32.3	-20.9	53.35	-	-	74	-20.65	125	120	H
3	* 2.484	30.56	RMS	32.3	-21	41.86	54	-12.14	-	-	125	120	H
4	* 2.484	31.2	RMS	32.3	-21	42.5	54	-11.5	-	-	125	120	H

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

Pk - Peak detector

RMS - RMS detection



DATA

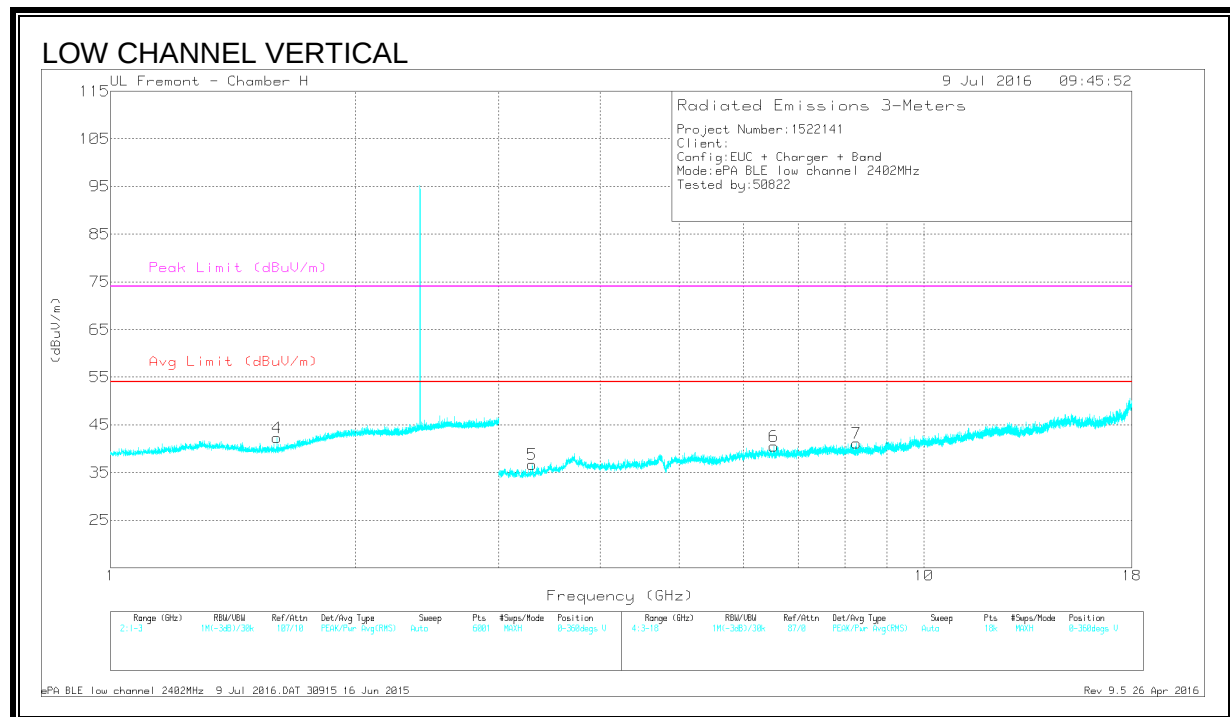
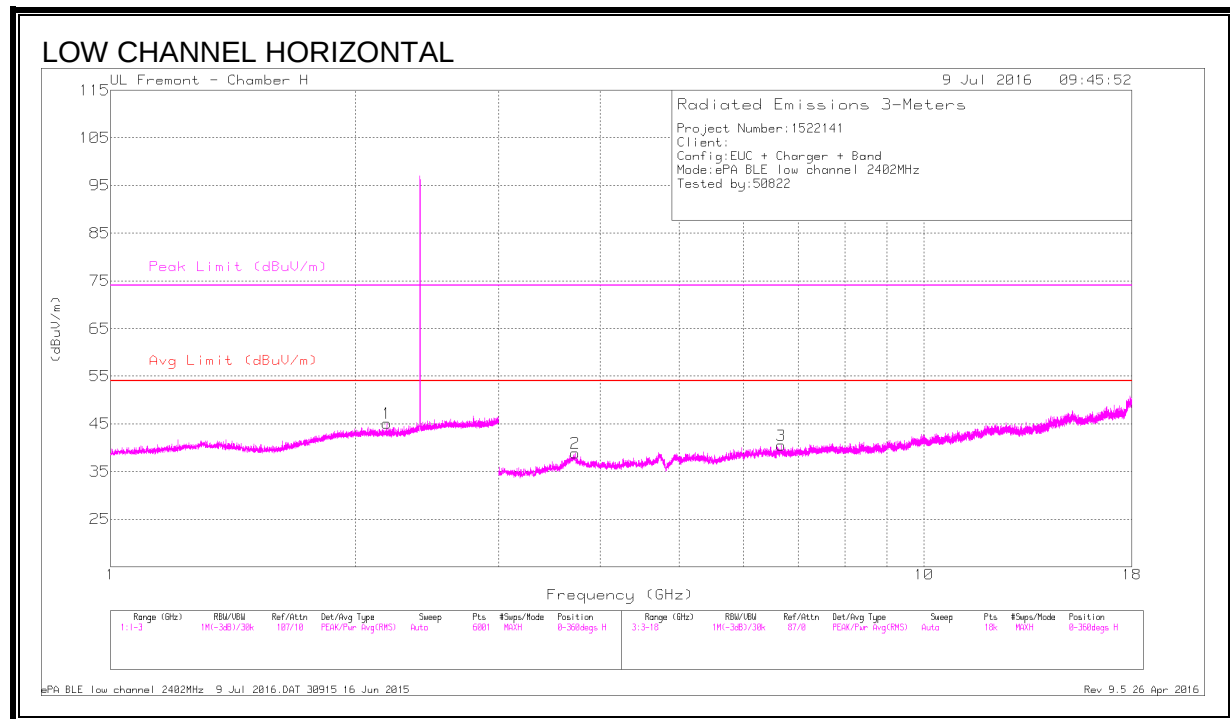
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.4	Pk	32.3	-21	50.7	-	-	74	-23.3	124	257	V
2	2.531	42.39	Pk	32.3	-20.9	53.79	-	-	74	-20.21	124	257	V
3	* 2.484	29.61	RMS	32.3	-21	40.91	54	-13.09	-	-	124	257	V
4	2.519	30.97	RMS	32.3	-21	42.27	54	-11.73	-	-	124	257	V

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

Pk - Peak detector

RMS - RMS detection

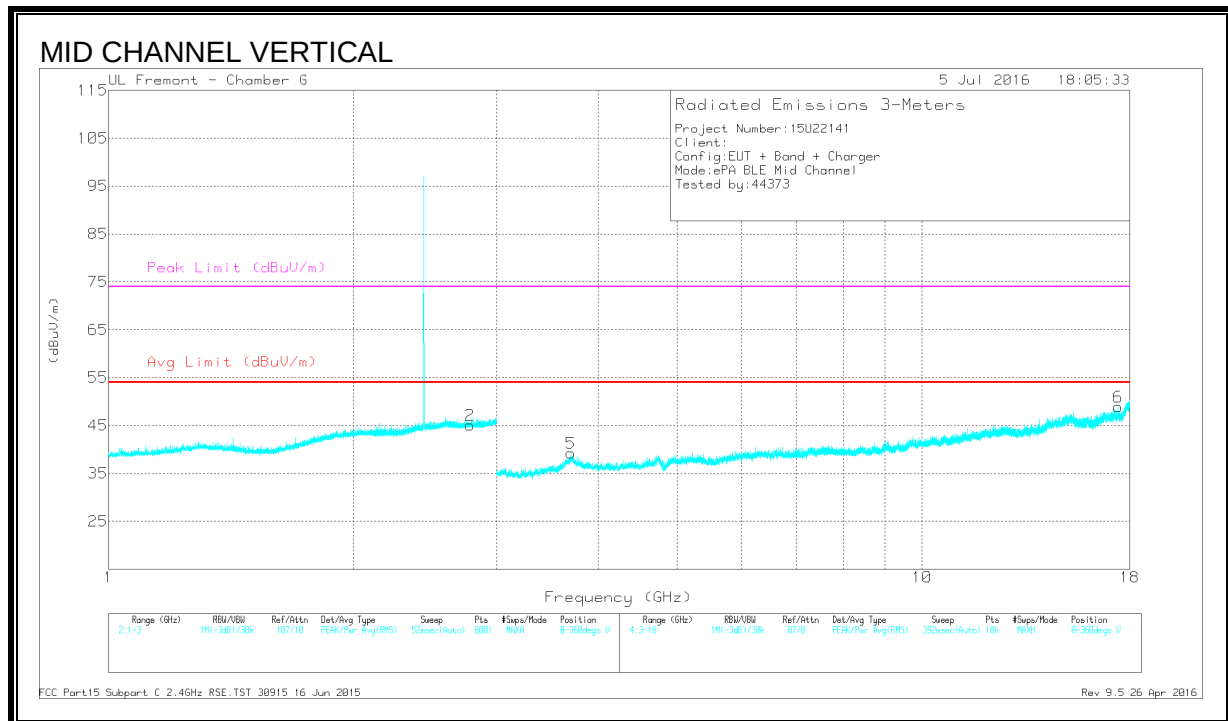
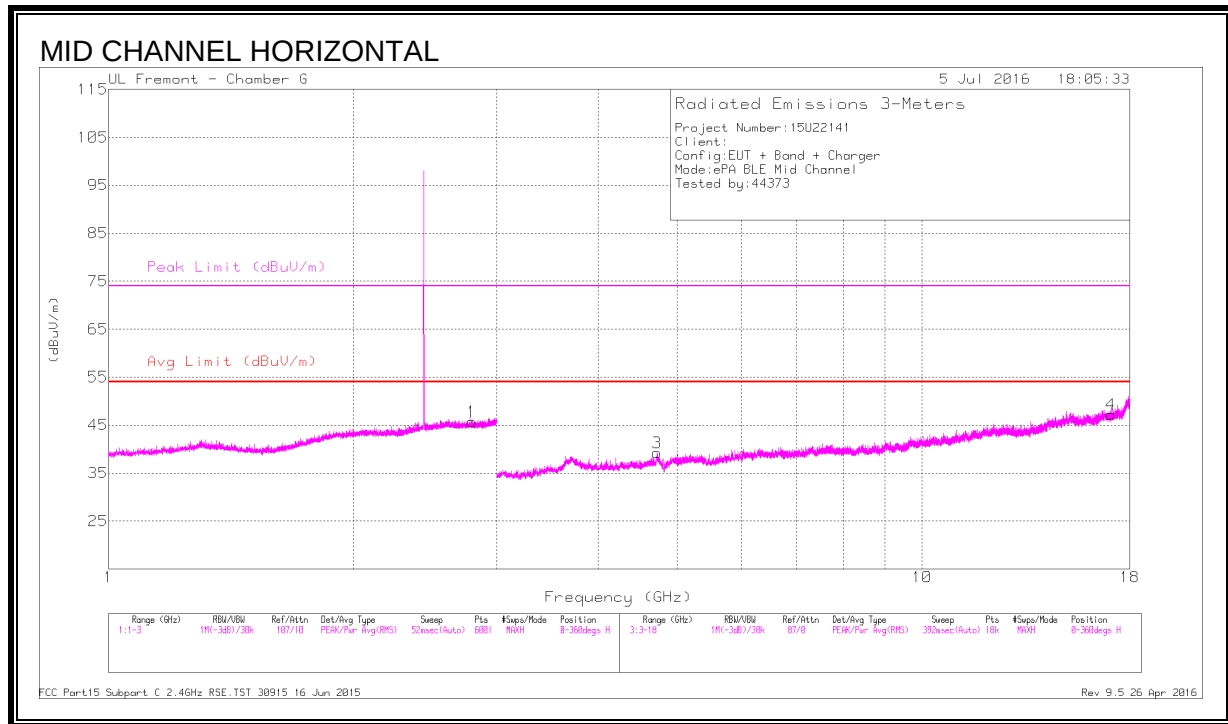
8.2.2. HIGH POWER ANTENNA HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/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	* 1.603	47.44	PK2	28.2	-24.4	51.24	-	-	74	-22.76	134	280	V
	* 1.603	35.66	MAv1	28.2	-24.4	39.46	54	-14.54	-	-	134	280	V
2	* 3.729	45.39	PK2	34.2	-30.7	48.89	-	-	74	-25.11	18	110	H
	* 3.729	33.77	MAv1	34.2	-30.7	37.27	54	-16.73	-	-	18	110	H
7	* 8.256	40.23	PK2	35.8	-29.4	46.63	-	-	74	-27.37	216	152	V
	* 8.255	29.01	MAv1	35.8	-29.3	35.51	54	-18.49	-	-	216	152	V
1	2.189	47.63	PK2	31.5	-23.9	55.23	-	-	-	-	146	252	H
	2.189	36.14	MAv1	31.5	-23.9	43.74	-	-	-	-	146	252	H
5	3.3	34.32	MAv1	33.1	-32.3	35.12	-	-	-	-	227	332	V
	3.301	46.1	PK2	33.1	-32.3	46.9	-	-	-	-	227	332	V
6	6.538	30.65	MAv1	35.7	-31.1	35.25	-	-	-	-	157	128	V
	6.54	41.02	PK2	35.7	-31	45.72	-	-	-	-	157	128	V
3	6.674	40.25	PK2	35.7	-30.4	45.55	-	-	-	-	126	267	H
	6.674	30.03	MAv1	35.7	-30.4	35.33	-	-	-	-	126	267	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average



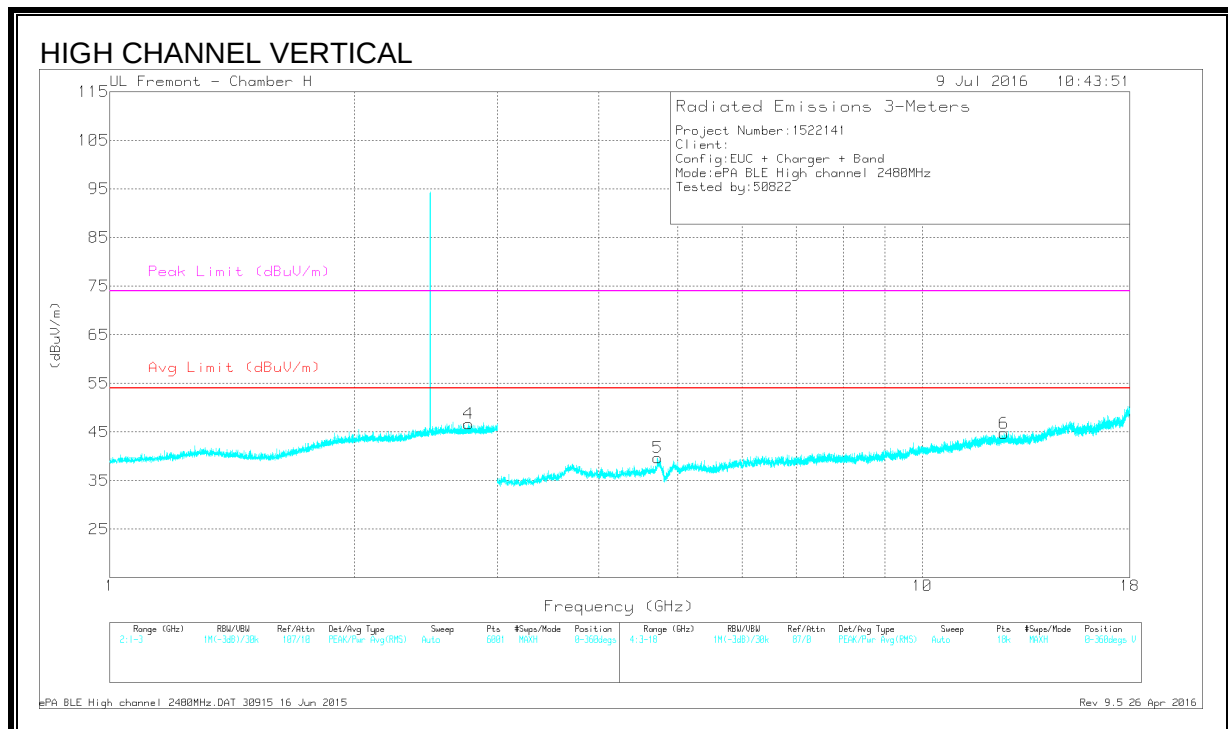
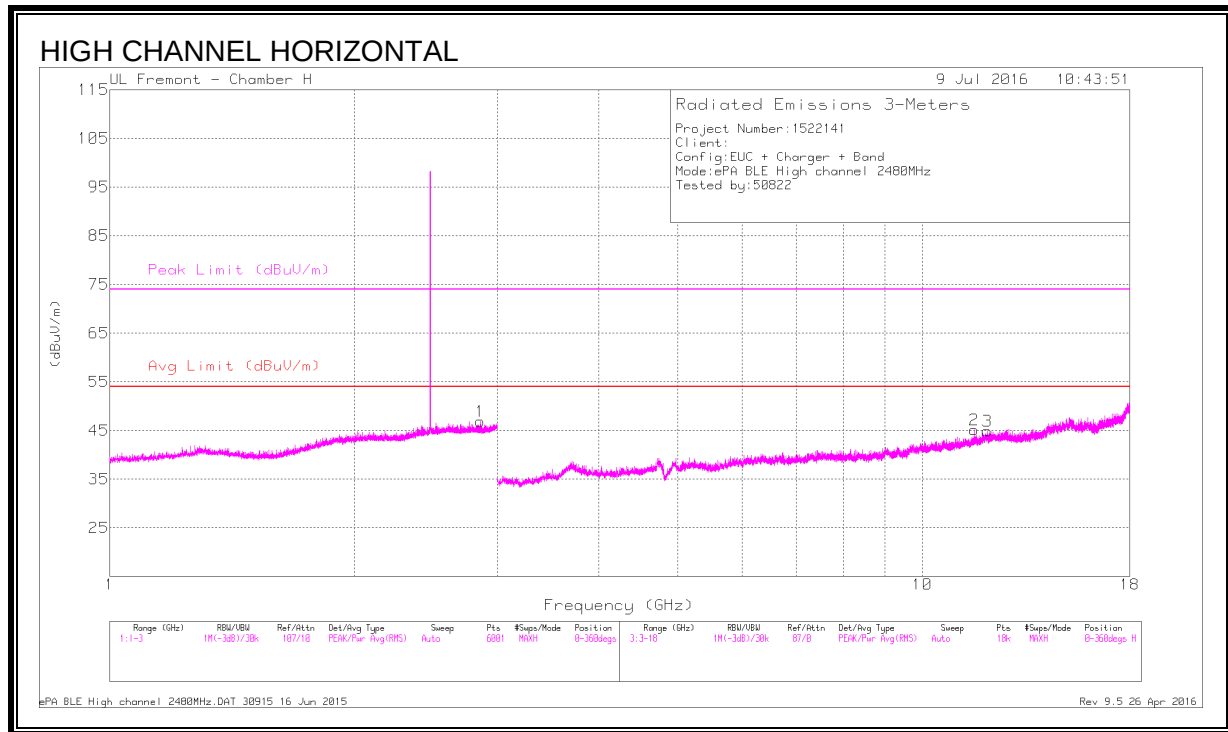
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.794	36.63	PK2	32.7	-23.6	45.73	-	-	74	-28.27	220	200	H
1	* 2.794	25.03	MAv1	32.7	-23.6	34.13	54	-19.87	-	-	220	200	H
2	* 2.78	43.46	PK2	32.7	-23.6	52.56	-	-	74	-21.44	232	228	V
2	* 2.78	32.41	MAv1	32.7	-23.6	41.51	54	-12.49	-	-	232	228	V
3	* 4.726	42.35	PK2	34.4	-31.7	45.05	-	-	74	-28.95	172	118	H
3	* 4.728	32.22	MAv1	34.4	-31.7	34.92	54	-19.08	-	-	172	118	H
5	* 3.703	40.93	PK2	34.3	-30.7	44.53	-	-	74	-29.47	137	238	V
5	* 3.701	30.56	MAv1	34.3	-30.7	34.16	54	-19.84	-	-	137	238	V
4	17.056	36.98	PK2	41.8	-24.6	54.18	-	-	74	-19.82	98	127	H
4	17.058	26.57	MAv1	41.7	-24.6	43.67	54	-10.33	-	-	98	127	H
6	17.416	36.43	PK2	41	-23	54.43	-	-	74	-19.57	268	122	V
6	17.415	25.78	MAv1	41	-23	43.78	54	-10.22	-	-	268	122	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



DATA

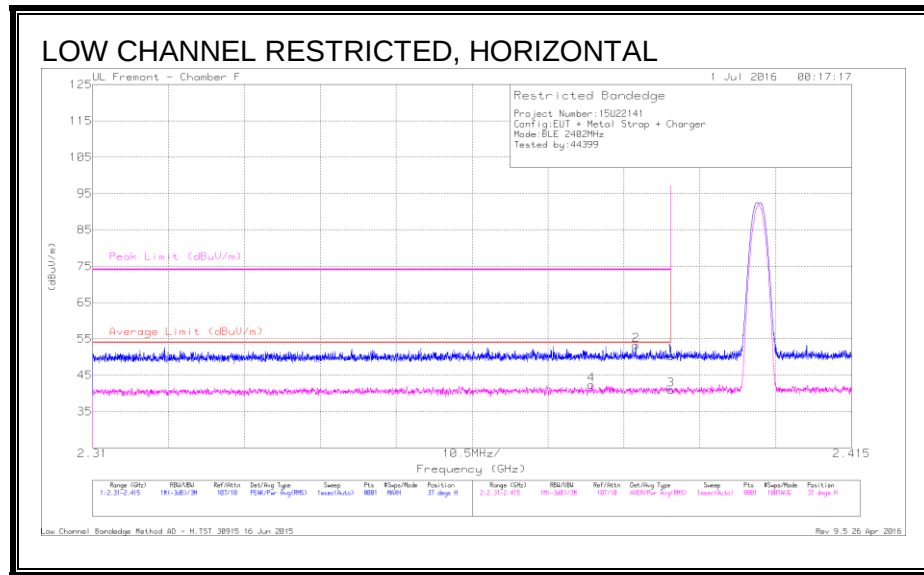
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.861	48.13	PK2	32.6	-23.5	57.23	-	-	74	-16.77	187	207	H
	* 2.858	36.04	MAv1	32.6	-23.5	45.14	54	-8.86	-	-	187	207	H
4	* 2.766	47.06	PK2	32.6	-23.6	56.06	-	-	74	-17.94	331	339	V
	* 2.766	36.15	MAv1	32.6	-23.6	45.15	54	-8.85	-	-	331	339	V
2	* 11.577	36.97	PK2	38.4	-25.5	49.87	-	-	74	-24.13	34	382	H
	* 11.579	26.65	MAv1	38.4	-25.5	39.55	54	-14.45	-	-	34	382	H
3	* 12.019	36.94	PK2	39	-25.6	50.34	-	-	74	-23.66	22	384	H
	* 12.019	26.57	MAv1	39	-25.6	39.97	54	-14.03	-	-	22	384	H
5	* 4.727	43.8	PK2	34.4	-31.7	46.5	-	-	74	-27.5	208	163	V
	* 4.726	32.52	MAv1	34.4	-31.7	35.22	54	-18.78	-	-	208	163	V
6	* 12.596	37.08	PK2	39.2	-25.6	50.68	-	-	74	-23.32	355	168	V
	* 12.595	26.74	MAv1	39.2	-25.6	40.34	54	-13.66	-	-	355	168	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

8.2.3. LOW POWER ANTENNA RESTRICTED BANDEDGE



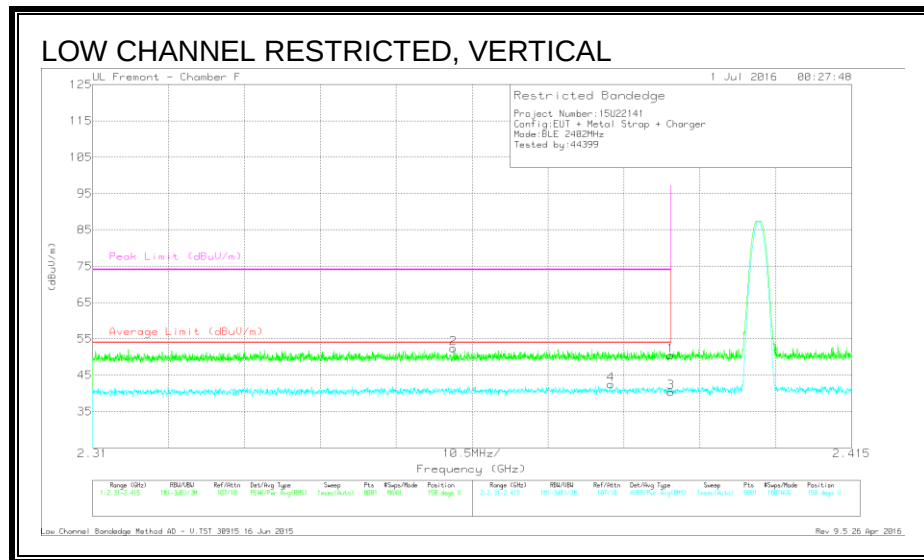
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.14	Pk	32.1	-20.9	50.34	-	-	74	-23.66	37	125	H
2	* 2.385	42.03	Pk	32.1	-20.9	53.23	-	-	74	-20.77	37	125	H
3	* 2.39	29.82	RMS	32.1	-20.9	41.02	54	-12.98	-	-	37	125	H
4	* 2.379	31.16	RMS	32.1	-20.9	42.36	54	-11.64	-	-	37	125	H

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

Pk - Peak detector

RMS - RMS detection



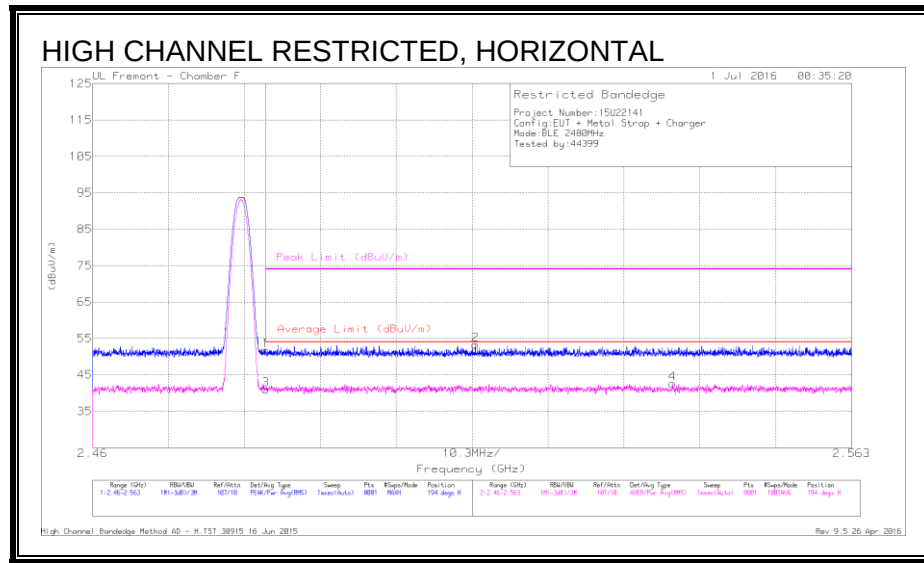
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.21	Pk	32.1	-20.9	50.41	-	-	74	-23.59	150	253	V
2	* 2.36	41.25	Pk	32	-20.9	52.35	-	-	74	-21.65	150	253	V
3	* 2.39	29.12	RMS	32.1	-20.9	40.32	54	-13.68	-	-	150	253	V
4	* 2.382	31.23	RMS	32.1	-20.9	42.43	54	-11.57	-	-	150	253	V

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

Pk - Peak detector

RMS - RMS detection



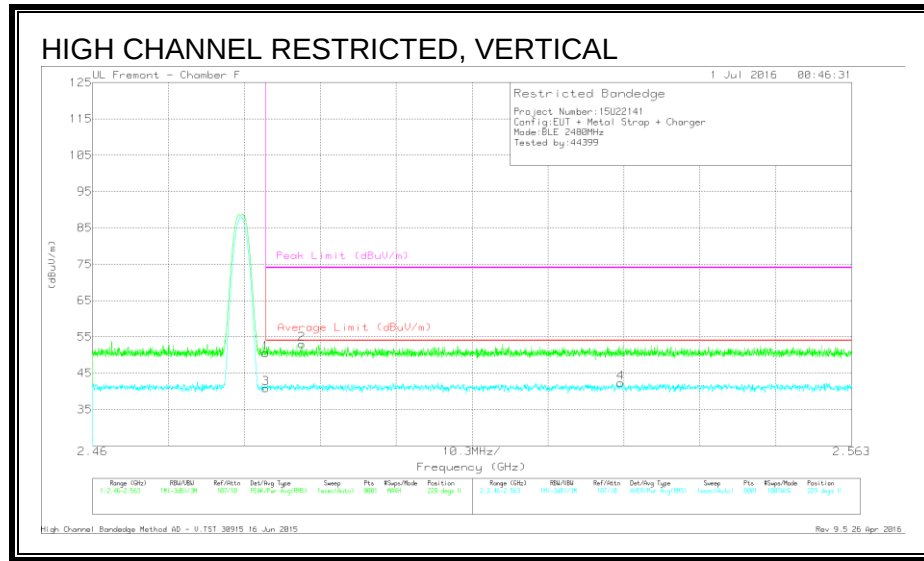
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.32	Pk	32.3	-21	51.62	-	-	74	-22.38	194	120	H
2	2.512	41.92	Pk	32.3	-21	53.22	-	-	74	-20.78	194	120	H
3	* 2.484	29.72	RMS	32.3	-21	41.02	54	-12.98	-	-	194	120	H
4	2.539	31.24	RMS	32.2	-20.9	42.54	54	-11.46	-	-	194	120	H

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

Pk - Peak detector

RMS - RMS detection



DATA

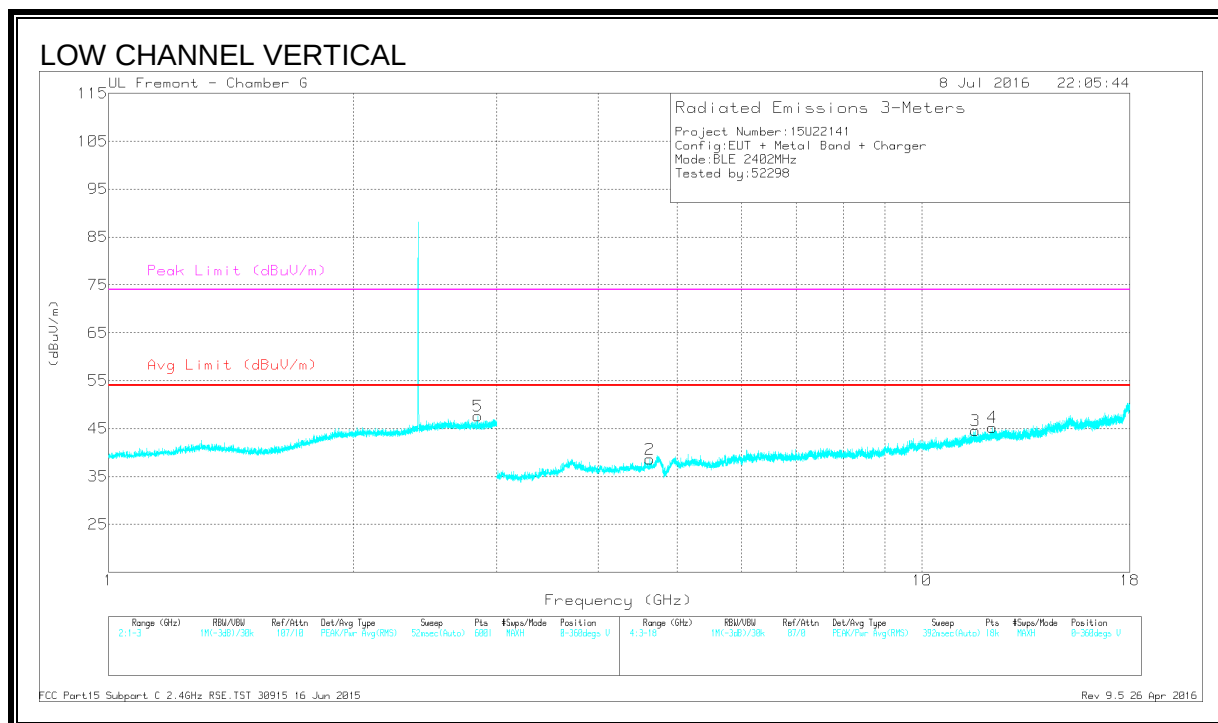
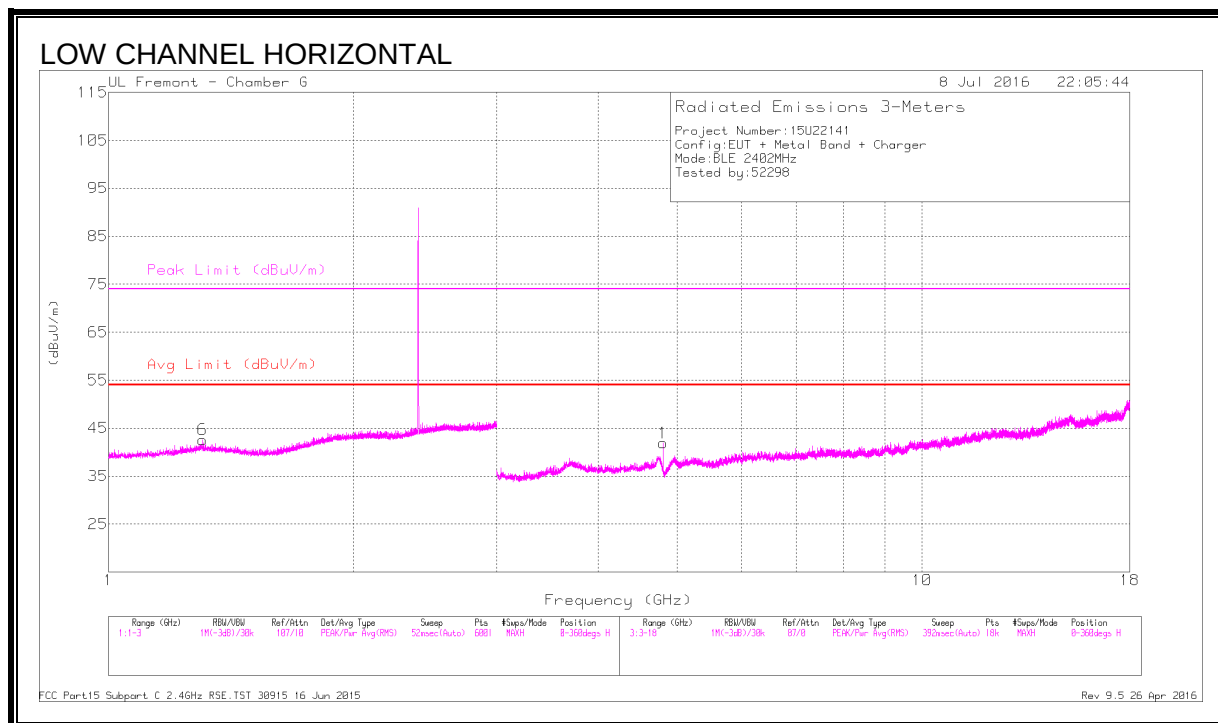
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.25	Pk	32.3	-21	50.55	-	-	74	-23.45	229	117	V
2	* 2.488	41.59	Pk	32.3	-20.9	52.99	-	-	74	-21.01	229	117	V
3	* 2.484	29.61	RMS	32.3	-21	40.91	54	-13.09	-	-	229	117	V
4	2.532	30.99	RMS	32.3	-20.9	42.39	54	-11.61	-	-	229	117	V

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

Pk - Peak detector

RMS - RMS detection

8.2.4. LOW POWER ANTENNA HARMONICS AND SPURIOUS EMISSIONS



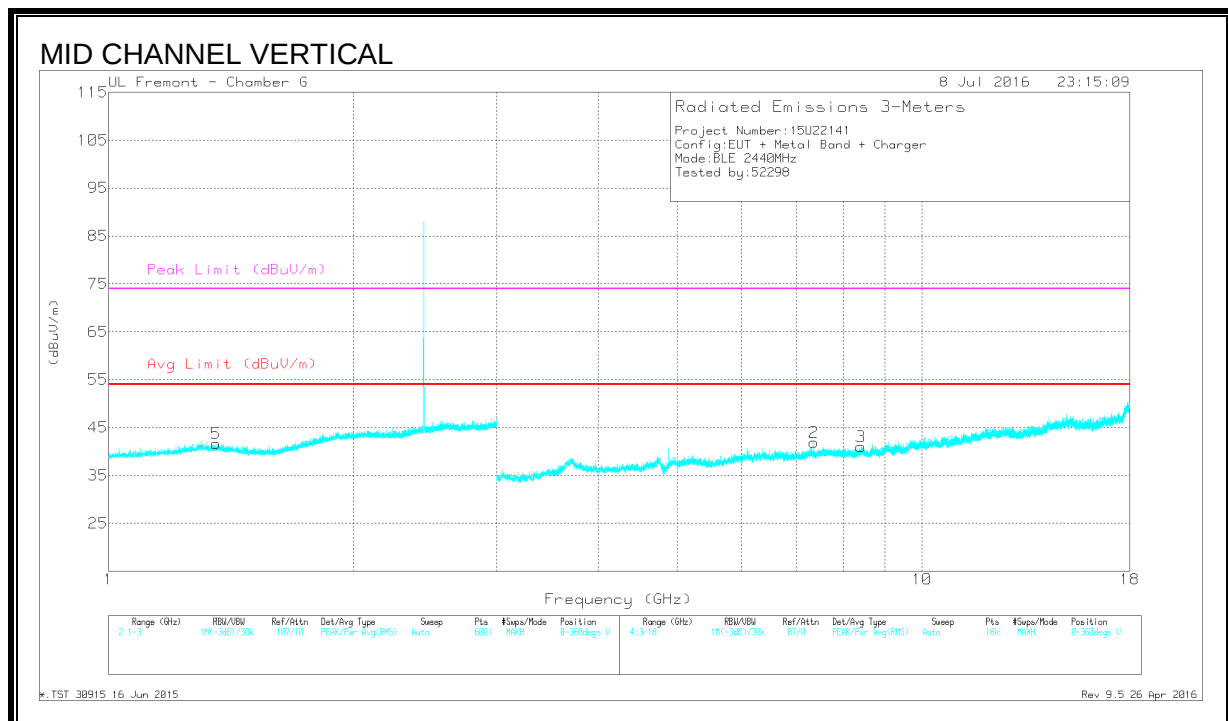
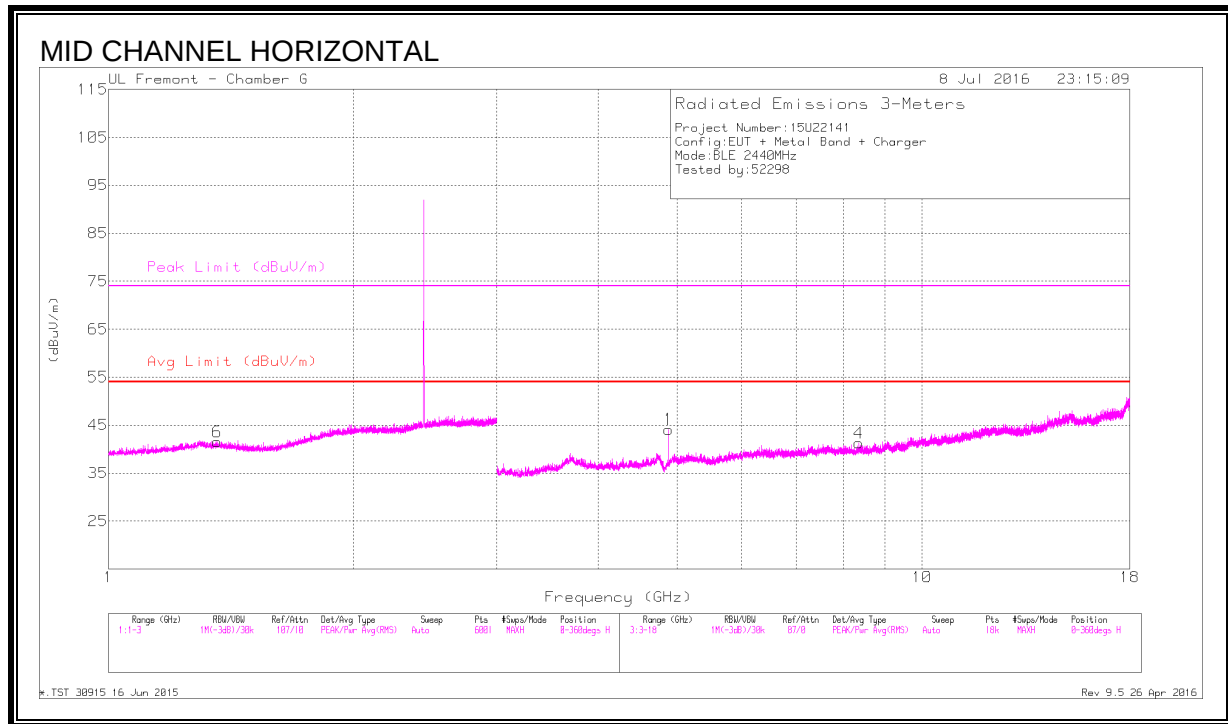
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 1.305	45.53	PK2	29.2	-25	49.73	-	-	74	-24.27	115	139	H
	* 1.303	33.06	MAv1	29.2	-25	37.26	54	-16.74	-	-	115	139	H
5	* 2.845	43.48	PK2	32.6	-23.6	52.48	-	-	74	-21.52	151	211	V
	* 2.843	32.52	MAv1	32.6	-23.6	41.52	54	-12.48	-	-	151	211	V
1	* 4.804	45.41	PK2	34.4	-31.9	47.91	-	-	74	-26.09	182	293	H
	* 4.804	38.47	MAv1	34.4	-31.9	40.97	54	-13.03	-	-	182	293	H
3	* 11.627	37.4	PK2	38.4	-25.4	50.4	-	-	74	-23.6	318	390	V
	* 11.627	26.67	MAv1	38.4	-25.4	39.67	54	-14.33	-	-	318	390	V
2	* 4.627	41.84	PK2	34.4	-31.8	44.44	-	-	74	-29.56	183	107	V
	* 4.627	31.19	MAv1	34.4	-31.8	33.79	54	-20.21	-	-	183	107	V
4	* 12.201	37.89	PK2	39.2	-25.7	51.39	-	-	74	-22.61	155	242	V
	* 12.202	27.62	MAv1	39.2	-25.7	41.12	54	-12.88	-	-	155	242	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



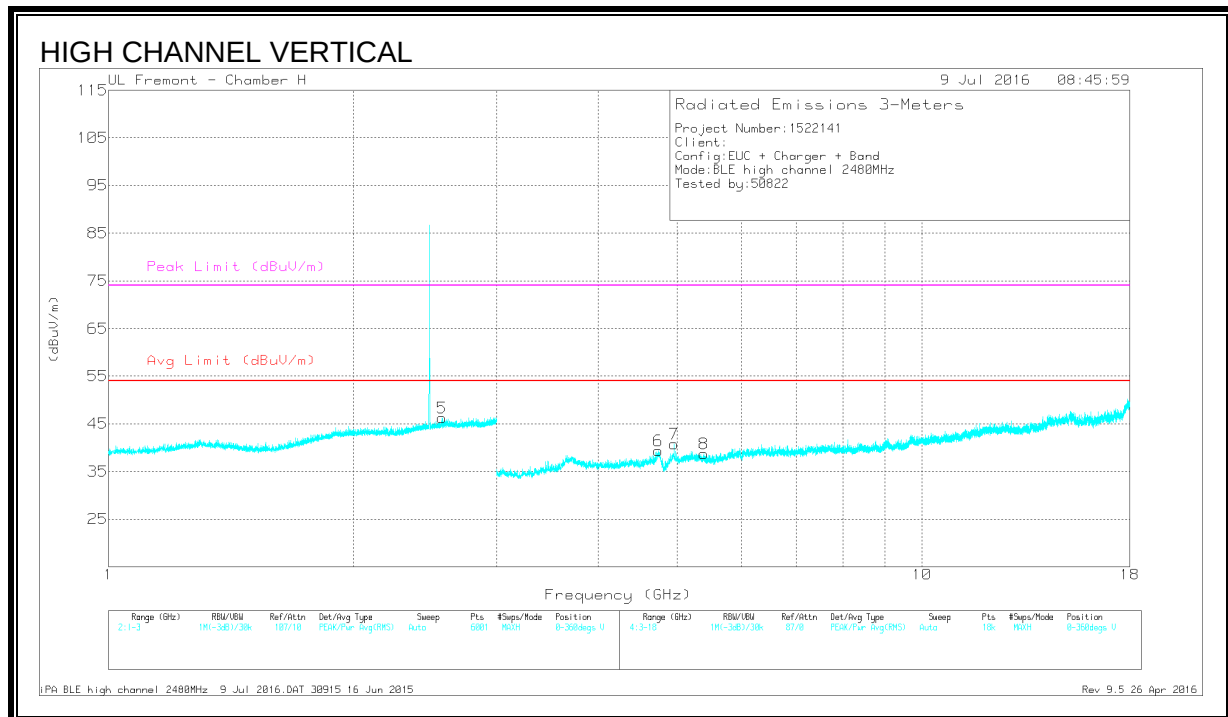
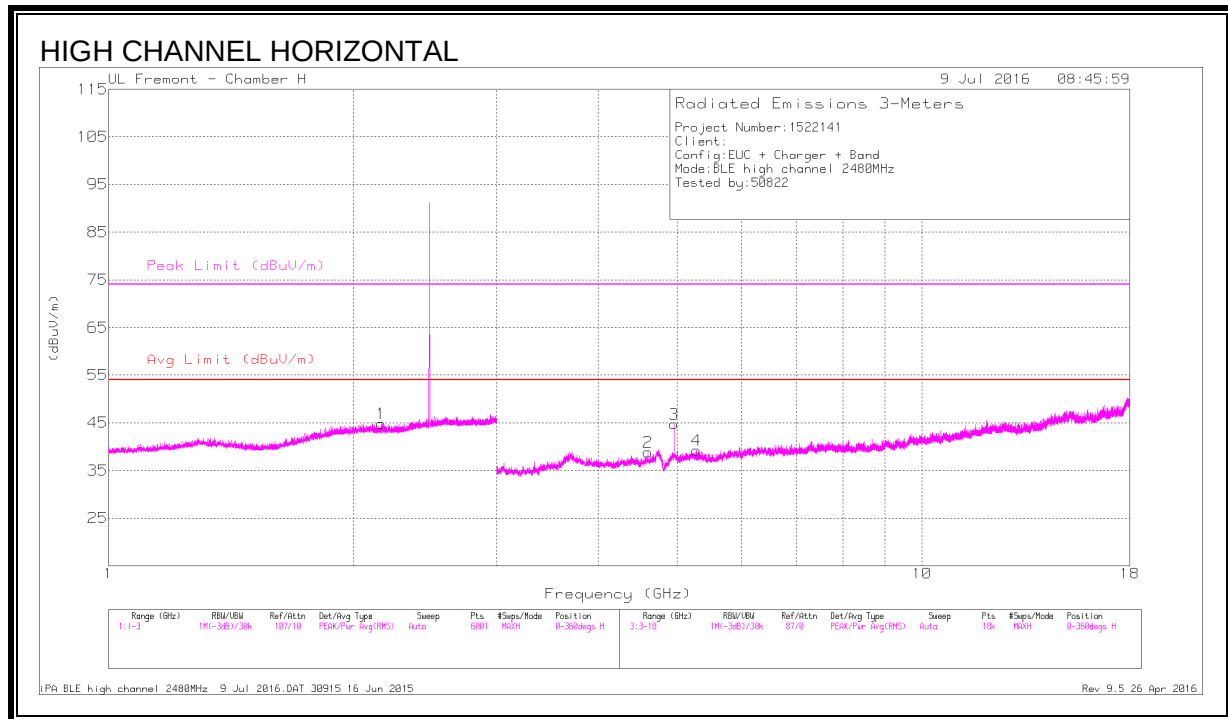
DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.36	43.78	PK2	29	-24.9	47.88	-	-	74	-26.12	309	282	H
* 1.36	32.95	MAv1	29	-24.9	37.05	54	-16.95	-	-	309	282	H
* 1.357	44.08	PK2	29	-24.9	48.18	-	-	74	-25.82	318	315	V
* 1.356	32.58	MAv1	29	-24.9	36.68	54	-17.32	-	-	318	315	V
* 4.88	45.61	PK2	34.5	-31.8	48.31	-	-	74	-25.69	202	121	H
* 4.88	39.62	MAv1	34.5	-31.8	42.32	54	-11.68	-	-	202	121	H
* 8.362	40.28	PK2	35.8	-28.8	47.28	-	-	74	-26.72	39	101	H
* 8.36	29.37	MAv1	35.8	-28.8	36.37	54	-17.63	-	-	39	101	H
* 7.355	41.09	PK2	35.8	-30.3	46.59	-	-	74	-27.41	190	161	V
* 7.355	30.25	MAv1	35.8	-30.3	35.75	54	-18.25	-	-	190	161	V
* 8.409	39.15	PK2	35.8	-28.5	46.45	-	-	74	-27.55	219	101	V
* 8.41	29.01	MAv1	35.8	-28.5	36.31	54	-17.69	-	-	219	101	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 4.608	44.59	PK2	34.4	-31.9	47.09	-	-	74	-26.91	224	147	H
	* 4.607	32.82	MAv1	34.4	-31.9	35.32	54	-18.68	-	-	224	147	H
3	* 4.961	42.53	PK2	34.6	-31.8	45.33	-	-	74	-28.67	142	230	H
	* 4.958	32.27	MAv1	34.6	-31.8	35.07	54	-18.93	-	-	142	230	H
6	* 4.743	44	PK2	34.4	-31.8	46.6	-	-	74	-27.4	338	166	V
	* 4.743	32.96	MAv1	34.4	-31.8	35.56	54	-18.44	-	-	338	166	V
7	* 4.961	43.25	PK2	34.6	-31.8	46.05	-	-	74	-27.95	64	137	V
	* 4.961	32.15	MAv1	34.6	-31.8	34.95	54	-19.05	-	-	64	137	V
8	* 5.394	42.8	PK2	34.7	-31	46.5	-	-	74	-27.5	79	107	V
	* 5.392	32.01	MAv1	34.7	-31	35.71	54	-18.29	-	-	79	107	V
1	2.166	47.38	PK2	31.5	-24	54.88	-	-	-	-	259	222	H
	2.167	35.91	MAv1	31.5	-24	43.41	-	-	-	-	259	222	H
5	2.574	36.28	MAv1	32.7	-23.7	45.28	-	-	-	-	148	322	V
	2.575	47.58	PK2	32.7	-23.7	56.58	-	-	-	-	148	322	V
4	5.282	42.1	PK2	35.1	-31.9	45.3	-	-	-	-	208	302	H
	5.282	31.96	MAv1	35.1	-31.9	35.16	-	-	-	-	208	302	H

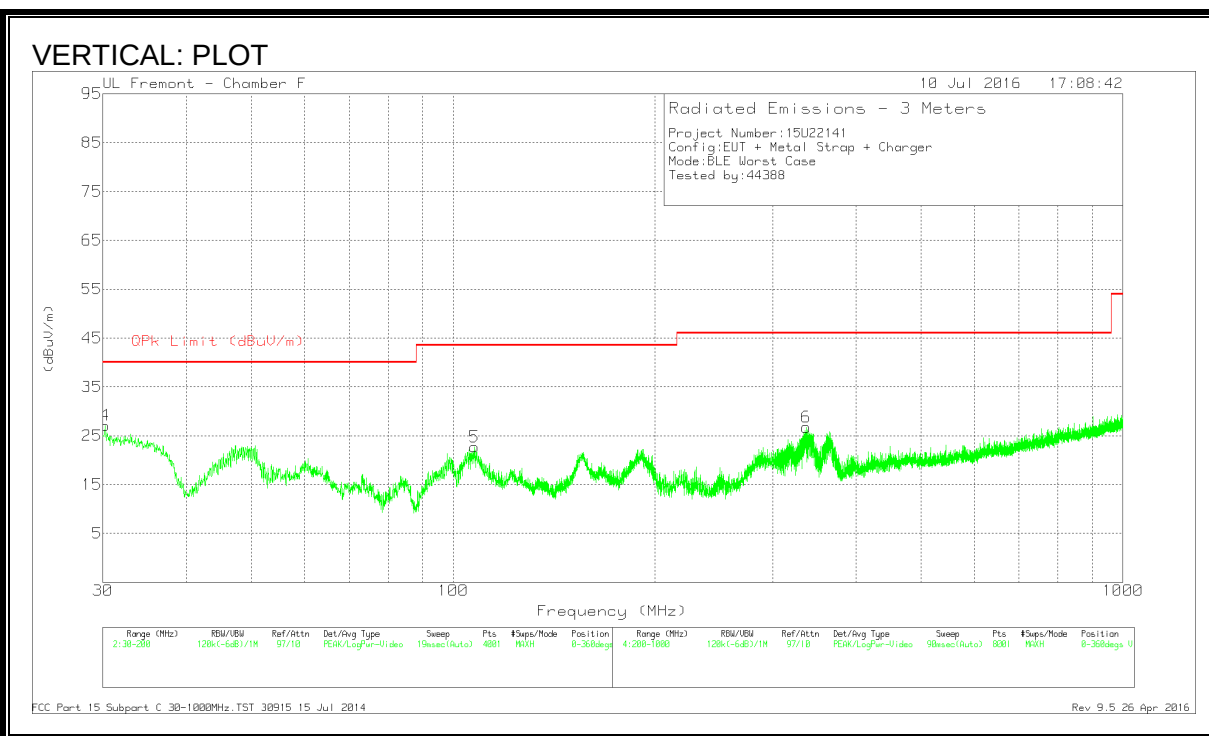
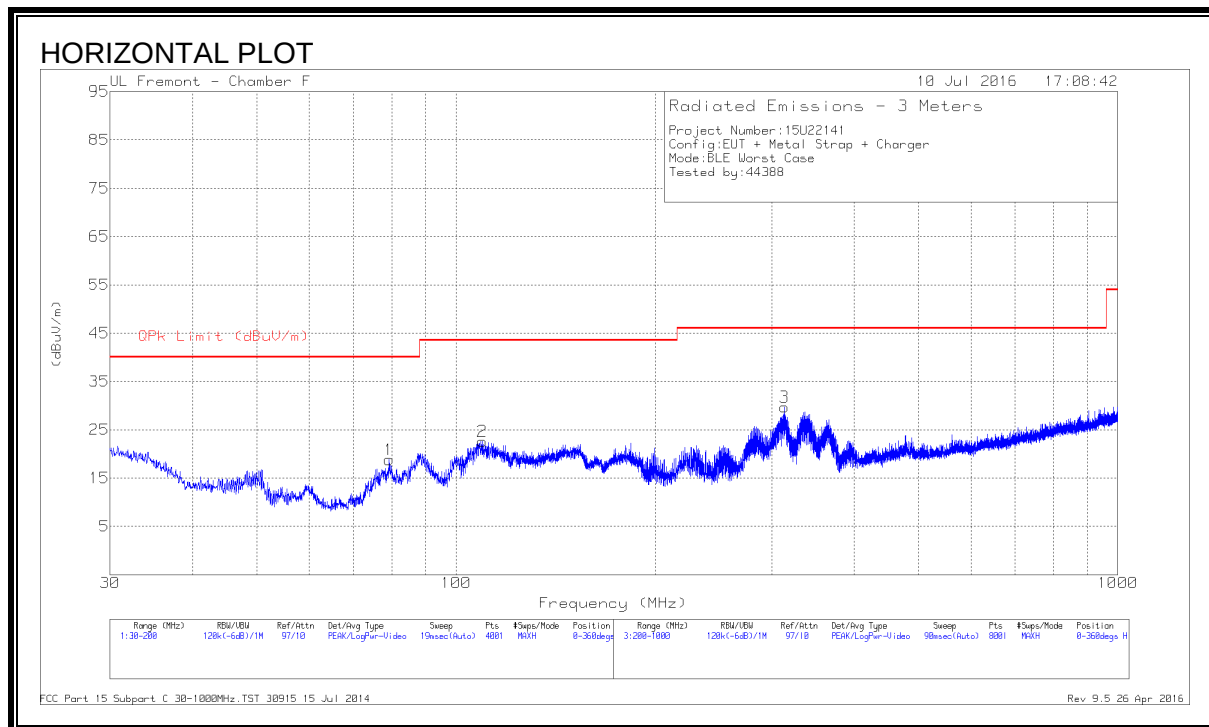
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

8.3. WORST-CASE BELOW 1 GHz

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



DATA

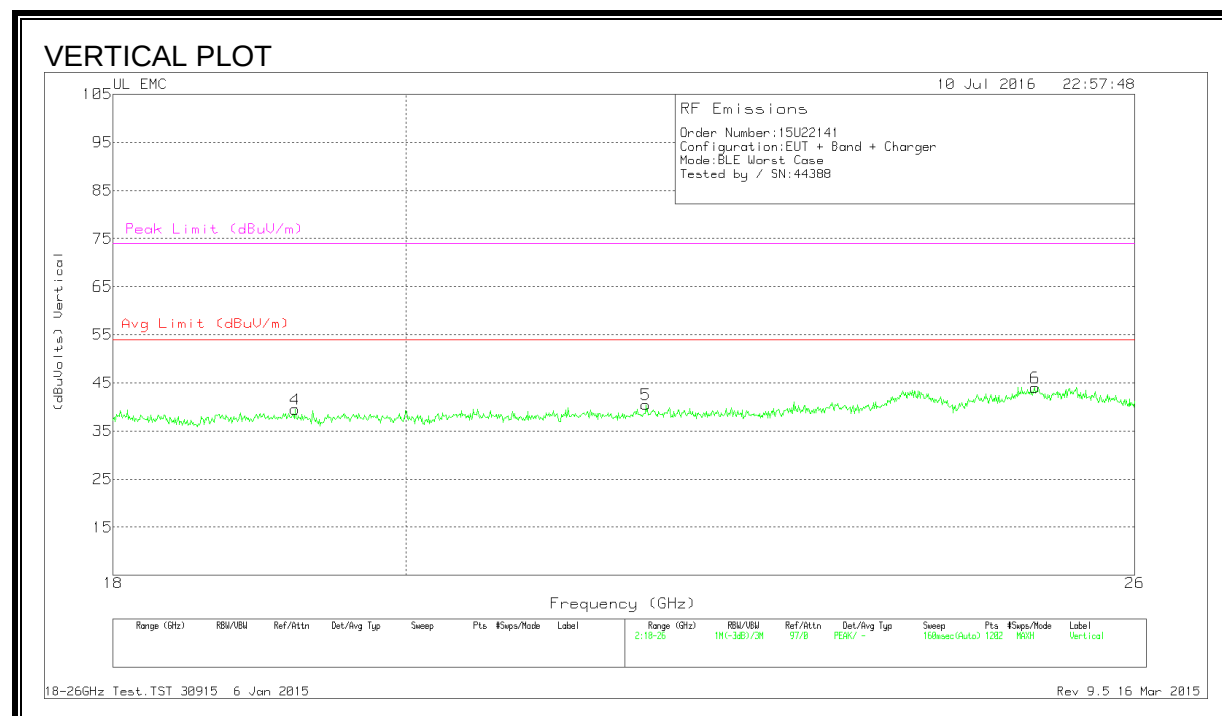
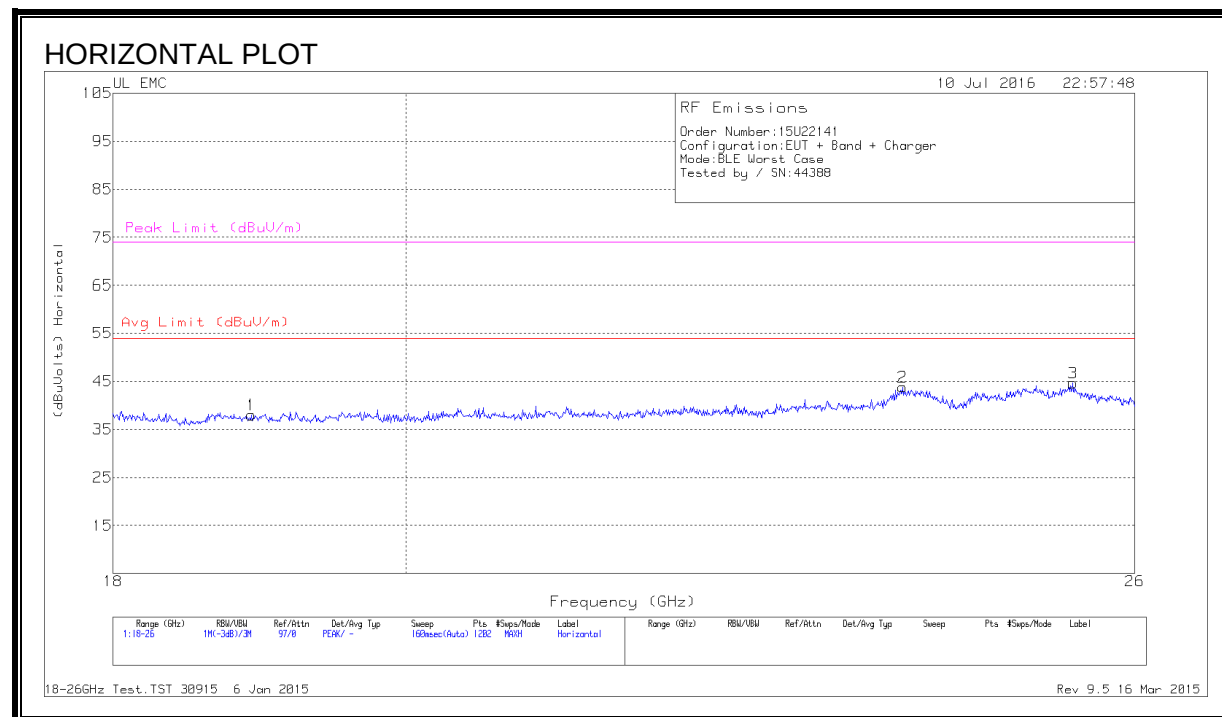
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	79.2575	38.32	Pk	11.8	-31.3	18.82	40	-21.18	0-360	299	H
2	* 109.6025	37.43	Pk	16.3	-31.1	22.63	43.52	-20.89	0-360	299	H
4	30.2125	33.52	Pk	25.4	-31.8	27.12	40	-12.88	0-360	100	V
5	107.605	37.92	Pk	15.9	-31.1	22.72	43.52	-20.8	0-360	100	V
3	313.5	41.81	Pk	17.7	-29.8	29.71	46.02	-16.31	0-360	99	H
6	337	38.46	Pk	18	-29.7	26.76	46.02	-19.26	0-360	100	V

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

Pk - Peak detector

8.4. WORST-CASE 18 to 26 GHz

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



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.919	40.4	Pk	32.5	-25.4	-9.5	38	54	-16	74	-36
2	23.915	43.23	Pk	34	-23.9	-9.5	43.83	54	-10.17	74	-30.17
3	25.427	44.07	Pk	34.4	-24.3	-9.5	44.67	54	-9.33	74	-29.33
4	19.219	41.1	Pk	32.7	-24.8	-9.5	39.5	54	-14.5	74	-34.5
5	21.803	41.1	Pk	33.3	-24.4	-9.5	40.5	54	-13.5	74	-33.5
6	25.081	43.8	Pk	34.3	-24.6	-9.5	44	54	-10	74	-30

PK - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

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

RESULTS

EUT is powered by battery. AC line conducted emission is not applicable.