



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

**BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT**

FOR

APPLE WATCH

MODEL NUMBER: A1758, A1817

**FCC ID: BCG-E3105
IC: 579C-E3105**

REPORT NUMBER: 16U23782-E2V3

ISSUE DATE: AUGUST 31, 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 Review	Chin Pang
V2	08/26/2016	Revised report to address TCB's questions	Tina Chu
V3	08/31/2016	Revised Section 5.5	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. ON TIME, DUTY CYCLE	15
7.3. HIGH POWER MODE.....	17
7.3.1. 6 dB BANDWIDTH.....	17
7.3.2. 99% BANDWIDTH.....	20
7.3.3. AVERAGE POWER	23
7.3.4. OUTPUT POWER	24
7.3.5. POWER SPECTRAL DENSITY	25
7.3.6. CONDUCTED SPURIOUS EMISSIONS.....	28
7.4. LOW POWER MODE	32
7.4.1. 6 dB BANDWIDTH.....	32
7.4.2. 99% BANDWIDTH.....	35
7.4.3. AVERAGE POWER.....	38
7.4.4. OUTPUT POWER	39
7.4.5. POWER SPECTRAL DENSITY	40
7.4.6. CONDUCTED SPURIOUS EMISSIONS.....	43
8. RADIATED TEST RESULTS.....	47
8.1. LIMITS AND PROCEDURE	47
8.2. HIGH POWER MODE.....	48
8.2.1. Above 1 GHz RESTRICTED BANDEDGE	48
8.2.2. HARMONICS AND SPURIOUS EMISSIONS	52

8.3.	LOW POWER MODE	58
8.3.1.	Above 1GHz RESTRICTED BANDEDGE	58
8.3.2.	HARMONICS AND SPURIOUS EMISSIONS	62
8.5.	WORST-CASE BELOW 1 GHz.....	68
8.6.	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: A1758, A1817

SERIAL NUMBER: FH7RN01HHDNC

DATE TESTED: JULY 01 – AUGUST 12, 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:

Prepared By:



CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.



KELVIN HUYNH
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:

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

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, NFC support and GPS Radio.

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	17.67	58.48

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	-10.70

5.4. SOFTWARE AND FIRMWARE

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

5.5. 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. 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 aluminum enclosure and 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 and above 18G was 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 X-Flatbed orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X-Flatbed 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

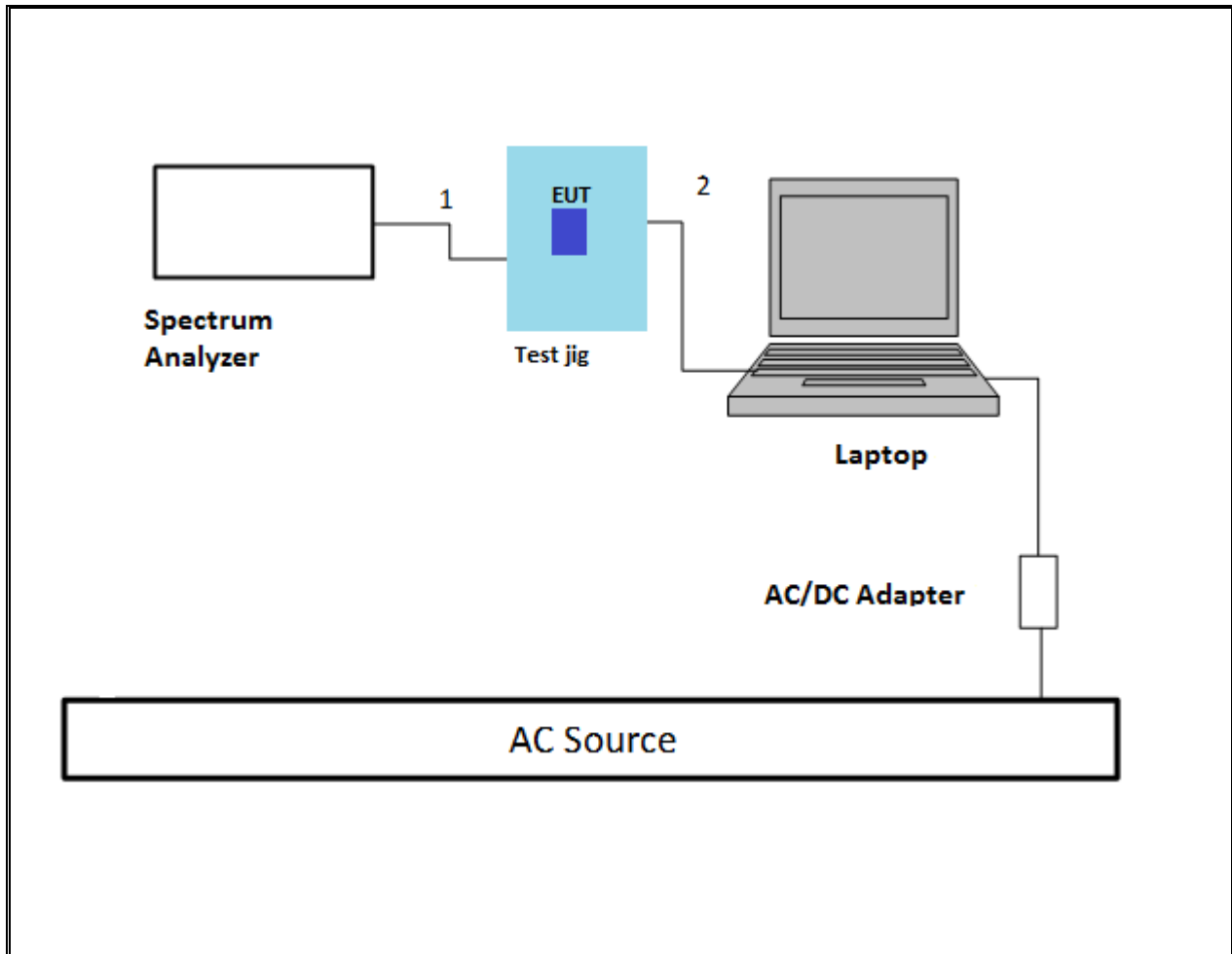
I/O CABLES (BELOW AND ABOVE 1G RADIATED TEST)

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.

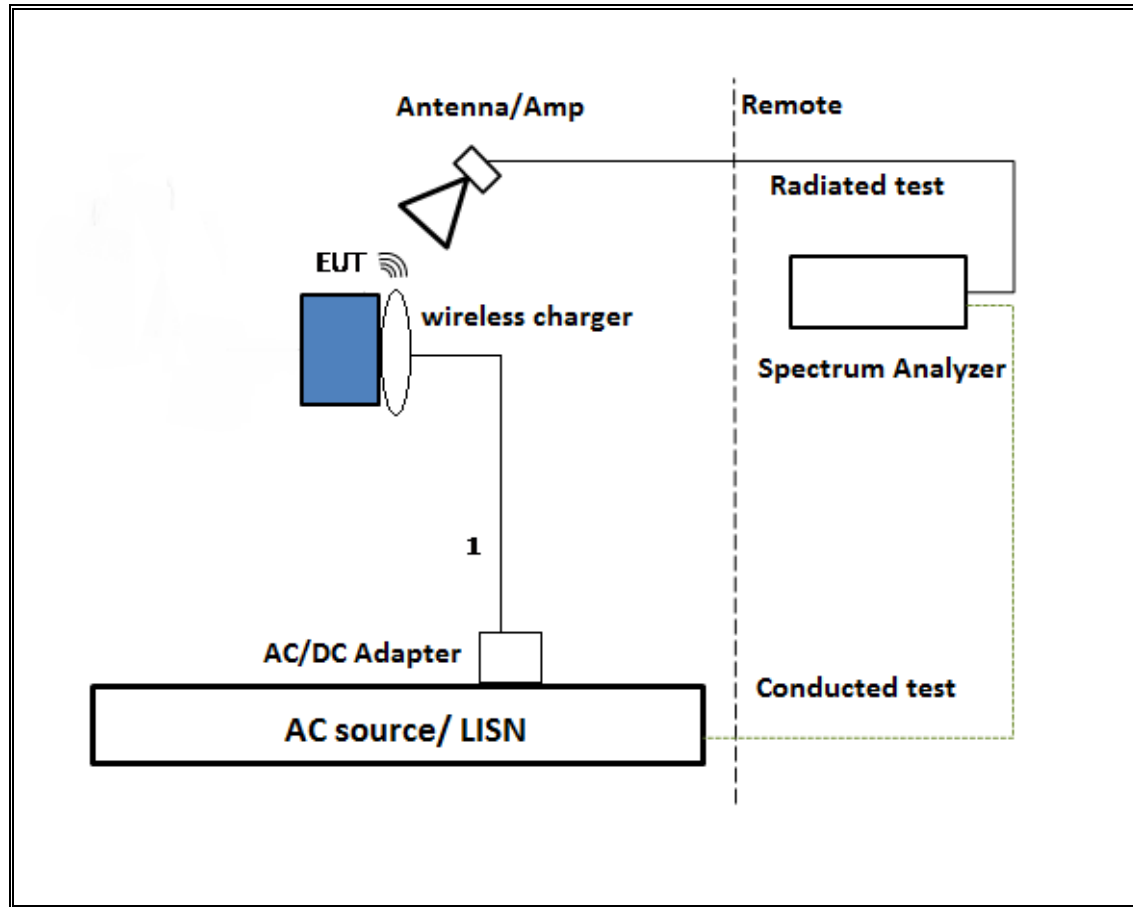
SETUP DIAGRAM



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, 32dB	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, 32dB	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
** Equipment was used after calibration.

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.

7.2. ON TIME, DUTY CYCLE

LIMITS

None; for reporting purposes only.

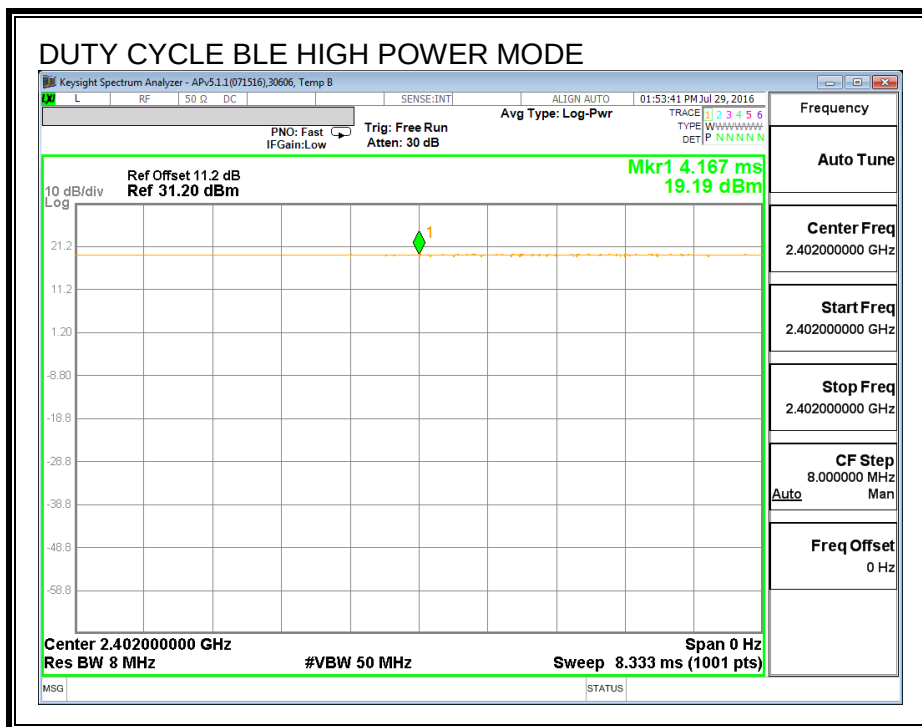
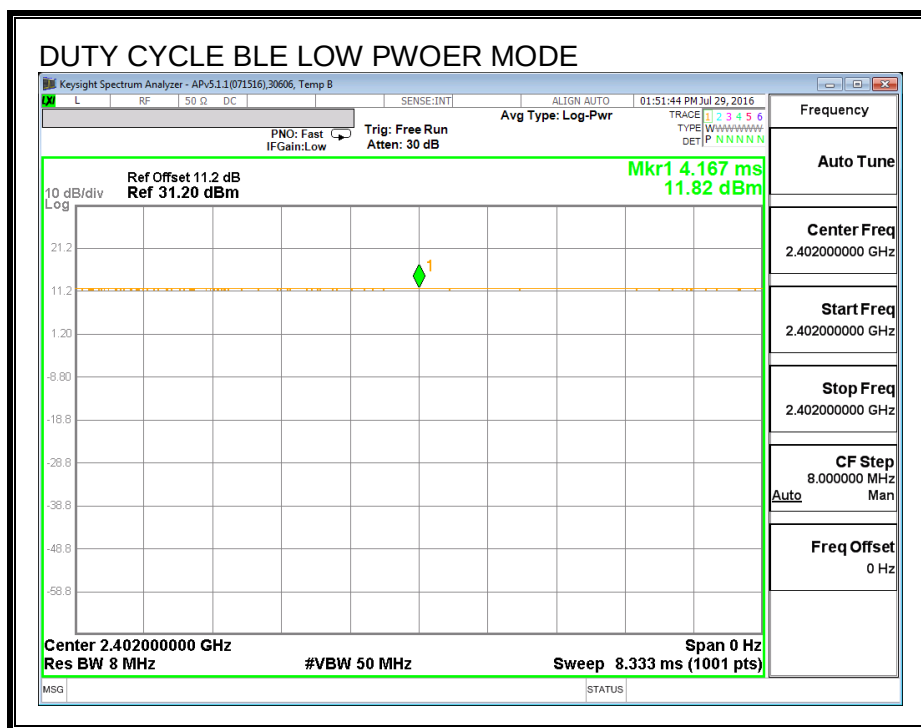
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
BLE LOW POWER	8.330	8.330	1.000	100.00%	0.00	0.010
BLE HIGH POWER	8.330	8.330	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOTS



7.3. HIGH POWER MODE

7.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

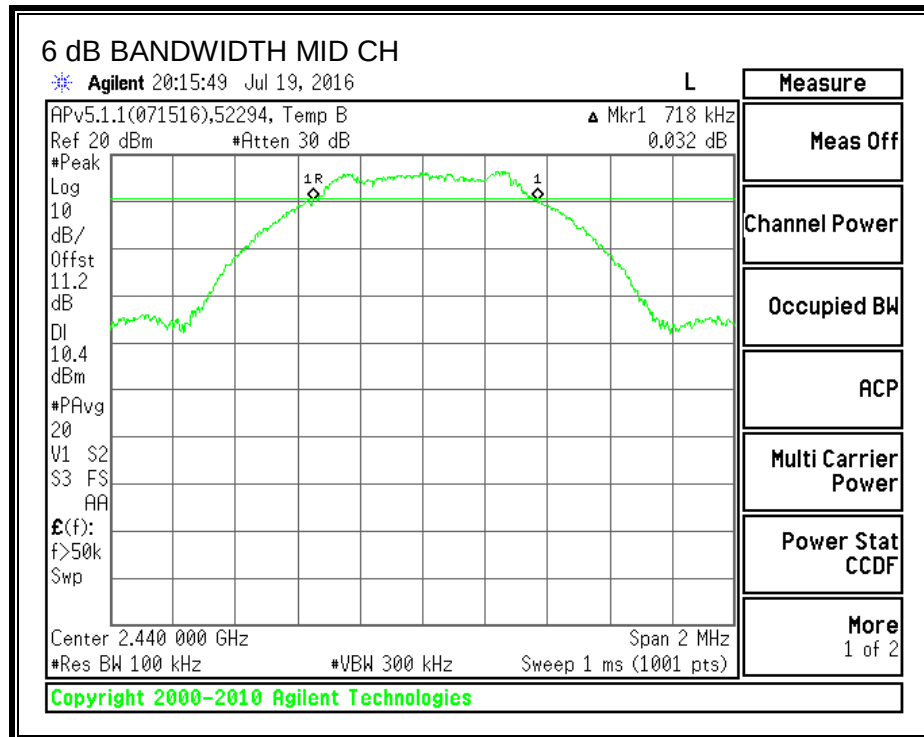
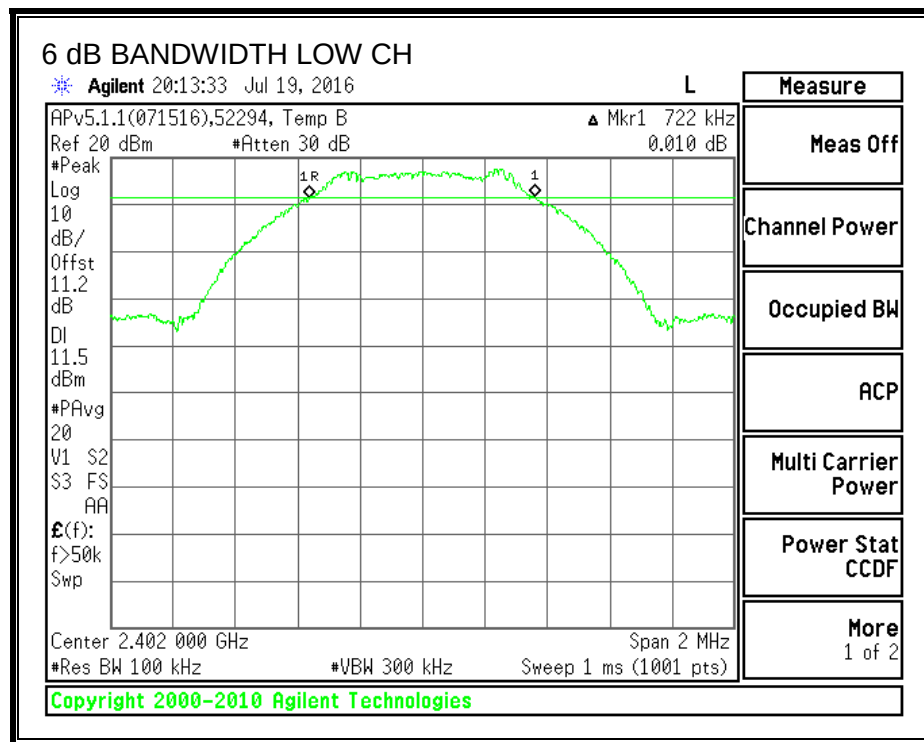
IC RSS-247 (5.2) (1)

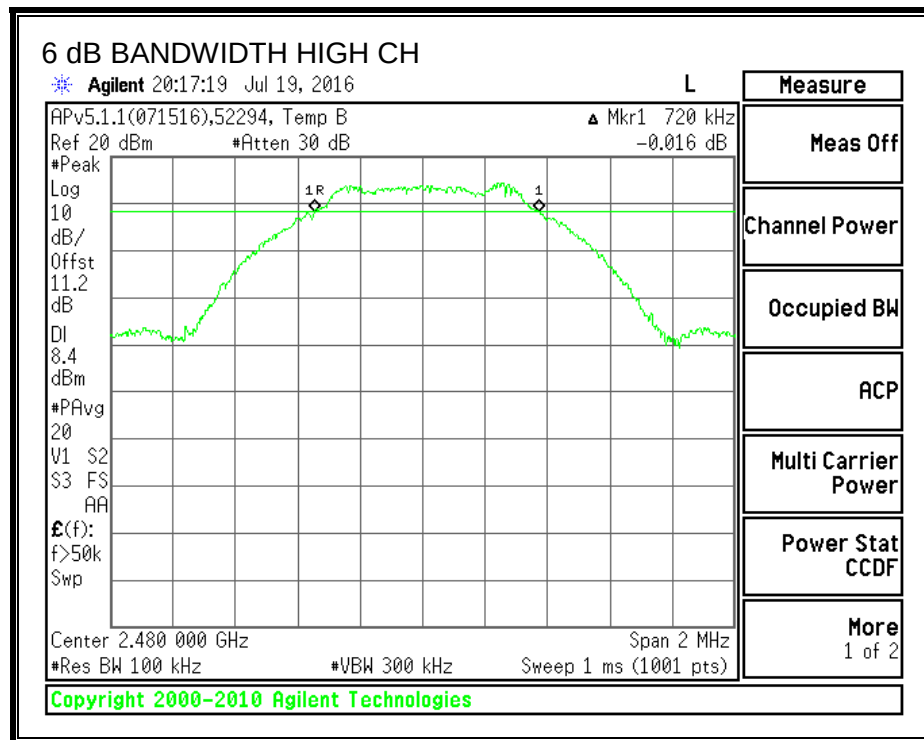
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.722	0.5
Middle	2440	0.718	0.5
High	2480	0.720	0.5

6 dB BANDWIDTH





7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

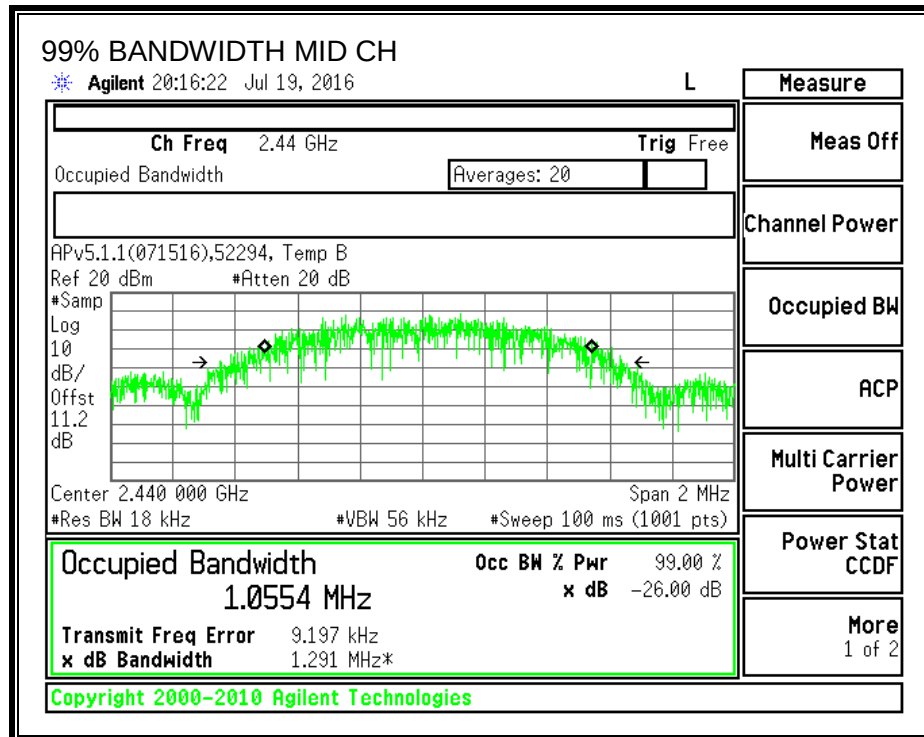
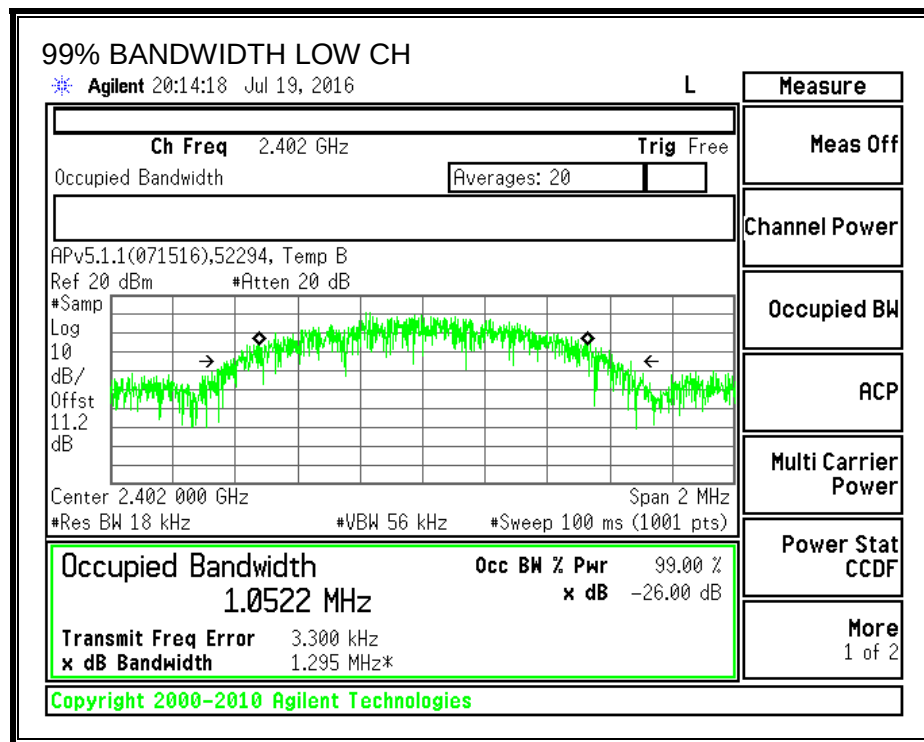
TEST PROCEDURE

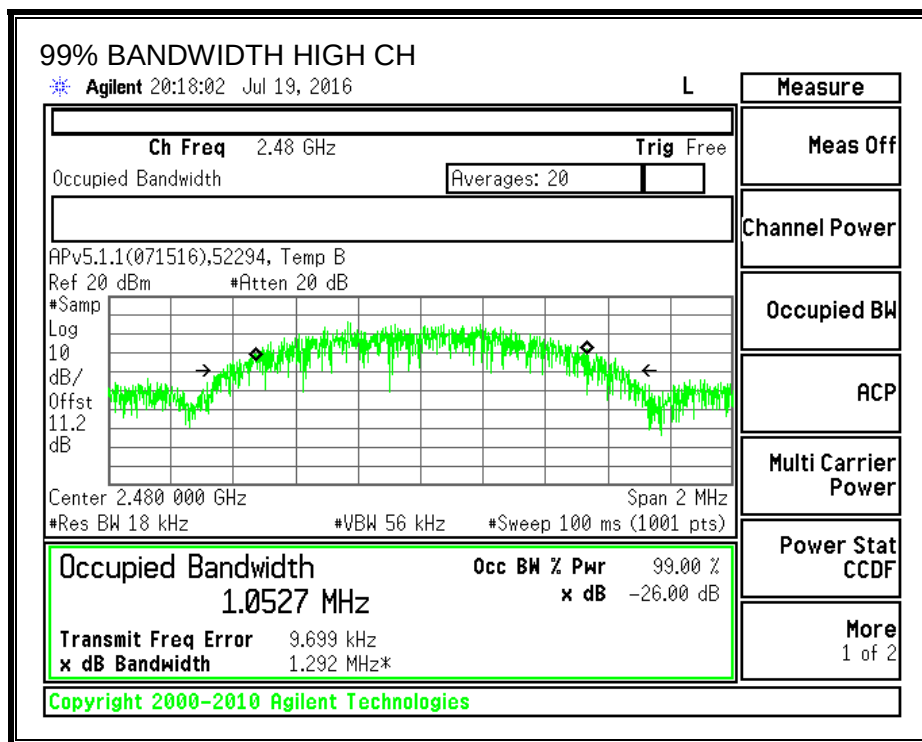
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth or to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0522
Middle	2440	1.0554
High	2480	1.0527

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:	8/11/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	17.4
Middle	2440	17.5
High	2480	17.48

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:	8/11/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.58	30	-12.420
Middle	2440	17.67	30	-12.330
High	2480	17.62	30	-12.380

7.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

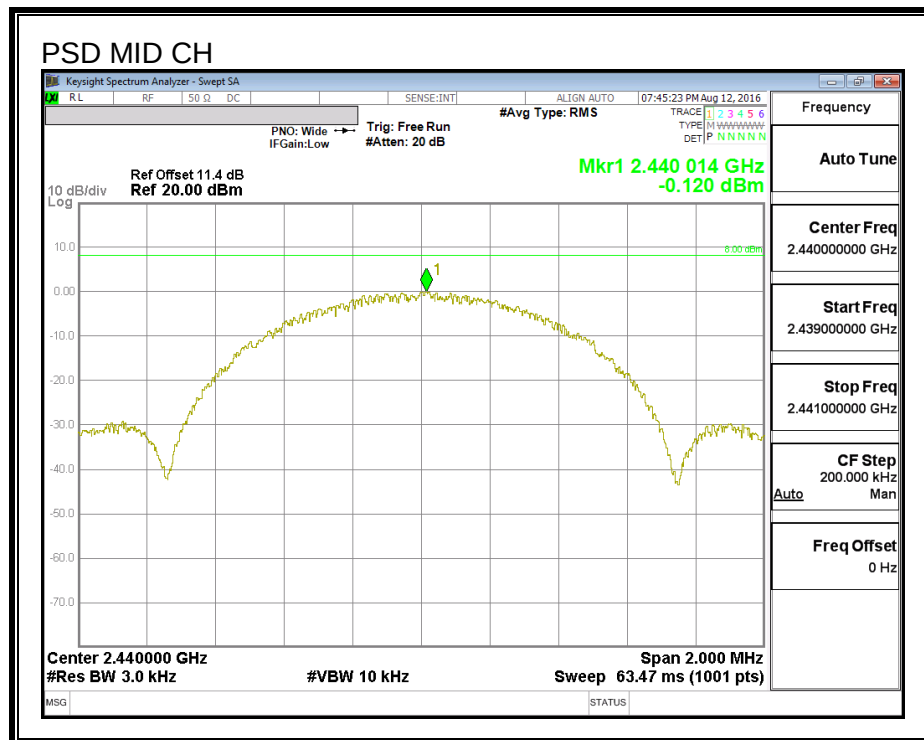
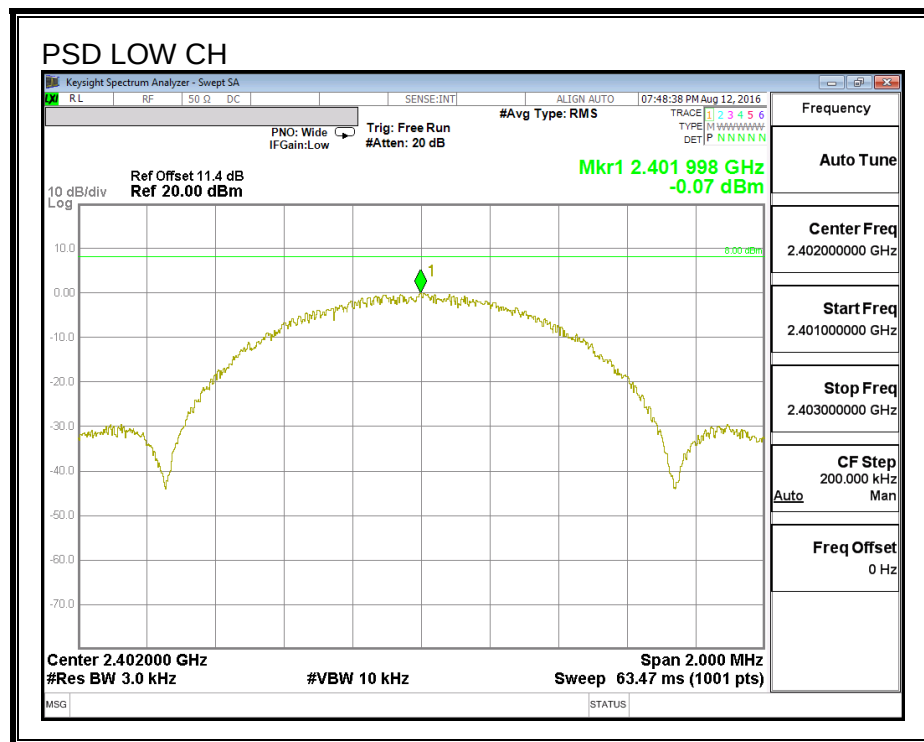
IC RSS-247 (5.2) (2)

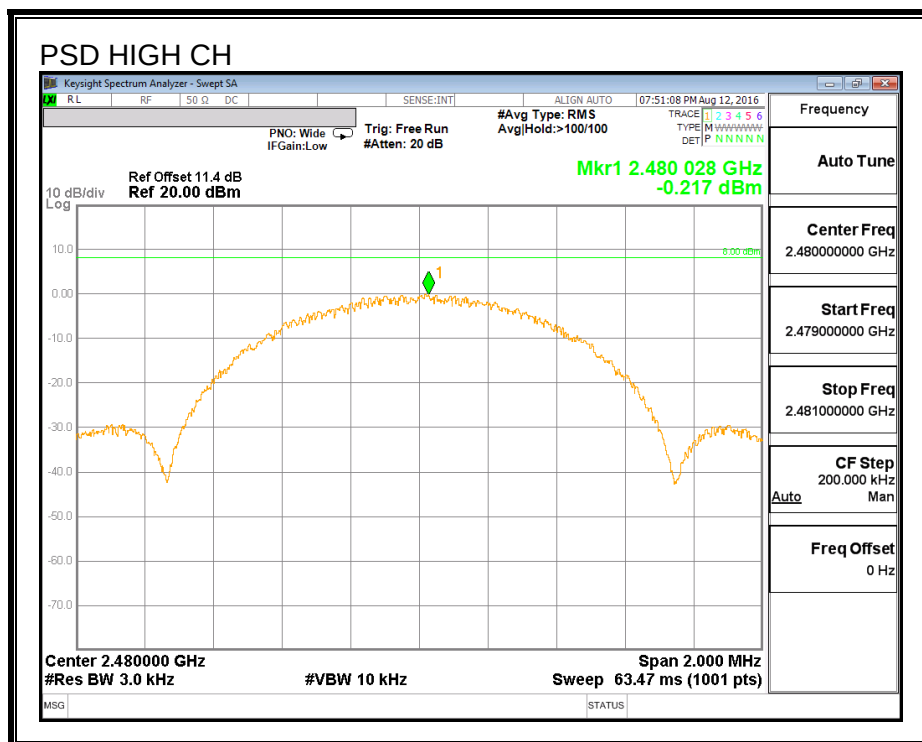
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-0.07	8	-8.07
Middle	2440	-0.12	8	-8.12
High	2480	-0.22	8	-8.22

POWER SPECTRAL DENSITY





7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

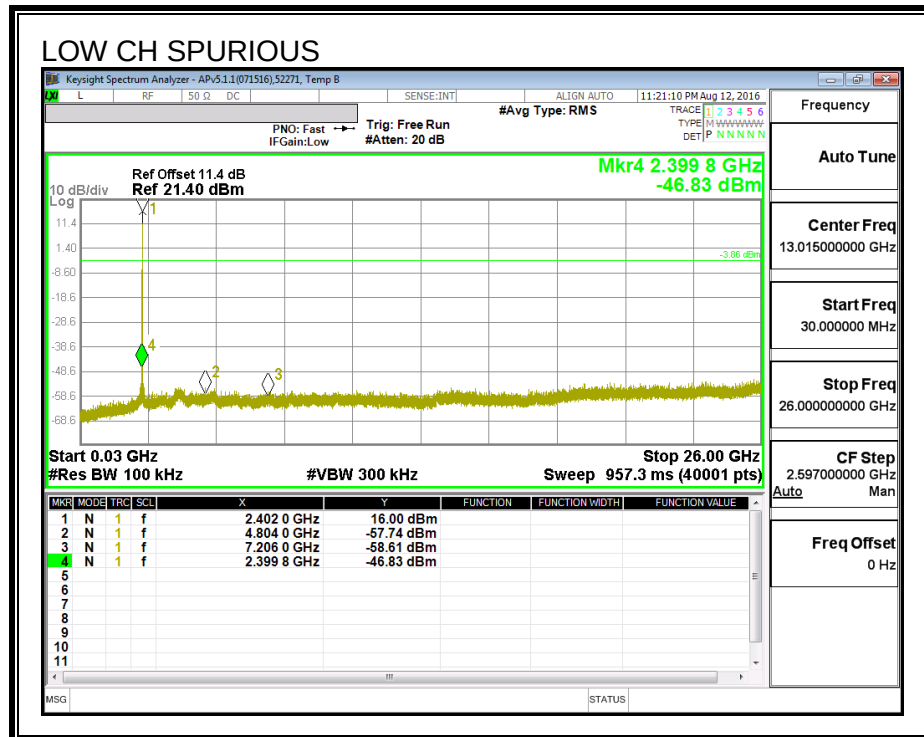
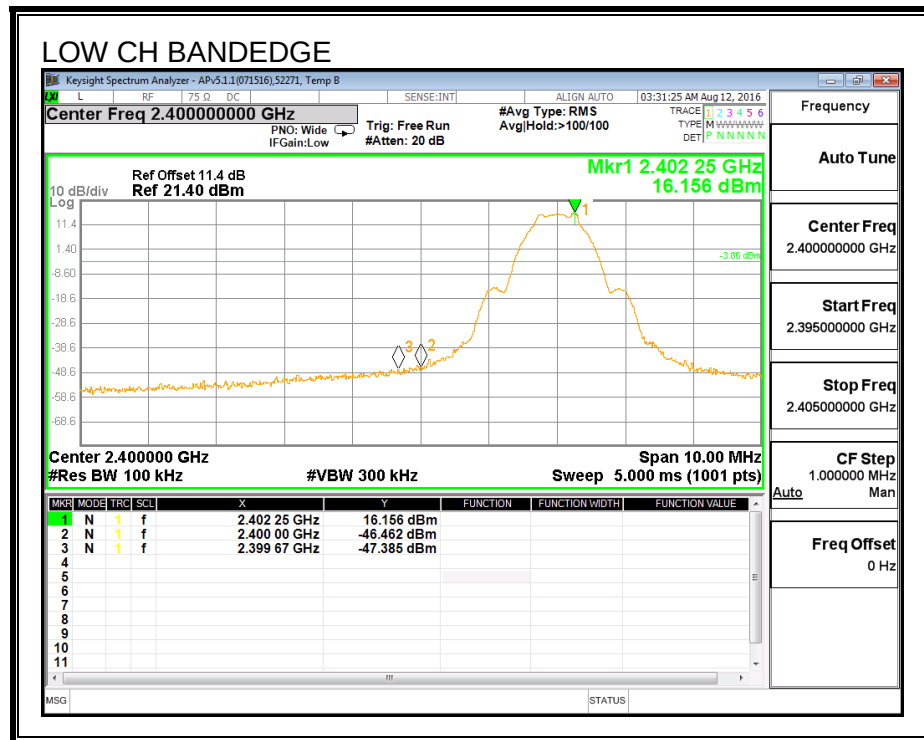
FCC §15.247 (d)

IC RSS-247 (5.5)

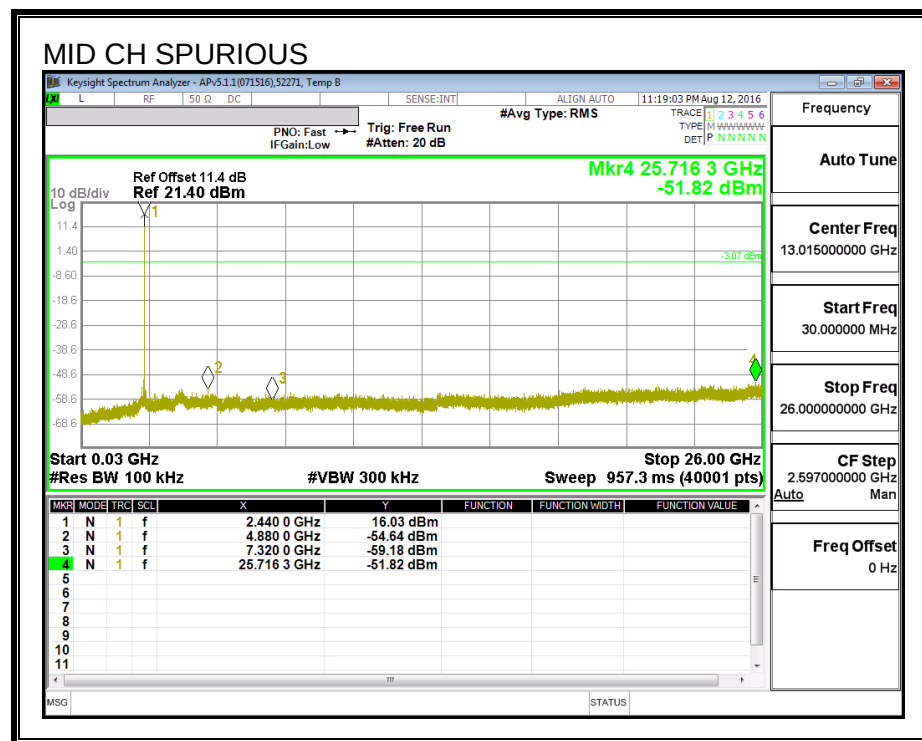
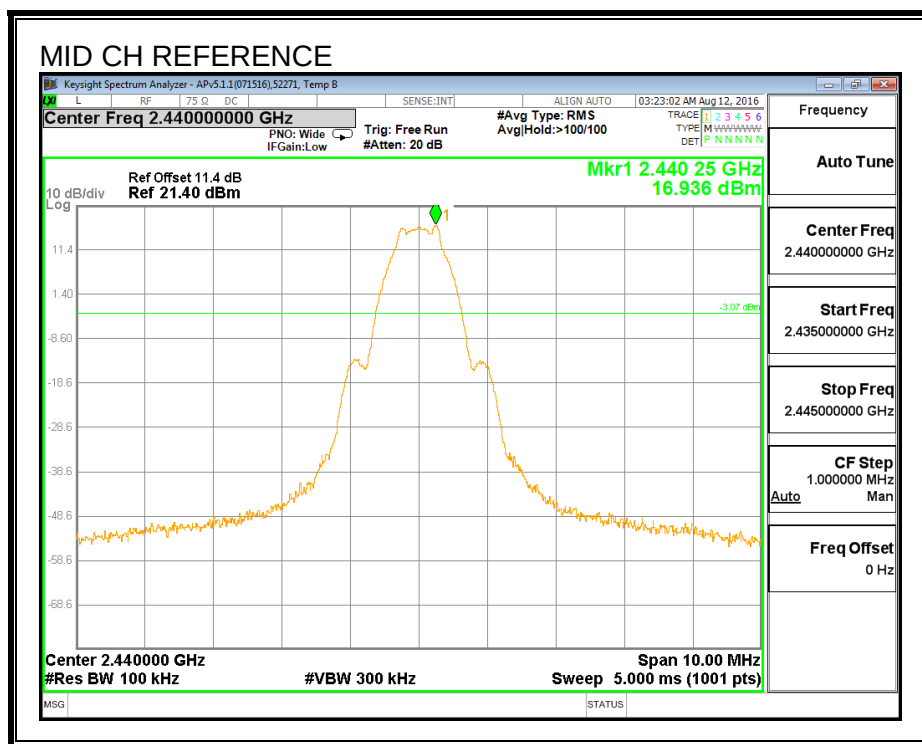
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

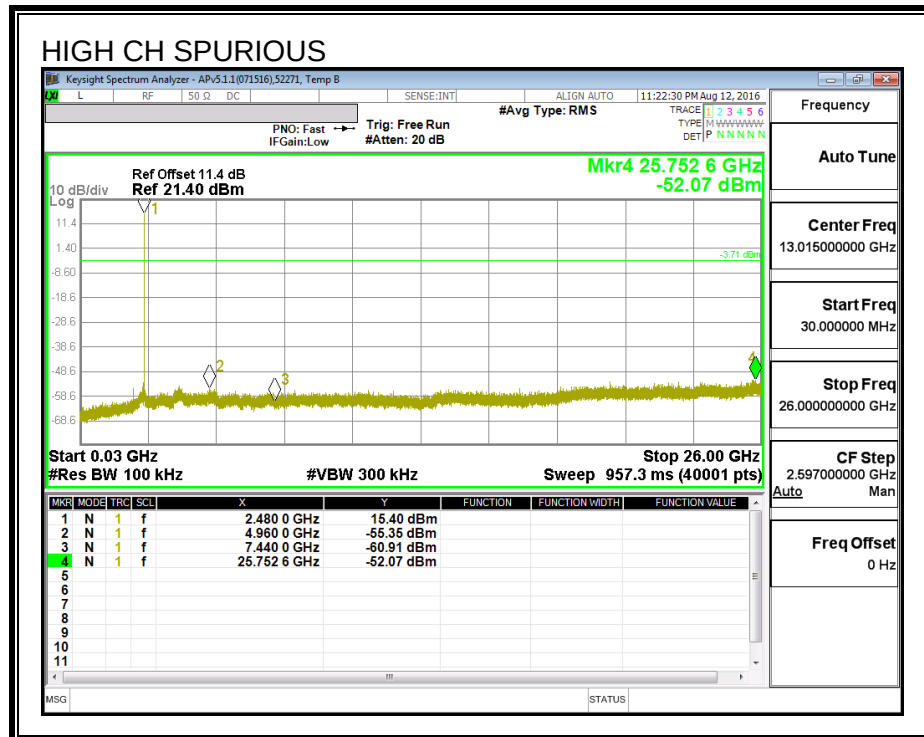
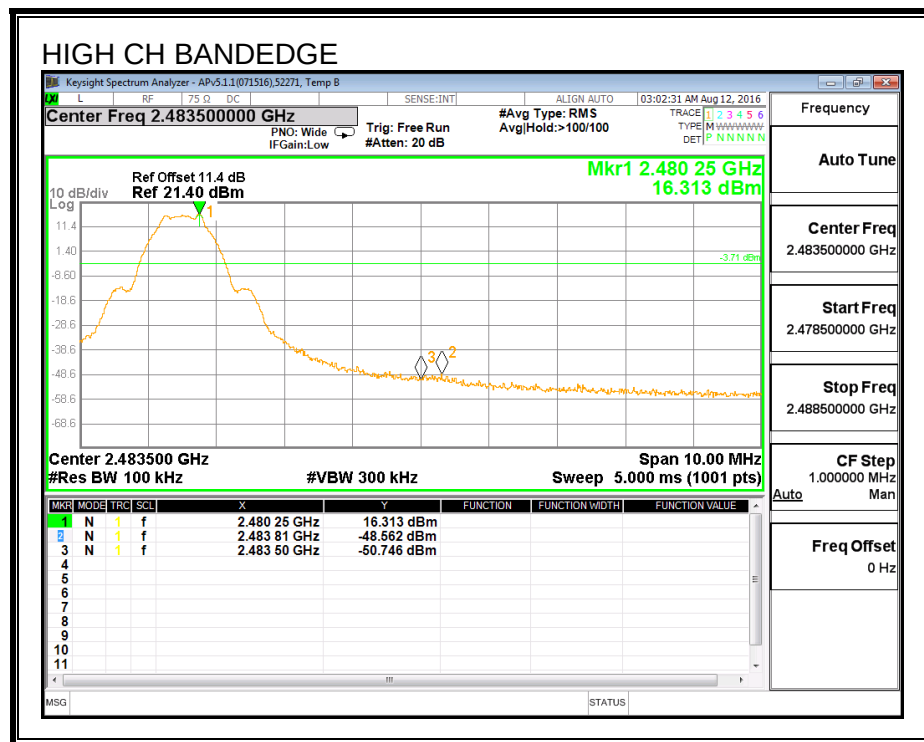
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



7.4. LOW POWER MODE

7.4.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

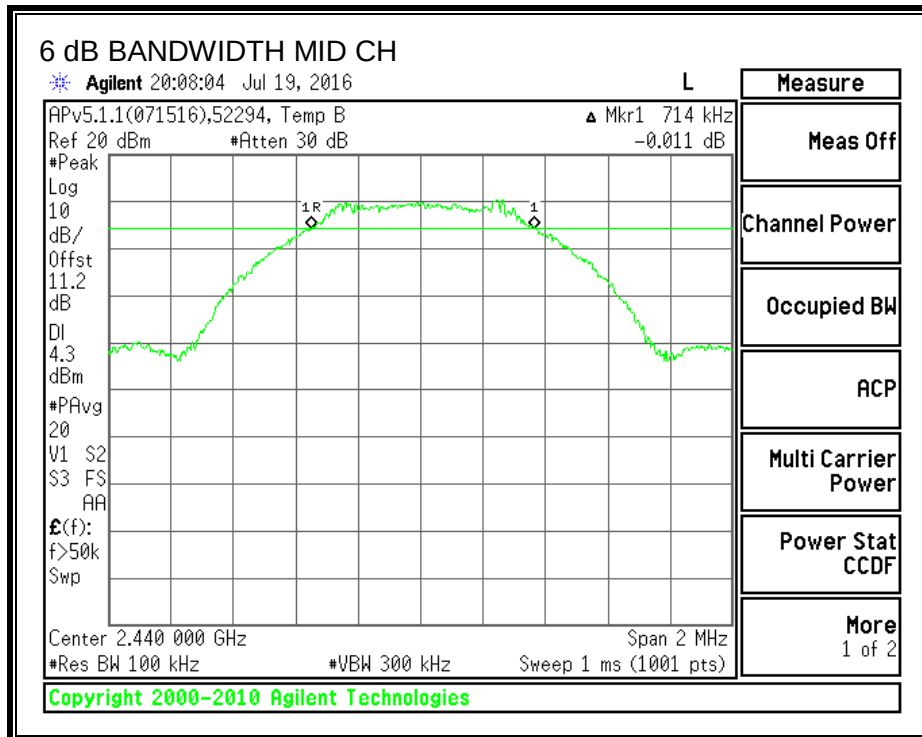
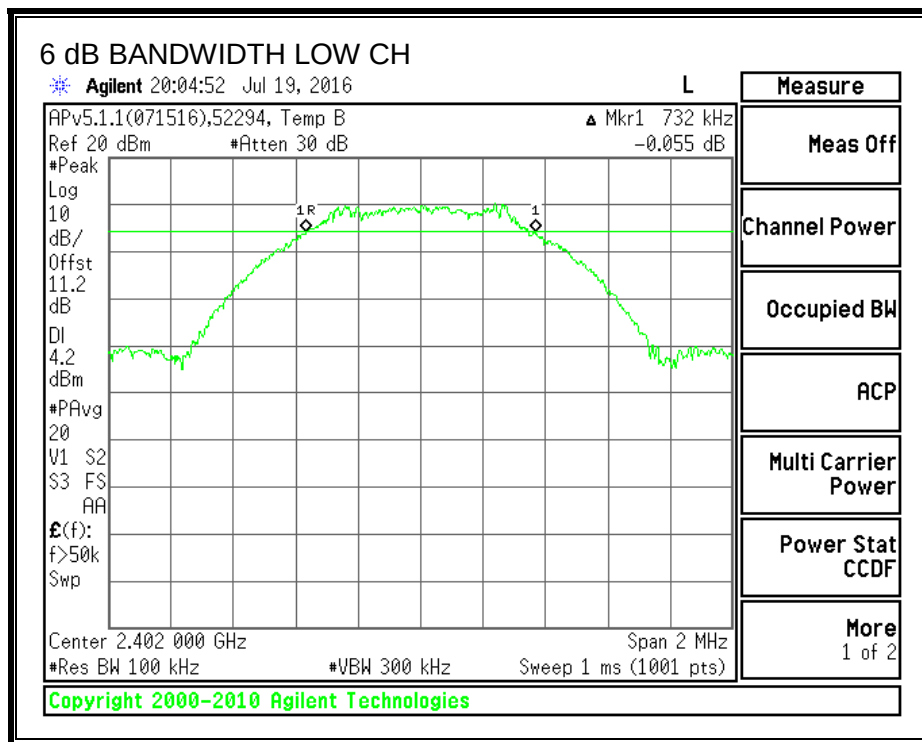
IC RSS-247 (5.2) (1)

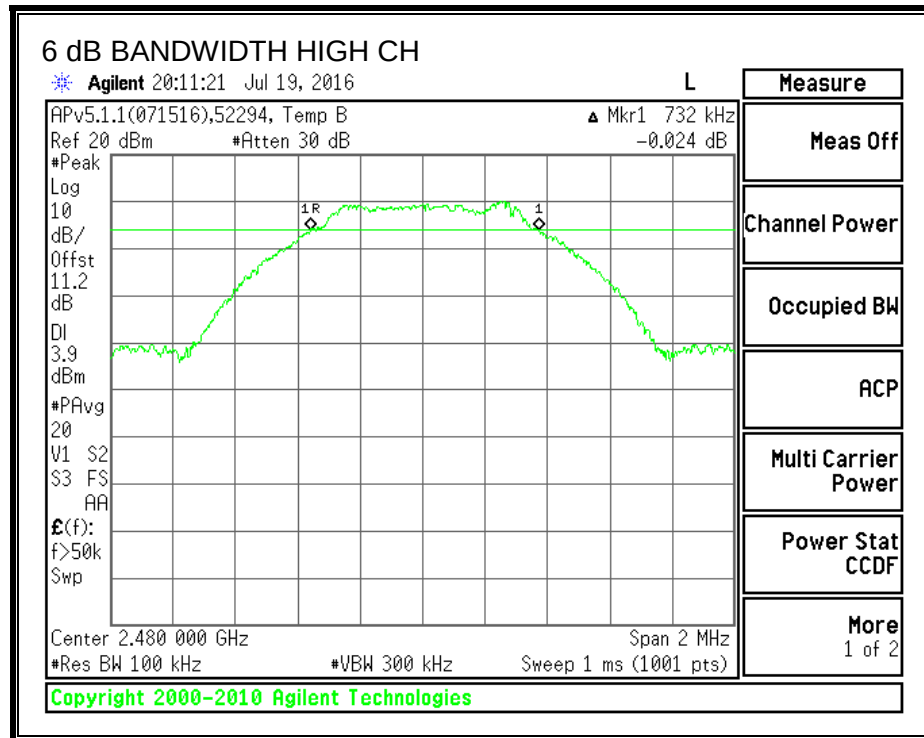
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.732	0.5
Middle	2440	0.714	0.5
High	2480	0.732	0.5

6 dB BANDWIDTH





7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

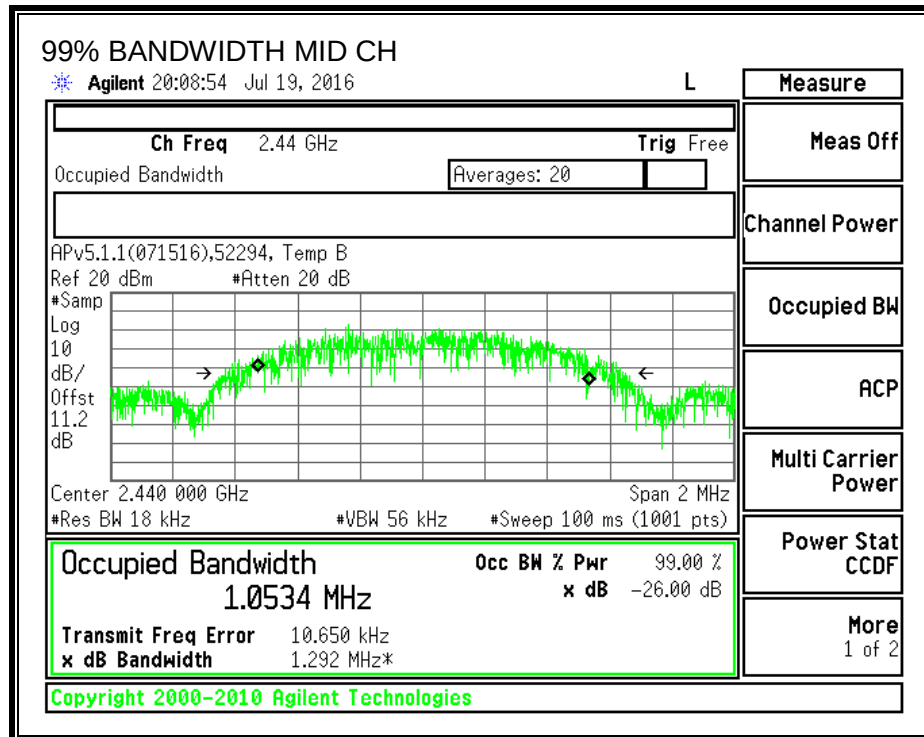
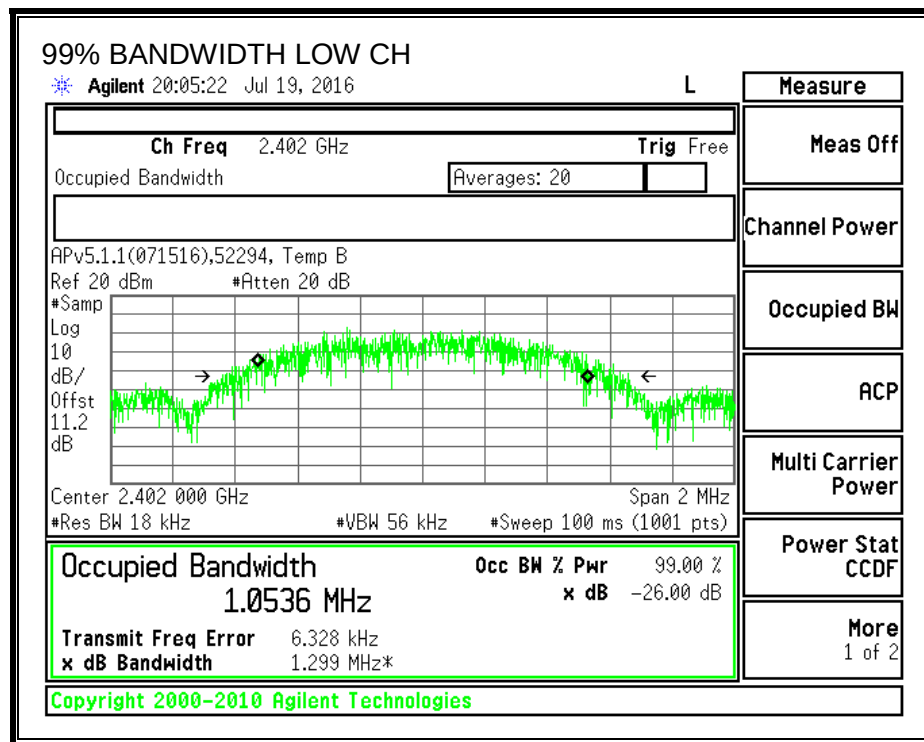
TEST PROCEDURE

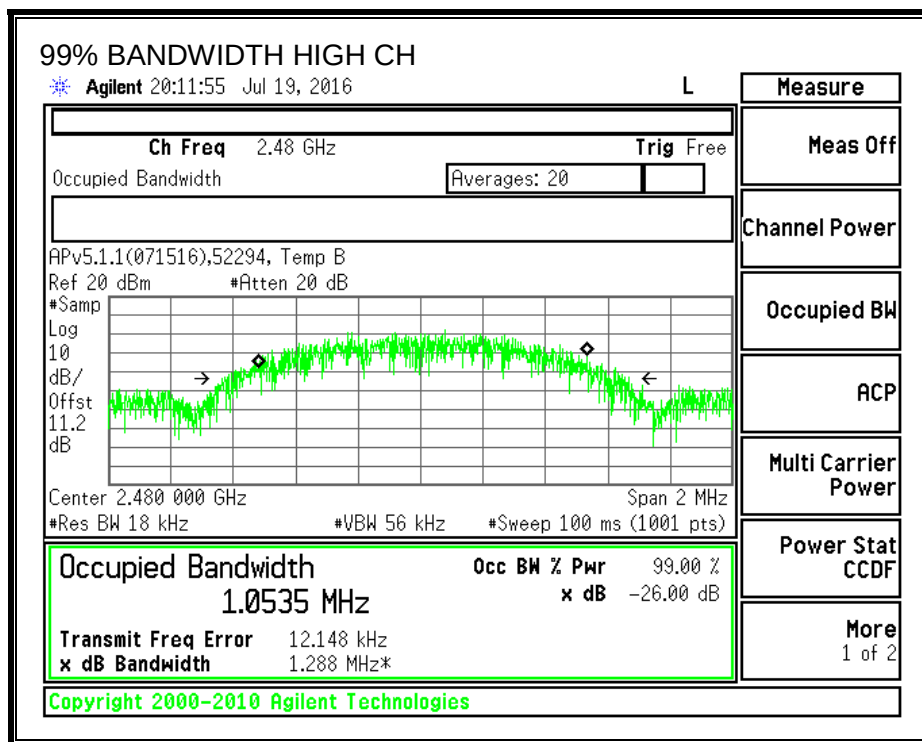
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0536
Middle	2440	1.0534
High	2480	1.0535

99% BANDWIDTH





7.4.3. 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:	7/22/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	9.78
Middle	2440	9.91
High	2480	9.85

7.4.4. 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:	7/22/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.08	30	-19.920
Middle	2440	10.16	30	-19.840
High	2480	10.12	30	-19.880

7.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

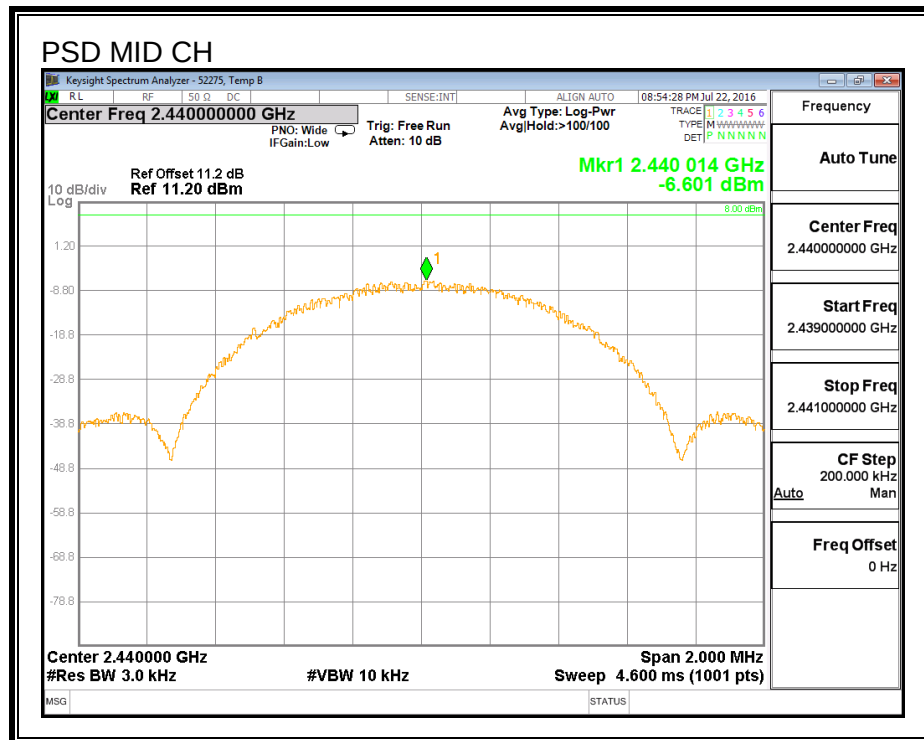
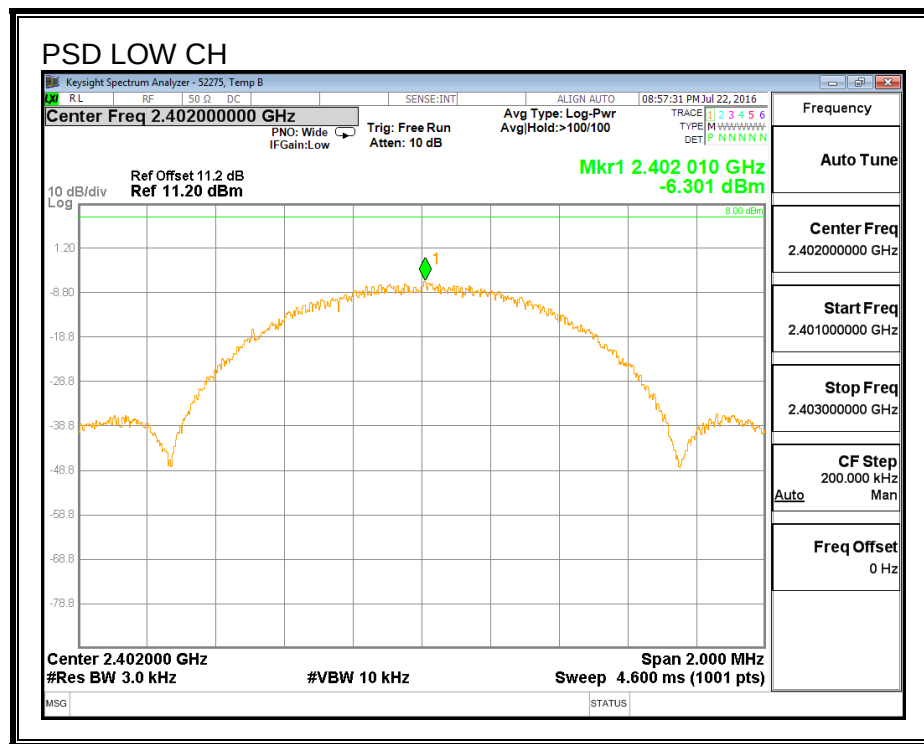
IC RSS-247 (5.2) (2)

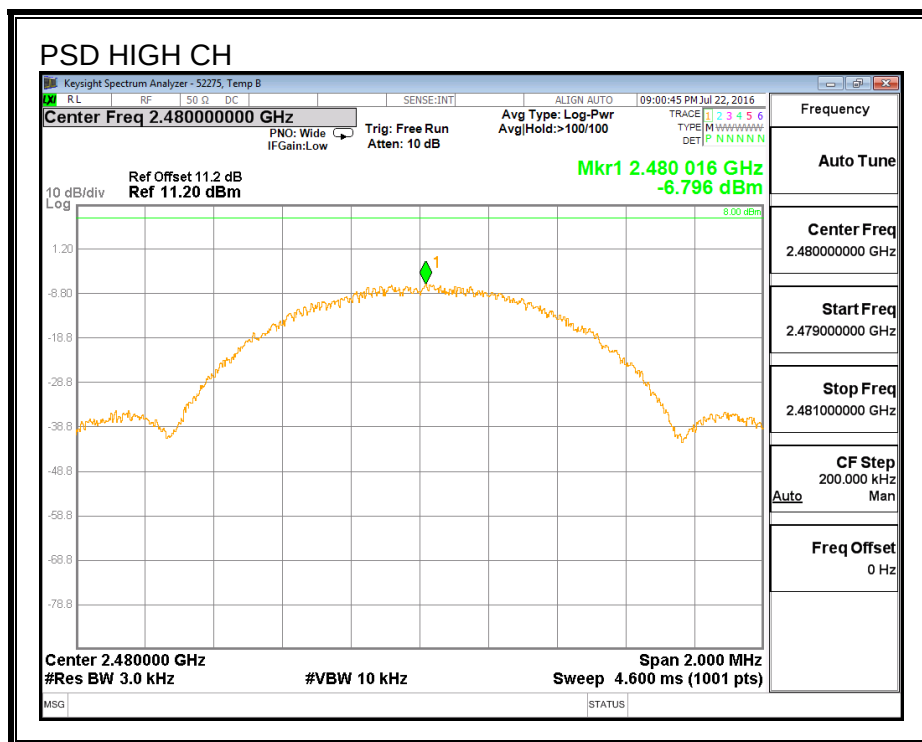
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-6.30	8	-14.30
Middle	2440	-6.60	8	-14.60
High	2480	-6.80	8	-14.80

POWER SPECTRAL DENSITY





7.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

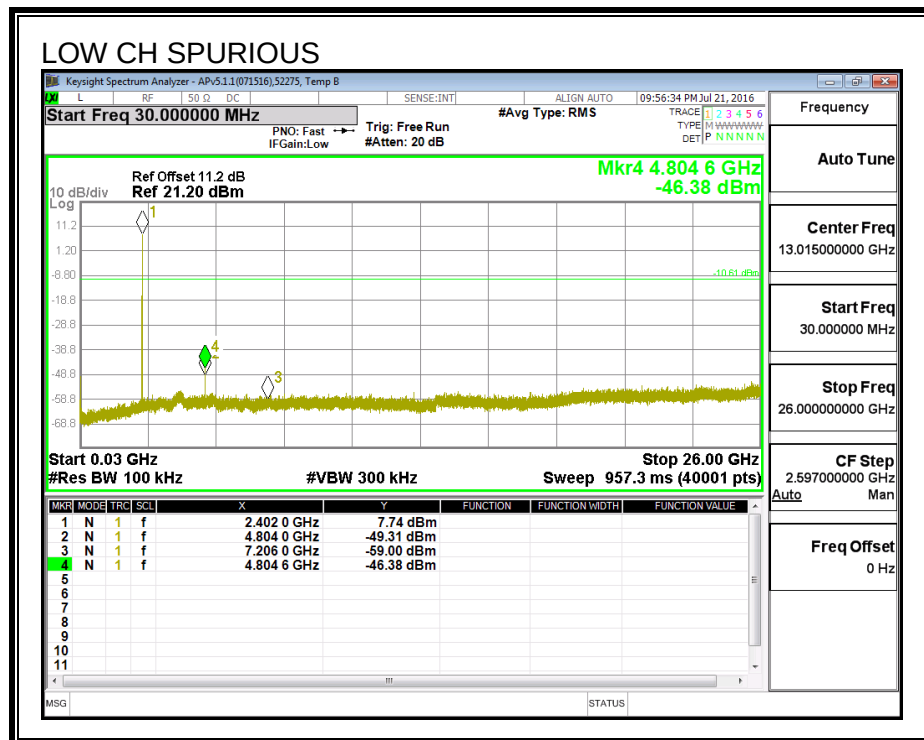
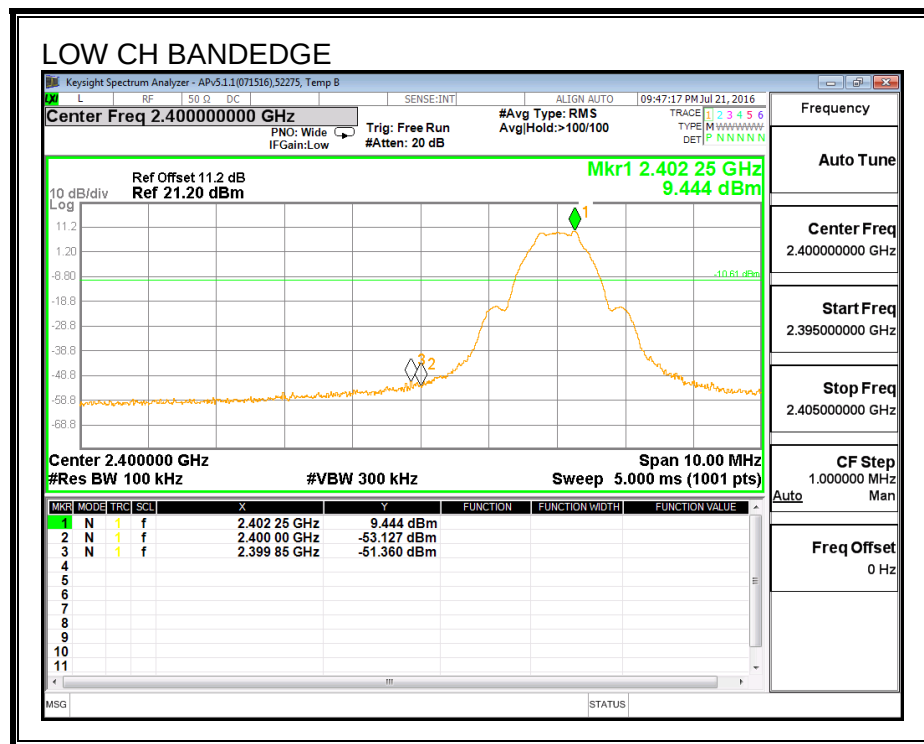
FCC §15.247 (d)

IC RSS-247 (5.5)

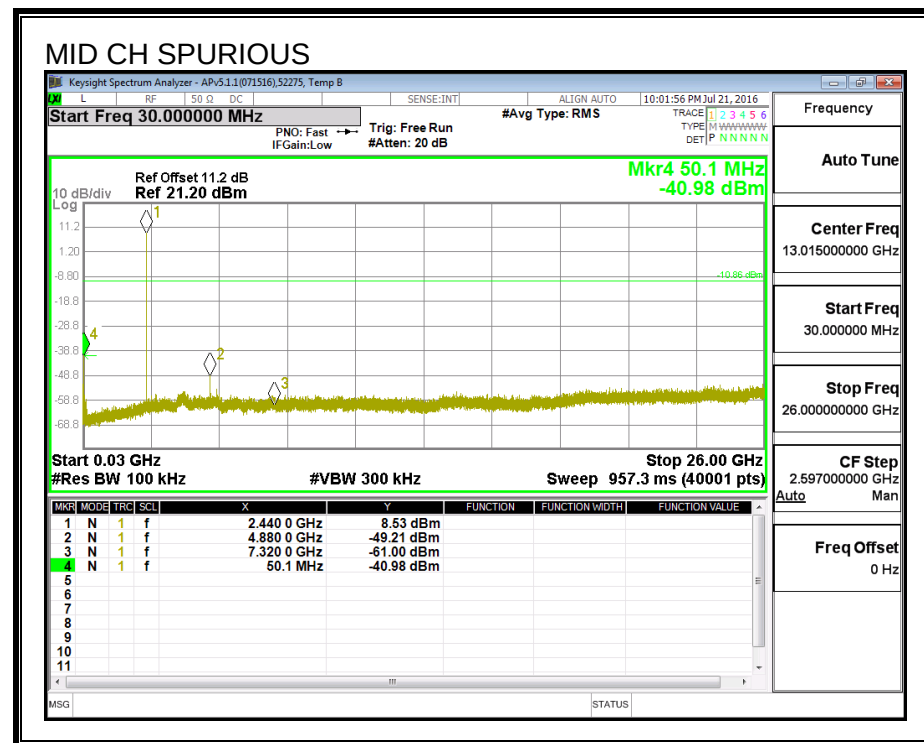
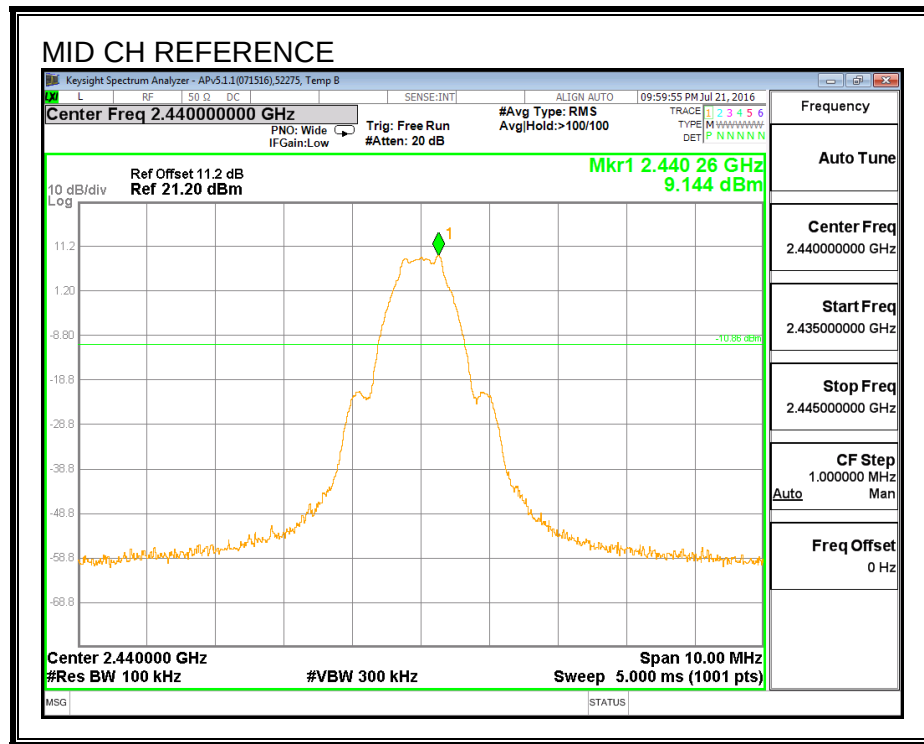
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

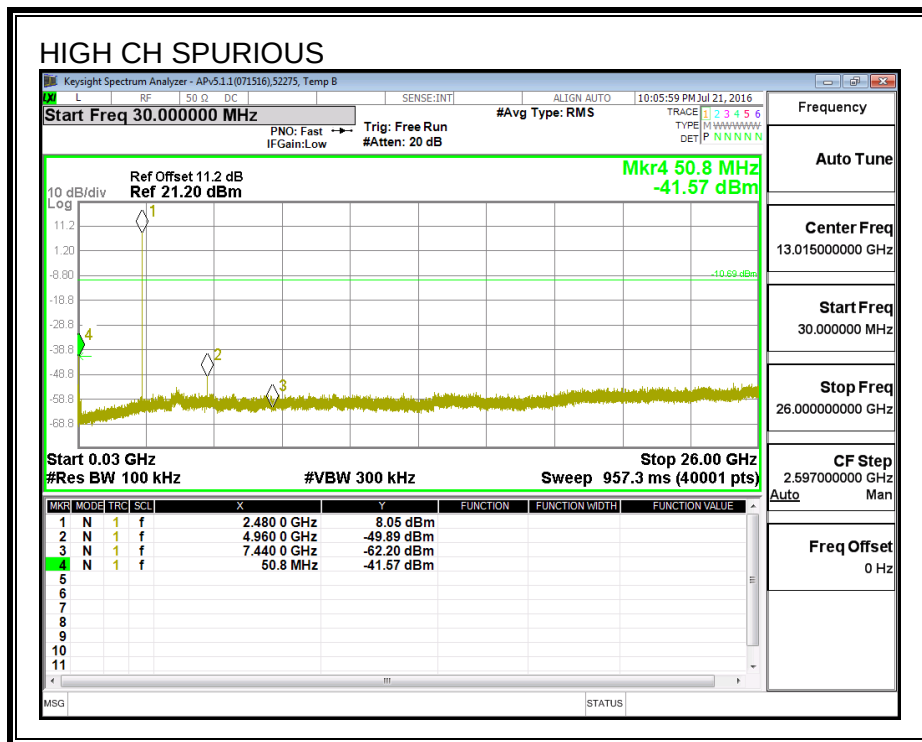
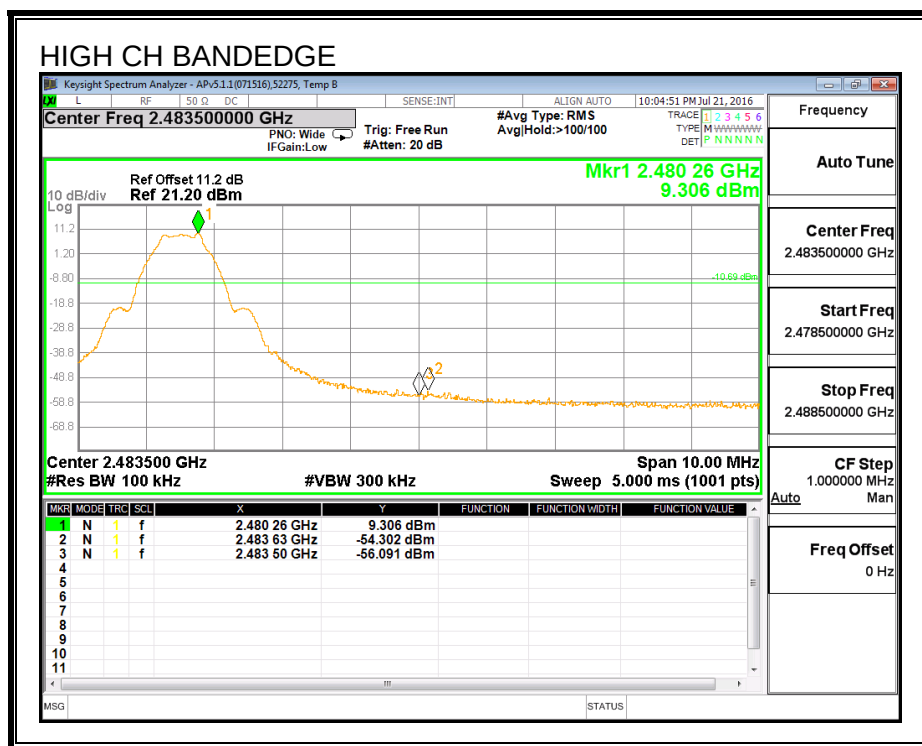
SPURIOUS EMISSIONS, LOW CHANNEL



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.

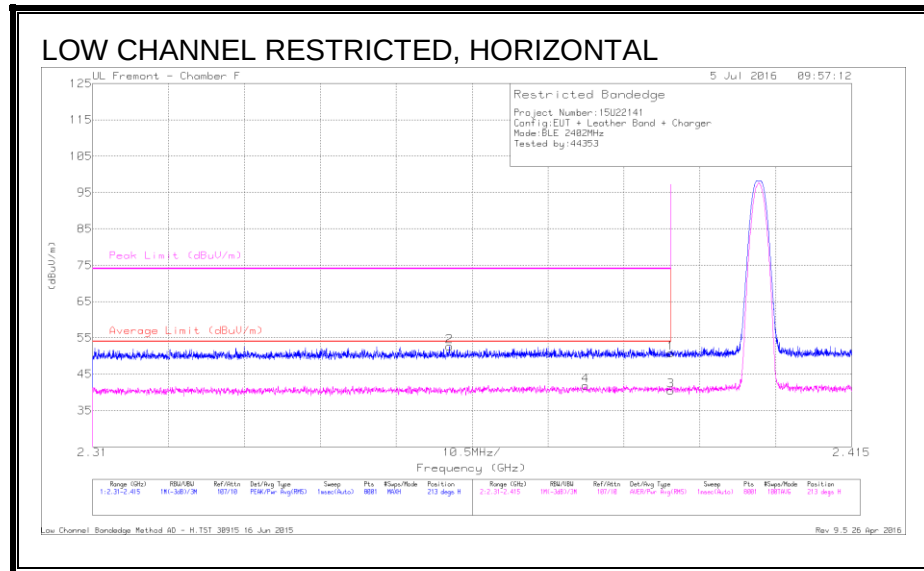
For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

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. HIGH POWER MODE

8.2.1. Above 1 GHz RESTRICTED BANDEDGE



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT344 (dB/m)	Amp/Chl/Filtr/Pa d (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	39.58	Pk	32.1	-20.9	50.78	-	-	74	-23.22	213	148	H
2	* 2.359	41.56	Pk	32	-20.9	52.66	-	-	74	-21.34	213	148	H
3	* 2.39	29.23	RMS	32.1	-20.9	40.43	54	-13.57	-	-	213	148	H
4	* 2.378	30.66	RMS	32.1	-20.9	41.86	54	-12.14	-	-	213	148	H

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

Pk - Peak detector

RMS - RMS detection



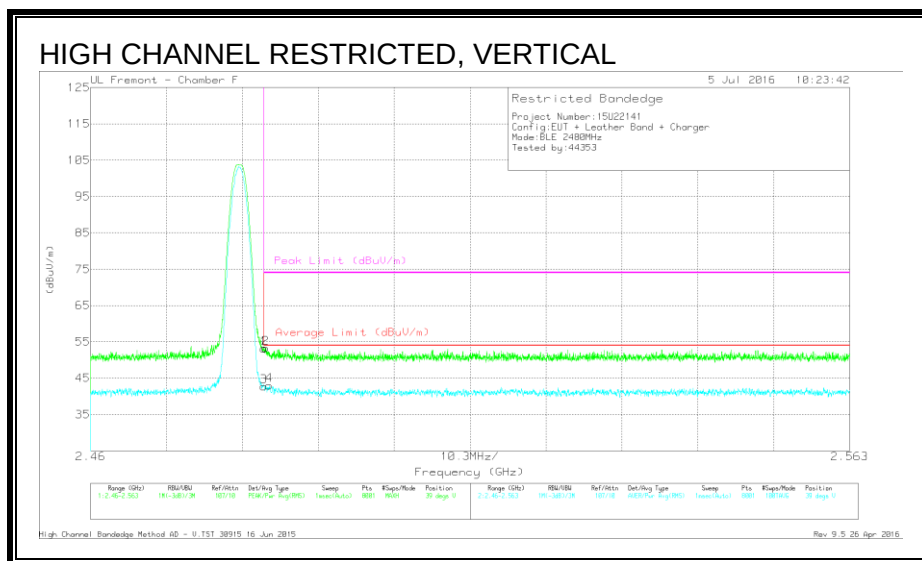
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Ctrl/Trt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.24	Pk	32.1	-20.9	50.44	-	-	74	-23.56	207	117	V
2	* 2.388	42.05	Pk	32.1	-20.9	53.25	-	-	74	-20.75	207	117	V
3	* 2.39	29.52	RMS	32.1	-20.9	40.72	54	-13.28	-	-	207	117	V
4	* 2.328	31.3	RMS	31.8	-20.9	42.2	54	-11.8	-	-	207	117	V

RMS - RMS detection



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/Fltr/Pa d (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	39.29	Pk	32.3	-21	50.59	-	-	74	-23.41	44	123	H
2	2.535	42.4	Pk	32.2	-20.8	53.8	-	-	74	-20.2	44	123	H
3	* 2.484	30.03	RMS	32.3	-21	41.33	54	-12.67	-	-	44	123	H
4	2.519	31.19	RMS	32.3	-21	42.49	54	-11.51	-	-	44	123	H

RMS - RMS detection



DATA

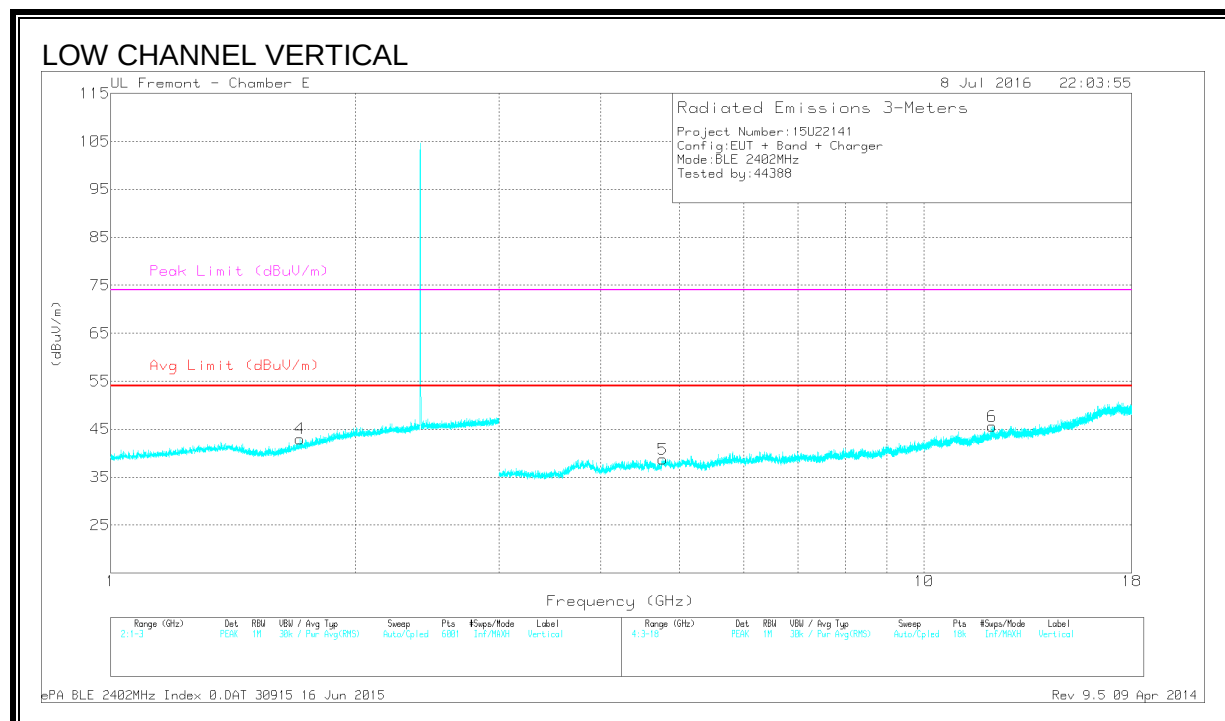
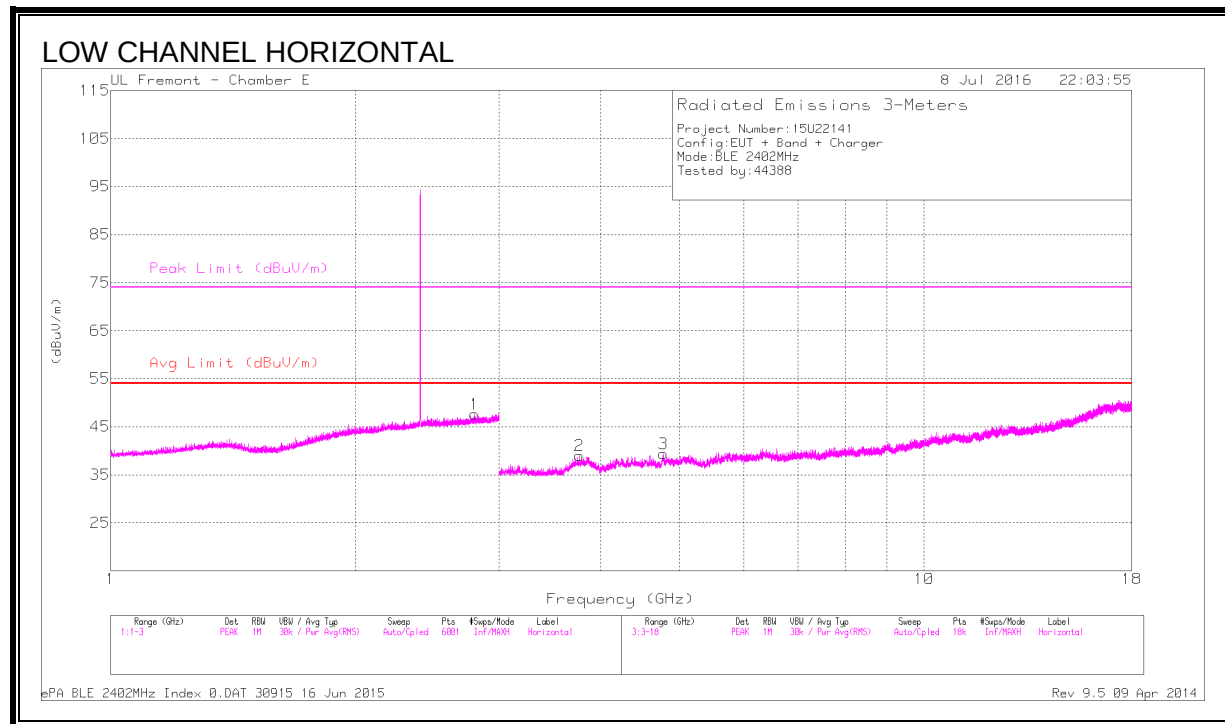
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT344 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.89	Pk	32.3	-21	53.19	-	-	74	-20.81	39	257	V
2	* 2.484	42.02	Pk	32.3	-21	53.32	-	-	74	-20.68	39	257	V
3	* 2.484	31.4	RMS	32.3	-21	42.7	54	-11.3	-	-	39	257	V
4	* 2.484	31.73	RMS	32.3	-21	43.03	54	-10.97	-	-	39	257	V

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

Pk - Peak detector

RMS - RMS detection

8.2.2. HARMONICS AND SPURIOUS EMISSIONS



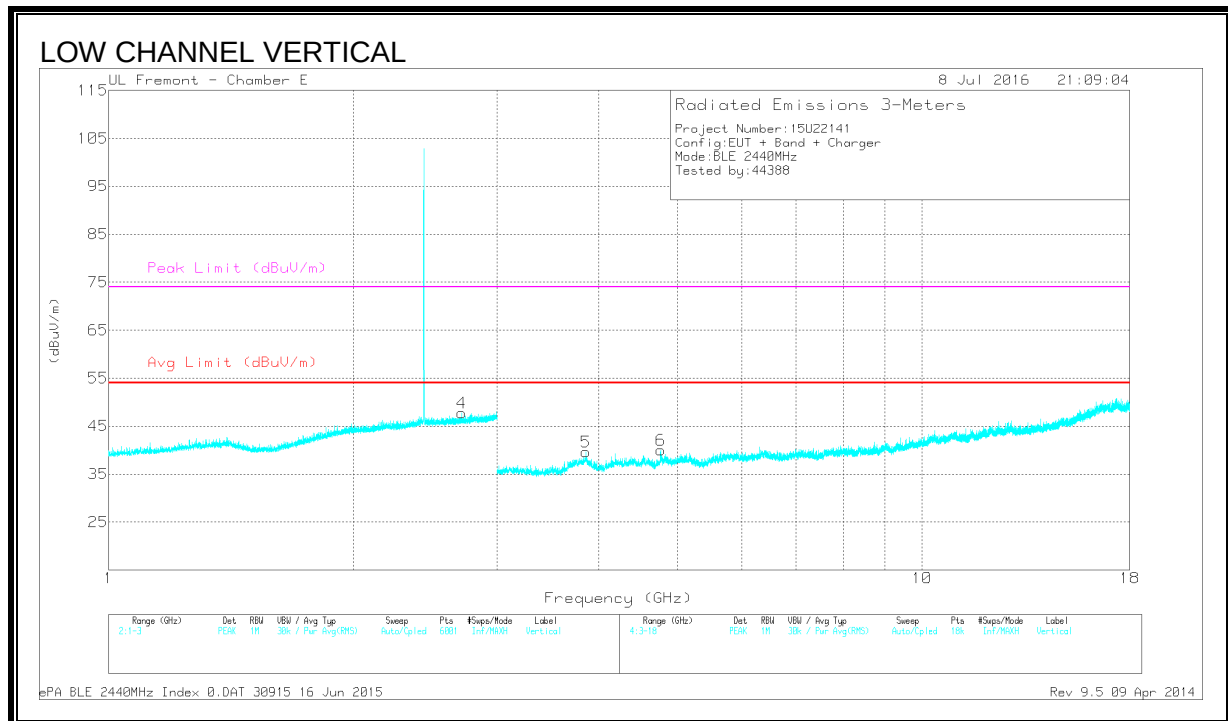
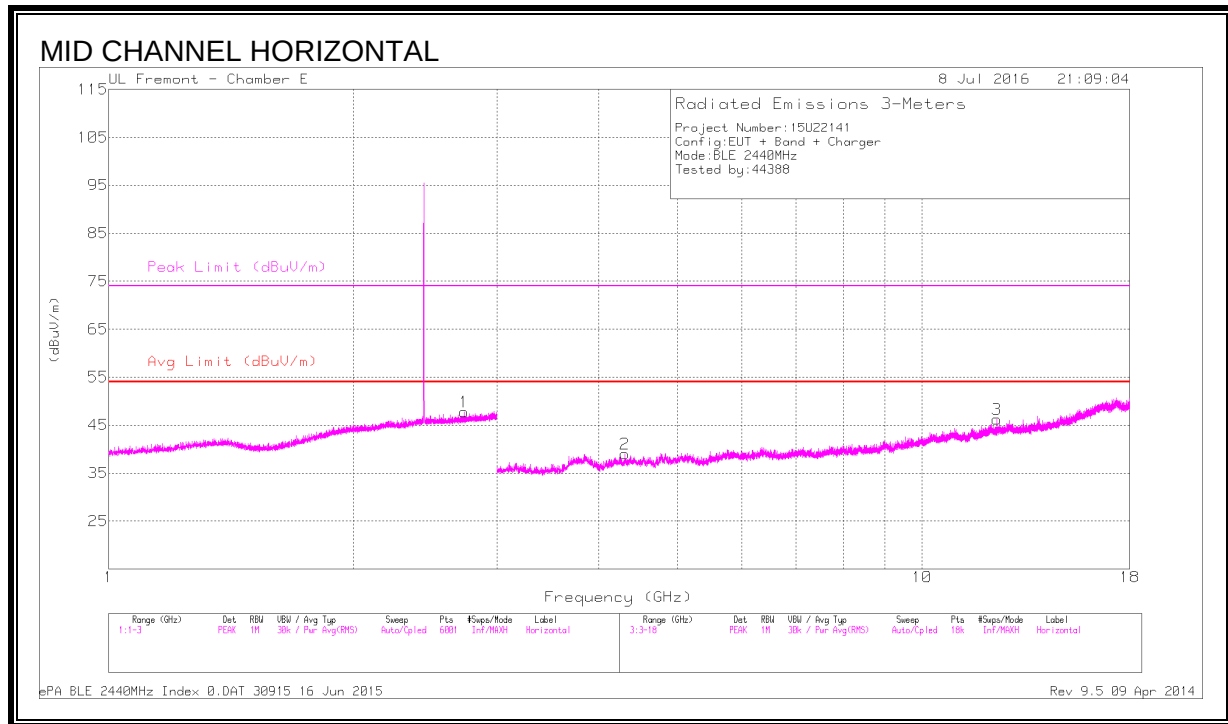
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.804	41.93	PK2	32.5	-20.4	54.03	-	-	74	-19.97	34	313	H
	* 2.803	30.71	MAv1	32.5	-20.4	42.81	54	-11.19	-	-	34	313	H
4	* 1.706	41.71	PK2	29.1	-21.7	49.11	-	-	74	-24.89	44	165	V
	* 1.709	31	MAv1	29.2	-21.7	38.5	54	-15.5	-	-	44	165	V
3	* 4.783	38.38	PK2	34	-27.8	44.58	-	-	74	-29.42	42	378	H
	* 4.782	27.28	MAv1	34	-27.8	33.48	54	-20.52	-	-	42	378	H
2	* 3.766	38.54	PK2	33.4	-29	42.94	-	-	74	-31.06	56	289	H
	* 3.768	28.1	MAv1	33.4	-29.1	32.4	54	-21.6	-	-	56	289	H
5	* 4.771	39.08	PK2	34.1	-27.9	45.28	-	-	74	-28.72	63	328	V
	* 4.77	27.68	MAv1	34.1	-27.9	33.88	54	-20.12	-	-	63	328	V
6	* 12.128	34.3	PK2	38.9	-21.6	51.6	-	-	74	-22.4	40	153	V
	* 12.131	23.98	MAv1	38.9	-21.6	41.28	54	-12.72	-	-	40	153	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



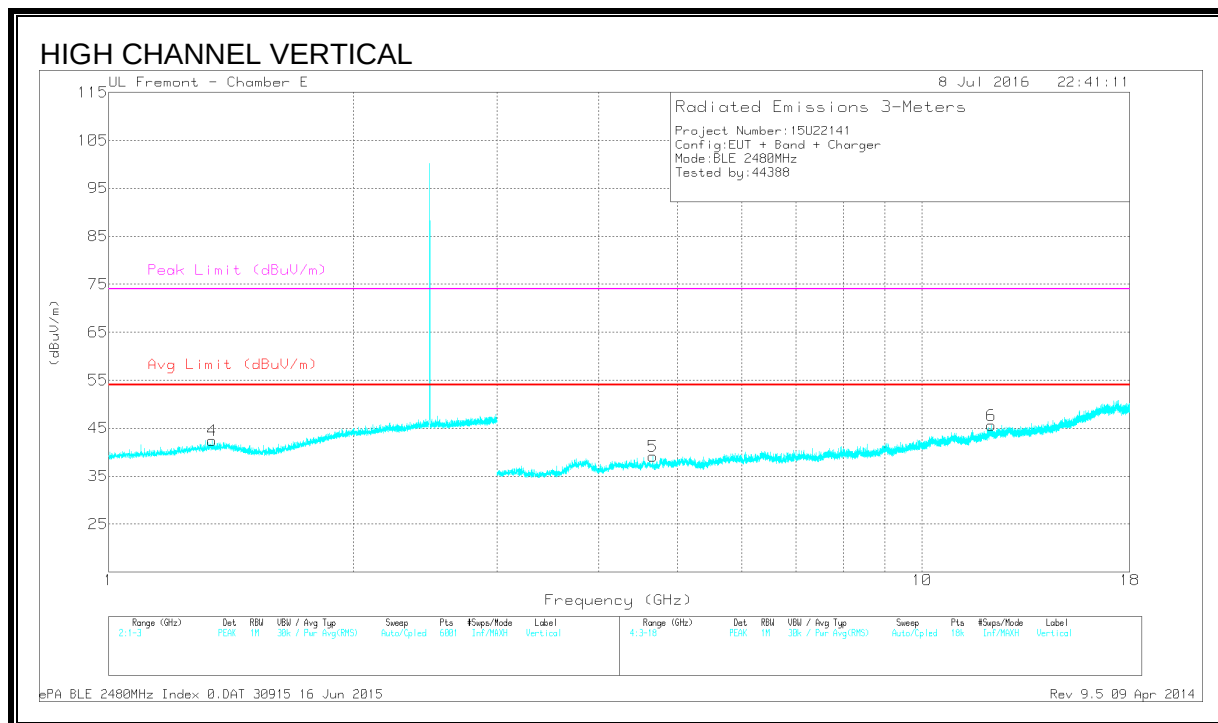
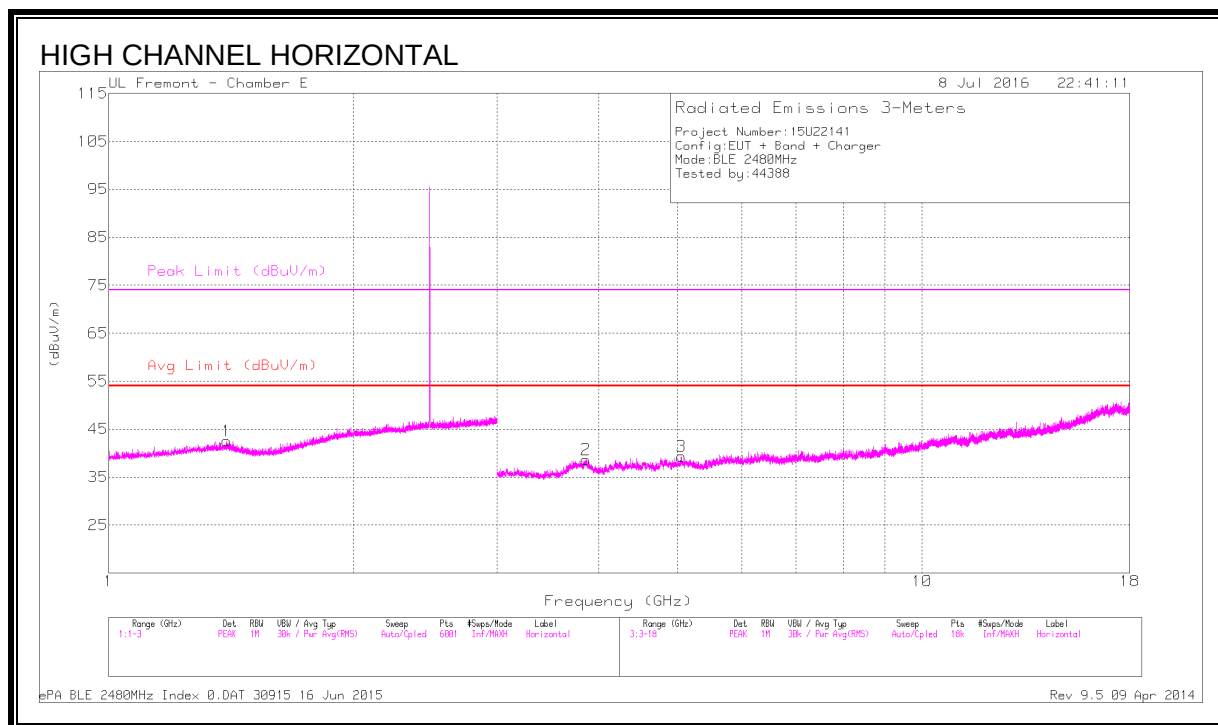
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.735	42.11	PK2	32.4	-20.5	54.01	-	-	74	-19.99	345	186	H
	* 2.732	30.93	MAv1	32.4	-20.5	42.83	54	-11.17	-	-	345	186	H
4	* 2.719	41.89	PK2	32.4	-20.6	53.69	-	-	74	-20.31	159	346	V
	* 2.716	30.9	MAv1	32.4	-20.6	42.7	54	-11.3	-	-	159	346	V
2	* 4.314	38.37	PK2	33.8	-28.8	43.37	-	-	74	-30.63	327	397	H
	* 4.315	27.59	MAv1	33.8	-28.8	32.59	54	-21.41	-	-	327	397	H
3	* 12.344	34.85	PK2	38.9	-22.7	51.05	-	-	74	-22.95	314	168	H
	* 12.346	24.61	MAv1	38.9	-22.7	40.81	54	-13.19	-	-	314	168	H
6	* 4.77	38.55	PK2	34.1	-27.9	44.75	-	-	74	-29.25	173	340	V
	* 4.767	27.81	MAv1	34.1	-27.9	34.01	54	-19.99	-	-	173	340	V
5	* 3.862	38	PK2	33.4	-28.2	43.2	-	-	74	-30.8	198	174	V
	* 3.862	28.24	MAv1	33.4	-28.2	33.44	54	-20.56	-	-	198	174	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 T344 (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	* 1.398	41.68	PK2	29.3	-22	48.98	-	-	74	-25.02	149	152	H
	* 1.396	31.19	MAv1	29.3	-22	38.49	54	-15.51	-	-	149	152	H
4	* 1.34	41.69	PK2	29.1	-22.1	48.69	-	-	74	-25.31	176	188	V
	* 1.343	31	MAv1	29.1	-22.1	38	54	-16	-	-	176	188	V
3	* 5.061	37.75	PK2	34.2	-27.8	44.15	-	-	74	-29.85	139	160	H
	* 5.061	27.37	MAv1	34.2	-27.8	33.77	54	-20.23	-	-	139	160	H
2	* 3.863	38.54	PK2	33.4	-28.2	43.74	-	-	74	-30.26	127	178	H
	* 3.861	28.34	MAv1	33.4	-28.2	33.54	54	-20.46	-	-	127	178	H
5	* 4.662	38.15	PK2	34.2	-28.9	43.45	-	-	74	-30.55	182	170	V
	* 4.665	28.1	MAv1	34.2	-28.9	33.4	54	-20.6	-	-	182	170	V
6	* 12.164	34.06	PK2	38.9	-21.4	51.56	-	-	74	-22.44	199	155	V
	* 12.162	23.82	MAv1	38.9	-21.4	41.32	54	-12.68	-	-	199	155	V

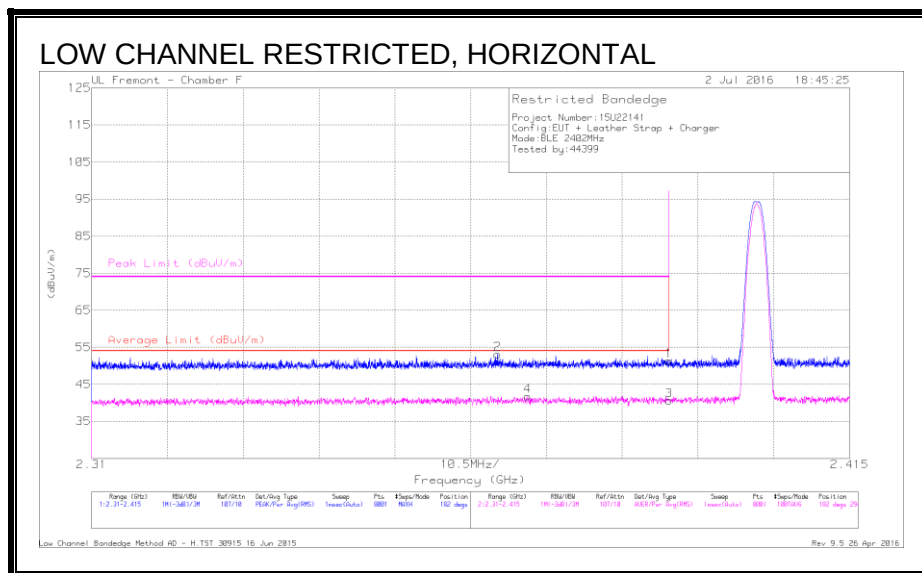
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

8.3. LOW POWER MODE

8.3.1. Above 1GHz RESTRICTED BANDEDGE



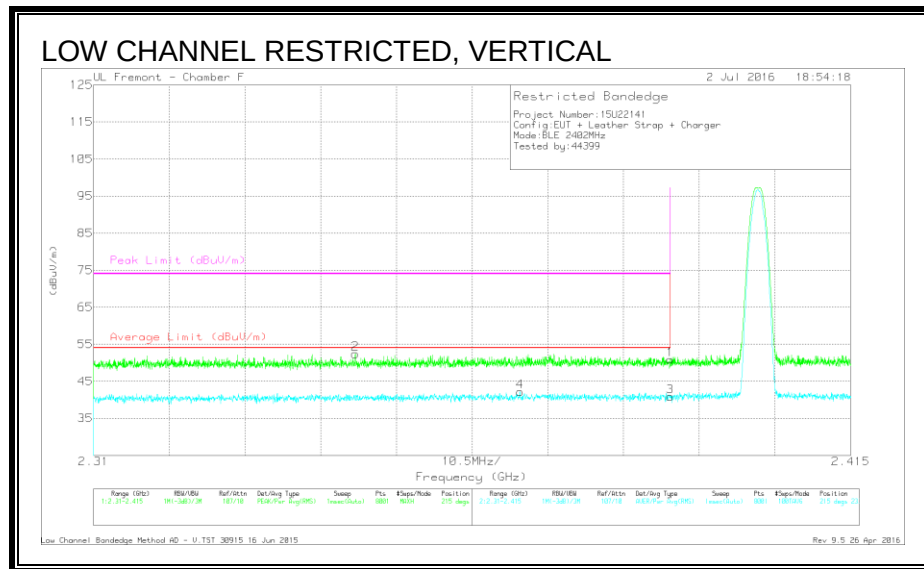
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Filtz/Pa d (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	40.2	Pk	32.1	-20.9	51.4	-	-	74	-22.6	182	294	H
2	* 2.366	42.02	Pk	32	-20.9	53.12	-	-	74	-20.88	182	294	H
3	* 2.39	29.45	RMS	32.1	-20.9	40.65	54	-13.35	-	-	182	294	H
4	* 2.37	30.71	RMS	32	-20.9	41.81	54	-12.19	-	-	182	294	H

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

Pk - Peak detector

RMS - RMS detection



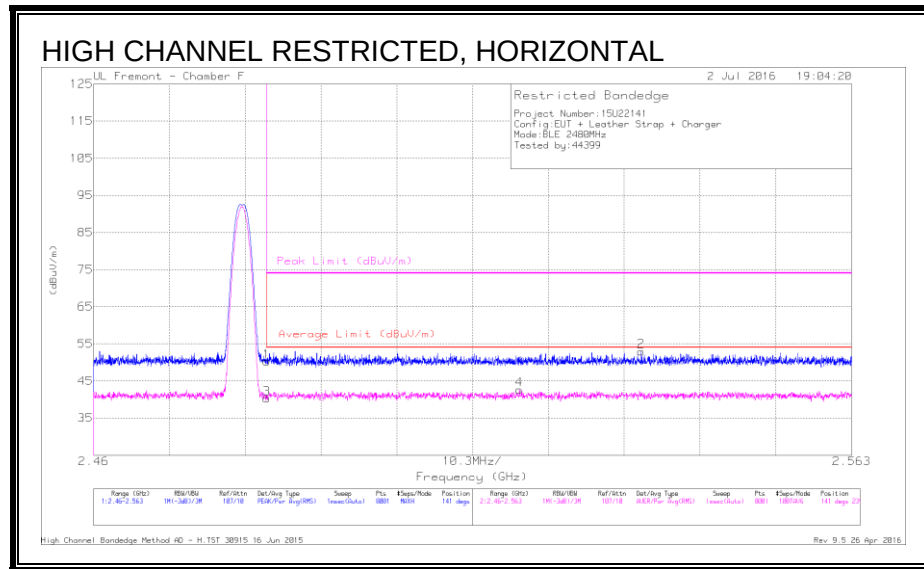
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/Fltr/Par d (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	39.68	Pk	32.1	-20.9	50.88	-	-	74	-23.12	215	233	V
2	* 2.346	41.52	Pk	31.9	-21	52.42	-	-	74	-21.58	215	233	V
3	* 2.39	29.66	RMS	32.1	-20.9	40.86	54	-13.14	-	-	215	233	V
4	* 2.369	31.09	RMS	32	-20.9	42.19	54	-11.81	-	-	215	233	V

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

Pk - Peak detector

RMS - RMS detection



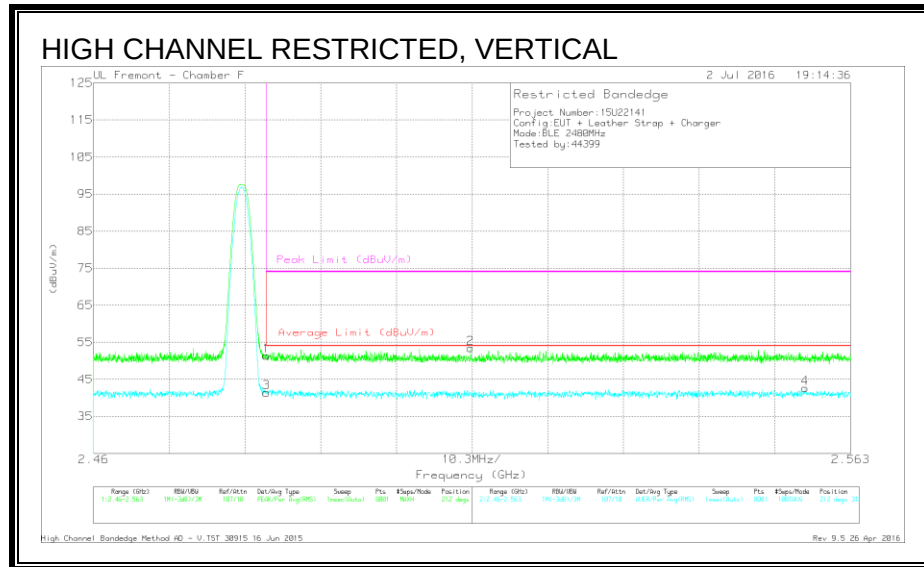
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fitr/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	38.95	Pk	32.3	-21	50.25	-	-	74	-23.75	141	239	H
2	2.534	41.6	Pk	32.2	-20.8	53	-	-	74	-21	141	239	H
3	* 2.484	28.99	RMS	32.3	-21	40.29	54	-13.71	-	-	141	239	H
4	2.518	31.36	RMS	32.3	-21	42.66	54	-11.34	-	-	141	239	H

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

Pk - Peak detector

RMS - RMS detection



DATA

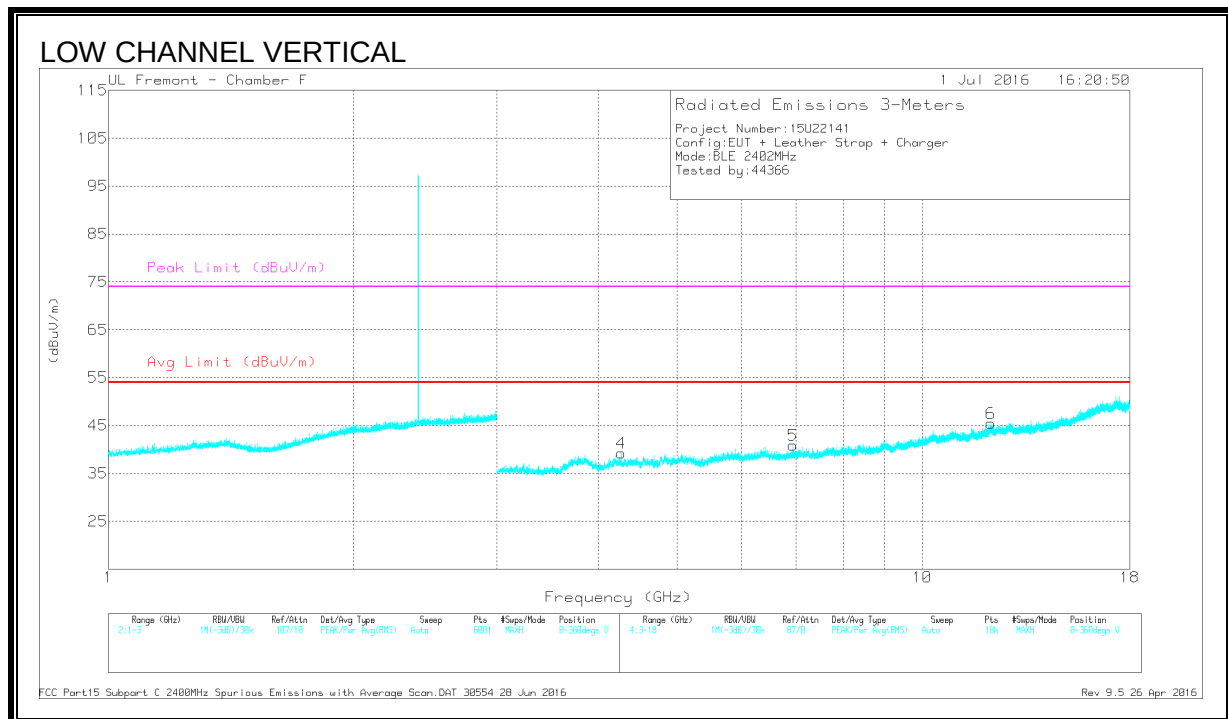
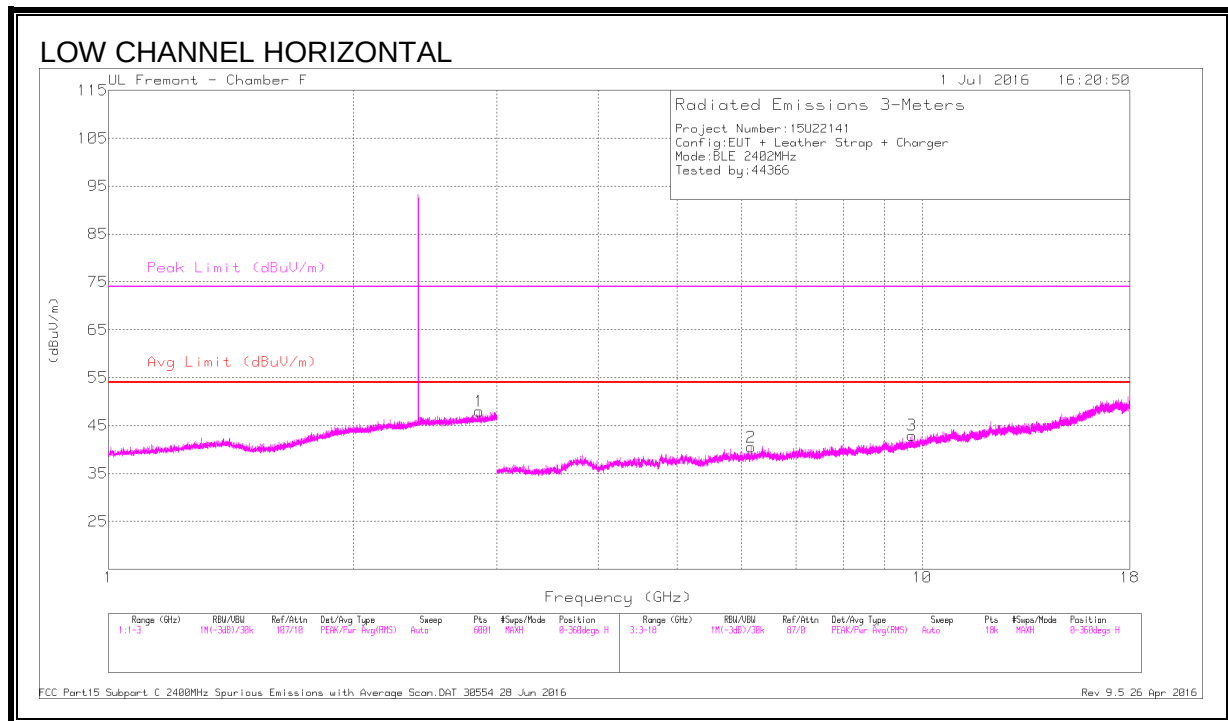
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.05	Pk	32.3	-21	51.35	-	-	74	-22.65	212	318	V
2	2.511	42.12	Pk	32.3	-21	53.42	-	-	74	-20.58	212	318	V
3	* 2.484	30.15	RMS	32.3	-21	41.45	54	-12.55	-	-	212	318	V
4	2.557	31.33	RMS	32.2	-20.9	42.63	54	-11.37	-	-	212	318	V

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

Pk - Peak detector

RMS - RMS detection

8.3.2. HARMONICS AND SPURIOUS EMISSIONS



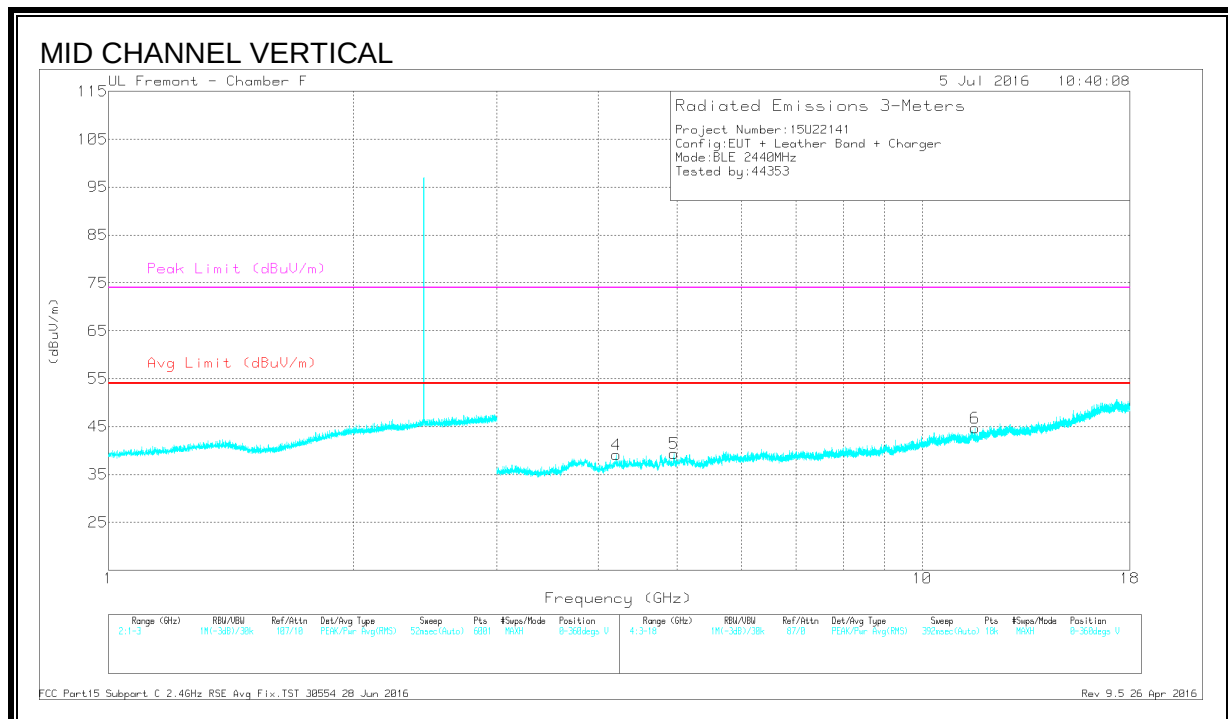
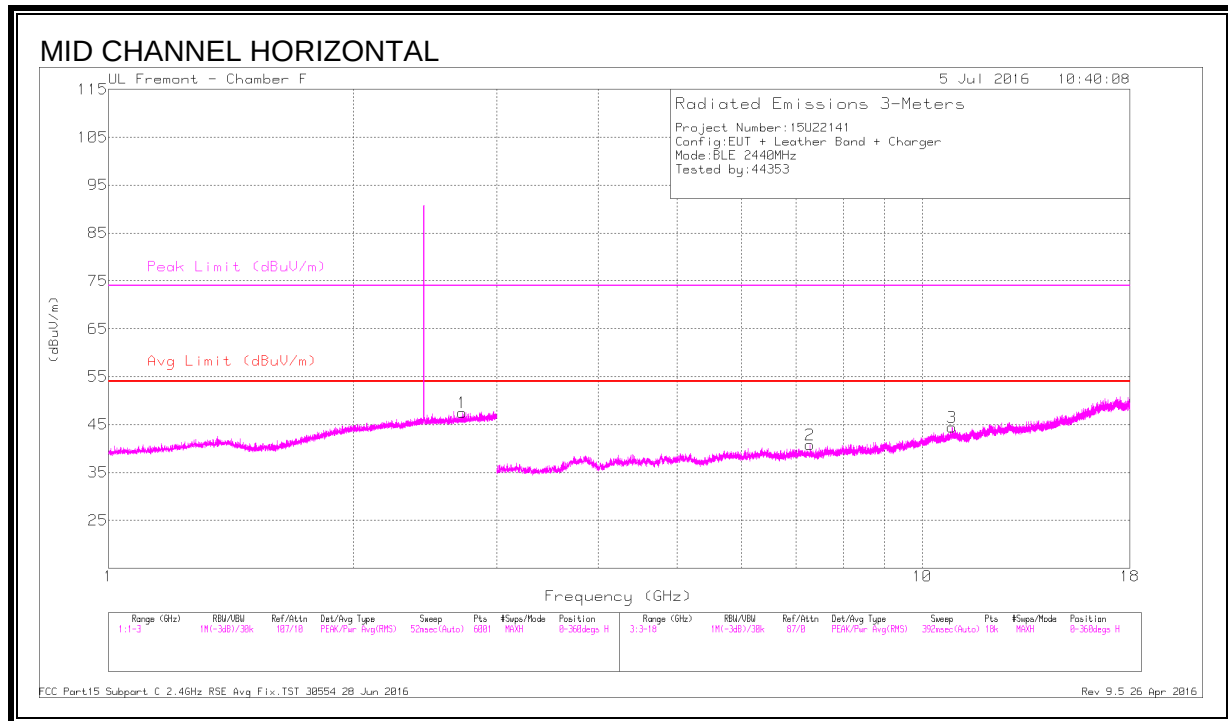
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.853	41.26	PK2	32.6	-20.3	53.56	-	-	74	-20.44	9	257	H
	* 2.855	30.09	MAv1	32.6	-20.3	42.39	54	-11.61	-	-	9	257	H
2	6.165	37.56	PK2	35.4	-27.2	45.76	-	-	-	-	24	218	H
	6.166	27.04	MAv1	35.4	-27.2	35.24	-	-	-	-	24	218	H
3	9.72	33.82	PK2	36.7	-22.2	48.32	-	-	-	-	31	187	H
	9.722	23.56	MAv1	36.7	-22.2	38.06	-	-	-	-	31	187	H
4	* 4.269	38.22	PK2	33.7	-28.5	43.42	-	-	74	-30.58	24	179	V
	* 4.268	27.52	MAv1	33.7	-28.4	32.82	54	-21.18	-	-	24	179	V
5	6.941	36.79	PK2	35.5	-26.4	45.89	-	-	-	-	53	194	V
	6.942	26.61	MAv1	35.5	-26.4	35.71	-	-	-	-	53	194	V
6	* 12.157	34.16	PK2	38.9	-21.4	51.66	-	-	74	-22.34	75	234	V
	* 12.157	23.91	MAv1	38.9	-21.4	41.41	54	-12.59	-	-	75	234	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



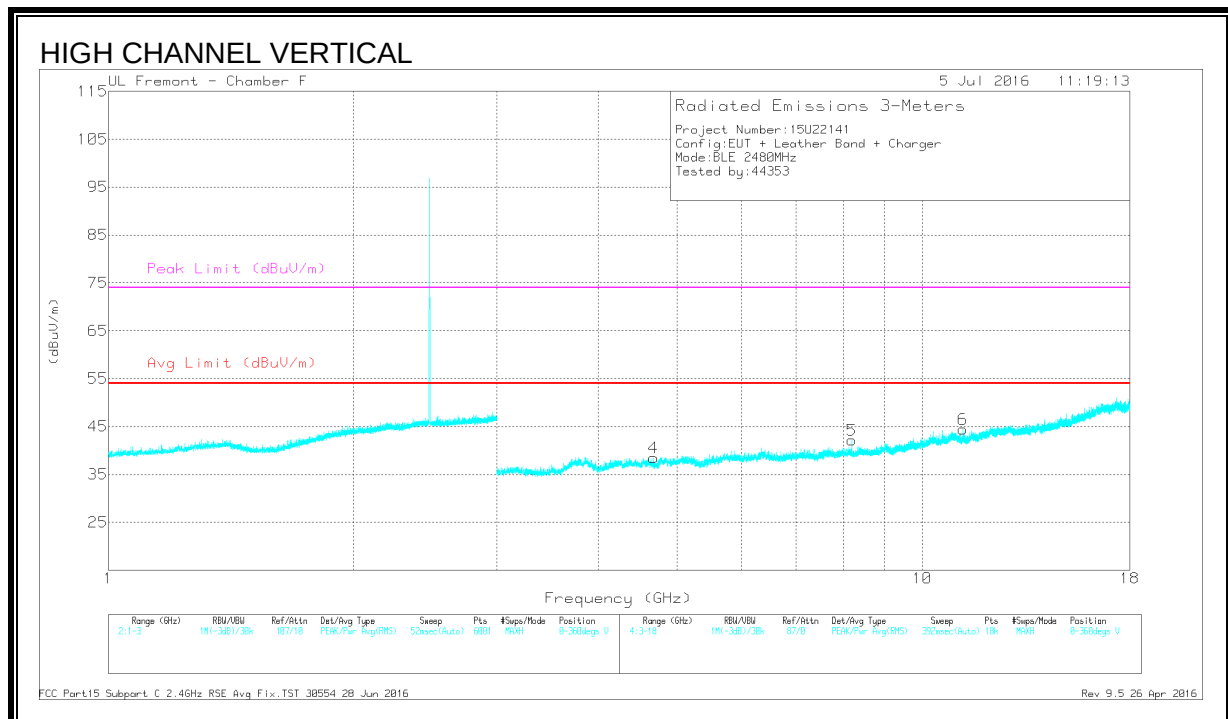
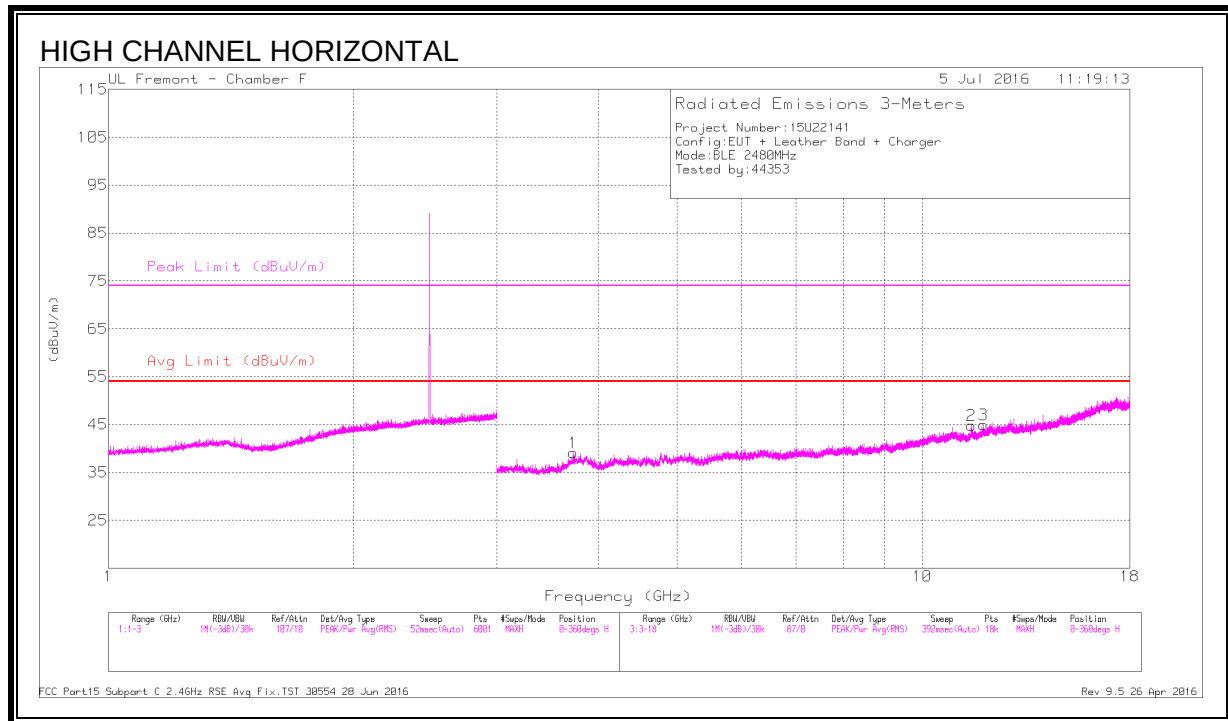
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.721	41.55	PK2	32.4	-20.5	53.45	-	-	74	-20.55	220	137	H
	* 2.722	30.84	MAv1	32.4	-20.6	42.64	54	-11.36	-	-	220	137	H
2	* 7.282	36.63	PK2	35.5	-26.5	45.63	-	-	74	-28.37	329	180	H
	* 7.282	26.95	MAv1	35.5	-26.5	35.95	54	-18.05	-	-	329	180	H
3	* 10.885	33.09	PK2	37.8	-21.6	49.29	-	-	74	-24.71	42	210	H
	* 10.883	23.36	MAv1	37.8	-21.6	39.56	54	-14.44	-	-	42	210	H
4	* 4.207	37.36	PK2	33.7	-27.9	43.16	-	-	74	-30.84	177	284	V
	* 4.207	27.39	MAv1	33.7	-27.9	33.19	54	-20.81	-	-	177	284	V
5	* 4.953	38.5	PK2	34.1	-28.5	44.1	-	-	74	-29.9	238	168	V
	* 4.95	28.28	MAv1	34.1	-28.5	33.88	54	-20.12	-	-	238	168	V
6	* 11.609	33.56	PK2	38.2	-22	49.76	-	-	74	-24.24	159	202	V
	* 11.608	23.46	MAv1	38.2	-21.9	39.76	54	-14.24	-	-	159	202	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 T344 (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	* 3.728	38.9	PK2	33.4	-29.3	43	-	-	74	-31	39	100	H
	* 3.726	28.63	MAv1	33.4	-29.3	32.73	54	-21.27	-	-	39	100	H
2	* 11.502	34.1	PK2	38.1	-21.2	51	-	-	74	-23	155	146	H
	* 11.501	23.43	MAv1	38.1	-21.2	40.33	54	-13.67	-	-	155	146	H
3	* 11.903	33.38	PK2	38.6	-21.7	50.28	-	-	74	-23.72	109	187	H
	* 11.903	23.77	MAv1	38.6	-21.7	40.67	54	-13.33	-	-	109	187	H
5	* 8.195	35.55	PK2	35.8	-24.8	46.55	-	-	74	-27.45	322	256	V
	* 8.196	24.78	MAv1	35.8	-24.8	35.78	54	-18.22	-	-	322	256	V
4	* 4.679	38.95	PK2	34.2	-28.9	44.25	-	-	74	-29.75	231	322	V
	* 4.677	28.41	MAv1	34.2	-29	33.61	54	-20.39	-	-	231	322	V
6	* 11.229	33.6	PK2	37.9	-21.4	50.1	-	-	74	-23.9	97	128	V
	* 11.228	23.07	MAv1	37.9	-21.5	39.47	54	-14.53	-	-	97	128	V

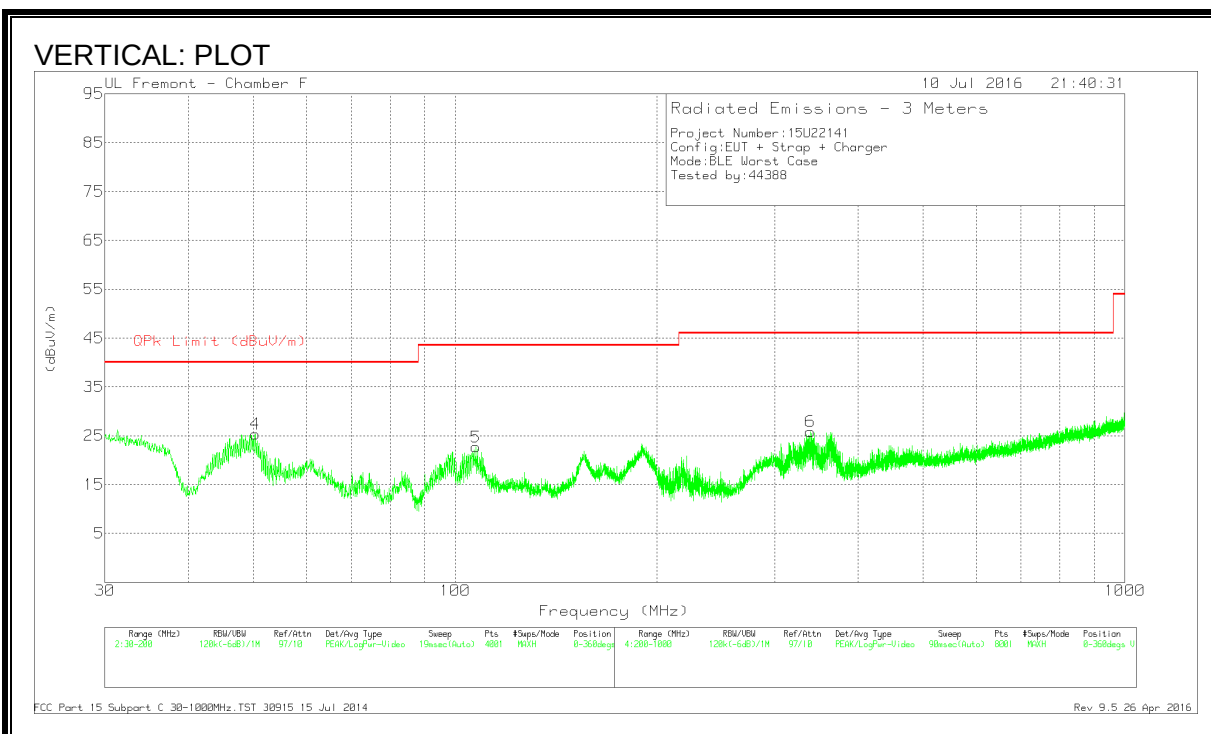
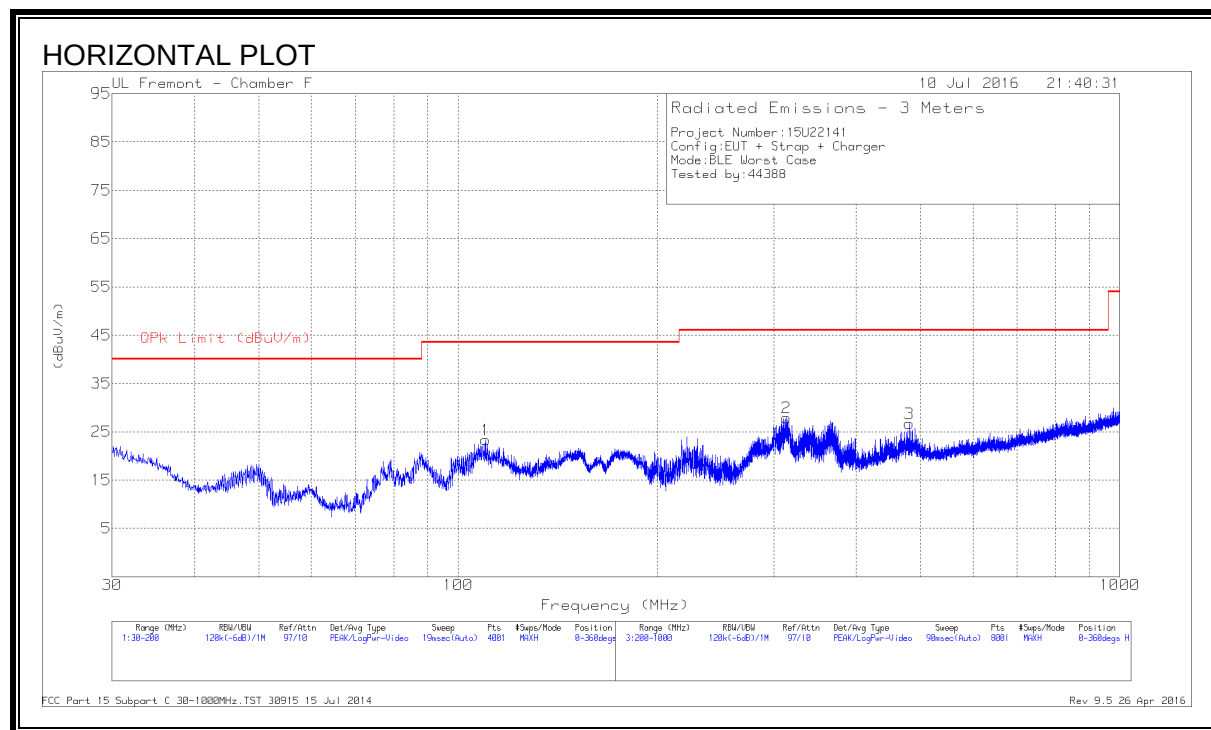
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

8.5. WORST-CASE BELOW 1 GHz

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



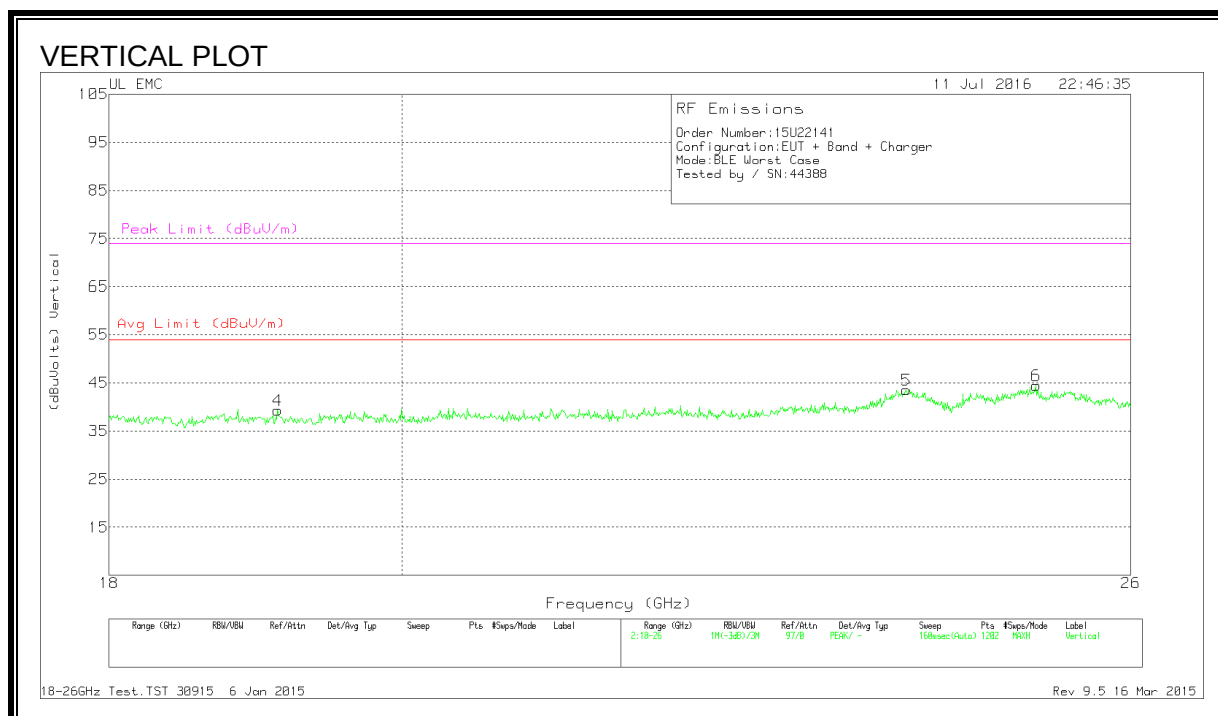
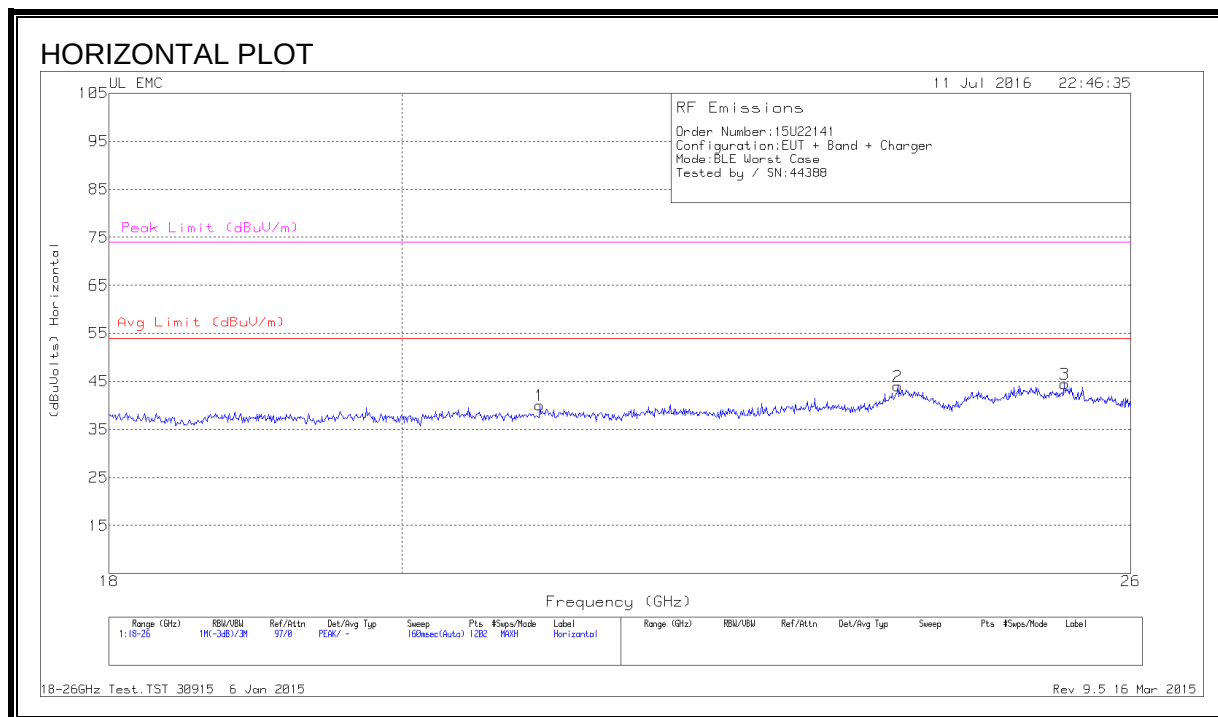
DATA

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	* 110.07	38.01	Pk	16.4	-31.1	23.31	43.52	-20.21	0-360	299	H
4	50.315	45.17	Pk	11.8	-31.6	25.37	40	-14.63	0-360	100	V
5	107.435	37.91	Pk	15.9	-31.1	22.71	43.52	-20.81	0-360	100	V
2	313.5	40	Pk	17.7	-29.8	27.9	46.02	-18.12	0-360	99	H
3	480.9	34.07	Pk	21.7	-29.1	26.67	46.02	-19.35	0-360	199	H
6	339.3	37.48	Pk	18.1	-29.7	25.88	46.02	-20.14	0-360	100	V

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

8.6. 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	21.017	41.8	Pk	33.2	-25.5	-9.5	40	54	-14	74	-34
2	23.908	43.4	Pk	34	-23.9	-9.5	44	54	-10	74	-30
3	25.387	44	Pk	34.3	-24.3	-9.5	44.5	54	-9.5	74	-29.5
4	19.126	40.53	Pk	32.7	-24.4	-9.5	39.33	54	-14.66	74	-34.66
5	23.982	43.3	Pk	34	-24.3	-9.5	43.5	54	-10.5	74	-30.5
6	25.127	44.3	Pk	34.3	-24.6	-9.5	44.5	54	-9.5	74	-29.5

Pk - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

RESULTS

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