FCC 47 CFR PART 15 SUBPART C
ISED CANADA RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

FOR

WIRELESS PLUG LOAD

MODEL NUMBER: CPLC-JB-CWC

FCC ID: 2ACQ6-PLM
IC: 11481A-PLM

REPORT NUMBER: R12005379-E1

ISSUE DATE: 2018-01-29

Prepared for
CREE INC.
4600 SILICON DRIVE
DURHAM, NC 27703-8475, USA

Prepared by
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NVLAP TESTING

NVLAP LAB CODE 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	2017-12-21	Initial Issue	Brian T. Kiewra
2	2018-01-29	Performed Radiated Emissions and AC Mains Emissions again with all ports and control lines populated.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Cree Inc.
4600 Silicon Drive
Durham, NC 27703-8475 USA

EUT DESCRIPTION: Wireless Plug Load Controller

MODEL: CPLC-JB-CWC

SERIAL NUMBER: Non-Serialized

DATE TESTED: 2017-11-27 to 2018-01-26

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
ISED CANADA RSS-247 Issue 2	Pass
ISED CANADA RSS-GEN Issue 4	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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, or any agency of the U.S. Government.

Approved & Released
For UL LLC By:

Jeffrey Moser
Operations Leader
UL – Consumer Technology Division

Prepared By:

Brian T. Kiewra
Project Engineer
UL – Consumer Technology Division

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 2, and KDB 5580704 D01 v04.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560
☐ Chamber NORTH
☒ Chamber SOUTH

The onsite chambers are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY	Required by standard
Occupied Channel Bandwidth	2.00%	±5 %
RF output power, conducted	1.3 dB	±1,5 dB
Power Spectral Density, conducted	2.47 dB	±3 dB
Unwanted Emissions, conducted	2.94 dB	±3 dB
All emissions, radiated	5.36 dB	±6 dB
Temperature	2.26 °C	±3 °C
Supply voltages	2.40%	±3 %
Time	3.39%	±5 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless plug load controller that contains an 802.15.4 transceiver.

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	4.23	2.65

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal PIFA antenna, with a maximum gain of -2.93 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was:.

For CH11 (2405MHz): Firmware name: “128RFR2_MOD_11.hex”, Rev0
For CH18 (2440MHz): Firmware name: “128RFR2_MOD_18.hex”, Rev0
For CH25 (2475MHz): Firmware name: “128RFR2_MOD_25.hex”, Rev0
For CH26 (2480MHz): Firmware name: “TAL_PRBS_CH26_1P2_DBM_FILT.hex”,

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions, 1-18GHz were performed with EUT set to transmit at low, mid, and high channels.

Radiated emissions (0.009-30MHz and above 18GHz) and power line conducted emissions were 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-Axis orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z-Axis orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Occupancy Sensor	CREE	WL391V01728	LAA01341X0002A0	NA
DC Power meter	Circuit Specialists	CS13005X5	NA	NA

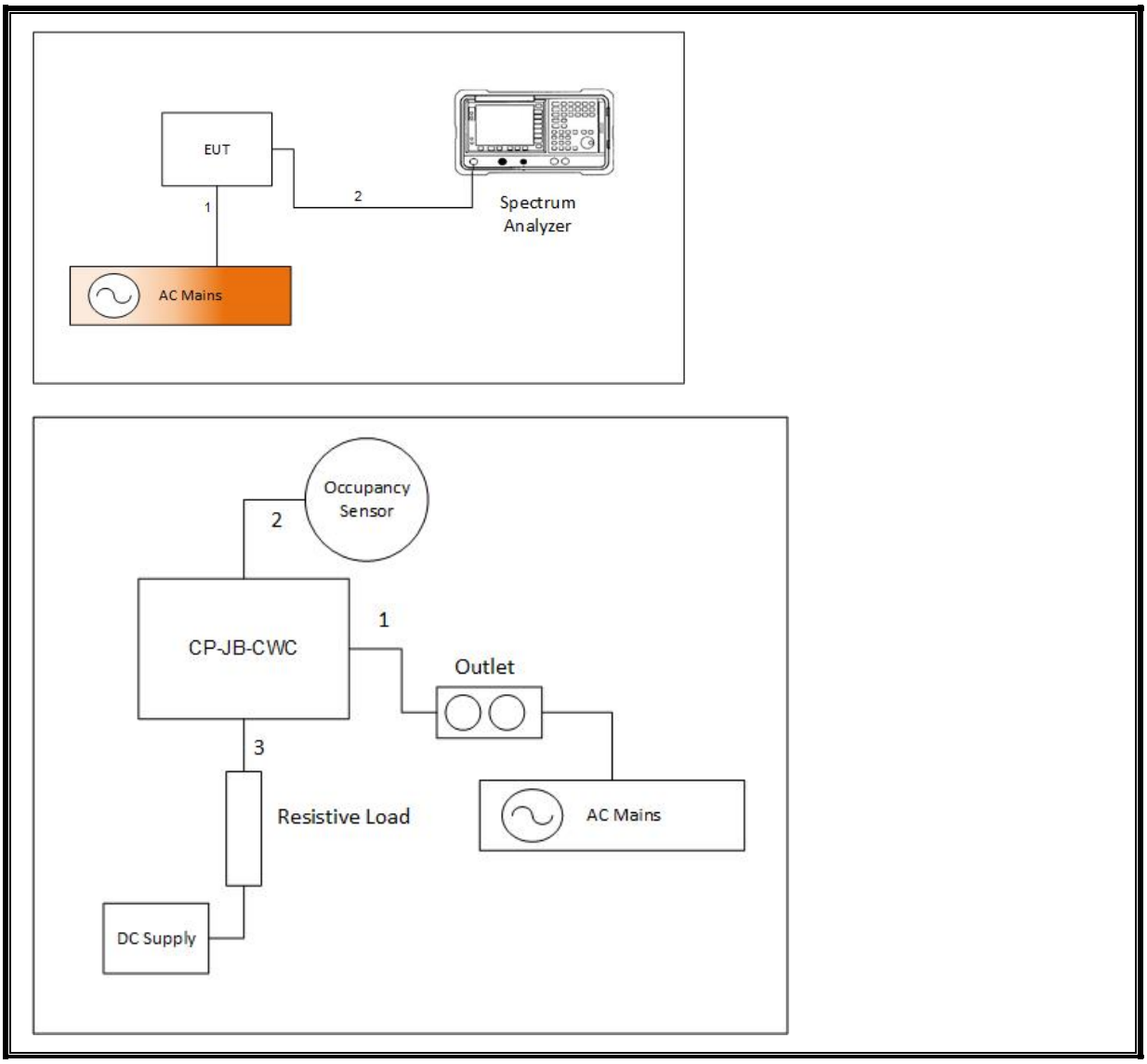
I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	3 conductor	>3m	AC Mains
2	ENET	1	RJ45	ENET	<3m	Connected to occ. sensor
3	CC0	1	Quick connect	Copper conductor	>3m	Connected to resistive load for test

TEST SETUP

The EUT is installed as a standalone device.

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 Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0059	Active Loop Antenna	ETS-Lindgren	6502	2017-06-05	2018-06-05
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2017-06-15	2018-06-15
1-18 GHz					
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2017-04-05	2018-04-05
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2017-10-10	2018-10-10
Gain-Loss Chains					
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2017-09-15	2018-09-15
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2017-06-11	2018-06-11
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2017-12-31	2018-12-31
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2017-03-03	2018-03-03
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2017-04-10	2018-04-10
SA0026 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2017-02-17	2018-02-28
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 161024887	Environmental Meter	Fisher Scientific	15-077-963	2016-12-23	2018-12-23

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Conducted Room 1					
T177	Spectrum Analyzer	Agilent Technologies	E4446A	2017-03-30	2018-03-30
SN 161024885	Environmental Meter	Fisher Scientific	15-077-963	2016-12-23	2018-12-23
Additional Equipment used					
PWM001	RF Power Meter	Keysight Technologies	N1912A	2017-05-23	2018-05-23
PWS006	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2017-05-18	2018-05-18
MM0168	True RMS Multimeter	Agilent	U1232A	2017-10-25	2018-10-30

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL076	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3476-240	2017-06-12	2018-06-12
s/n 160938893	Environmental Meter	Fisher Scientific	14-650-118	2016-11-02	2018-11-02
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2017-08-22	2018-08-22
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2017-08-23	2018-08-23
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2017-06-12	2018-06-12
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Miscellaneous (if needed)					
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2017-08-22	2018-08-22

7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.0

6 dB BW: KDB 558074 D01 v04, Section 8.1.

99% Bandwidth: ANSI C63.10-2013, Sections 6.9.3

Output Power: KDB 558074 D01 v04, Section 9.1.3.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

AC Mains: ANSI C63.10:2013 Section 6.2

8. ANTENNA PORT TEST RESULTS

8.1. 802.15.4 MODE IN THE 2.4 GHz BAND

8.1.1. ON TIME, DUTY CYCLE

LIMITS

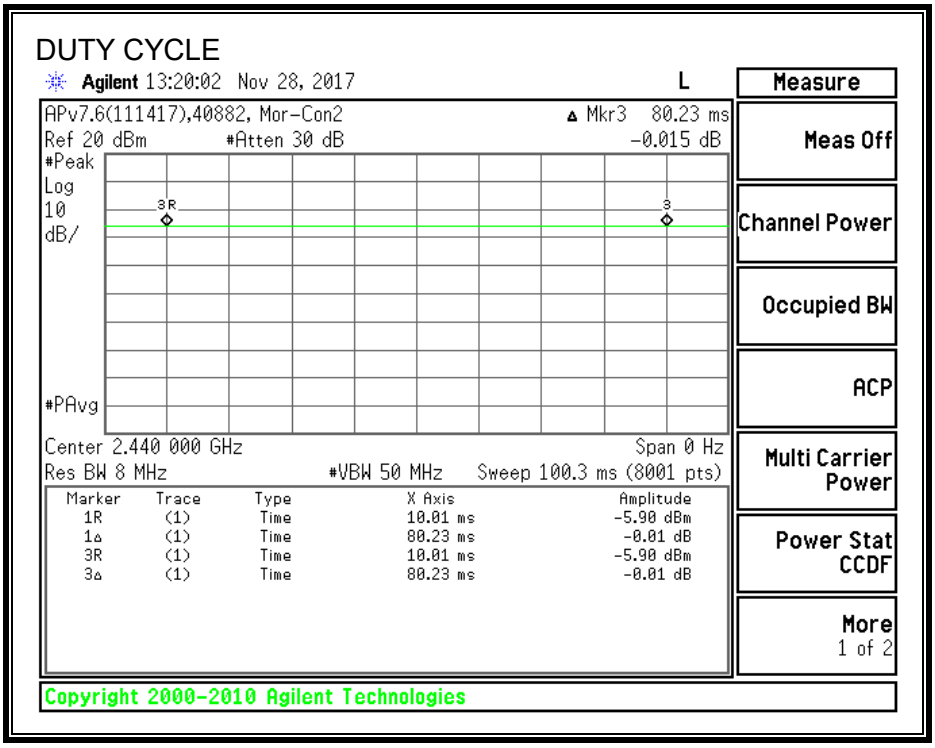
None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.15.4 Zigbee	80.230	80.230	1.000	100.00%	0.00



TEST INFORMATION
Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

8.1.2. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 5.2 (a)

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.

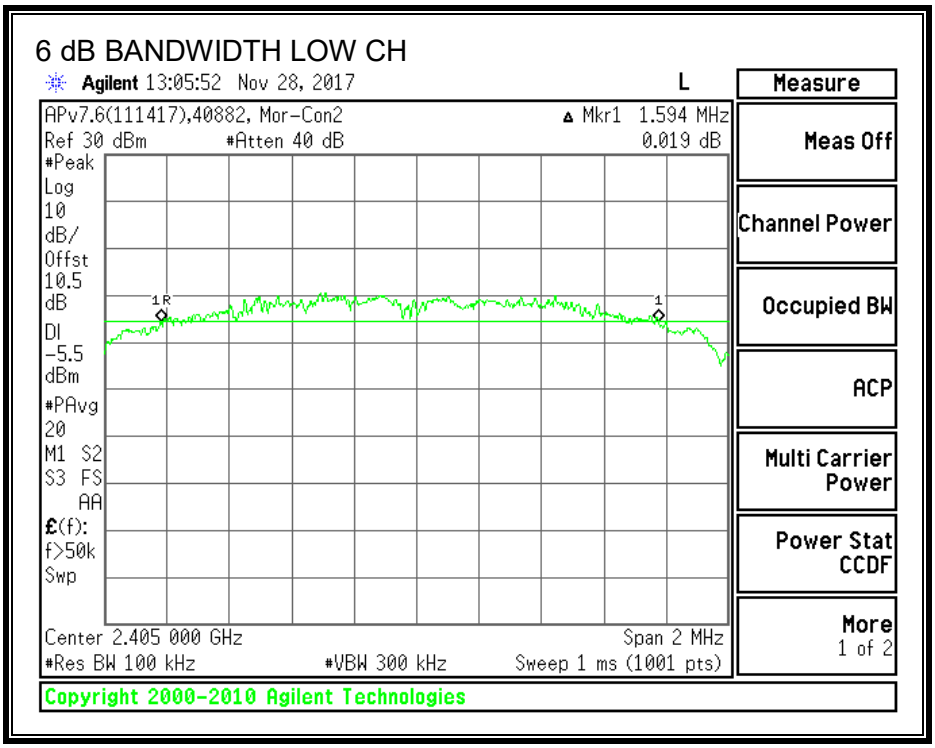
RESULTS

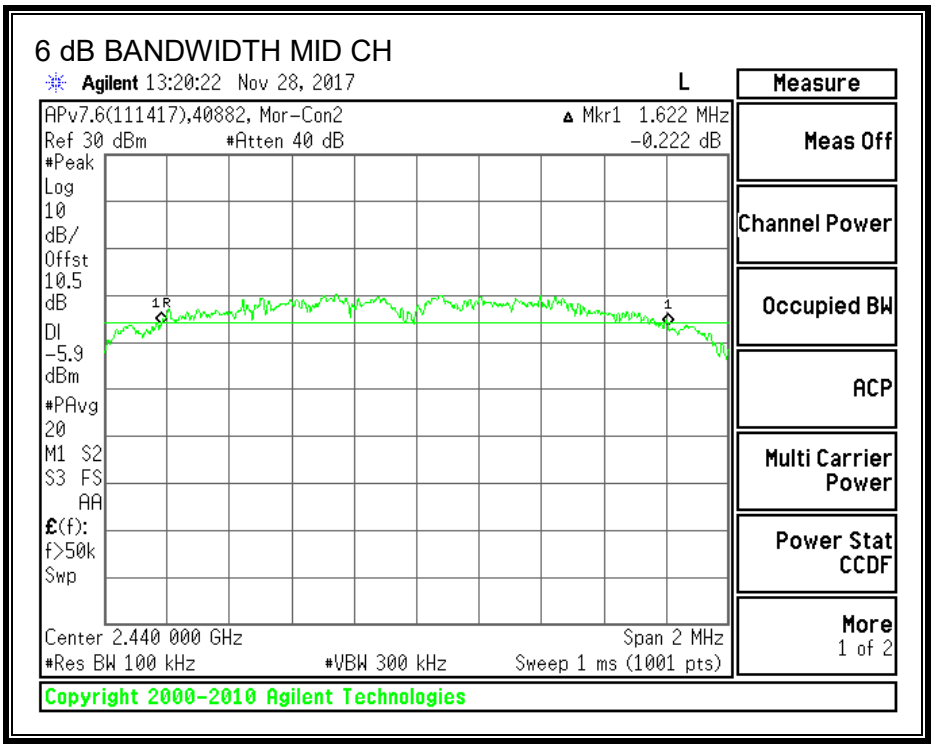
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.594	0.5
Middle	2440	1.622	0.5
High	2475	1.638	0.5
High	2480	1.248	0.5

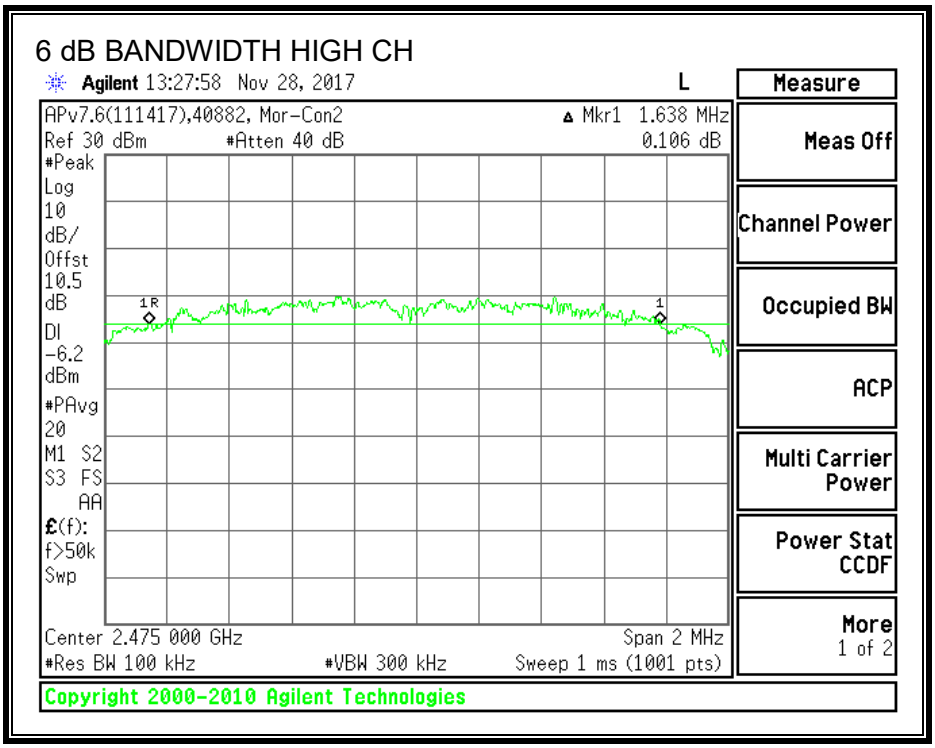
TEST INFORMATION

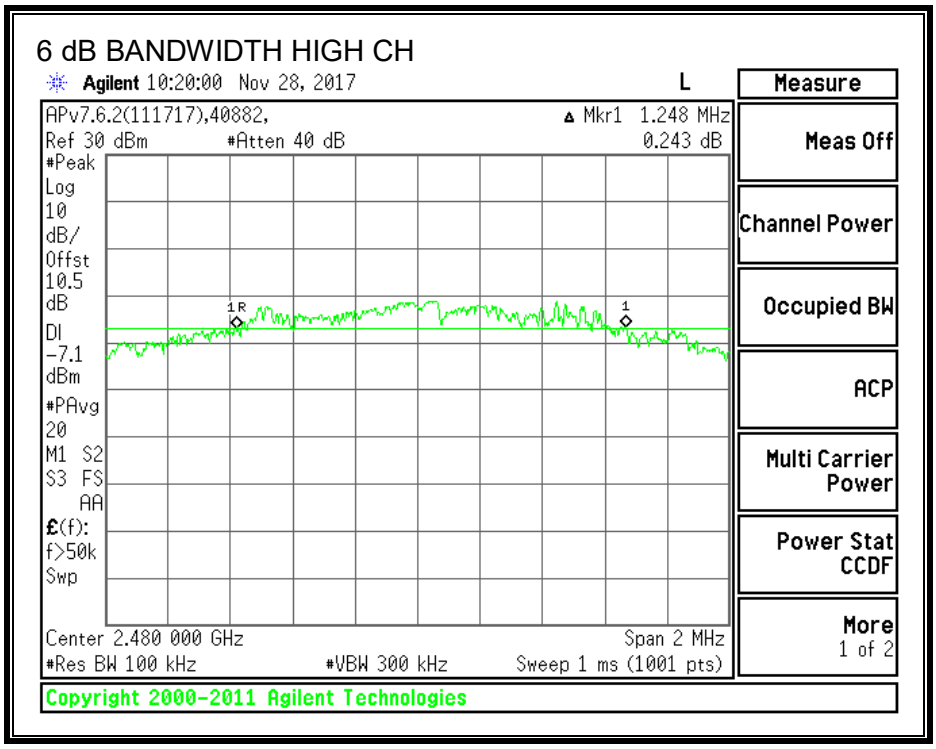
Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

6 dB BANDWIDTH









8.1.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

Tested per ANSI C63.10:2013 Section 6.9.3

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 5% 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.

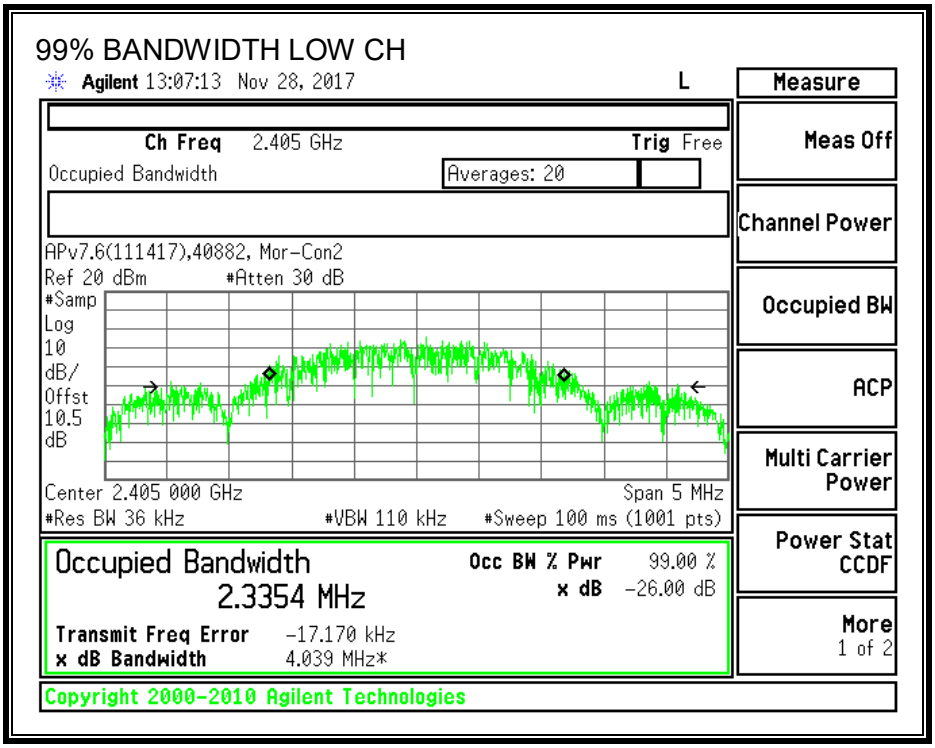
RESULTS

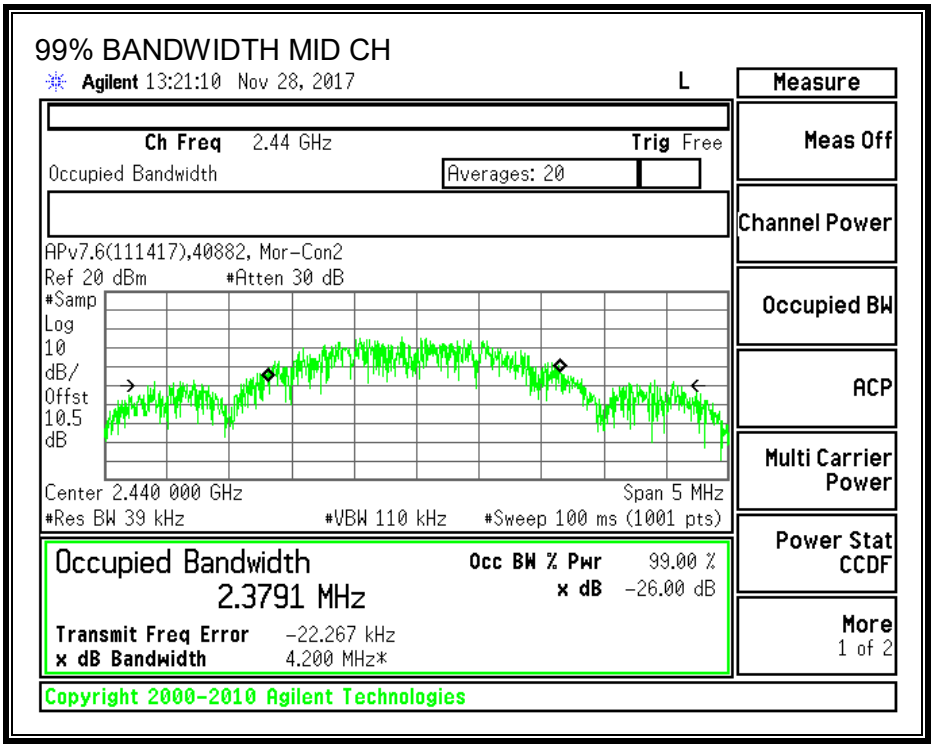
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.3354
Middle	2440	2.3791
High	2475	2.4344
High	2480	2.2788

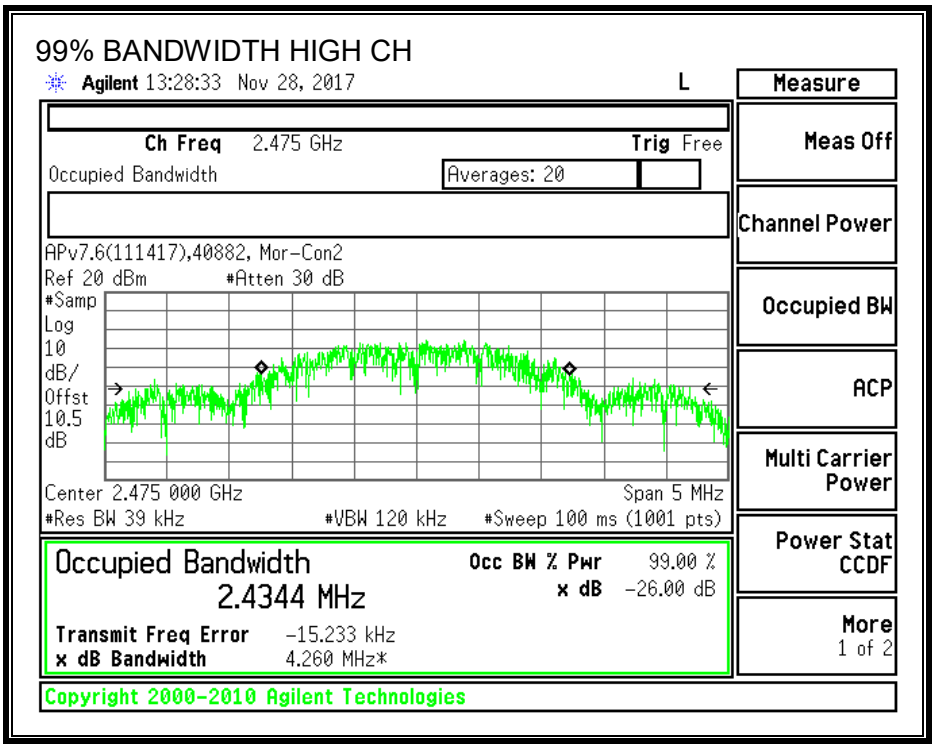
TEST INFORMATION

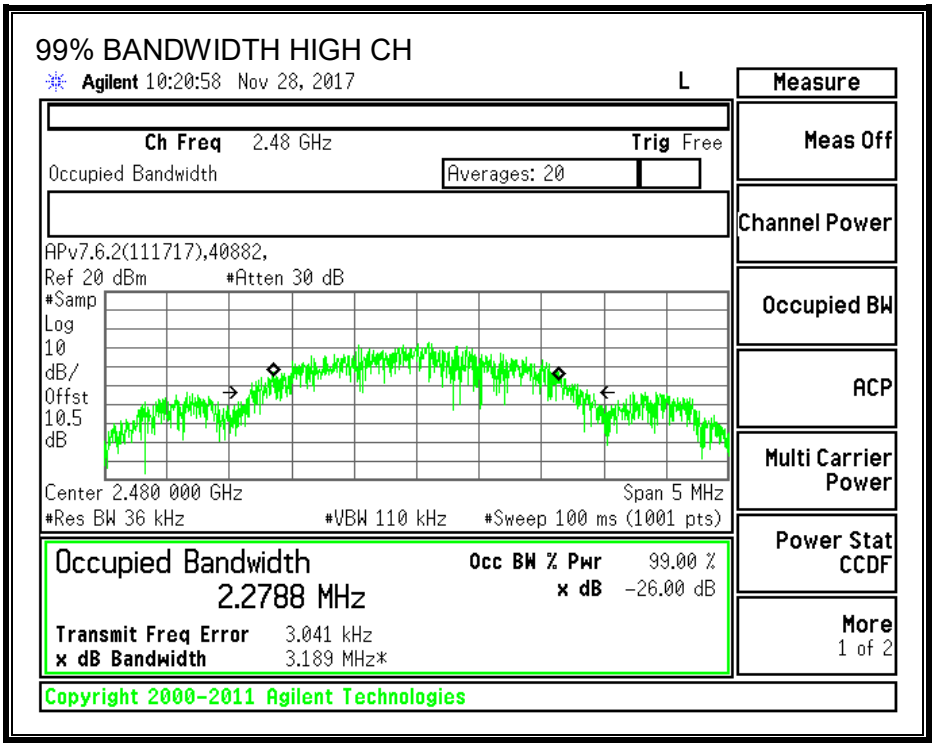
Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

99% BANDWIDTH









8.1.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 5.4 (d)

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	3.99	30	-26.01
Middle	2440	3.98	30	-26.02
High	2475	4.23	30	-25.77
High	2480	1.84	30	-28.16

TEST INFORMATION

Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

8.1.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2405	3.87
Middle	2440	3.85
High	2475	4.10
High	2480	1.62

TEST INFORMATION

Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

8.1.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 5.2 (b)

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

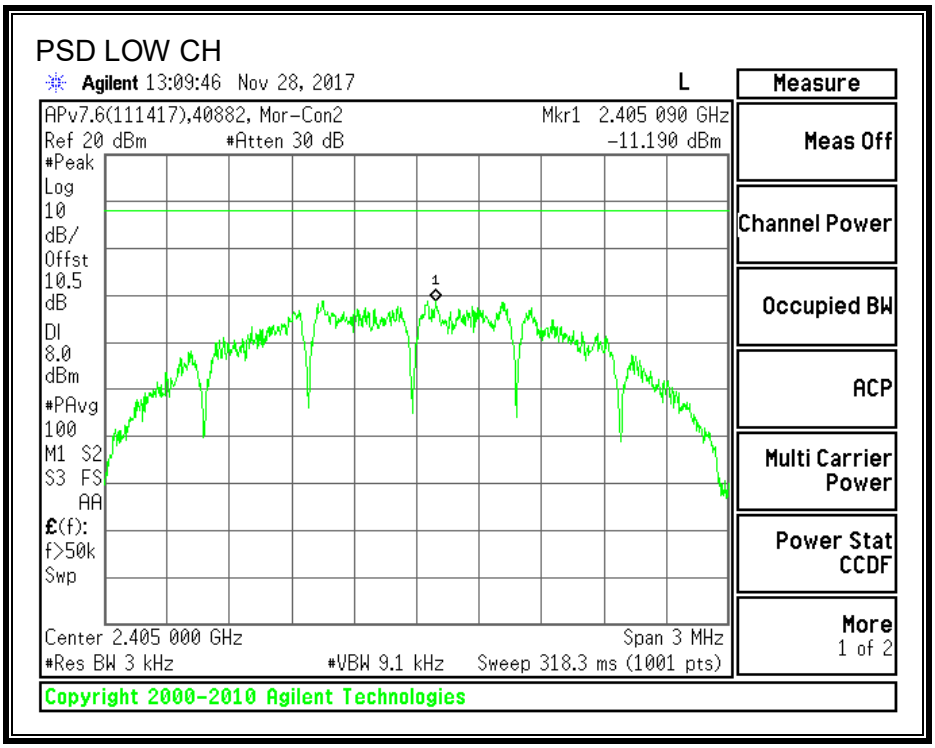
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-11.19	8	-19.19
Middle	2440	-10.14	8	-18.14
High	2475	-10.22	8	-18.22
High	2480	-13.33	8	-21.33

TEST INFORMATION

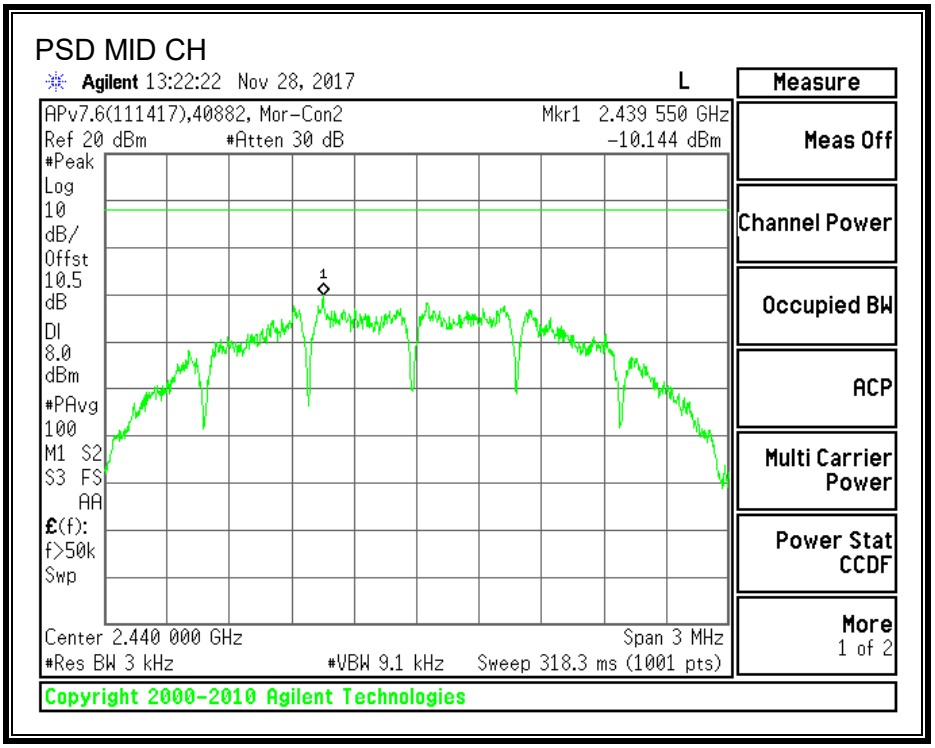
Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

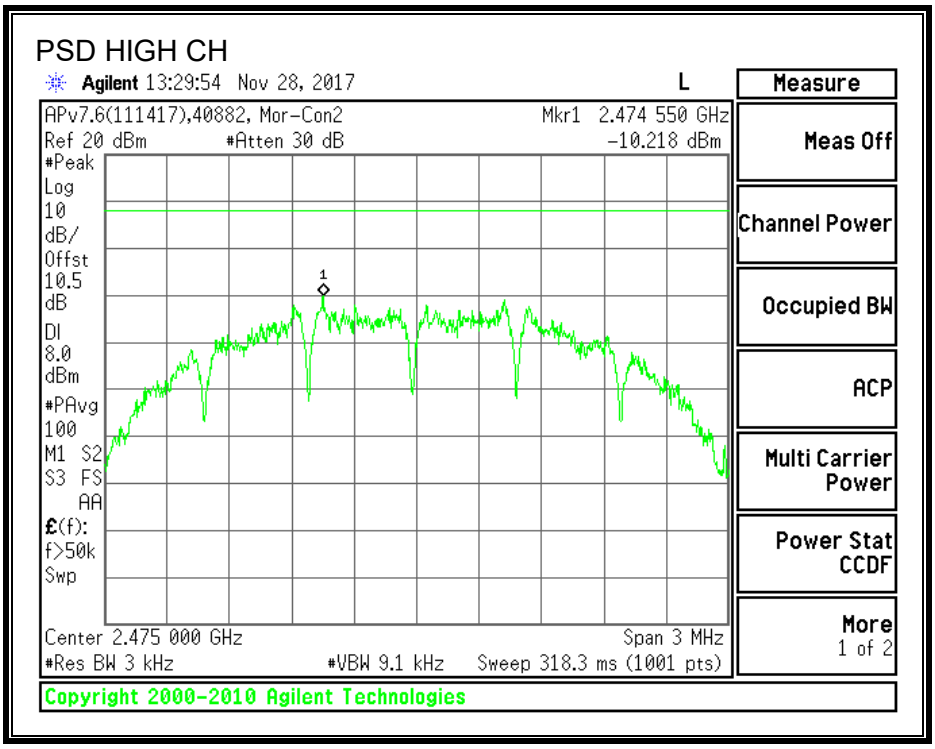
POWER SPECTRAL DENSITY

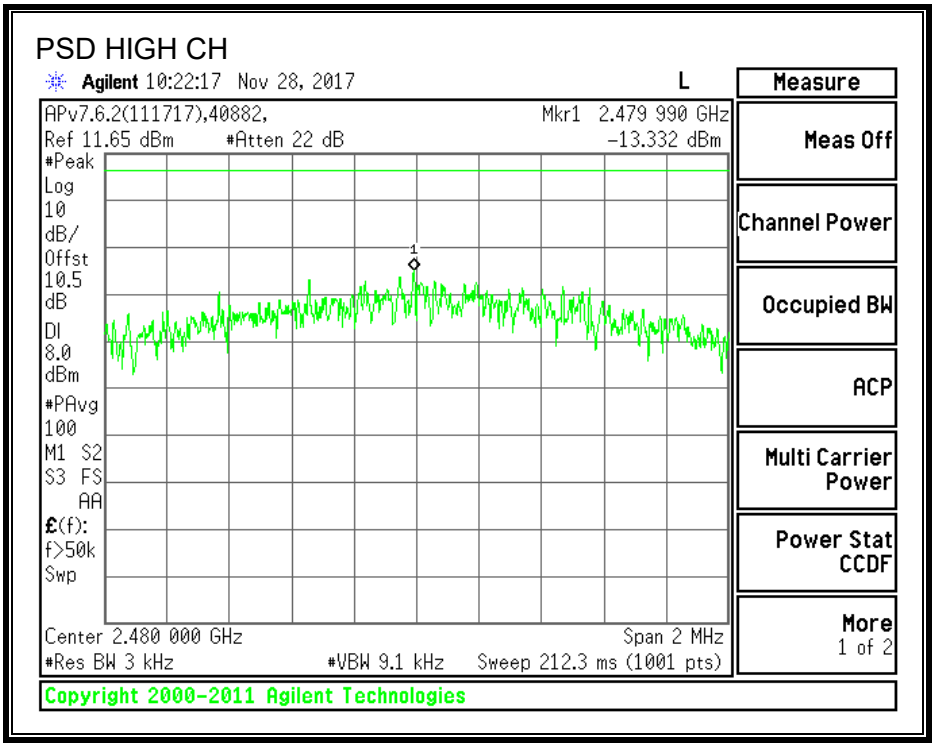
PSD LOW CH



PSD MID CH







8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 5.5

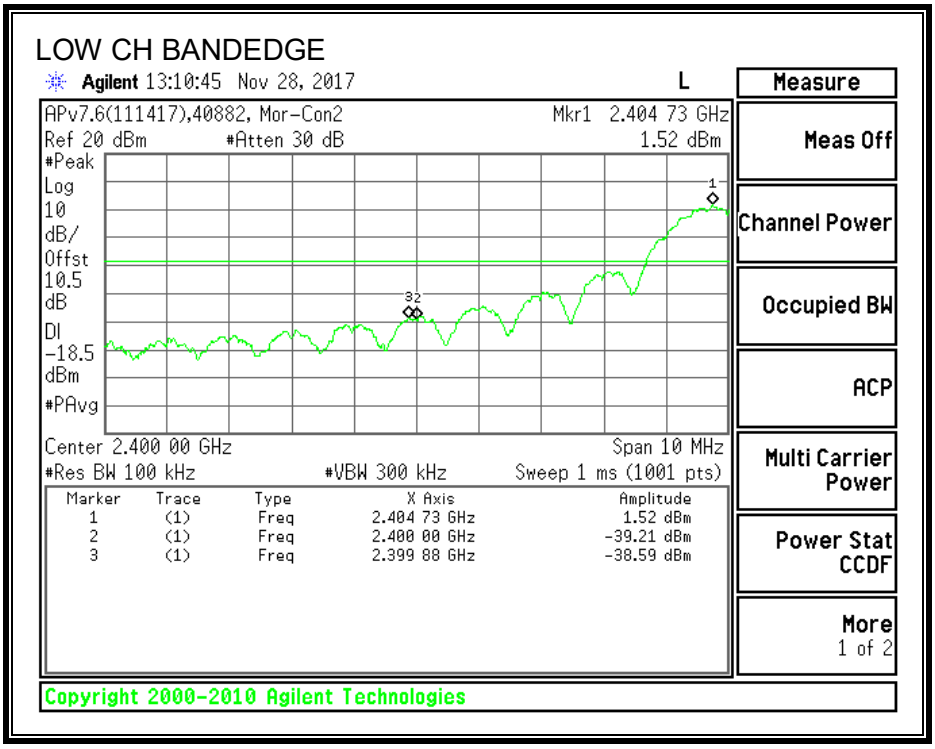
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

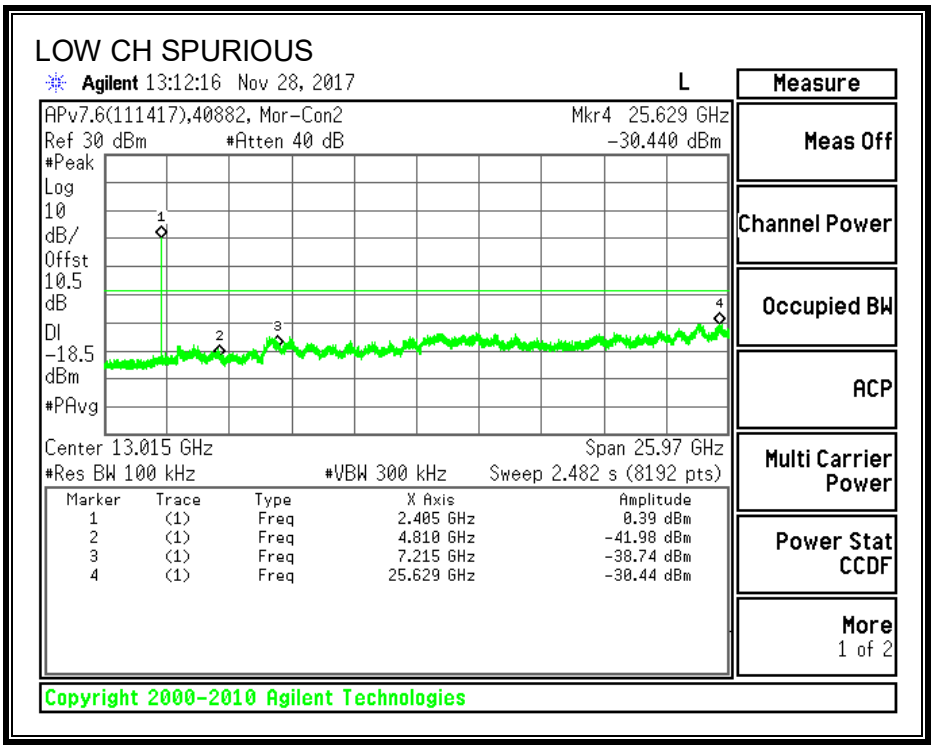
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

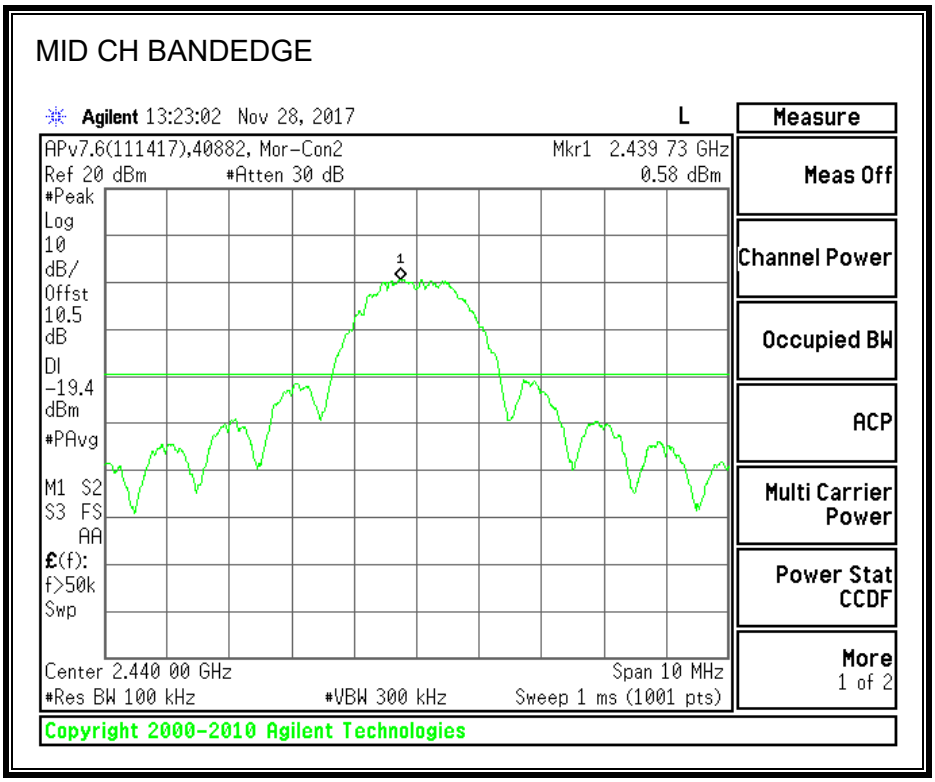
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

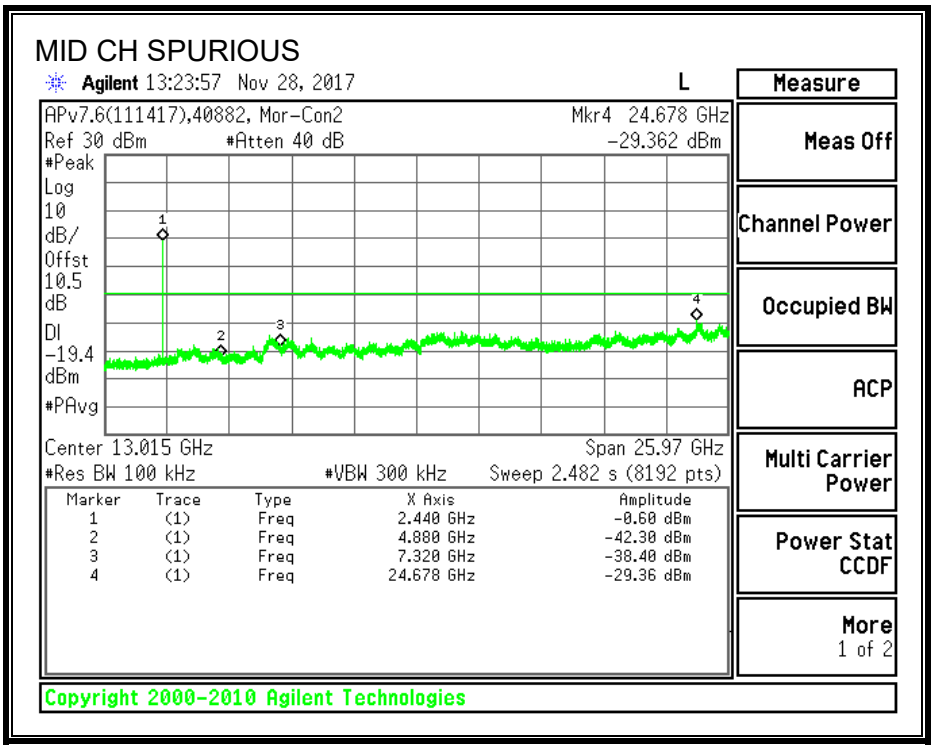
SPURIOUS EMISSIONS, LOW CHANNEL



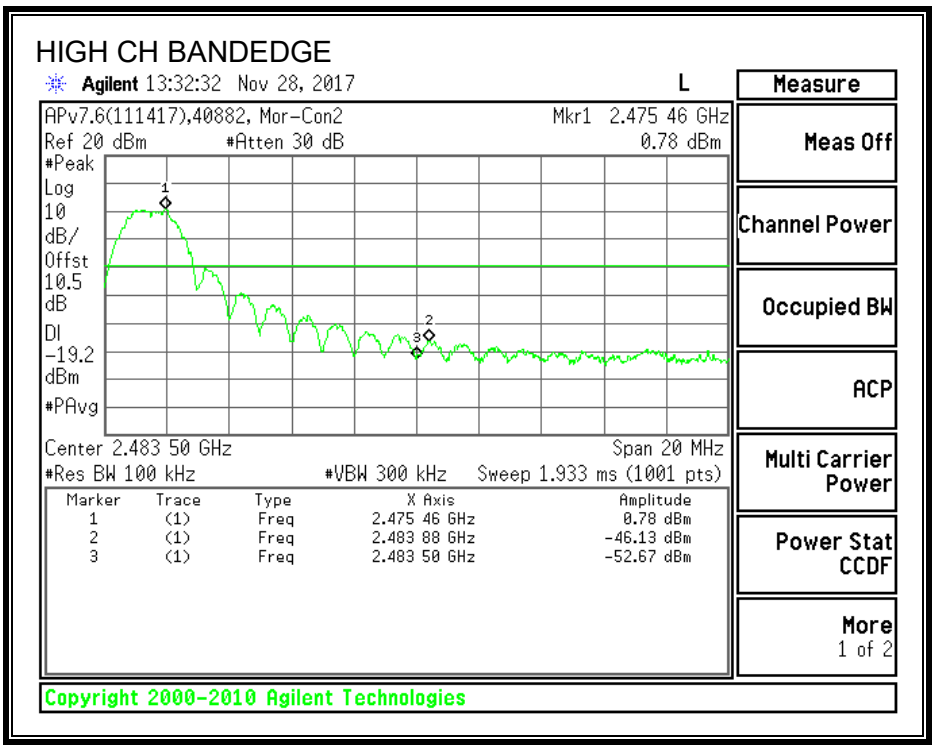


SPURIOUS EMISSIONS, MID CHANNEL

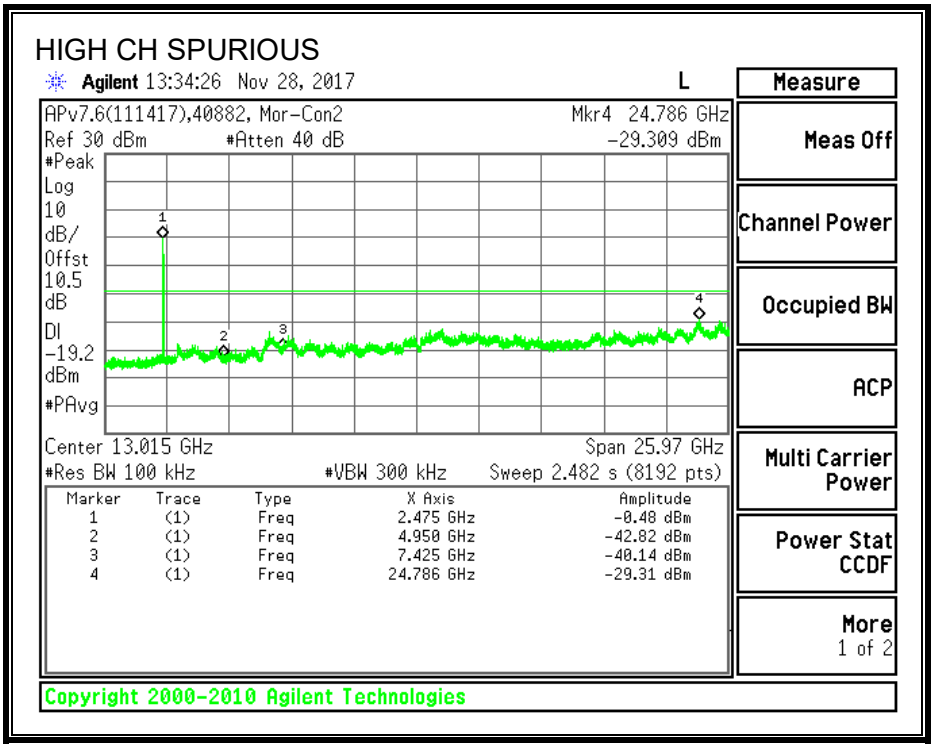




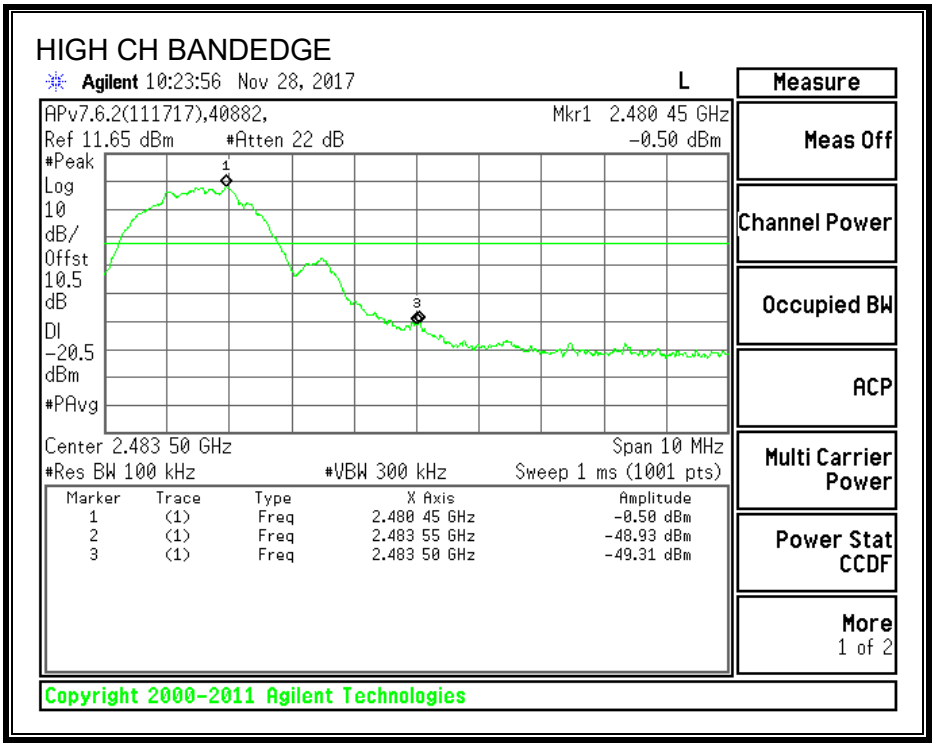
SPURIOUS EMISSIONS, HIGH CHANNEL

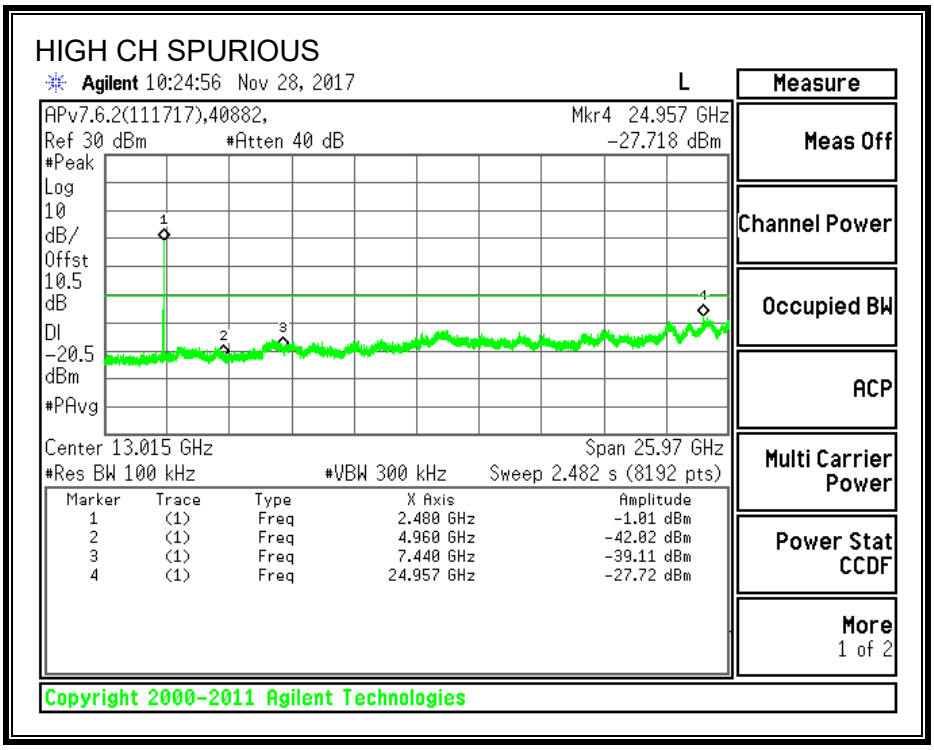


HIGH CH SPURIOUS



HIGH CH BANDEDGE





TEST INFORMATION

Test Date: 2017-11-28
Tested By: Jeffrey Cabrera

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
IC RSS-GEN Clause 8.9 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was RMS.

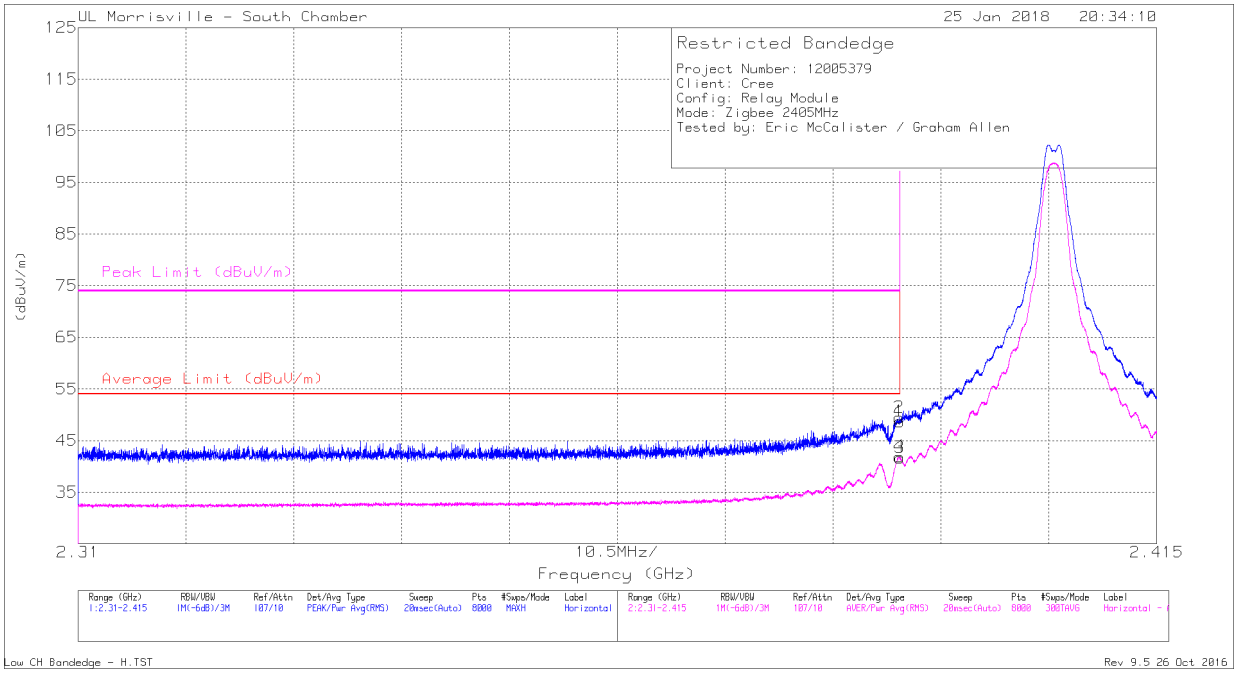
The spectrum from 1 to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. The spectrum from 9kHz to 1000MHz and 18 to 26GHz was investigated on the worst-case channel.

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.

9.2. TRANSMITTER ABOVE 1 GHz

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

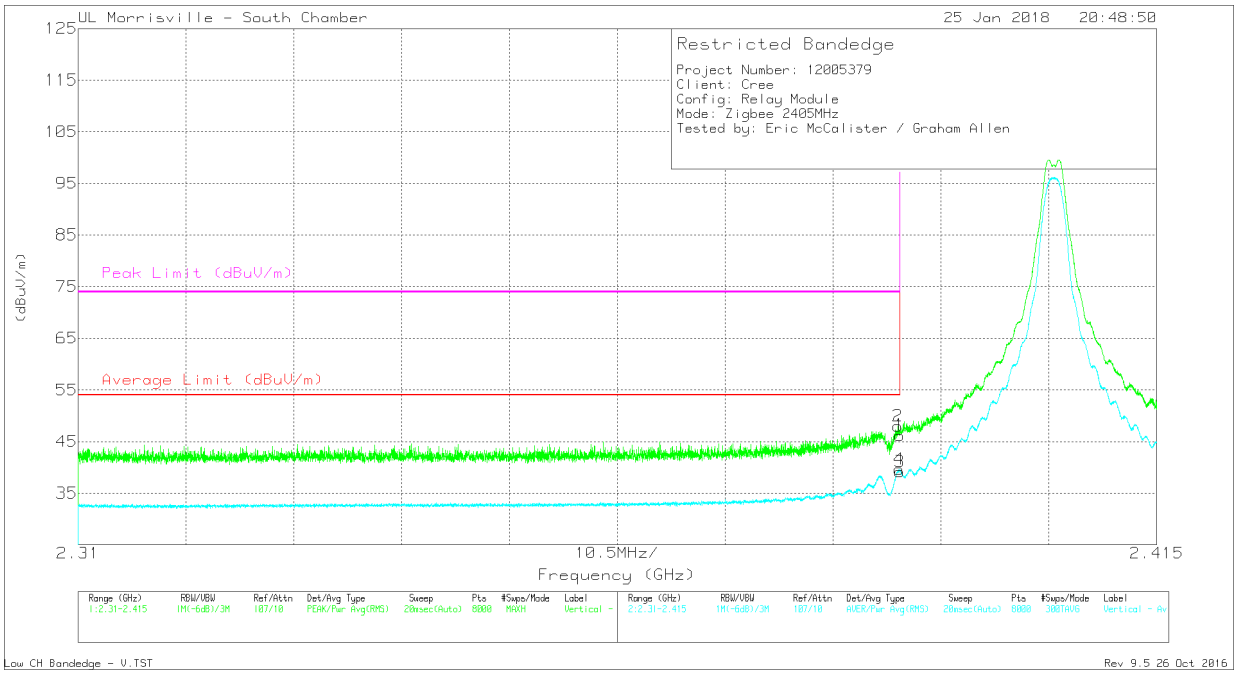
RESTRICTED BANDEDGE (2405 MHz, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/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	40.9	Pk	31.9	-24.1	48.7	-	-	74	-25.3	245	179	H
2	* 2.39	41.63	Pk	31.9	-24.1	49.43	-	-	74	-24.57	245	179	H
3	* 2.39	33.88	RMS	31.9	-24.1	41.68	54	-12.32	-	-	245	179	H
4	* 2.39	34.11	RMS	31.9	-24.1	41.91	54	-12.09	-	-	245	179	H

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

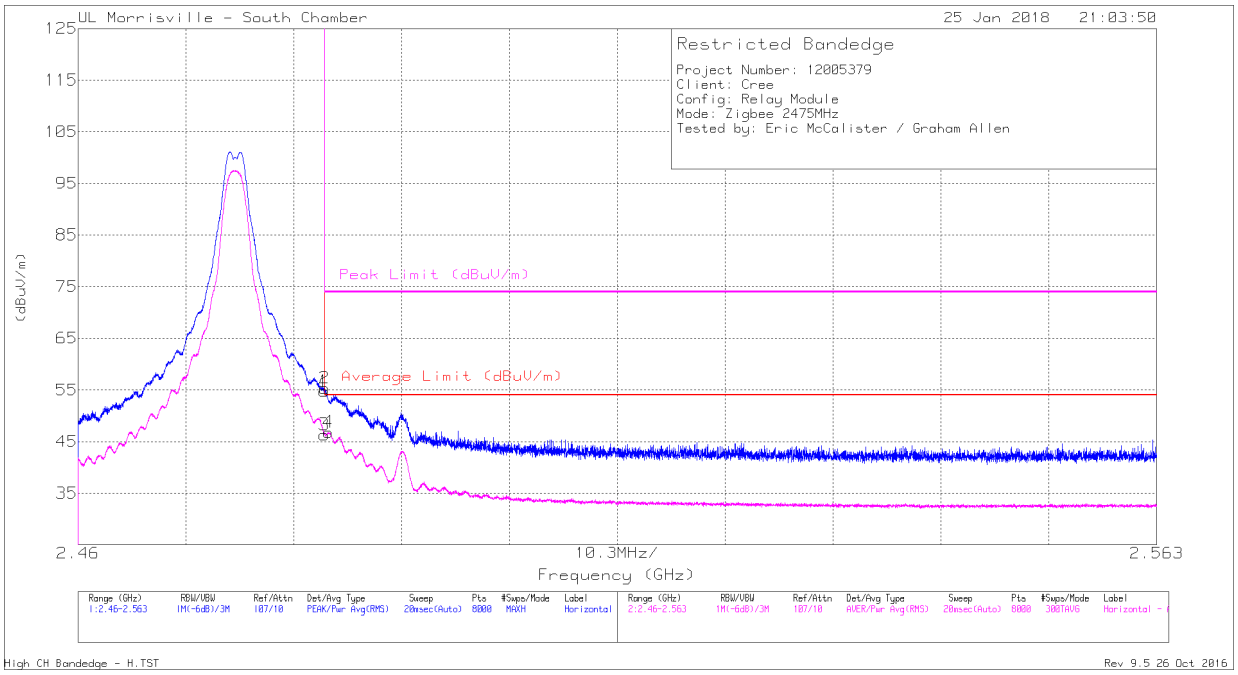
RESTRICTED BANDEDGE (2405 MHz, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/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	38.43	Pk	31.9	-24.1	46.23	-	-	74	-27.77	308	177	V
2	* 2.39	40.19	Pk	31.9	-24.1	47.99	-	-	74	-26.01	308	177	V
3	* 2.39	31.35	RMS	31.9	-24.1	39.15	54	-14.85	-	-	308	177	V
4	* 2.39	31.88	RMS	31.9	-24.1	39.68	54	-14.32	-	-	308	177	V

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

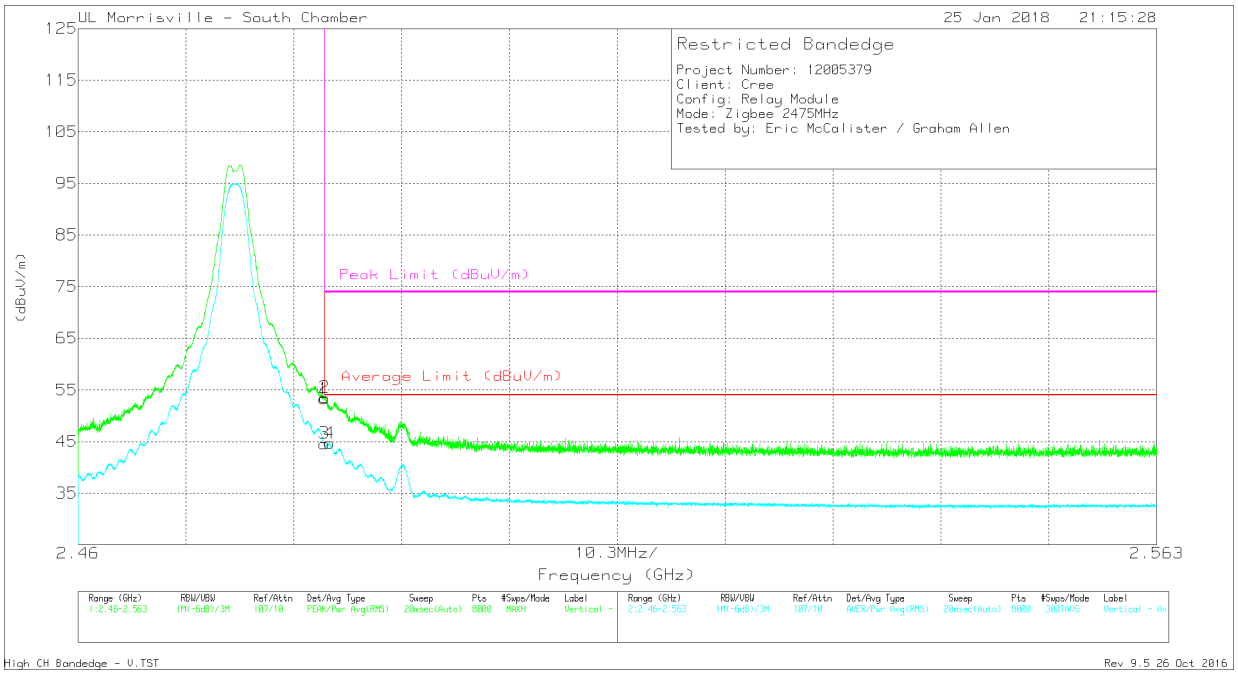
RESTRICTED BANDEDGE (2475 MHz, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/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	46.95	Pk	32.4	-24.6	54.75	-	-	74	-19.25	243	144	H
2	* 2.484	47.53	Pk	32.4	-24.6	55.33	-	-	74	-18.67	243	144	H
3	* 2.484	38.52	RMS	32.4	-24.6	46.32	54	-7.68	-	-	243	144	H
4	* 2.484	39.01	RMS	32.4	-24.6	46.81	54	-7.19	-	-	243	144	H

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

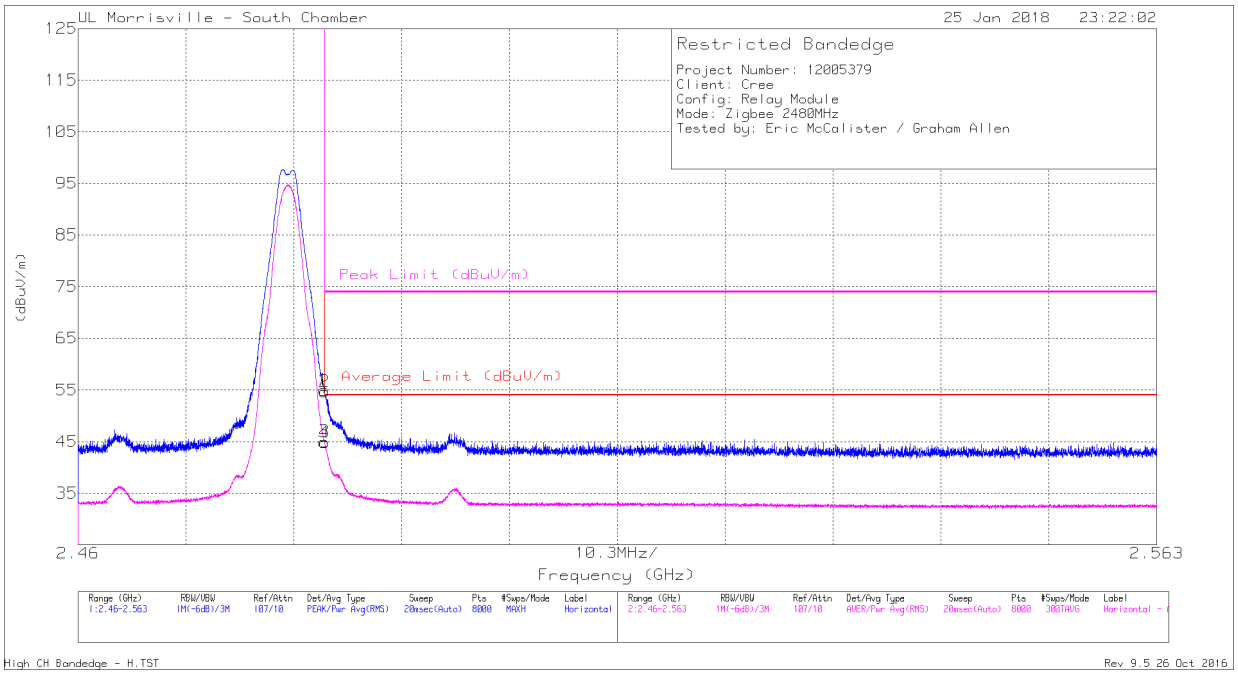
RESTRICTED BANDEDGE (2475 MHz, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/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	45.47	Pk	32.4	-24.6	53.27	-	-	74	-20.73	280	203	V
2	* 2.484	45.77	Pk	32.4	-24.6	53.57	-	-	74	-20.43	280	203	V
3	* 2.484	36.83	RMS	32.4	-24.6	44.63	54	-9.37	-	-	280	203	V
4	* 2.484	36.88	RMS	32.4	-24.6	44.68	54	-9.32	-	-	280	203	V

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

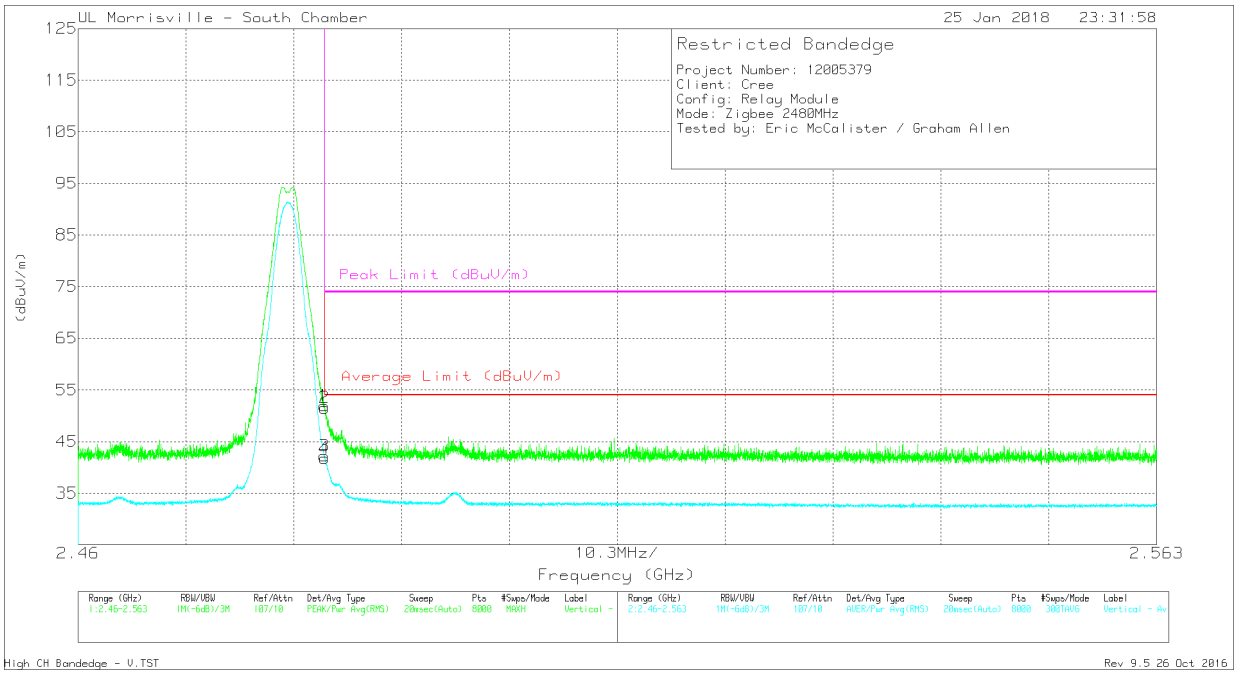
RESTRICTED BANDEDGE (2480MHz, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/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	47.17	Pk	32.4	-24.6	54.97	-	-	74	-19.03	242	123	H
2	* 2.484	46.88	Pk	32.4	-24.6	54.68	-	-	74	-19.32	242	123	H
3	* 2.484	37.18	RMS	32.4	-24.6	44.98	54	-9.02	-	-	242	123	H
4	* 2.484	36.99	RMS	32.4	-24.6	44.79	54	-9.21	-	-	242	123	H

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

RESTRICTED BANDEDGE (2480MHz, VERTICAL)

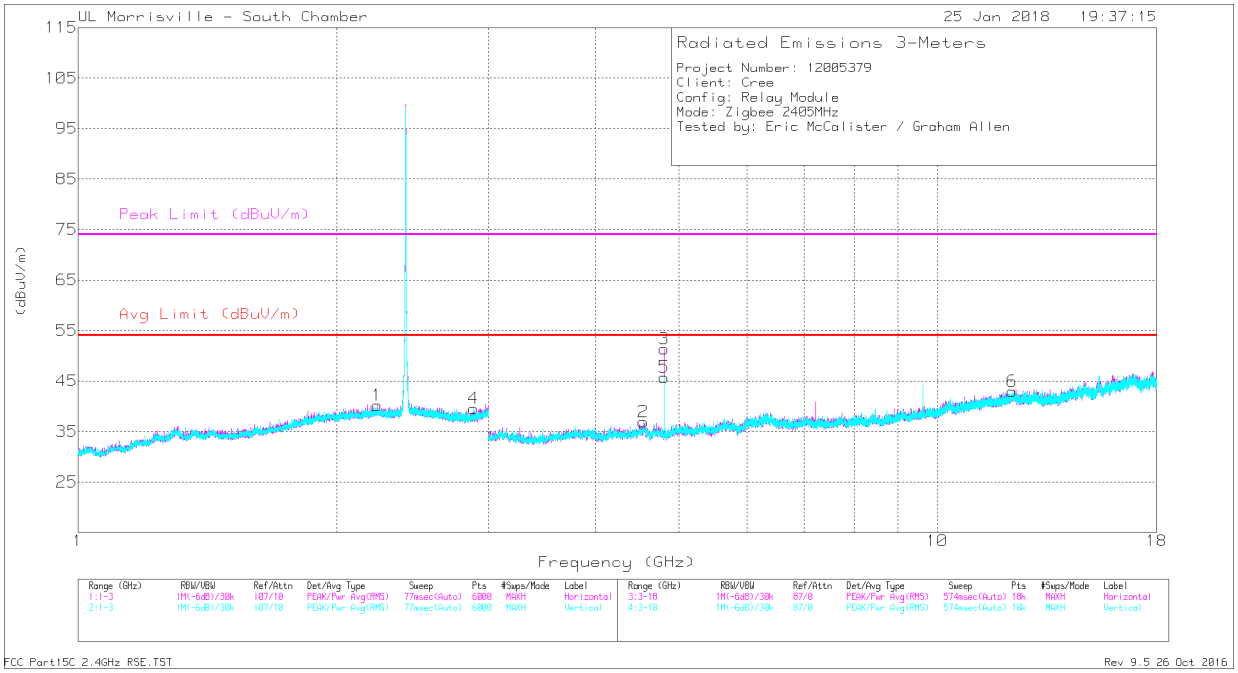


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	44.11	Pk	32.4	-24.6	51.91	-	-	74	-22.09	291	192	V
2	* 2.484	43.72	Pk	32.4	-24.6	51.52	-	-	74	-22.48	291	192	V
3	* 2.484	34.44	RMS	32.4	-24.6	42.24	54	-11.76	-	-	291	192	V
4	* 2.484	33.97	RMS	32.4	-24.6	41.77	54	-12.23	-	-	291	192	V

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

HARMONICS AND SPURIOUS EMISSIONS

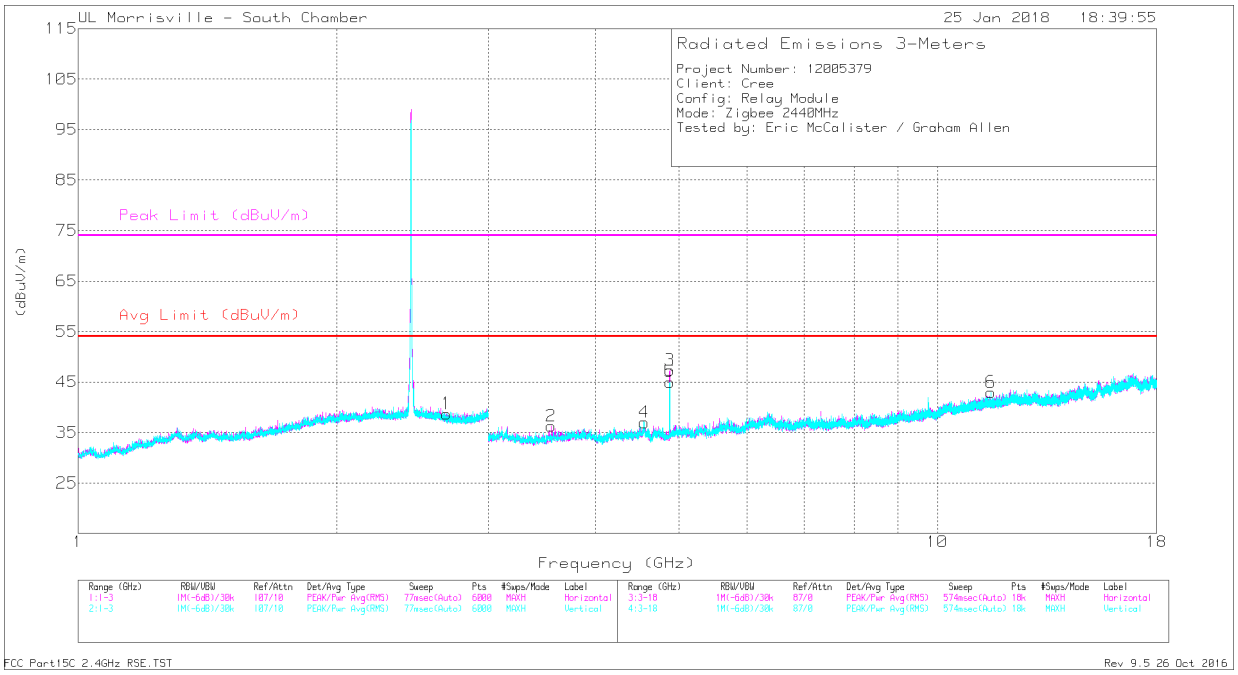
2405 MHz



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.228	37.23	PK2	32	-23.4	45.83	-	-	74	-28.17	133	274	H
	* 2.229	24.74	MAv1	32	-23.4	33.34	54	-20.66	-	-	133	274	H
2	* 4.549	40.46	PK2	33.9	-31.5	42.86	-	-	74	-31.14	213	204	H
	* 4.547	28.44	MAv1	33.9	-31.5	30.84	54	-23.16	-	-	213	204	H
3	* 4.809	52.58	PK2	34	-31.2	55.38	-	-	74	-18.62	27	106	H
	* 4.809	46.9	MAv1	34	-31.2	49.7	54	-4.3	-	-	27	106	H
4	* 2.886	37.31	PK2	32.4	-26	43.71	-	-	74	-30.29	207	131	V
	* 2.886	25.71	MAv1	32.4	-26	32.11	54	-21.89	-	-	207	131	V
5	* 4.811	47.32	PK2	34	-31.1	50.22	-	-	74	-23.78	44	108	V
	* 4.811	40.49	MAv1	34	-31.1	43.39	54	-10.61	-	-	44	108	V
6	* 12.229	34.51	PK2	38.9	-24.3	49.11	-	-	74	-24.89	18	199	V
	* 12.227	22.81	MAv1	38.9	-24.3	37.41	54	-16.59	-	-	18	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

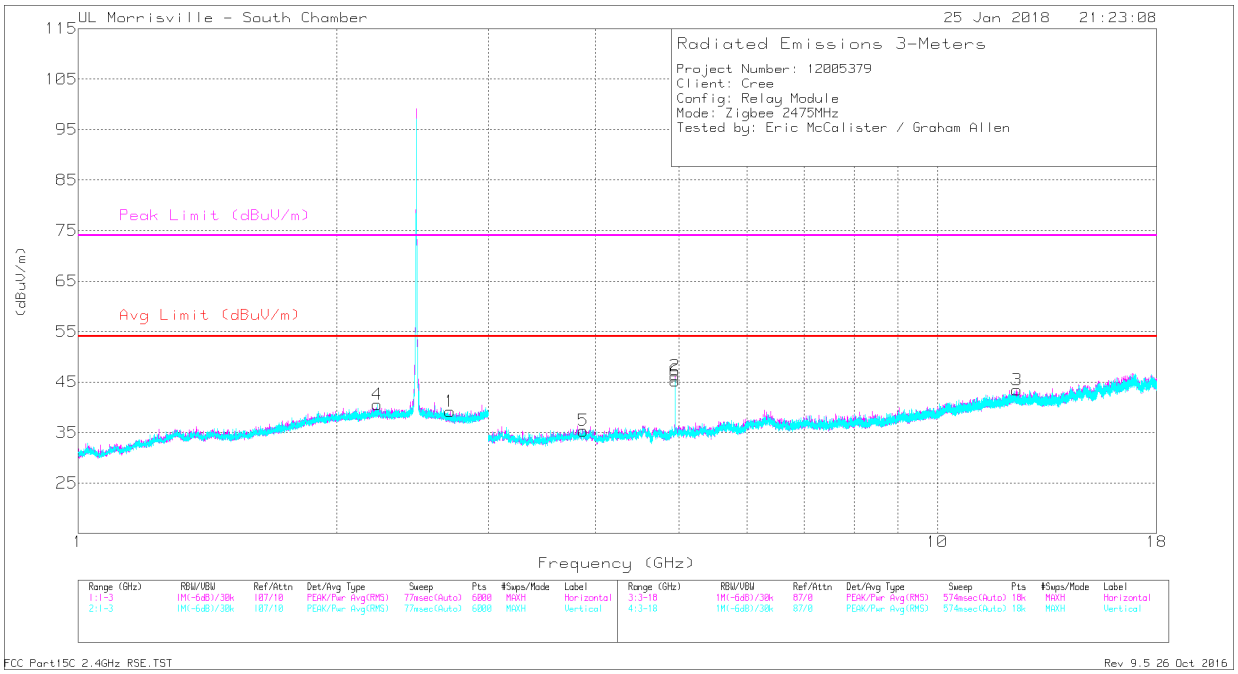
2440 MHz



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.688	38.14	PK2	32.2	-25.8	44.54	-	-	74	-29.46	250	286	H
	* 2.687	25.71	MAv1	32.2	-25.8	32.11	54	-21.89	-	-	250	286	H
2	* 3.555	40.31	PK2	33.1	-32.5	40.91	-	-	74	-33.09	101	288	H
	* 3.555	28.74	MAv1	33.1	-32.5	29.34	54	-24.66	-	-	101	288	H
3	* 4.879	48.73	PK2	34	-30.8	51.93	-	-	74	-22.07	30	104	H
	* 4.881	42.46	MAv1	34	-30.8	45.66	54	-8.34	-	-	30	104	H
4	* 4.558	40.5	PK2	33.9	-31.6	42.8	-	-	74	-31.2	99	391	V
	* 4.56	28.71	MAv1	33.9	-31.6	31.01	54	-22.99	-	-	99	391	V
5	* 4.881	47.22	PK2	34	-30.8	50.42	-	-	74	-23.58	34	224	V
	* 4.881	40.48	MAv1	34	-30.8	43.68	54	-10.32	-	-	34	224	V
6	* 11.55	34.33	PK2	38.3	-24.8	47.83	-	-	74	-26.17	250	397	V
	* 11.551	22.98	MAv1	38.3	-24.8	36.48	54	-17.52	-	-	250	397	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

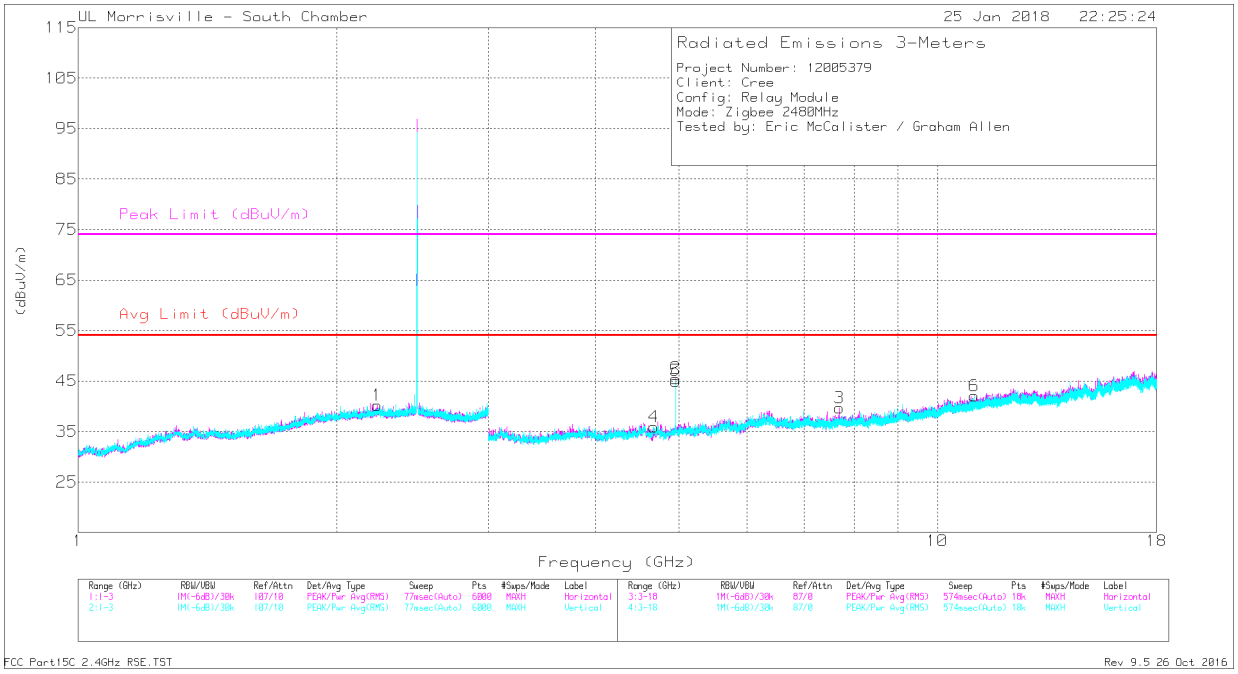
2475 MHz



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.709	37.54	PK2	32.1	-25.8	43.84	-	-	74	-30.16	26	208	H
	* 2.708	25.78	MAv1	32.1	-25.8	32.08	54	-21.92	-	-	26	208	H
2	* 4.949	47.87	PK2	34	-31.2	50.67	-	-	74	-23.33	28	226	H
	* 4.949	41.2	MAv1	34	-31.2	44	54	-10	-	-	28	226	H
3	* 12.377	37.71	PK2	38.9	-24.7	51.91	-	-	74	-22.09	1	179	H
	* 12.378	26.01	MAv1	38.9	-24.7	40.21	54	-13.79	-	-	1	179	H
4	* 2.229	37.05	PK2	32	-23.4	45.65	-	-	74	-28.35	28	347	V
	* 2.228	24.75	MAv1	32	-23.4	33.35	54	-20.65	-	-	28	347	V
5	* 3.871	40.28	PK2	33.3	-32.3	41.28	-	-	74	-32.72	239	155	V
	* 3.87	28.78	MAv1	33.3	-32.3	29.78	54	-24.22	-	-	239	155	V
6	* 4.951	47.57	PK2	34	-31.2	50.37	-	-	74	-23.63	27	115	V
	* 4.951	40.57	MAv1	34	-31.2	43.37	54	-10.63	-	-	27	115	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - Maximum Peak
MAv1 - Maximum RMS Average

2480 MHz



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.228	37.66	PK2	32	-23.4	46.26	-	-	74	-27.74	280	189	H
	* 2.231	24.71	MAv1	32	-23.4	33.31	54	-20.69	-	-	280	189	H
2	* 4.961	47.29	PK2	34	-31.3	49.99	-	-	74	-24.01	85	102	H
	* 4.961	40.33	MAv1	34	-31.3	43.03	54	-10.97	-	-	85	102	H
3	* 7.694	36.69	PK2	35.7	-27.8	44.59	-	-	74	-29.41	307	203	H
	* 7.691	24.53	MAv1	35.7	-27.8	32.43	54	-21.57	-	-	307	203	H
4	* 4.679	39.43	PK2	34	-31.9	41.53	-	-	74	-32.47	81	149	V
	* 4.678	28.34	MAv1	34	-31.9	30.44	54	-23.56	-	-	81	149	V
5	* 4.961	46.98	PK2	34	-31.3	49.68	-	-	74	-24.32	38	215	V
	* 4.961	39.87	MAv1	34	-31.3	42.57	54	-11.43	-	-	38	215	V
6	* 11.048	33.86	PK2	37.9	-24.5	47.26	-	-	74	-26.74	306	193	V
	* 11.048	22.43	MAv1	37.9	-24.5	35.83	54	-18.17	-	-	306	193	V

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

PK2: Maximum Peak

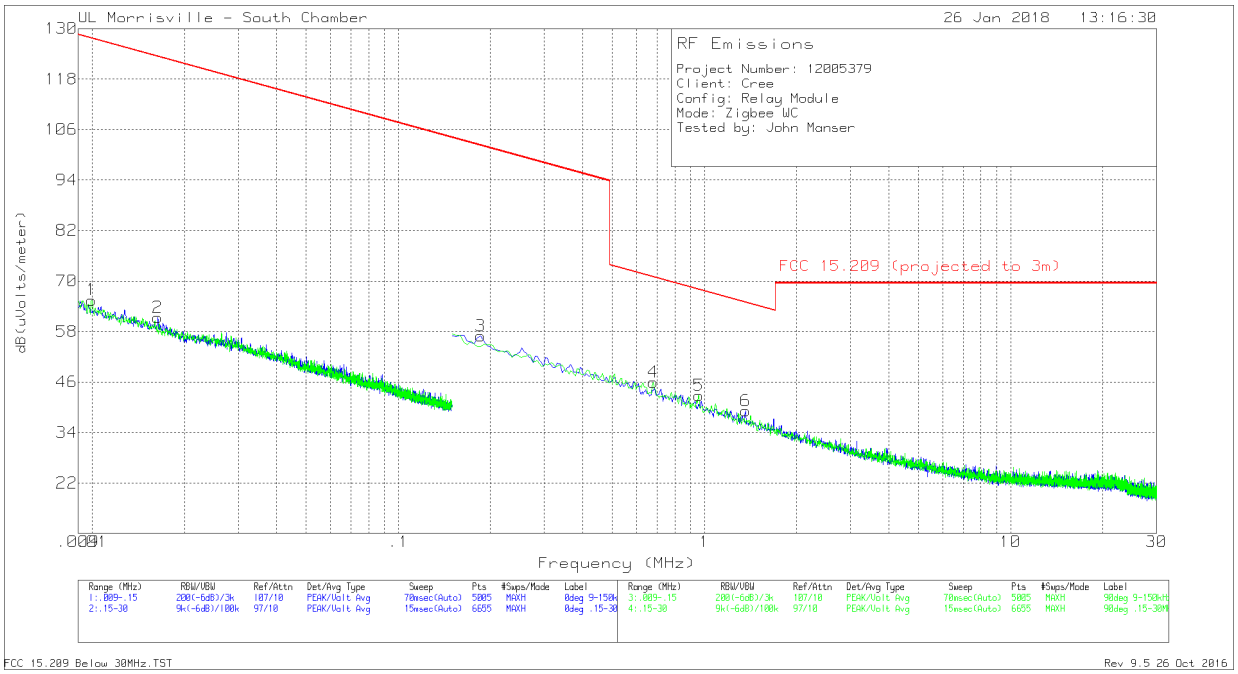
Mav1: Maximum RMS Average

9.3. WORST-CASE CONFIGURATION SCANS

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (specification distance / test distance).

Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



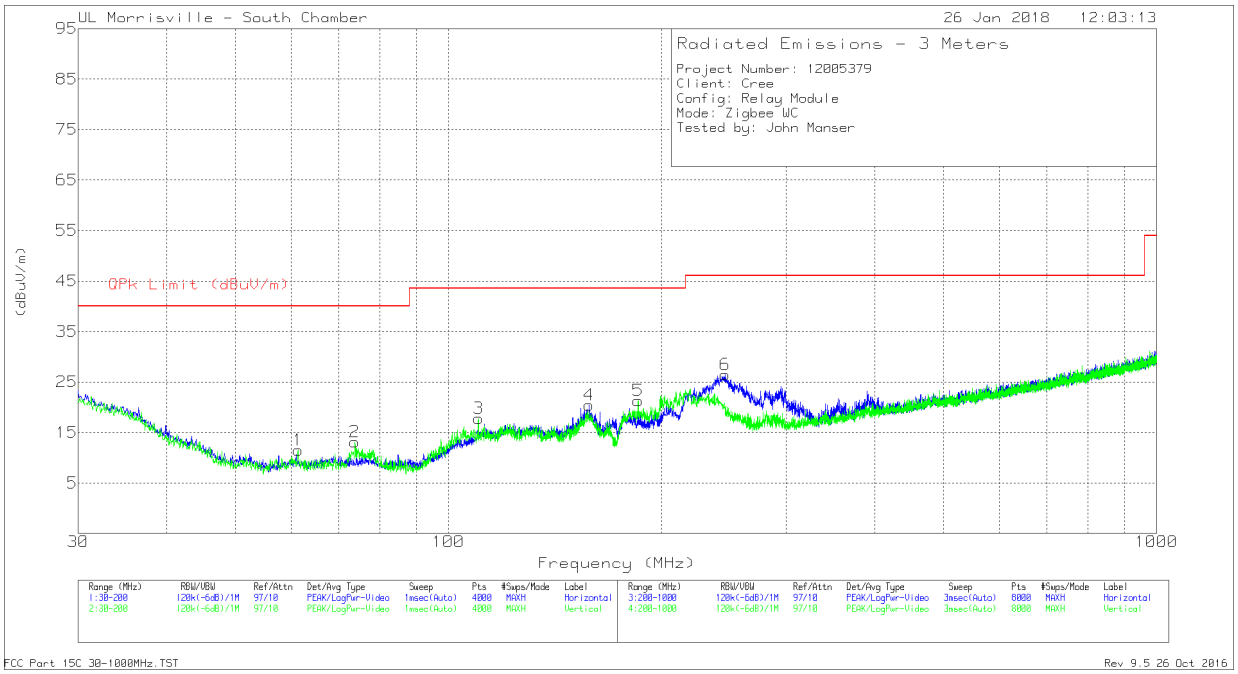
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
1	.00995	45.98	Pk	19.4	.1	65.48	127.65	-62.17	0-360
2	.01639	44.91	Pk	16.3	.1	61.31	123.31	-62	0-360
3	.18589	46.45	Pk	10.4	.1	56.95	102.22	-45.27	0-360
4	.67935	35.41	Pk	10.4	.1	45.91	70.96	-25.05	0-360
5	.95748	32.06	Pk	10.6	.1	42.76	67.98	-25.22	0-360
6	1.36122	28.32	Pk	10.6	.2	39.12	64.93	-25.81	0-360

Pk - Peak detector

Marker	Freq. (MHz)	Meter Reading (dBuV)	Det	AF (dB/m)	Cbl (dB)	Corrected Reading dB(uV/m)	FCC 15.209 QP (proj. to 3m)	Margin QP (dB)	FCC 15.209 AV (proj. to 3m)	Margin AV (dB)	FCC 15.209 PK (proj. to 3m	Margin PK (dB)	Azimuth (Degs)
1	.00995	45.98	Pk	19.4	.1	65.48	-	-	127.65	-62.17	147.65	-82.17	0-360
2	.01639	44.91	Pk	16.3	.1	61.31	-	-	123.31	-62	143.31	-82	0-360
3	.18589	46.45	Pk	10.4	.1	56.95	-	-	102.22	-45.27	122.22	-65.27	0-360
4	.67935	35.41	Pk	10.4	.1	45.91	70.96	-25.05	-	-	-	-	0-360
5	.95748	32.06	Pk	10.6	.1	42.76	67.98	-25.22	-	-	-	-	0-360
6	1.36122	28.32	Pk	10.6	.2	39.12	64.93	-25.81	-	-	-	-	0-360

Pk - Peak detector

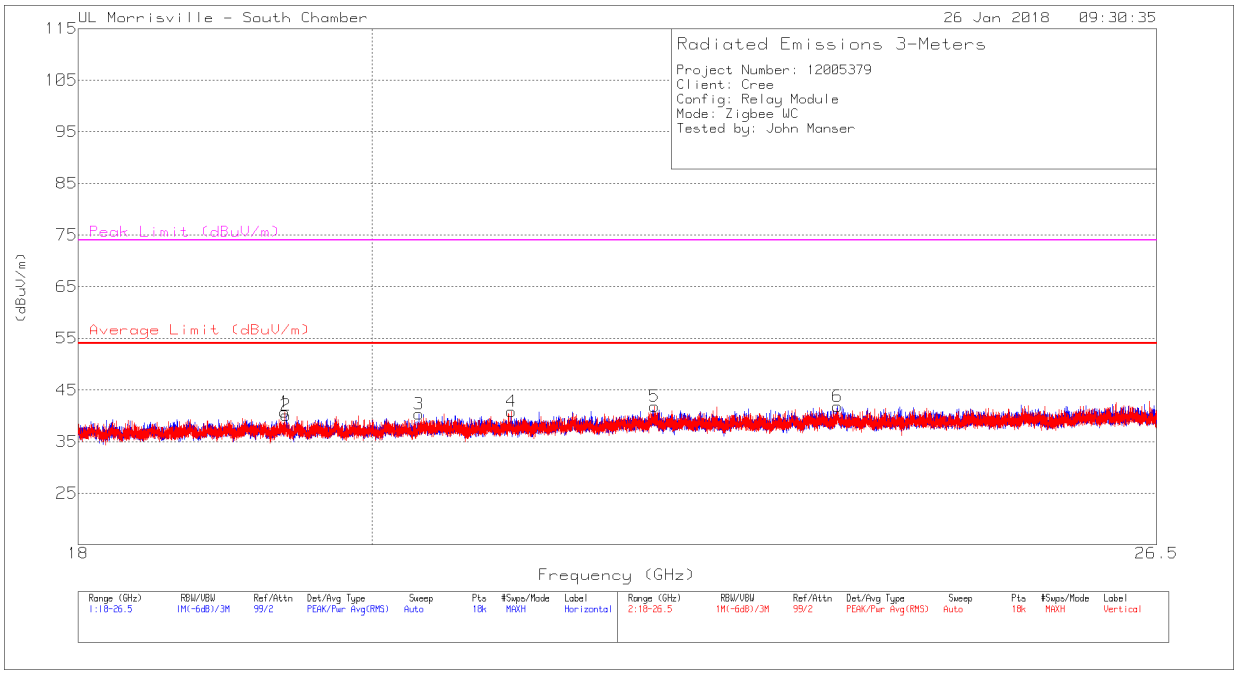
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	61.5029	24.05	Qp	12	-31.4	4.65	40	-35.35	26	373	V
2	73.5566	25.06	Qp	12.4	-31.2	6.26	40	-33.74	166	156	V
3	110.3949	24.55	Qp	17	-30.9	10.65	43.52	-32.87	186	116	V
4	157.9497	28.18	Qp	16.8	-30.6	14.38	43.52	-29.14	116	169	H
5	185.1809	29.34	Qp	15.7	-30.4	14.64	43.52	-28.88	236	109	V
6	246.1356	35.23	Qp	16.3	-29.9	21.63	46.02	-24.39	151	145	H

Qp - Quasi-Peak detector

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



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 19.395	47.39	Pk	32.9	-40.2	40.09	54	-13.91	74	-33.91	0-360	299	H
3	* 20.338	46.95	Pk	33.1	-39.7	40.35	54	-13.65	74	-33.65	0-360	199	H
6	* 23.633	46.38	Pk	33.9	-38.5	41.78	54	-12.22	74	-32.22	0-360	199	H
1	* 19.384	48.02	Pk	32.9	-40.2	40.72	54	-13.28	74	-33.28	0-360	251	V
4	* 21.024	47.34	Pk	33.2	-39.7	40.84	54	-13.16	74	-33.16	0-360	151	V
5	* 22.132	47.5	Pk	33.7	-39.4	41.8	54	-12.2	74	-32.2	0-360	151	V

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

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

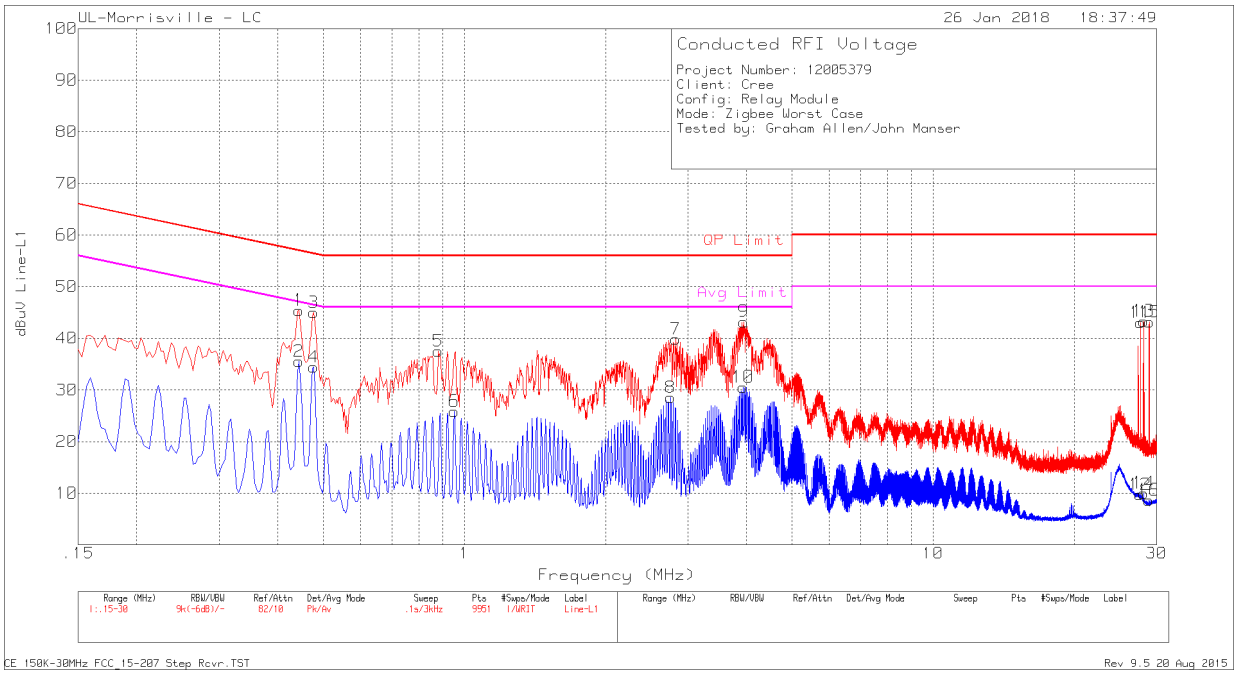
TEST PROCEDURE

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

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 lines.

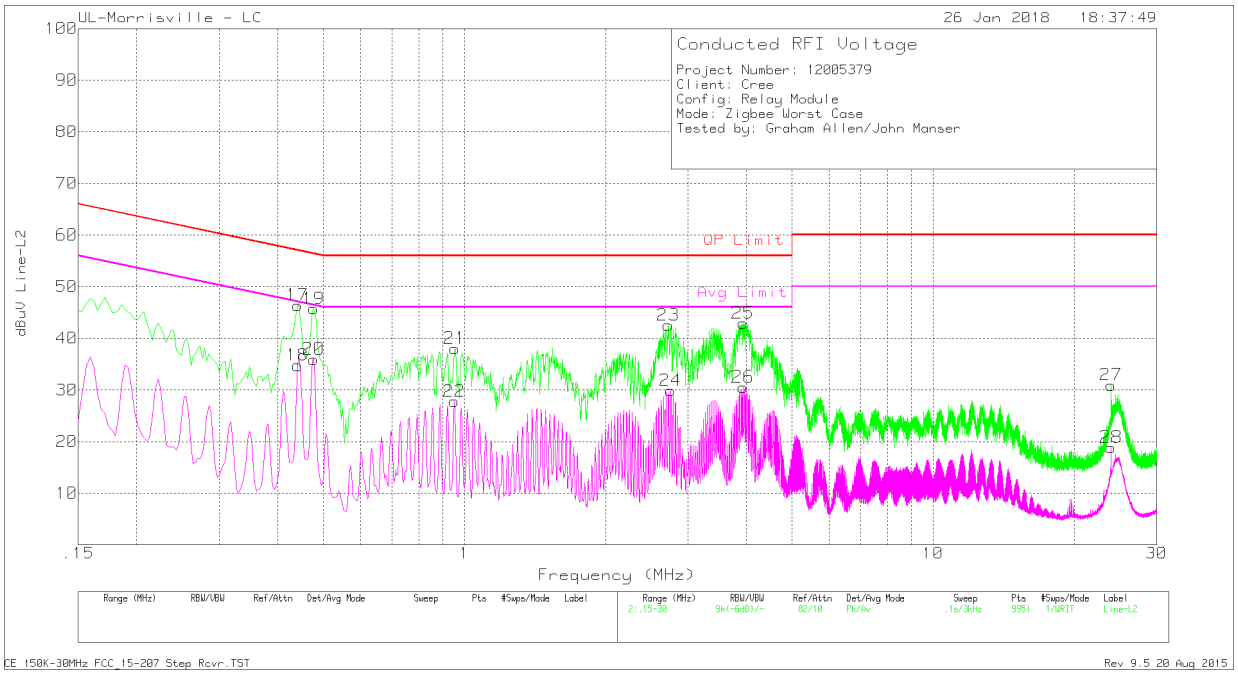
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
1	.444	35.43	Pk	.1	9.9	45.43	56.99	-11.56	-	-
2	.444	25.52	Av	.1	9.9	35.52	-	-	46.99	-11.47
3	.477	35.09	Pk	0	9.9	44.99	56.39	-11.4	-	-
4	.477	24.53	Av	0	9.9	34.43	-	-	46.39	-11.96
5	.879	27.61	Pk	0	9.9	37.51	56	-18.49	-	-
6	.951	15.98	Av	0	9.9	25.88	-	-	46	-20.12
7	2.826	29.81	Pk	0	10	39.81	56	-16.19	-	-
8	2.757	18.52	Av	0	10	28.52	-	-	46	-17.48
9	3.948	33.23	Pk	0	10	43.23	56	-12.77	-	-
10	3.93	20.54	Av	0	10	30.54	-	-	46	-15.46
11	27.687	32.43	Pk	.3	10.3	43.03	60	-16.97	-	-
12	27.657	-.87	Av	.3	10.3	9.73	-	-	50	-40.27
13	28.164	32.74	Pk	.3	10.3	43.34	60	-16.66	-	-
14	28.164	-.58	Av	.3	10.3	10.02	-	-	50	-39.98
15	28.941	32.53	Pk	.3	10.3	43.13	60	-16.87	-	-
16	28.875	-1.94	Av	.3	10.3	8.66	-	-	50	-41.34

Pk - Peak detector
Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	**Frequency (MHz)**	**Meter Reading (dBuV)**	**Det**	**LISN VCF (dB)**	**Cbl/Limiter (dB)**	**Corrected Reading dBuV**	**QP Limit**	**Margin (dB)**	**Avg Limit**	**Margin (dB)**
17	.441	36.42	Pk	.1	9.9	46.42	57.04	-10.62	-	-
18	.441	24.76	Av	.1	9.9	34.76	-	-	47.04	-12.28
19	.477	35.77	Pk	.1	9.9	45.77	56.39	-10.62	-	-
20	.477	25.97	Av	.1	9.9	35.97	-	-	46.39	-10.42
21	.954	28.14	Pk	0	9.9	38.04	56	-17.96	-	-
22	.951	17.93	Av	0	9.9	27.83	-	-	46	-18.17
23	2.724	32.54	Pk	0	10	42.54	56	-13.46	-	-
24	2.757	19.87	Av	0	10	29.87	-	-	46	-16.13
25	3.93	32.91	Pk	0	10	42.91	56	-13.09	-	-
26	3.93	20.55	Av	0	10	30.55	-	-	46	-15.45
27	23.997	20.54	Pk	.2	10.2	30.94	60	-29.06	-	-
28	24	8.47	Av	.2	10.2	18.87	-	-	50	-31.13

Pk - Peak detector
Av - Average detection