



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

CERTIFICATION TEST REPORT

FOR

SMARTCAST WIRELESS GATEWAY

MODEL NUMBER: CSC-GW-CWC

**FCC ID: 2ACQ6-SWG
IC: 11481A-SWG**

REPORT NUMBER: R12126187-E1

ISSUE DATE: 2018-05-10

**Prepared for
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4600 SILICON DRIVE
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NVLAP LAB CODE 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	2018-05-07	Initial Issue	Brian T. Kiewra
2	2018-05-08	Corrected antenna gain to -2dBi.	Brian T. Kiewra
3	2018-05-10	Added note to clarify non-restricted band markers in 30-1000MHz radiated scan.	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: SmartCast Wireless Gateway

MODEL: CSC-GW-CWC

SERIAL NUMBER: Non-Serialized

DATE TESTED: 2018-04-02 to 2018-04-16

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

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.

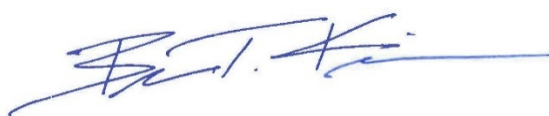
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this 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, KDB 558074 D01 v04, RSS-GEN Issue 4, RSS-247 Issue 2.

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 Drive, Suite B, Morrisville, NC 27560.

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 ISED 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:

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

4.3 MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY	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 SmartCast Wireless Gateway enables external control and data reporting for SmartCast Lighting Networks (independent mesh networks), by translating 802.15.4 protocol to 802.3 Ethernet protocol. This device transmits and receives messages from the SmartCast Lighting Network and reports the information to a back end server for data analytics and control.

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 ZigBee	4.78	3.01

5.3 DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal PIFA antenna, with a maximum gain of -2 dBi.

5.4 SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was:

For CH11 (2405MHz): Firmware name: TAL_PERFORMANCE_ANALYZER1.hex, Rev0
For CH18 (2440MHz): Firmware name: TAL_PERFORMANCE_ANALYZER1.hex, Rev0
For CH25 (2475MHz): Firmware name: TAL_PERFORMANCE_ANALYZER1.hex, Rev0
For CH26 (2480MHz): Firmware name: TAL_PRBS_CH26_1P2_DBM_FILT.hex, Rev0

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 (0.009-1000MHz 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 X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

5.6 DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
ENET Switch	NetGear	ProSafe 8 Port 10/100 Switch	3BN146798058C	NA

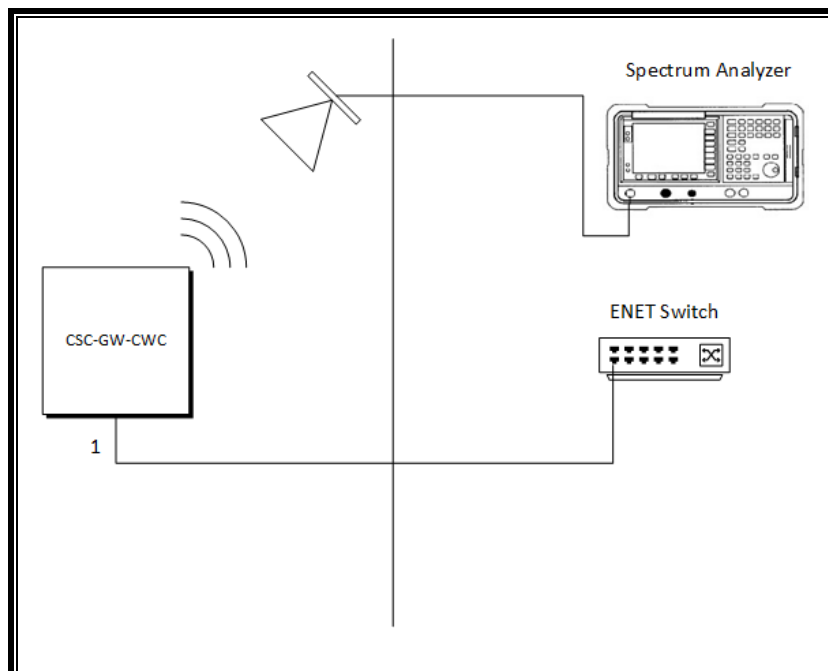
I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	ENET	1	RJ45	ENET	>3m	POE

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 - North Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2017-10-10	2018-10-10
Gain-Loss Chains					
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2018-04-03	2019-04-03
Receiver & Software					
SA0027 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2018-04-04	2019-04-04
Additional Equipment used					
s/n 161024690	Environmental Meter	Fisher Scientific	15-077-963	2016-12-21	2018-12-21

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2018-01-02	2019-01-02
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2017-06-15	2018-06-15
1-18 GHz					
AT0078	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2017-09-26	2018-09-26
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	2018-03-20	2019-03-20
Receiver & Software					
SA0026	Spectrum Analyzer	Agilent	N9030A	2018-03-20	2019-03-20
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 Antenna Port Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Conducted Room 2					
72822 (SA0019)	Spectrum Analyzer	Agilent Technologies	E4446A	2017-08-21	2018-08-21
SN 161016511	Environmental Meter	Fisher Scientific	15-077-963	2016-12-21	2018-12-21
Additional Equipment used					
MM0168	True RMS Multimeter	Agilent	U1232A	2017-08-25	2018-08-25
PWM002	RF Power Meter	Keysight Technologies	N1911A	2017-07-17	2018-07-17
PWS002	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2017-07-14	2018-07-14

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 11724196	Environmental Meter	Fisher Scientific	15-077-963	2017-12-23	2018-12-23
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)					
MM0168	Multi-meter	Agilent	U1232A	2017-09-25	2018-09-30

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, Section 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 Line Conducted Emissions: 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.

TEST INFORMATION

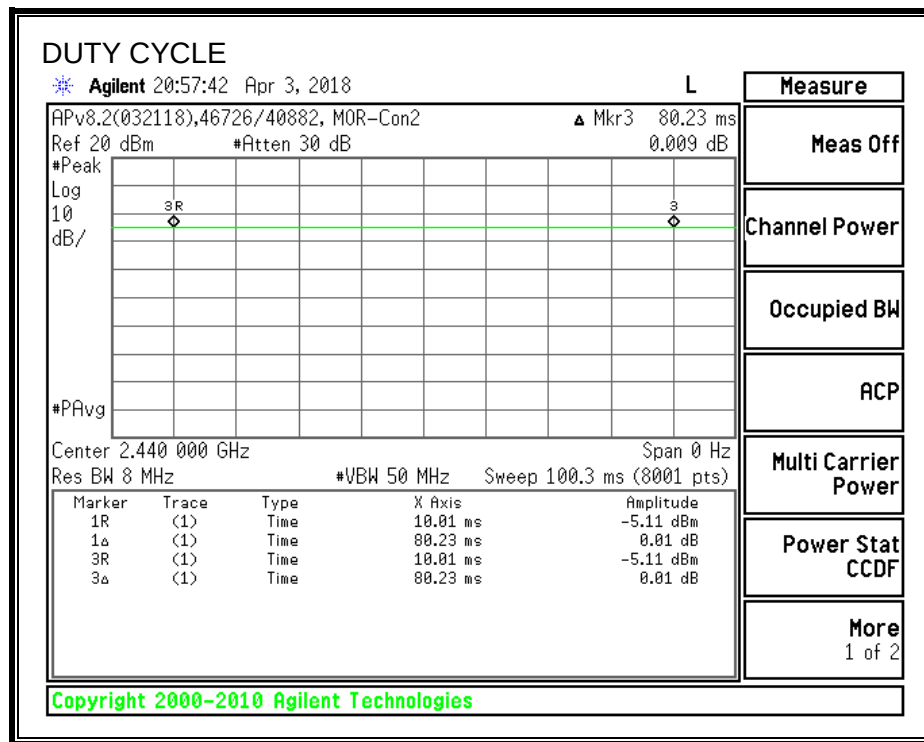
Test Date: 2018-04-03

Project: 12126187

Tested By: 46726 / 40882

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



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.

TEST INFORMATION

Test Date: 2018-04-08

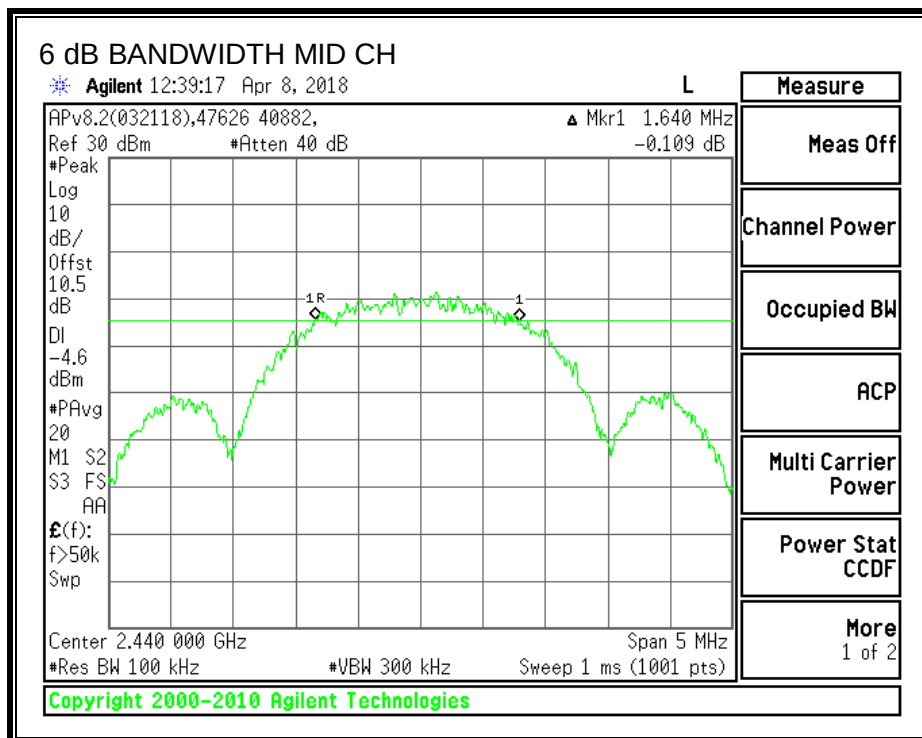
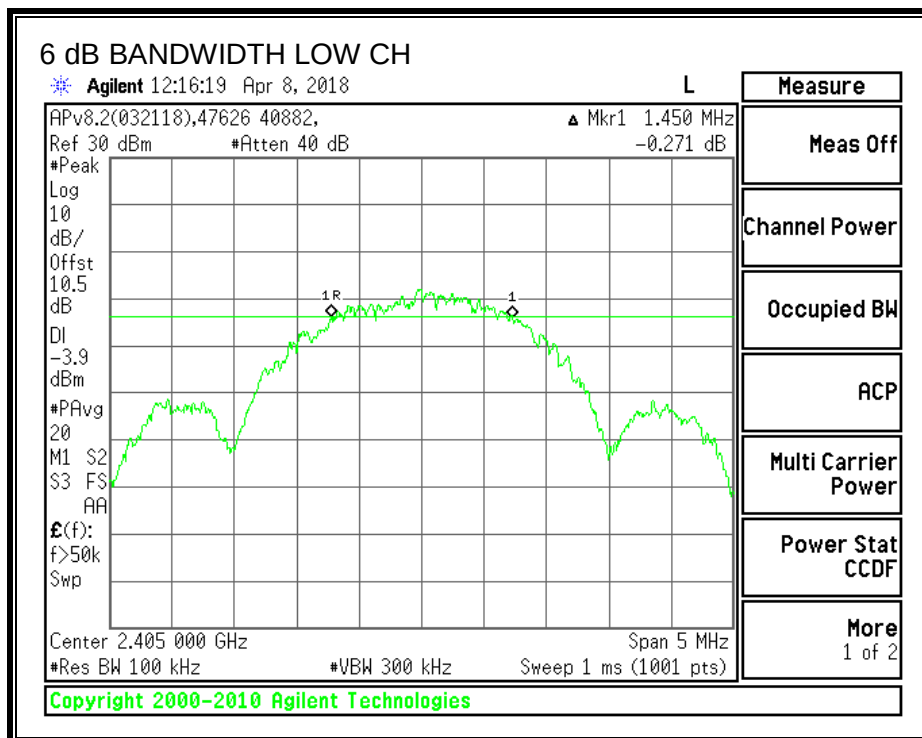
Project: 12126187

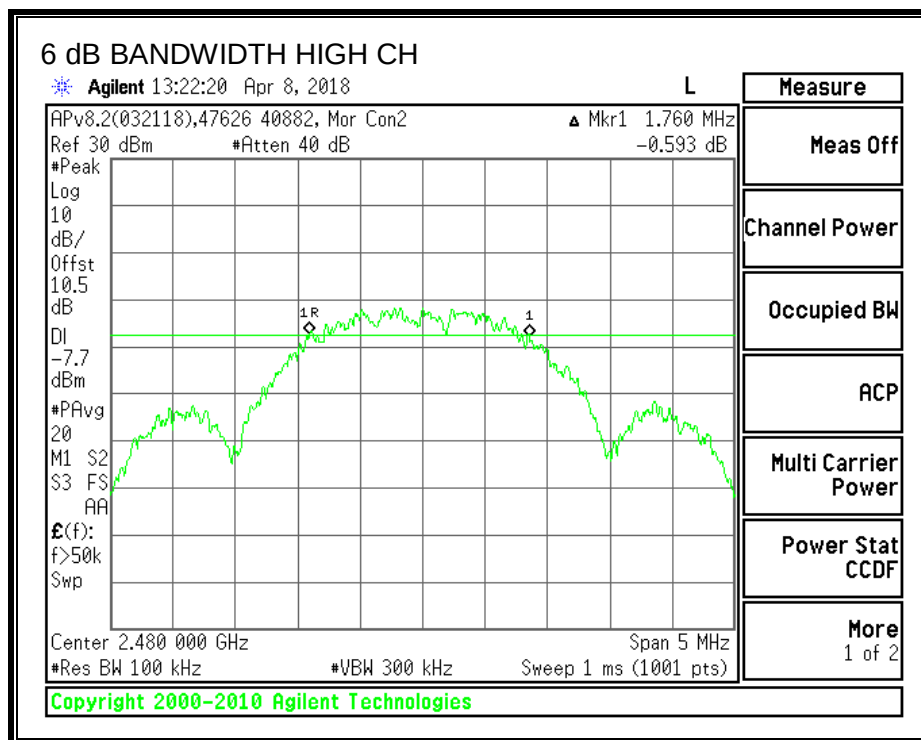
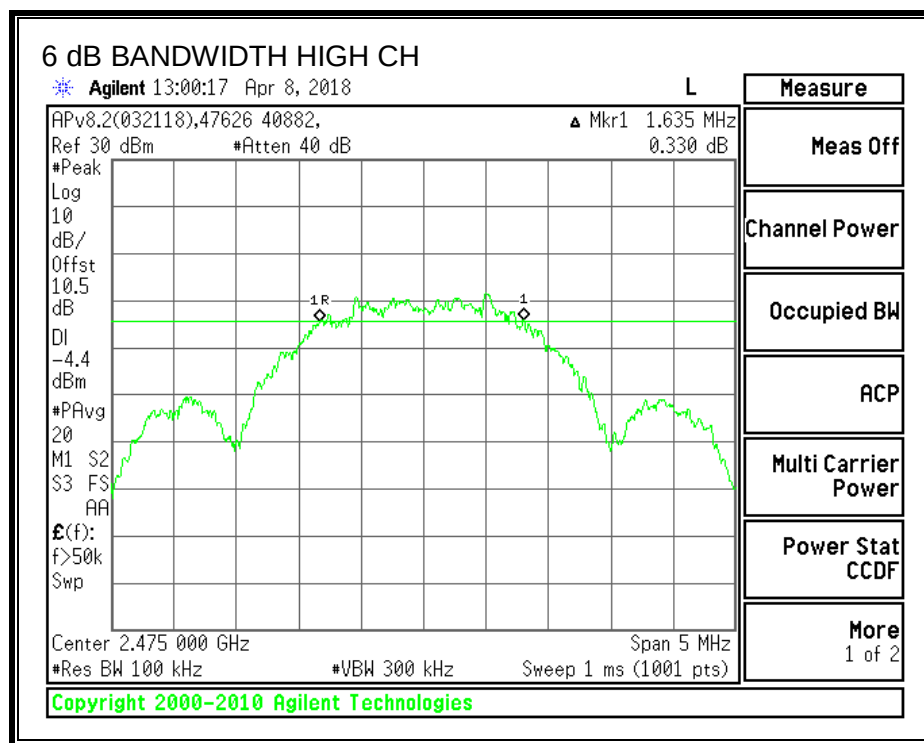
Tested By: 46726 / 40882

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.450	0.5
Middle	2440	1.640	0.5
High	2475	1.635	0.5
High	2480	1.760	0.5

6 dB BANDWIDTH PLOTS





8.1.3 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 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.

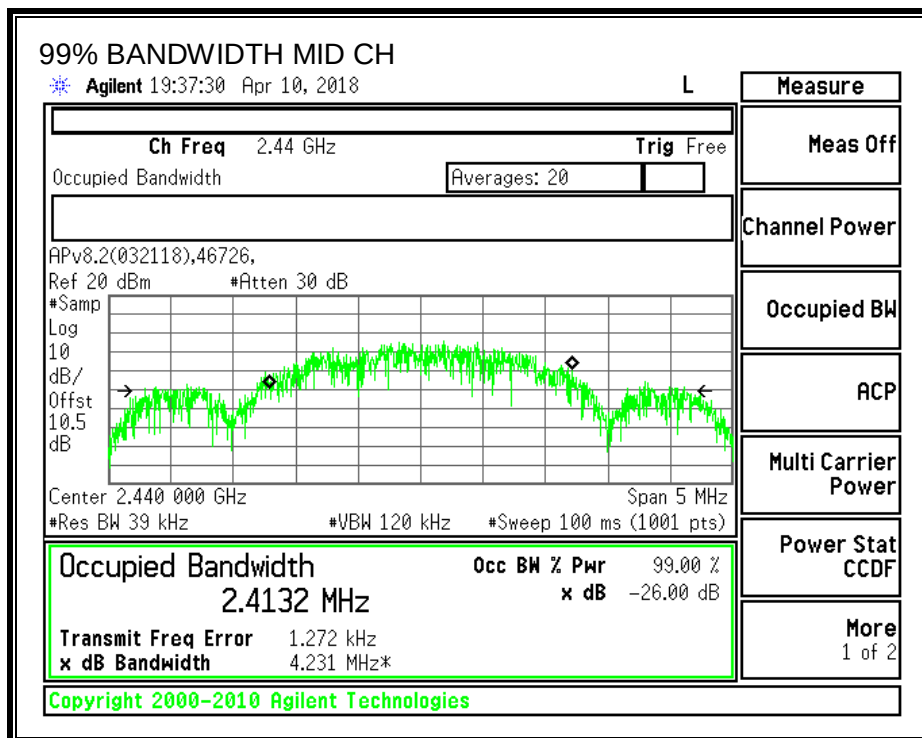
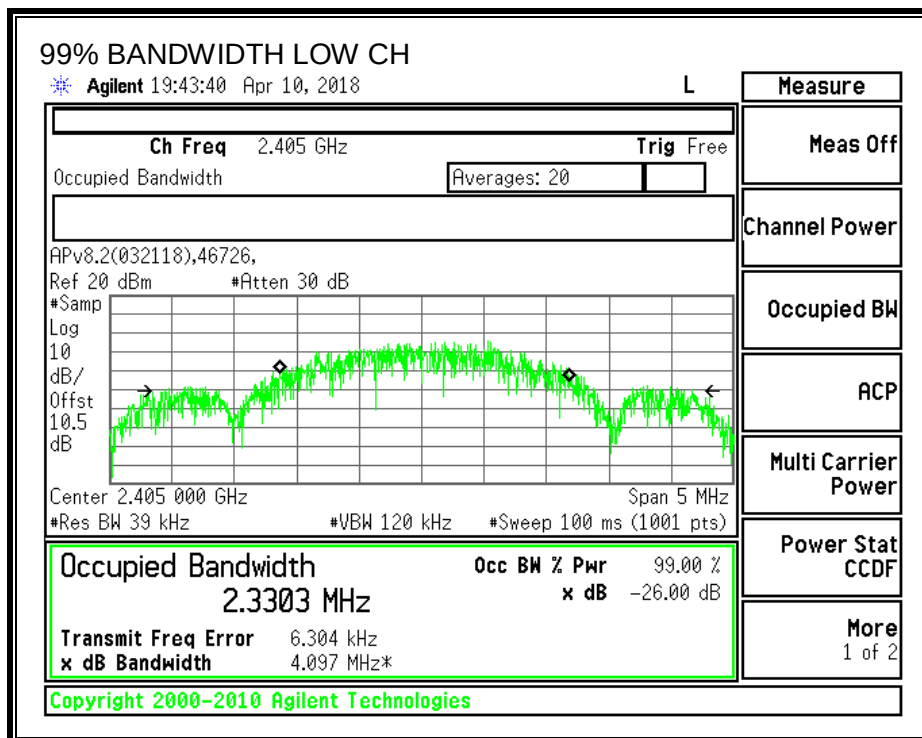
TEST INFORMATION

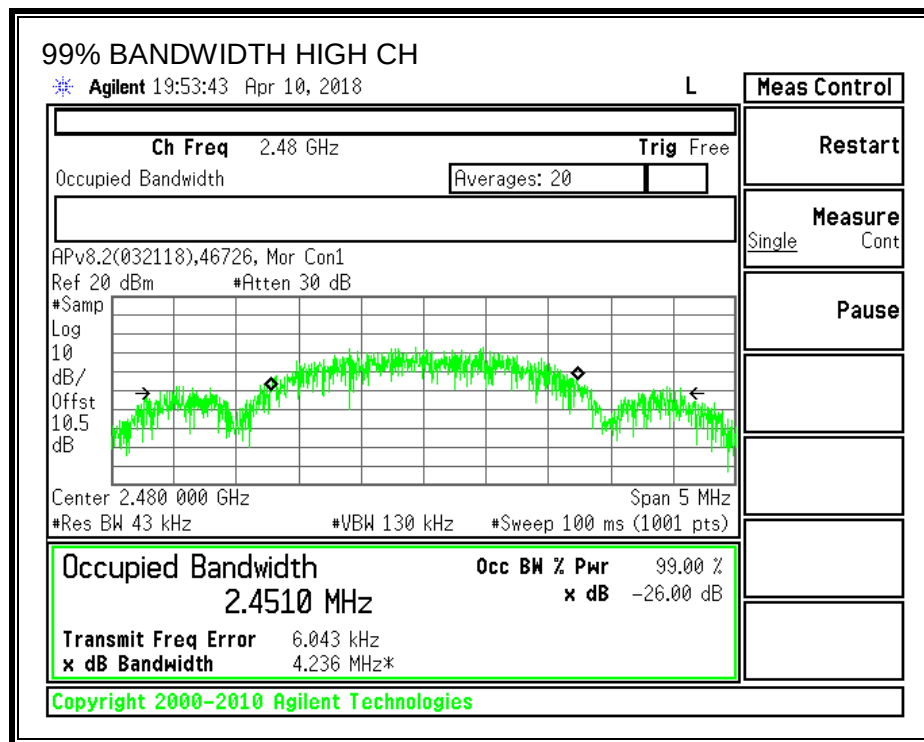
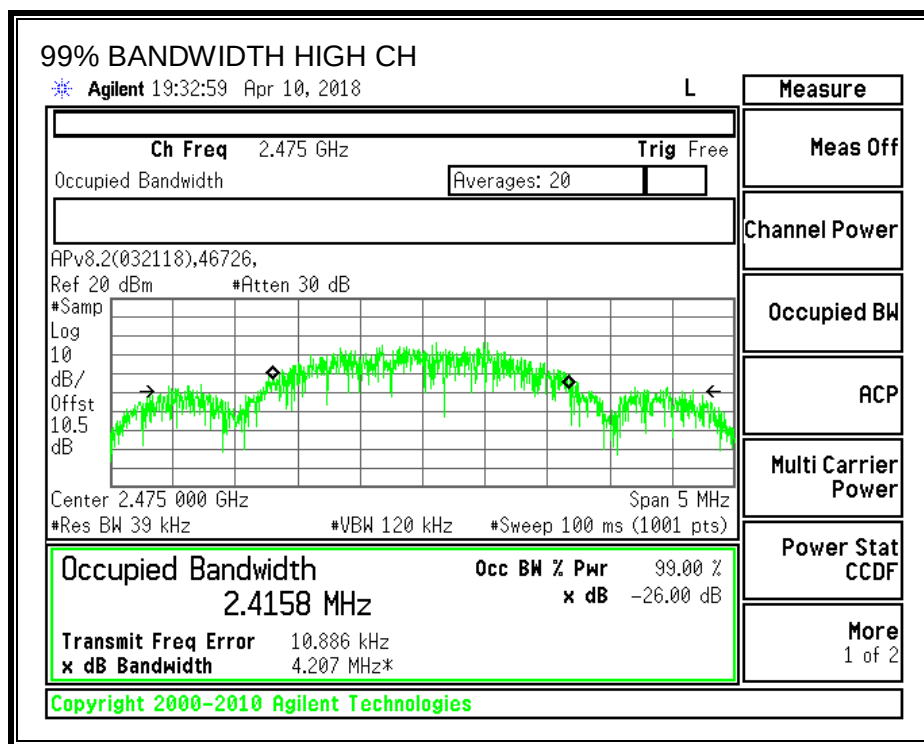
Test Date: 2018-04-10
Project: 12126187
Tested By: 46726 / 40882

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.3303
Middle	2440	2.4132
High	2475	2.4158
High	2480	2.4510

99% BANDWIDTH PLOTS





8.1.4 OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-247 5.4

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.

TEST INFORMATION

Test Date: 2018-04-02

Project: 12126187

Tested By: 46726 / 40882

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	4.78	30	-25.22
Middle	2440	4.63	30	-25.37
High	2475	4.45	30	-25.55
High	2480	2.04	30	-27.96

8.1.5 AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Test Date: 2018-04-02
Project: 12126187
Tested By: 46726 / 40882

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	4.66
Middle	2440	4.53
High	2475	4.35
High	2480	1.88

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.

TEST INFORMATION

Test Date: 2018-04-08

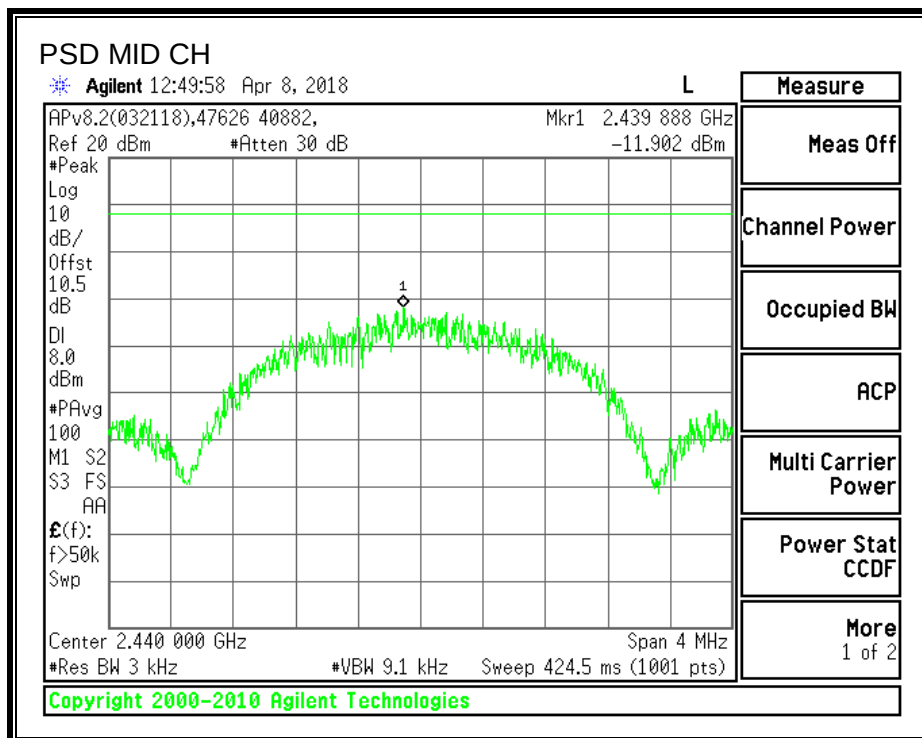
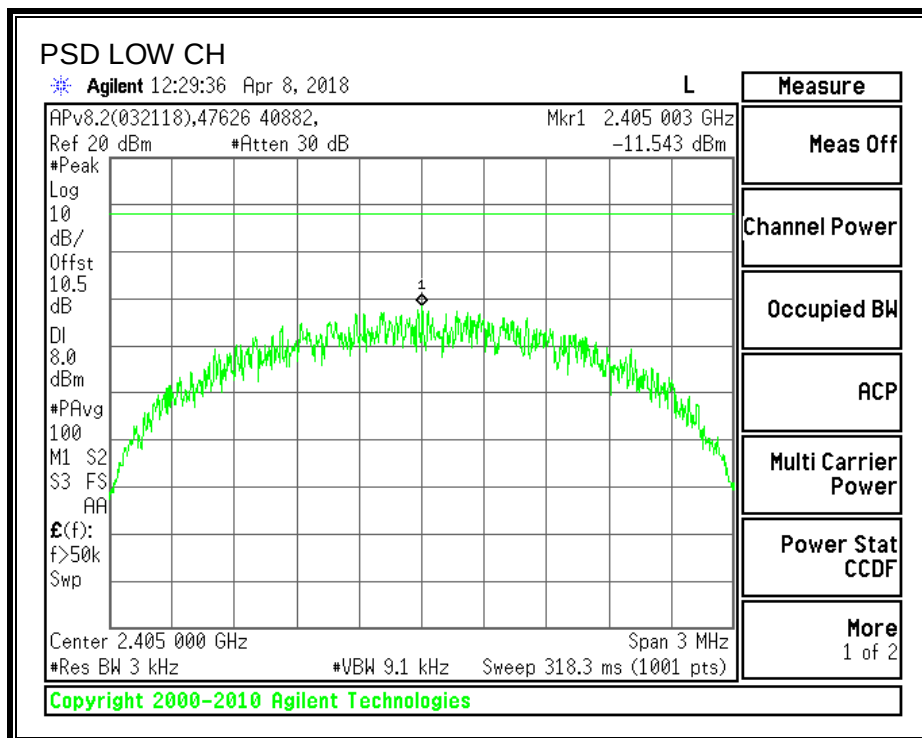
Project: 12126187

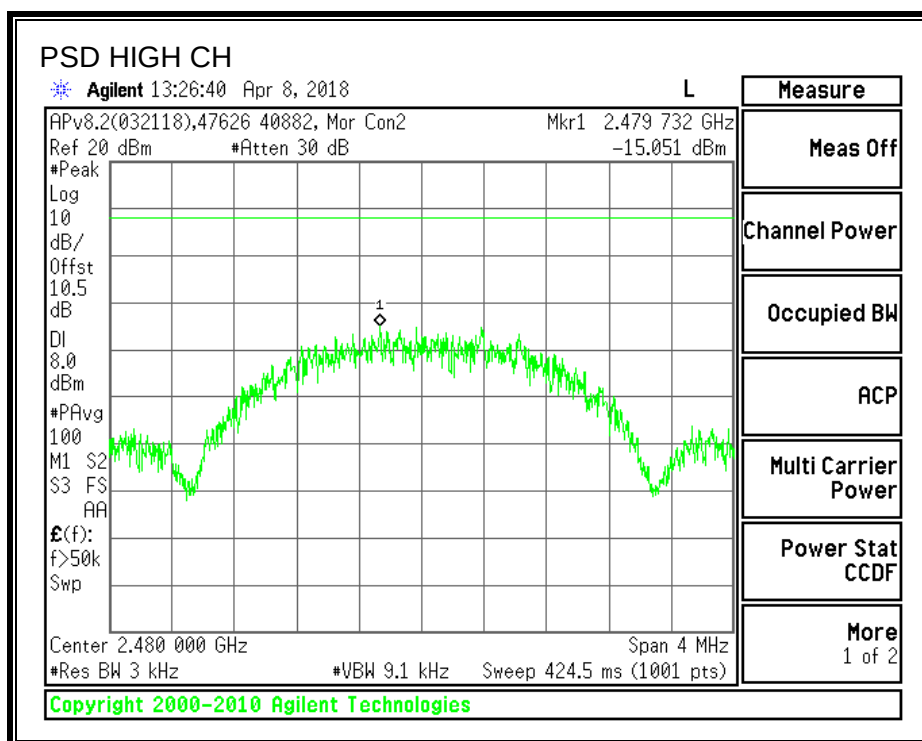
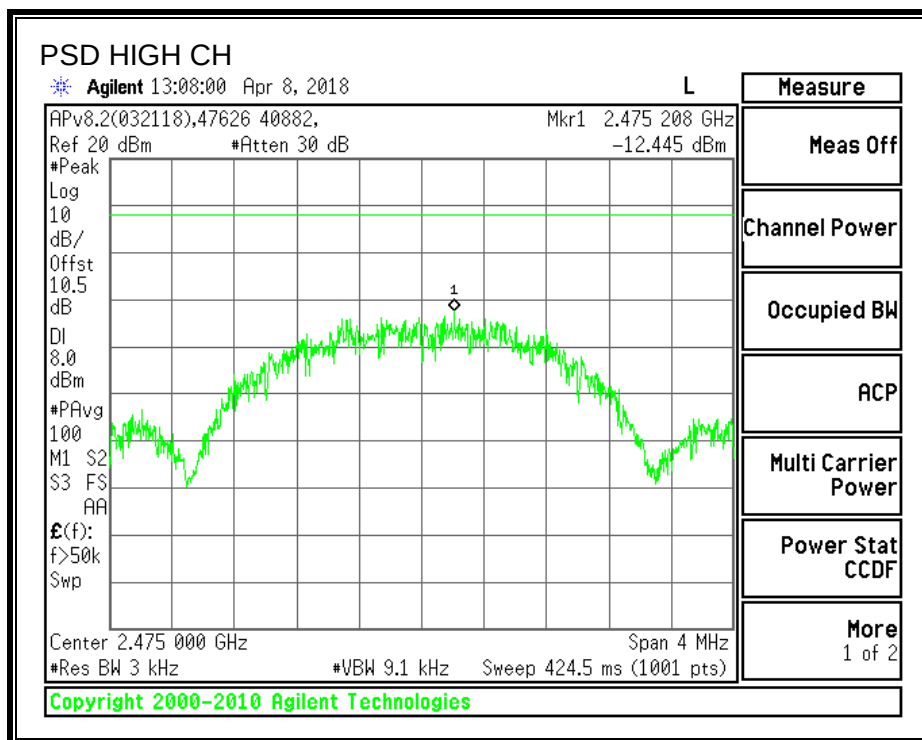
Tested By: 47626 / 40882

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-11.543	8	-19.54
Middle	2440	-11.902	8	-19.90
High	2475	-12.445	8	-20.45
High	2480	-15.051	8	-23.05

POWER SPECTRAL DENSITY PLOTS





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.

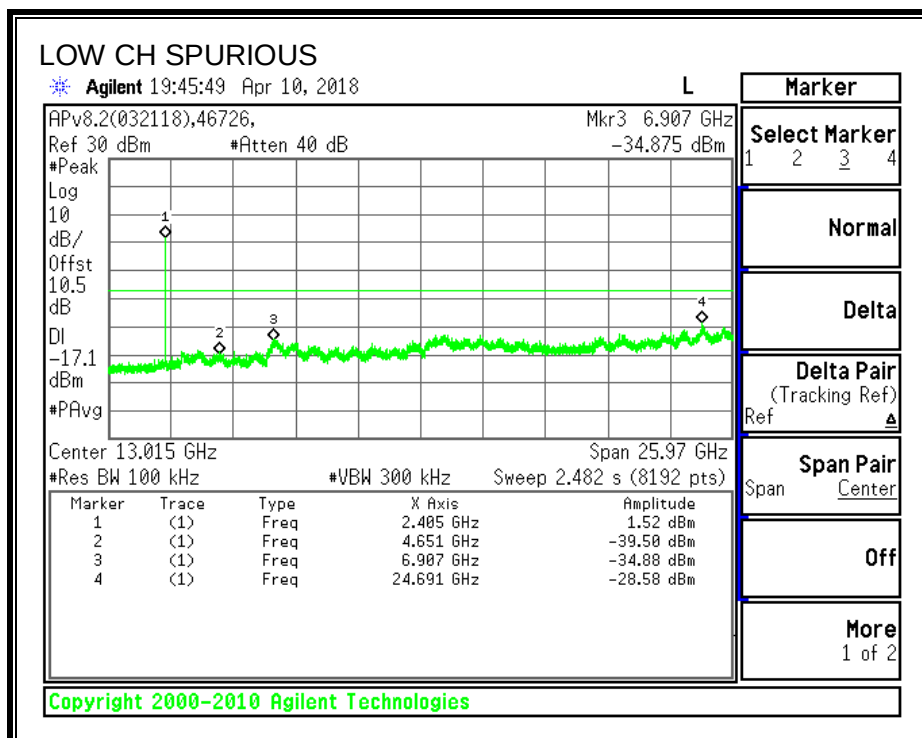
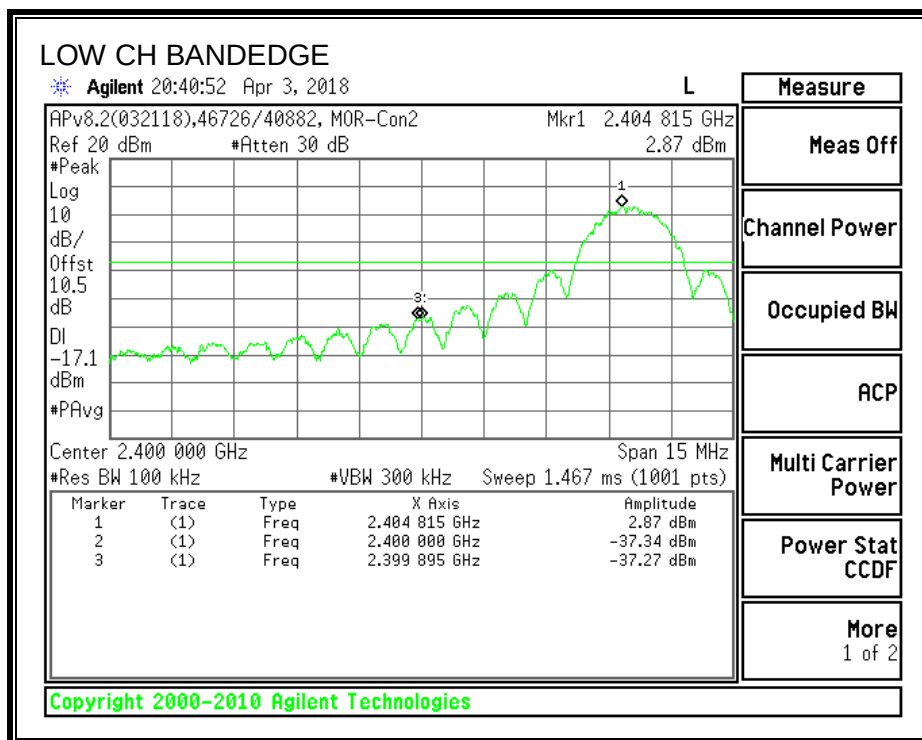
TEST INFORMATION

Test Date: 2018-04-03

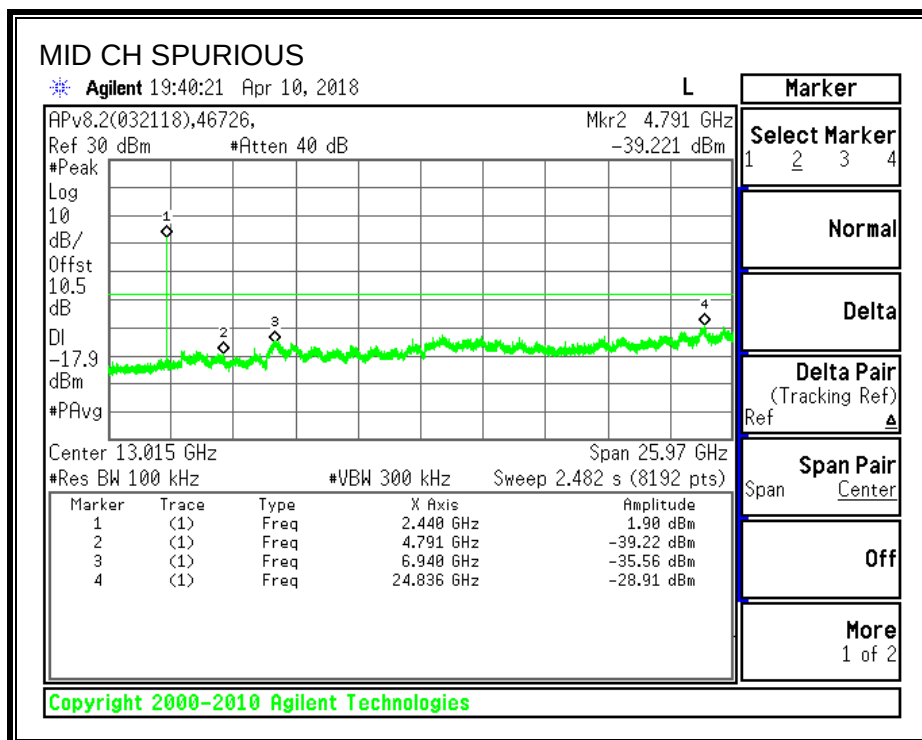
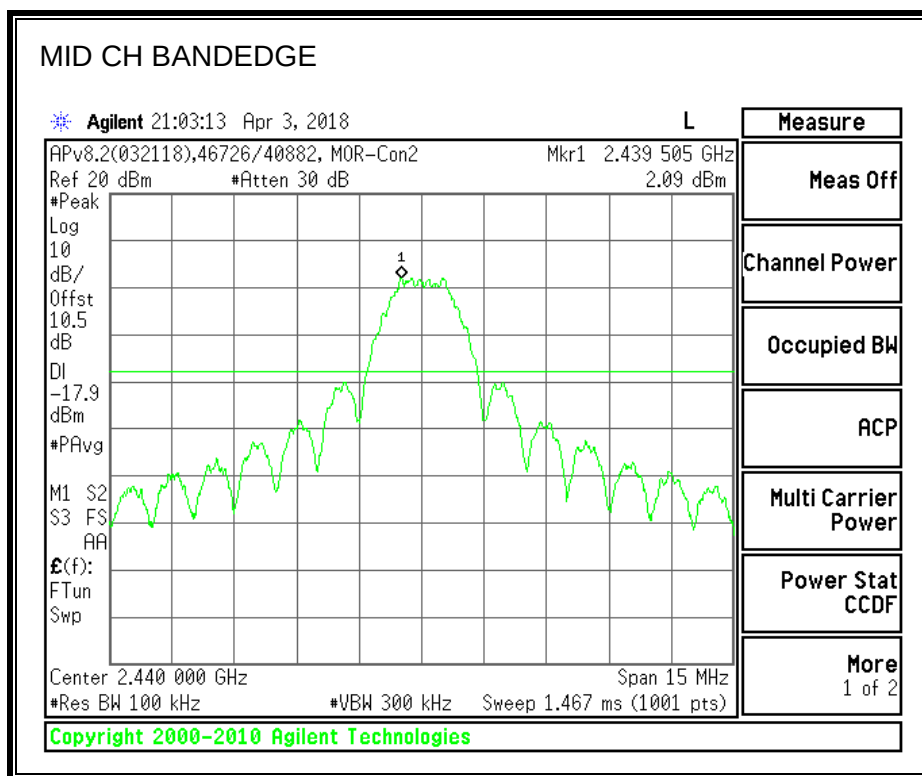
Project: 12126187

Tested By: 46726 / 40882

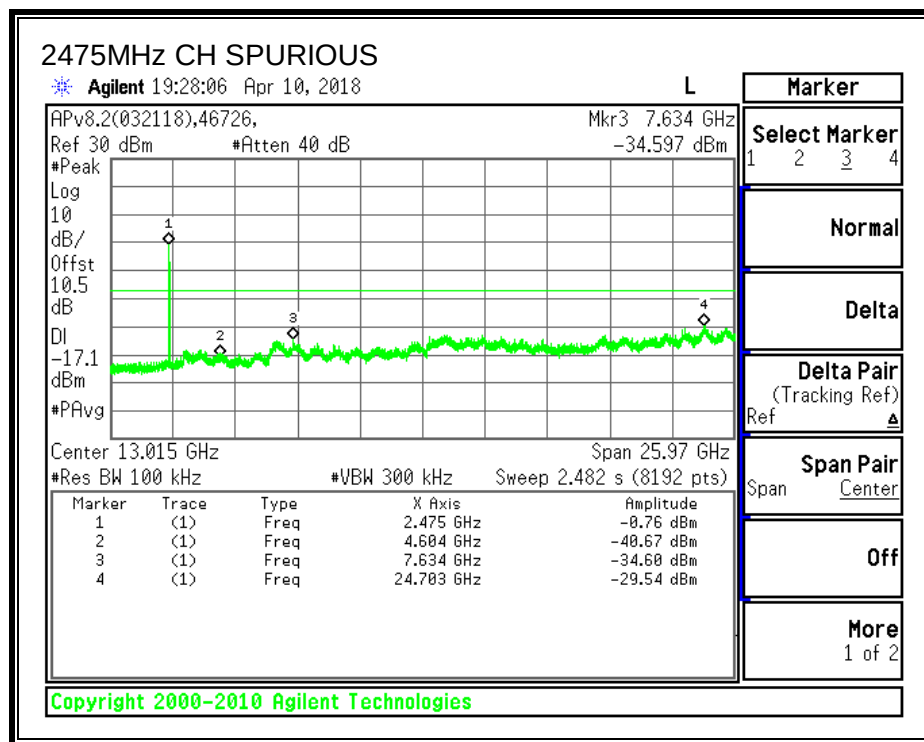
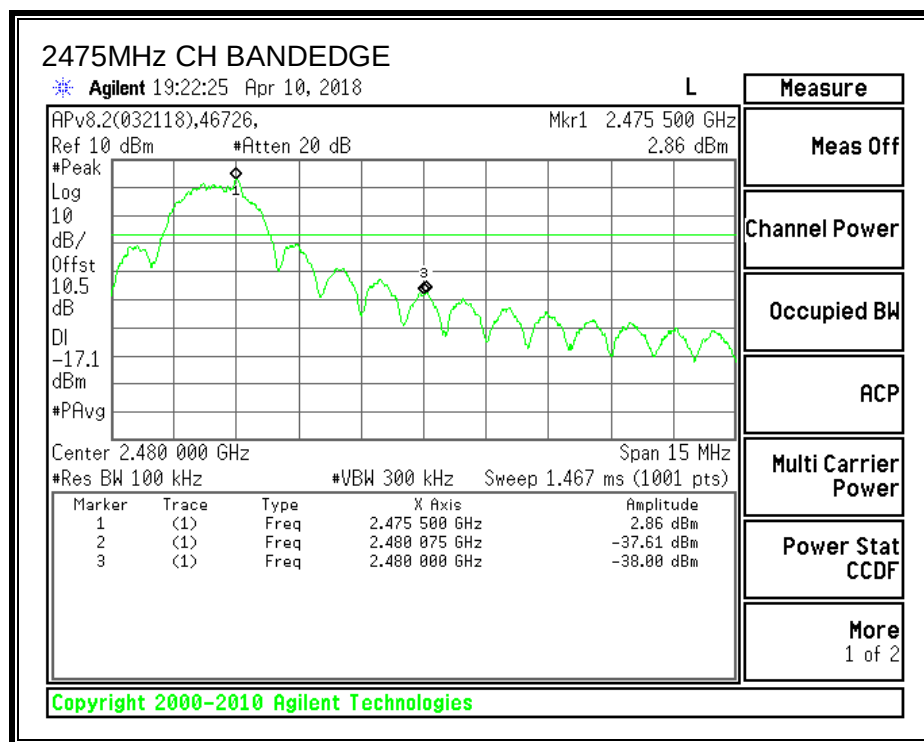
SPURIOUS EMISSIONS, LOW CHANNEL

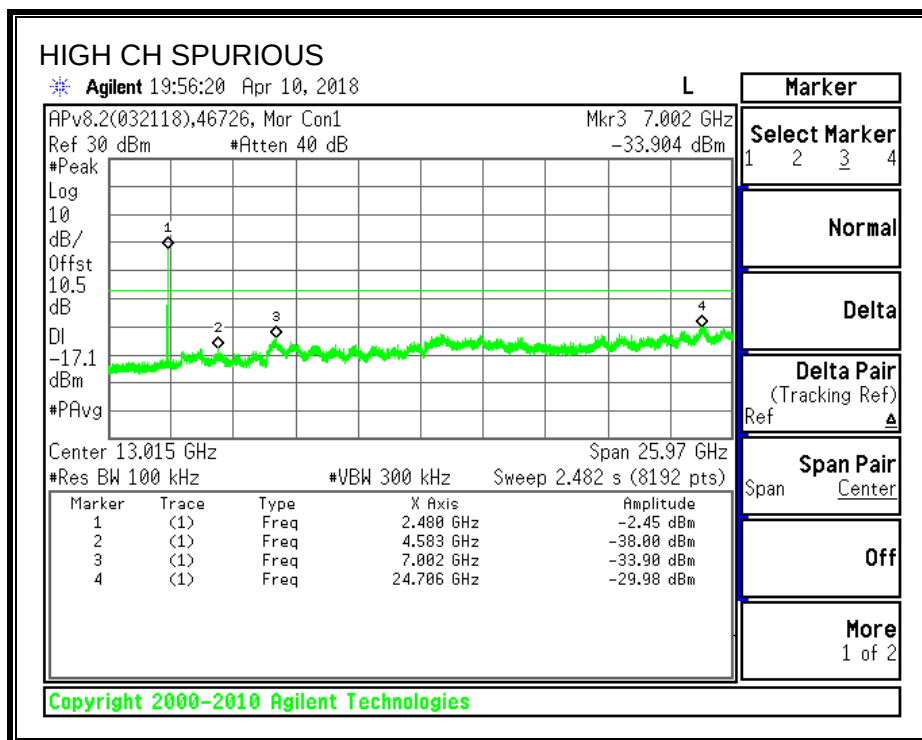
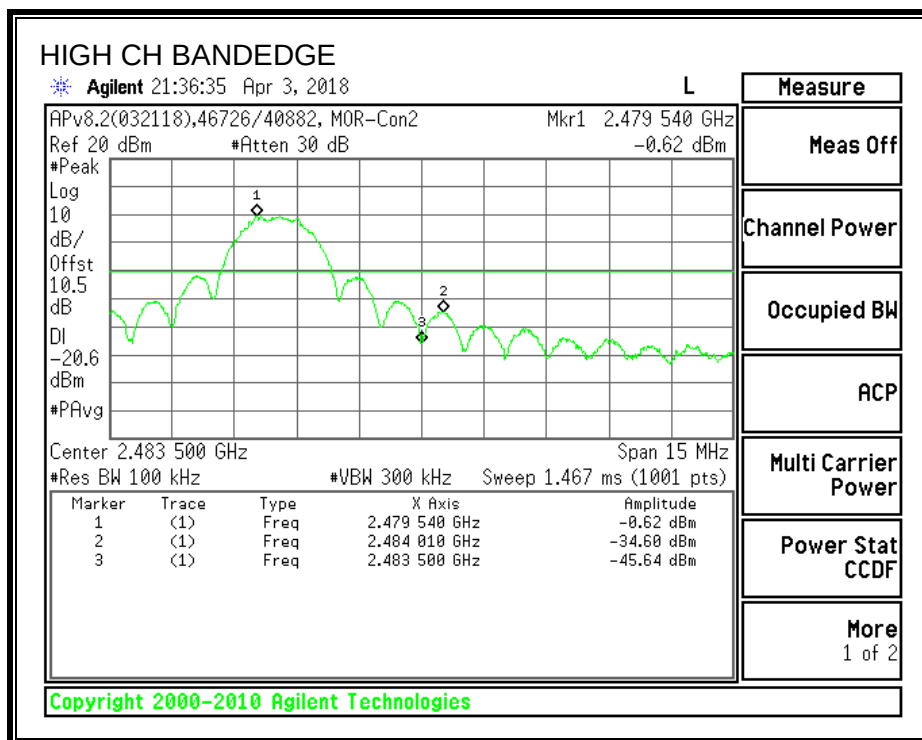


SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL





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.

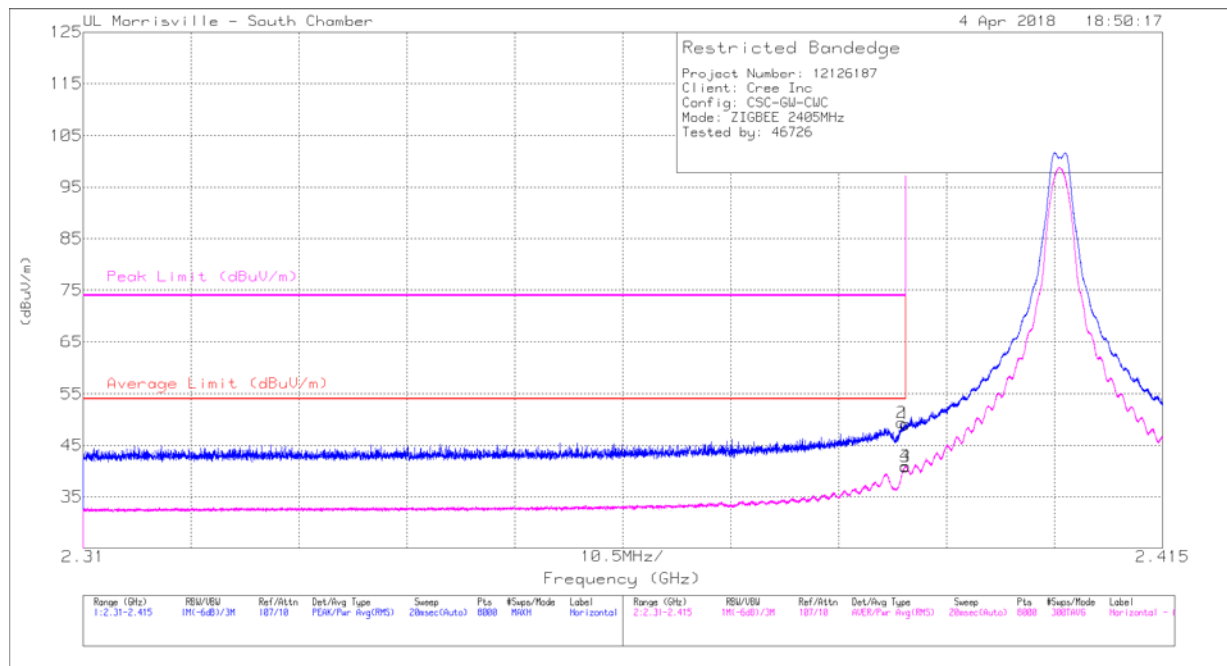
The spectrum from 1 to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. The spectrum from 9kHz to 1000MHz and 18 to 26GHz was investigated on the worst-case channel.

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/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	41.27	Pk	31.9	-24.1	49.07	-	-	74	-24.93	253	170	H
2	*** 2.39	41.58	Pk	31.9	-24.1	49.38	-	-	74	-24.62	253	170	H
3	*** 2.39	33.08	RMS	31.9	-24.1	40.88	54	-13.12	-	-	253	170	H
4	*** 2.39	33.17	RMS	31.9	-24.1	40.97	54	-13.03	-	-	253	170	H

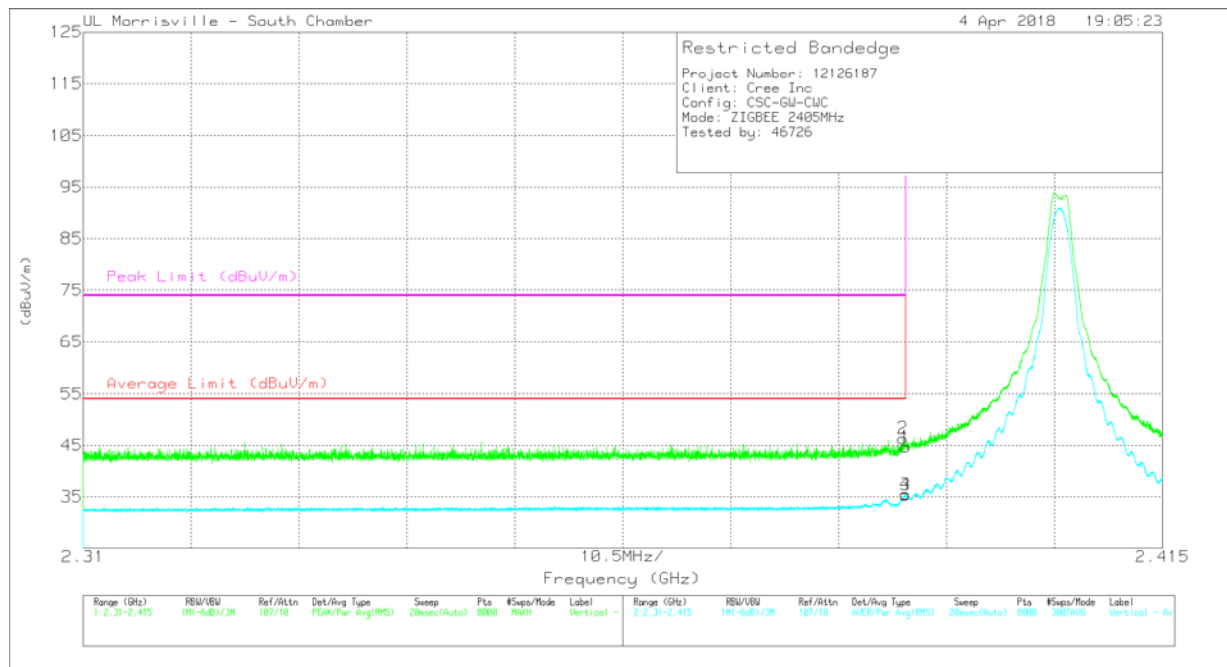
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 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/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	36.85	Pk	31.9	-24.1	44.65	-	-	74	-29.35	254	359	V
2	*** 2.39	38.52	Pk	31.9	-24.1	46.32	-	-	74	-27.68	254	359	V
3	*** 2.39	27.52	RMS	31.9	-24.1	35.32	54	-18.68	-	-	254	359	V
4	*** 2.39	27.69	RMS	31.9	-24.1	35.49	54	-18.51	-	-	254	359	V

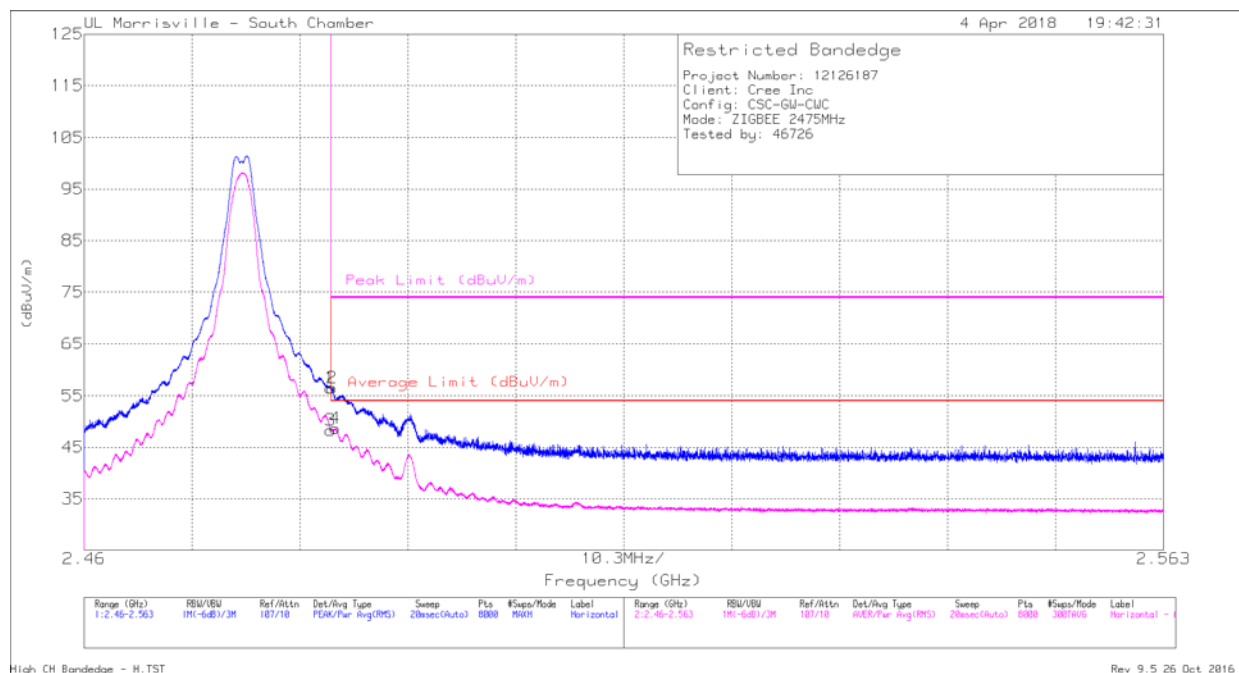
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 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/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	48.67	Pk	32.4	-24.6	56.47	-	-	74	-17.53	258	200	H
2	* ** 2.484	48.7	Pk	32.4	-24.6	56.5	-	-	74	-17.5	258	200	H
3	* ** 2.484	40.44	RMS	32.4	-24.6	48.24	54	-5.76	-	-	258	200	H
4	* ** 2.484	40.81	RMS	32.4	-24.6	48.61	54	-5.39	-	-	258	200	H

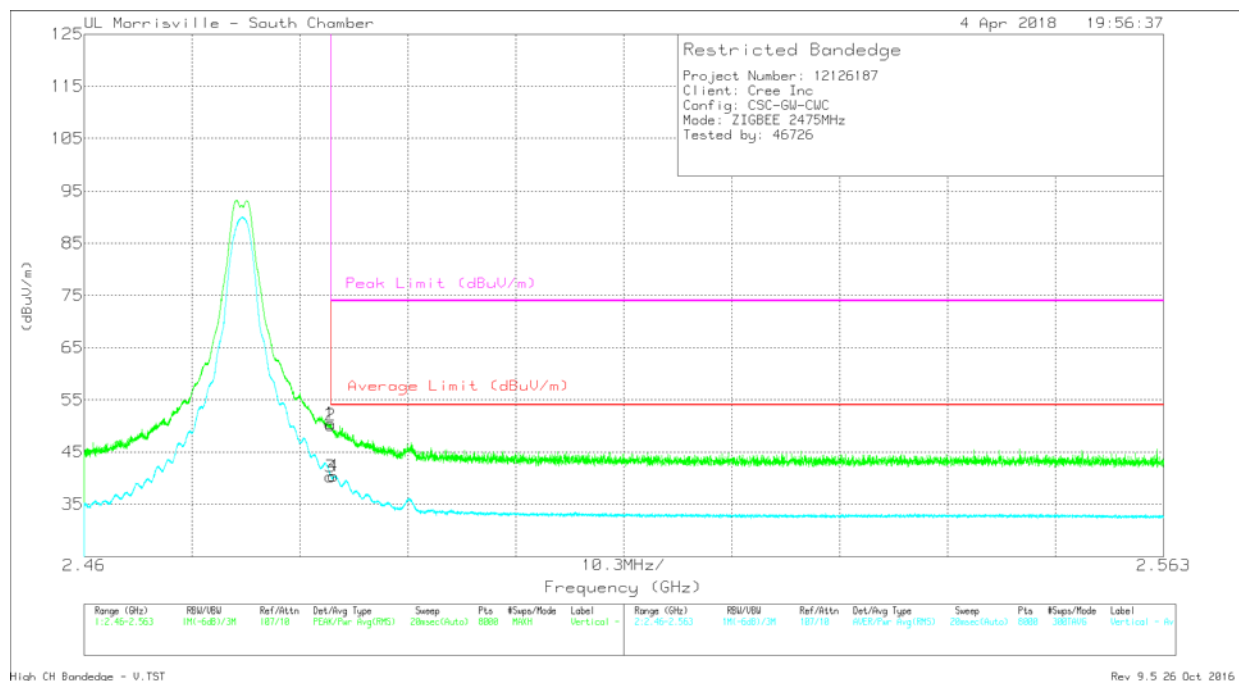
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 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/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	42.63	Pk	32.4	-24.6	50.43	-	-	74	-23.57	256	283	V
2	* ** 2.484	42.3	Pk	32.4	-24.6	50.1	-	-	74	-23.9	256	283	V
3	* ** 2.484	32.45	RMS	32.4	-24.6	40.25	54	-13.75	-	-	256	283	V
4	* ** 2.484	32.59	RMS	32.4	-24.6	40.39	54	-13.61	-	-	256	283	V

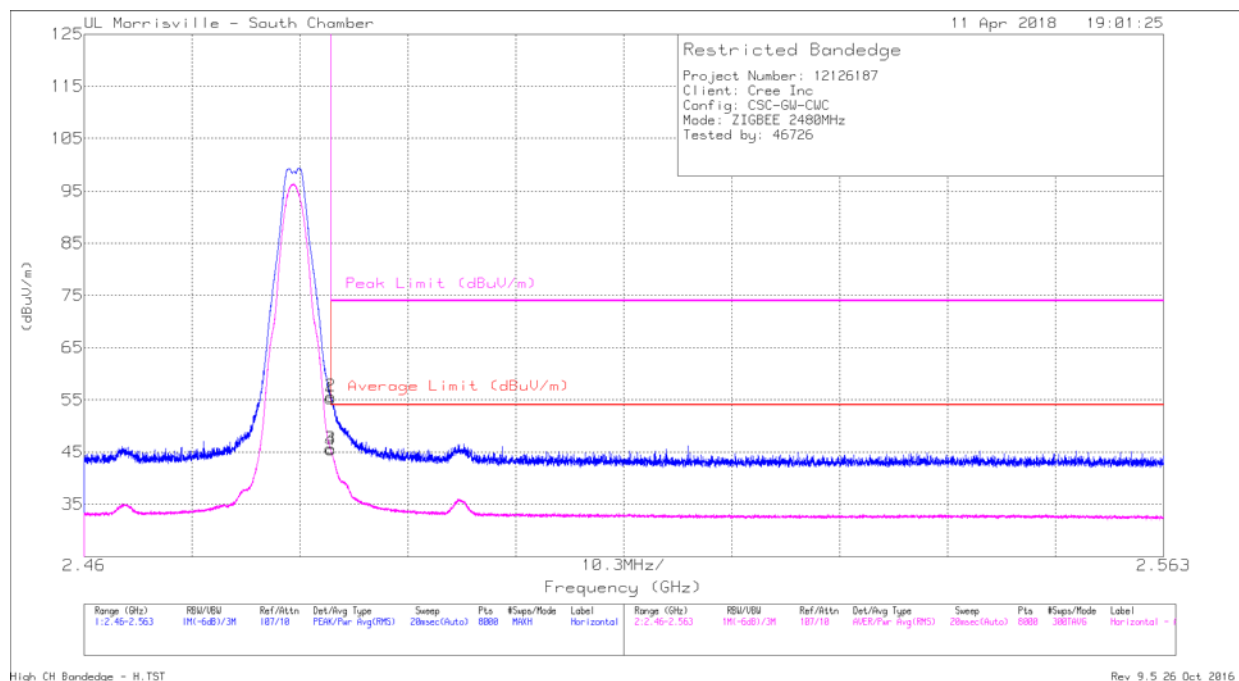
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 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/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	47.42	Pk	32.4	-24.6	55.22	-	-	74	-18.78	268	258	H
2	* ** 2.484	47.89	Pk	32.4	-24.6	55.69	-	-	74	-18.31	268	258	H
3	* ** 2.484	37.89	RMS	32.4	-24.6	45.69	54	-8.31	-	-	268	258	H
4	* ** 2.484	37.63	RMS	32.4	-24.6	45.43	54	-8.57	-	-	268	258	H

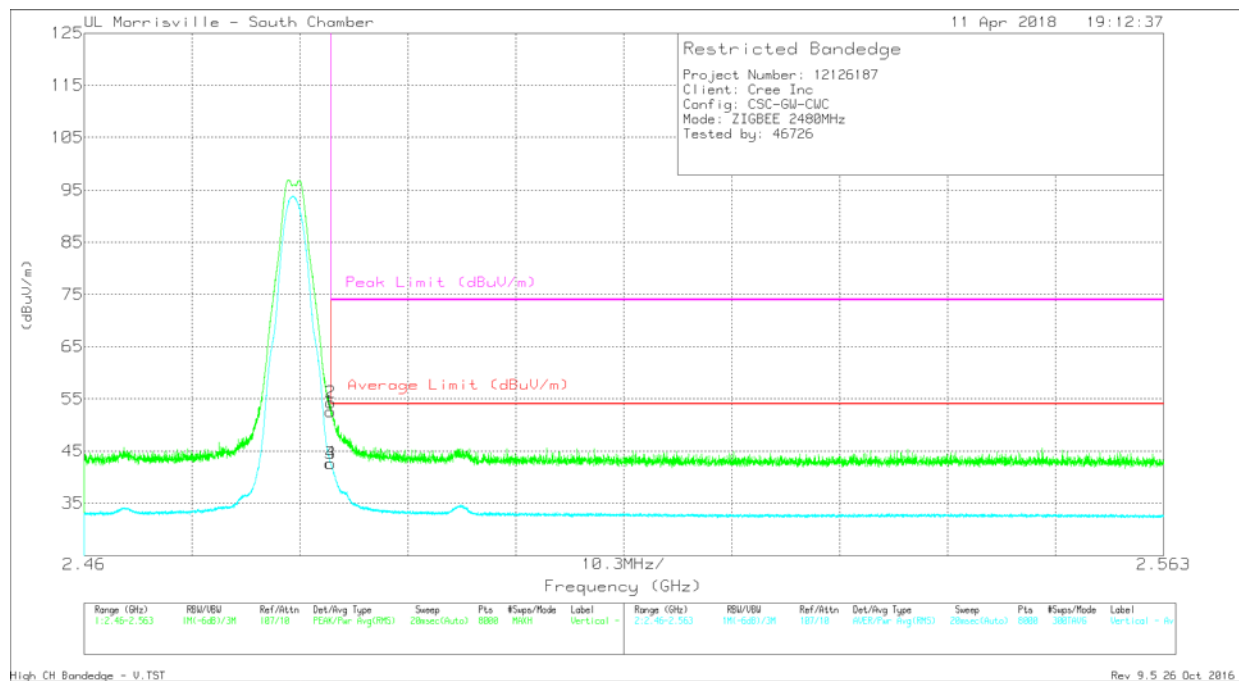
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 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/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	44.74	Pk	32.4	-24.6	52.54	-	-	74	-21.46	294	366	V
2	* ** 2.484	46.47	Pk	32.4	-24.6	54.27	-	-	74	-19.73	294	366	V
3	* ** 2.484	34.81	RMS	32.4	-24.6	42.61	54	-11.39	-	-	294	366	V
4	* ** 2.484	34.84	RMS	32.4	-24.6	42.64	54	-11.36	-	-	294	366	V

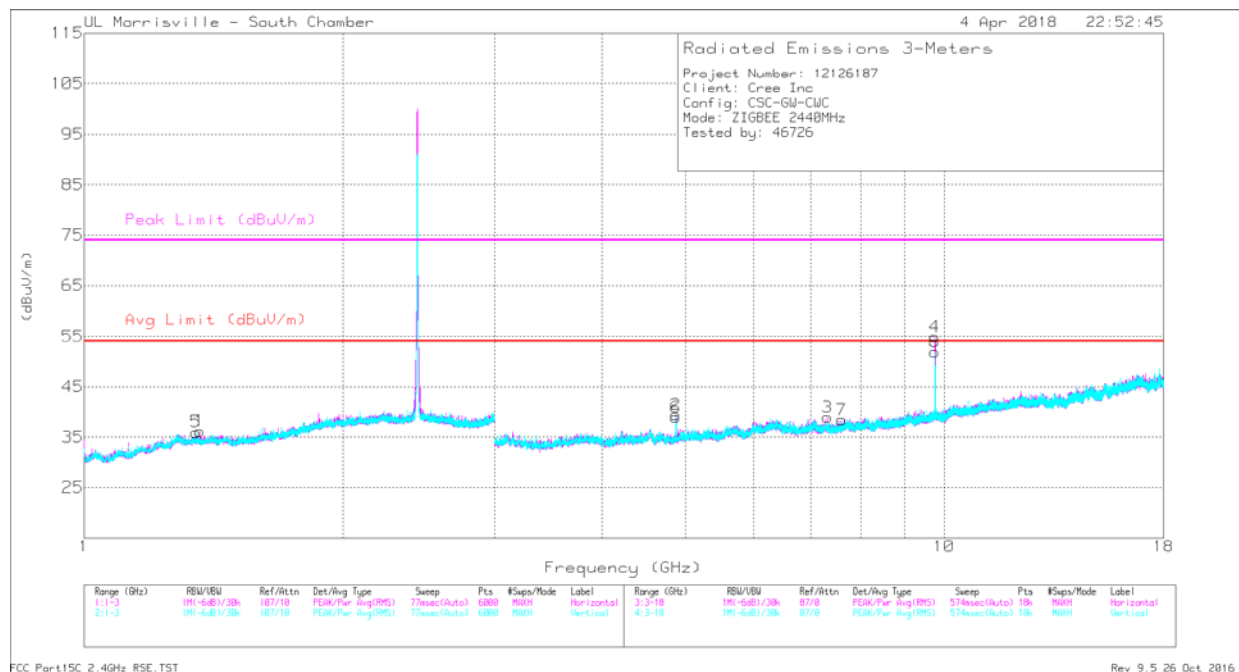
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

RMS - RMS detection

2440 MHz



Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/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	* ** 1.363	35.37	PK2	28.8	-23	41.17	-	-	74	-32.83	173	164	H
	* ** 1.363	23.34	MAv1	28.8	-23	29.14	54	-24.86	-	-	173	164	H
2	* ** 4.879	43.81	PK2	34	-30.9	46.91	-	-	74	-27.09	141	317	H
	* ** 4.879	34.4	MAv1	34	-30.9	37.5	54	-16.5	-	-	141	317	H
3	* ** 7.318	38.26	PK2	35.5	-27.6	46.16	-	-	74	-27.84	244	113	H
	* ** 7.318	26.91	MAv1	35.5	-27.6	34.81	54	-19.19	-	-	244	113	H
5	* ** 1.347	35.7	PK2	28.7	-23	41.4	-	-	74	-32.6	148	383	V
	* ** 1.347	23.76	MAv1	28.7	-23	29.46	54	-24.54	-	-	148	383	V
6	* ** 4.879	43.17	PK2	34	-30.9	46.27	-	-	74	-27.73	248	291	V
	* ** 4.879	32.78	MAv1	34	-30.9	35.88	54	-18.12	-	-	248	291	V
7	* ** 7.604	36.57	PK2	35.6	-27.8	44.37	-	-	74	-29.63	138	317	V
	* ** 7.604	24.56	MAv1	35.6	-27.7	32.46	54	-21.54	-	-	138	317	V
4	9.758	43.9	Pk	36.8	-25.8	54.9	-	-	-	-	0-360	102	H
8	9.758	40.89	Pk	36.8	-25.8	51.89	-	-	-	-	0-360	101	V

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

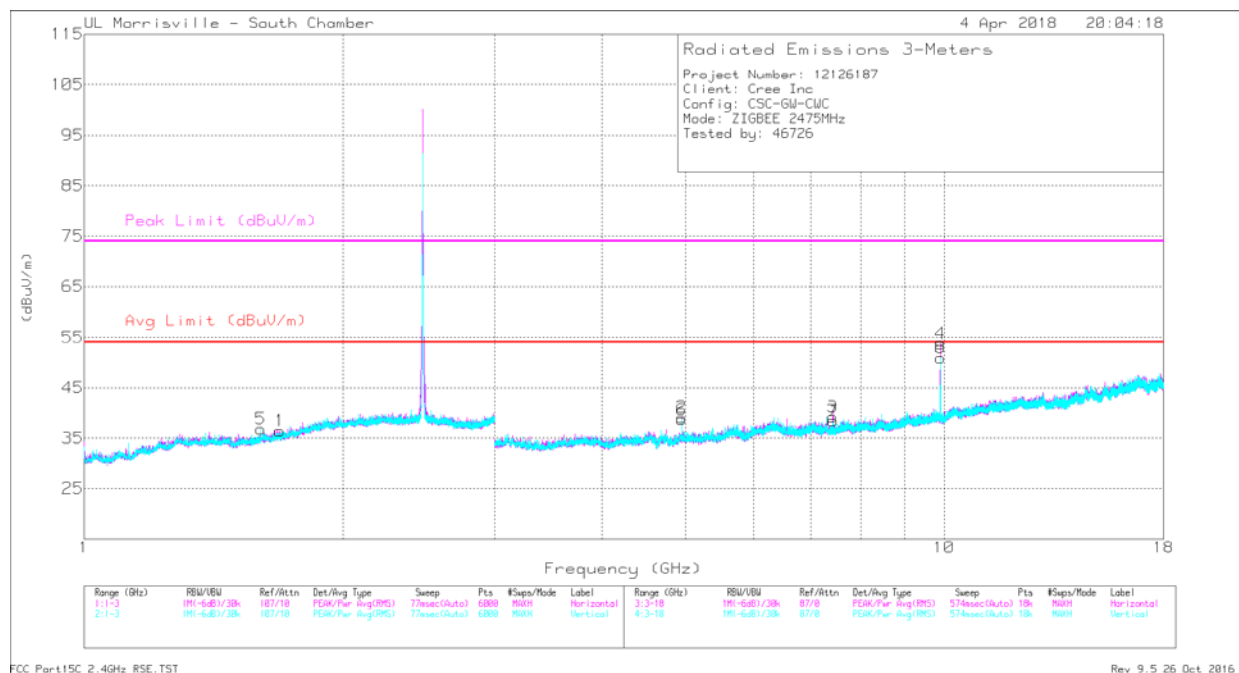
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

2475 MHz



Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/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	* ** 1.688	36.18	PK2	28.8	-22.2	42.78	-	-	74	-31.22	77	203	H
	* ** 1.688	23.75	MAv1	28.8	-22.2	30.35	54	-23.65	-	-	77	203	H
2	* ** 4.949	43.91	PK2	34	-31.1	46.81	-	-	74	-27.19	131	328	H
	* ** 4.949	33.58	MAv1	34	-31.1	36.48	54	-17.52	-	-	131	328	H
3	* ** 7.424	39.16	PK2	35.5	-27.9	46.76	-	-	74	-27.24	238	142	H
	* ** 7.424	28.34	MAv1	35.5	-27.9	35.94	54	-18.06	-	-	238	142	H
5	* ** 1.605	35.71	PK2	28.4	-22.3	41.81	-	-	74	-32.19	163	159	V
	* ** 1.605	23.73	MAv1	28.4	-22.3	29.83	54	-24.17	-	-	163	159	V
6	* ** 4.951	42.77	PK2	34	-31.1	45.67	-	-	74	-28.33	244	312	V
	* ** 4.951	33.11	MAv1	34	-31.1	36.01	54	-17.99	-	-	244	312	V
7	* ** 7.427	39.19	PK2	35.5	-27.9	46.79	-	-	74	-27.21	293	298	V
	* ** 7.427	27.54	MAv1	35.5	-27.9	35.14	54	-18.86	-	-	293	298	V
8	9.901	39.61	Pk	37	-25.7	50.91	-	-	-	-	0-360	101	V
4	9.902	42.4	Pk	37	-25.7	53.7	-	-	-	-	0-360	102	H

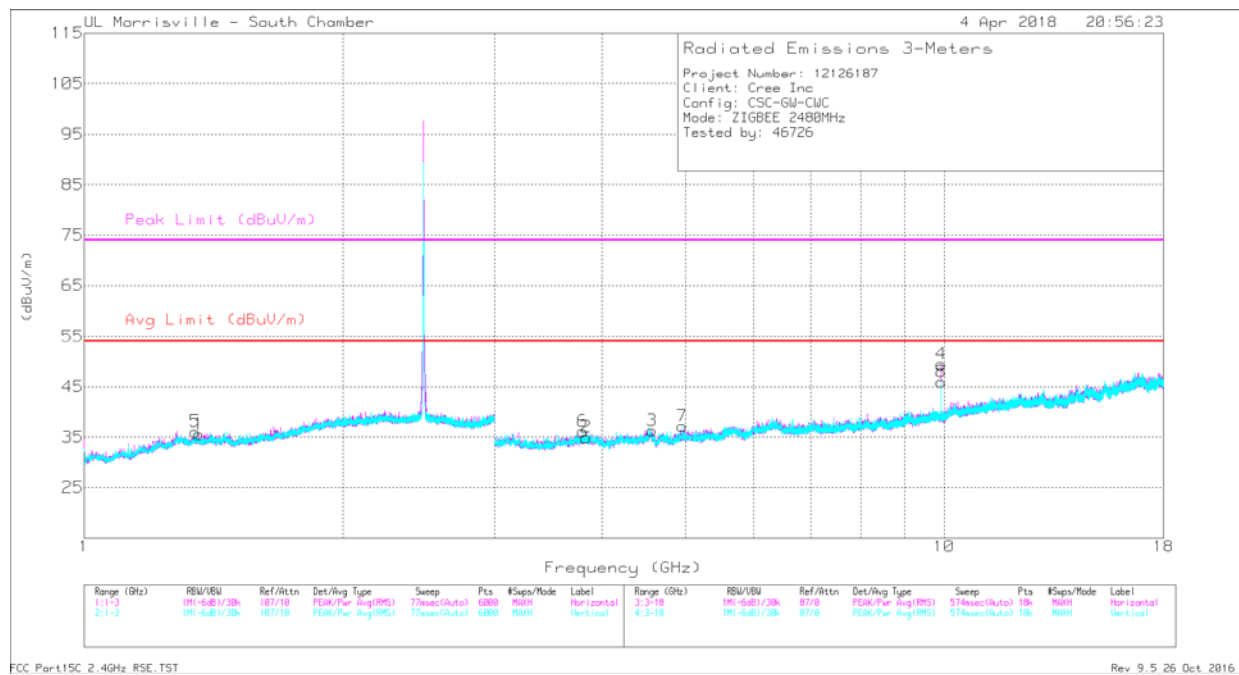
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

MAv1 - Maximum RMS Average



Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/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	*** 1.358	36.84	PK2	28.7	-23	42.54	-	-	74	-31.46	202	344	H
	*** 1.358	23.44	MAv1	28.7	-23	29.14	54	-24.86	-	-	202	344	H
2	*** 3.835	41.41	PK2	33.4	-32.3	42.51	-	-	74	-31.49	198	158	H
	*** 3.835	29.11	MAv1	33.4	-32.3	30.21	54	-23.79	-	-	198	158	H
3	*** 4.574	39.94	PK2	33.9	-31.6	42.24	-	-	74	-31.76	143	284	H
	*** 4.574	27.93	MAv1	33.9	-31.6	30.23	54	-23.77	-	-	143	284	H
5	*** 1.345	36.32	PK2	28.6	-23	41.92	-	-	74	-32.08	341	397	V
	*** 1.345	23.76	MAv1	28.6	-23	29.36	54	-24.64	-	-	341	397	V
6	*** 3.801	41.13	PK2	33.4	-32.6	41.93	-	-	74	-32.07	229	279	V
	*** 3.801	29.18	MAv1	33.4	-32.6	29.98	54	-24.02	-	-	229	279	V
7	*** 4.959	42.38	PK2	34	-31.1	45.28	-	-	74	-28.72	233	215	V
	*** 4.959	31.69	MAv1	34	-31.1	34.59	54	-19.41	-	-	233	215	V
4	9.918	38.18	Pk	37	-25.7	49.48	-	-	-	-	0-360	102	H
8	9.922	34.67	Pk	37	-25.7	45.97	-	-	-	-	0-360	101	V

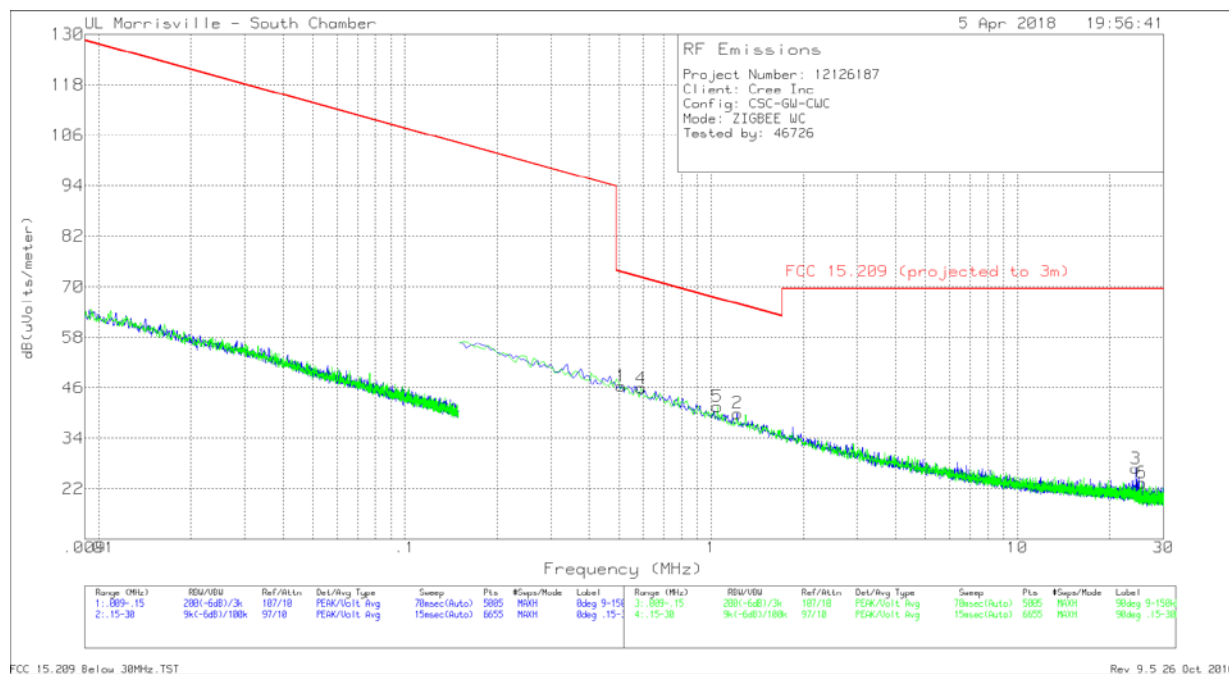
MAv1 - Maximum RMS Average

9.3 RADIATED WORST-CASE CONFIGURATION

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 $40 \cdot \log(\text{specification distance} / \text{test distance})$.

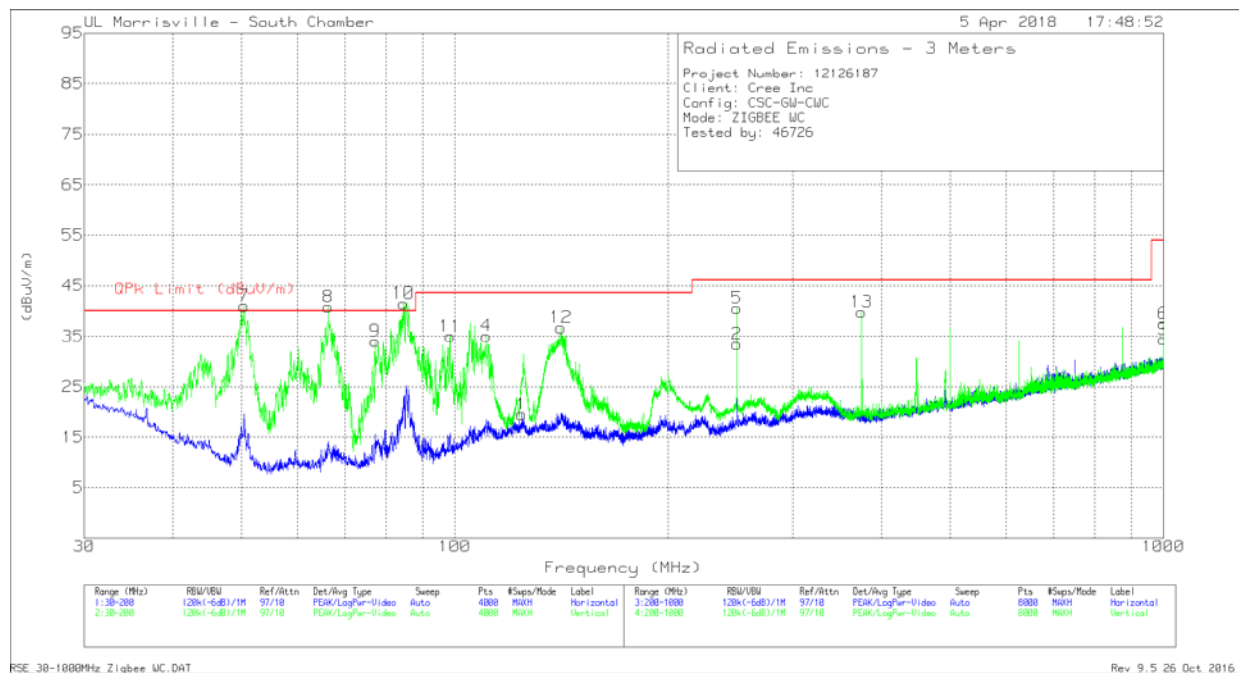
Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made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



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uV/m)	FCC QP 15.209 (projected to 3m)	QP Margin (dB)	FCC AV 15.209 (projected to 3m)	AV Margin (dB)	FCC PK 15.209 (projected to 3m)	PK Margin (dB)	Azimuth (Degs)
1	.50888	34.76	Pk	11.5	.1	46.36	73.47	-27.11	-	-	-	-	0-360
4	.58963	34.27	Pk	11.5	.1	45.87	72.19	-26.32	-	-	-	-	0-360
5	1.0472	29.84	Pk	11.5	.2	41.54	67.2	-25.66	-	-	-	-	0-360
2	1.21767	28.26	Pk	11.5	.2	39.96	65.89	-25.93	-	-	-	-	0-360
3	24.35197	17.01	Pk	9	.8	26.81	69.54	-42.73	-	-	-	-	0-360
6	25.45104	13.85	Pk	8.8	.8	23.45	69.54	-46.09	-	-	-	-	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	* ** 124.3175	25.18	Qp	18.2	-30.8	12.58	43.52	-30.94	7	103	H
4	* ** 110.8186	41.82	Qp	17.1	-30.9	28.02	43.52	-15.5	112	113	V
2	* ** 250.006	45.29	Qp	16.2	-29.9	31.59	46.02	-14.43	231	141	H
3	* ** 999.9798	33.82	Qp	28.2	-25.7	36.32	53.97	-17.65	281	221	H
5	* ** 250.0051	52.69	Qp	16.2	-29.9	38.99	46.02	-7.03	300	103	V
6	* ** 999.9889	30.02	Qp	28.2	-25.7	32.52	53.97	-21.45	16	159	V
7	50.4478	59.89	Pk	12.6	-31.5	40.99	-	-	0-360	101	V
8	66.3044	59.82	Pk	12.3	-31.3	40.82	-	-	0-360	101	V
9	77.1872	53.04	Pk	12.3	-31.3	34.04	-	-	0-360	101	V
10	84.6691	60.96	Pk	11.6	-31.1	41.46	-	-	0-360	101	V
11	98.4852	52.13	Pk	13.9	-31	35.03	-	-	0-360	101	V
12	141.2088	49.92	Pk	17.4	-30.6	36.72	-	-	0-360	101	V
13	375.0228	49.15	Pk	19.8	-29.2	39.75	-	-	0-360	102	V

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

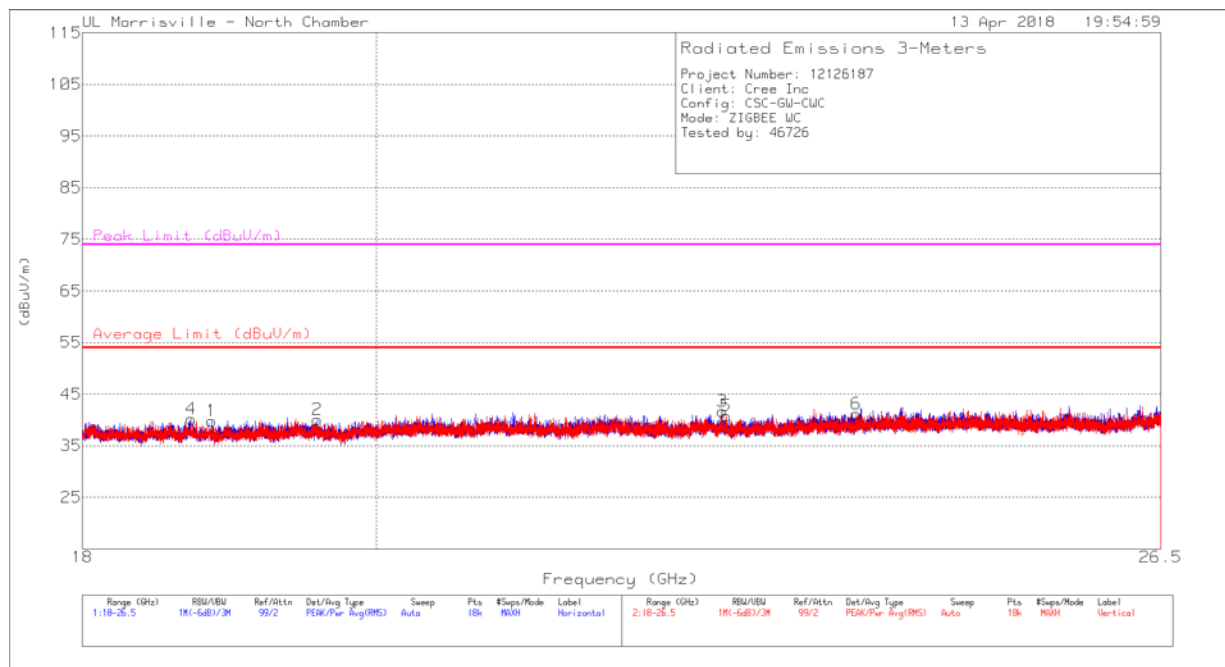
** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

Note: frequencies not located within restricted bands not measured.

SPURIOUS EMISSIONS 18 TO 26.5 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
1	* ** 18.857	48.14	Pk	32.6	-40.9	39.84	54	-14.16	74	-34.16	0-360	199	H
2	* ** 19.585	48.47	Pk	32.7	-41.1	40.07	54	-13.93	74	-33.93	0-360	299	H
3	* ** 22.643	48.77	Pk	33.7	-40.8	41.67	54	-12.33	74	-32.33	0-360	148	H
4	* ** 18.717	48.39	Pk	32.5	-40.7	40.19	54	-13.81	74	-33.81	0-360	202	V
5	* ** 22.674	47.9	Pk	33.7	-40.8	40.8	54	-13.2	74	-33.2	0-360	102	V
6	* ** 23.758	47.33	Pk	34	-40.2	41.13	54	-12.87	74	-32.87	0-360	299	V

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

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

^{*} Decreases with the logarithm of the frequency.

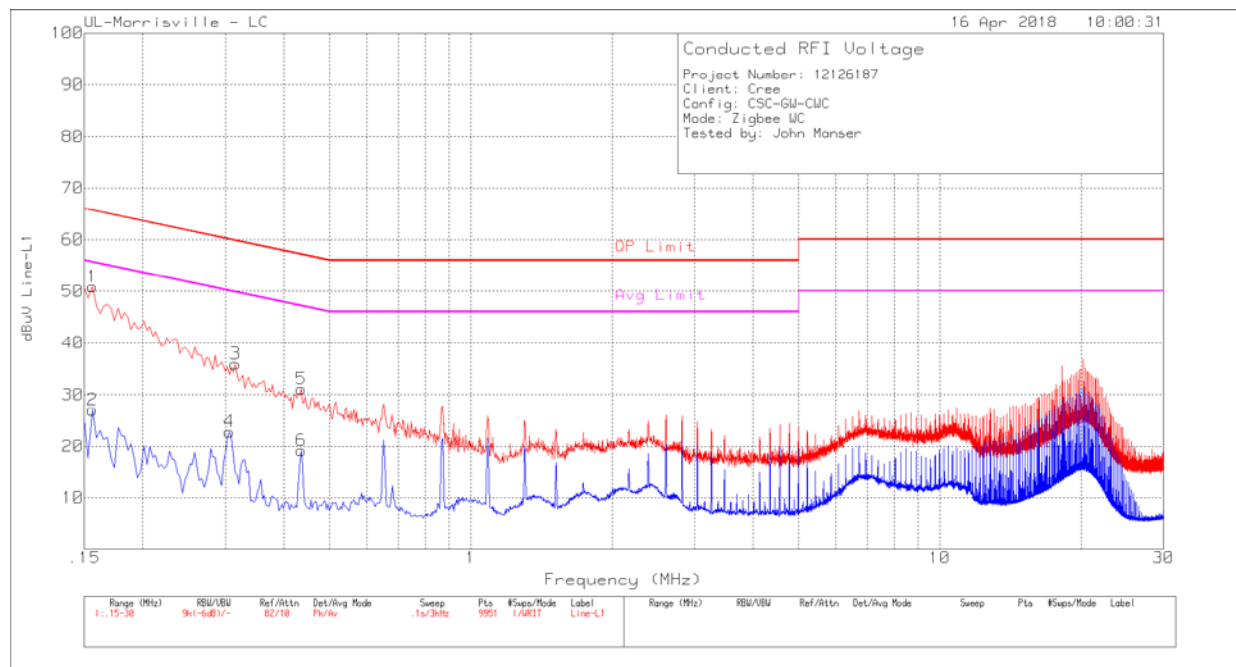
TEST PROCEDURE

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

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

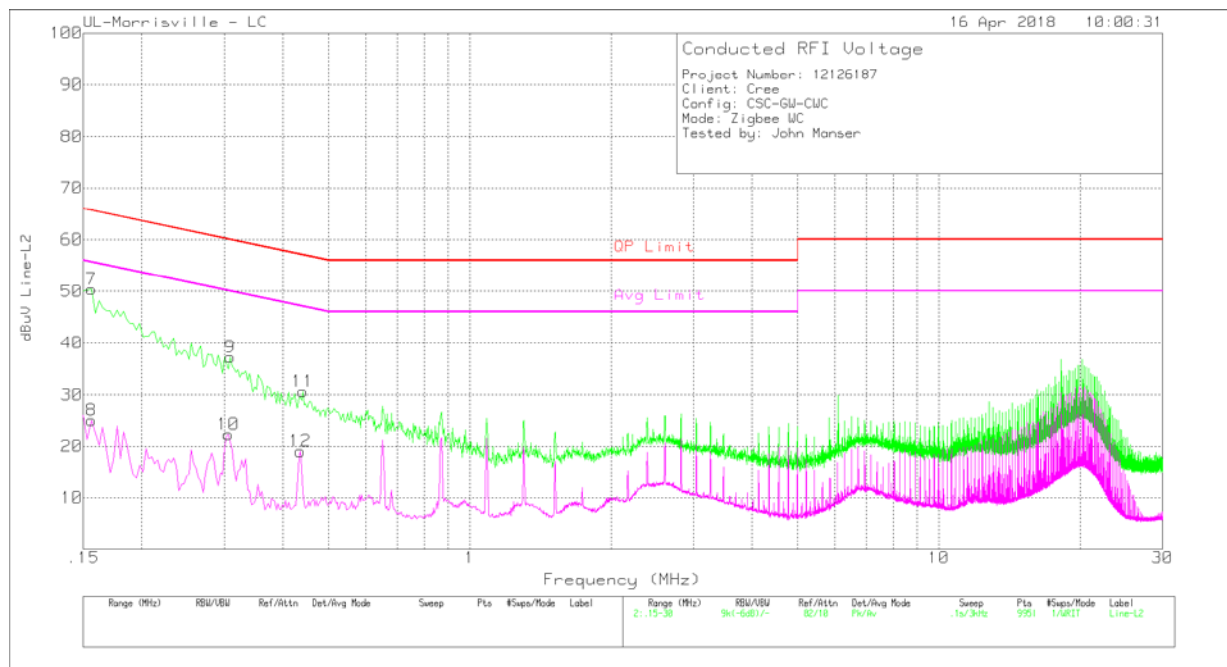


Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
1	.156	40.72	Pk	.2	10	50.92	65.67	-14.75	-	-
2	.156	16.82	Av	.2	10	27.02	-	-	55.67	-28.65
3	.315	25.96	Pk	.1	9.9	35.96	59.84	-23.88	-	-
4	.306	12.81	Av	.1	9.9	22.81	-	-	50.08	-27.27
5	.435	21.09	Pk	.1	9.9	31.09	57.16	-26.07	-	-
6	.435	9.18	Av	.1	9.9	19.18	-	-	47.16	-27.98

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)
7	.156	40.21	Pk	.2	10	50.41	65.67	-15.26	-	-
8	.156	14.81	Av	.2	10	25.01	-	-	55.67	-30.66
9	.309	27.28	Pk	.1	9.9	37.28	60	-22.72	-	-
10	.306	12.3	Av	.1	9.9	22.3	-	-	50.08	-27.78
11	.441	20.59	Pk	.1	9.9	30.59	57.04	-26.45	-	-
12	.435	9.03	Av	.1	9.9	19.03	-	-	47.16	-28.13

Pk - Peak detector

Av - Average detection