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

BLUETOOTH LOW ENERGY CERTIFICATION TEST REPORT

FOR

BLE MODULE

MODEL NUMBER: 101

FCC ID: 2AB8ZND12
IC: 1000X-ND12

REPORT NUMBER: 15U21795-E1V4

ISSUE DATE: OCTOBER 09, 2015

Prepared for
INTEL CORPORATION
2200 MISSION COLLEGE BOULEVARD,
SANTA CLARA, CA 95052, U.S.A

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/29/2015	Initial Issue	C. PANG
V2	10/05/2015	Updated Equipment list date	C. PANG
V3	10/07/2015	Address TCB's question	C. PANG
V4	10/09/2015	Update to RSS-247	C. Pang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: INTEL CORPORATION
2200 MISSION COLLEGE BOULEVARD
SANTA CLARA, CA 95052, U.S.A.

EUT DESCRIPTION: BLE MODULE

MODEL: 101

SERIAL NUMBER: AEDVT1SQ5360091 (CONDUCTED);
AEDVT1SQ536009A (RADIATED)

DATE TESTED: SEPTEMBER 15 -18, 2015

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

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

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

Approved & Released For
UL Verification Services Inc. By:

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EMC SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:

CLIFFORD SUSA
EMC ENGINEER
UL VERIFICATION SERVICES INC.

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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 and RSS-247 Issue 1.

Testing for radiated emissions above 1GHz was performed with the EUT elevated at 1.5m instead of 0.8m. 1.5m is the required height in ANSI C63.10:2013 as referenced by RSS GEN issue 4. This test height has been permitted by FCC as discussed in FCC/TCB conference call in December 2014.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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.

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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
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a BLE module

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	3.87	2.44

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a trace antenna, with a maximum gain of 0 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was DVT Eng. Build.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

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

BLE: 1 Mbps.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	Yoga 2 11	YB04499042	N/A
AC Adapter	Lenovo	ADLX45NCC3A	11S45N0297ZSH443C	N/A
Test Board	Zitrades	CP2102	X0000IXYXP3	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	3-Prong	Un-Shielded	1.8	N/A
2	DC	1	DC	Un-Shielded	1	N/A
3	AC/DC	1	DC	Un-Shielded	1.6	N/A
4	USB	1	USB	Un-Shielded	0.2	Laptop to Test Board
5	TX/RX/GND Pins	1	TX/RX/GND Pins	Un-Shielded	0.1	Test board to EUT
6	Antenna	1	SMA	Un-Shielded	0.025	To Spectrum Analyzer
7	USB	1	USB	Shielded	1.8	N/A

TEST SETUP

Test software exercised the radio card.

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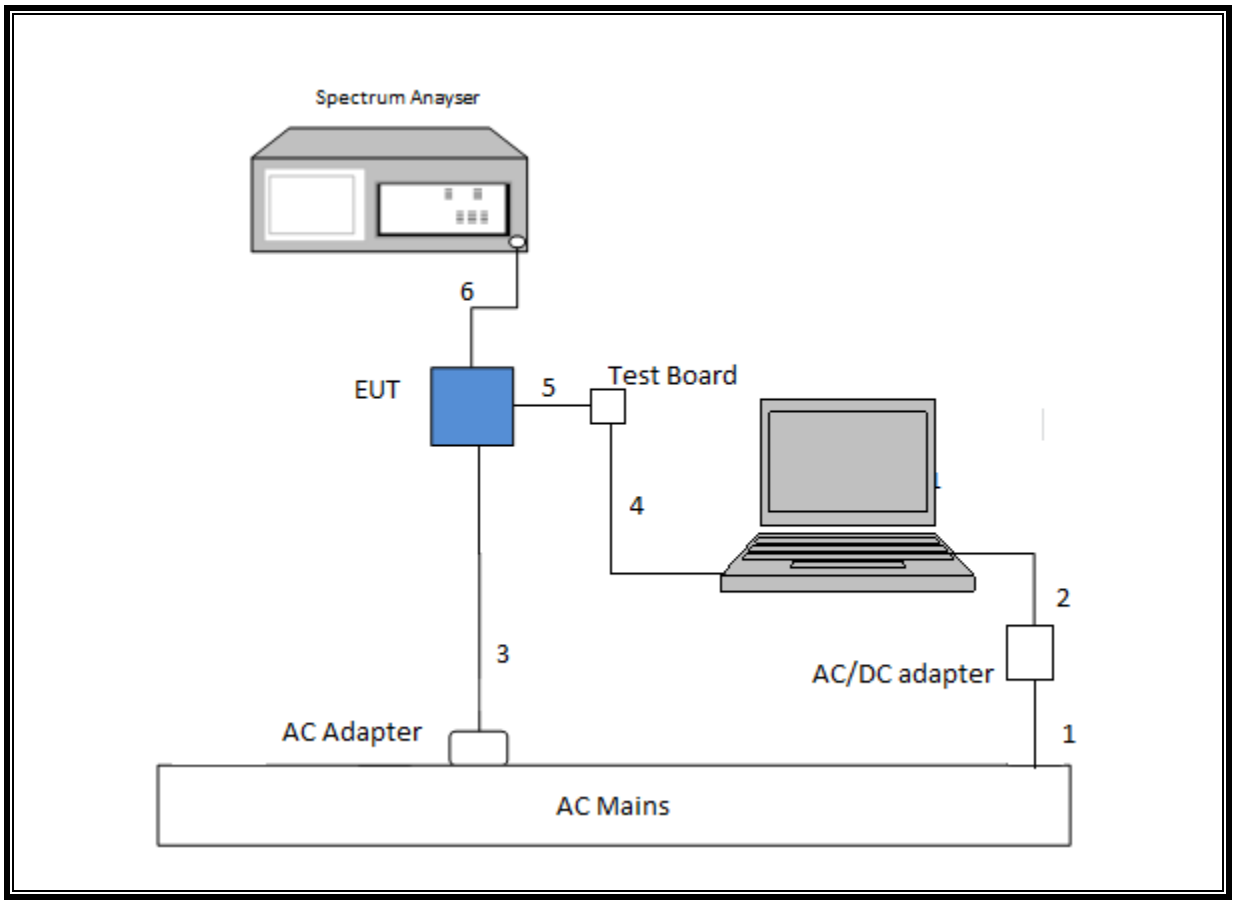
SETUP DIAGRAM FOR CONDUCTED TESTS



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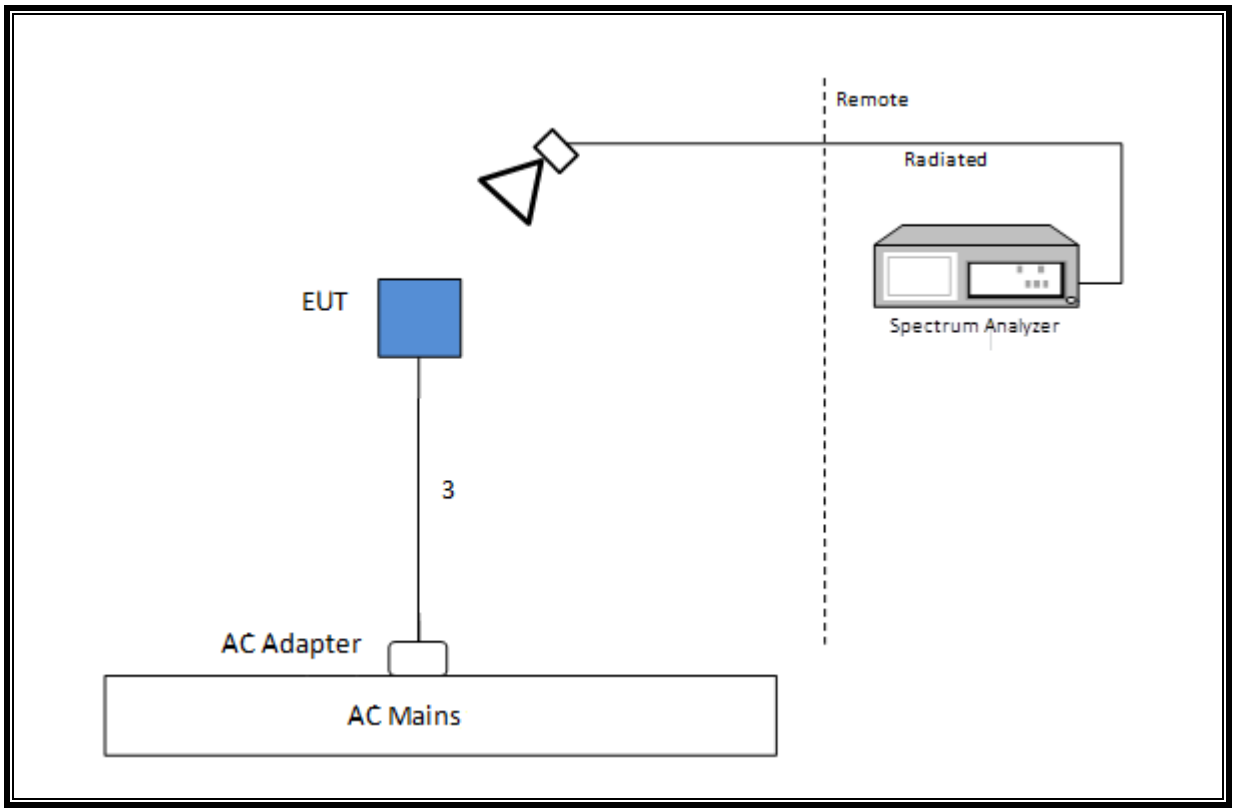
SETUP DIAGRAM FOR RADIATED TESTS



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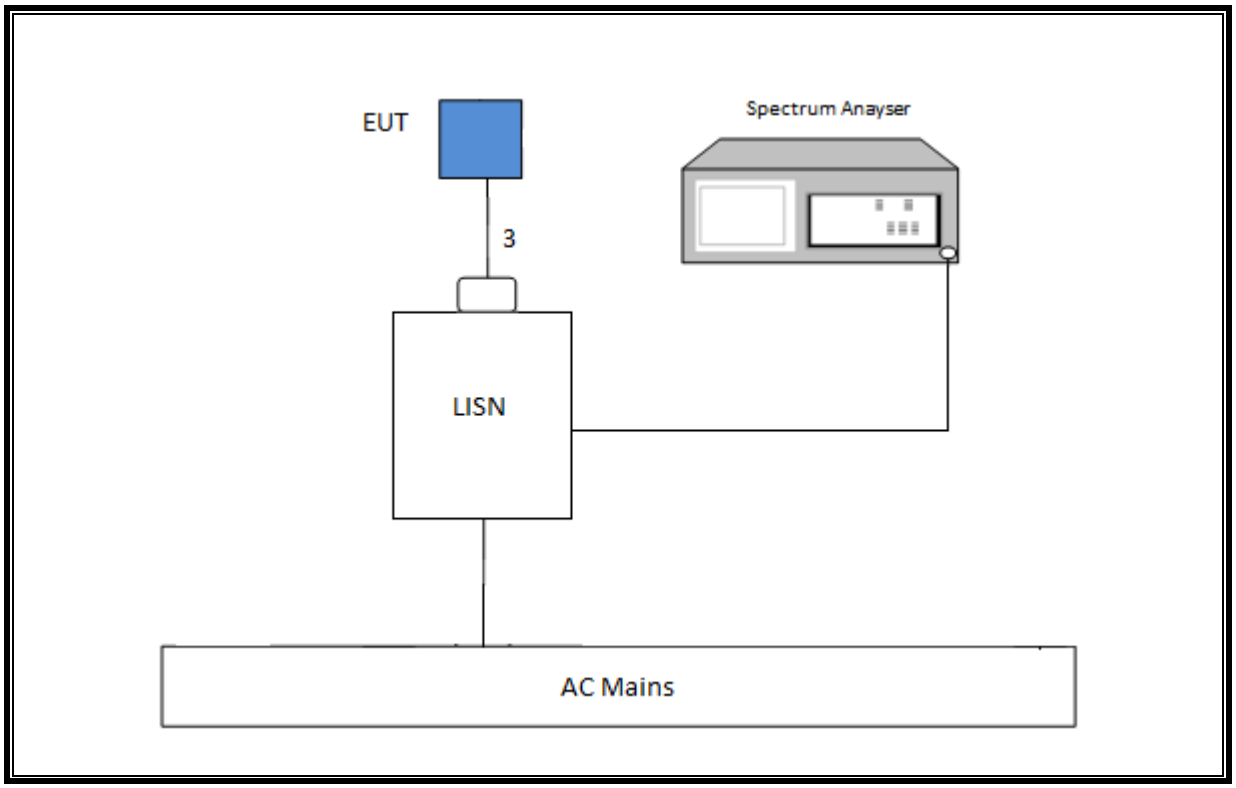
SETUP DIAGRAM 1 FOR LINE CONDUCTED TEST



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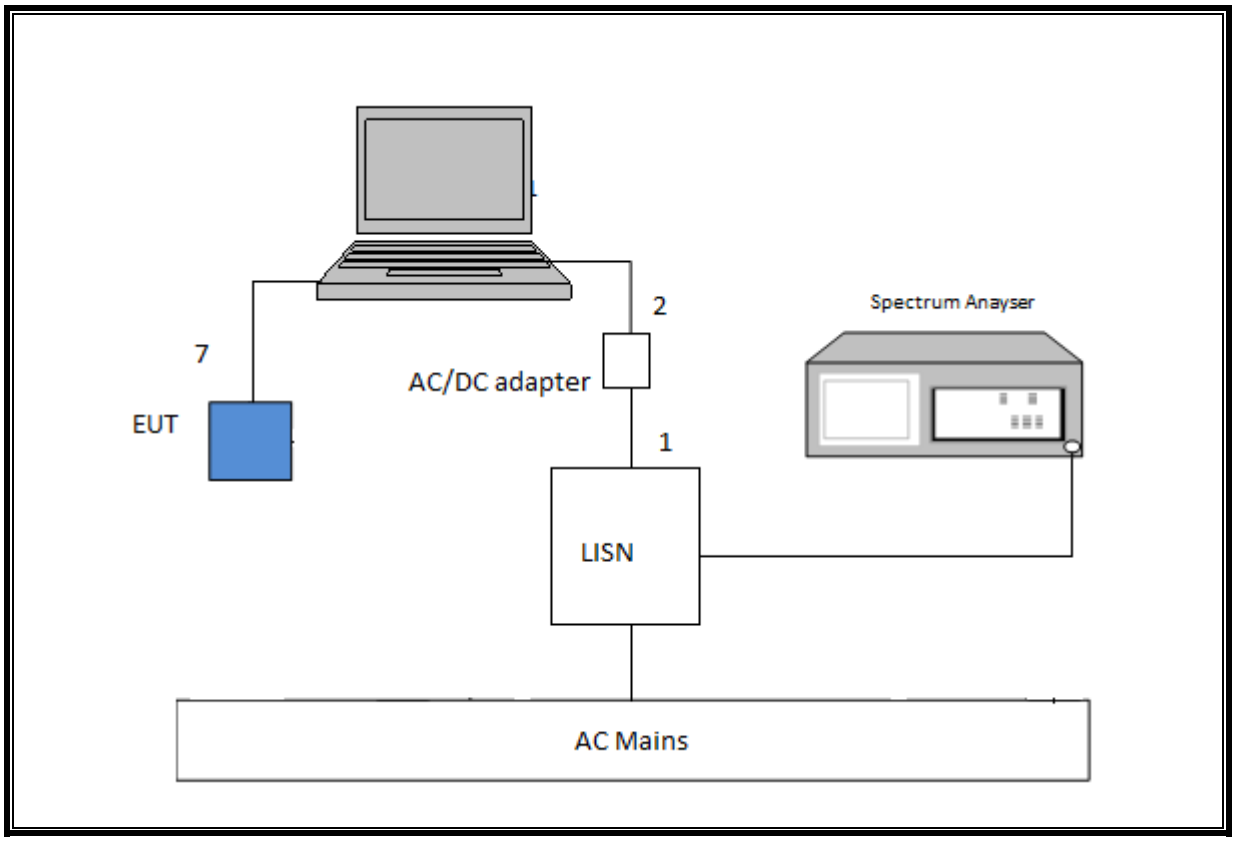
SETUP DIAGRAM 2 FOR LINE CONDUCTED TEST



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6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	**Manufacturer**	**Model**	**T No.**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015	
Conducted Software	UL	UL EMC	Ver 3.3	
Spectrum Analyzer PSA, 3Hz to 44GHz	Keysight	E4446A	T123	10/21/15
Power Meter	Keysight	N1911A	T1244	04/02/16
Power Sensor	Keysight	N1921A	T1226	05/06/16
Spectrum Analyzer PXA, 3Hz to 44GHz	Keysight	N9030A	T917	03/31/16
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	02/10/16
Antenna, Broadband Hybrid 30MHz to 2000MHz	Sunol Sciences	JB3	T408	01/14/16
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T741	04/29/16
Amplifier, 10KHz to 1GHz	Sonoma	310N	T285	06/08/16
Spectrum Analyzer PXA, 3Hz to 44GHz	Keysight	N9030A	T342	06/29/16
LISN, 30MHz	FCC	50/250-25-2	24	01/16/16
EMI Test Receiver, 9kHz to	Rhode & Schwarz	ESCI 7	1124	09/30/15

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7. ANTENNA PORT TEST RESULTS

7.1. MEASUREMENT METHODS

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

Output Power: KDB 558074 D01 v03r03, Section 9.1.2.

Power Spectral Density: KDB 558074 D01 v03r03, Section 10.2.

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

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

Band-edge: KDB 558074 D01 v03r03, Section 12.1

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7.2. ON TIME, DUTY CYCLE

None; for reporting purposes only.

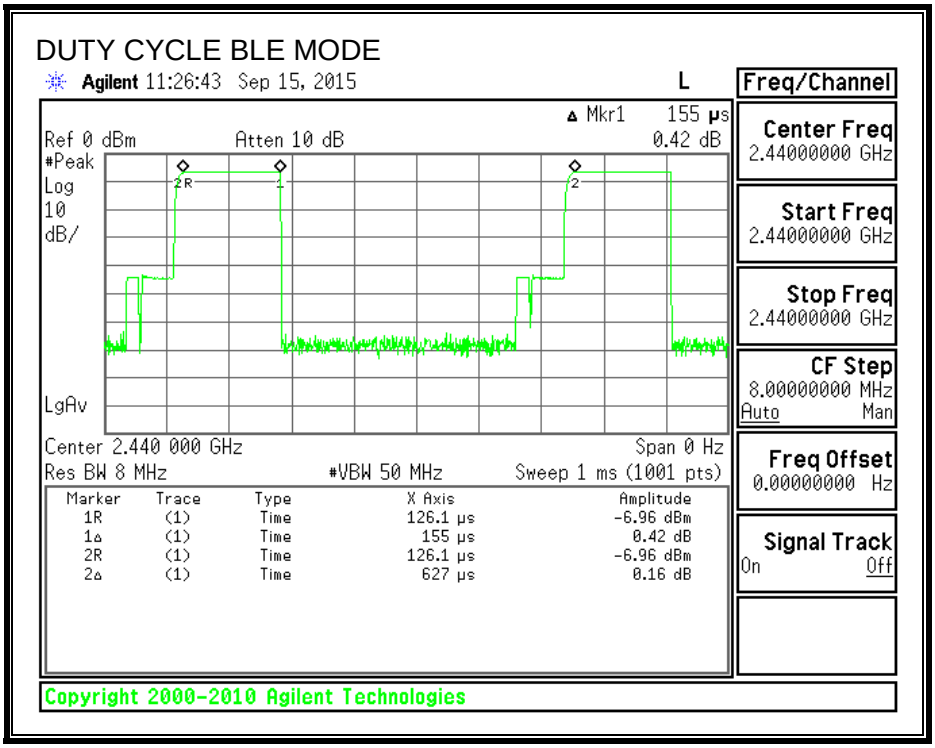
PROCEDURE

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	0.155	0.627	0.247	24.72%	6.07	6.452

DUTY CYCLE PLOTS



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7.3. 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	0.647	0.5
Middle	2440	0.662	0.5
High	2480	0.649	0.5

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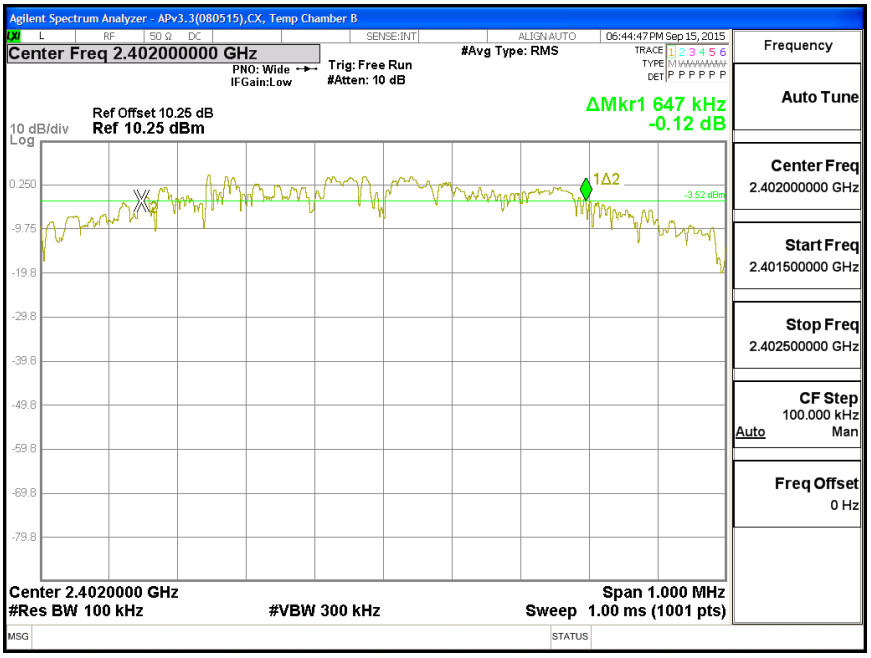
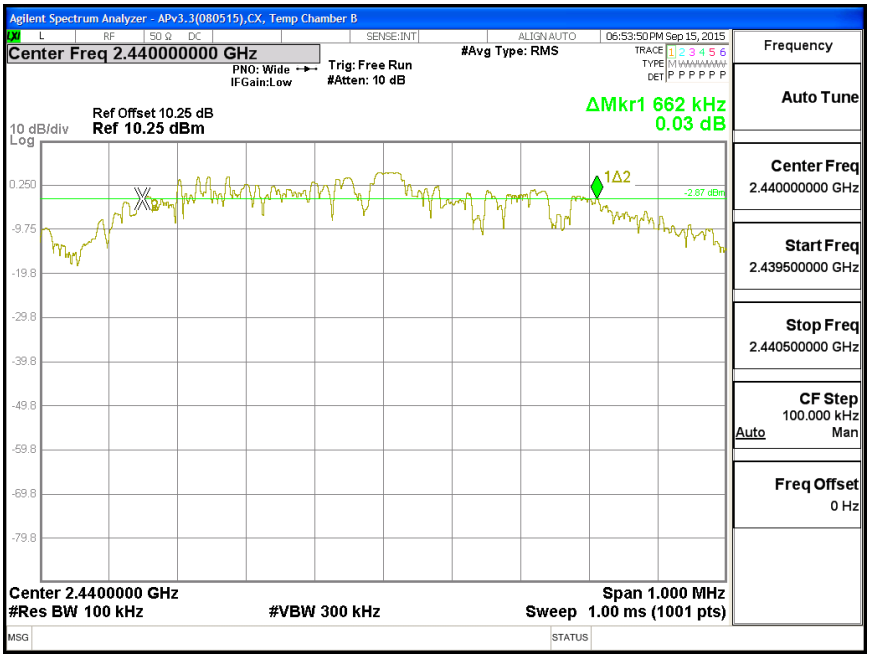
6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



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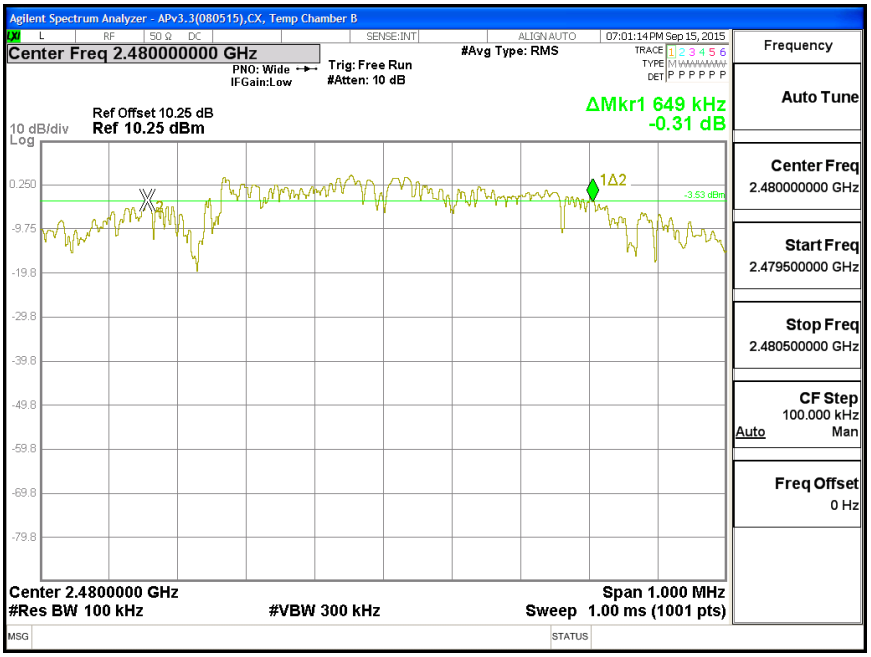
6 dB BANDWIDTH HIGH CH



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7.4. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth 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	0.96643
Middle	2440	0.96116
High	2480	0.99044

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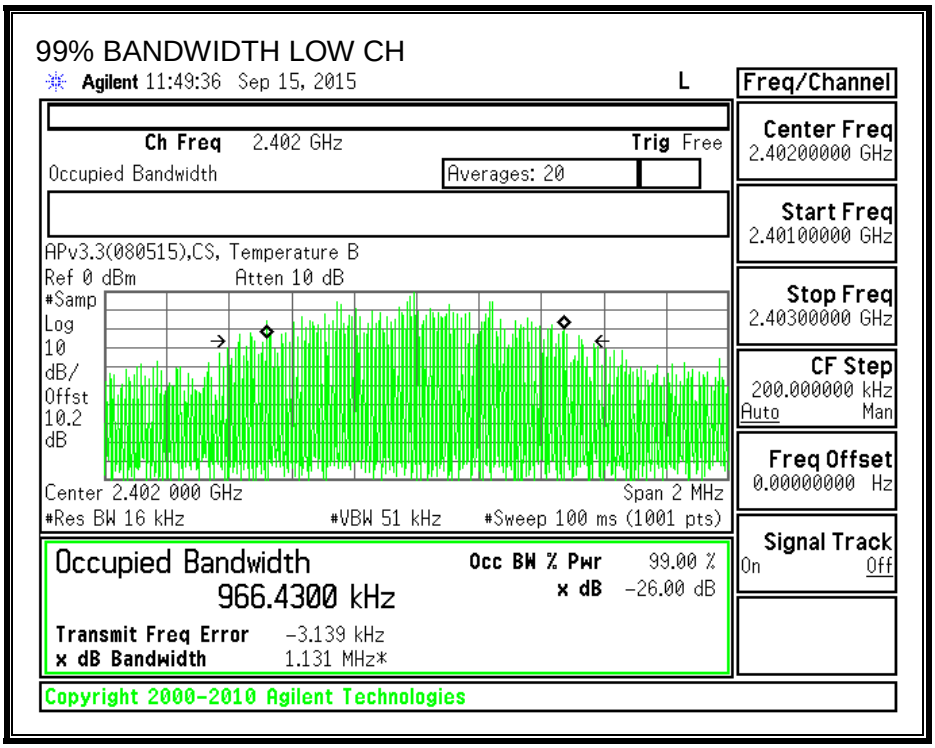
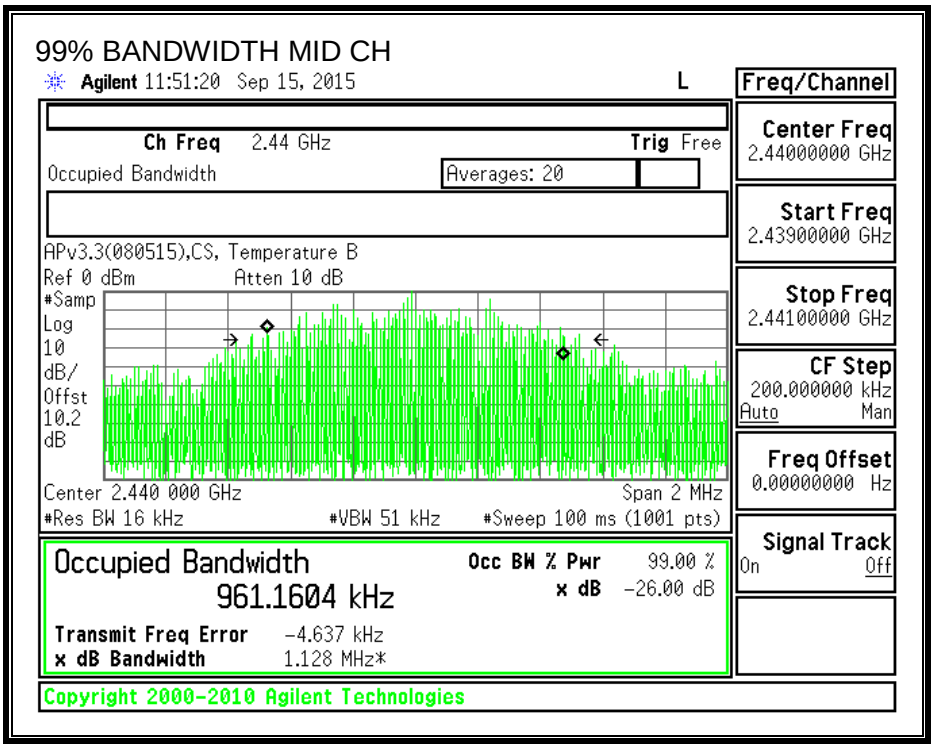
99% BANDWIDTH





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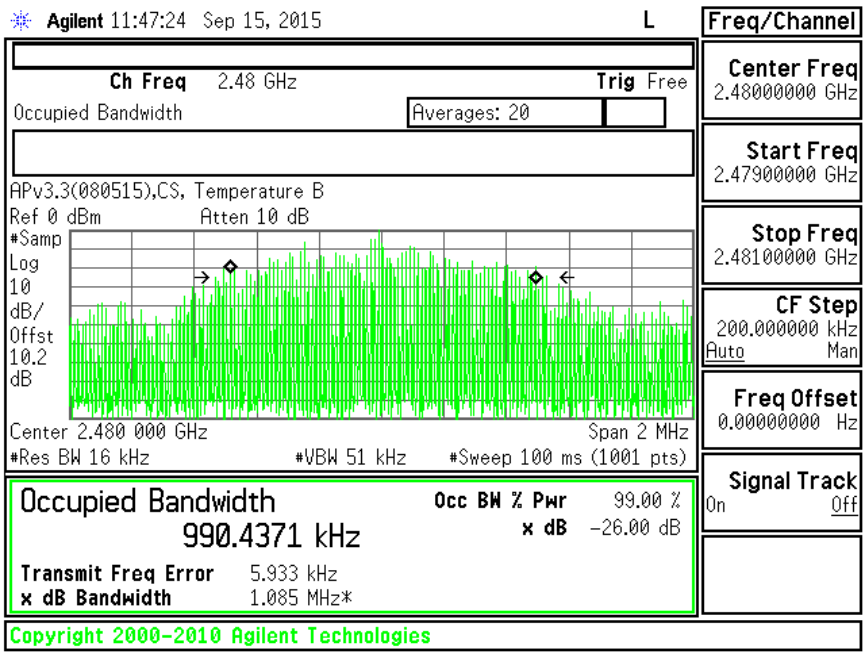
99% BANDWIDTH HIGH CH



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7.5. 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

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.87	30	-26.13
Middle	2440	3.67	30	-26.33
High	2480	3.37	30	-26.63

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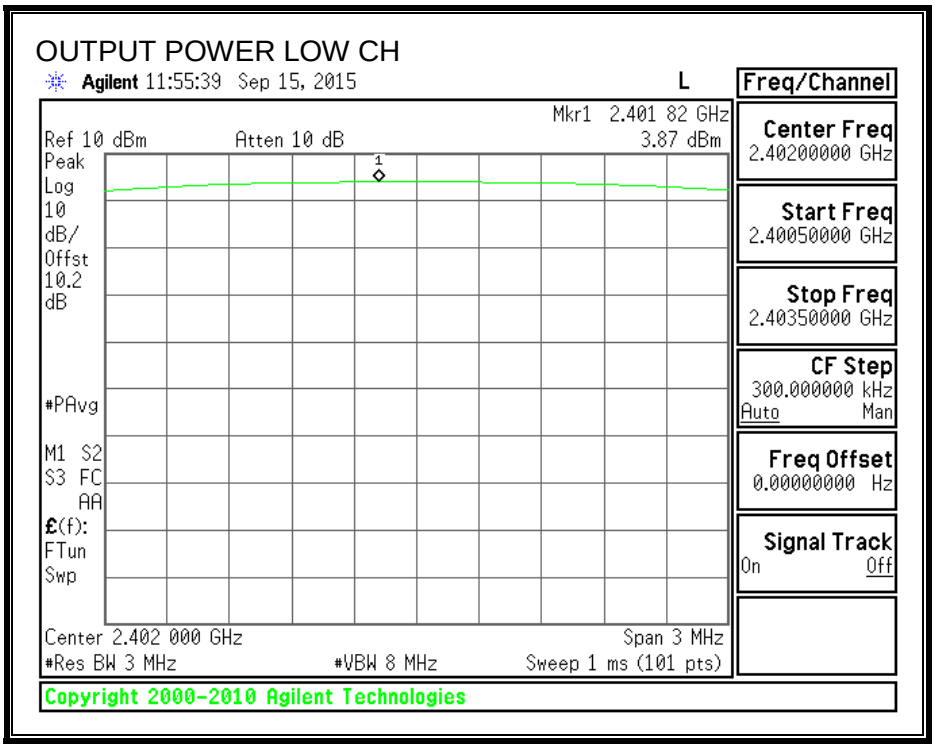
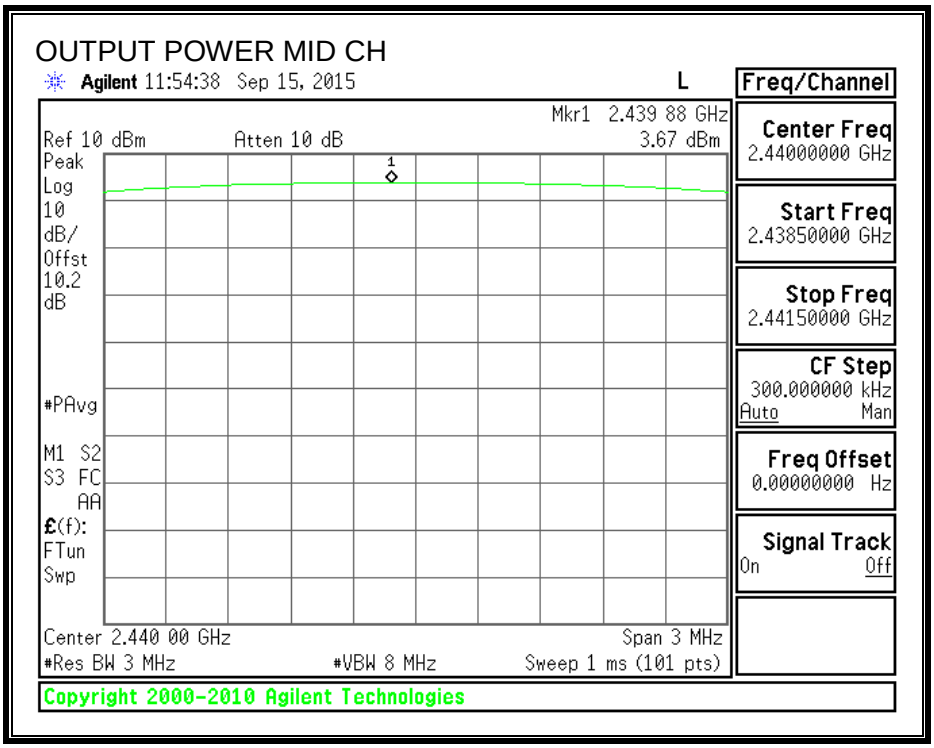
OUTPUT POWER





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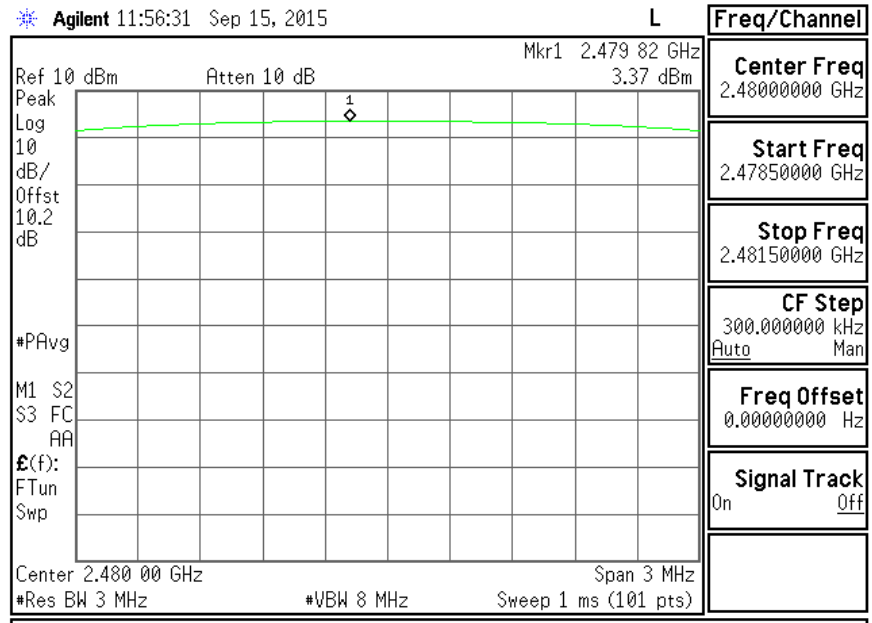
OUTPUT POWER HIGH CH



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7.6. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 10.25 dB (including 10 dB pad and 0.25 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.74
Middle	2440	3.53
High	2480	3.17

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7.7. 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	-8.94	8	-16.94
Middle	2440	-8.78	8	-16.78
High	2480	-8.53	8	-16.53

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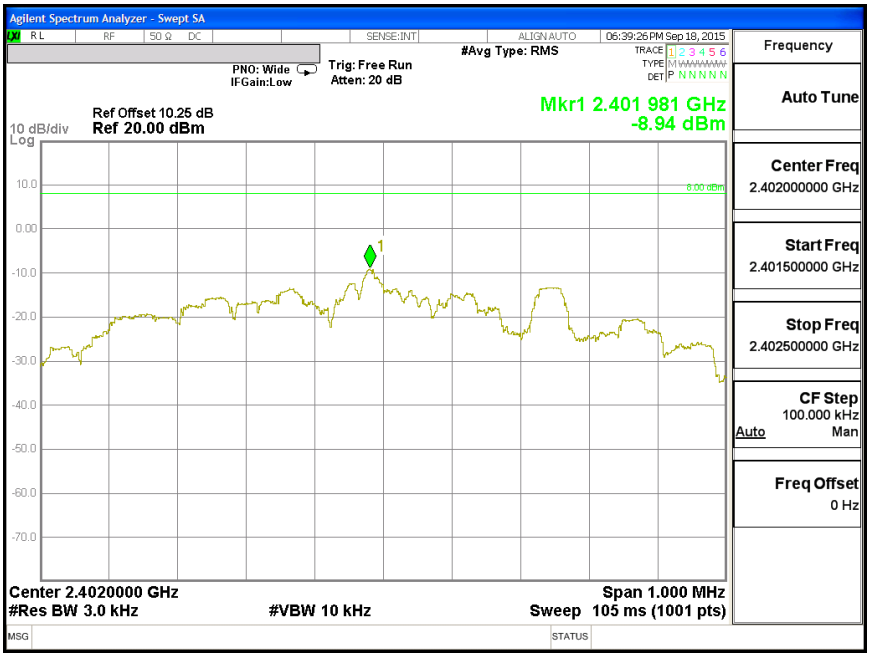
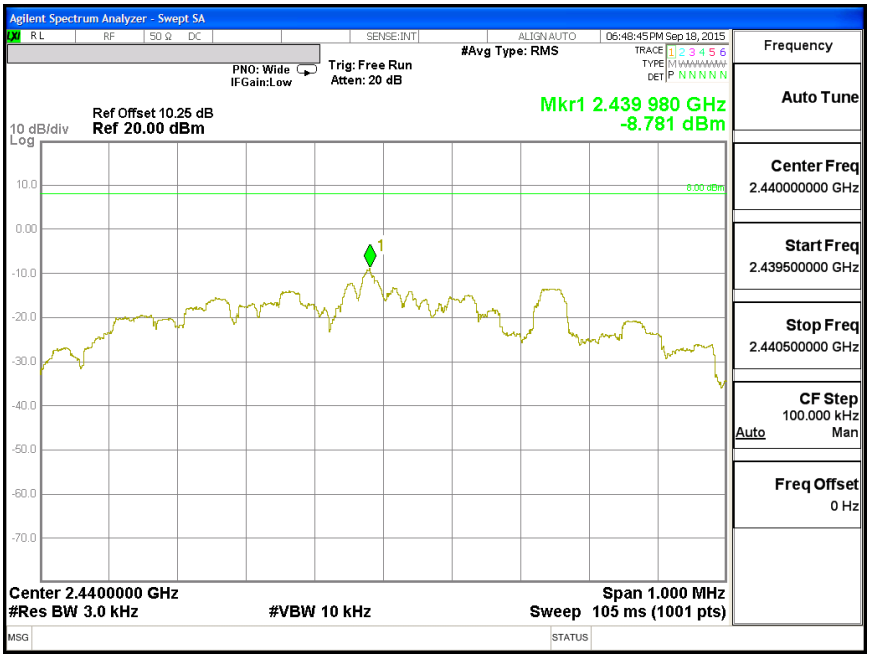
POWER SPECTRAL DENSITY

PSD LOW CH



PSD MID CH



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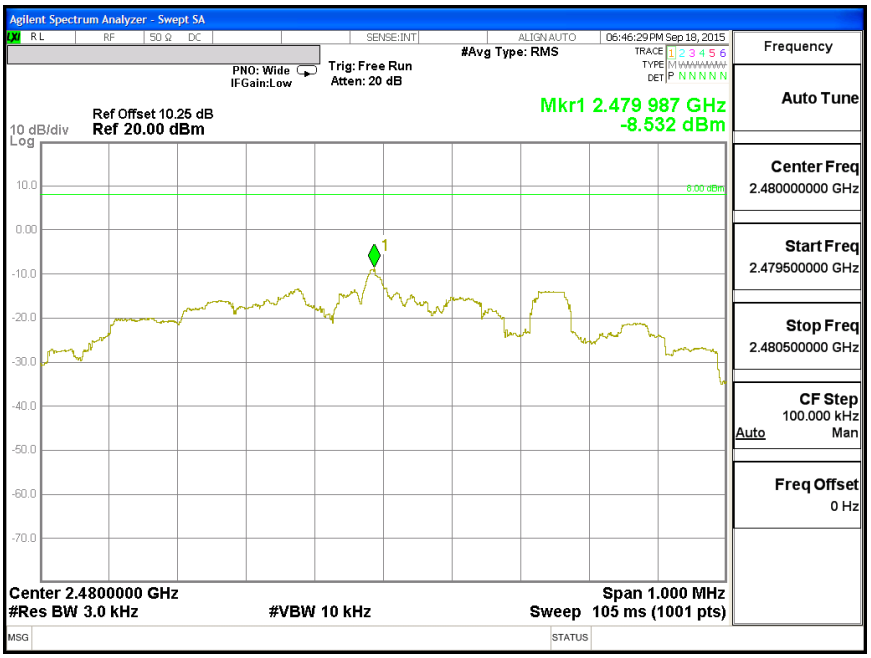
PSD HIGH CH



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7.8. 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.

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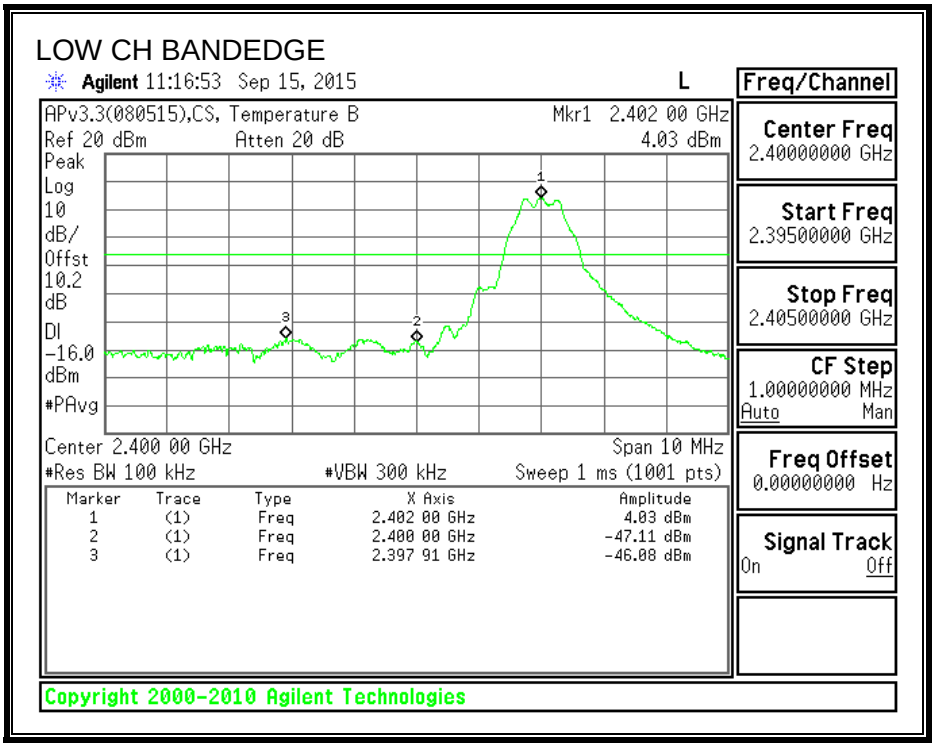
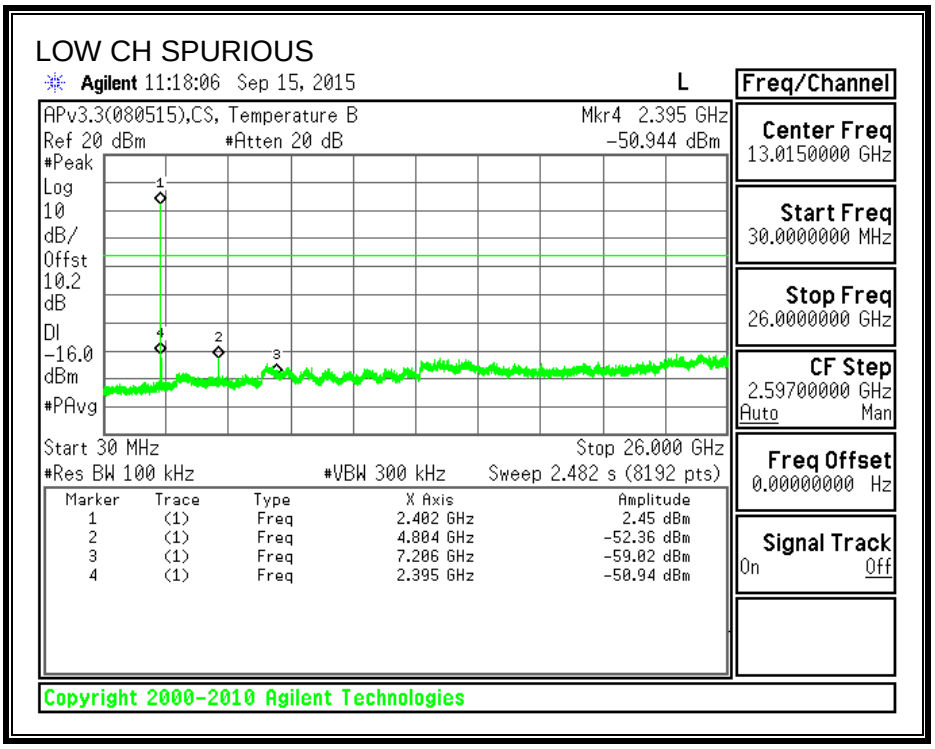
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL





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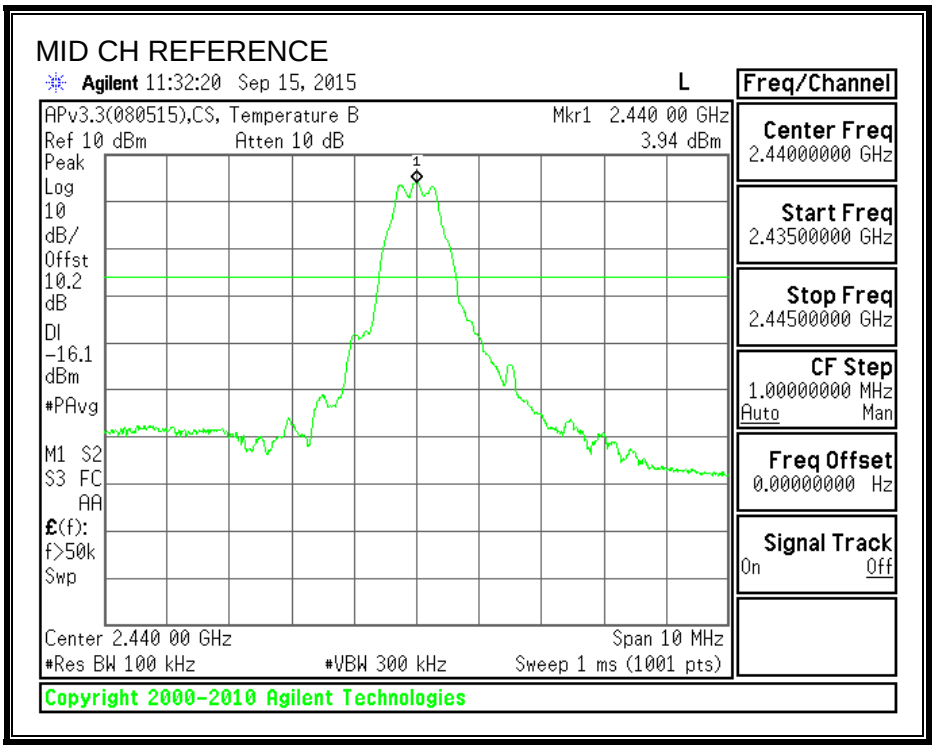
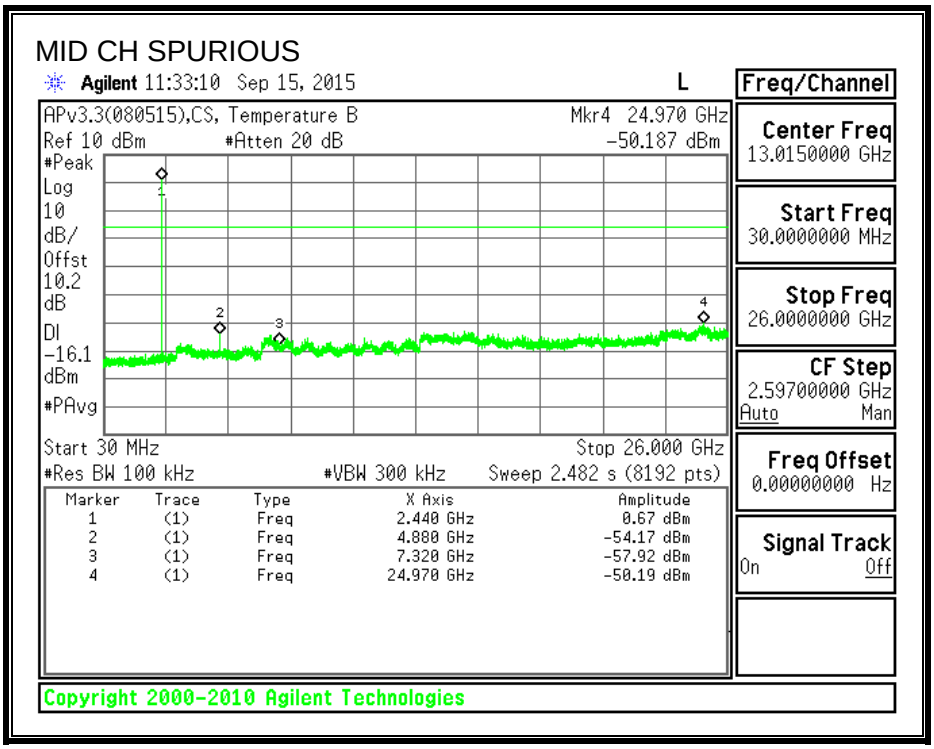
SPURIOUS EMISSIONS, MID CHANNEL





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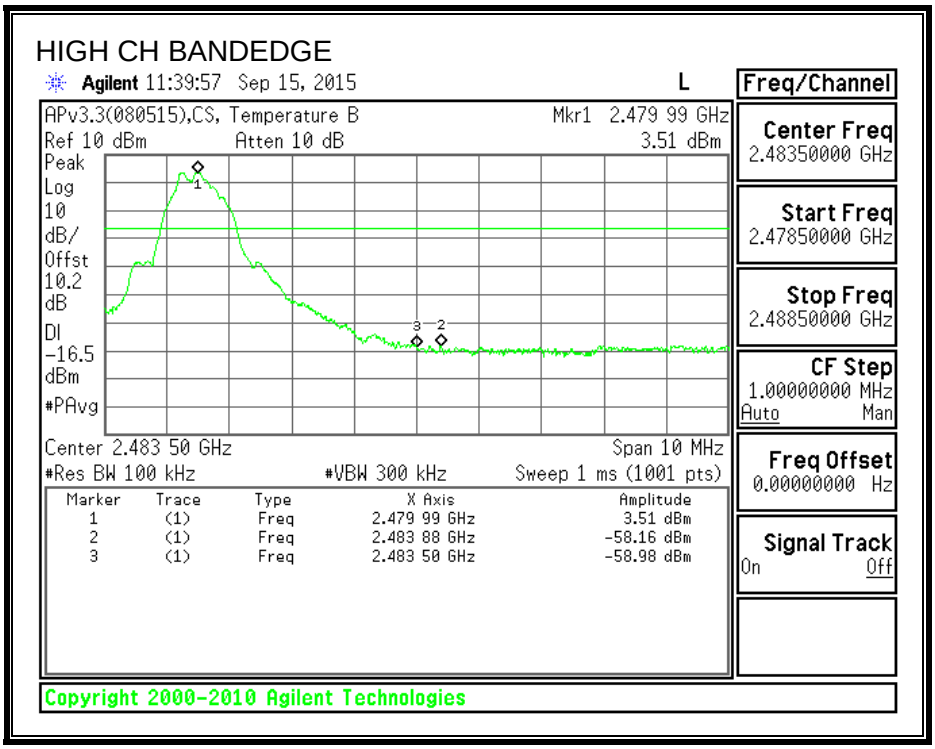
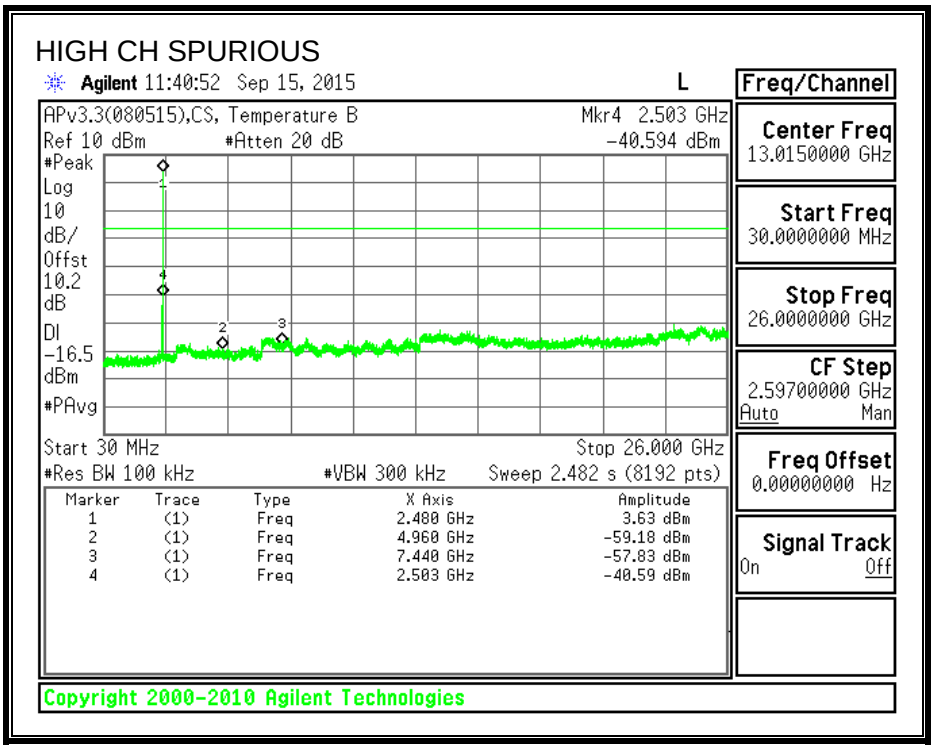
SPURIOUS EMISSIONS, HIGH CHANNEL





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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 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

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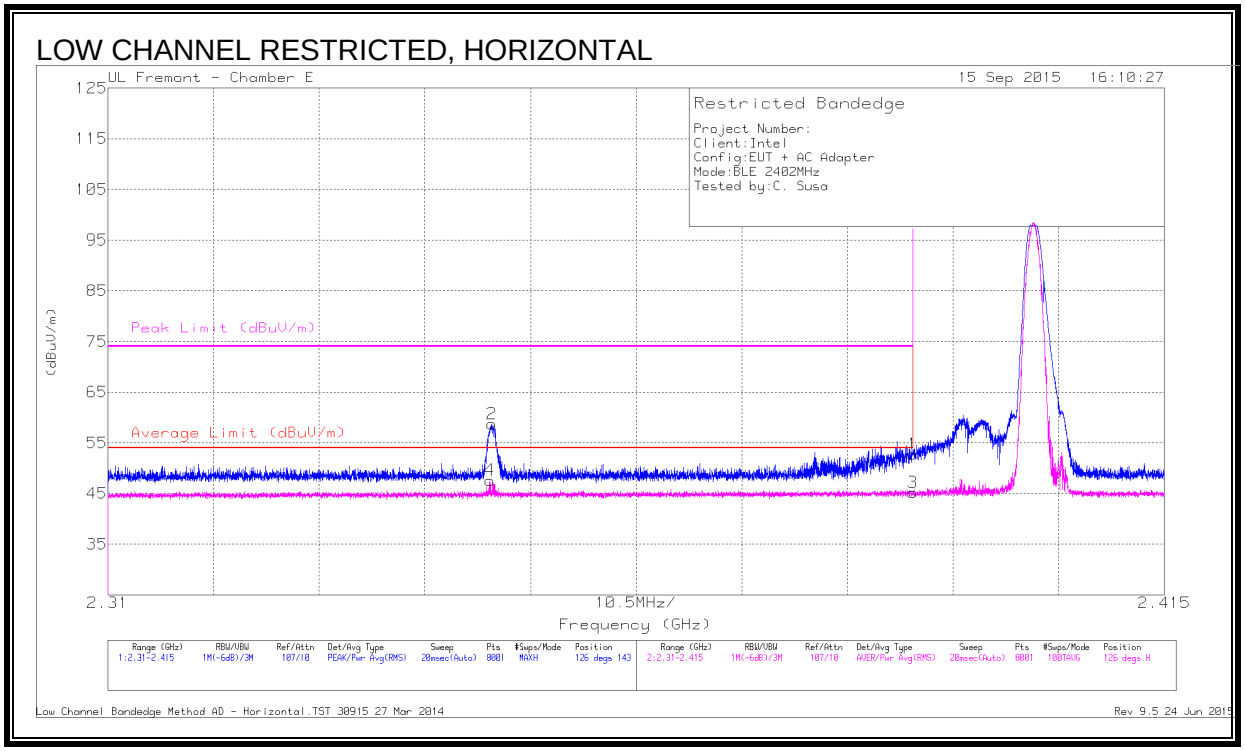
8.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL)



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	43.93	Pk	32.1	-23.2	0	52.83	-	-	74	-21.17	126	143	H
2	* 2.348	49.91	Pk	32	-23.2	0	58.71	-	-	74	-15.29	126	143	H
3	* 2.39	30.24	RMS	32.1	-23.2	6.07	45.21	54	-8.79	-	-	126	143	H
4	* 2.348	32.75	RMS	32	-23.2	6.07	47.62	54	-6.38	-	-	126	143	H

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

Pk - Peak detector

RMS - RMS detection

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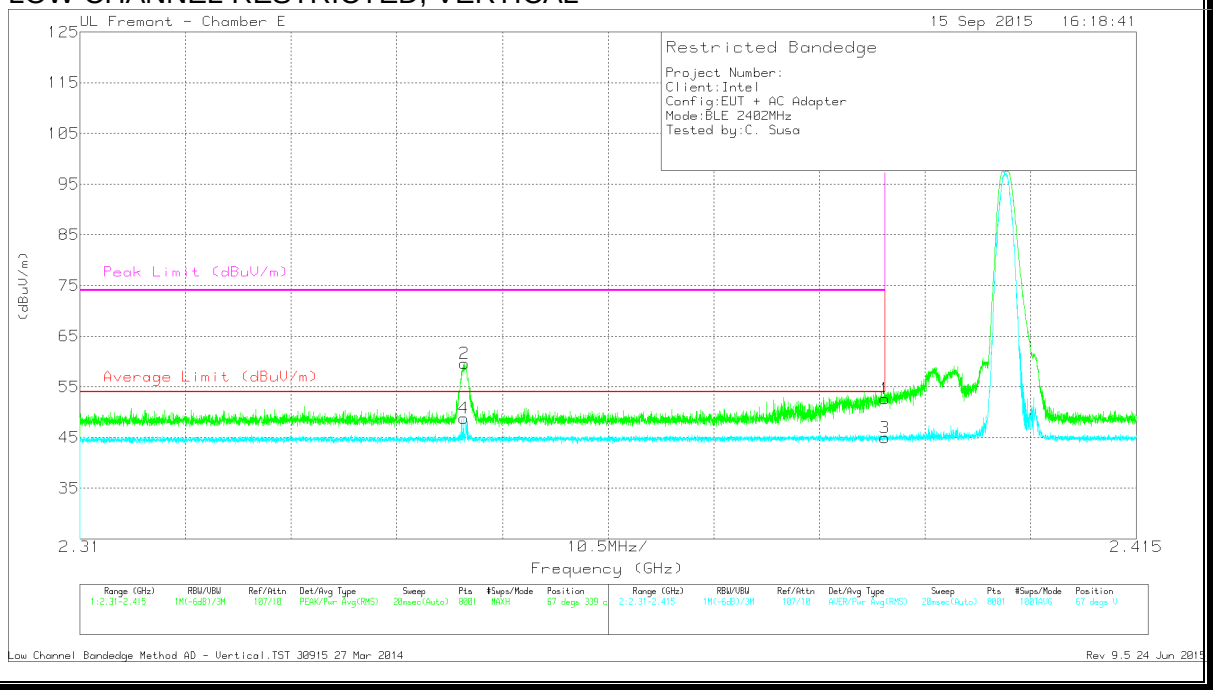
LOW CHANNEL RESTRICTED, VERTICAL



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.348	50.76	Pk	32	-23.2	0	59.56	-	-	74	-14.44	67	339	V
4	* 2.348	33.97	RMS	32	-23.2	6.07	48.84	54	-5.16	-	-	67	339	V
1	* 2.39	43.79	Pk	32.1	-23.2	0	52.69	-	-	74	-21.31	67	339	V
3	* 2.39	30	RMS	32.1	-23.2	6.07	44.97	54	-9.03	-	-	67	339	V

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

Pk - Peak detector

RMS - RMS detection

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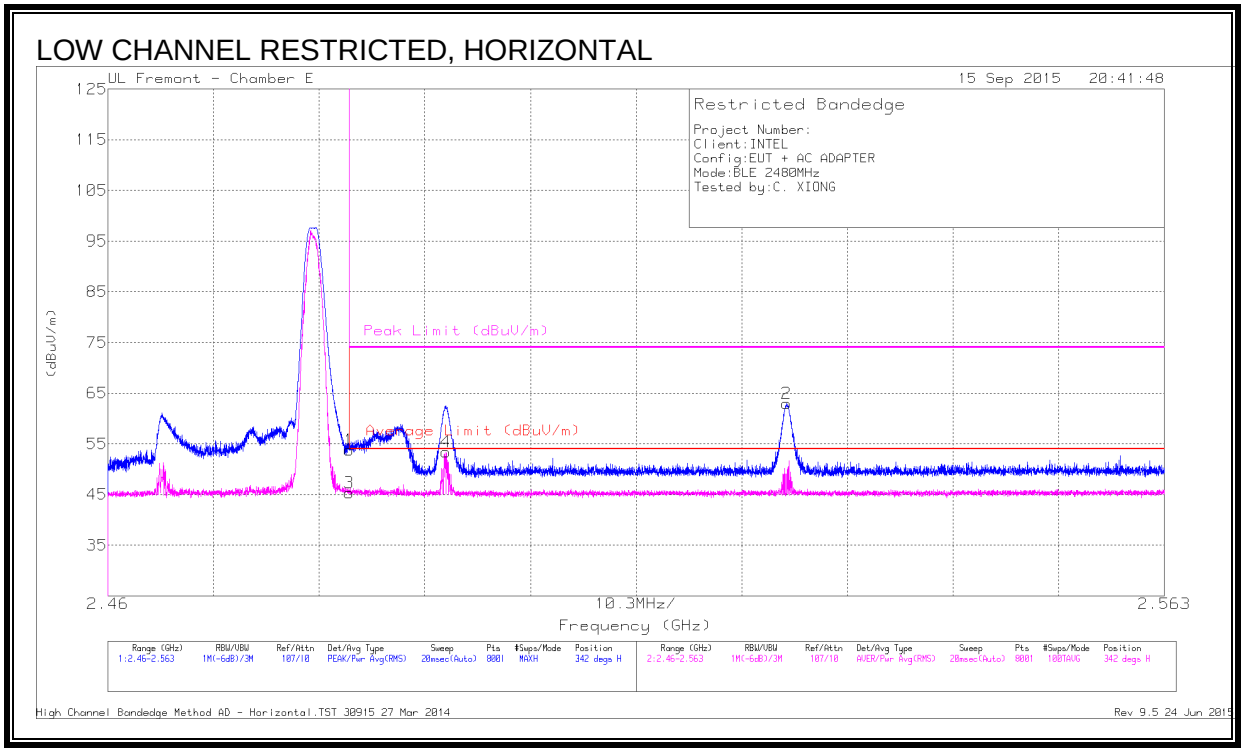
RESTRICTED BANDEDGE (HIGH CHANNEL)



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	44.48	Pk	32.2	-22.9	0	53.78	-	-	74	-20.22	342	165	H
3	* 2.484	29.91	RMS	32.2	-22.9	6.07	45.28	54	-8.72	-	-	342	165	H
4	* 2.493	37.97	RMS	32.2	-22.9	6.07	53.34	54	-.66	-	-	342	165	H
2	2.526	53.58	Pk	32.2	-22.8	0	62.98	-	-	74	-11.02	342	165	H

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

Pk - Peak detector

RMS - RMS detection

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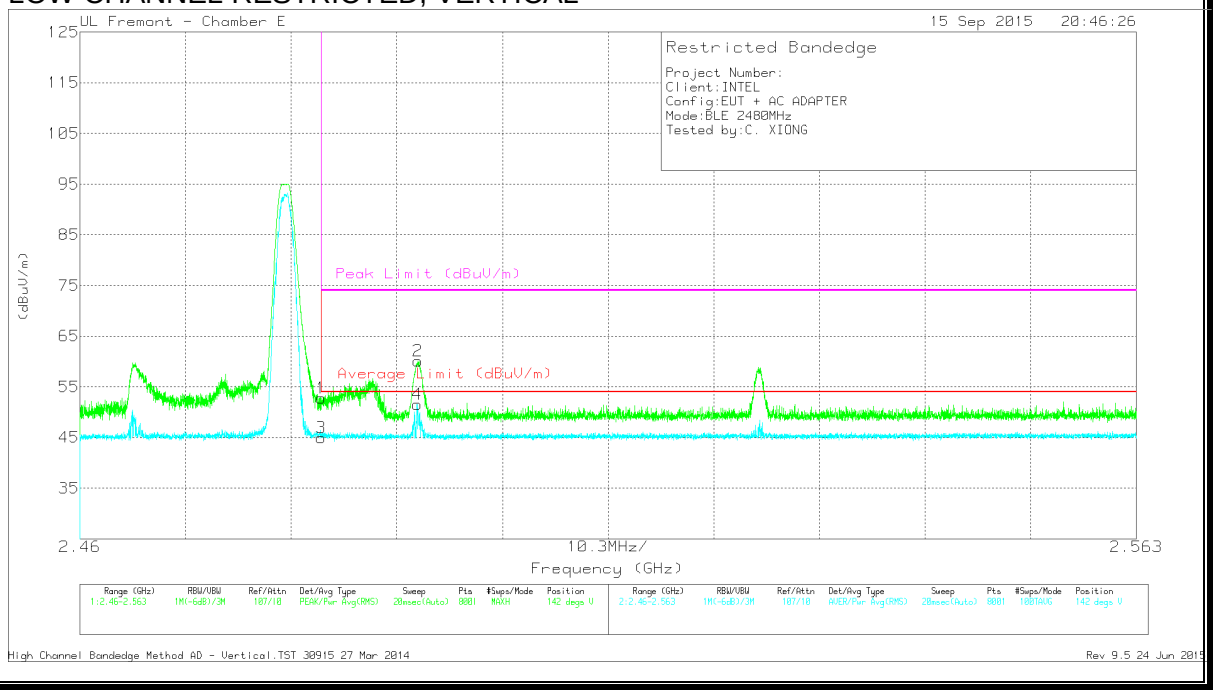
LOW CHANNEL RESTRICTED, VERTICAL



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.47	Pk	32.2	-22.9	0	52.77	-	-	74	-21.23	142	203	V
3	* 2.484	29.6	RMS	32.2	-22.9	6.07	44.97	54	-9.03	-	-	142	203	V
2	* 2.493	50.8	Pk	32.2	-22.9	0	60.1	-	-	74	-13.9	142	203	V
4	* 2.493	36.15	RMS	32.2	-22.9	6.07	51.52	54	-2.48	-	-	142	203	V

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

Pk - Peak detector

RMS - RMS detection

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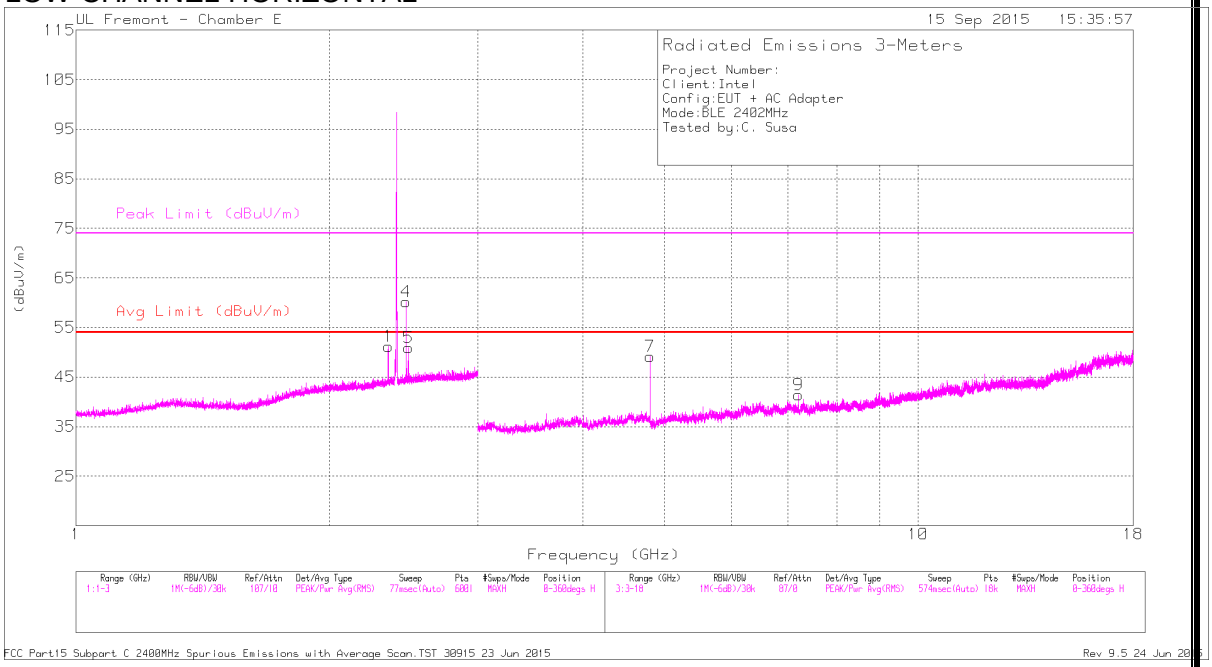
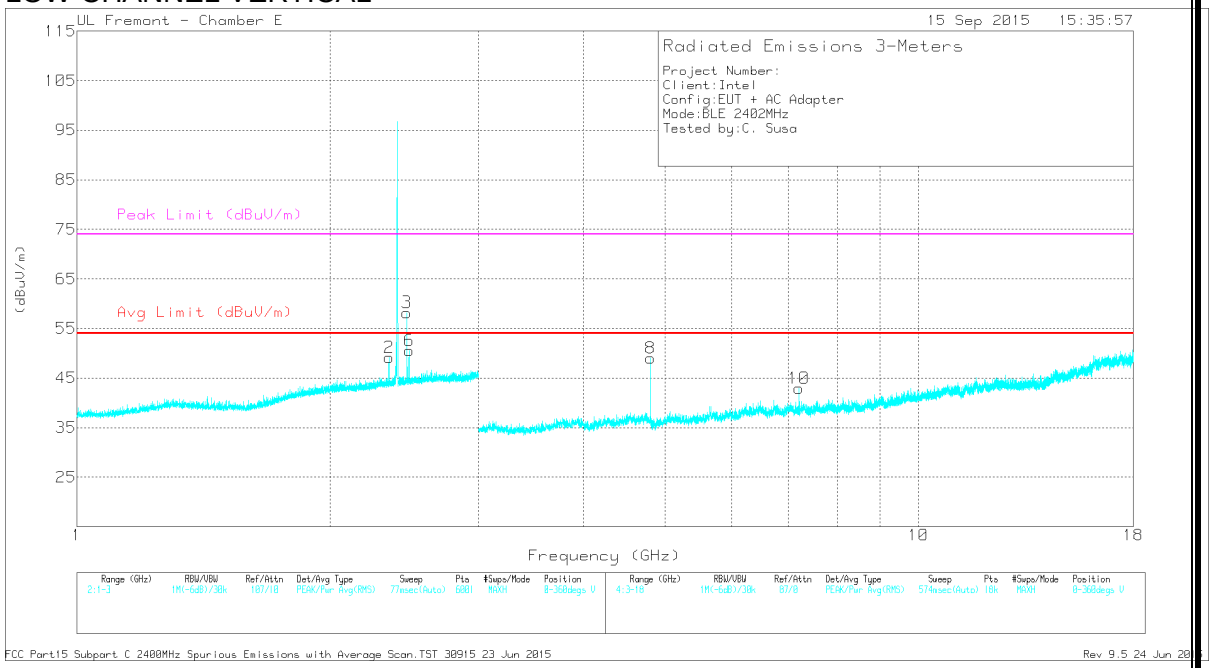
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



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DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.348	51.21	PK2	32	-23.2	0	60.01	-	-	74	-13.99	141	101	H
	* 2.348	33.6	MAv1	32	-23.2	6.07	48.47	54	-5.53	-	-	141	101	H
2	* 2.348	51.16	PK2	32	-23.2	0	59.96	-	-	74	-14.04	49	342	V
	* 2.348	34.11	MAv1	32	-23.2	6.07	48.98	54	-5.02	-	-	49	342	V
7	* 4.804	49.39	PK2	34.1	-29.8	0	53.69	-	-	74	-20.31	347	291	H
	* 4.804	40.39	MAv1	34.1	-29.8	6.07	50.76	54	-3.24	-	-	347	291	H
8	* 4.805	50.36	PK2	34.1	-29.8	0	54.66	-	-	74	-19.34	237	313	V
	* 4.804	41.64	MAv1	34.1	-29.8	6.07	52.01	54	-1.99	-	-	237	313	V
4	2.466	51.1	Pk	32.1	-23	0	60.2	-	-	74	-13.8	0-360	100	H
3	2.466	49.13	Pk	32.1	-23	0	58.23	-	-	74	-15.77	0-360	200	V
5	2.481	41.75	Pk	32.1	-22.9	0	50.95	-	-	74	-23.05	0-360	100	H
6	2.481	41.33	Pk	32.1	-22.9	0	50.53	-	-	74	-23.47	0-360	200	V
9	7.205	33.51	Pk	35.5	-27.6	0	41.41	-	-	74	-32.59	0-360	200	H
10	7.206	35.07	Pk	35.5	-27.6	0	42.97	-	-	74	-31.03	0-360	200	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

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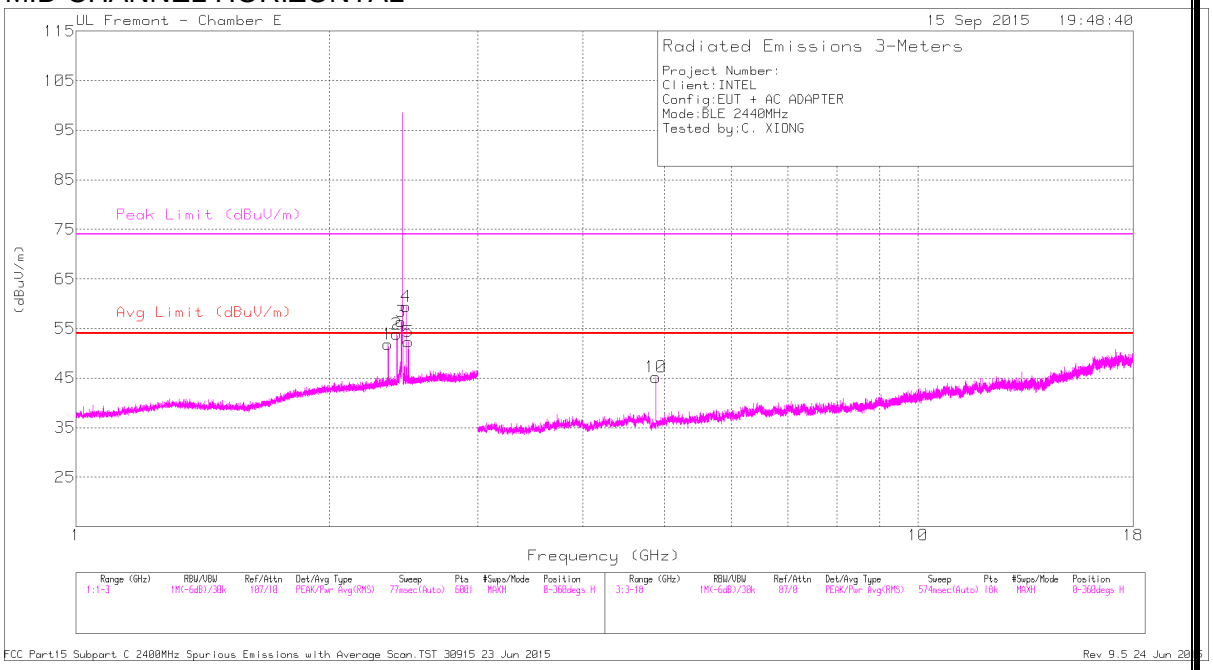
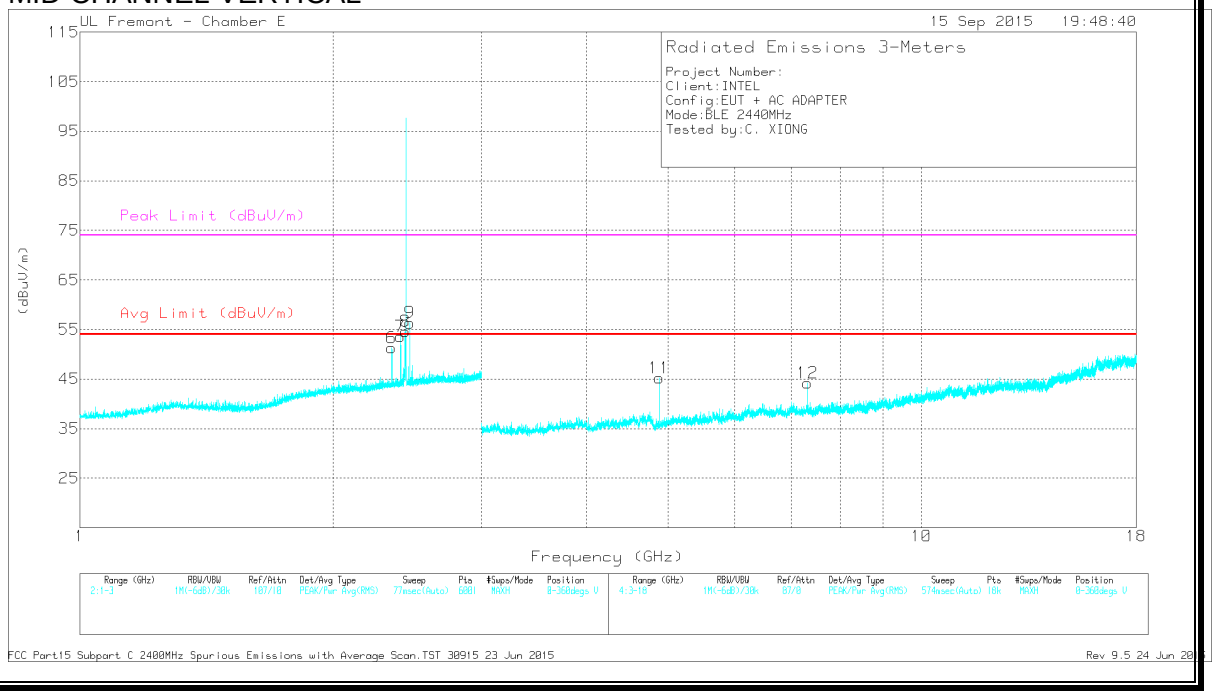
MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.348	49.63	PK2	32	-23.2	0	58.43	-	-	74	-15.57	0	101	H
	* 2.348	33.04	MAv1	32	-23.2	6.07	47.91	54	-6.09	-	-	0	101	H
6	* 2.348	50.6	PK2	32	-23.2	0	59.4	-	-	74	-14.6	85	267	V
	* 2.348	33.15	MAv1	32	-23.2	6.07	48.02	54	-5.98	-	-	85	267	V
10	* 4.88	46.15	PK2	34.1	-30.4	0	49.85	-	-	74	-24.15	172	102	H
	* 4.88	35.64	MAv1	34.1	-30.4	6.07	45.41	54	-8.59	-	-	172	102	H
11	* 4.881	45.92	PK2	34.1	-30.4	0	49.62	-	-	74	-24.38	257	125	V
	* 4.88	36.07	MAv1	34.1	-30.4	6.07	45.84	54	-8.16	-	-	257	125	V
12	* 7.32	40.96	PK2	35.5	-26.2	0	50.26	-	-	74	-23.74	276	100	V
	* 7.32	29.02	MAv1	35.5	-26.2	6.07	44.39	54	-9.61	-	-	276	100	V
2	2.404	44.93	Pk	32.1	-23.2	0	53.83	-	-	74	-20.17	0-360	200	H
7	2.405	44.74	Pk	32.1	-23.2	0	53.64	-	-	74	-20.36	0-360	200	V
3	2.434	47.48	Pk	32.1	-23.2	0	56.38	-	-	74	-17.62	0-360	101	H
8	2.434	45.72	Pk	32.1	-23.2	0	54.62	-	-	74	-19.38	0-360	200	V
9	2.465	47.23	Pk	32.1	-23	0	56.33	-	-	74	-17.67	0-360	200	V
4	2.466	50.31	Pk	32.1	-23	0	59.41	-	-	74	-14.59	0-360	101	H
5	2.481	43.11	Pk	32.1	-22.9	0	52.31	-	-	74	-21.69	0-360	101	H

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

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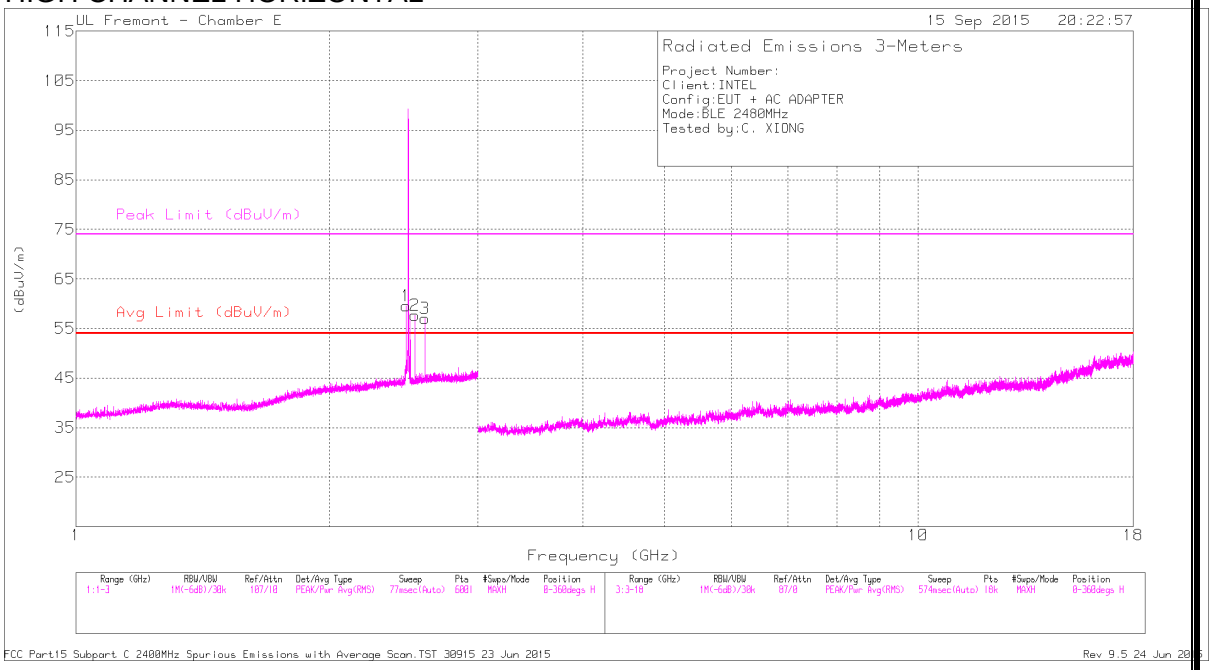
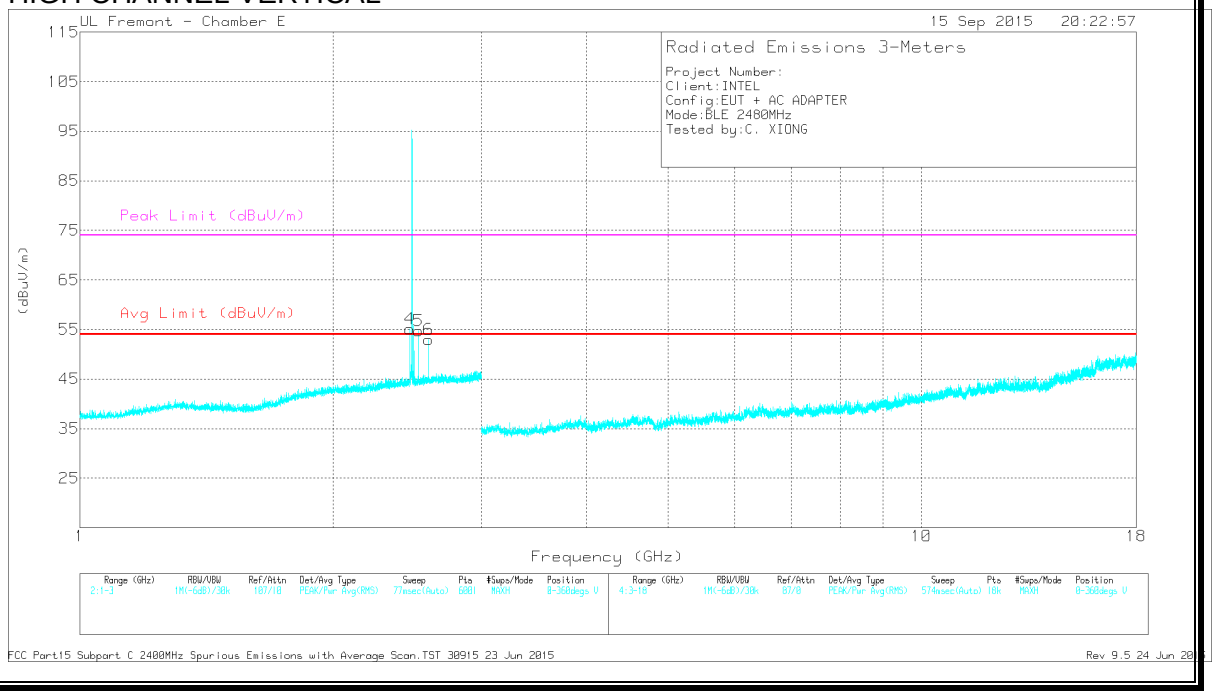
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



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DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.465	50.43	Pk	32.1	-23	0	59.53	-	-	74	-14.47	0-360	100	H
4	2.465	46.01	Pk	32.1	-23	0	55.11	-	-	74	-18.89	0-360	200	V
2	2.526	48.26	Pk	32.2	-22.8	0	57.66	-	-	74	-16.34	0-360	100	H
5	2.526	45.37	Pk	32.2	-22.8	0	54.77	-	-	74	-19.23	0-360	200	V
3	2.596	47.31	Pk	32.4	-22.7	0	57.01	-	-	74	-16.99	0-360	100	H
6	2.596	43.32	Pk	32.4	-22.7	0	53.02	-	-	74	-20.98	0-360	101	V

Pk - Peak detector

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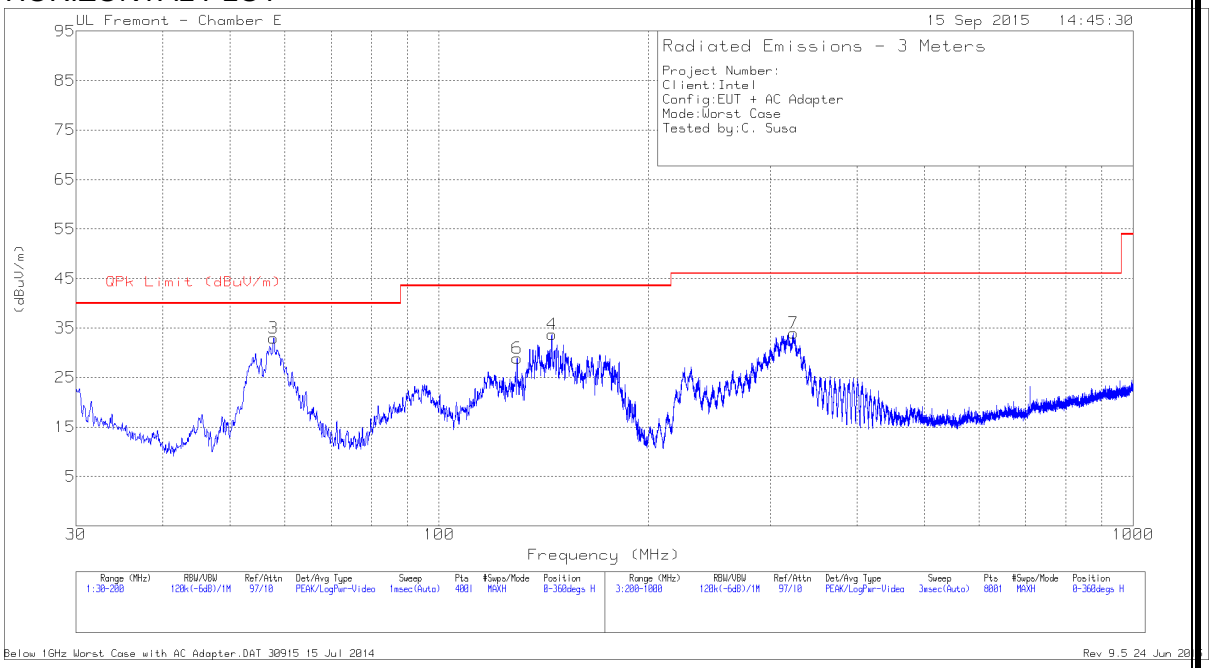
8.3. WORST-CASE BELOW 1 GHz

8.3.1. EUT WITH AC ADAPTER

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

HORIZONTAL PLOT



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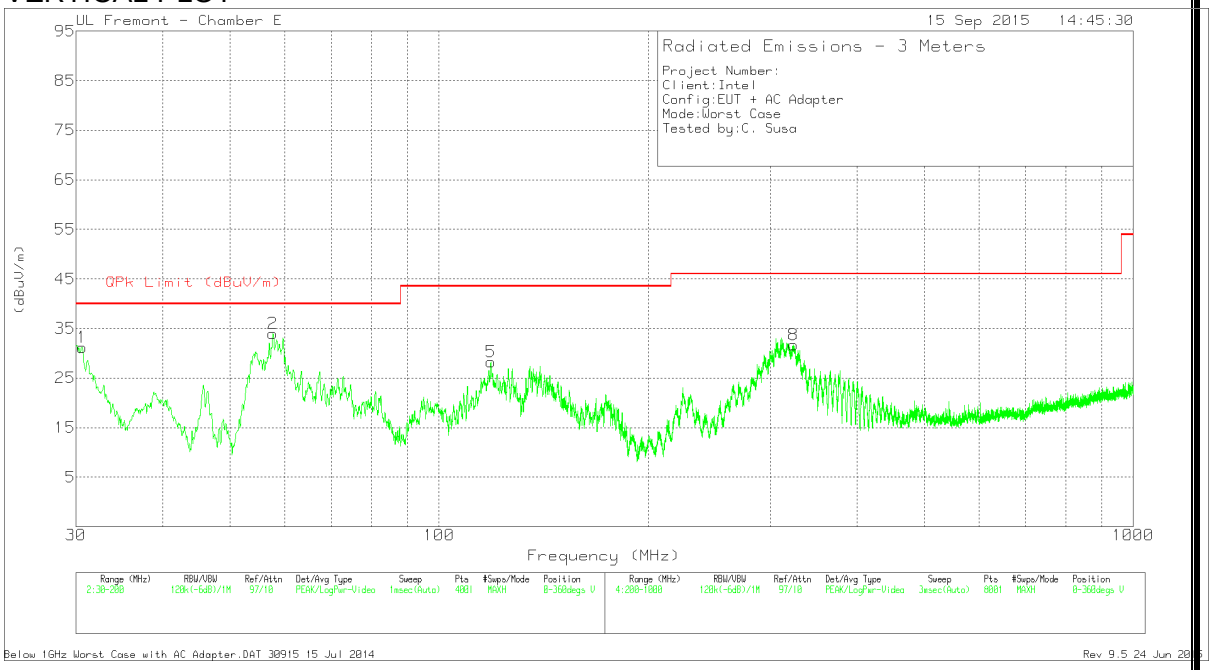
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T408 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 129.5775	46.39	Pk	13.7	-31.2	28.89	43.52	-14.63	0-360	201	H
5	* 118.825	45.82	Pk	13.7	-31.2	28.32	43.52	-15.2	0-360	100	V
7	* 324.4	50.43	Pk	13.9	-30.3	34.03	46.02	-11.99	0-360	100	H
8	* 324.4	48.14	Pk	13.9	-30.3	31.74	46.02	-14.28	0-360	99	V
1	30.595	41.99	Pk	21	-31.8	31.19	40	-8.81	0-360	100	V
2	57.6675	58.13	Pk	7.5	-31.7	33.93	40	-6.07	0-360	100	V
3	57.795	57.12	Pk	7.5	-31.6	33.02	40	-6.98	0-360	401	H
4	145.3875	52.14	Pk	12.6	-31	33.74	43.52	-9.78	0-360	201	H

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

Pk - Peak detector

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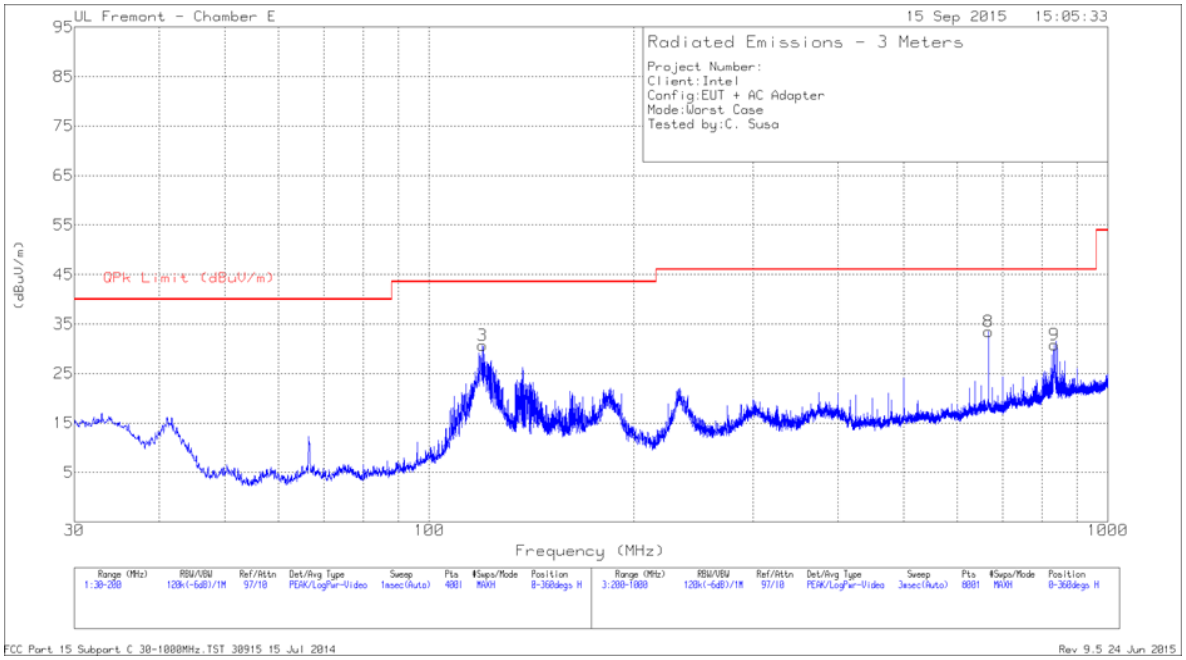
8.3.2. EUT WITH USB LAPTOP

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

HORIZONTAL PLOT



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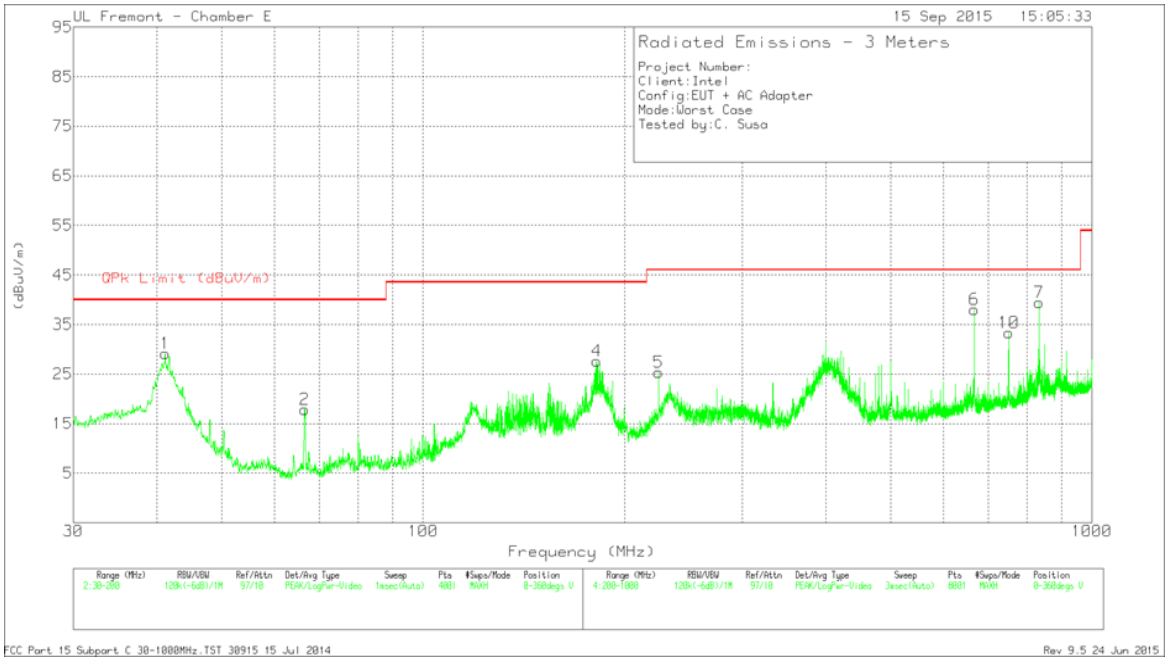
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T408 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 119.93	48.03	Pk	13.8	-31.2	30.63	43.52	-12.89	0-360	201	H
1	41.1775	47.77	Pk	13.2	-31.8	29.17	40	-10.83	0-360	100	V
2	66.5925	40.99	Pk	8.4	-31.5	17.89	40	-22.11	0-360	100	V
4	181.8525	47.14	Pk	11.4	-30.9	27.64	43.52	-15.88	0-360	100	V
5	225	45.33	Pk	10.7	-30.7	25.33	46.02	-20.69	0-360	99	V
8	666.7	43.03	Pk	19.6	-29.2	33.43	46.02	-12.59	0-360	201	H
6	666.7	47.61	Pk	19.6	-29.2	38.01	46.02	-8.01	0-360	99	V
10	750.6	41.86	Pk	20.5	-29	33.36	46.02	-12.66	0-360	99	V
9	833.3	38.31	Pk	21.1	-28.6	30.81	46.02	-15.21	0-360	301	H
7	833.4	46.9	Pk	21.1	-28.6	39.4	46.02	-6.62	0-360	99	V

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

Pk - Peak detector

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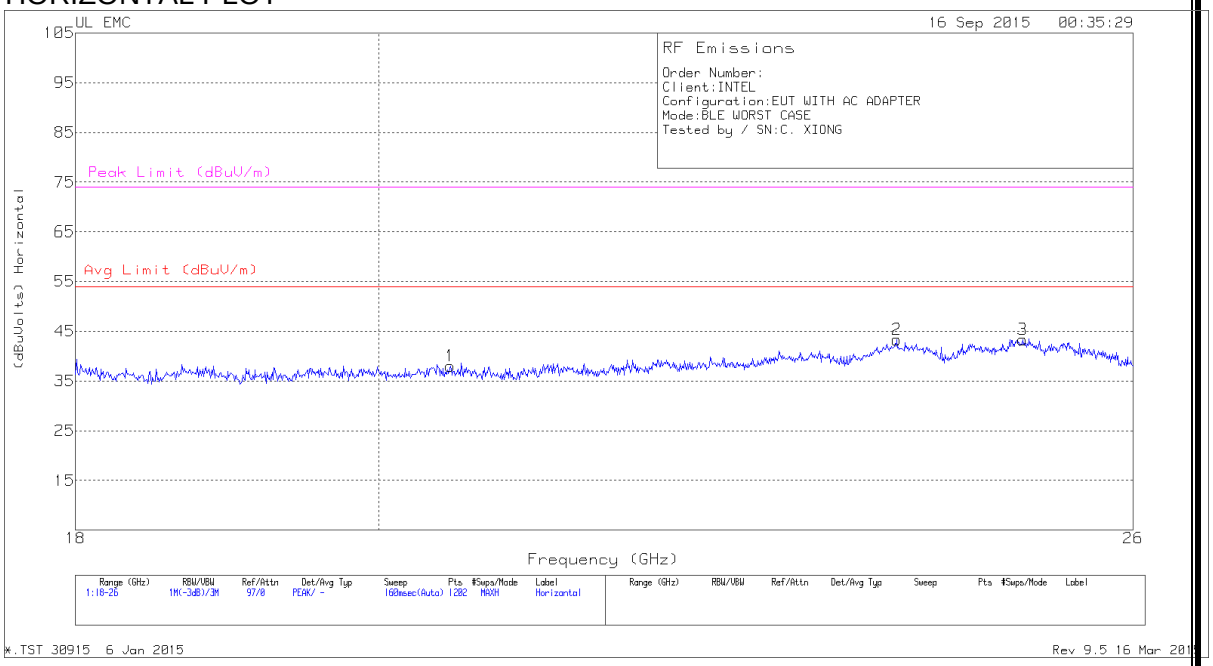
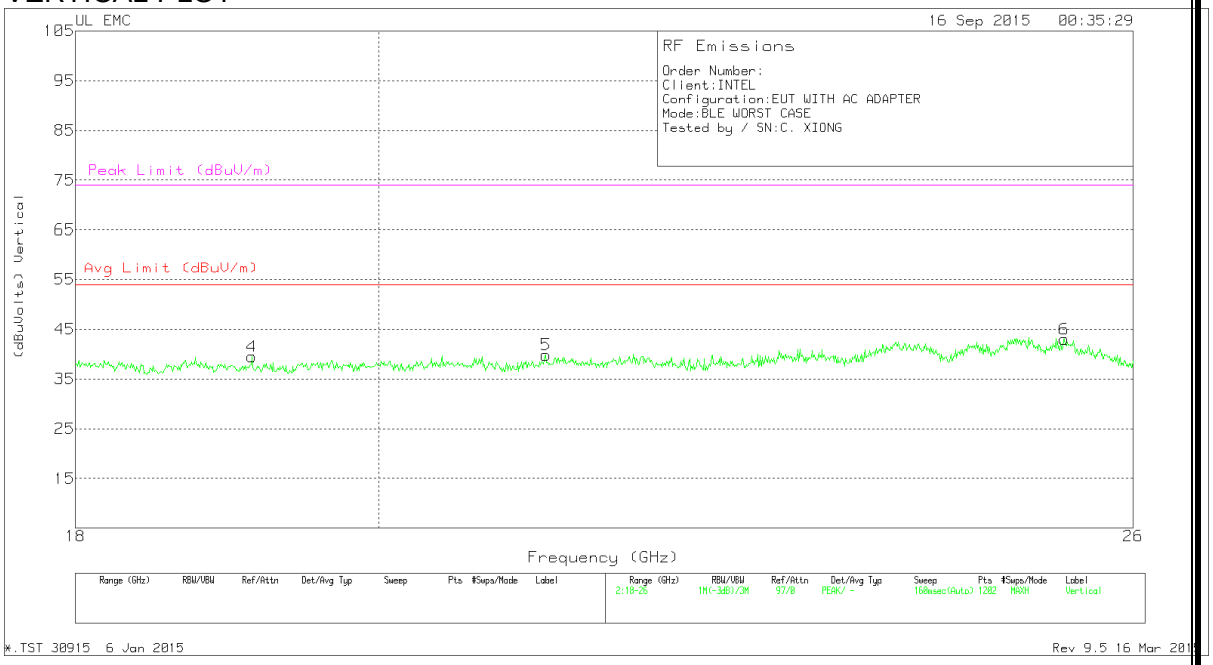
8.4. WORST-CASE 18 to 26 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (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	20.505	39.9	Pk	32.7	-25.1	-9.5	38	54	-16	74	-36
2	23.948	43.83	Pk	33.3	-24.3	-9.5	43.33	54	-10.66	74	-30.66
3	25.021	43.13	Pk	34.1	-24.4	-9.5	43.33	54	-10.66	74	-30.66
4	19.139	41.5	Pk	32.2	-24.7	-9.5	39.5	54	-14.5	74	-34.5
5	21.197	41.13	Pk	33	-24.8	-9.5	39.83	54	-14.16	74	-34.16
6	25.384	43.2	Pk	33.7	-24.4	-9.5	43	54	-11	74	-31

Pk - Peak detector

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10-2013
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

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9.1. EUT WITH AC ADAPTER

LINE 1 RESULTS

DATA

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.177	44.17	Pk	1.1	0	45.27	64.63	-19.36	54.63	-9.36
2	.186	29.29	Av	1	0	30.29	-	-	54.21	-23.92
3	.2535	46.17	Pk	.7	0	46.87	61.64	-14.77	51.64	-4.77
4	.2535	33.19	Av	.7	0	33.89	-	-	51.64	-17.75
5	.3795	45.43	Pk	.4	0	45.83	58.29	-12.46	48.29	-2.46
6	.3795	33.66	Av	.4	0	34.06	-	-	48.29	-14.23

Pk - Peak detector

Av - Average detection

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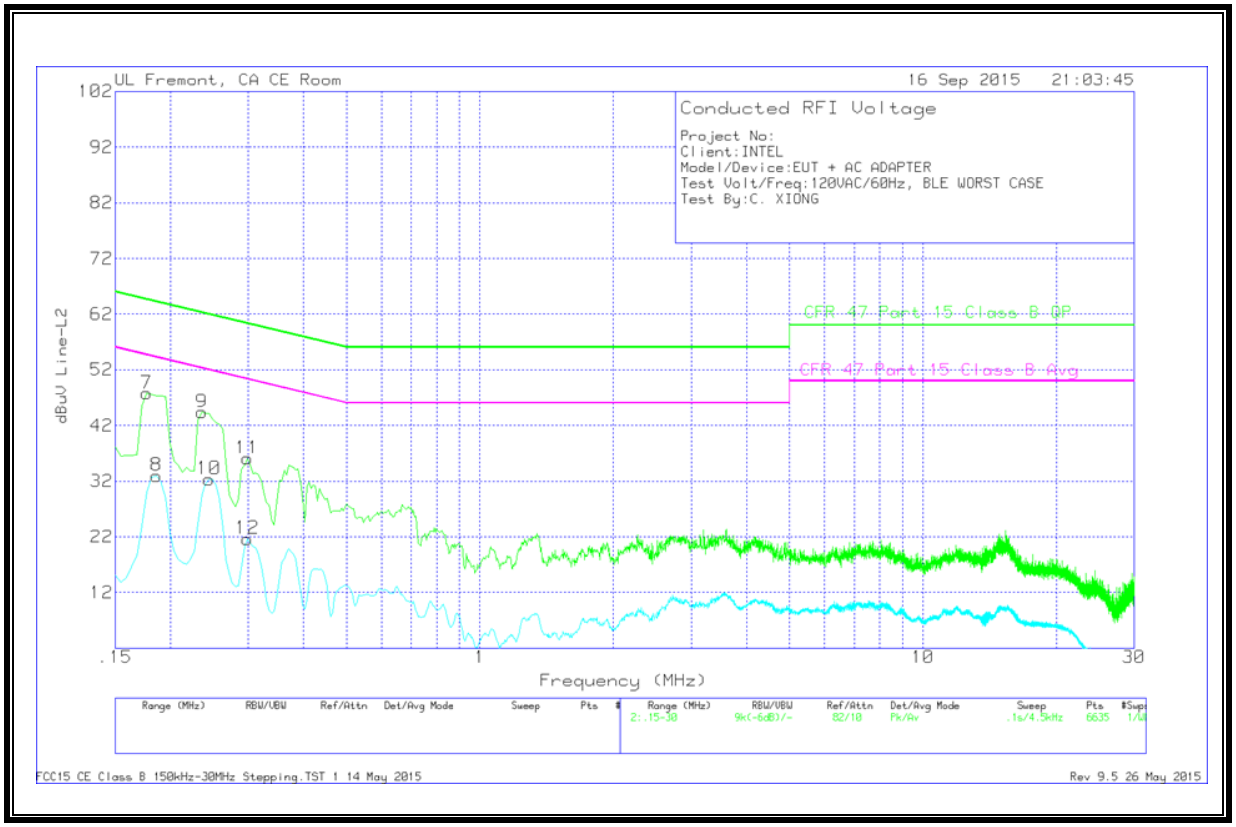
LINE 2 RESULTS



DATA

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
7	.177	46.56	Pk	1.2	0	47.76	64.63	-16.87	54.63	-6.87
8	.186	31.86	Av	1.1	0	32.96	-	-	54.21	-21.25
9	.2355	43.57	Pk	.8	0	44.37	62.25	-17.88	52.25	-7.88
10	.2445	31.56	Av	.8	0	32.36	-	-	51.94	-19.58
11	.2985	35.46	Pk	.6	0	36.06	60.28	-24.22	50.28	-14.22
12	.2985	21.05	Av	.6	0	21.65	-	-	50.28	-28.63

Pk - Peak detector

Av - Average detection

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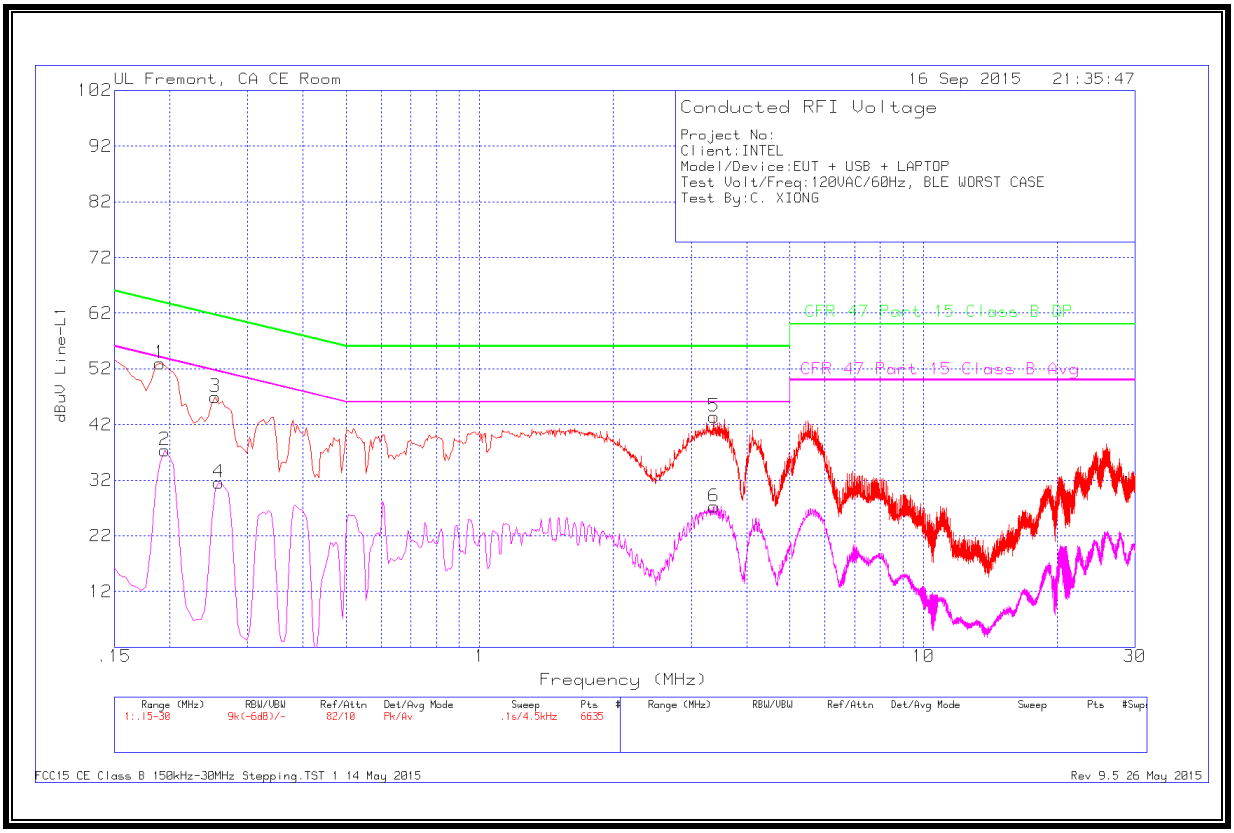
9.2. EUT WITH USB LAPTOP

LINE 1 RESULTS



DATA

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.1905	52	Pk	1	0	53	64.01	-11.01	54.01	-1.01
2	.195	36.37	Av	1	0	37.37	-	-	53.82	-16.45
3	.2535	46.21	Pk	.7	0	46.91	61.64	-14.73	51.64	-4.73
4	.258	30.9	Av	.7	0	31.6	-	-	51.5	-19.9
5	3.372	43.11	Pk	.2	.1	43.41	56	-12.59	46	-2.59
6	3.372	26.94	Av	.2	.1	27.24	-	-	46	-18.76

Pk - Peak detector

Av - Average detection

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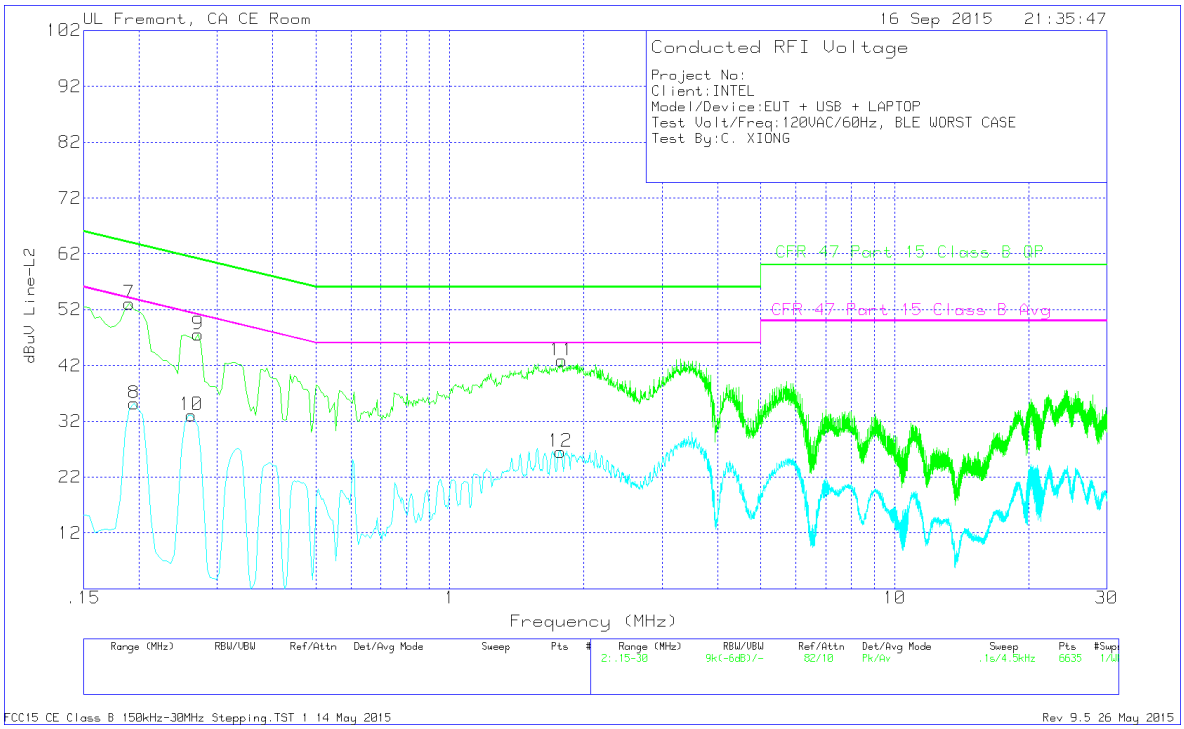
LINE 2 RESULTS



DATA

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
7	.1905	52	Pk	1.1	0	53.1	64.01	-10.91	54.01	-.91
8	.195	34.19	Av	1	0	35.19	-	-	53.82	-18.63
9	.2715	46.85	Pk	.7	0	47.55	61.07	-13.52	51.07	-3.52
10	.2625	32.4	Av	.7	0	33.1	-	-	51.35	-18.25
11	1.788	42.6	Pk	.2	.1	42.9	56	-13.1	46	-3.1
12	1.7745	26.26	Av	.2	.1	26.56	-	-	46	-19.44

Pk - Peak detector

Av - Average detection

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