FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1

BLUETOOTH LOW ENERGY CERTIFICATION TEST REPORT

FOR

RADIO TRANSCEIVER DEVICE

MODEL NUMBER: 1688

FCC ID: C3K1688
IC ID: 3048A-1688

REPORT NUMBER: 15U21746-E2V1

ISSUE DATE: OCTOBER 16, 2015

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	10/16/15	Initial Issue	C. S.OOI

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MICROSOFT CORP.
EUT DESCRIPTION: RADIO TRANSCEIVER DEVICE
MODEL: 1688
SERIAL NUMBER: 26653556, 28453556
DATE TESTED: SEPTEMBER 15 – 24, 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.

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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, KDB 558074 D01 v03r03, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☐ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☒ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

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 radio transceiver device, which contains an integrated 802.11 a/b/g/n/ac and BT 4.1 radios.

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	5.38	3.45

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of 5.3dBi.

5.4. SOFTWARE AND FIRMWARE

The software installed in the EUT during testing was Microsoft Ver. Th2_analog1_dev.150917-2108.

The EUT HW Buid Phase: EV3B

The test utility software used during testing was Microsoft WiFi Tool, Ver 3.2.1 (526/2015)

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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,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	X1 Carbon	N/A	N/A
AC Adapter	Microsoft	1623	0D130B03GDE54	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A

TEST SETUP

EUT was set in the BLE mode to enable BLE communications.

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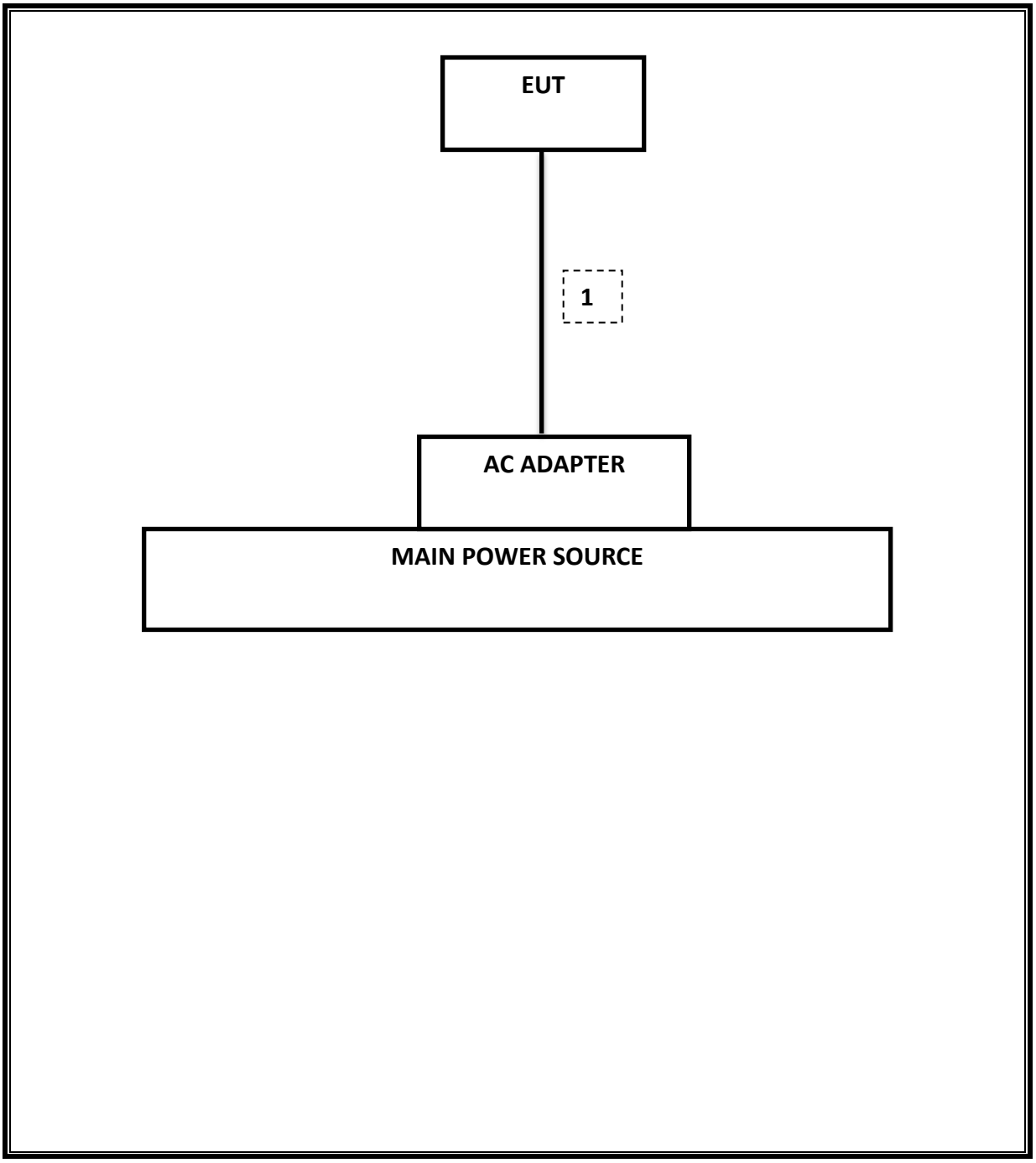
SETUP DIAGRAM FOR TESTS



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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**	**Asset**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/15
Spectrum Analyzer,9KHz-40GHz	HP	8564E	C00986	04/01/16
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	08/13/16
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/18/16
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/15
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/15
Antenna, Horn, 1-18 GHz	ETS	3117	C01022	02/21/16
Antenna, Horn,18- 26 GHz	ARA	MWH-1826/B	C00946	11/12/15
Antenna, Horn, 26-40 GHz	ARA	MWH-2640	C00891	06/28/16
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	T243	03/06/16
RF Preamplifier, 1GHz - 18GHz	Miteq	NSP4000-SP2	924343	03/23/16
RF Preamplifier, 1GHz - 26.5GHz	HP	8449B	T404	06/29/16
AC Power Supply, 2,500VA 45-500Hz	Elgar-Ametek	CW2501M	F00013	CNR
RF Preamplifier, 1GHz - 40GHz	Miteq	NSP4000-SP2	C00990	08/20/16
Attenuator / Switch driver	HP	11713A	F00204	CNR
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	F00219	05/23/16
High Pass Filter 6GHz	Micro-Tronics	HPS17542	F00222	05/22/16
High Pass Filter 3GHz	Micro-Tronics	HPM17543	F00224	05/22/16

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Version 9.5, 07/22/14
Conducted Software	UL	UL EMC	Version 9.5, 05/17/14
CLT Software	UL	UL RF	Version 1.0, 02/02/15
Antenna Port Software	UL	UL RF	Version 2.1.1.1, 1/20/15

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7. SUMMARY

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	RSS-247 5.2 (1)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	0.682 MHz
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-48.9 dBm
15.247	RSS-247 5.4 (4)	TX conducted output power	<30dBm		Pass	5.38 dBm
15.247	RSS-247 5.2 (2)	PSD	<8dBm		Pass	-0.08 dBm
15.207 (a)	RSS-GEN 8.8	AC Power Line conducted emissions	Section 10	Radiated	Pass	47.0dBuV(PK)
15.205, 15.209	RSS-GEN 8.9	Radiated Spurious Emission	< 54dBuV/m		Pass	44.28dBuV/m

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ANTENNA PORT TEST RESULTS

8.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 5.2.1

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

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	2402	0.682	0.5
Middle	2440	0.676	0.5
High	2480	0.706	0.5

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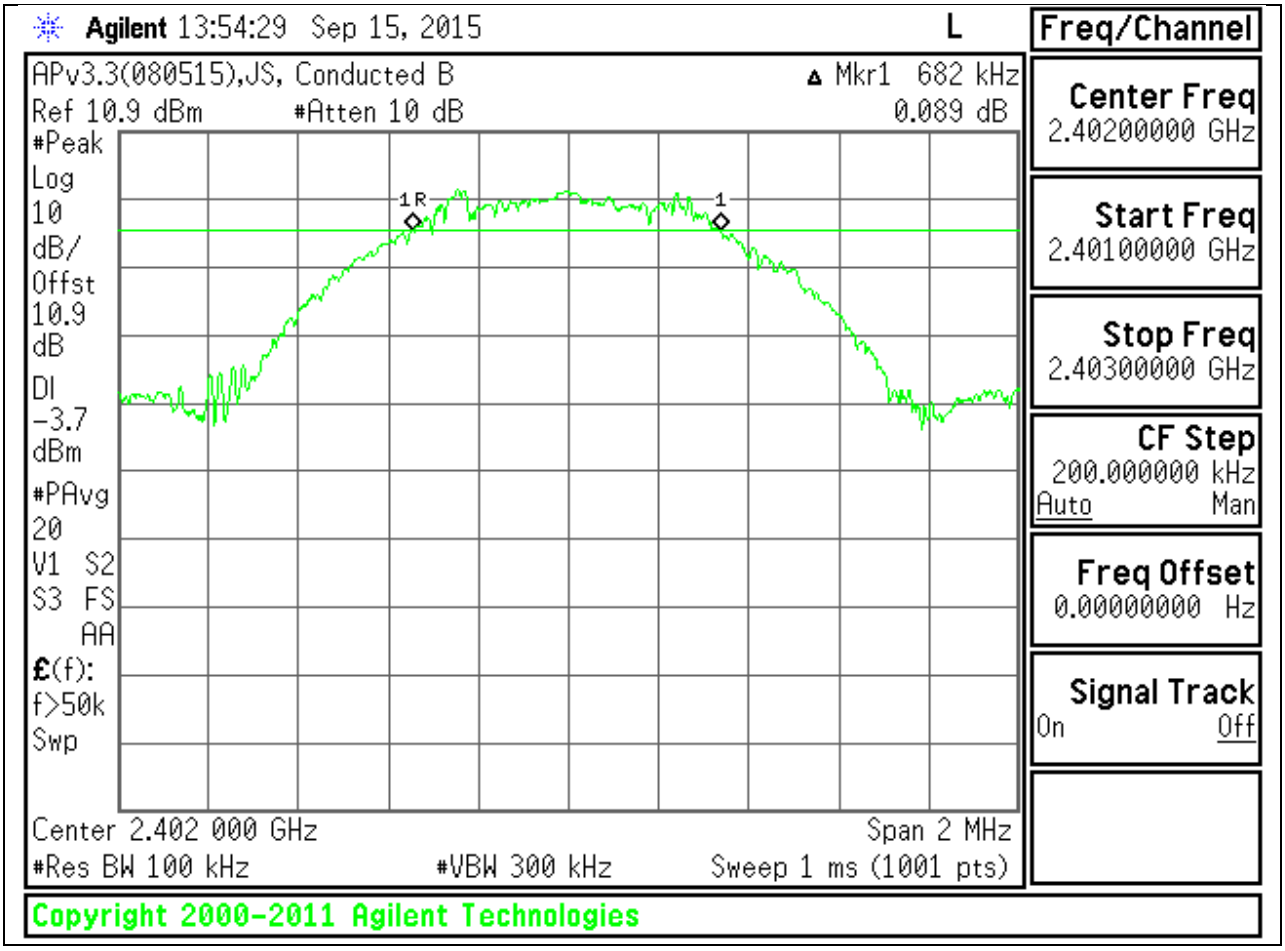
6 dB BANDWIDTH PLOTS

LOW CHANNEL



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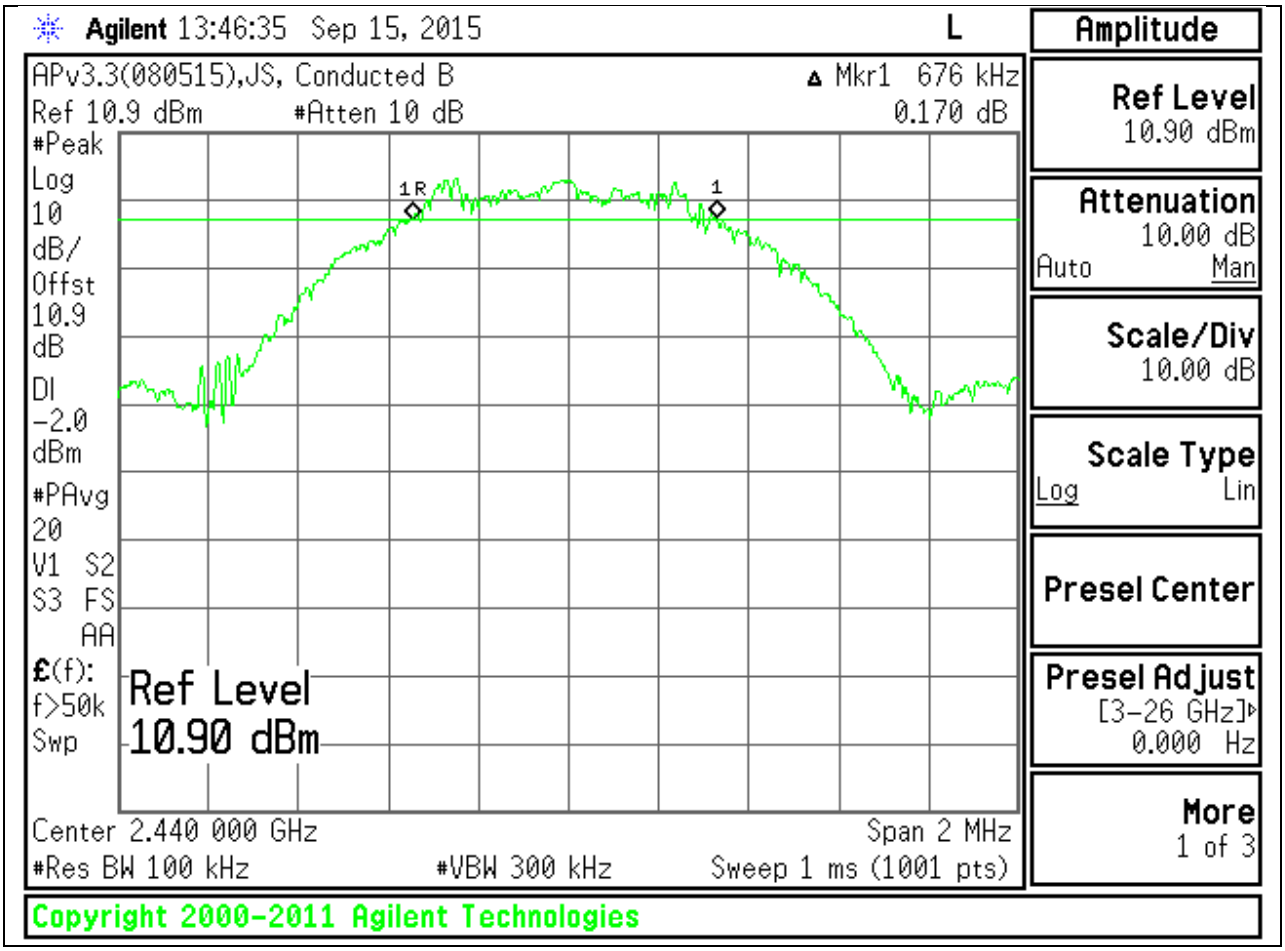
MID CHANNEL



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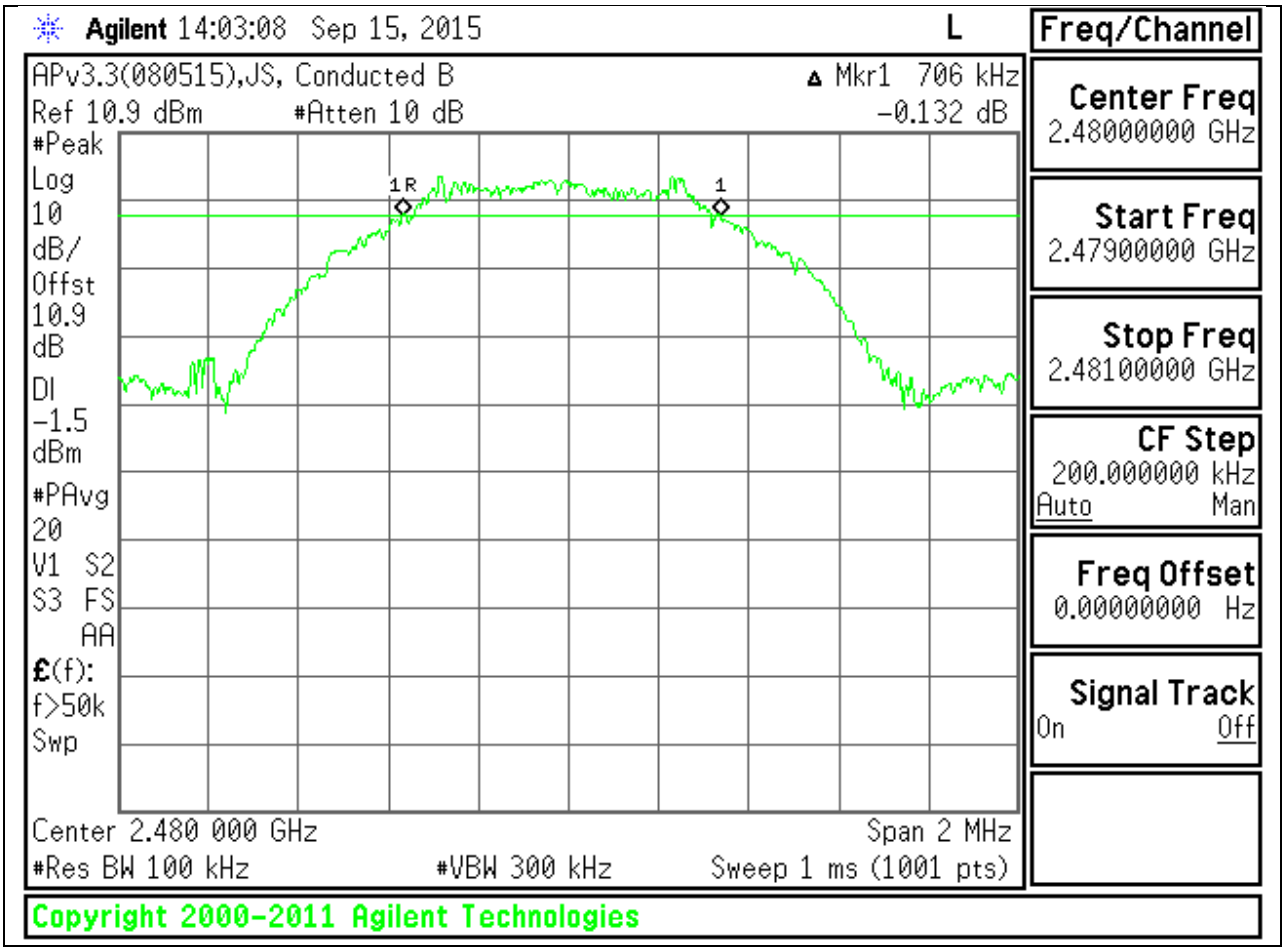
HIGH CHANNEL



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8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Reference to KDB558074 D01 DTS Meas Guidance v03r03: The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0602
Middle	2440	1.0621
High	2480	1.0631

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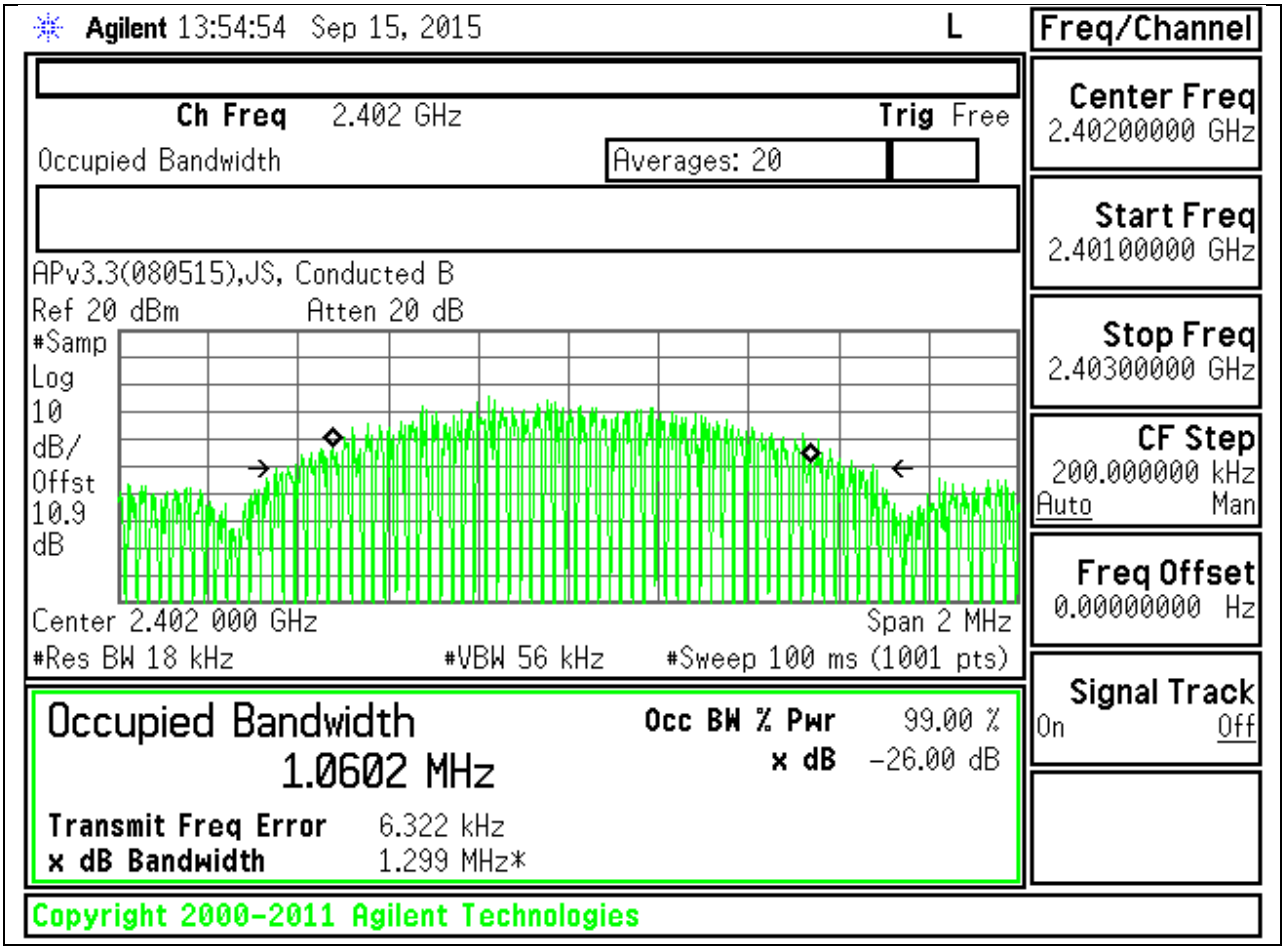
99% BANDWIDTH PLOTS

LOW CHANNEL



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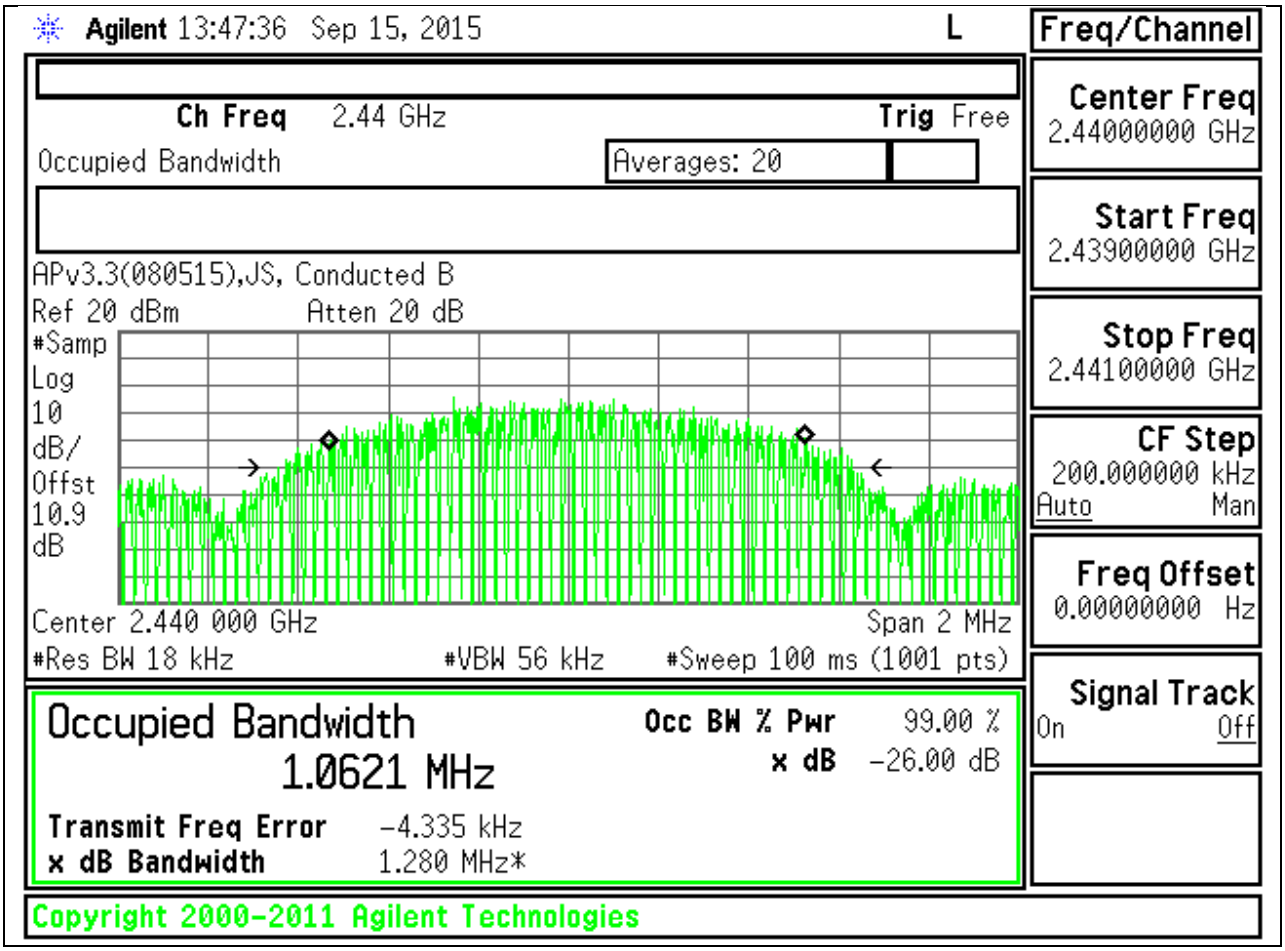
MID CHANNEL



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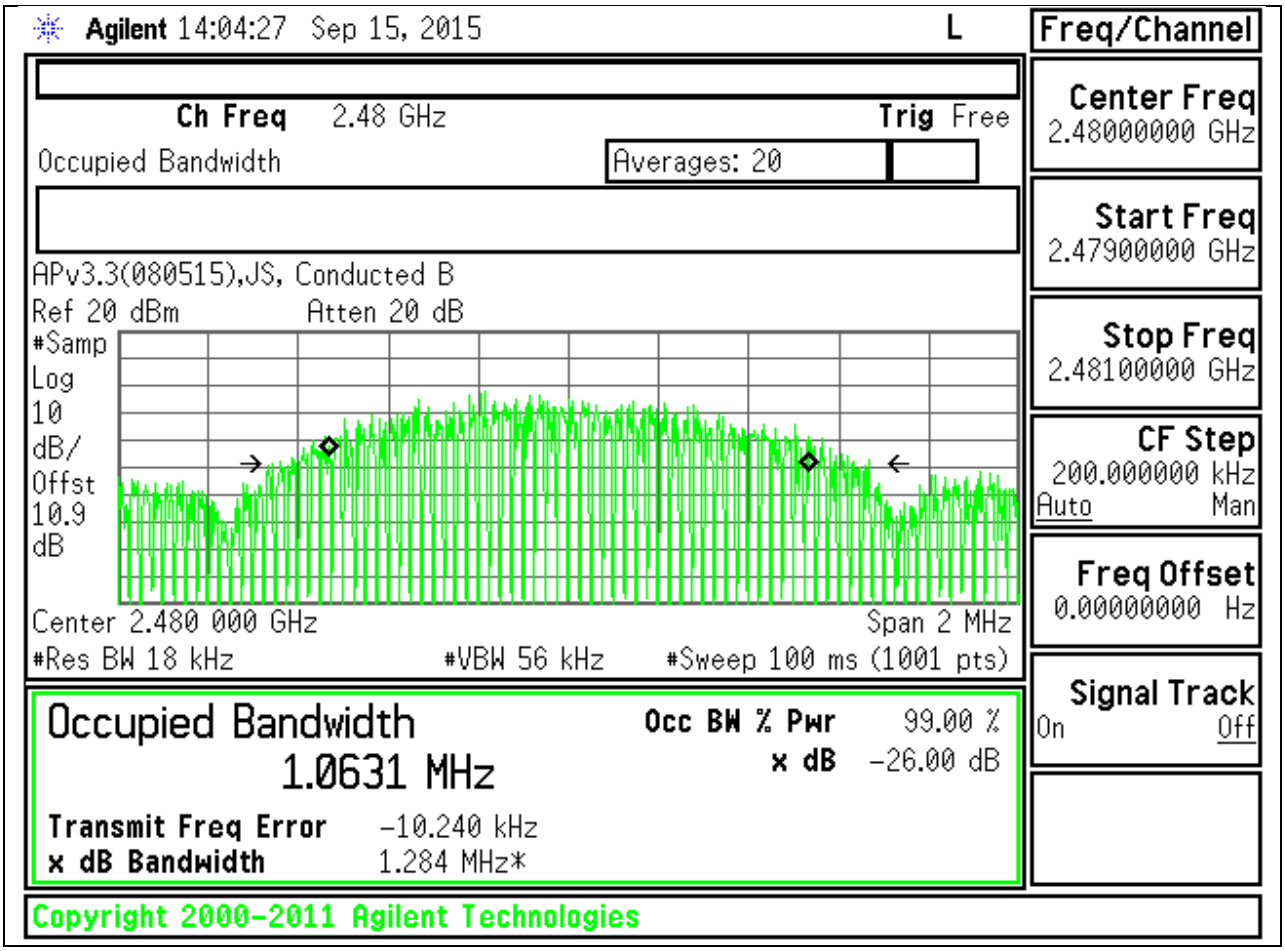
HIGH CHANNEL



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8.3. 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.

TEST PROCEDURE

Peak power is measured using KDB558074 D01 DTS Meas Guidance v03r03 utilizing spectrum analyzer.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.94	30	-27.060
Middle	2440	4.70	30	-25.300
High	2480	5.38	30	-24.620

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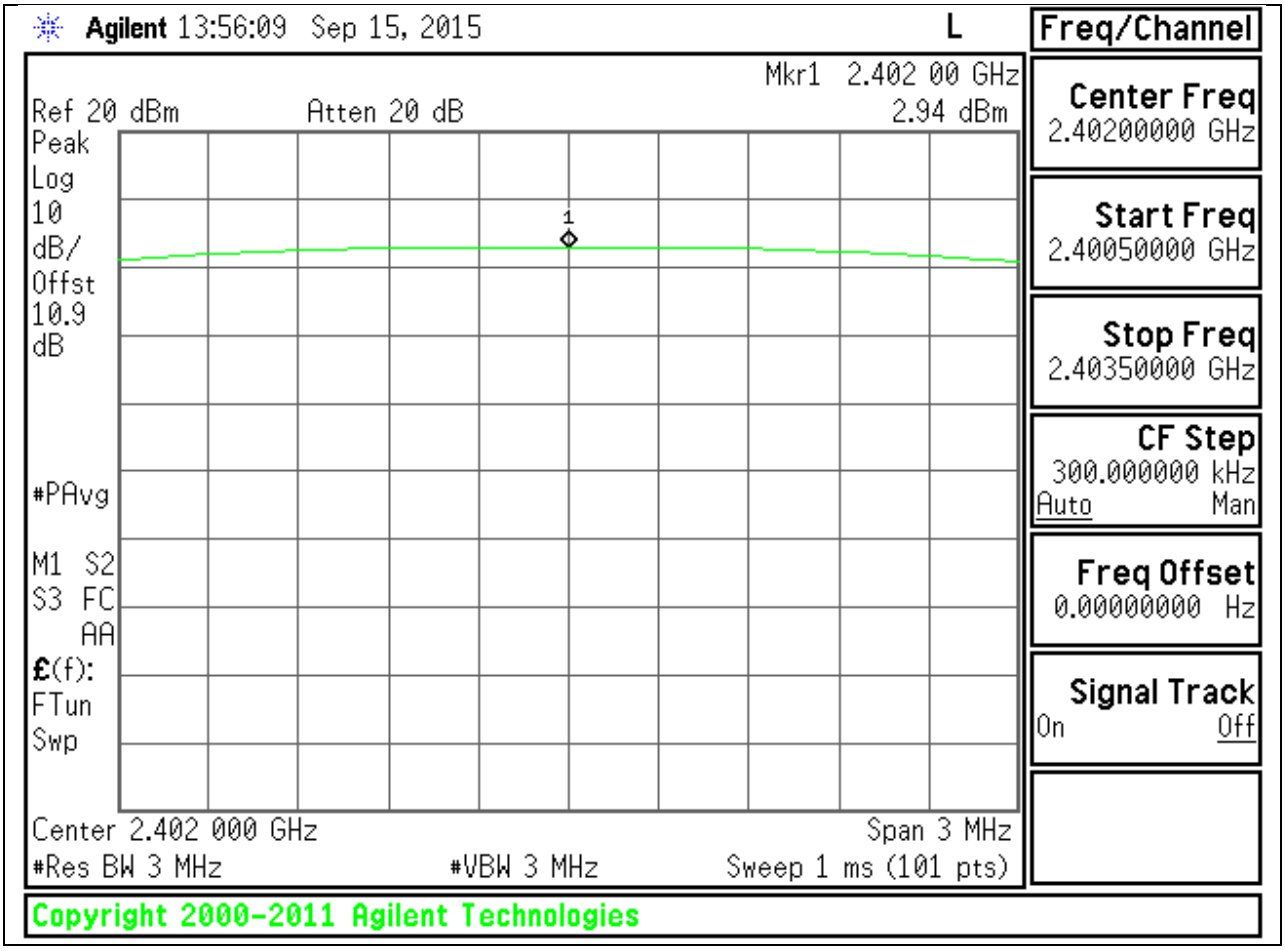
OUTPUT POWER PLOTS

LOW CHANNEL



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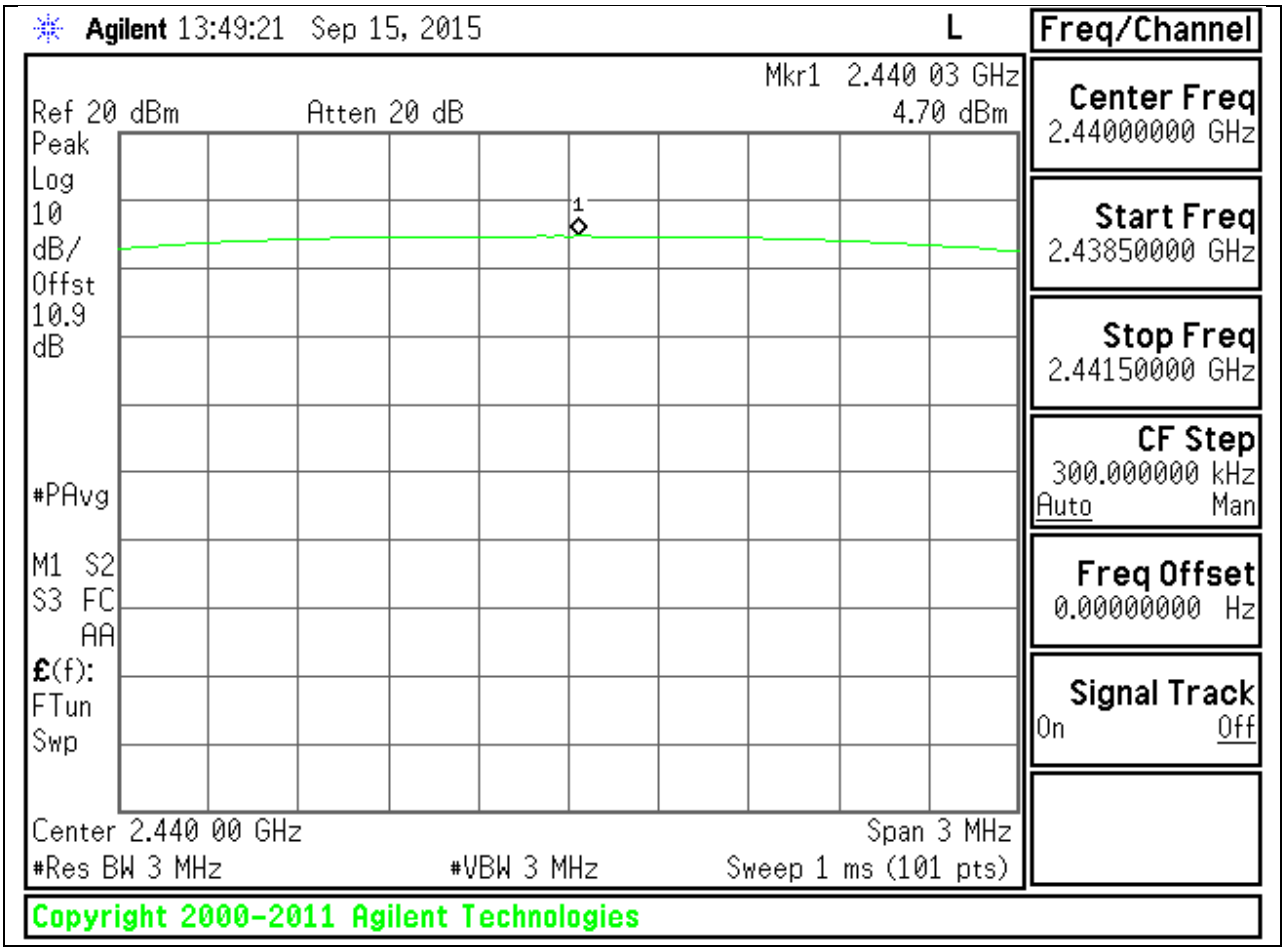
MID CHANNEL



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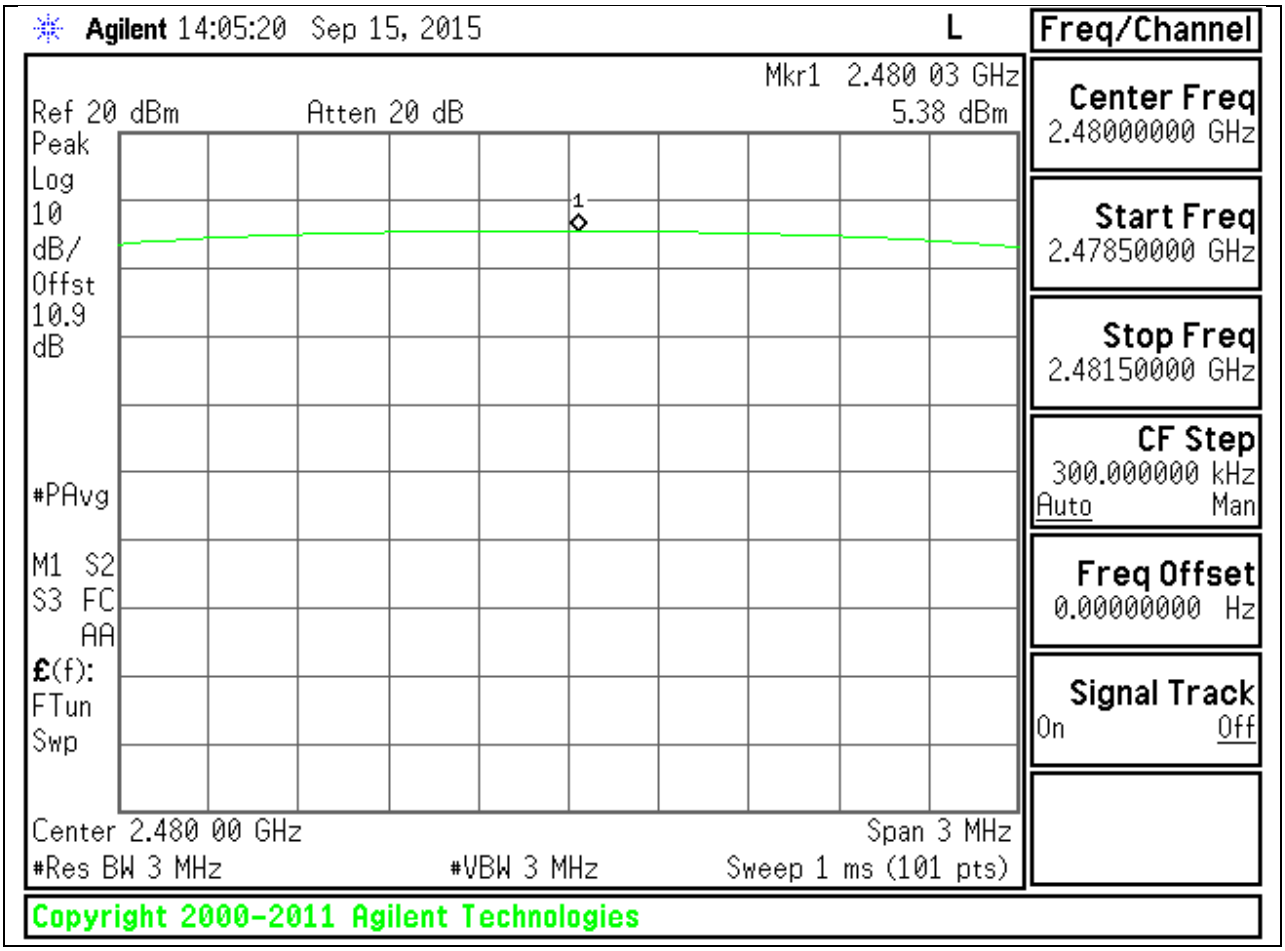
HIGH CHANNEL



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8.4. 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 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	2.66
Middle	2440	4.4
High	2480	5.18

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8.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 5.2.2

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

TEST PROCEDURE

Power Spectral Density was performed utilizing the "Method PKPSD (Peak PSD)" under KDB558074 D01 DTS Meas Guidance v03r03.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-2.41	8	-10.41
Middle	2440	-0.88	8	-8.88
High	2480	-0.08	8	-8.08

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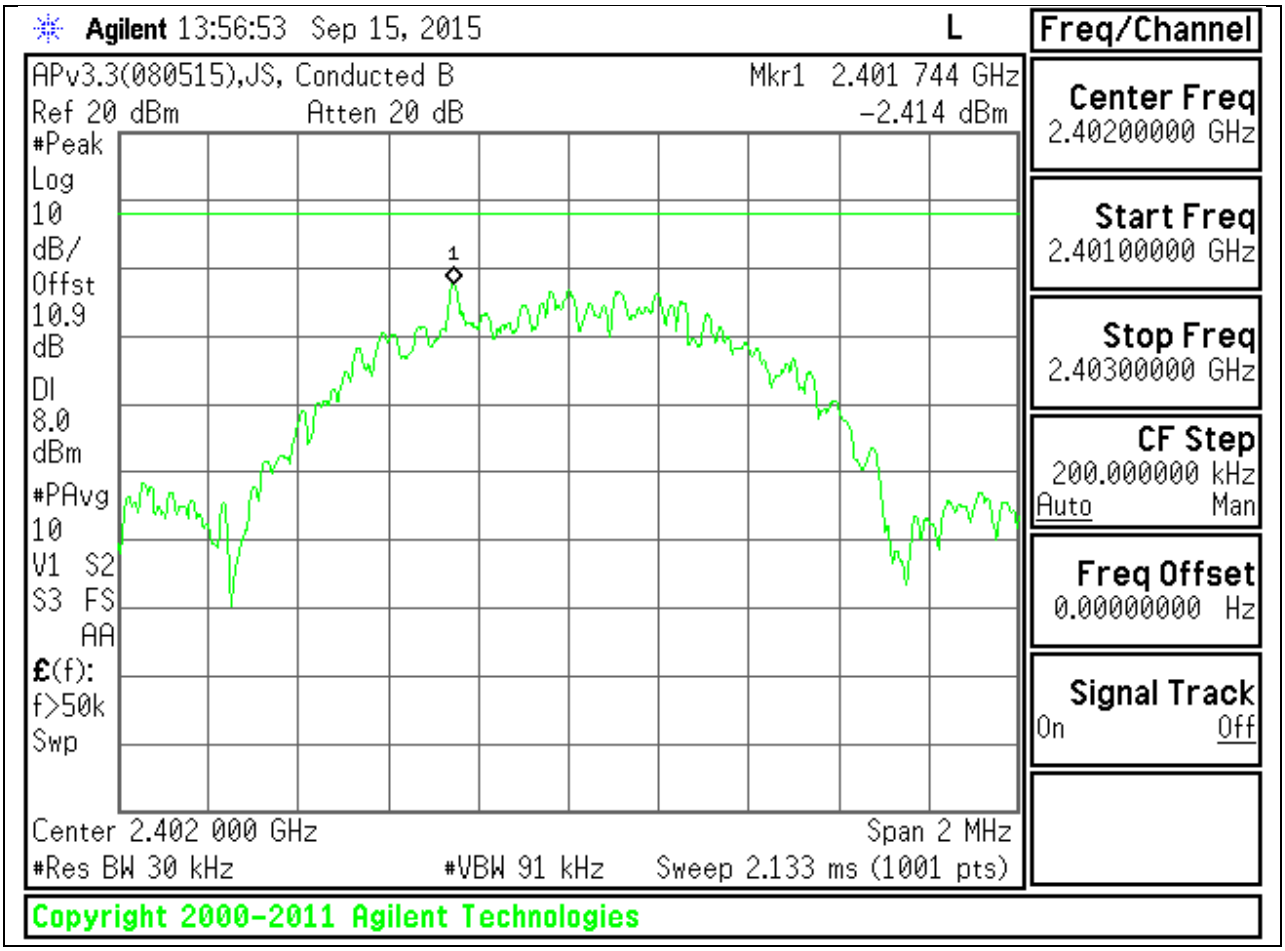
POWER SPECTRAL DENSITY PLOTS

LOW CHANNEL



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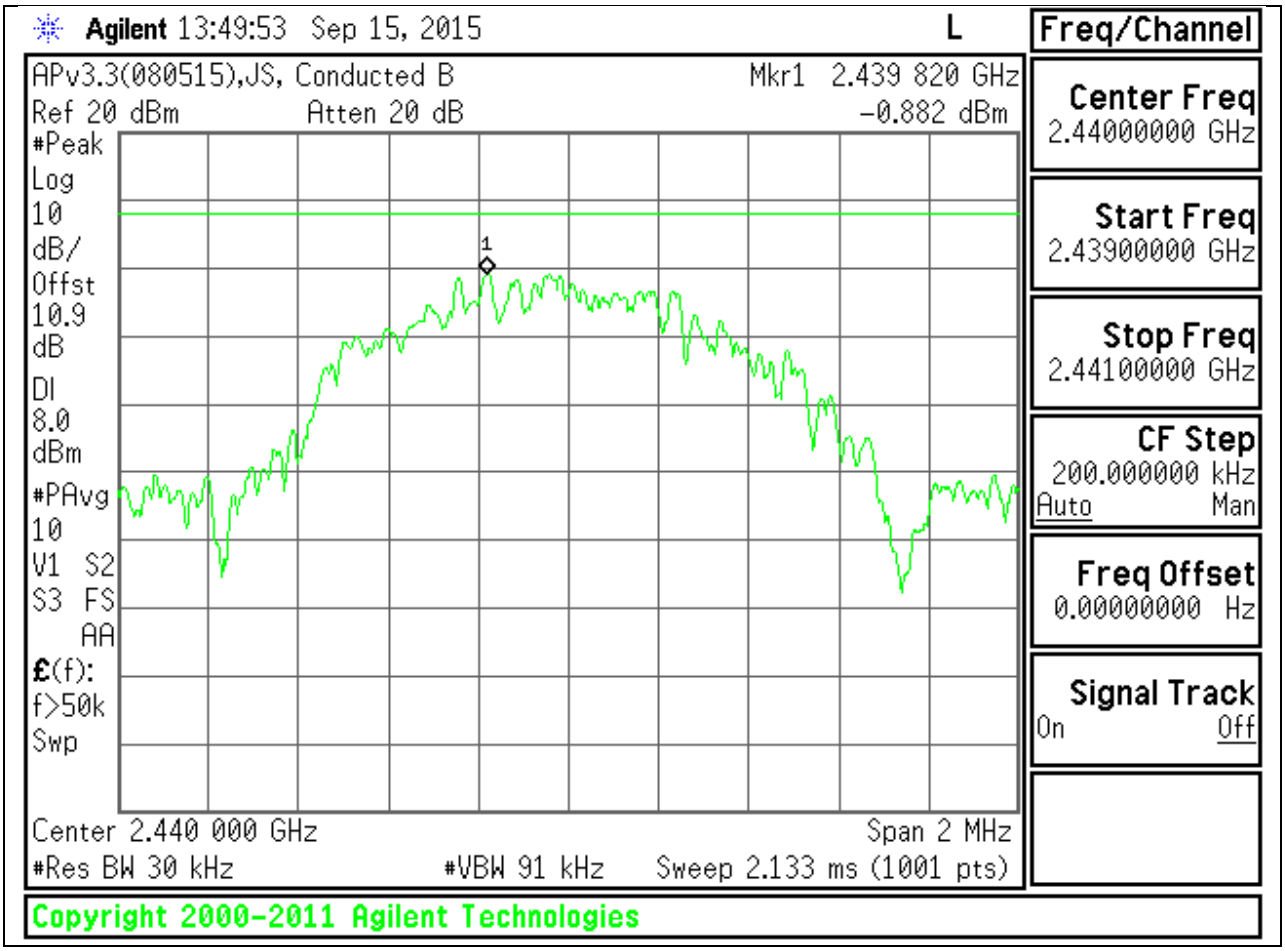
MID CHANNEL



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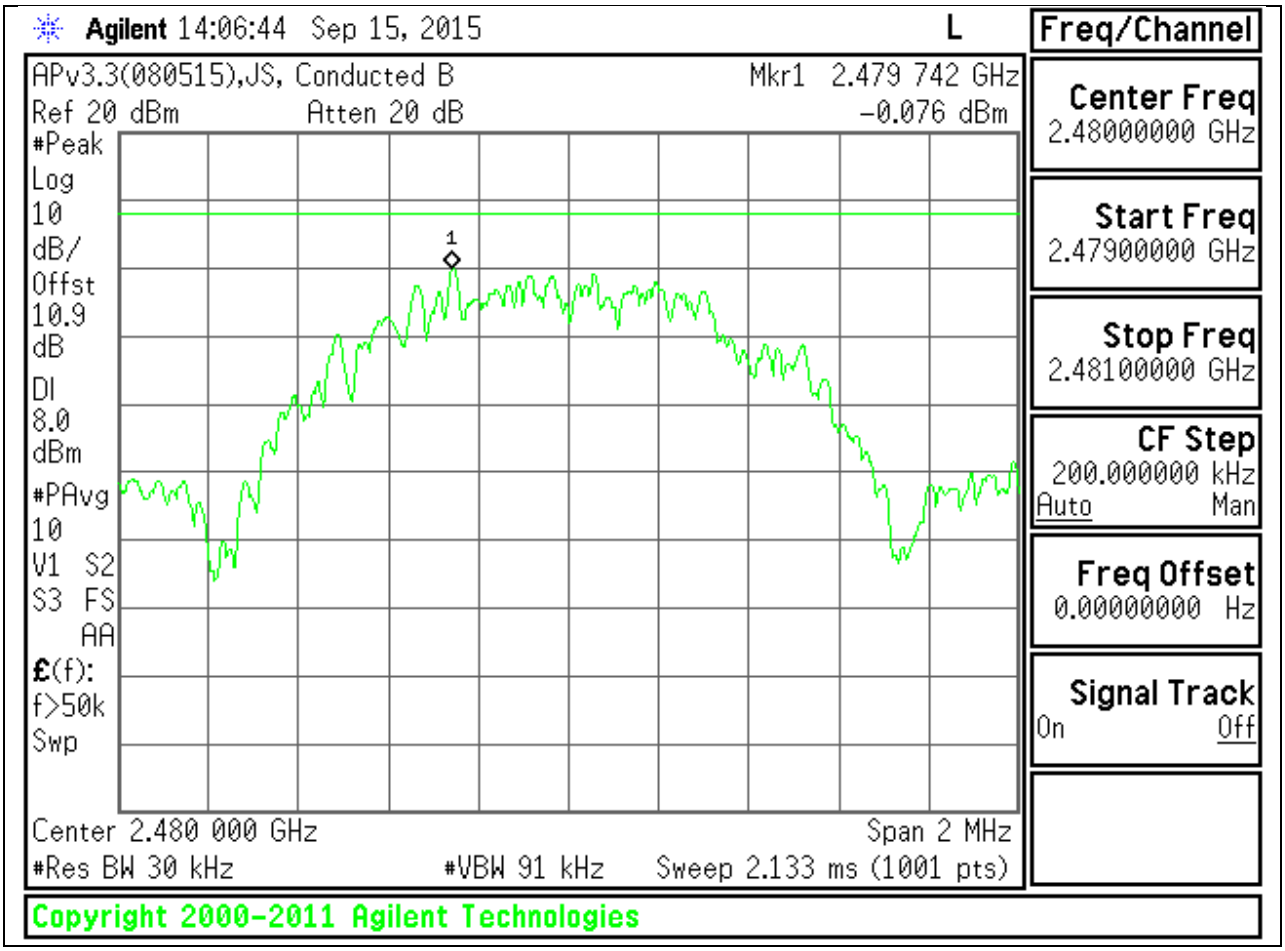
HIGH CHANNEL



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8.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 5.5

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

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.

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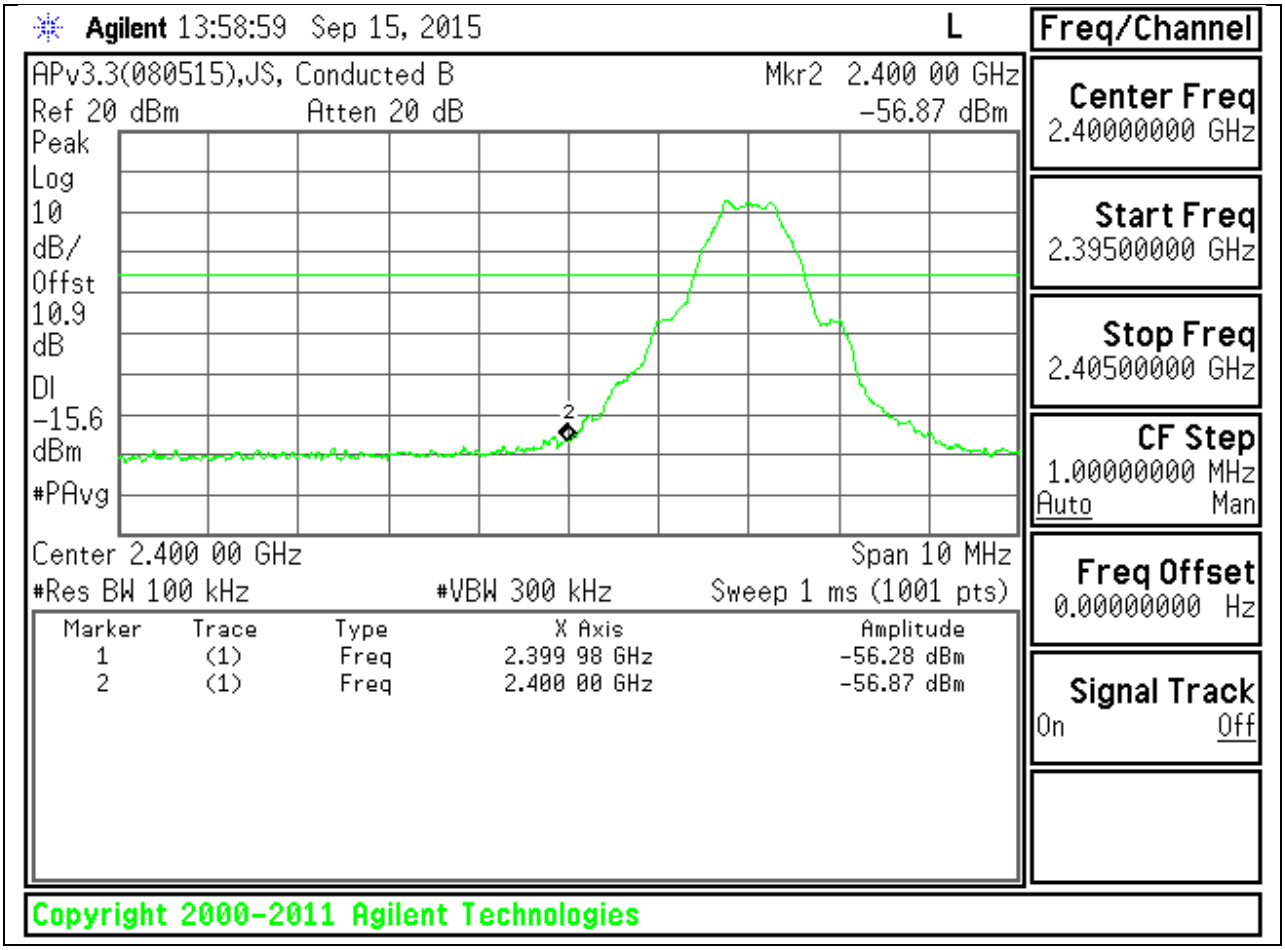
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE



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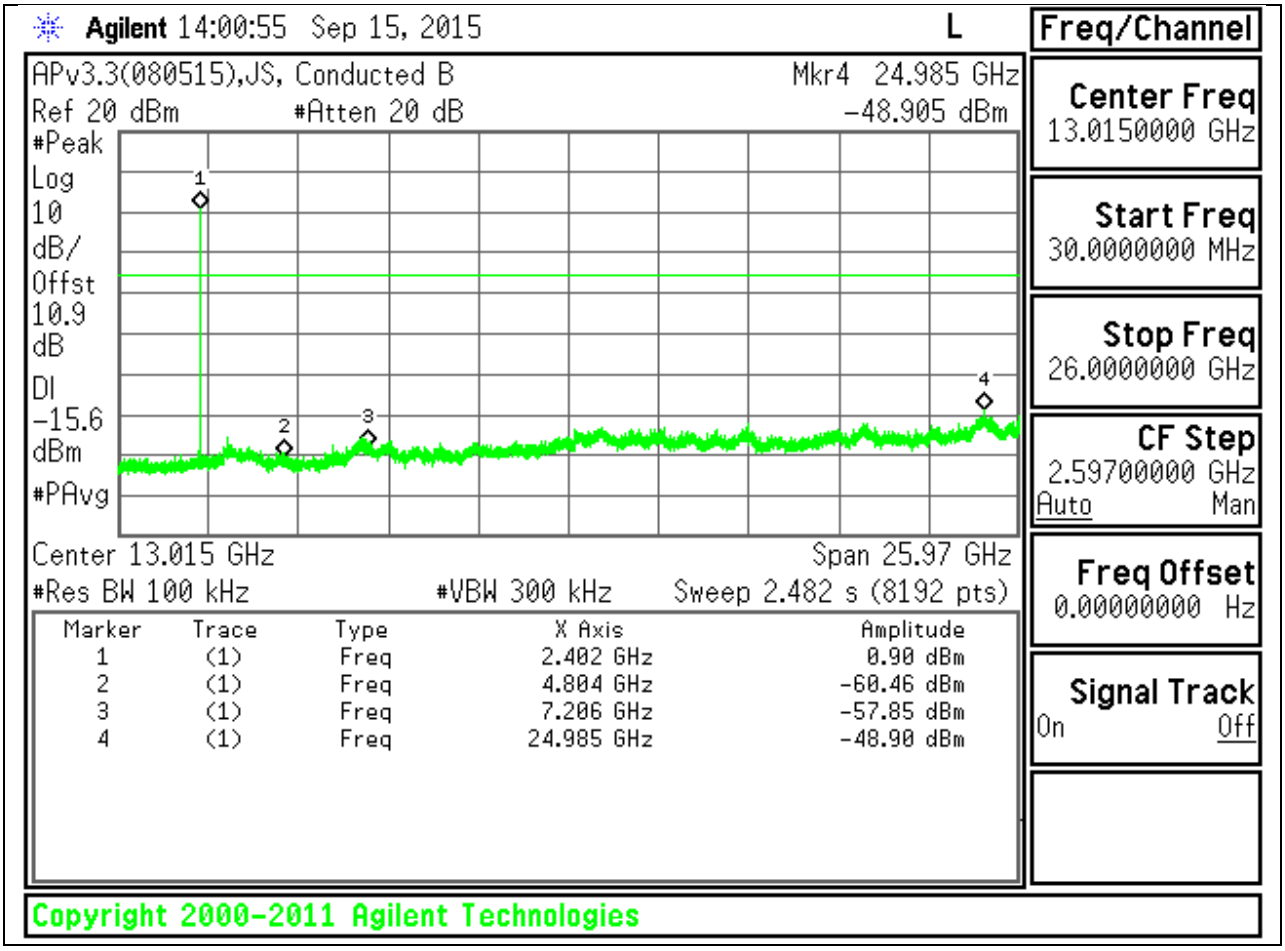
LOW CHANNEL SPURIOUS



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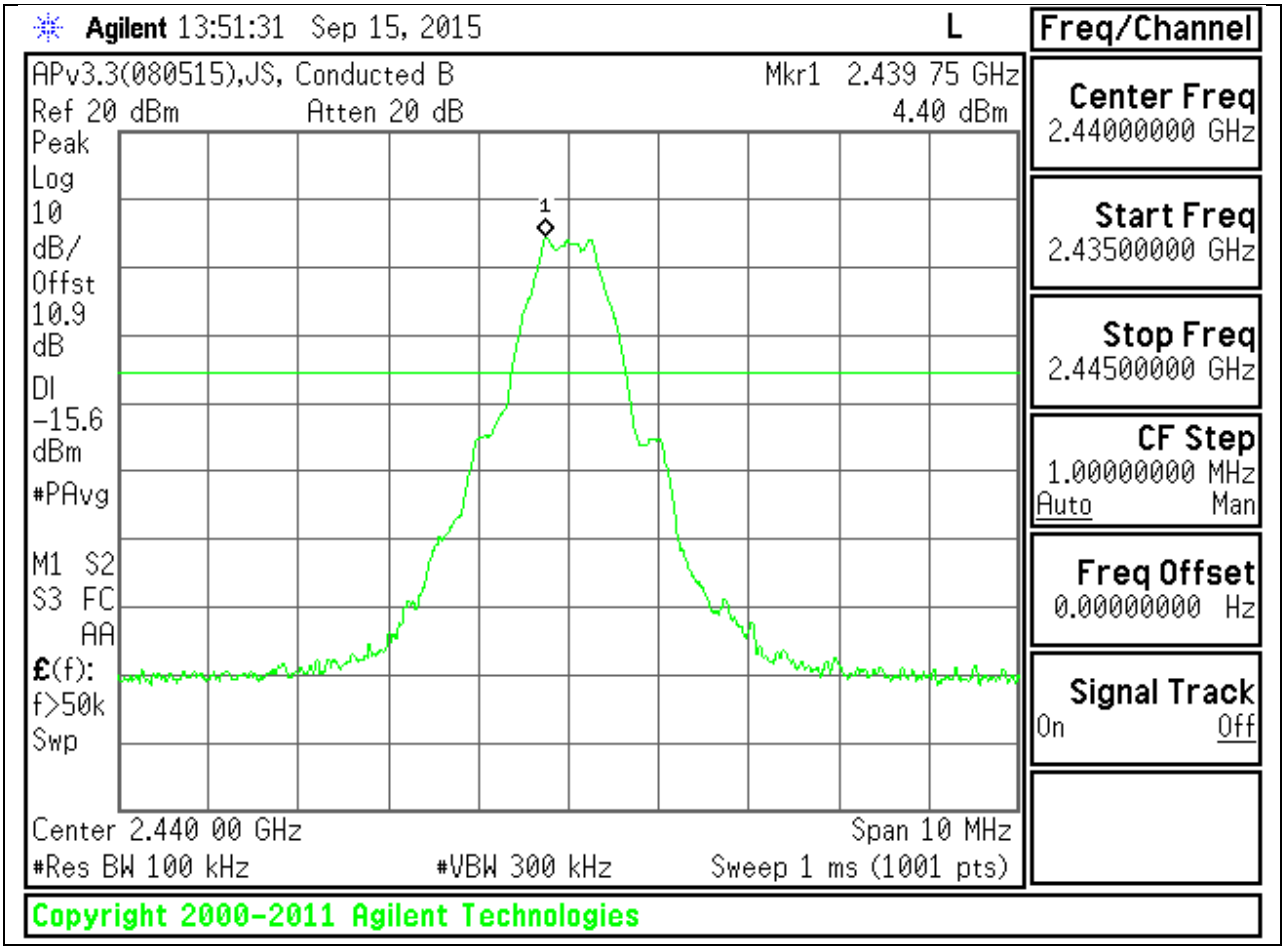
SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE



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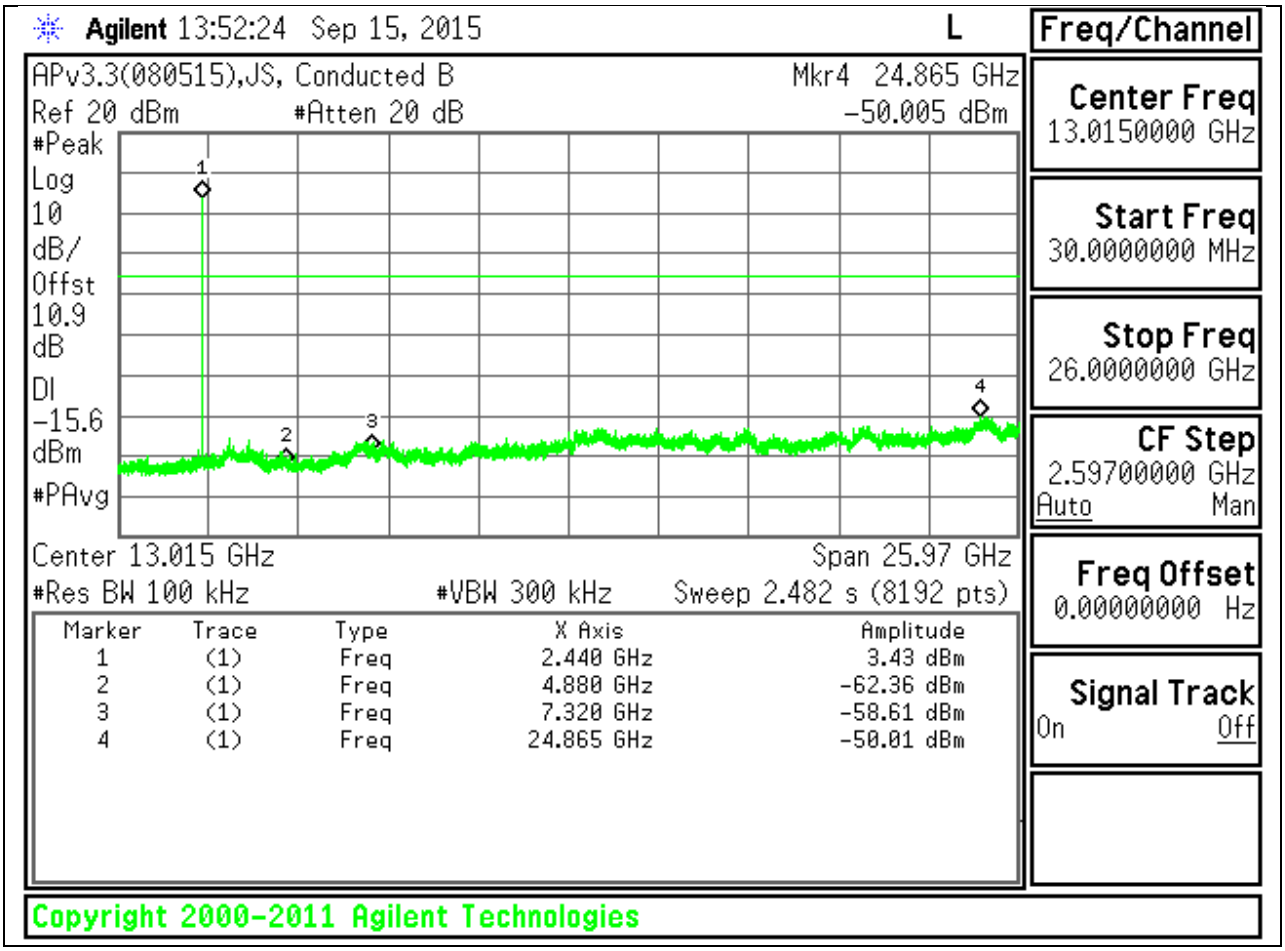
MID CHANNEL SPURIOUS



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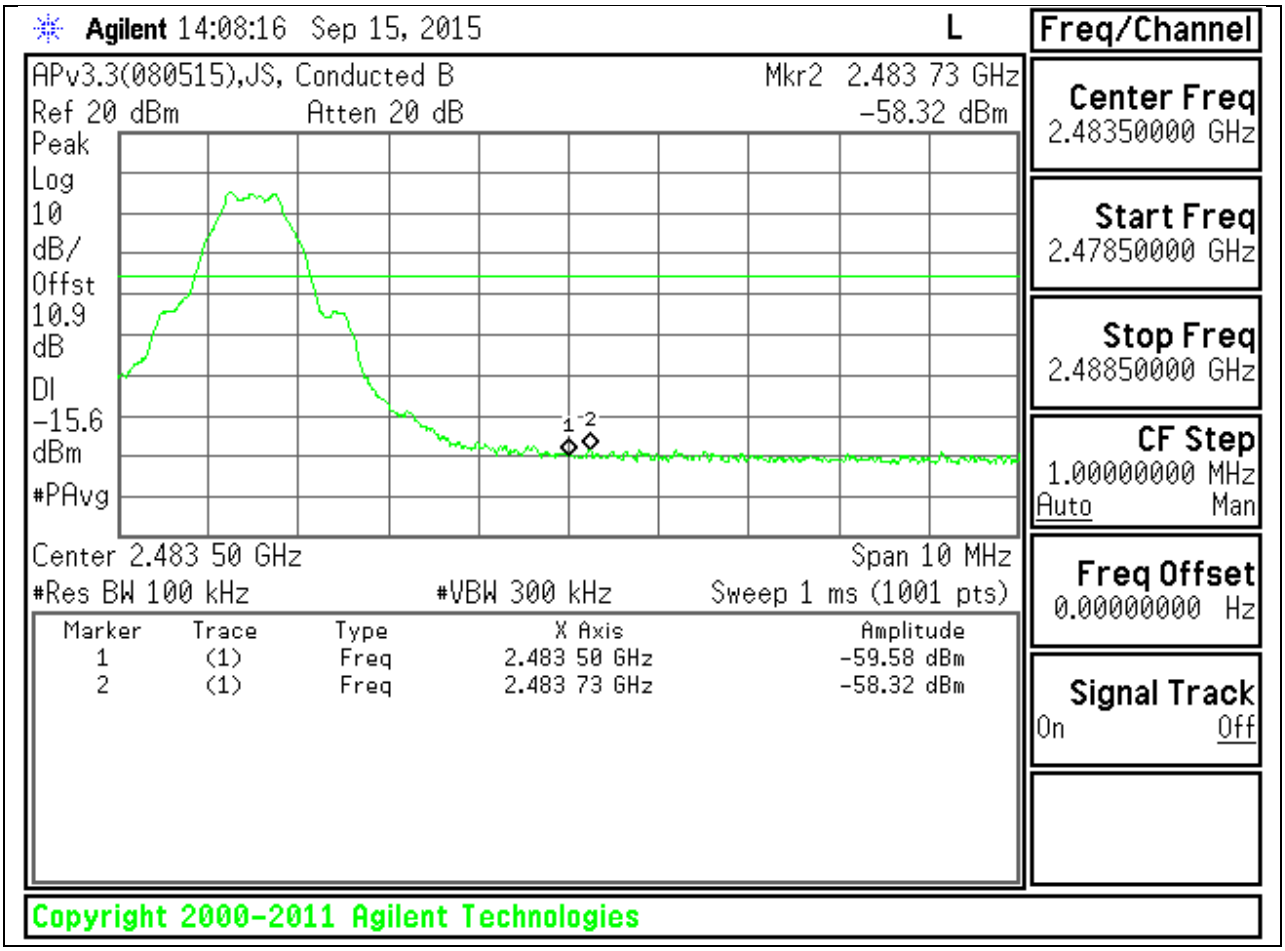
SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE



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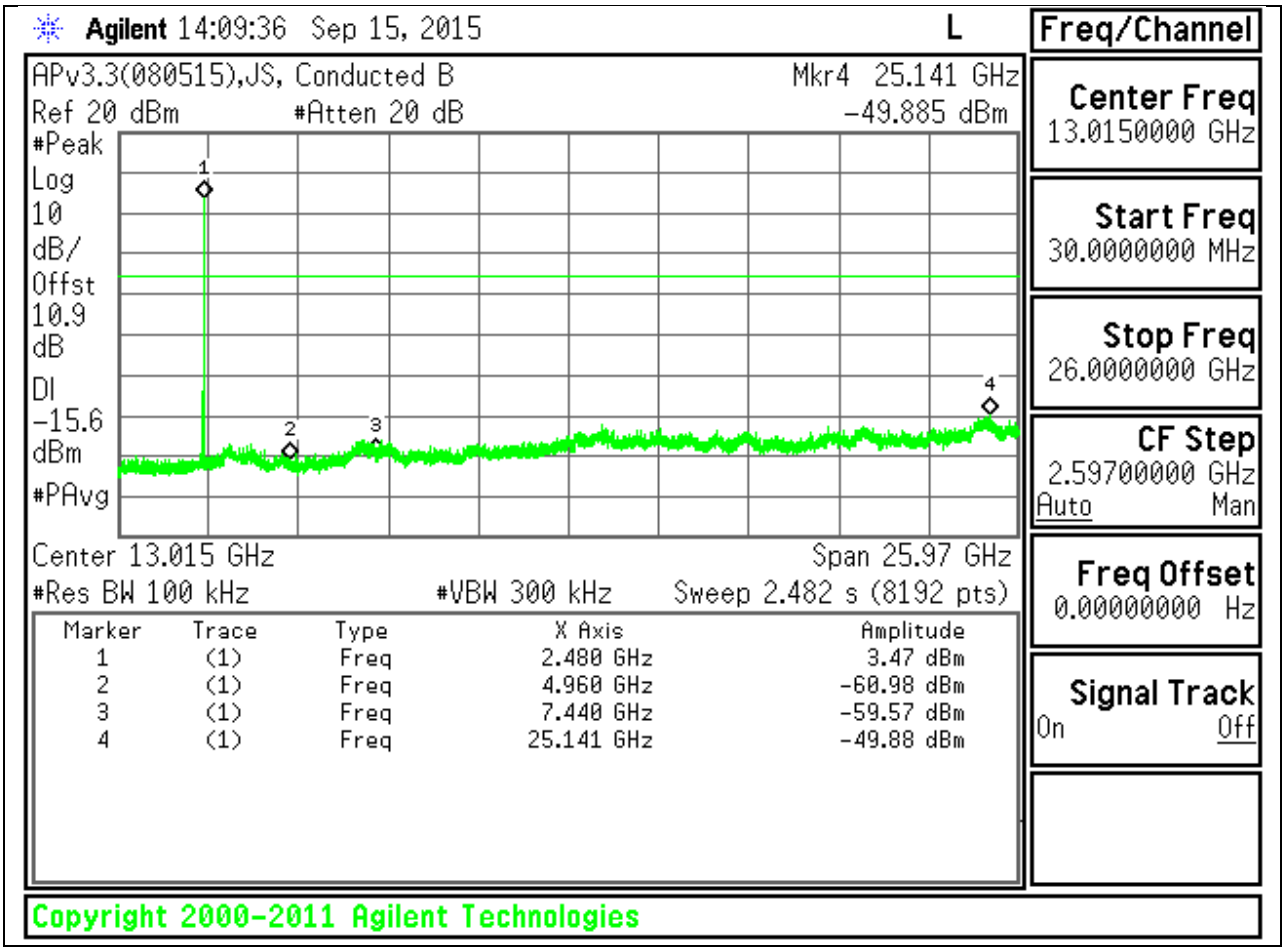
HIGH CHANNEL SPURIOUS



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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
IC RSS-GEN Clause 8.9 (Transmitter)
IC RSS-GEN Clause 7 (Receiver)

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150cm for above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and add duty cycle factor for average measurements. Duty cycle factor = 10 log (1/x). For this sample: DCF = 10log(1/0.71)=1.47 dB

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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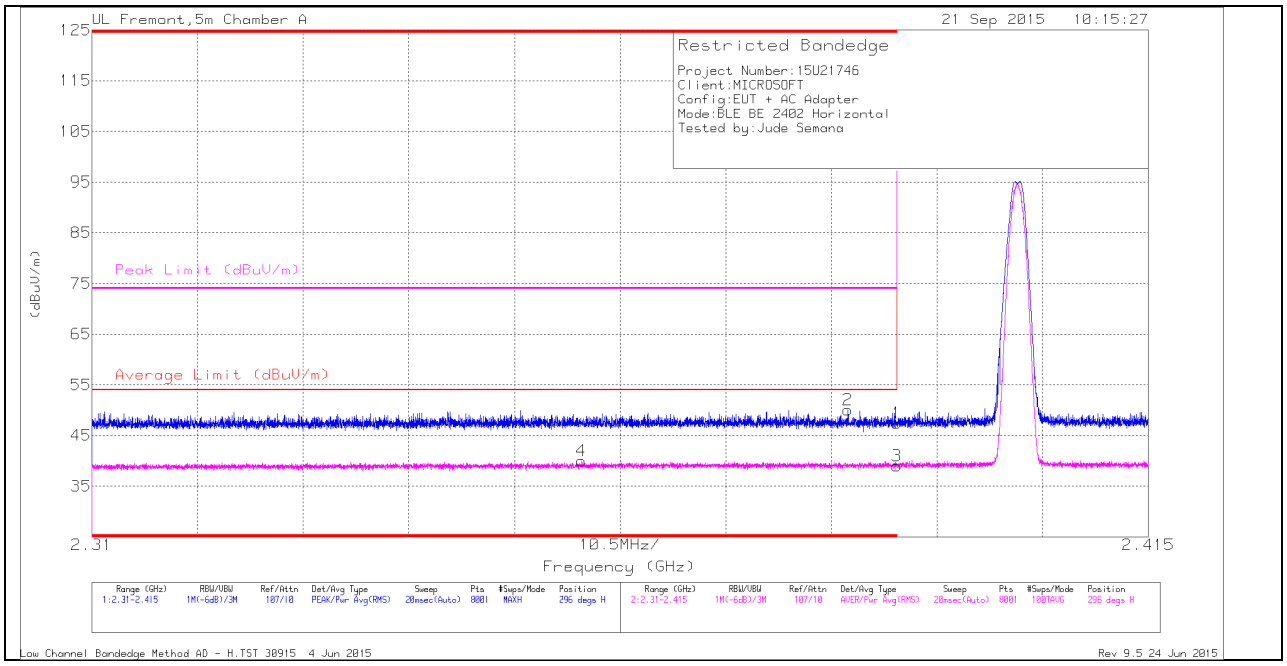
9.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	* 2.39	40.08	Pk	32	-24.6	0	47.48	-	-	74	-26.52	296	115	H
2	* 2.385	42.69	Pk	32	-24.6	0	50.09	-	-	74	-23.91	296	115	H
3	* 2.39	30.1	RMS	32	-24.6	1.47	38.97	54	-15.03	-	-	296	115	H
4	* 2.359	31.3	RMS	31.9	-24.7	1.47	39.97	54	-14.03	-	-	296	115	H

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

Pk - Peak detector

RMS - RMS detection

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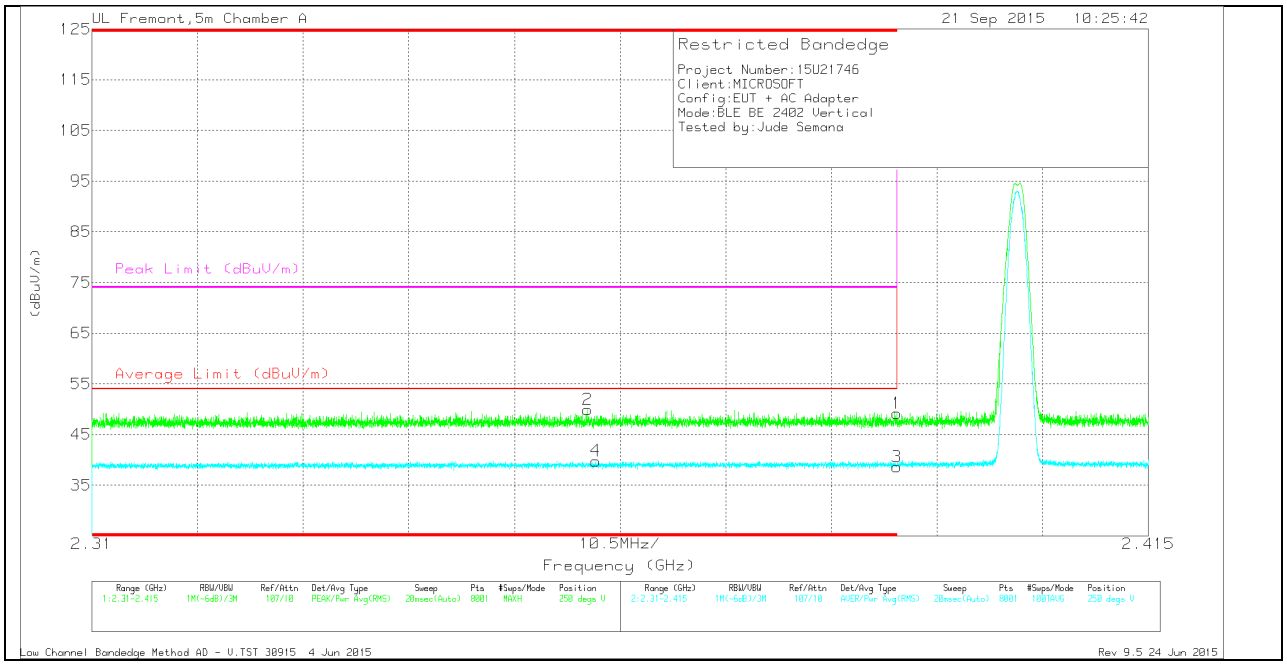
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	* 2.39	41.73	Pk	32	-24.6	0	49.13	-	-	74	-24.87	250	111	V
2	* 2.359	42.75	Pk	31.9	-24.7	0	49.95	-	-	74	-24.05	250	111	V
3	* 2.39	29.78	RMS	32	-24.6	1.47	38.65	54	-15.35	-	-	250	111	V
4	* 2.36	31.13	RMS	31.9	-24.7	1.47	39.8	54	-14.2	-	-	250	111	V

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

Pk - Peak detector

RMS - RMS detection

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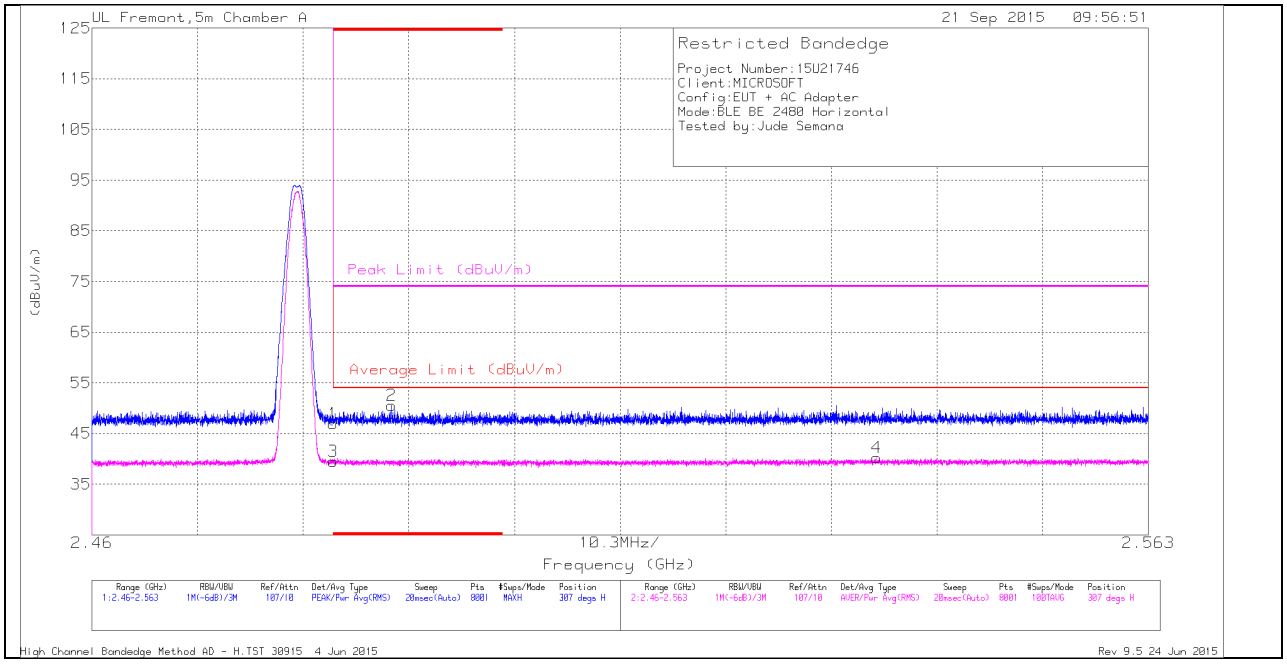
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	39.31	Pk	32.1	-24.5	0	46.91	-	-	74	-27.09	307	107	H
2	* 2.489	42.92	Pk	32.1	-24.5	0	50.52	-	-	74	-23.48	307	107	H
3	* 2.484	30.44	RMS	32.1	-24.5	1.47	39.51	54	-14.49	-	-	307	107	H
4	2.537	31.02	RMS	32.1	-24.4	1.47	40.19	54	-13.81	-	-	307	107	H

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

Pk - Peak detector

RMS - RMS detection

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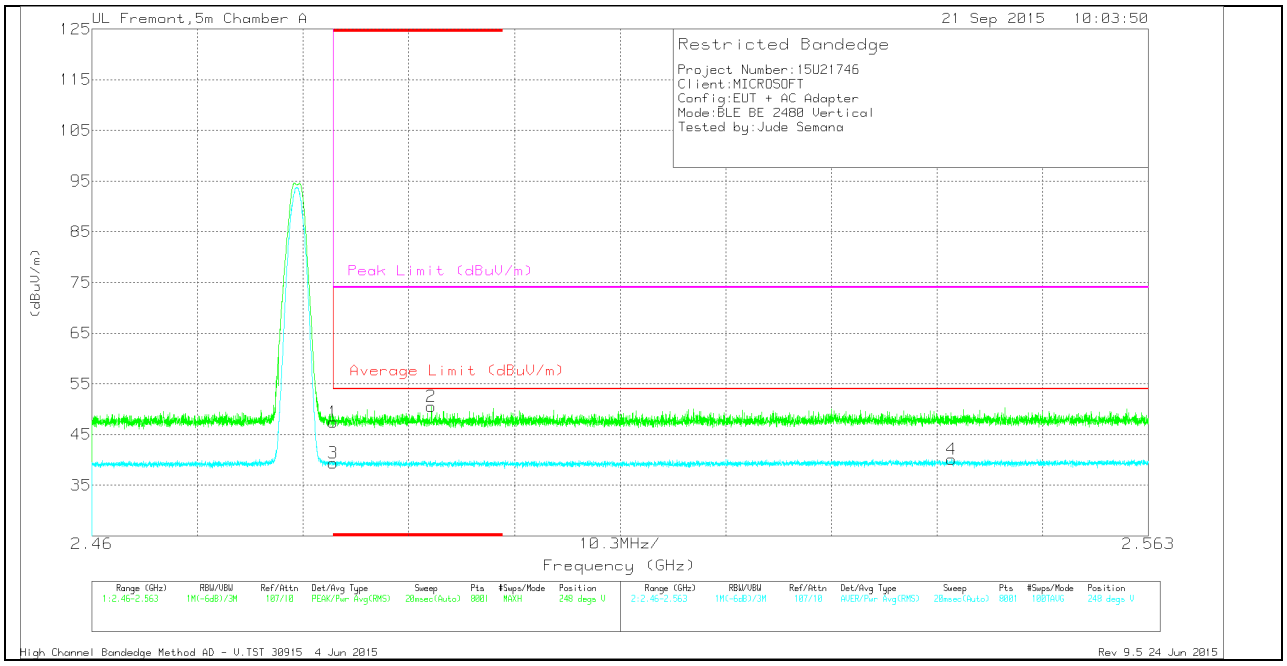
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	39.84	Pk	32.1	-24.5	0	47.44	-	-	74	-26.56	248	111	V
2	* 2.493	42.98	Pk	32.1	-24.5	0	50.58	-	-	74	-23.42	248	111	V
3	* 2.484	30.3	RMS	32.1	-24.5	1.47	39.37	54	-14.63	-	-	248	111	V
4	2.544	30.97	RMS	32.2	-24.5	1.47	40.14	54	-13.86	-	-	248	111	V

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

Pk - Peak detector

RMS - RMS detection

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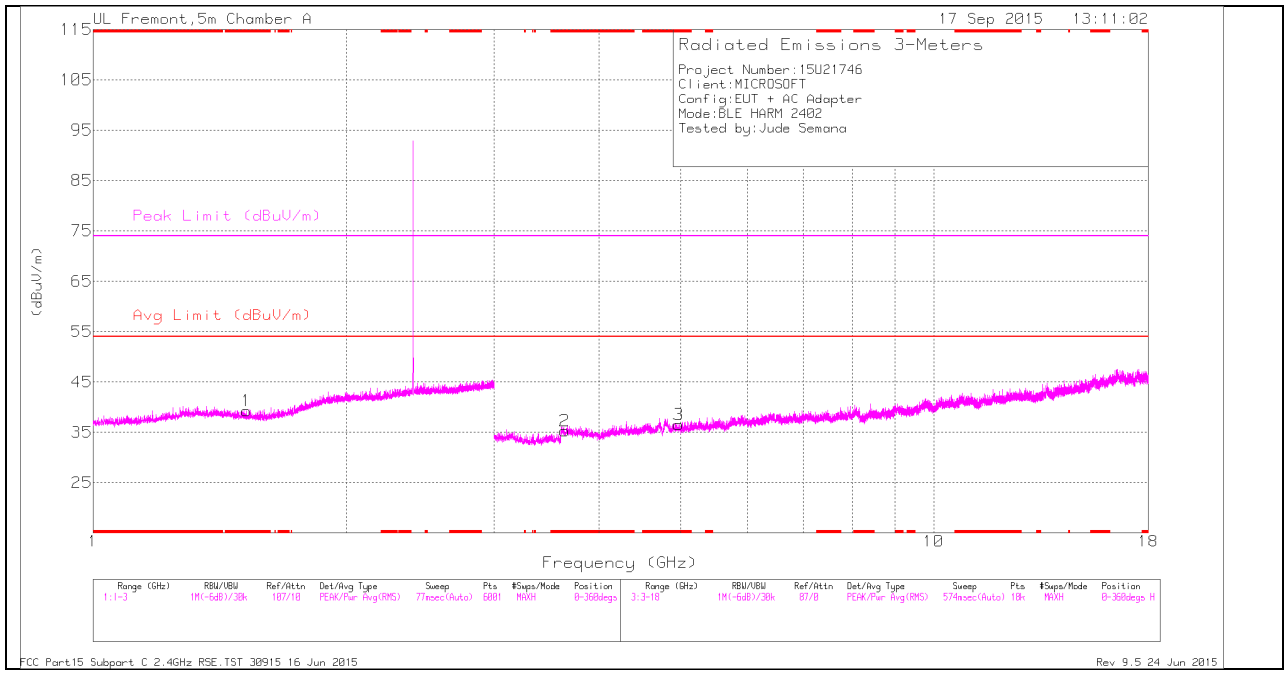
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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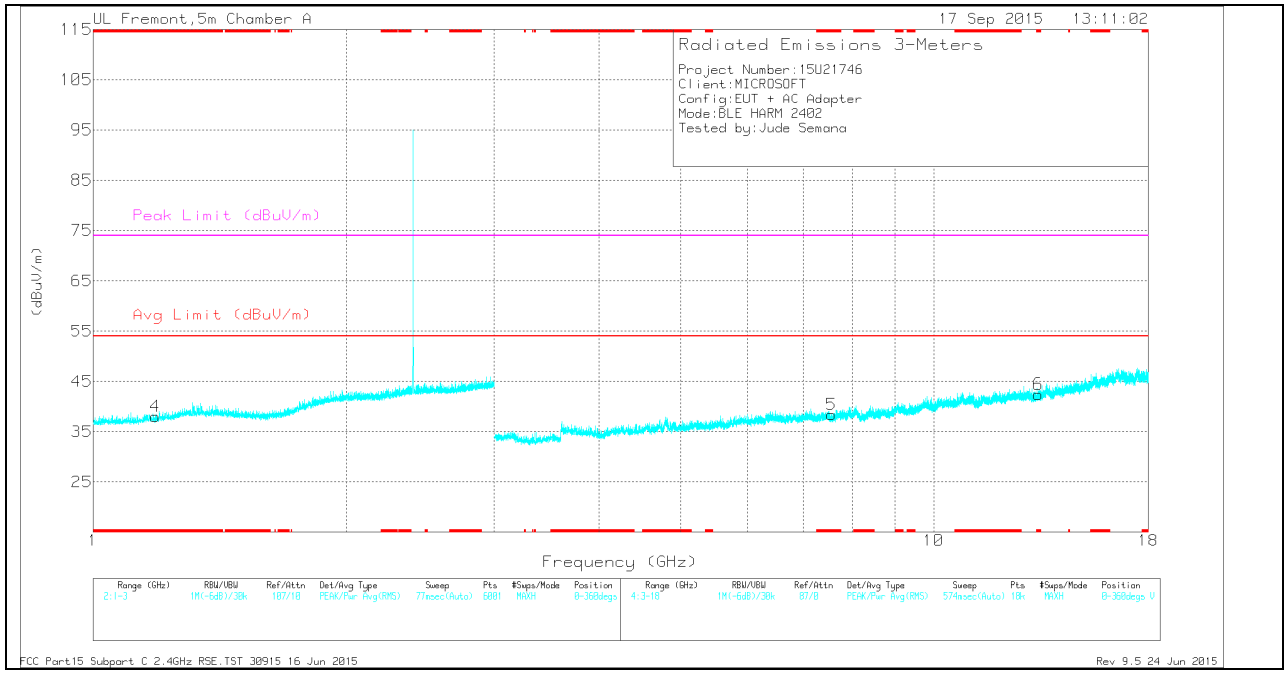
LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	* 1.521	36.75	Pk	28.1	-25.6	0	39.25	-	-	74	-34.75	0-360	201	H
4	* 1.186	36.2	Pk	27.9	-26.1	0	38	-	-	74	-36	0-360	200	V
2	* 3.64	34.08	Pk	33.2	-32	0	35.28	-	-	74	-38.72	0-360	100	H
3	* 4.972	32.93	Pk	33.9	-30.3	0	36.53	-	-	74	-37.47	0-360	201	H
5	* 7.558	28.48	Pk	35.5	-25.6	0	38.38	-	-	74	-35.62	0-360	200	V
6	* 13.315	25.72	Pk	39.1	-22.4	0	42.42	-	-	74	-31.58	0-360	100	V

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

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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
* 1.522	44.93	PK2	28.1	-25.6	0	47.43	-	-	74	-26.57	360	202	H
* 1.522	33.09	MAv1	28.1	-25.6	1.47	37.06	54	-16.94	-	-	360	202	H
* 1.187	44.92	PK2	27.9	-26.1	0	46.72	-	-	74	-27.28	360	202	V
* 1.184	33.04	MAv1	27.9	-26.1	1.47	36.31	54	-17.69	-	-	360	202	V
* 3.639	42.31	PK2	33.2	-32	0	43.51	-	-	74	-30.49	360	100	H
* 3.64	30.9	MAv1	33.2	-32	1.47	33.57	54	-20.43	-	-	360	100	H
* 4.973	40.52	PK2	34	-30.3	0	44.22	-	-	74	-29.78	360	202	H
* 4.97	29.68	MAv1	33.9	-30.3	1.47	34.75	54	-19.25	-	-	360	202	H
* 7.556	36.32	PK2	35.5	-25.6	0	46.22	-	-	74	-27.78	360	202	V
* 7.559	25.23	MAv1	35.5	-25.6	1.47	36.6	54	-17.4	-	-	360	202	V
* 13.317	33.74	PK2	39.1	-22.4	0	50.44	-	-	74	-23.56	360	100	V
* 13.316	22.91	MAv1	39.1	-22.4	1.47	41.08	54	-12.92	-	-	360	100	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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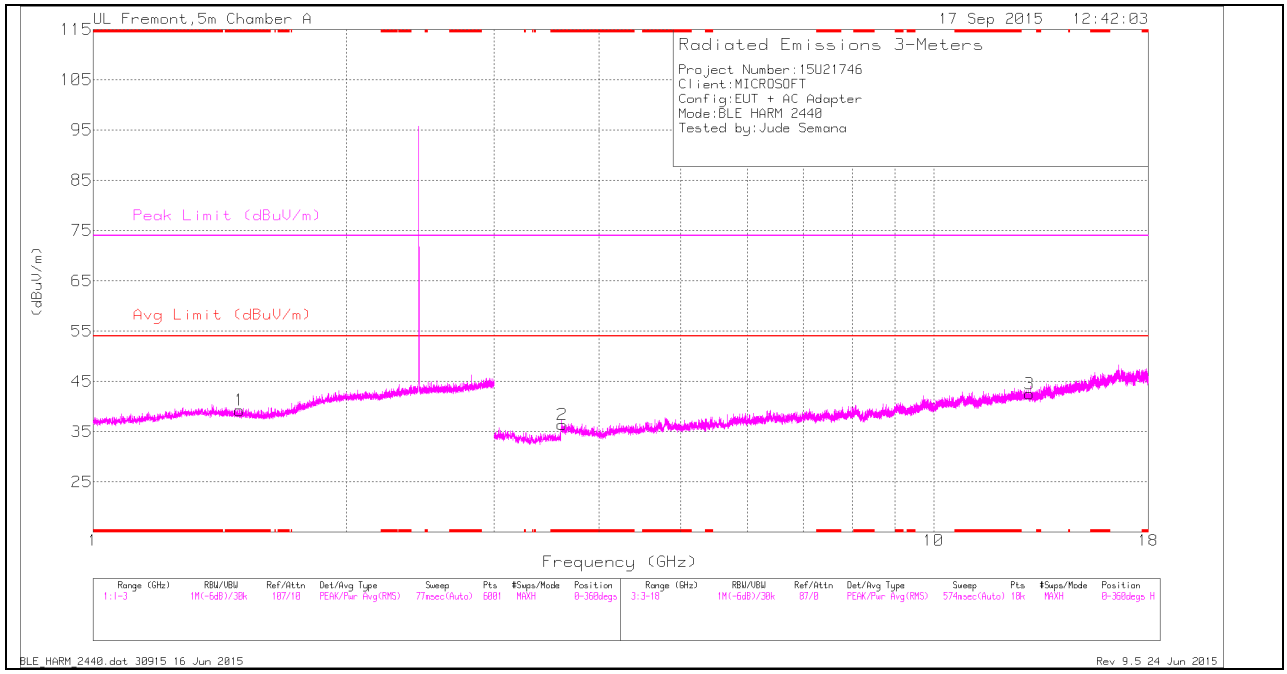
MID CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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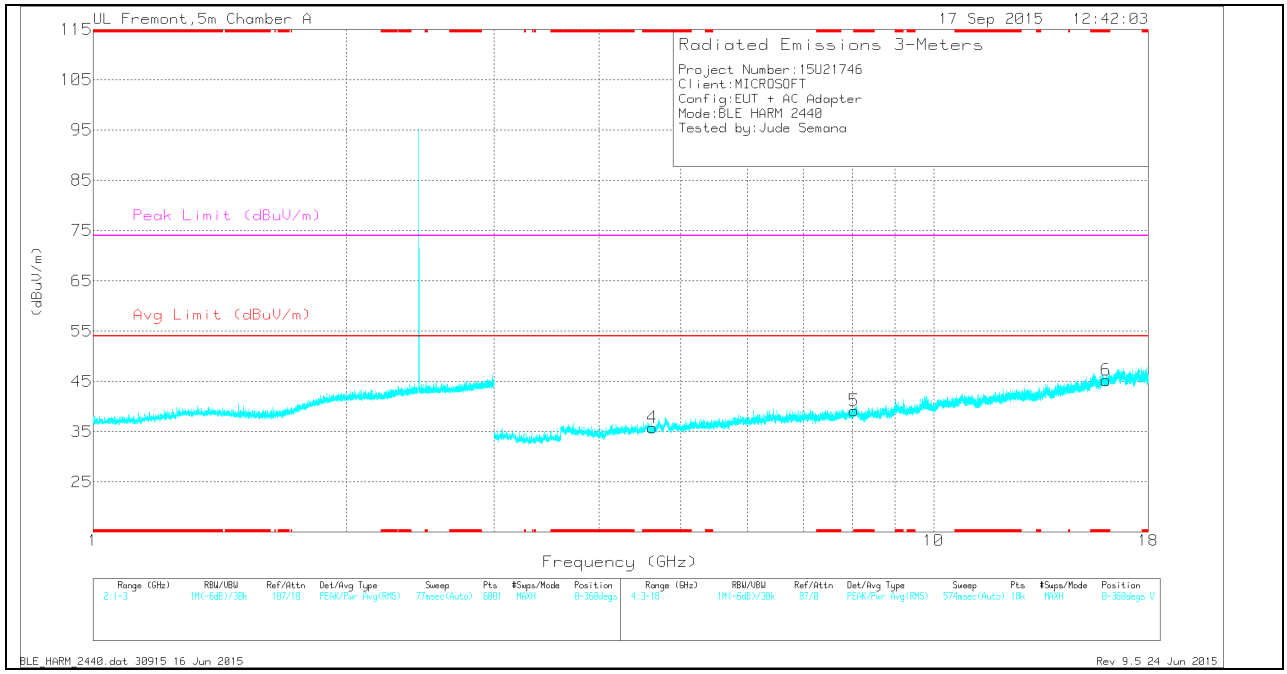
MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	* 1.495	36.74	Pk	28.1	-25.6	0	39.24	-	-	74	-34.76	0-360	201	H
2	* 3.616	35.5	Pk	33.1	-32.2	0	36.4	-	-	74	-37.6	0-360	201	H
4	* 4.628	32.22	Pk	34.1	-30.5	0	35.82	-	-	74	-38.18	0-360	100	V
5	* 8.037	28.57	Pk	35.7	-25.1	0	39.17	-	-	74	-34.83	0-360	200	V
6	* 16.038	26.23	Pk	41	-22	0	45.23	-	-	74	-28.77	0-360	100	V
3	13	25.51	Pk	39.1	-22.1	0	42.51	-	-	-	-	0-360	201	H

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

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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
* 1.496	45.35	PK2	28.1	-25.6	0	47.85	-	-	74	-26.15	360	202	H
* 1.496	33.19	MAv1	28.1	-25.6	1.47	37.16	54	-16.84	-	-	360	202	H
* 3.615	42.49	PK2	33.1	-32.2	0	43.39	-	-	74	-30.61	360	202	H
* 3.615	31.3	MAv1	33.1	-32.2	1.47	33.67	54	-20.33	-	-	360	202	H
* 4.628	40.49	PK2	34.1	-30.5	0	44.09	-	-	74	-29.91	360	100	V
* 4.63	29.75	MAv1	34.1	-30.6	1.47	34.72	54	-19.28	-	-	360	100	V
* 8.035	37.59	PK2	35.7	-25.1	0	48.19	-	-	74	-25.81	360	201	V
* 8.039	25.67	MAv1	35.7	-25	1.47	37.84	54	-16.16	-	-	360	201	V
* 16.037	34.71	PK2	41	-22	0	53.71	-	-	74	-20.29	360	100	V
* 16.039	23.52	MAv1	41	-22	1.47	43.99	54	-10.01	-	-	360	100	V
13.001	22.59	MAv1	39.1	-22.1	1.47	41.06	-	-	-	-	360	202	H
13.002	33.76	PK2	39.1	-22.2	0	50.66	-	-	-	-	360	202	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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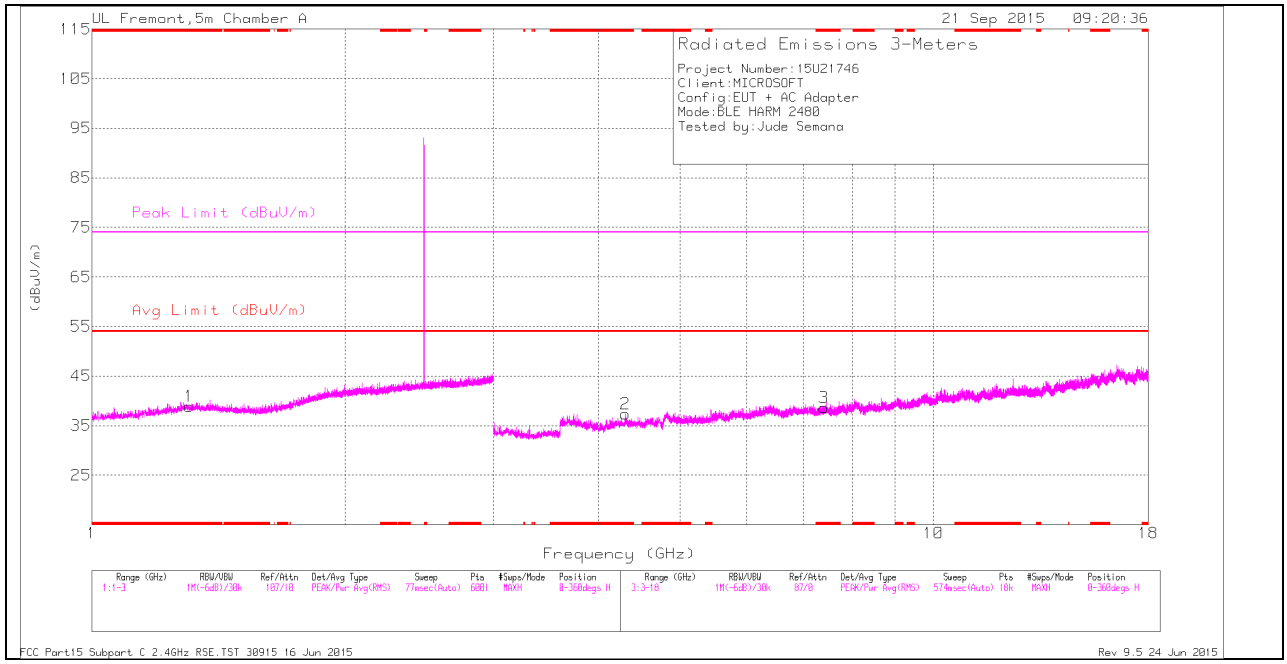
HIGH CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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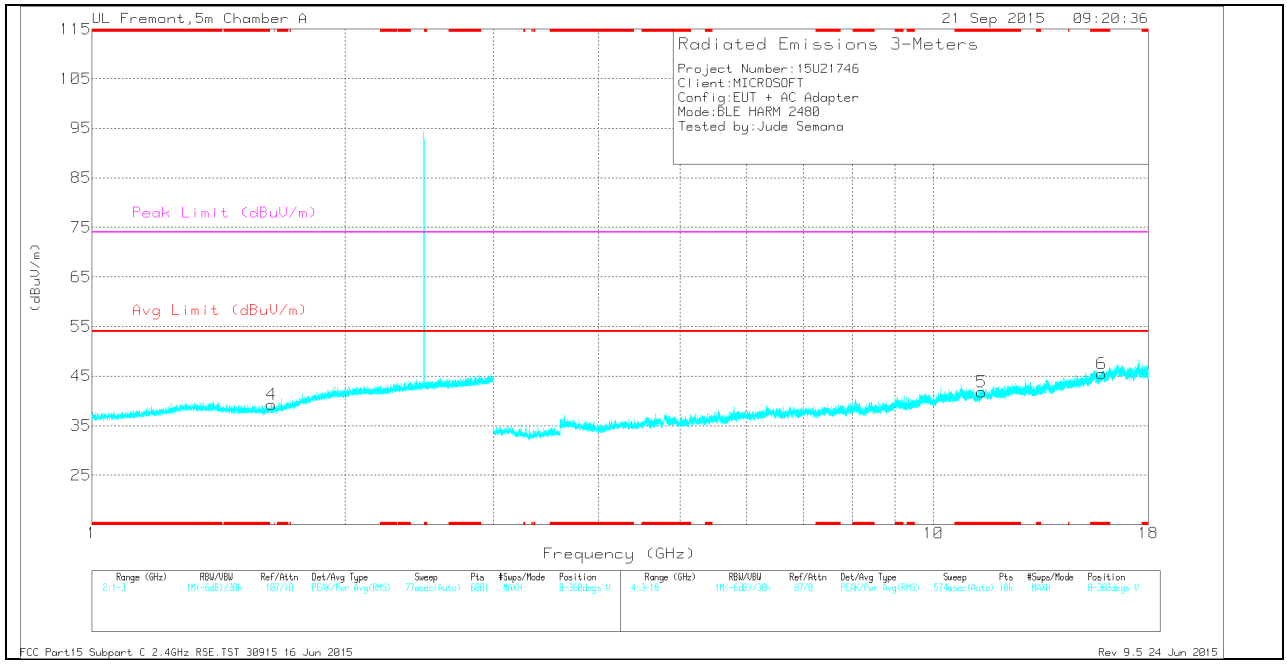
HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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	* 1.306	35.95	Pk	28.8	-25.9	0	38.85	-	-	74	-35.15	0-360	100	H
2	* 4.302	34.46	Pk	33.5	-30.6	0	37.36	-	-	74	-36.64	0-360	201	H
3	* 7.406	28.46	Pk	35.6	-25.4	0	38.66	-	-	74	-35.34	0-360	100	H
5	* 11.412	25.68	Pk	37.9	-21.8	0	41.78	-	-	74	-32.22	0-360	100	V
6	* 15.848	26.27	Pk	40.6	-21.4	0	45.47	-	-	74	-28.53	0-360	100	V
4	1.636	36.54	Pk	28.2	-25.5	0	39.24	-	-	-	-	0-360	100	V

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

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (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
* 1.304	45.38	PK2	28.8	-25.9	0	48.28	-	-	74	-25.72	1	100	H
* 1.305	32.91	MAv1	28.8	-25.9	1.47	37.28	54	-16.72	-	-	1	100	H
* 4.3	41.12	PK2	33.5	-30.6	0	44.02	-	-	74	-29.98	1	202	H
* 4.303	29.96	MAv1	33.5	-30.7	1.47	34.23	54	-19.77	-	-	1	202	H
* 7.408	35.99	PK2	35.5	-25.4	0	46.09	-	-	74	-27.91	1	100	H
* 7.406	25.37	MAv1	35.6	-25.4	1.47	37.04	54	-16.96	-	-	1	100	H
* 11.41	33.88	PK2	37.9	-21.8	0	49.98	-	-	74	-24.02	1	100	V
* 11.411	22.73	MAv1	37.9	-21.8	1.47	40.3	54	-13.7	-	-	1	100	V
* 15.847	34.11	PK2	40.6	-21.4	0	53.31	-	-	74	-20.69	1	100	V
* 15.847	23.61	MAv1	40.6	-21.4	1.47	44.28	54	-9.72	-	-	1	100	V
1.635	44.99	PK2	28.2	-25.5	0	47.69	-	-	-	-	1	100	V
1.637	32.92	MAv1	28.2	-25.5	1.47	37.09	-	-	-	-	1	100	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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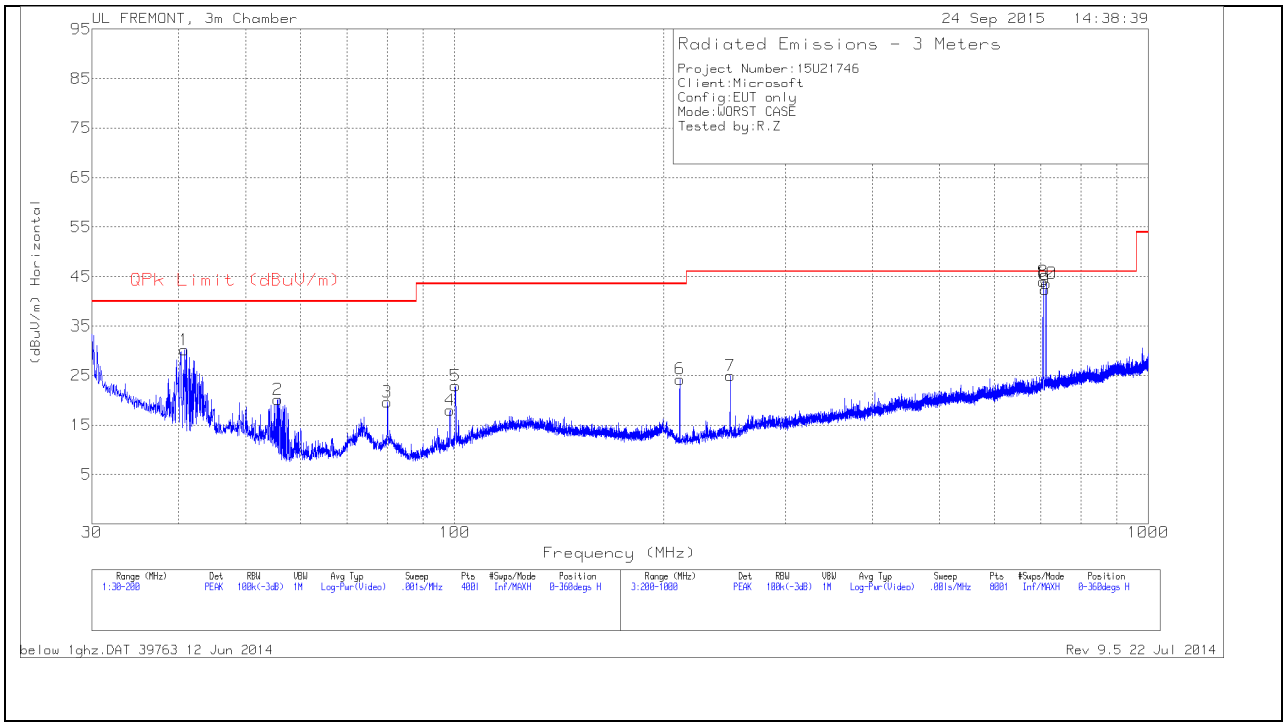
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



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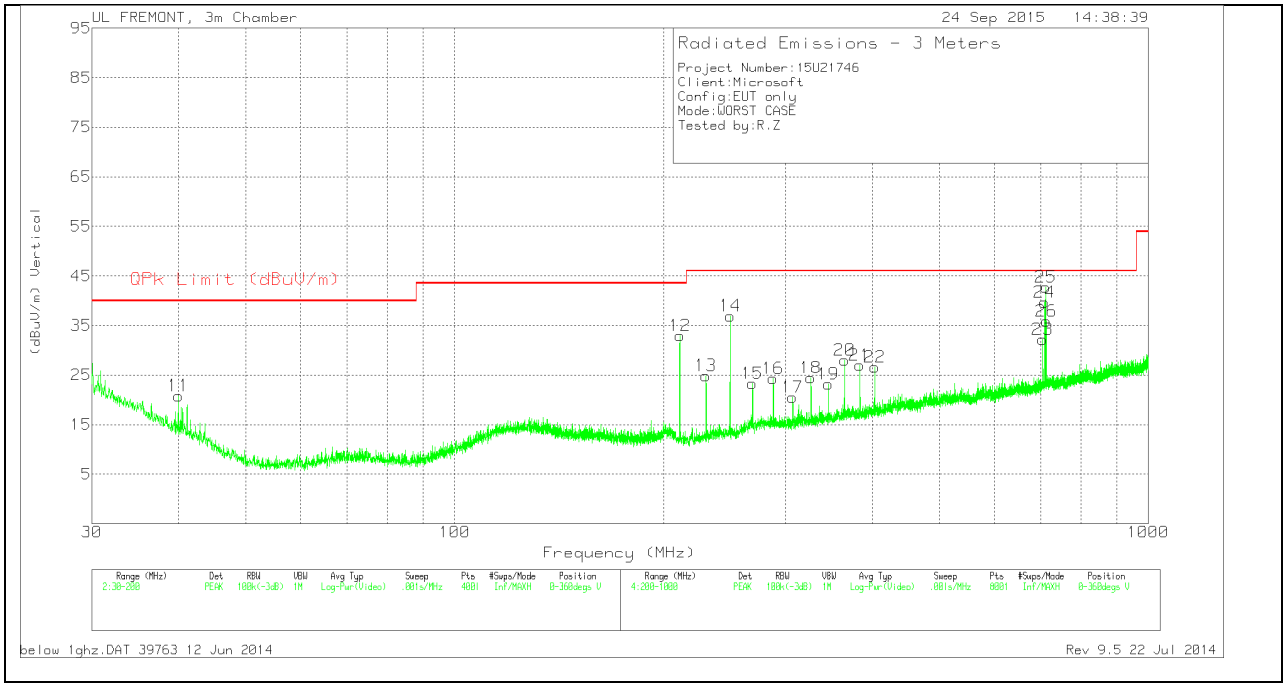
VERTICAL PLOT



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BELOW 1 GHz TABLE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
11	39.9875	33.54	PK	14.3	-27	20.84	40	-19.16	0-360	100	V
1	40.7525	43.5	PK	13.7	-27	30.2	40	-9.8	0-360	100	H
2	55.6275	39.97	PK	7.1	-26.9	20.17	40	-19.83	0-360	300	H
3	79.98	38.24	PK	8	-26.6	19.64	40	-20.36	0-360	400	H
4	98.4888	34.94	PK	9.4	-26.3	18.04	43.52	-25.48	0-360	300	H
5	100.2525	39.49	PK	9.8	-26.3	22.99	43.52	-20.53	0-360	300	H
6	211.2	38.97	PK	10.3	-25	24.27	43.52	-19.25	0-360	100	H
12	211.2	47.66	PK	10.3	-25	32.96	43.52	-10.56	0-360	100	V
13	230.4	38.7	PK	11.1	-24.9	24.9	46.02	-21.12	0-360	100	V
7	249.6	38.16	PK	11.5	-24.7	24.96	46.02	-21.06	0-360	200	H
14	249.6	50.16	PK	11.5	-24.7	36.96	46.02	-9.06	0-360	100	V
15	268.8	34.82	PK	13	-24.5	23.32	46.02	-22.7	0-360	100	V
16	288	35.34	PK	13.4	-24.4	24.34	46.02	-21.68	0-360	100	V
17	307.2	31.56	PK	13.4	-24.4	20.56	46.02	-25.46	0-360	100	V
18	326.4	35.01	PK	13.9	-24.4	24.51	46.02	-21.51	0-360	100	V
19	345.6	33.54	PK	14.2	-24.5	23.24	46.02	-22.78	0-360	100	V
20	364.8	37.73	PK	14.9	-24.6	28.03	46.02	-17.99	0-360	100	V
21	384	36.74	PK	15	-24.7	27.04	46.02	-18.98	0-360	100	V
22	403.2	35.95	PK	15.5	-24.8	26.65	46.02	-19.37	0-360	100	V
23	704.6	36.16	PK	20.1	-24.1	32.16	46.02	-13.86	0-360	200	V
8	706	48.05	PK	20.1	-24.1	44.05	46.02	-1.97	0-360	200	H
24	709	43.56	PK	20.2	-24.1	39.66	46.02	-6.36	0-360	200	V
9	709.6	46.29	PK	20.2	-24.1	42.39	46.02	-3.63	0-360	300	H
25	710.9	46.62	PK	20.2	-24.1	42.72	46.02	-3.3	0-360	100	V
26	713.2	39.64	PK	20.3	-24	35.94	46.02	-10.08	0-360	300	V
10	713.4	47.29	PK	20.3	-24	43.59	46.02	-2.43	0-360	200	H

PK - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
706.1778	23.17	QP	20.1	-24.1	19.17	46.02	-26.85	341	390	H
709.6315	23.18	QP	20.2	-24.1	19.28	46.02	-26.74	236	300	H
713.4433	33.61	QP	20.3	-24	29.91	46.02	-16.11	236	200	H
710.9423	23.1	QP	20.2	-24.1	19.2	46.02	-26.82	236	100	V

QP - Quasi-Peak detector

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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

ANSI C63.10

RESULTS

6 WORST EMISSIONS

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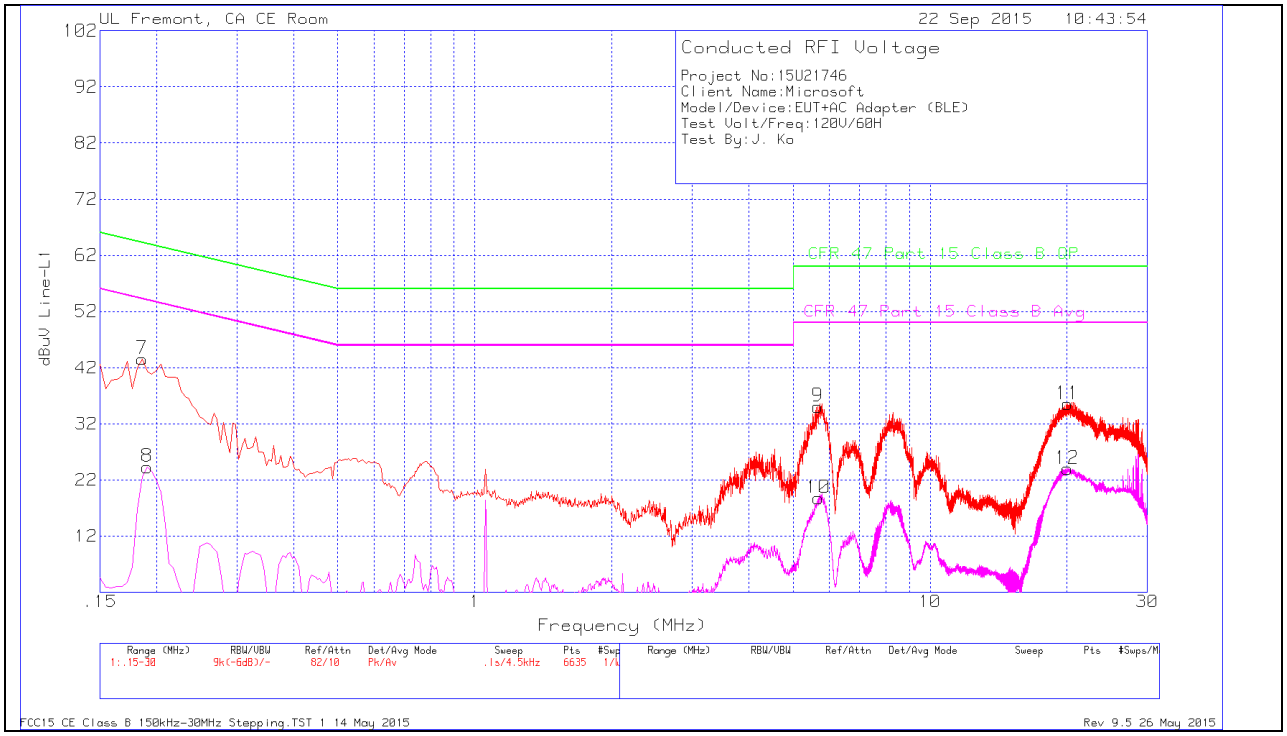
LINE 1 PLOT



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LINE 1 RESULTS

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)
7	.186	42.55	Pk	1	0	43.55	64.21	-20.66		
8	.1905	23.33	Av	1	0	24.33	-	-	54.01	-29.68
9	5.6715	34.79	Pk	.2	.1	35.09	60	-24.91		
10	5.6895	18.46	Av	.2	.1	18.76	-	-	50	-31.24
11	20.0625	35.02	Pk	.3	.2	35.52	60	-24.48		
12	20.0265	23.49	Av	.3	.2	23.99	-	-	50	-26.01

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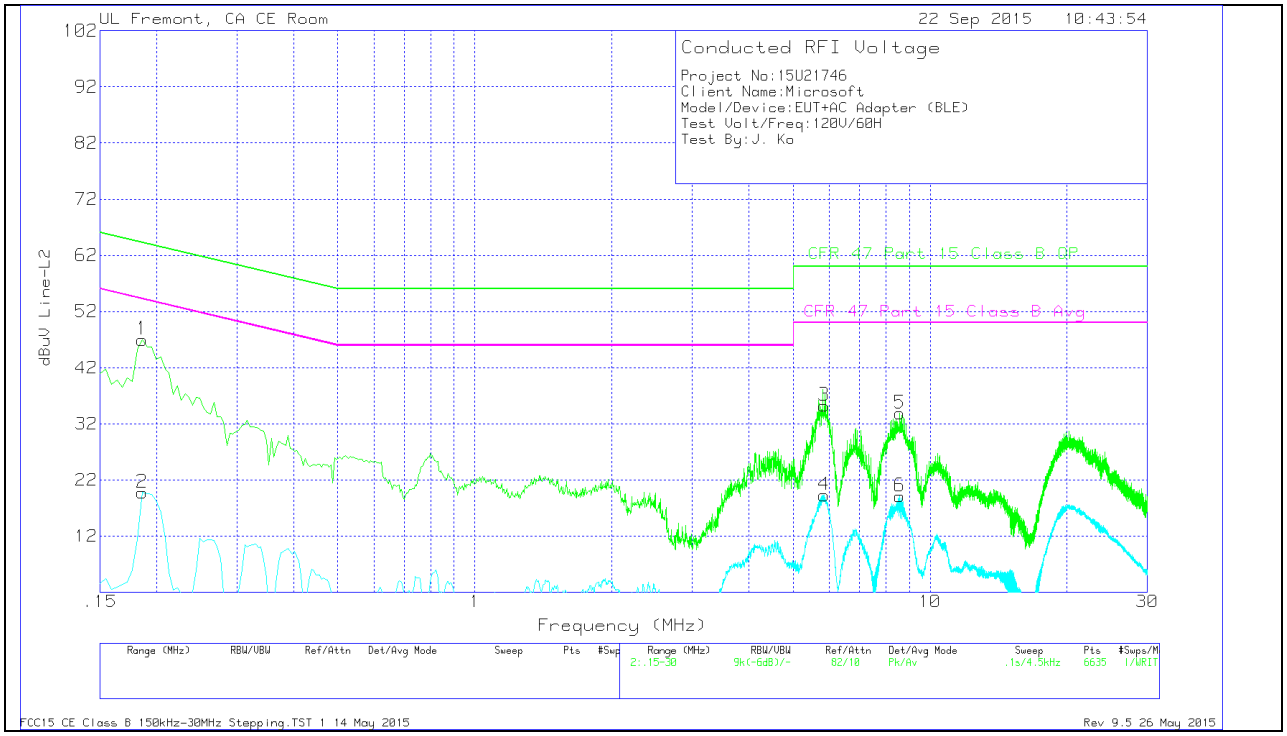
LINE 2 PLOT



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LINE 2 RESULTS

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)
1	.186	45.9	Pk	1.1	0	47	64.21	-17.21		
2	.186	18.66	Av	1.1	0	19.76	-	-	54.21	-34.45
3	5.8515	34.93	Pk	.2	.1	35.23	60	-24.77		
4	5.8515	19.02	Av	.2	.1	19.32	-	-	50	-30.68
5	8.583	33.56	Pk	.2	.1	33.86	60	-26.14		
6	8.5785	18.82	Av	.2	.1	19.12	-	-	50	-30.88

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