CERTIFICATION TEST REPORT

Report Number. : 11618371-E1V2

Applicant	:	FCL Tech, Inc. 1601 Willow Road Menlo Park, CA 94025
Model	:	FBC-1701
FCC ID	:	2AK7S-FBC1701
EUT Description	:	BLUETOOTH LE 4.0 MODULE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
May 18, 2017

Prepared by:
UL Verification Services Inc.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	05/10/17	Initial Issue	C. Vergonio
V2	05/18/17	Updated Test setup Diagram. Updated Output power results in Section 5.2 and Section 10.5.2. Added 18-26Ghz data in Section 11.3	C. Vergonio

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: FCL Tech, Inc.
1601 Willow Road
Menlo Park CA 94025

EUT DESCRIPTION: Bluetooth LE 4.0 Module

MODEL: FBC-1701

SERIAL NUMBER: PA1716EVT3P0B3038

DATE TESTED: MAY 5-18, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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 v03r05, ANSI C63.10-2013.

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)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

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
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 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 Bluetooth LE 4.0 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	1.48	1.41

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes a PIFA antenna with maximum peak gain of 3.3dBi across operation frequency 2402 – 2480MHz band.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was RFTest program.
The firmware installed in the EUT during testing was FW: DVT-001.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated bandedge, harmonics, and spurious emissions from 1 GHz to 18GHz were performed. The EUT was set to transmit at the Low/Middle/High channels with designed (target) output powers.

Radiated emission below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT was set to transmit at the channel with highest output power as worst-case scenario.

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

Worst-case data rate as provided by the client was: 1Mbps.

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6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T420	PB-FBKHK12/07	N/A
AC Adapter	Lenovo	ADLX65NCC2A	-	N/A
AC Adapter	Kaya Electronics	KTPS05-03315U-VI	-	N/A

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1.5	N/A
2	USB	1	USB	Un-Shielded	2	N/A
3	DC	1	DC	Un-Shielded	2	N/A

I/O CABLES (RADIATED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1.5	N/A

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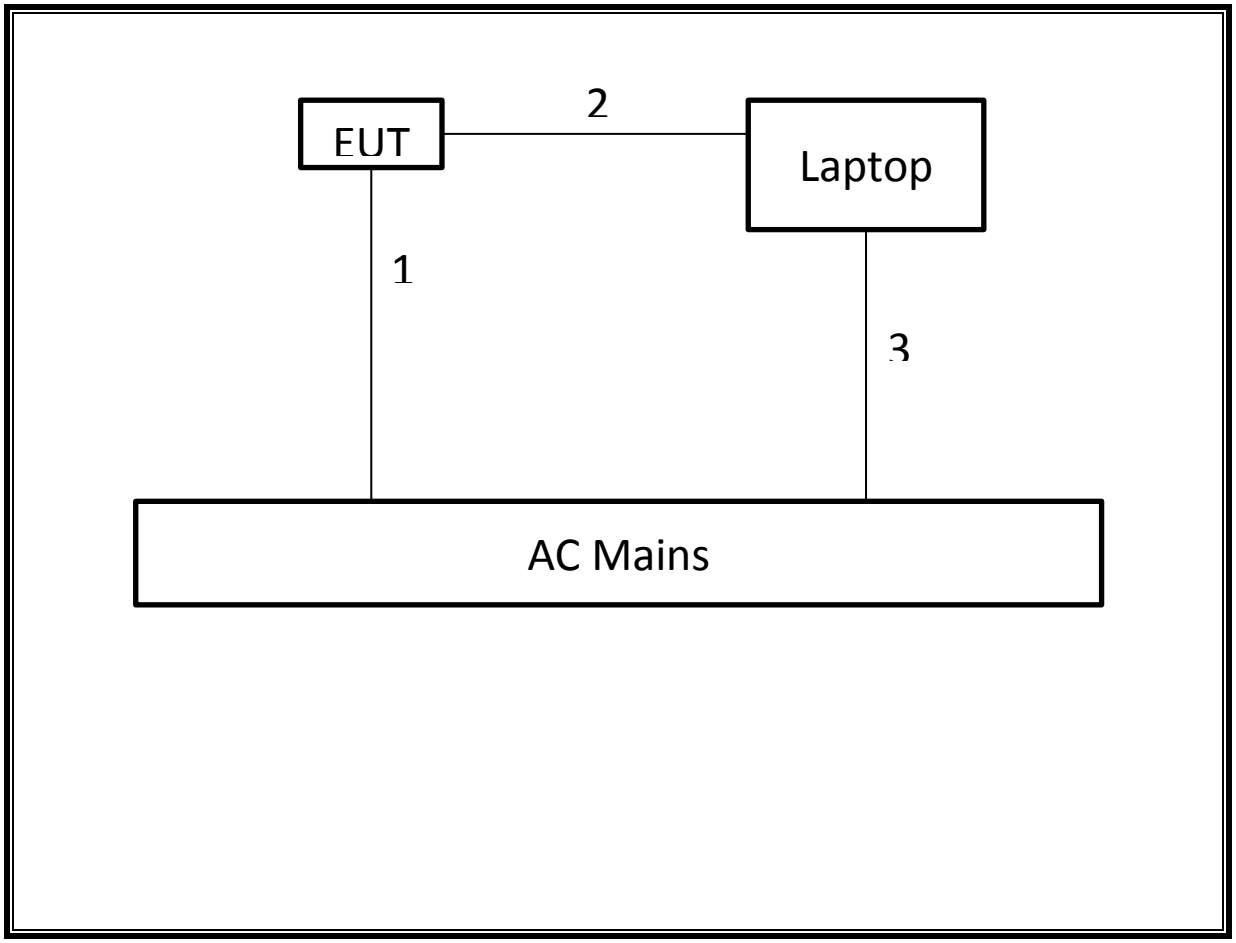
SETUP DIAGRAM

CONDUCTED



TEST SETUP

The EUT was connected to a test fixture which connected to a laptop via USB cable. Test software exercised the EUT.

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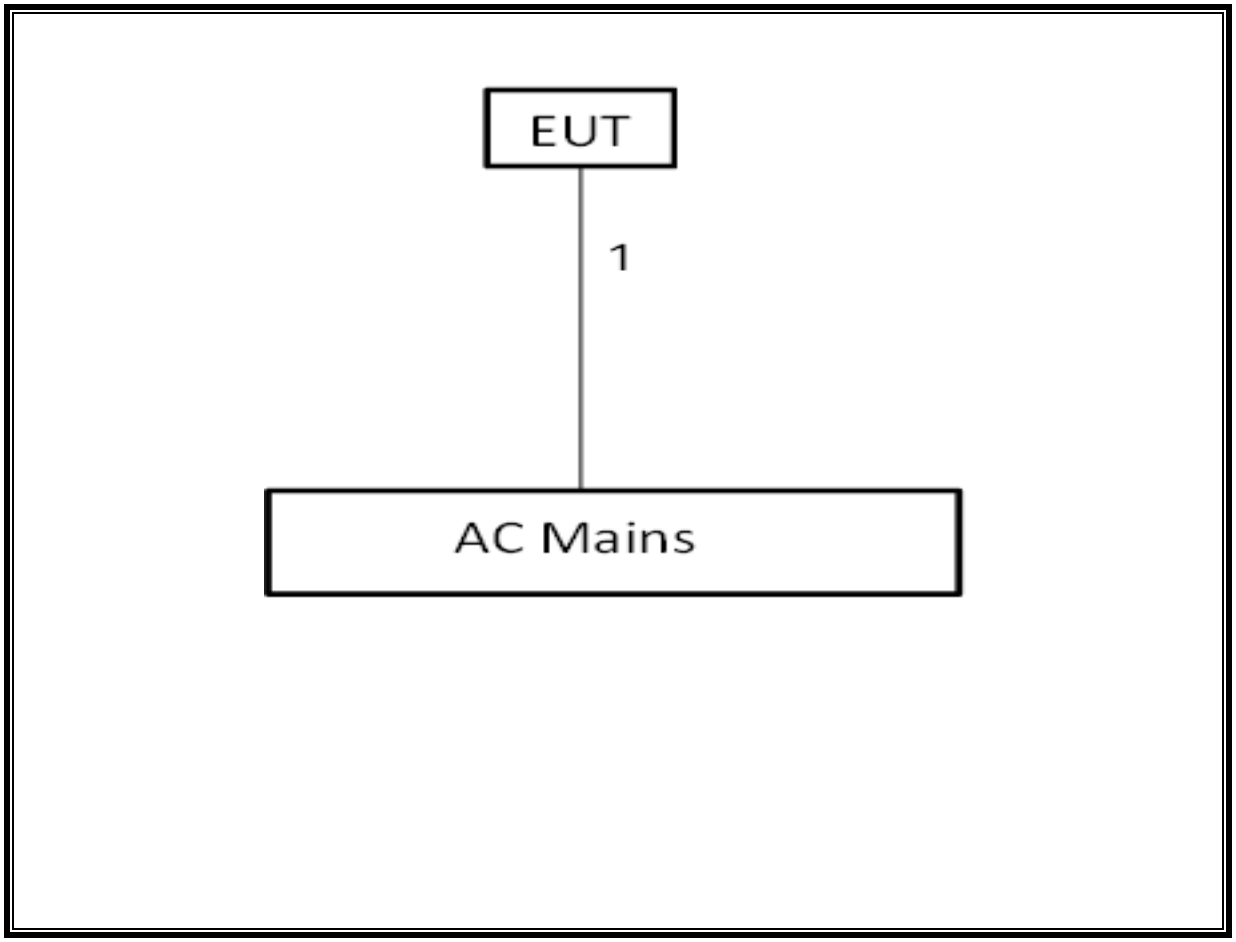
RADIATED



TEST SETUP

The EUT was standalone.

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7. 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**
Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB Pad	Sunol Sciences Corp.	JB3	T477	06/22/2017
Antenna, Active Loop 9kHz-30MHz	ETS-Lindgren	6502	T1683	02/17/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T345	03/07/2018
Antenna, Horn 18-26.5GHz	ARA	MWH-1826/B	T449	05/26/2017
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1264	07/08/2017
Power Sensor, P – series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T413	06/20/2017
Amplifier, 1-26.5GHz	Agilent (Keysight) Technologies	8449B	T404	07/05/2017
Amplifier, 10kHz-1GHz	Agilent (Keysight) Technologies	8447D	T15	08/26/2017
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T493	02/15/2018
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E4440A	T199	07/22/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T907	01/23/2018
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E9030A	T905	01/11/2018
LISN	FISCHER	FCC-LISN-50/250-25-2-01	T1310	06/08/2017

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, Apr 26, 2016
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Antenna Port Software	UL	UL RF	Ver 5.1.1, July 15, 2016

NOTE: *testing is completed before equipment calibration expiration date.

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8. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r05, Section 8.1.

Output Power: KDB 558074 D01 v03r05, Section 9.1.1.

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.1.

Band-edge: KDB 558074 D01 v03r05, Section 12.1.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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9. SUMMARY TABLE

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	RSS-247 5.2.1	Occupied Band width (6dB)	>500KHz	Conducted	Pass
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass
15.247	RSS-247 5.4.4	TX conducted output power	<30dBm		Pass
15.247	RSS-247 5.2.2	PSD	<8dBm		Pass
15.207 (a)	RSS-GEN 8.8	AC Power Line conducted emissions	Section 10	Radiated	Pass
15.205, 15.209, 15.247(d)	RSS-GEN 8.9/7	Radiated Spurious Emission	< 54dBuV/m		Pass

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10. ANTENNA PORT TEST RESULTS

10.1. ON TIME, DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
1.060	1.179	0.899	89.91%	0.46	0.943

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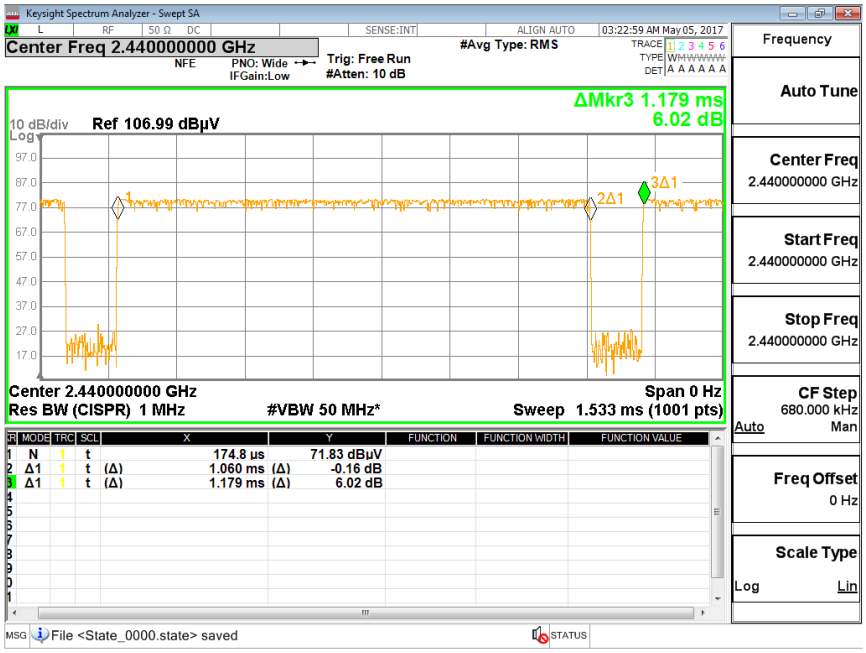
DUTY CYCLE PLOTS

DUTY CYCLE BLE MODE



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10.2. 6 dB BANDWIDTH

10.2.1. LIMITS

FCC §15.247 (a) (2)

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

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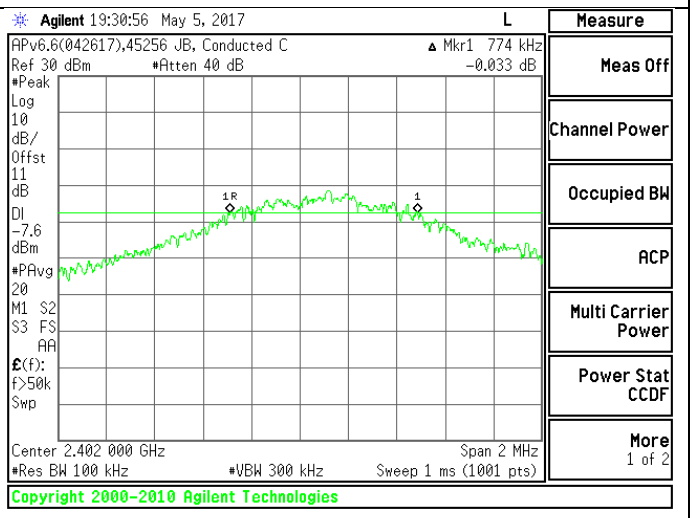
10.2.2. RESULTS

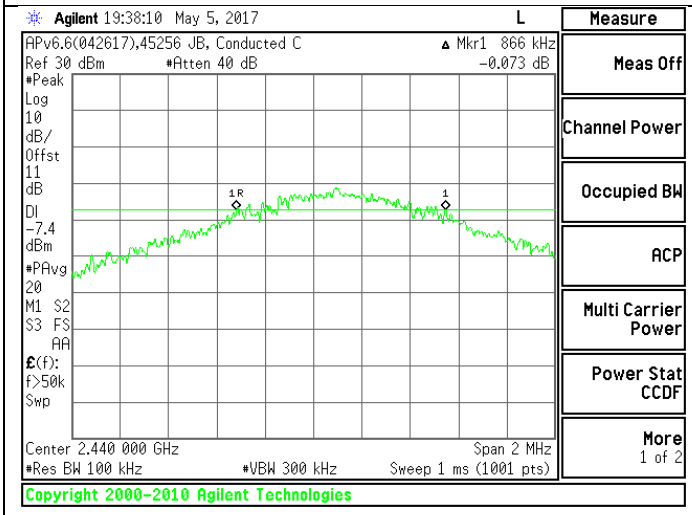
TEST RESULT TABLE

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.7740	0.5000
Middle	2440	0.8660	0.5000
High	2480	0.7740	0.5000

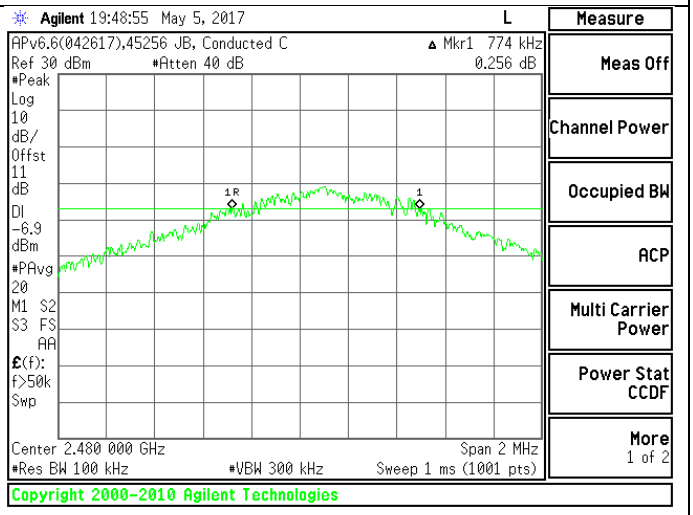
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



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10.3. 99% BANDWIDTH

10.3.1. 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.

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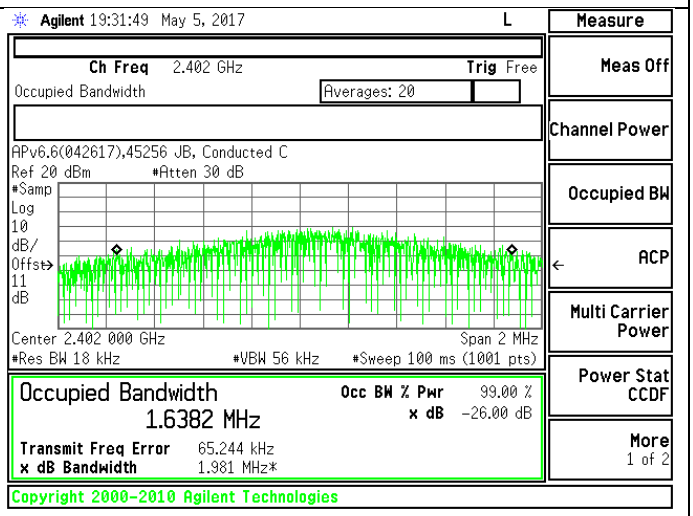
10.3.2. RESULTS

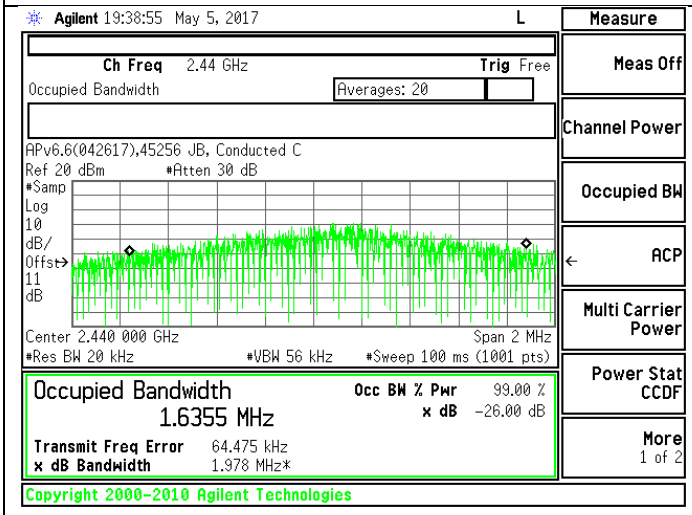
TEST RESULT TABLE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.6382
Middle	2440	1.6355
High	2480	1.6397

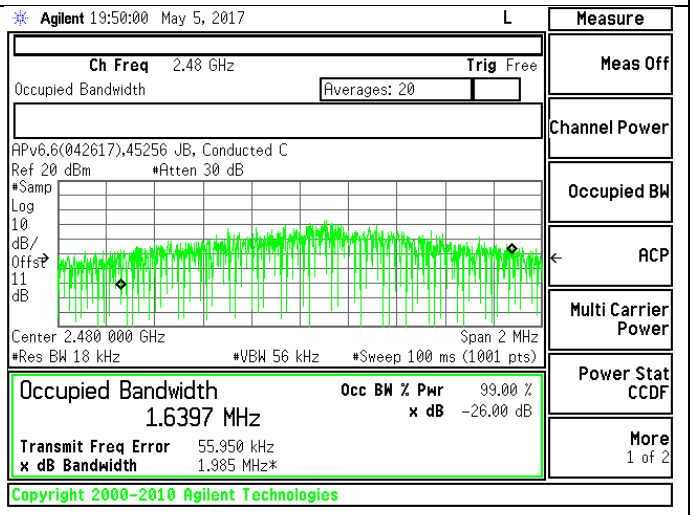
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



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10.4. AVERAGE POWER

10.4.1. LIMITS

None; for reporting purposes only.

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.

10.4.2. RESULTS

Test Engineer ID:	45256	**Date:**	05/05/17

Channel	Frequency (MHz)	AV Power (MHz)
Low	2402	-1.52
Middle	2440	-1.11
High	2480	-0.79

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10.5. OUTPUT POWER

10.5.1. LIMITS

FCC §15.247 (b)

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

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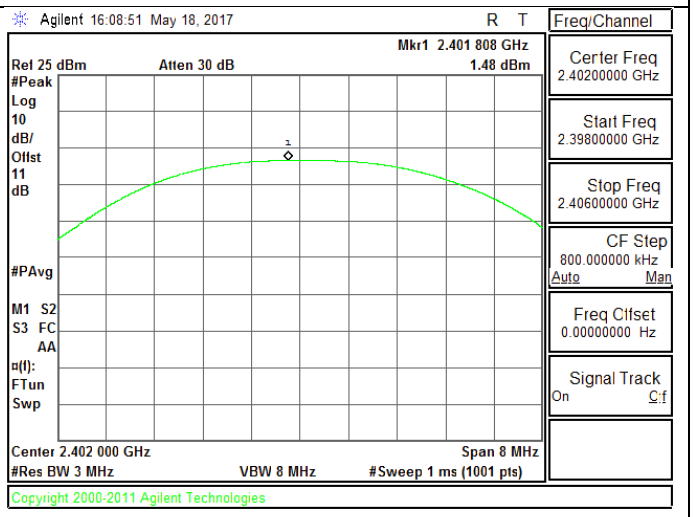
10.5.2. RESULTS

TEST RESULT TABLE

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	1.48	30.0	-28.52
Middle	2440	1.33	30.0	-28.67
High	2480	1.02	30.0	-28.98

LOW CHANNEL



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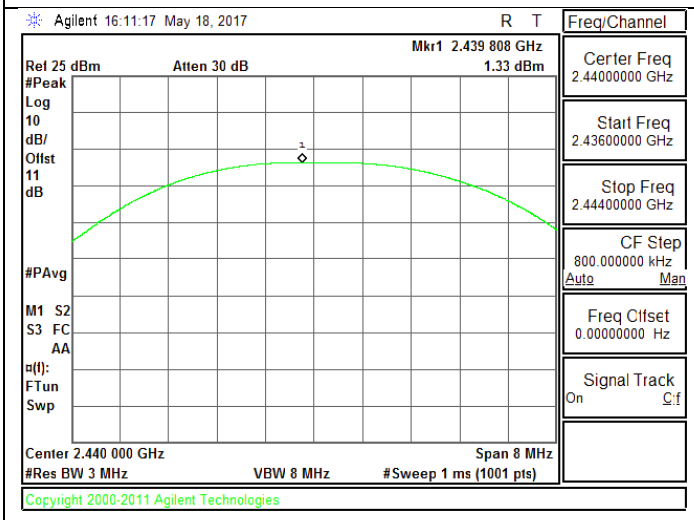
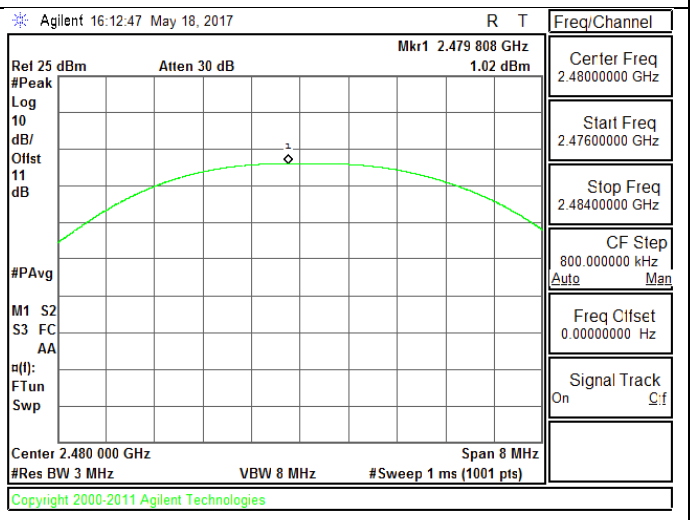


HIGH CHANNEL



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10.6. POWER SPECTRAL DENSITY

10.6.1. LIMITS

FCC §15.247 (e)

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.

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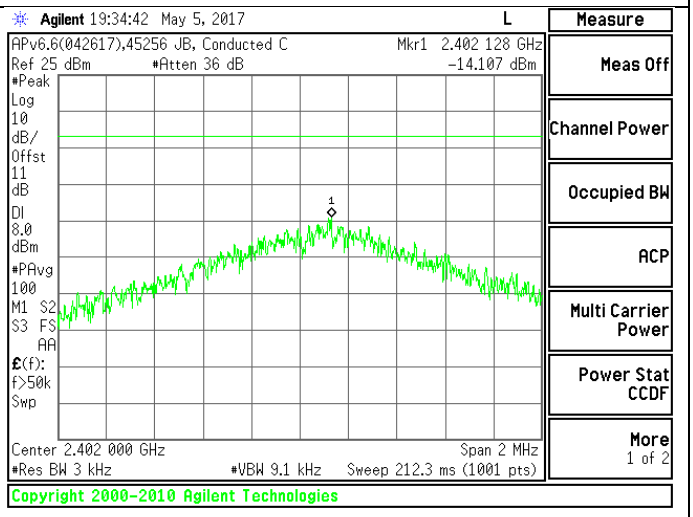
10.6.2. RESULTS

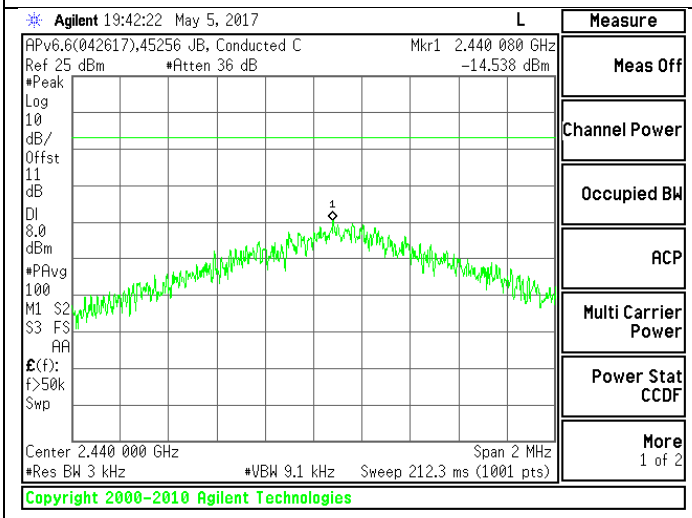
TEST RESULT TABLE

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-14.107	8.0	-22.11
Middle	2440	-14.538	8.0	-22.54
High	2480	-14.434	8.0	-22.43

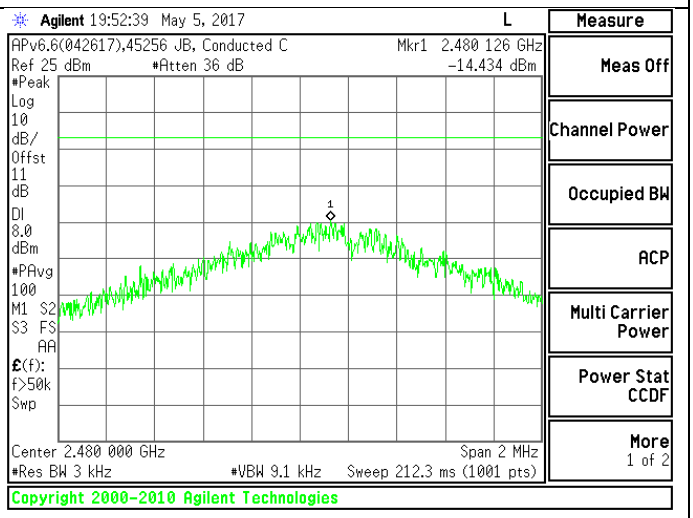
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



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10.7. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

10.7.1. LIMITS

FCC §15.247 (d)

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

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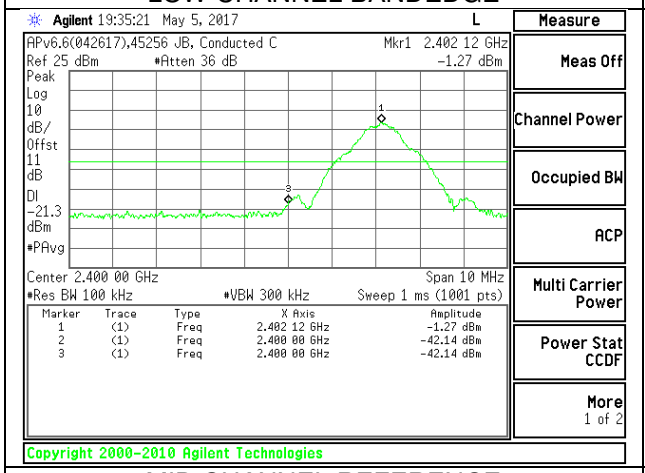
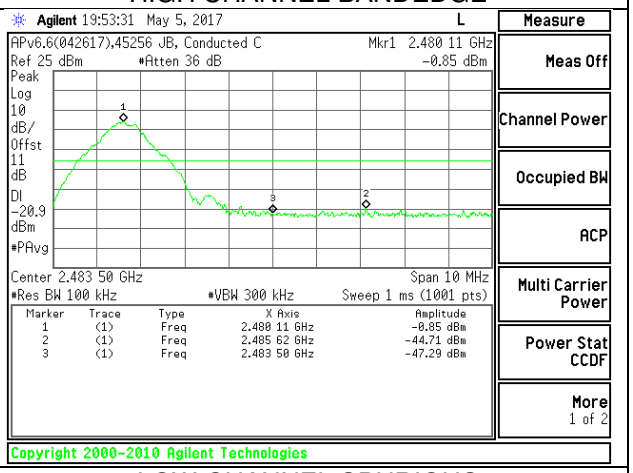
10.7.2. RESULTS

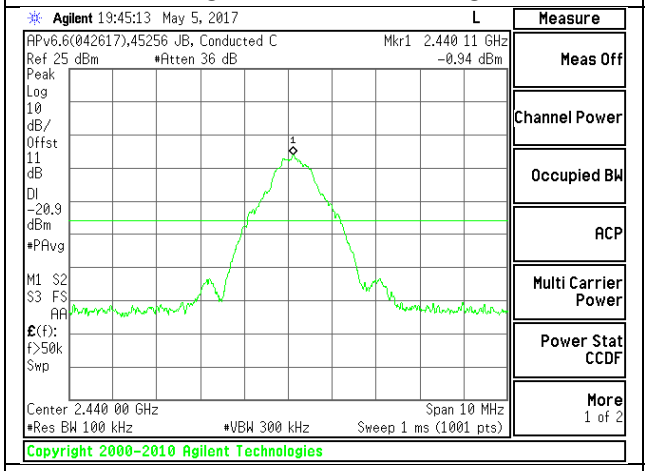
LOW CHANNEL BANDEDGE



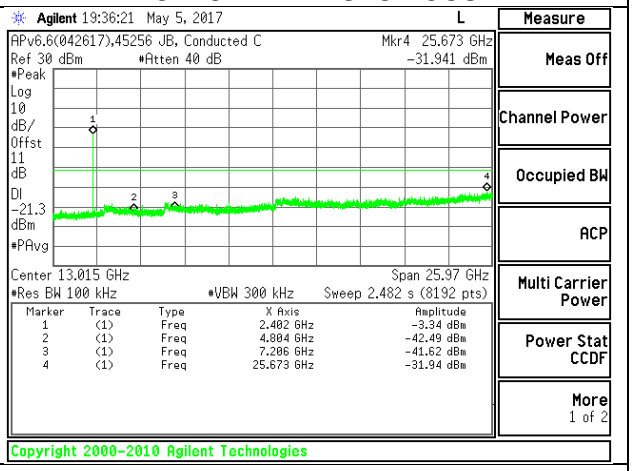
HIGH CHANNEL BANDEDGE



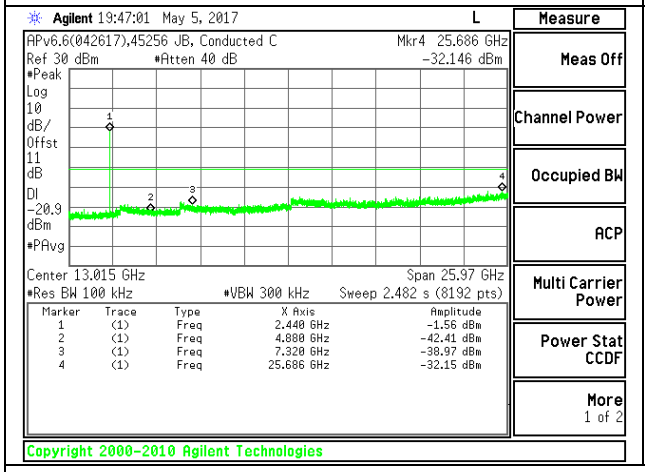
MID CHANNEL REFERENCE



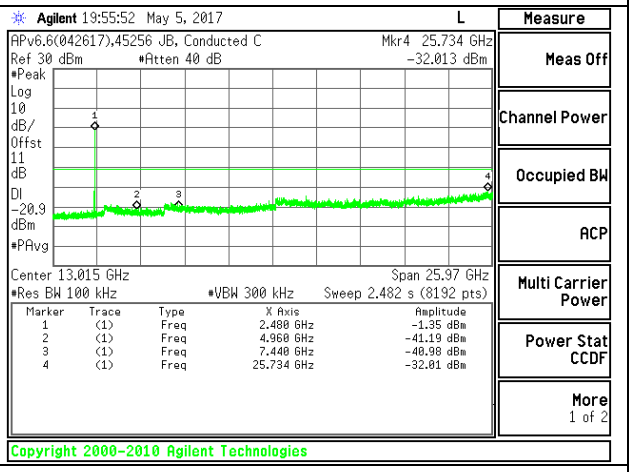
LOW CHANNEL SPURIOUS



MID CHANNEL SPURIOUS



HIGH CHANNEL SPURIOUS



NOTE:--

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11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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

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

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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

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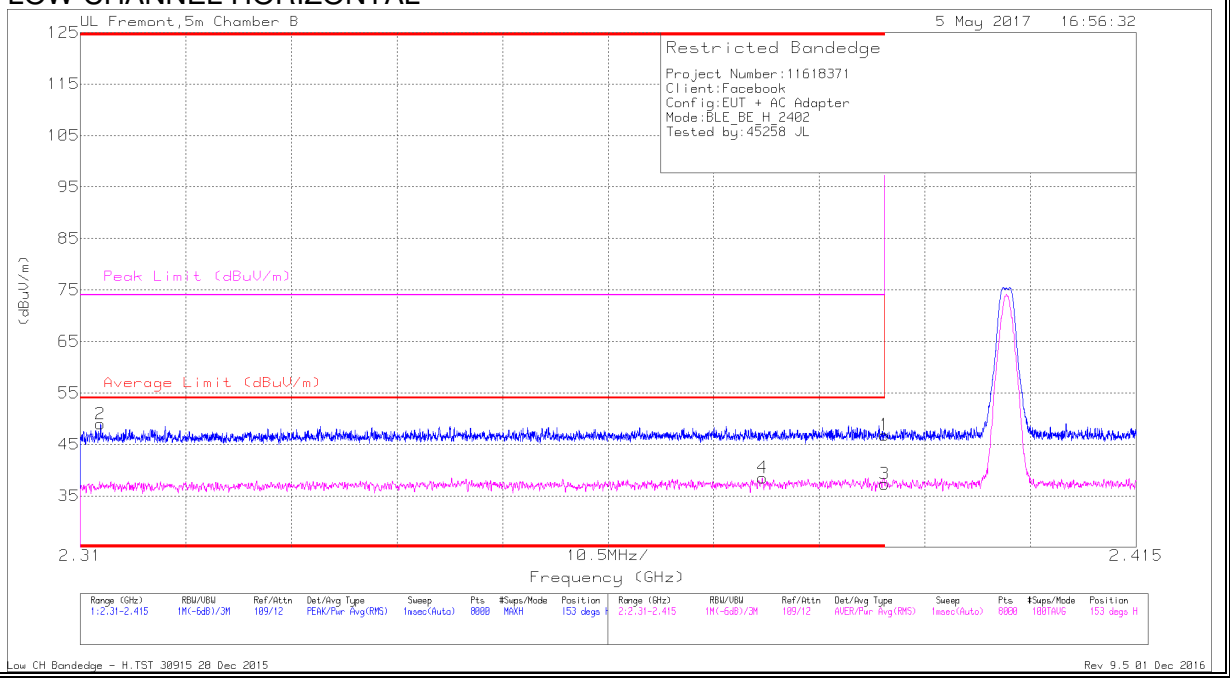
11.2. RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL HORIZONTAL



Trace Markers

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	36.13	Pk	32	-21.3	0	46.83	-	-	74	-27.17	153	139	H
2	* 2.312	38.46	Pk	31.7	-21.2	0	48.96	-	-	74	-25.04	153	139	H
3	* 2.39	26.18	RMS	32	-21.3	.46	37.34	54	-16.66	-	-	153	139	H
4	* 2.378	27.46	RMS	31.9	-21.3	.46	38.52	54	-15.48	-	-	153	139	H

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector
RMS - RMS detection

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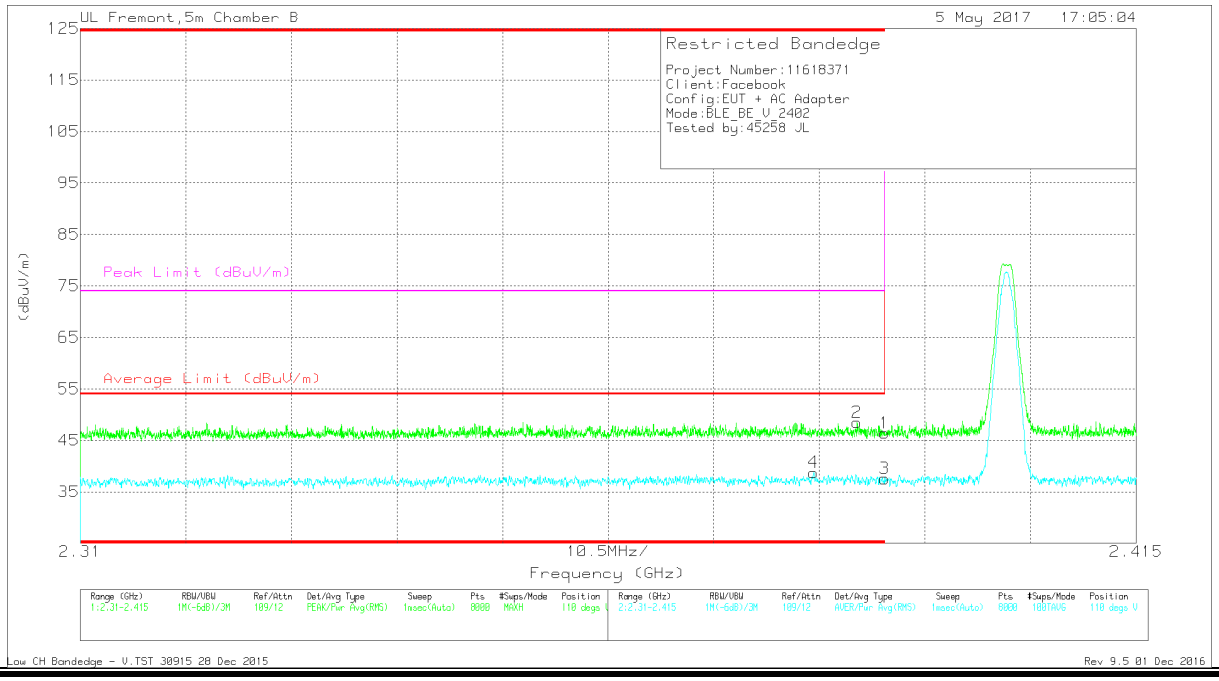
LOW CHANNEL VERTICAL



Trace Markers

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	35.69	Pk	32	-21.3	0	46.39	-	-	74	-27.61	110	165	V
2	* 2.387	37.87	Pk	31.9	-21.3	0	48.47	-	-	74	-25.53	110	165	V
3	* 2.39	26.41	RMS	32	-21.3	.46	37.57	54	-16.43	-	-	110	165	V
4	* 2.383	27.7	RMS	31.9	-21.3	.46	38.76	54	-15.24	-	-	110	165	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector
RMS - RMS detection

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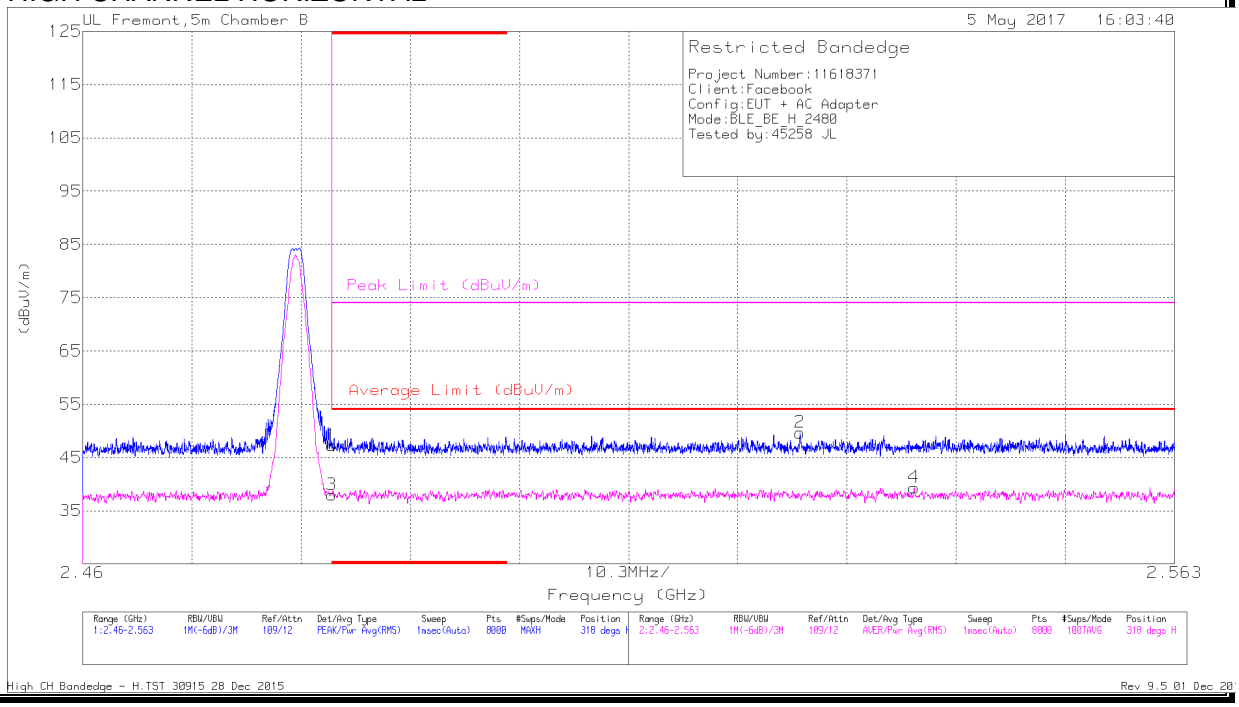
8.1.1 AUTHORIZED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL HORIZONTAL



Trace Markers

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	36.36	Pk	32.1	-21.2	0	47.26	-	-	74	-26.74	318	115	H
3	* 2.484	26.62	RMS	32.1	-21.2	.46	37.98	54	-16.02	-	-	318	115	H
2	2.528	38.76	Pk	32.1	-21.2	0	49.66	-	-	74	-24.34	318	115	H
4	2.538	27.81	RMS	32.1	-21	.46	39.37	54	-14.63	-	-	318	115	H

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector
RMS - RMS detection

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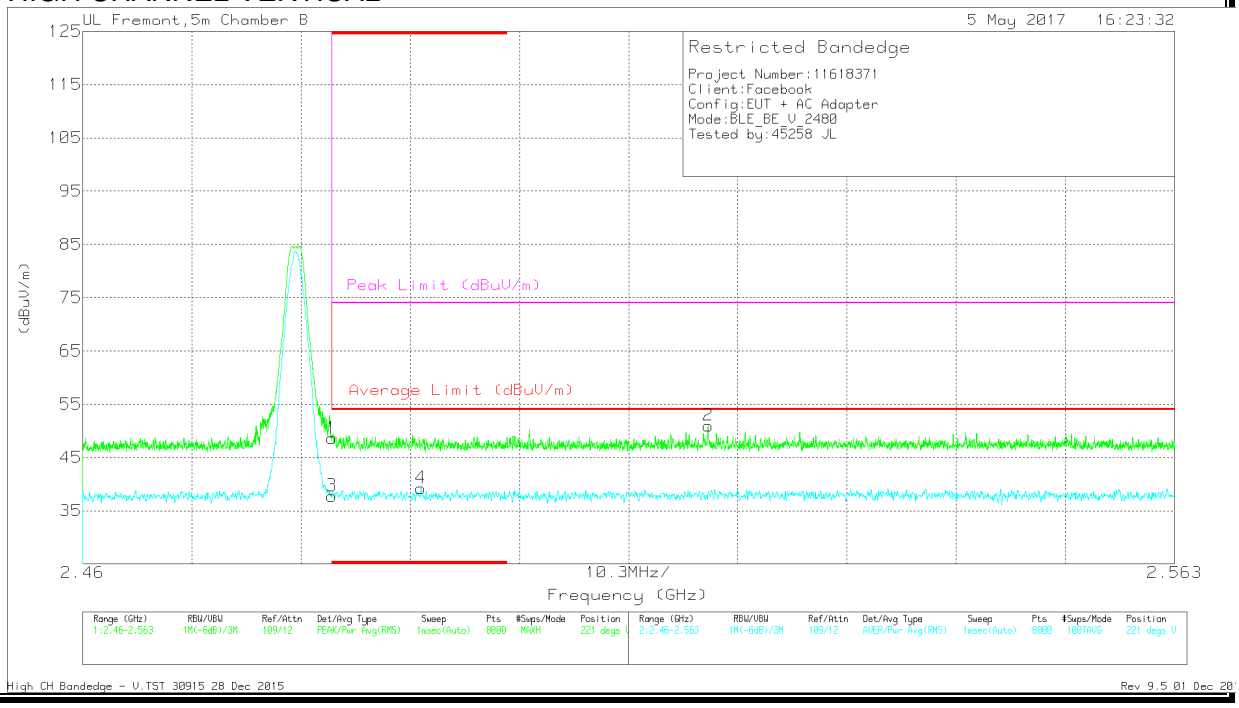
HIGH CHANNEL VERTICAL



Trace Markers

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	37.72	Pk	32.1	-21.2	0	48.62	-	-	74	-25.38	221	175	V
3	* 2.484	26.42	RMS	32.1	-21.2	.46	37.78	54	-16.22	-	-	221	175	V
4	* 2.492	27.88	RMS	32.1	-21.2	.46	39.24	54	-14.76	-	-	221	175	V
2	2.519	39.89	Pk	32.1	-21	0	50.99	-	-	74	-23.01	221	175	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector
RMS - RMS detection

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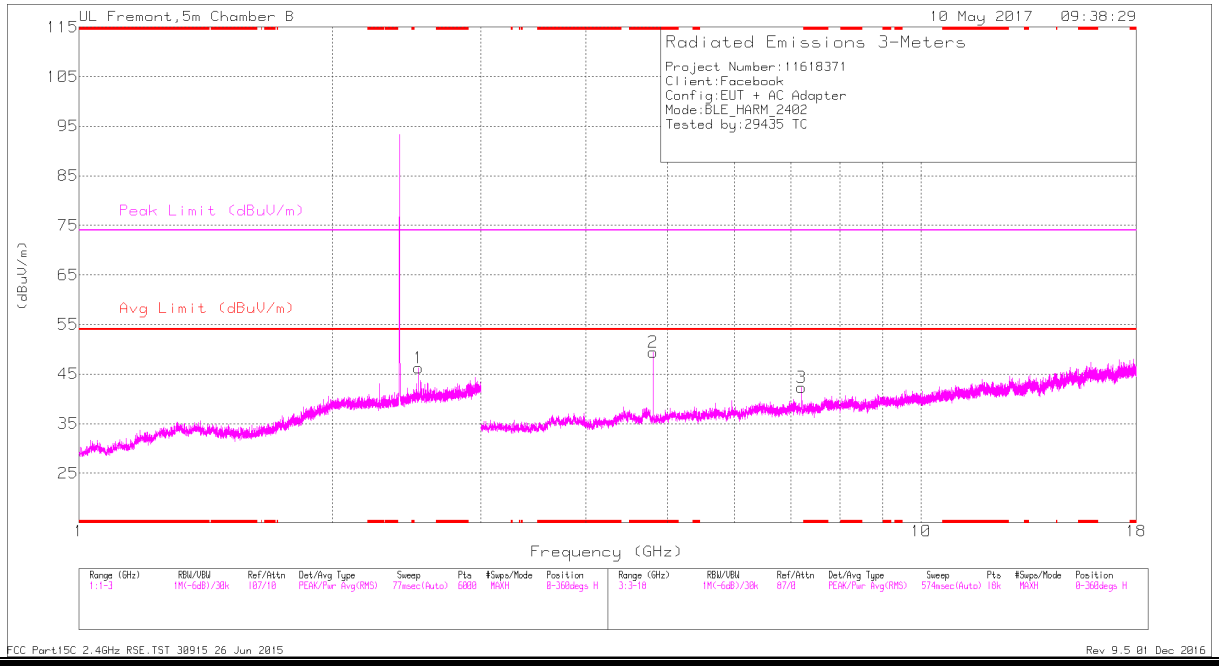
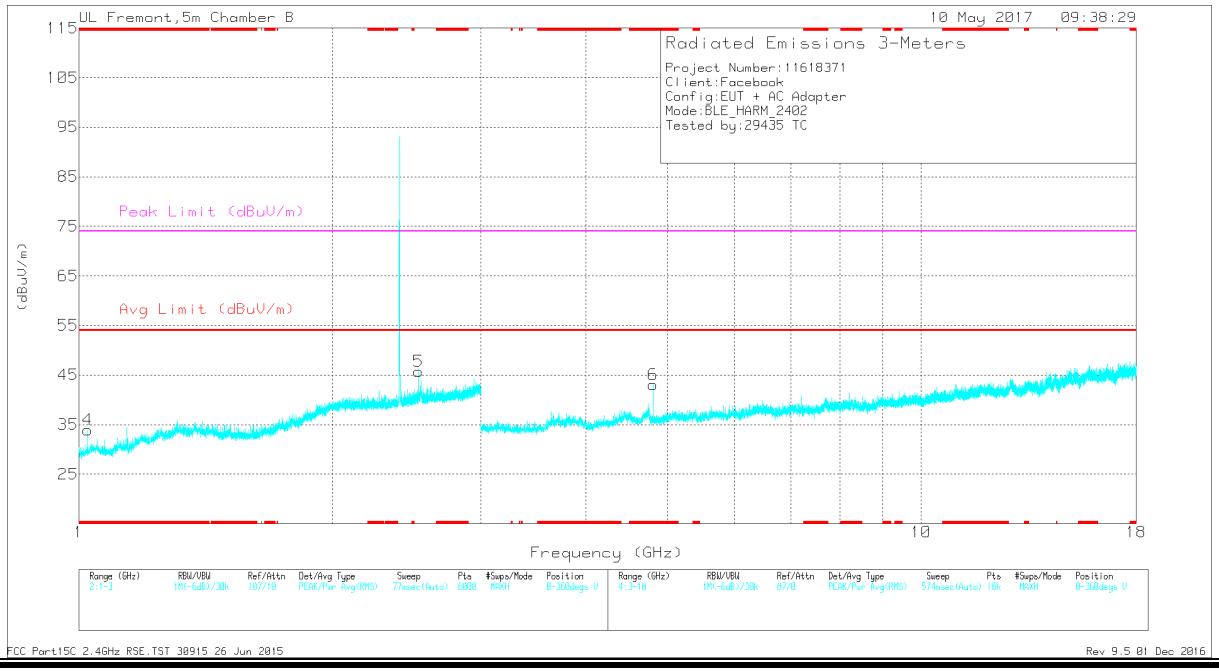
8.1.2 HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



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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Trace Markers

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
4	* 1.024	31.14	Pk	26.5	-23.7	0	33.94	-	-	74	-40.06	0-360	200	V
2	* 4.804	44.05	Pk	34.4	-29	0	49.45	-	-	74	-24.55	0-360	102	H
6	* 4.804	37.66	Pk	34.4	-29	0	43.06	-	-	74	-30.94	0-360	102	V
1	2.53	35.18	Pk	32.1	-21.1	0	46.18	-	-	-	-	0-360	102	H
5	2.53	34.67	Pk	32.1	-21.1	0	45.67	-	-	-	-	0-360	200	V
3	7.206	33.48	Pk	36.1	-27.3	0	42.28	-	-	-	-	0-360	199	H

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector

Radiated Emissions

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
* 1.024	34.89	PK2	26.5	-23.7	0	37.69	-	-	74	-36.31	29	135	V
* 1.026	18.62	MAv1	26.4	-23.7	.46	21.78	54	-32.22	-	-	29	135	V
* 4.804	51.83	PK2	34.4	-29	0	57.23	-	-	74	-16.77	127	126	H
* 4.804	42.59	MAv1	34.4	-29	.46	48.45	54	-5.55	-	-	127	126	H
* 4.804	45.05	PK2	34.4	-29	0	50.45	-	-	74	-23.55	160	302	V
* 4.804	34.48	MAv1	34.4	-29	.46	40.34	54	-13.66	-	-	160	302	V
2.53	40.66	PK2	32.1	-21.1	0	51.66	-	-	-	-	166	109	H
2.53	33.62	MAv1	32.1	-21.1	.46	45.08	-	-	-	-	166	109	H
2.53	40.36	PK2	32.1	-21.1	0	51.36	-	-	-	-	289	368	V
2.53	33.2	MAv1	32.1	-21.1	.46	44.66	-	-	-	-	289	368	V
7.207	39.69	PK2	36.1	-27.3	0	48.49	-	-	-	-	132	105	H
7.207	29.44	MAv1	36.1	-27.3	.46	38.7	-	-	-	-	132	105	H

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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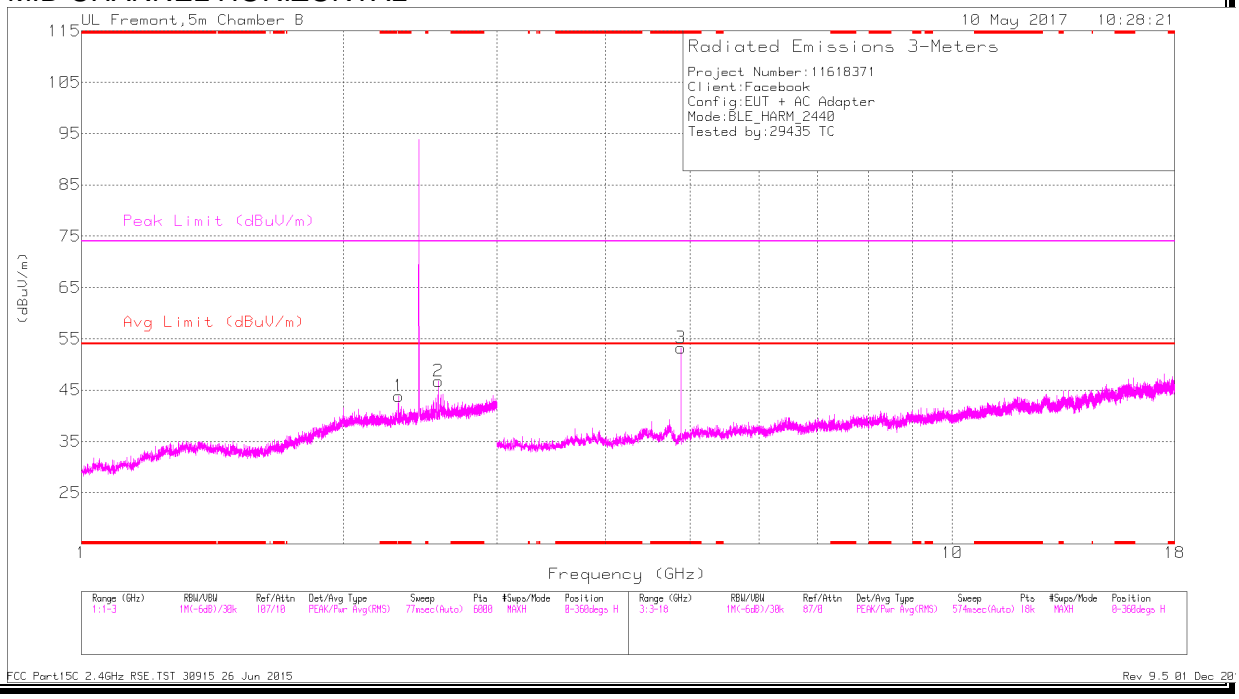
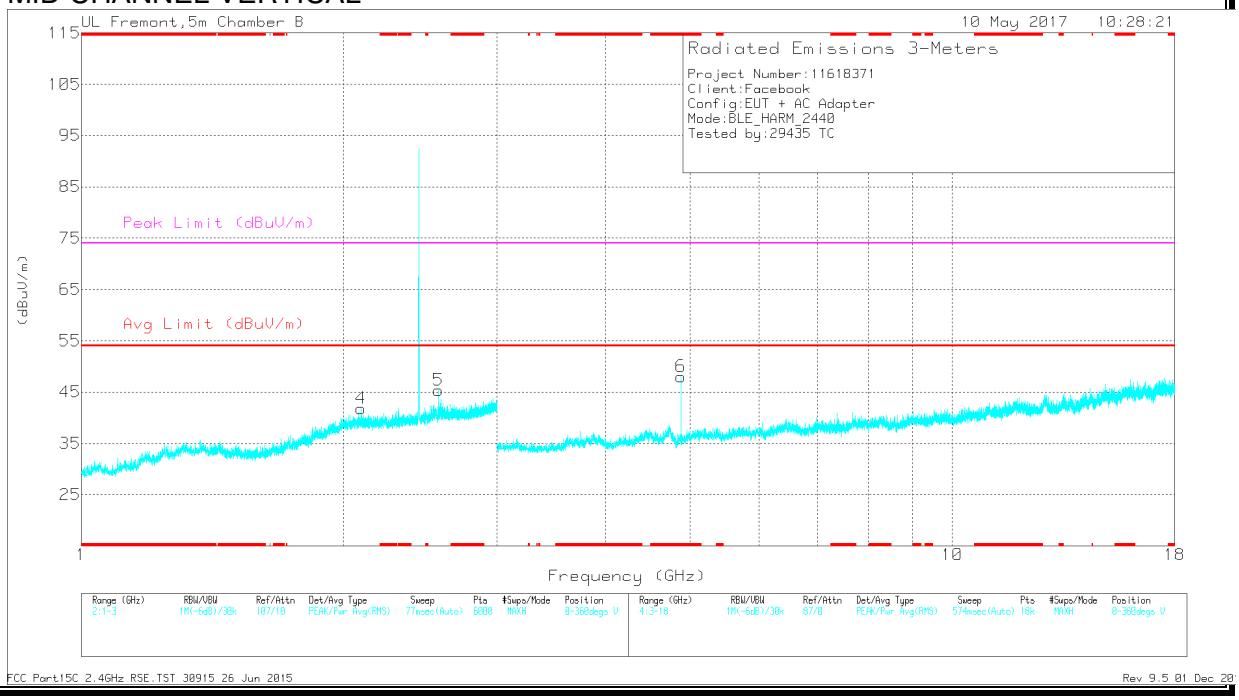
MID CHANNEL HORIZONTAL



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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Trace Markers

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	* 2.312	33.37	Pk	31.7	-21.2	0	43.87	-	-	74	-30.13	0-360	102	H
3	* 4.88	49.22	Pk	34.5	-30.5	0	53.22	-	-	74	-20.78	0-360	102	H
6	* 4.881	44	Pk	34.5	-30.5	0	48	-	-	74	-26	0-360	102	V
4	2.096	30.68	Pk	32.1	-21	0	41.78	-	-	-	-	0-360	102	V
2	2.568	35.75	Pk	32.1	-21.1	0	46.75	-	-	-	-	0-360	102	H
5	2.568	34.32	Pk	32.1	-21.1	0	45.32	-	-	-	-	0-360	102	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector

Radiated Emissions

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
* 4.88	53.57	PK2	34.5	-30.5	0	57.57	-	-	74	-16.43	140	315	H
* 4.88	46.1	MAv1	34.5	-30.5	.46	50.56	54	-3.44	-	-	140	315	H
* 4.88	48.16	PK2	34.5	-30.5	0	52.16	-	-	74	-21.84	127	120	V
* 4.88	40.32	MAv1	34.5	-30.5	.46	44.78	54	-9.22	-	-	127	120	V
2.097	34.83	PK2	32.1	-21	0	45.93	-	-	-	-	41	224	V
2.098	17.84	MAv1	32.1	-21	.46	29.4	-	-	-	-	41	224	V
2.31	36.34	PK2	31.7	-21.3	0	46.74	-	-	-	-	107	125	H
2.31	19.78	MAv1	31.7	-21.3	.46	30.64	-	-	-	-	107	125	H
2.568	40.74	PK2	32.1	-21	0	51.84	-	-	-	-	172	110	H
2.568	33.55	MAv1	32.1	-21	.46	45.11	-	-	-	-	172	110	H
2.568	39.58	PK2	32.1	-21.1	0	50.58	-	-	-	-	149	169	V
2.568	31.06	MAv1	32.1	-21	.46	42.62	-	-	-	-	149	169	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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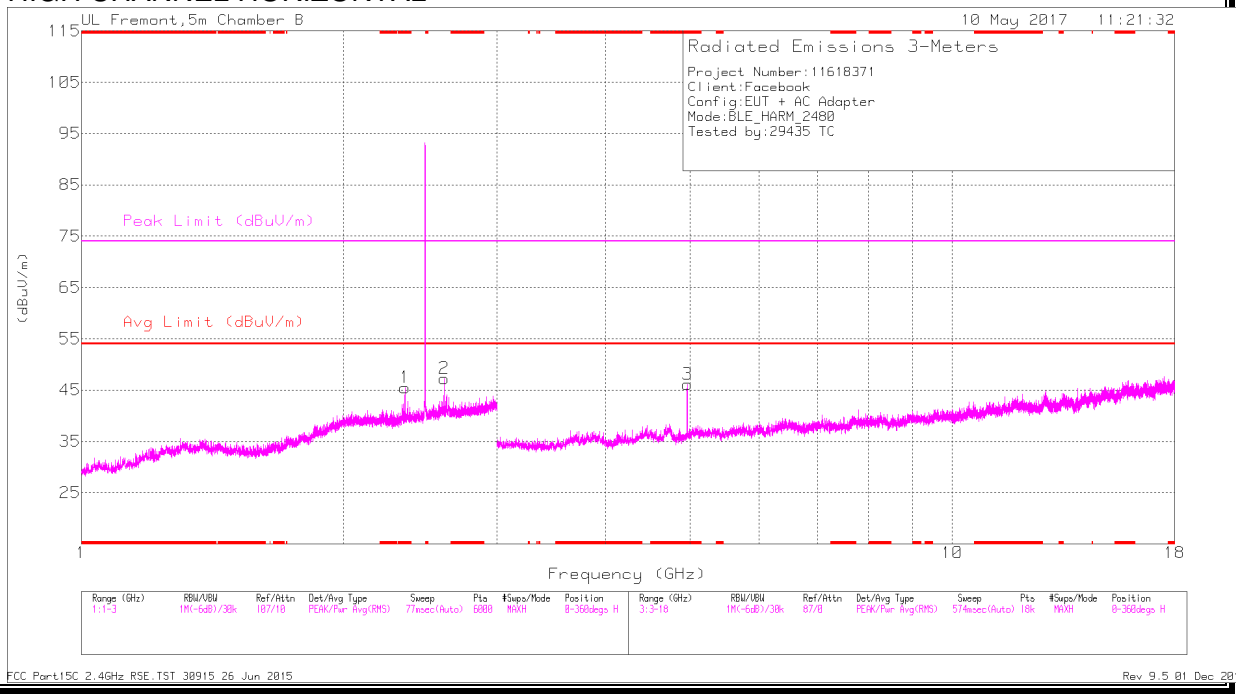
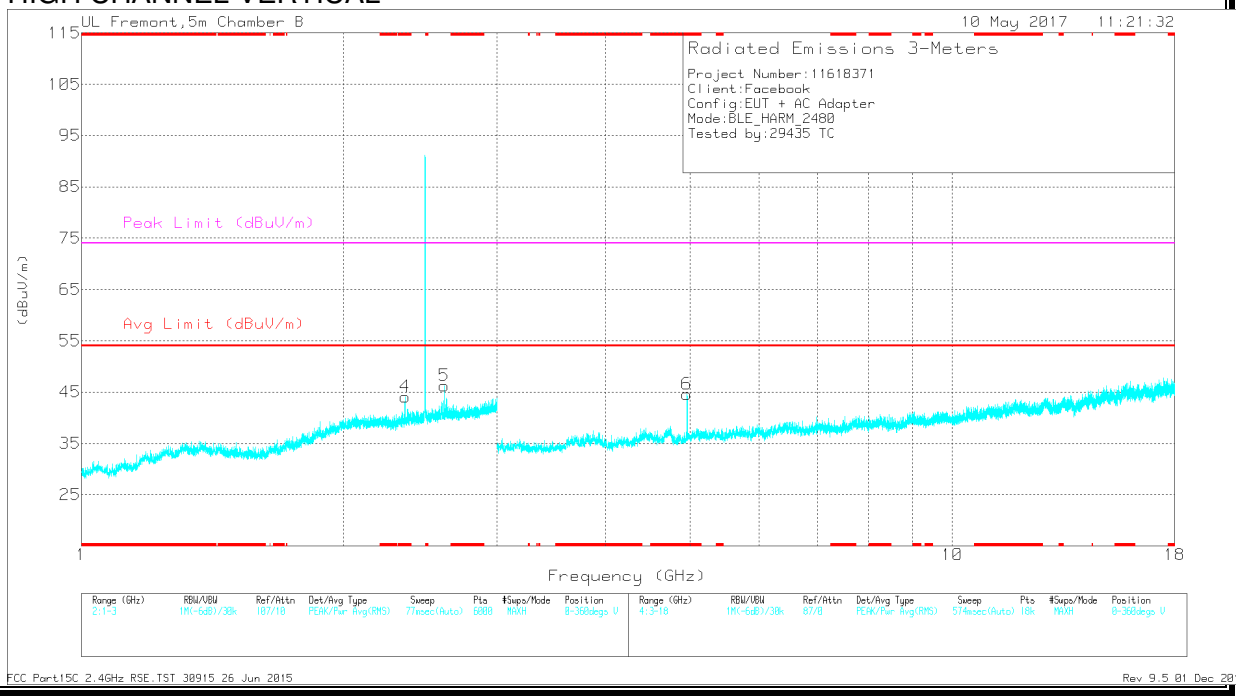
HIGH CHANNEL HORIZONTAL



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.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Trace Markers

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	* 2.352	35.02	Pk	31.8	-21.3	0	45.52	-	-	74	-28.48	0-360	102	H
4	* 2.352	33.57	Pk	31.8	-21.3	0	44.07	-	-	74	-29.93	0-360	200	V
3	* 4.961	41.35	Pk	34.5	-29.7	0	46.15	-	-	74	-27.85	0-360	102	H
6	* 4.959	39.83	Pk	34.5	-29.7	0	44.63	-	-	74	-29.37	0-360	101	V
2	2.608	36	Pk	32.2	-20.9	0	47.3	-	-	-	-	0-360	102	H
5	2.608	34.91	Pk	32.2	-20.9	0	46.21	-	-	-	-	0-360	200	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
Pk - Peak detector

Radiated Emissions

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
* 2.352	39.74	PK2	31.8	-21.3	0	50.24	-	-	74	-23.76	113	161	H
* 2.352	32.32	MAv1	31.8	-21.3	.46	43.28	54	-10.72	-	-	113	161	H
* 2.352	40.11	PK2	31.8	-21.3	0	50.61	-	-	74	-23.39	307	346	V
* 2.352	32.86	MAv1	31.8	-21.3	.46	43.82	54	-10.18	-	-	307	346	V
* 4.959	47.11	PK2	34.5	-29.7	0	51.91	-	-	74	-22.09	135	364	H
* 4.96	39.79	MAv1	34.5	-29.7	.46	45.05	54	-8.95	-	-	135	364	H
* 4.961	45.78	PK2	34.5	-29.7	0	50.58	-	-	74	-23.42	145	102	V
* 4.96	38.01	MAv1	34.5	-29.7	.46	43.27	54	-10.73	-	-	145	102	V
2.608	40.53	PK2	32.2	-20.9	0	51.83	-	-	-	-	168	235	H
2.608	33.96	MAv1	32.2	-20.9	.46	45.72	-	-	-	-	168	235	H
2.608	40.52	PK2	32.2	-20.9	0	51.82	-	-	-	-	314	249	V
2.608	33.72	MAv1	32.2	-20.9	.46	45.48	-	-	-	-	314	249	V

* - indicates frequency in CFR15.205/RSS-GEN 8.10 -Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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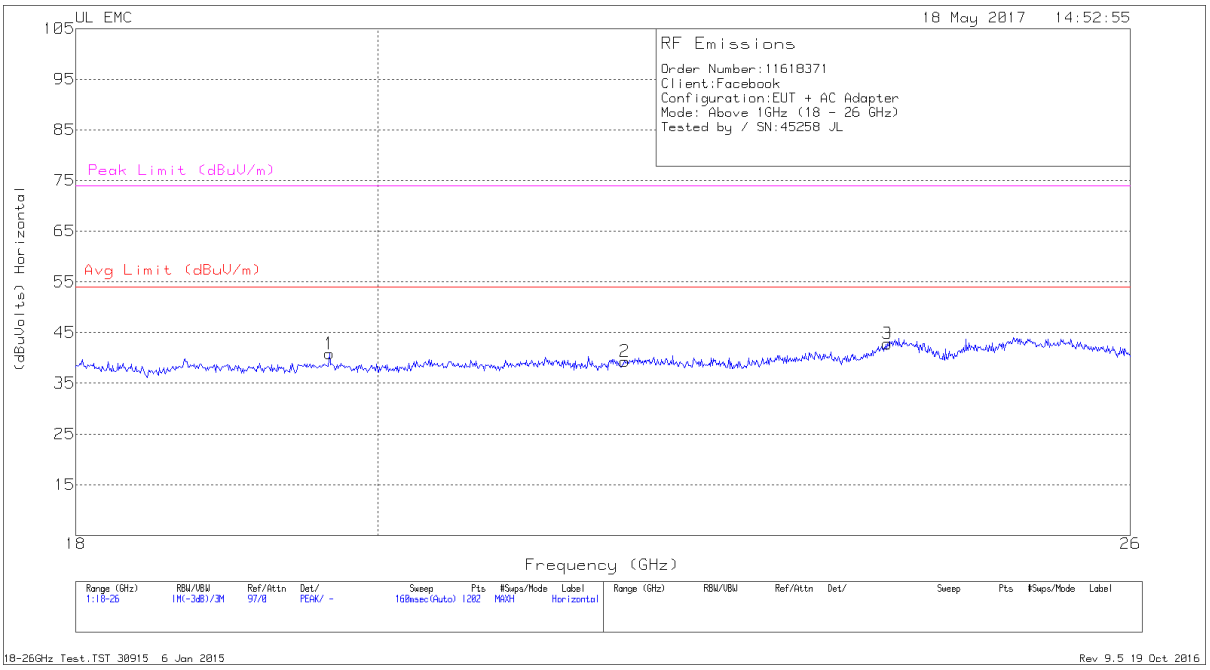
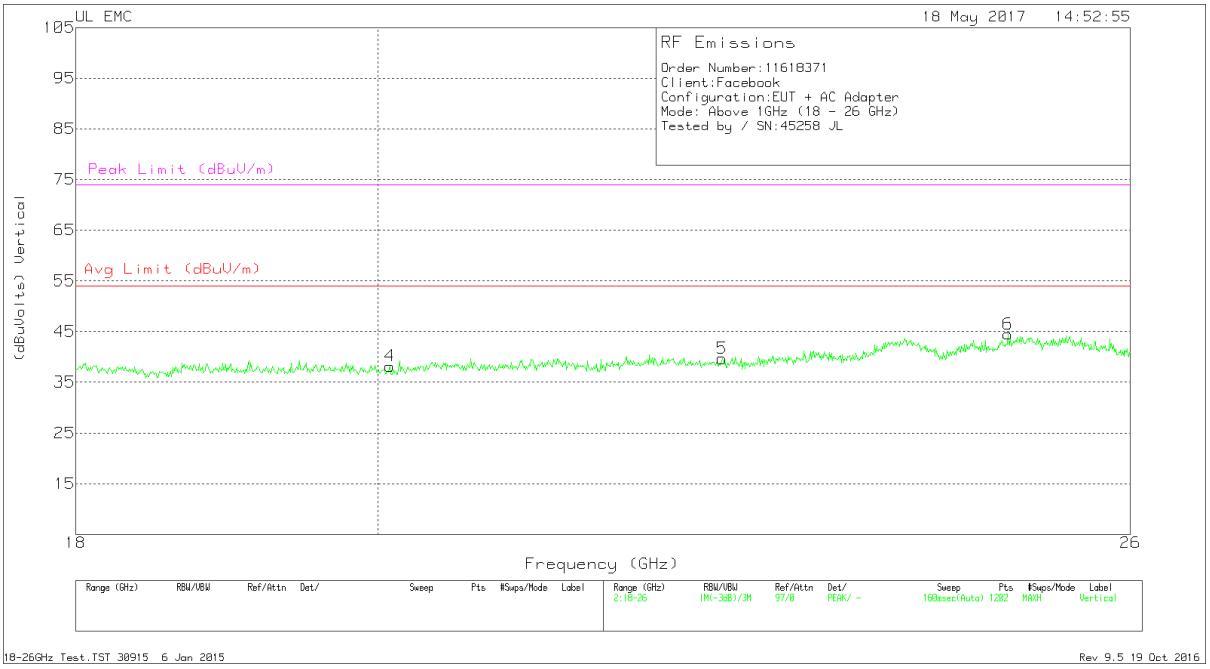
11.3 WORST-CASE 18 - 26GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.665	42.53	Pk	32.7	-24.9	-9.5	40.83	54	-13.16	74	-33.16
2	21.797	40.23	Pk	33.2	-24.6	-9.5	39.33	54	-14.66	74	-34.66
3	23.888	42.43	Pk	33.9	-24	-9.5	42.83	54	-11.16	74	-31.16
4	20.085	39.97	Pk	32.7	-25	-9.5	38.16	54	-15.83	74	-35.83
5	22.55	40.67	Pk	33.4	-24.9	-9.5	39.66	54	-14.33	74	-34.33
6	24.914	44	Pk	34.2	-24.2	-9.5	44.5	54	-9.5	74	-29.5

Pk - Peak detector

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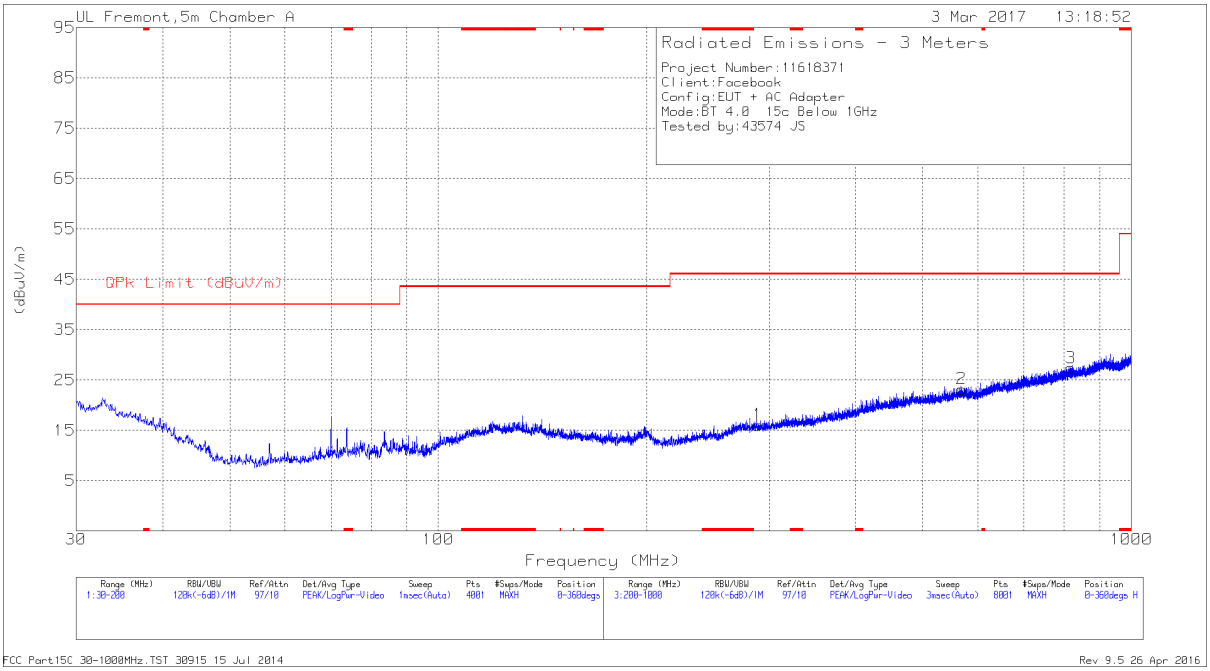
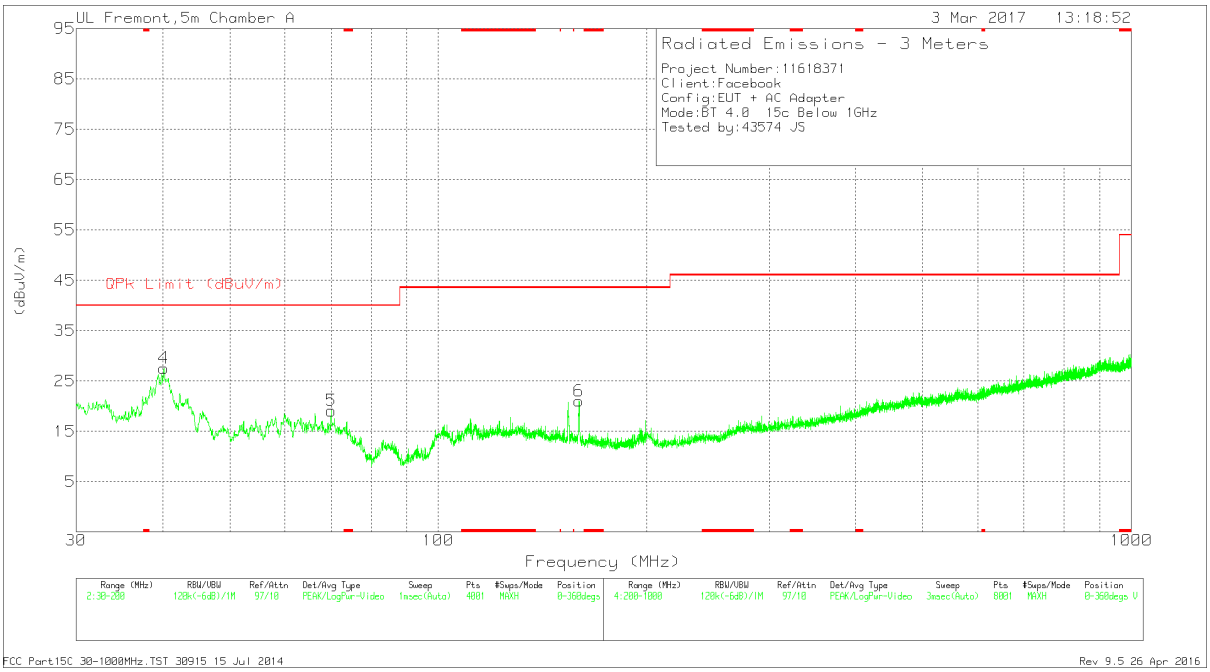
11.4 WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	40.1575	40.64	Pk	18	-31.1	27.54	40	-12.46	0-360	100	V
5	70.035	37.41	Pk	12.5	-30.8	19.11	40	-20.89	0-360	100	V
6	159.625	35	Pk	16.2	-30.2	21	43.52	-22.52	0-360	100	V
1	289.5	28.18	Pk	17.3	-29.4	16.08	46.02	-29.94	0-360	300	H
2	569	29.11	Pk	22.7	-28.6	23.21	46.02	-22.81	0-360	300	H
3	818.1	29.69	Pk	25.7	-28	27.39	46.02	-18.63	0-360	100	H

Pk - Peak detector

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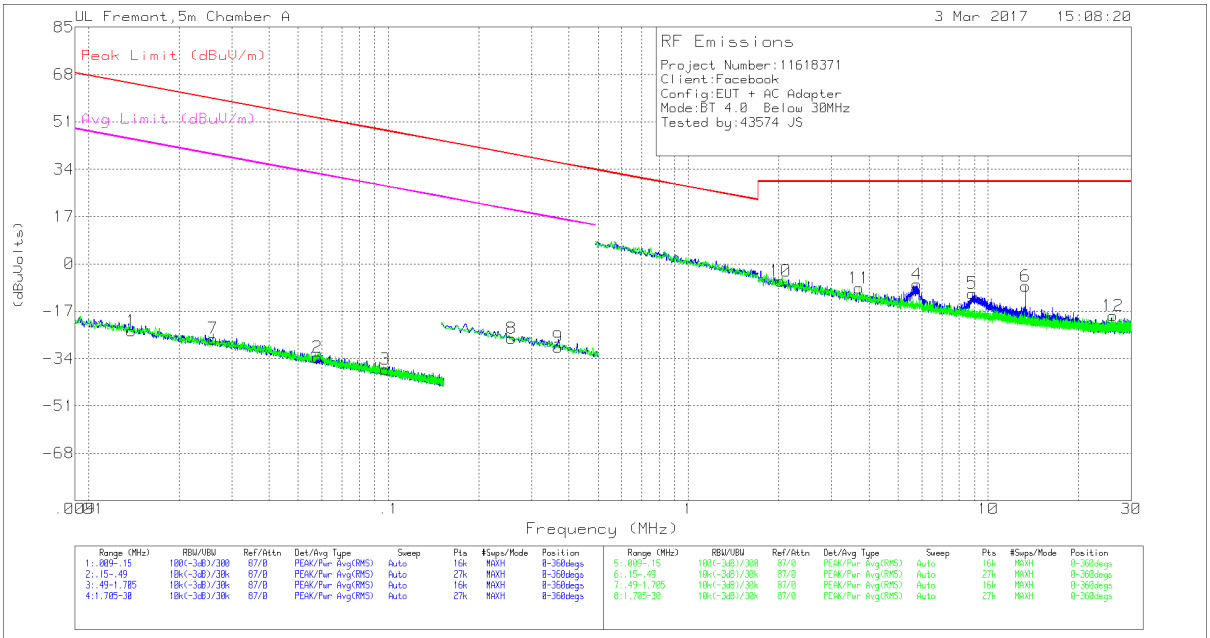
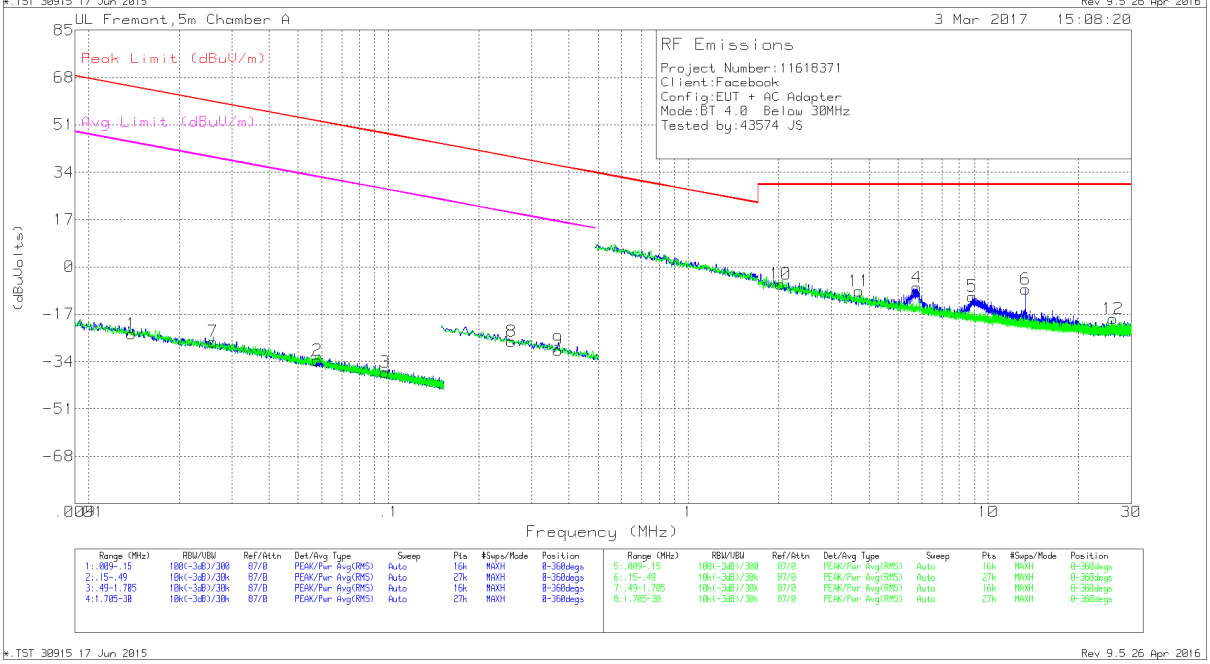
11.5 WORST-CASE BELOW 30 MHz

SPURIOUS EMISSIONS BELOW 30MHz (WORST-CASE CONFIGURATION)

PLOT





NOTE: KDB 414788 OATS and Chamber Correlation Justification

- Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
- OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01389	39.42	Pk	16.4	.1	-80	-24.08	64.75	-88.83	44.75	-68.83	0-360
7	.02597	39.73	Pk	13.3	.1	-80	-26.87	59.31	-86.18	39.31	-66.18	0-360
2	.05789	35.06	Pk	11.2	.1	-80	-33.64	52.35	-85.99	32.35	-65.99	0-360
3	.09751	31.16	Pk	10.9	.1	-80	-37.84	47.82	-85.66	27.82	-65.66	0-360
8	.25726	42.35	Pk	10.8	.1	-80	-26.75	39.4	-66.15	19.4	-46.15	0-360
9	.36783	39.31	Pk	10.7	.1	-80	-29.89	36.29	-66.18	16.29	-46.18	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
10	2.03198	22.88	Pk	10.8	.2	-40	-6.12	29.54	-35.66	-	-	0-360
11	3.71506	20.19	Pk	10.9	.3	-40	-8.61	29.54	-38.15	-	-	0-360
4	5.78958	21.32	Pk	10.9	.4	-40	-7.38	29.54	-36.92	-	-	0-360
5	8.85655	18.09	Pk	10.8	.5	-40	-10.61	29.54	-40.15	-	-	0-360
6	13.31736	20.67	Pk	10.7	.6	-40	-8.03	29.54	-37.57	-	-	0-360
12	26.01126	11.59	Pk	9	.8	-40	-18.61	29.54	-48.15	-	-	0-360

Pk - Peak detector

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12. 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.

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 Line 1 (HOT) and Line 2 (NEUTRAL).

RESULTS

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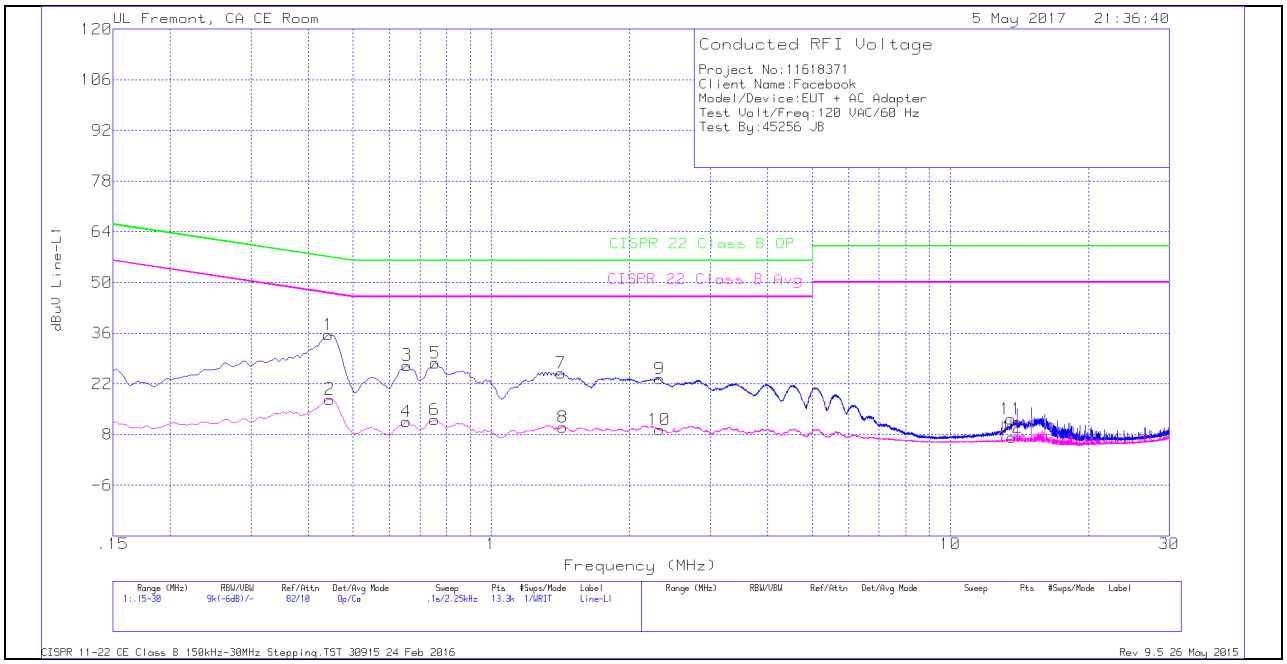
WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULT

Trace Markers

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.4425	25.36	Qp	0	.1	10.1	35.56	57.01	-21.45	-	-
2	.44475	7.55	Ca	0	.1	10.1	17.75	-	-	46.97	-29.22
3	.65625	16.94	Qp	0	.1	10.1	27.14	56	-28.86	-	-
4	.654	1.41	Ca	0	.1	10.1	11.61	-	-	46	-34.39
5	.75525	17.6	Qp	0	.1	10.1	27.8	56	-28.2	-	-
6	.753	1.83	Ca	0	.1	10.1	12.03	-	-	46	-33.97
7	1.41675	14.81	Qp	0	.1	10.1	25.01	56	-30.99	-	-
8	1.43025	-.23	Ca	0	.1	10.1	9.97	-	-	46	-36.03
9	2.32575	13.25	Qp	0	.1	10.1	23.45	56	-32.55	-	-
10	2.3235	-.86	Ca	0	.1	10.1	9.34	-	-	46	-36.66
11	13.56	1.77	Qp	.1	.2	10.2	12.27	60	-47.73	-	-
12	13.6365	-3.3	Ca	.1	.2	10.2	7.2	-	-	50	-42.8

Qp - Quasi-Peak detector

Ca - CISPR average detection

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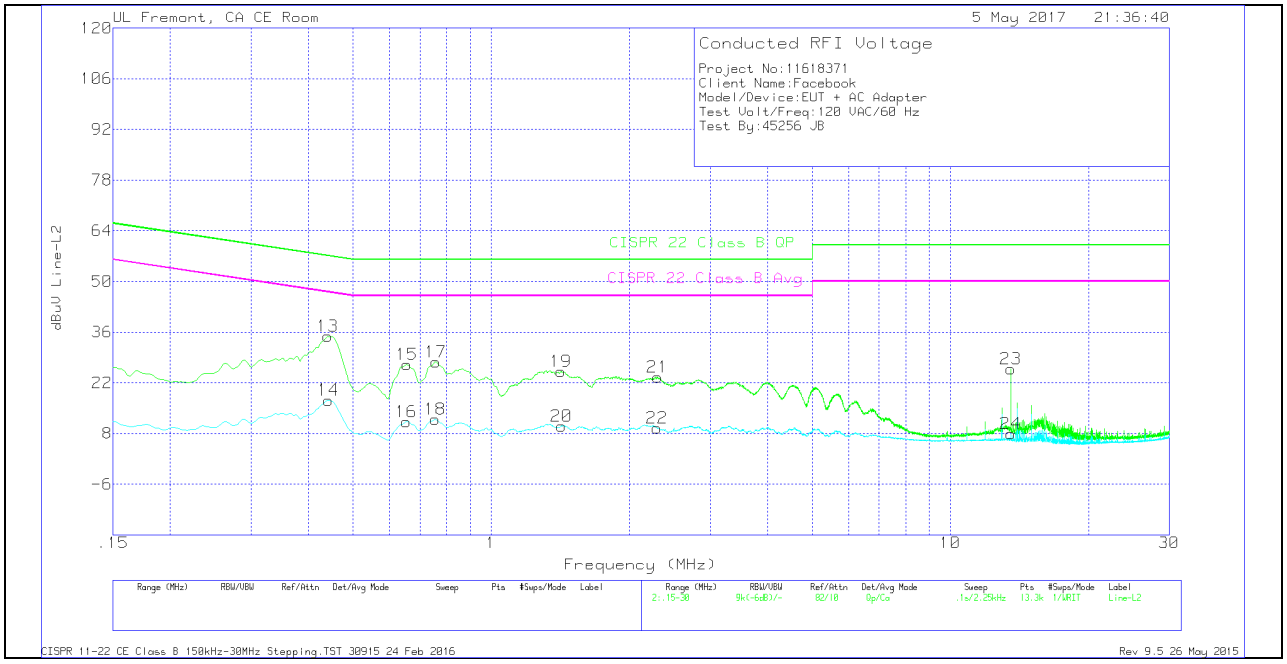
LINE 2 PLOT



LINE 2 RESULT

Trace Markers

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
13	.44025	24.62	Qp	0	.1	10.1	34.82	57.06	-22.24	-	-
14	.4425	7.03	Ca	0	.1	10.1	17.23	-	-	47.01	-29.78
15	.65625	16.82	Qp	0	.1	10.1	27.02	56	-28.98	-	-
16	.654	1.1	Ca	0	.1	10.1	11.3	-	-	46	-34.7
17	.75862	17.58	Qp	0	.1	10.1	27.78	56	-28.22	-	-
18	.75525	1.67	Ca	0	.1	10.1	11.87	-	-	46	-34.13
19	1.41675	14.89	Qp	0	.1	10.1	25.09	56	-30.91	-	-
20	1.42125	-.11	Ca	0	.1	10.1	10.09	-	-	46	-35.91
21	2.30325	13.33	Qp	0	.1	10.1	23.53	56	-32.47	-	-
22	2.301	-.7	Ca	0	.1	10.1	9.5	-	-	46	-36.5
23	13.56	15.34	Qp	.1	.2	10.2	25.84	60	-34.16	-	-
24	13.56	-2.56	Ca	.1	.2	10.2	7.94	-	-	50	-42.06

Qp - Quasi-Peak detector

Ca - CISPR average detection

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