CERTIFICATION TEST REPORT

Report Number. : 12750204-E1V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	:	A2015
FCC ID	:	BCGA2015
IC	:	579C-A2015
EUT Description	:	WIRELESS HEADPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
December 12, 2019

Prepared by:
UL Verification Services Inc.
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	11/25/2019	Initial Issue	Chin Pang
V2	12/12/2019	Address TCB questions	Chin Pang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: WIRELESS HEADPHONE

MODEL: A2015

Serial Number: F9FZG0SDP4GN (CONDUCTED)
F9FZM00DP4GN (RADIATED)

DATE TESTED: NOVEMBER 08-15 AND DECEMBER 12, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

Approved & Released For
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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, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd.
☒ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☒ Chamber I (IC: 2324A-5)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☒ Chamber F (IC:22541-3)	☐ Chamber K (IC: 2324A-1)
	☐ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ Chamber M (IC: 2324A-2)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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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

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a wireless headphone with integrated battery, microphone and antenna. It can play music from Bluetooth audio source. It has lightning connector port for charging. It has Red/White LEDs, volume up, volume down buttons.

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	Basic GFSK	12.81	19.10
2402 - 2480	Enhanced DQPSK	12.18	16.52
2402 - 2480	Enhanced 8PSK	12.20	16.60

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance. For average power data please refer to section 8.7.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of 1 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 2B20121d

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 30MHz, below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y (landscape) orientation was the worst-case orientation without AC/DC adapter; For below 1GHz and 30MHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration was tested with EUT only.

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

GFSK mode: DH5
8PSK mode: 3-DH5

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	A1398	C02PM012G3QD	QDS-BRCM1069
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D29325SM03XDHLHC9	NA

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	SMA	Un-Shielded	0.3	To Spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	Antenna	1	AC	Un-shielded	2	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
NA						

I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

I/O Cable List						
Cable No	**Port**	**# of identical**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-shielded	2	N/A
2	USB	1	Lightning	Un-shielded	1	N/A

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

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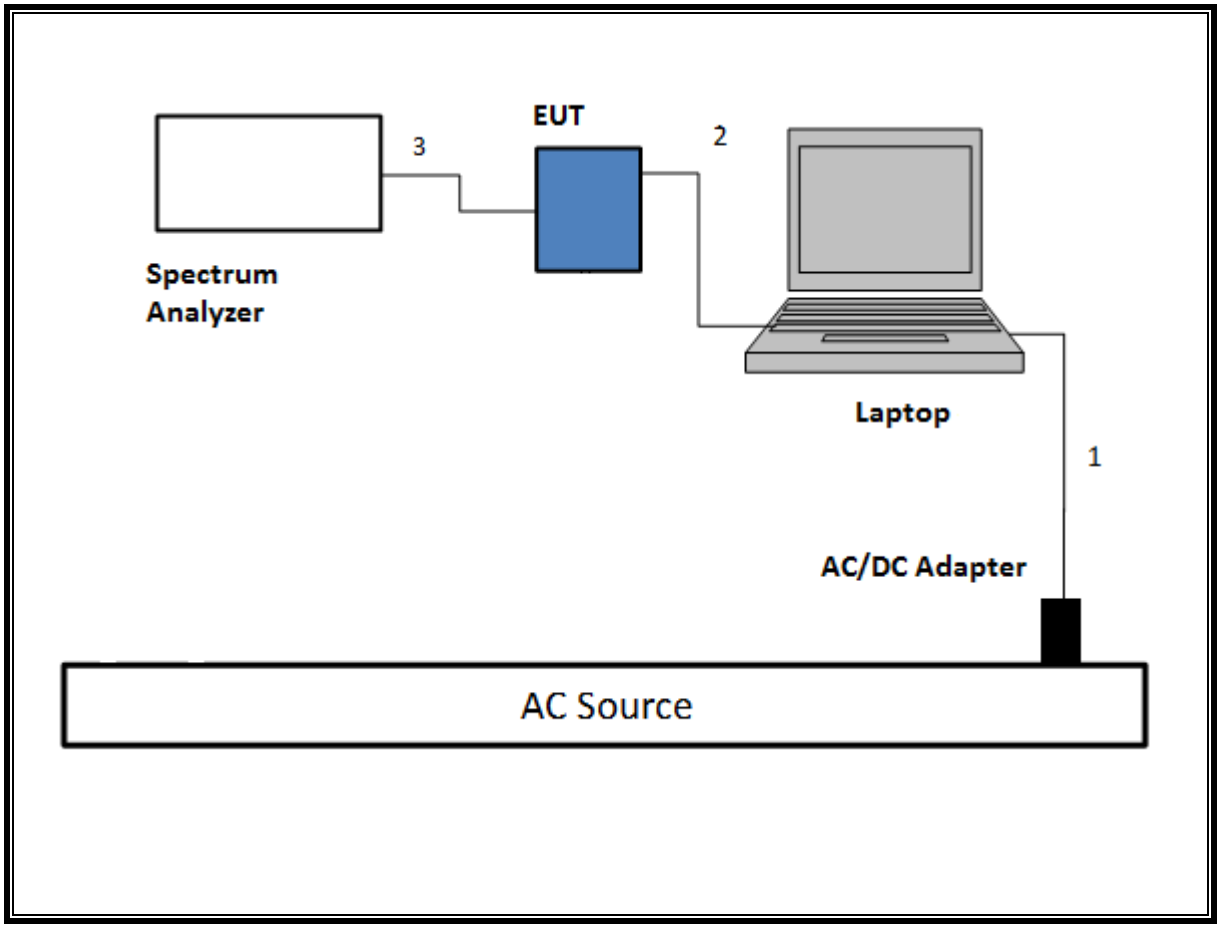
SETUP DIAGRAM FOR CONDUCTED TESTS



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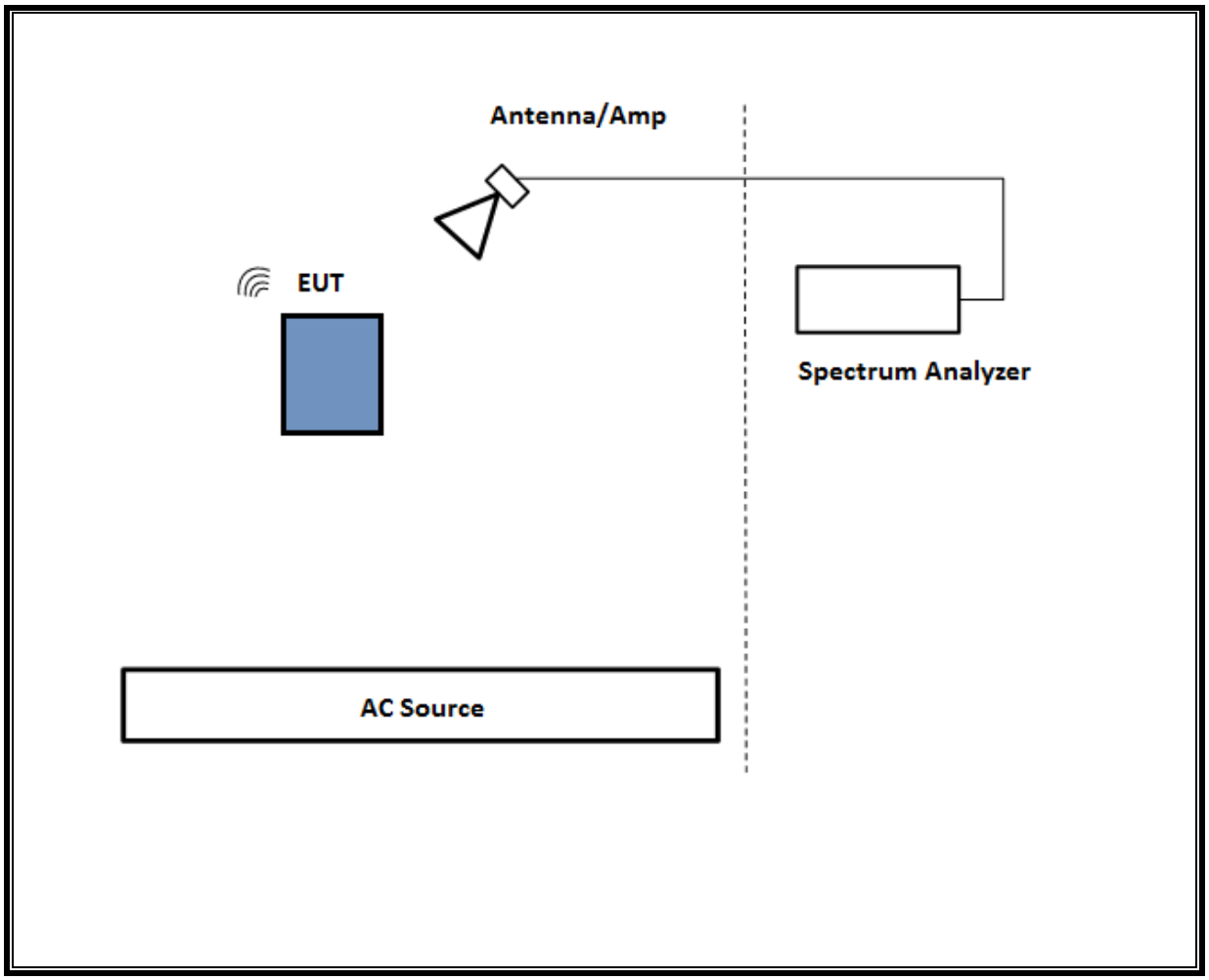
SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



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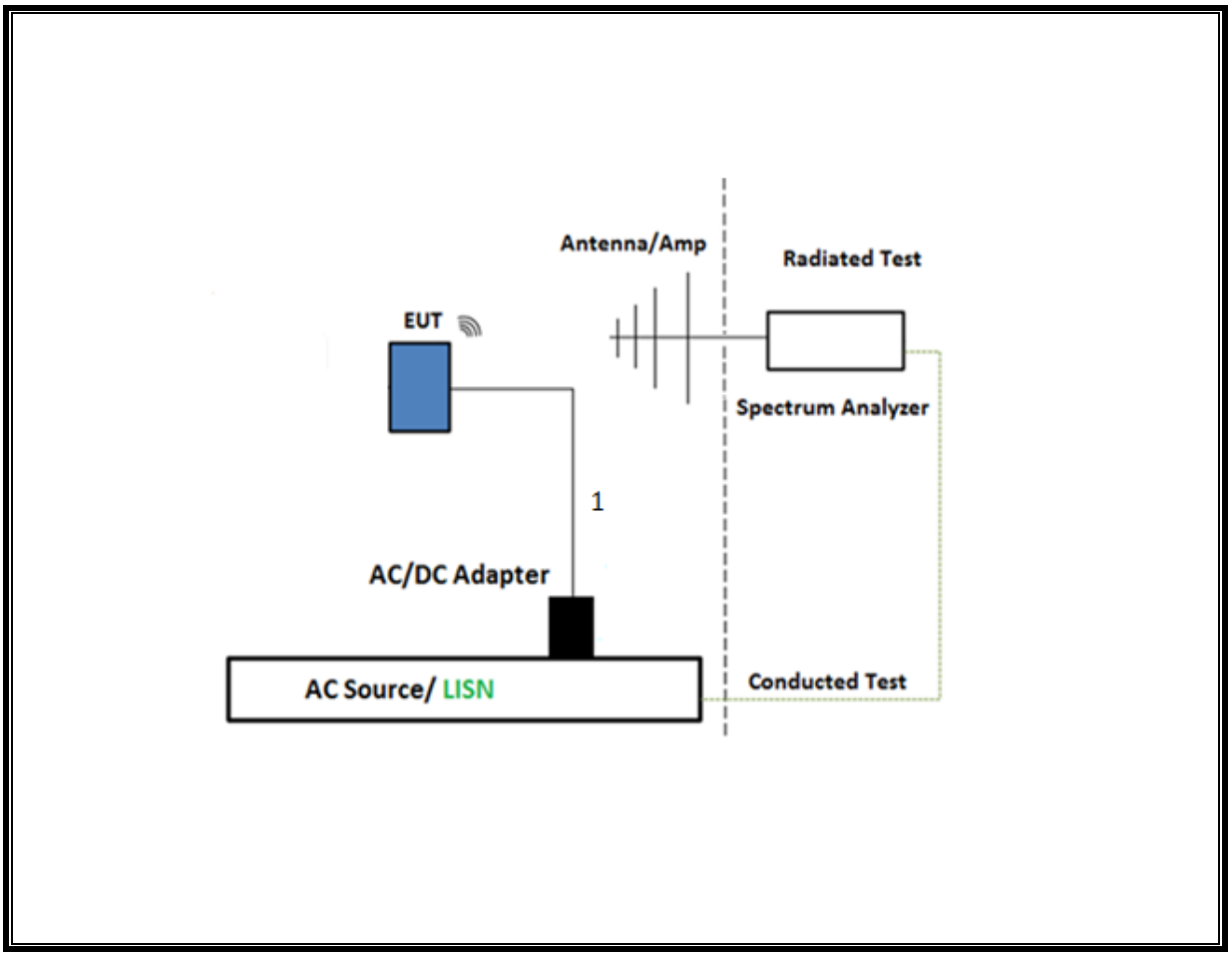
SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



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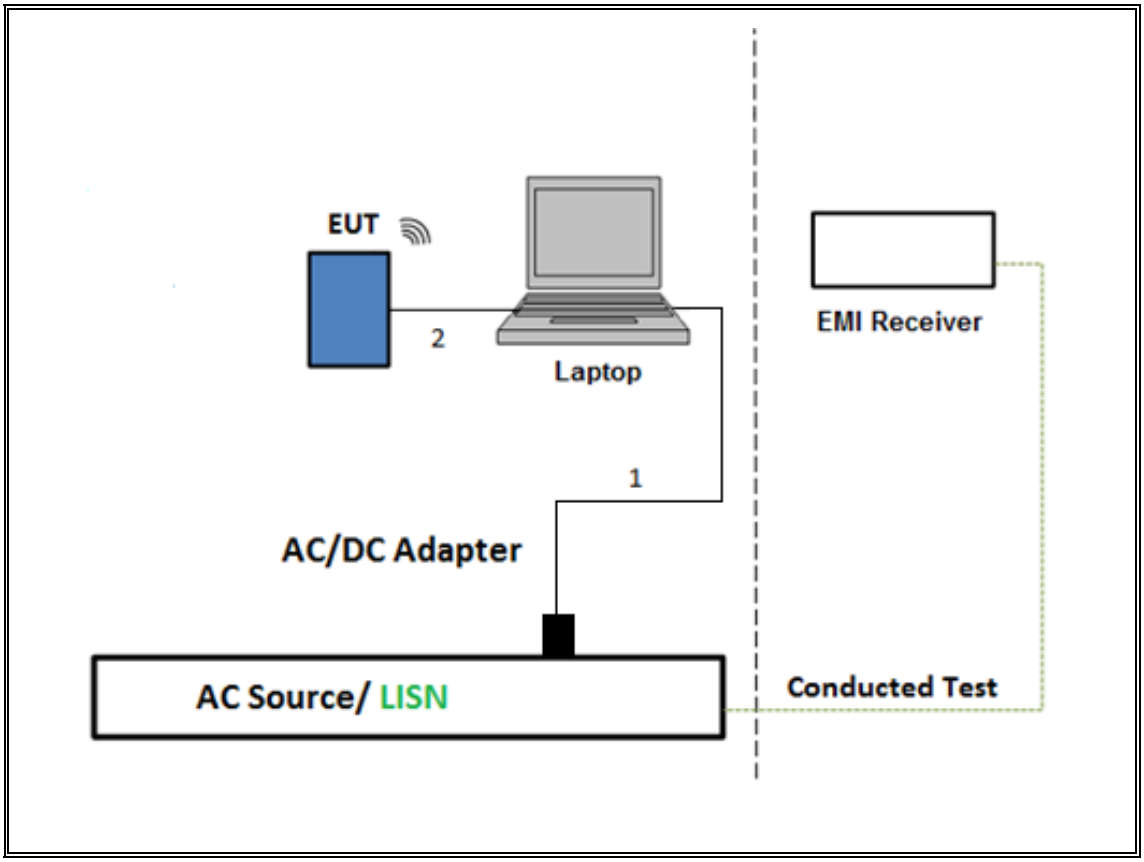
TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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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**	**ID Num**	**Cal Due**	**Last Cal**
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	10/06/2020	10/06/2019
Amplifier, 1 - 18GHz, 45dB Min	AMPLICAL	AMP0.1G18-47-20	172121	07/15/2020	07/15/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma Instrument Co.	310N	T286	07/31/2020	07/31/2019
Amplifier, 1 to 26.5GHz, 23.5dB Gain mini	Agilent (Keysight) Technologies	8449B	T404	03/23/2020	03/23/2019
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	10/01/2020	10/01/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T185	06/06/2020	06/06/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	05/14/2020	05/14/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T345	04/20/2020	04/20/2019
Antenna	ETS-Lindgren	3117	EMC4294	06/14/2020	06/14/2019
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	PRE0141167	05/04/2020	05/04/2019
Antenna Horn, 18 to 26GHz	ARA	MWH-1826	T447	08/13/2020	08/13/2019
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T486	10/06/2020	10/06/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1272	01/29/2020	01/29/2019
Power Sensor	Power Sensor	Keysight	T1226	02/06/2020	02/06/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T908	01/23/2020	01/23/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	01/23/2020	01/23/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T905	01/24/2020	01/24/2019
Thermo-Hygrometer	Contact East	445703	T909	02/26/2020	02/26/2020
AC Line Conducted					
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/23/2020	02/23/2019
Power Cable, Line Conducted Emissions	UL	PG1	T861	10/19/2020	10/19/2019
**LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	01/24/2020	01/24/2019
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, September 24, 2019		
Conducted Software	UL	UL EMC	Ver 10.4, October 10, 2019		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		

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7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

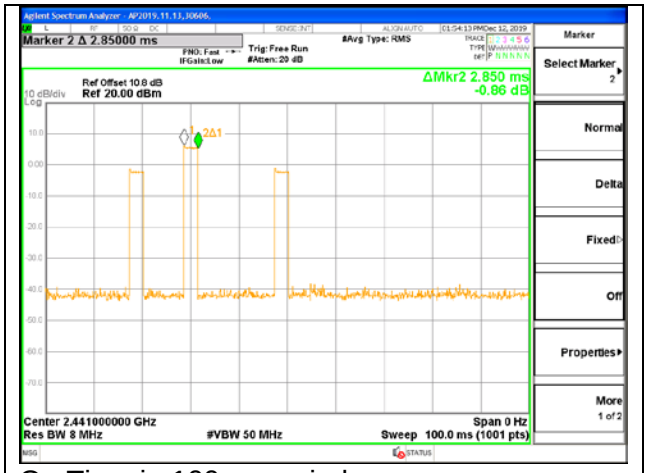
None; for reporting purposes only.

PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE CORRECTION FACTOR RESULTS

Mode	ON Time (msec)	Number of pulses	Total On Time (msec)	Period (msec)	DCCF
Bluetooth	2.85	3.00	8.55	100.00	-21.361



On Time in 100ms period

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8.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ 3xRBW. The sweep time is coupled.

RESULTS

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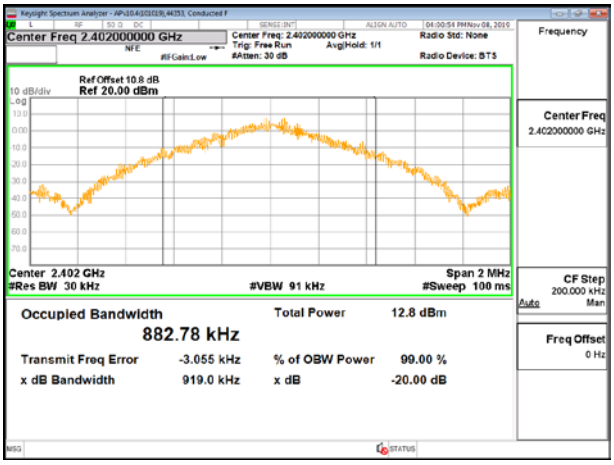
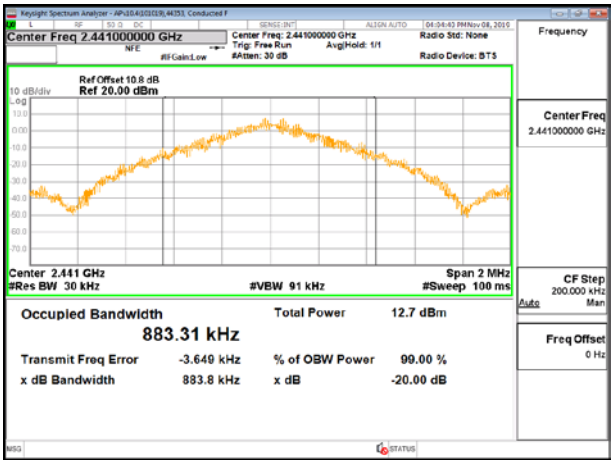
8.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

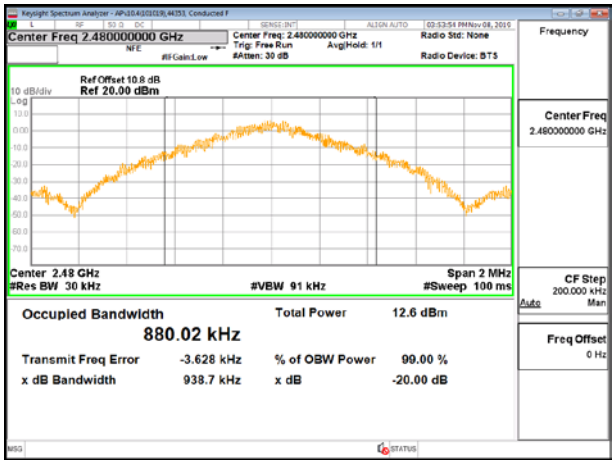
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.919	0.883
Mid	2441	0.884	0.883
High	2480	0.939	0.880



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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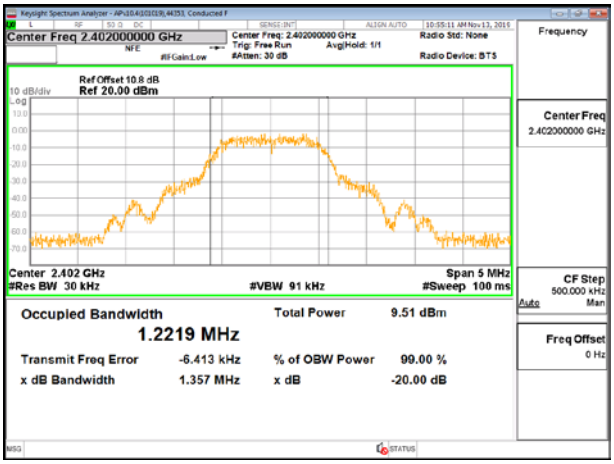
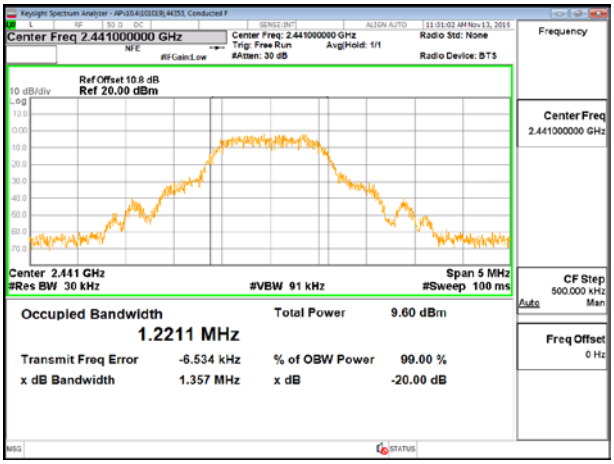
8.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

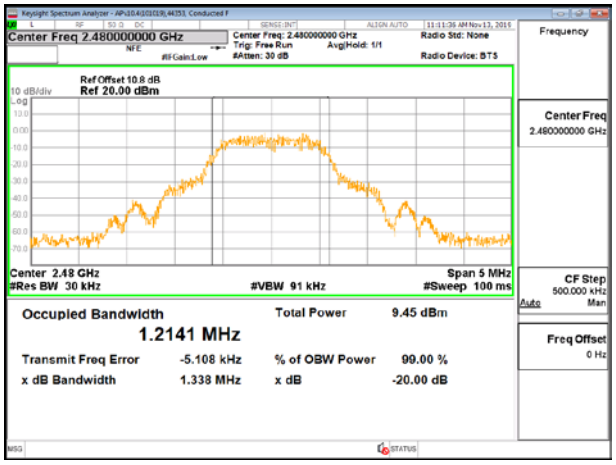
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.357	1.222
Mid	2441	1.357	1.221
High	2480	1.338	1.214



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

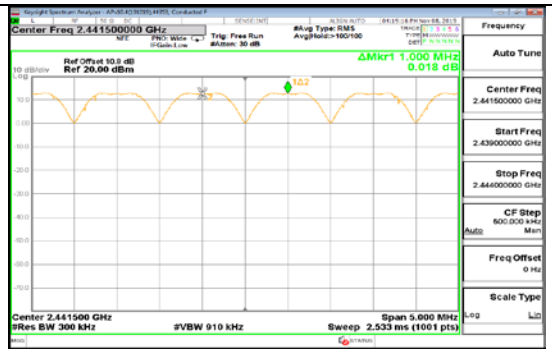
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

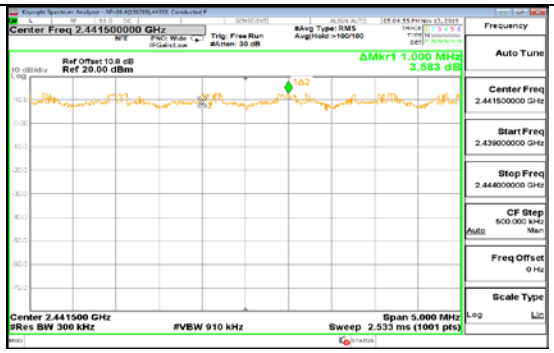
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW >= 3xRBW. The sweep time is coupled.

RESULTS

BLUETOOTH MODULATION



GFSK



8PSK

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8.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels Observed

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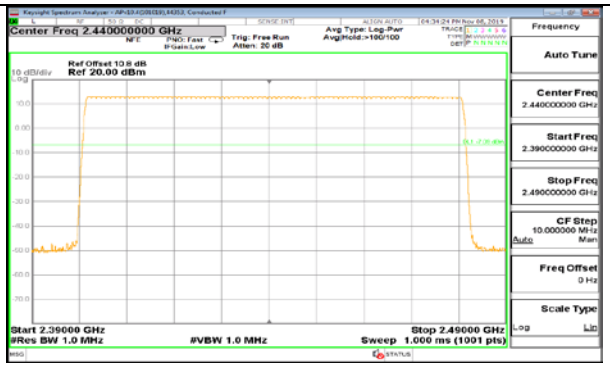
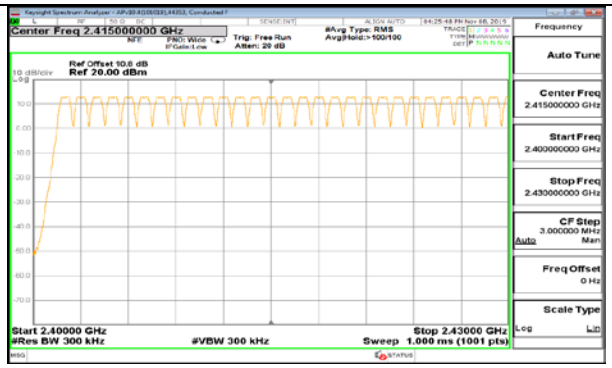
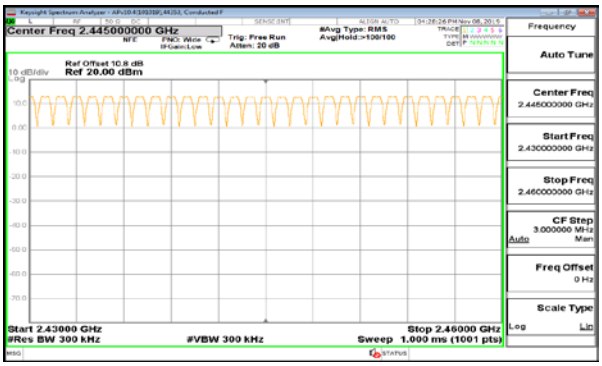
8.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



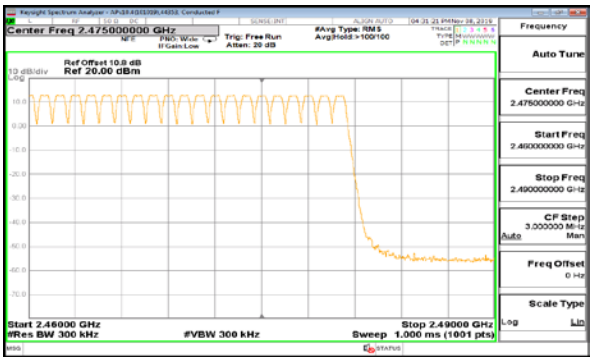
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

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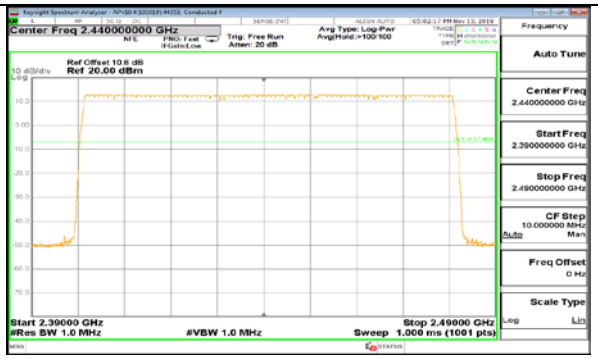
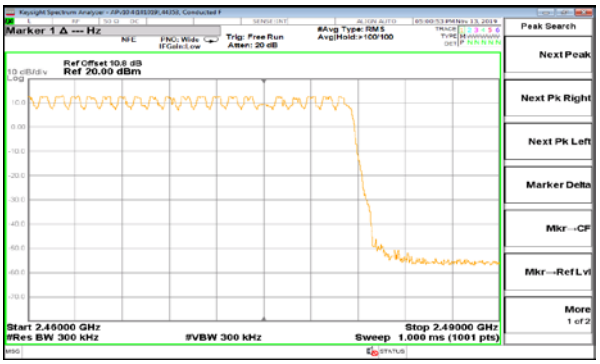
8.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



100MHz SPAN

30MHz SPAN, SEGMENT 1 OF 3

30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

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8.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

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8.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.370	31	0.1147	0.4	-0.2853
DH3	1.626	15	0.2439	0.4	-0.1561
DH5	2.872	8	0.2298	0.4	-0.1702
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.37	7.75	0.02868	0.4	-0.3713
DH3	1.626	3.75	0.06098	0.4	-0.3390
DH5	2.872	2	0.05744	0.4	-0.3426

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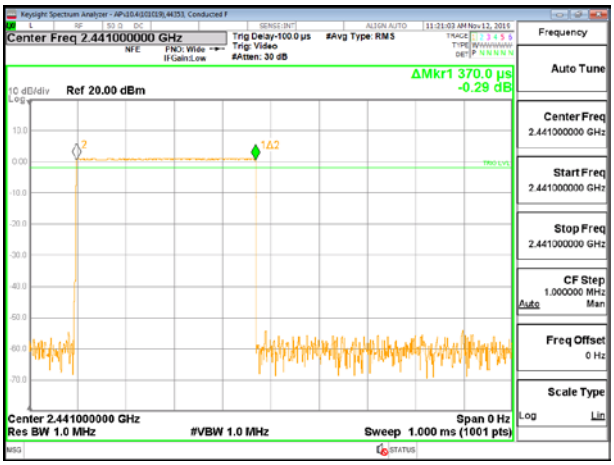
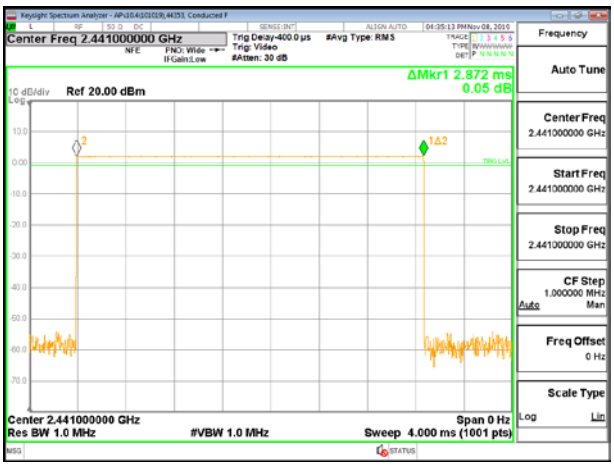
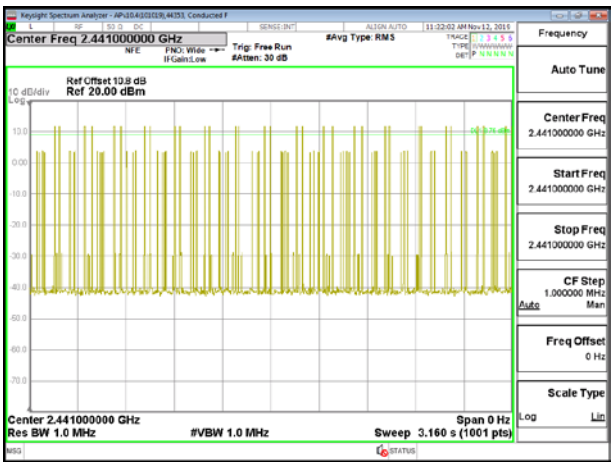


PULSE WIDTH – DH1

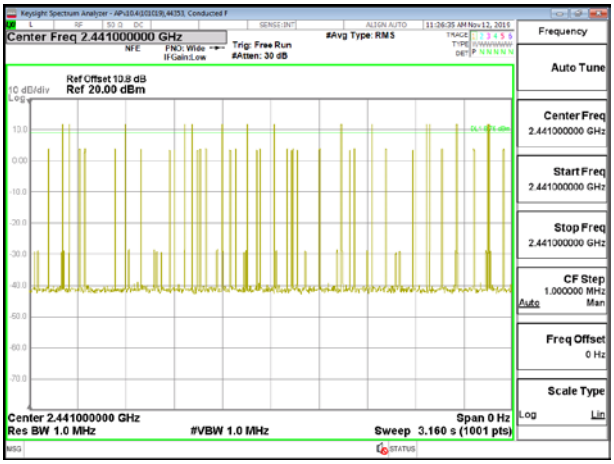
PULSE WIDTH – DH3



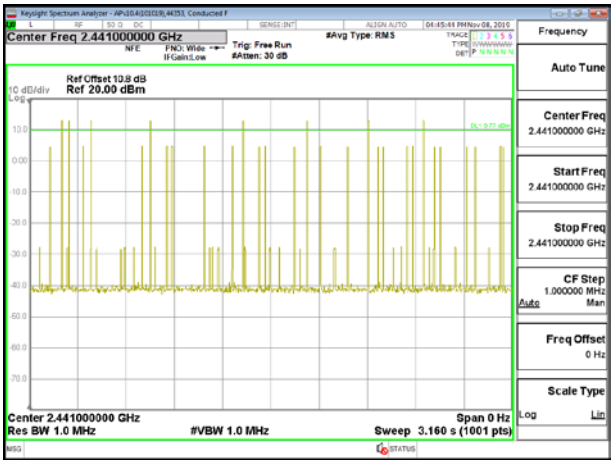
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

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8.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.380	32	0.1216	0.4	-0.2784
3DH3	1.630	15	0.2445	0.4	-0.1555
3DH5	2.884	9	0.25956	0.4	-0.1404

Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.

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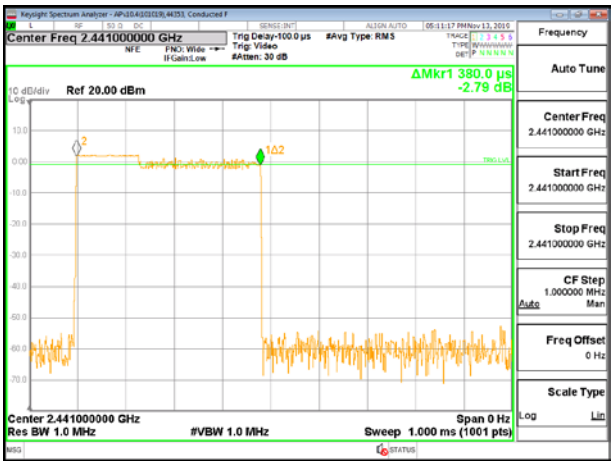
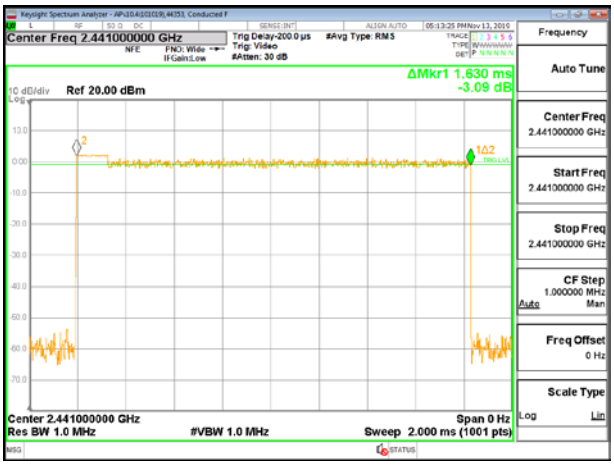
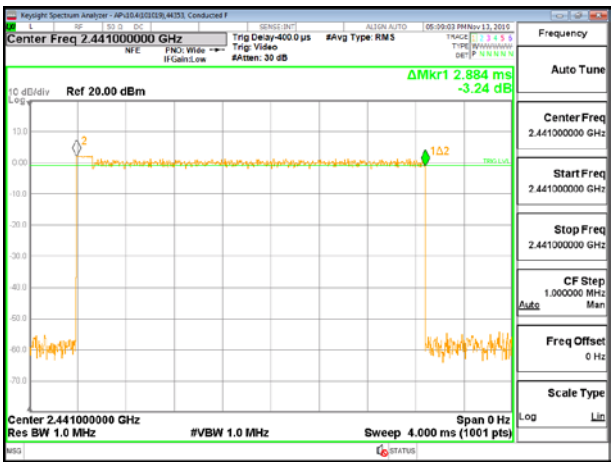


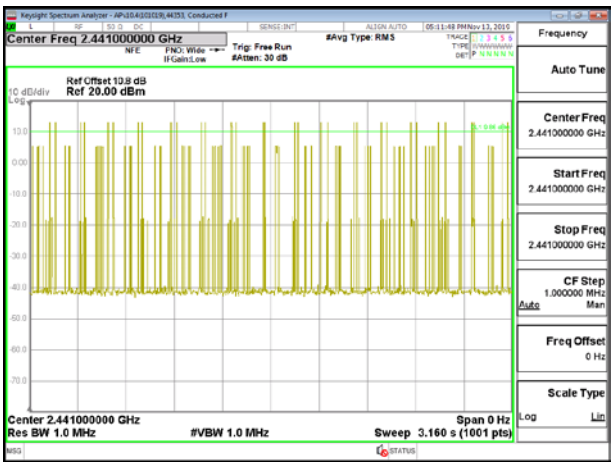
PULSE WIDTH – 3DH1



PULSE WIDTH – 3DH3

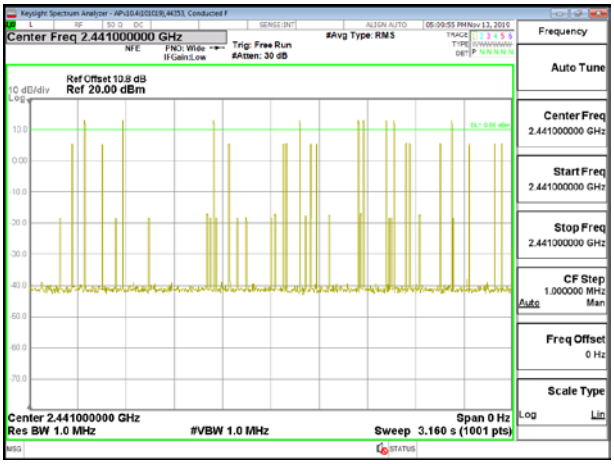


PULSE WIDTH – 3DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH5

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8.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

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8.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	44353
Date:	11/14/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.81	21	-8.19
Middle	2441	12.73	21	-8.27
High	2480	12.62	21	-8.38

8.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	44353
Date:	11/14/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.18	21	-8.82
Middle	2441	12.11	21	-8.89
High	2480	12.07	21	-8.93

8.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	44353
Date:	11/14/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.20	21	-8.8
Middle	2441	12.14	21	-8.86
High	2480	12.08	21	-8.92

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8.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

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8.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	44353
Date	11/14/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	12.50
Middle	2441	12.42
High	2480	12.34

8.7.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	44353
Date	11/14/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.47
Middle	2441	9.43
High	2480	9.32

8.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	44353
Date	11/14/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.49
Middle	2441	9.45
High	2480	9.37

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8.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Limit = -20 dBc

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.

The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

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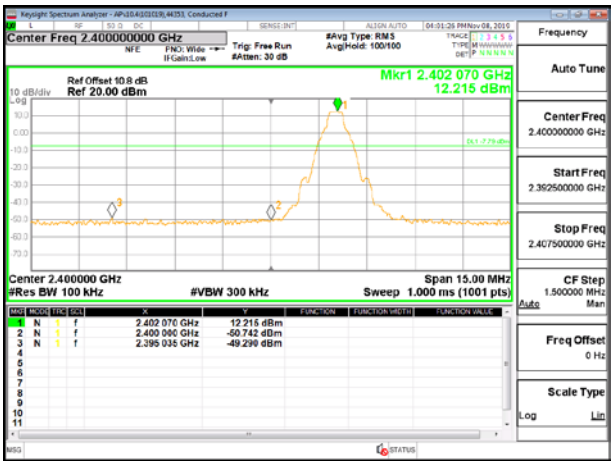
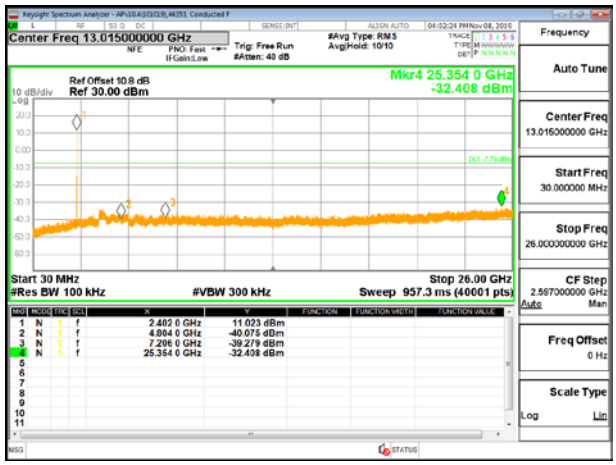
8.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

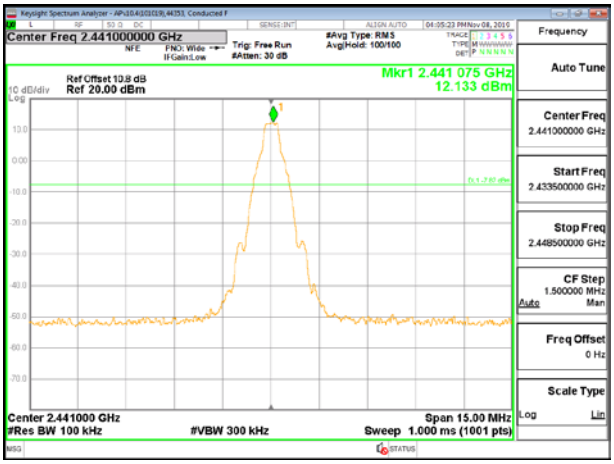
SPURIOUS EMISSIONS, NON-HOPPING



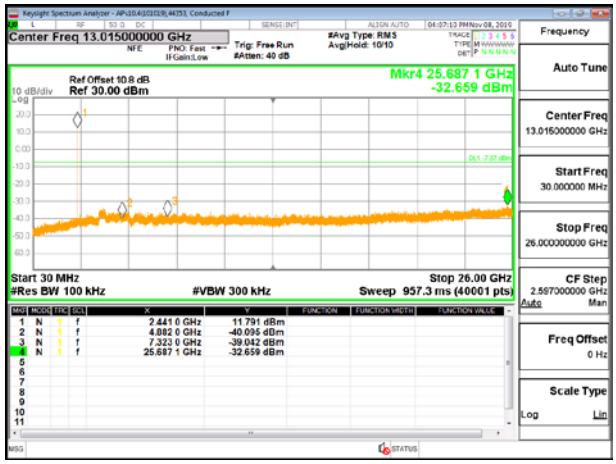
LOW CHANNEL BANDEDGE



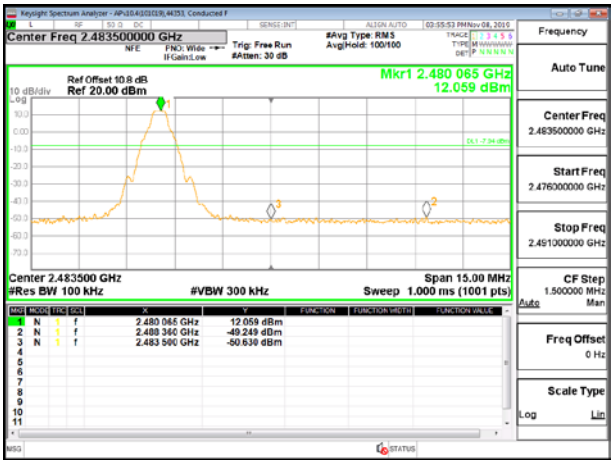
OUT-OF-BAND LOW CHANNEL



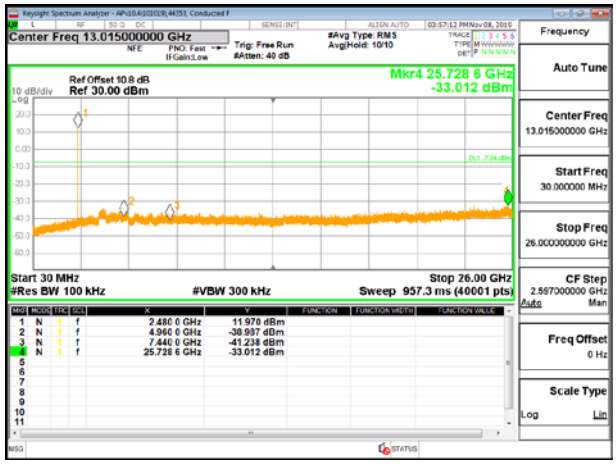
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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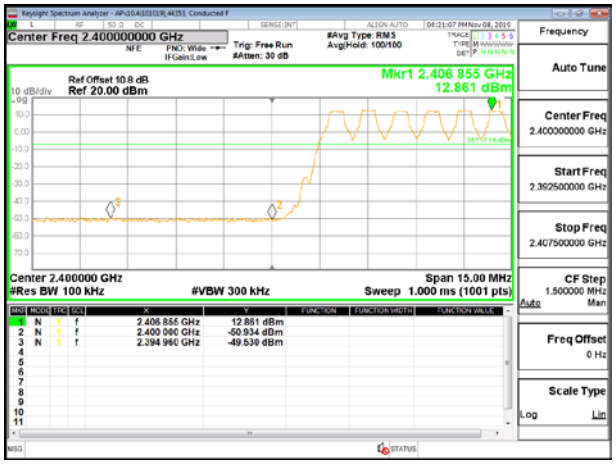
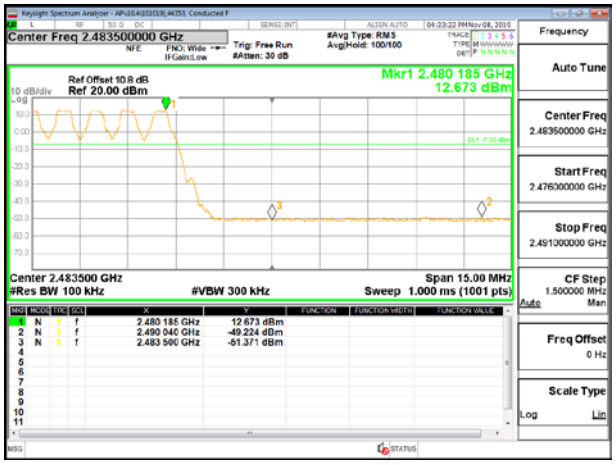
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

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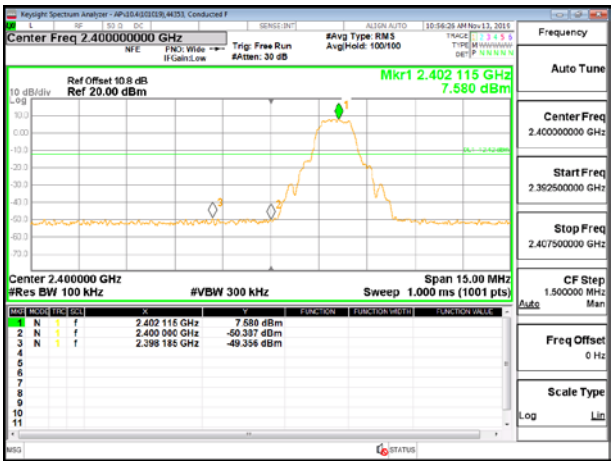
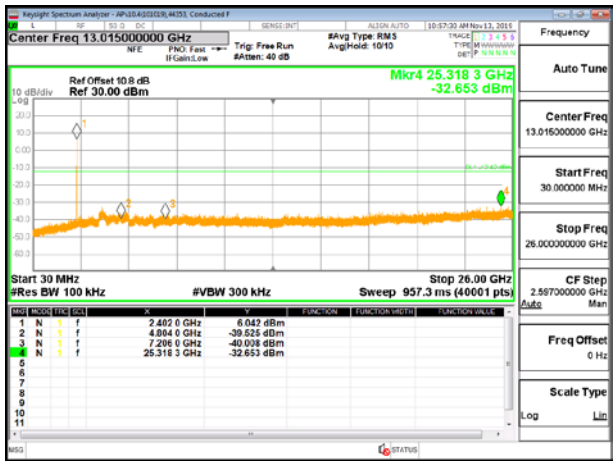
8.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

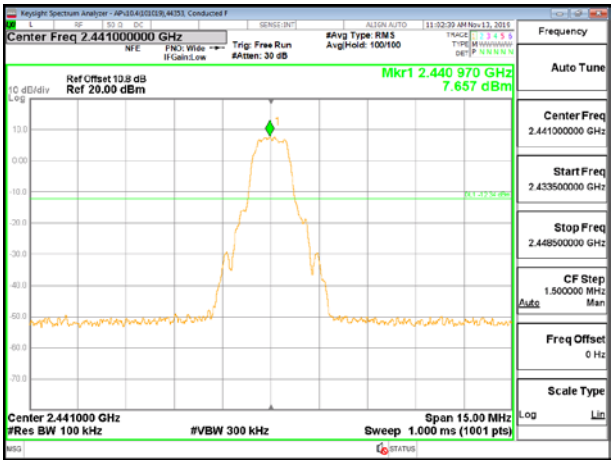
SPURIOUS EMISSIONS, NON-HOPPING



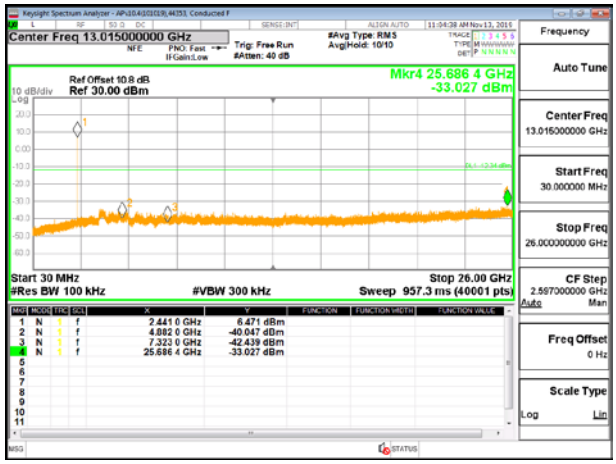
LOW CHANNEL BANDEDGE



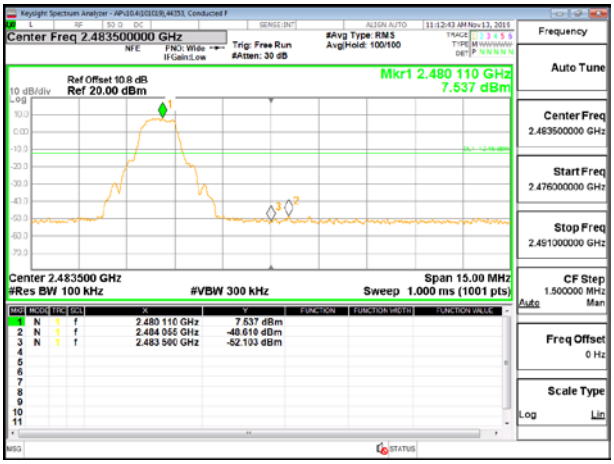
OUT-OF-BAND LOW CHANNEL



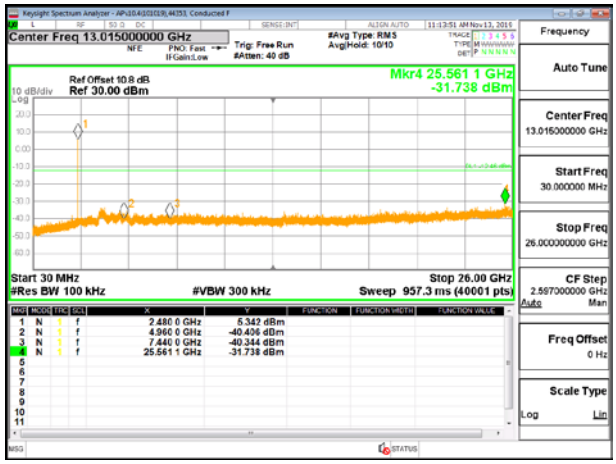
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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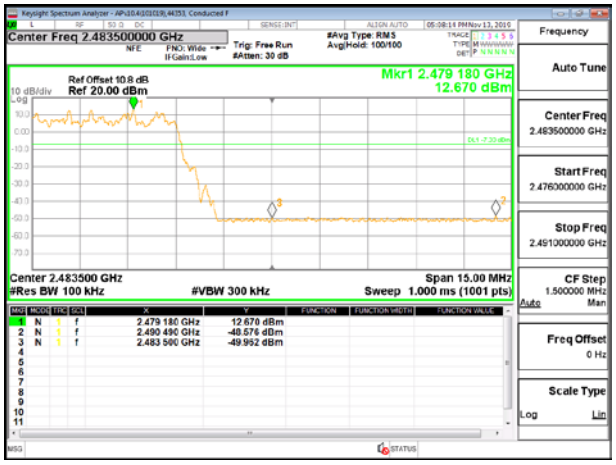
Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE



HIGH BANDEDGE

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9. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

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
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for 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 scans above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (510KHz) video bandwidth with peak detector for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

For the final measurements above 1GHz radiated spurious harmonics and band edge measurement, there is no need for the average reading since the peak reading passed with the peak limit. The average reading = peak reading – duty cycle Correction Factor (DCCF) which is 20 log (ON time/100 milliseconds) and greater than 20dB

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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For below 30MHz testing, investigation was done on three antenna orientations parallel, perpendicular, and ground-parallel. Parallel and perpendicular are the worst orientations and the final test was done on these two orientations only.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base 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.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

KDB 558074 D01 15.247 Meas Guidance v05r02

Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100msec transmission period.

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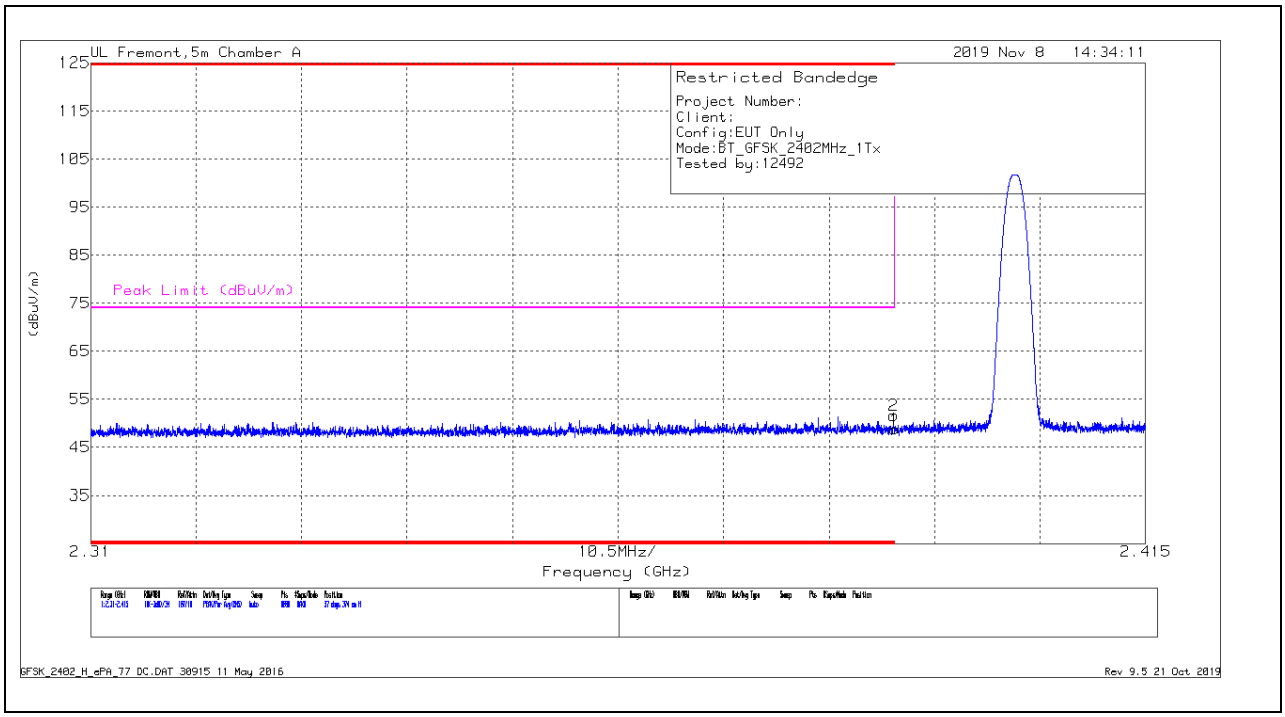
9.1. TRANSMITTER ABOVE 1 GHz

9.1.1. BLUETOOTH ENHANCED DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.18	Pk	32.2	-23.6	48.78	74	-25.22	37	374	H
2	* 2.3899	43.07	Pk	32.2	-23.6	51.67	74	-22.33	37	374	H

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

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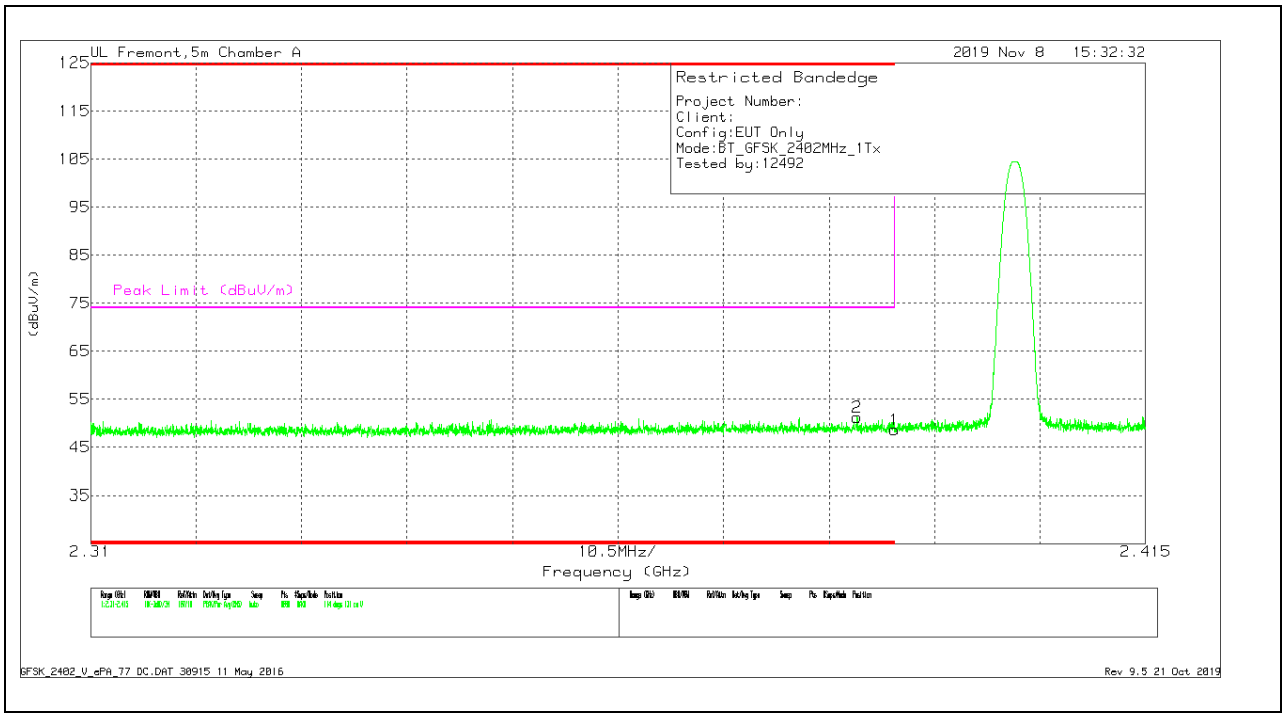
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.07	Pk	32.2	-23.6	48.67	74	-25.33	114	131	V
2	* 2.38629	42.66	Pk	32.2	-23.6	51.26	74	-22.74	114	131	V

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

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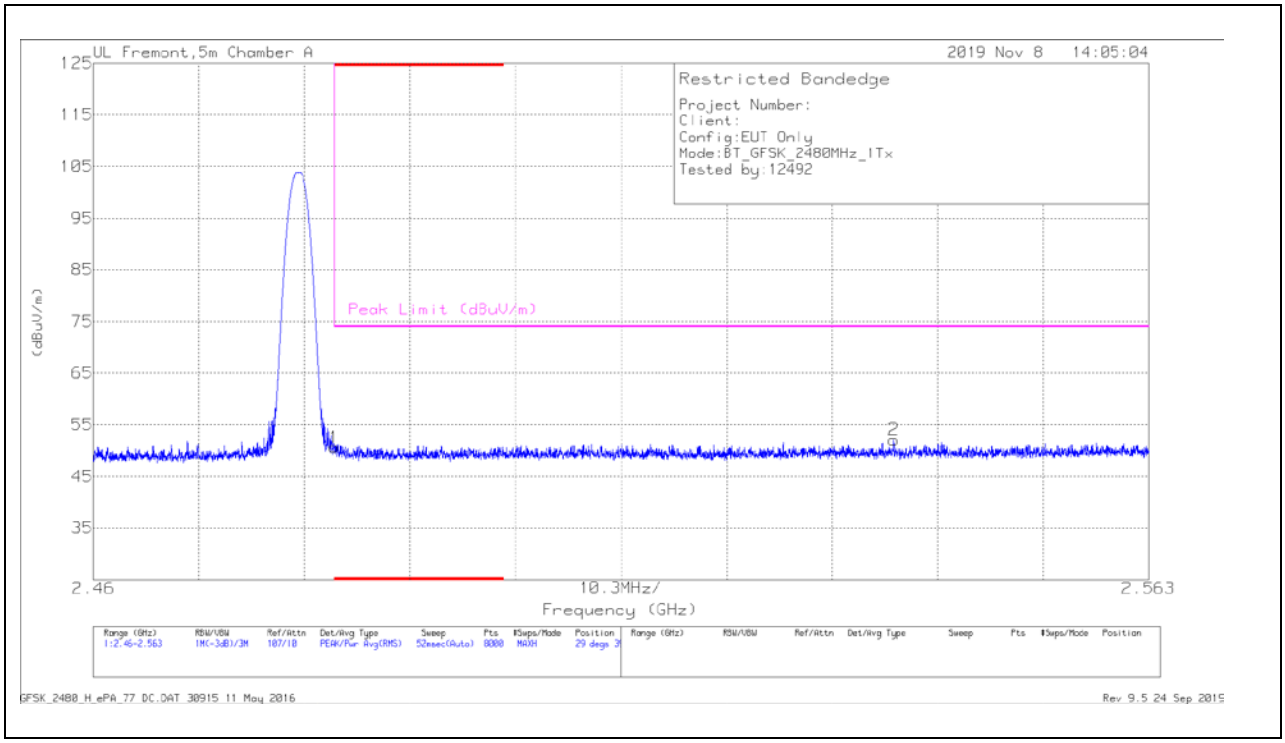
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	41.23	Pk	32.6	-23.2	50.63	74	-23.37	29	399	H
2	2.53811	42.51	Pk	32.6	-23	52.11	74	-21.89	29	399	H

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

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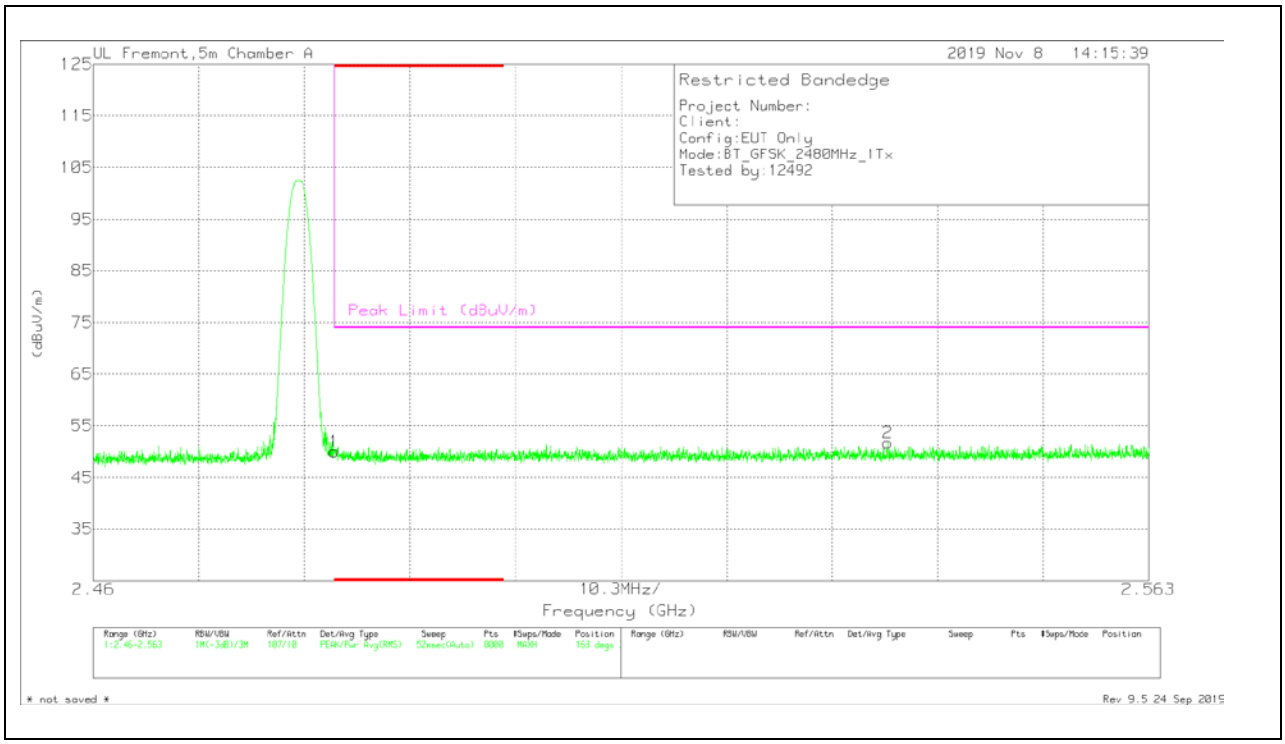
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	40.6	Pk	32.6	-23.2	50	74	-24	168	342	V
2	2.53753	42.1	Pk	32.6	-23	51.7	74	-22.3	168	342	V

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

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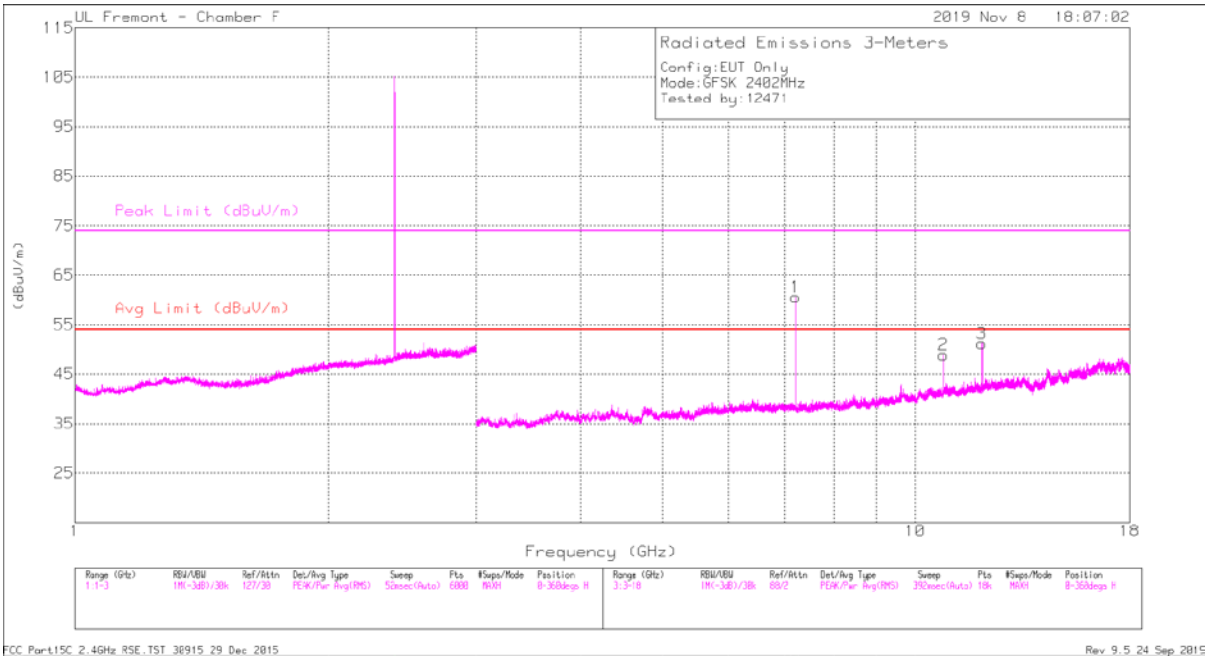
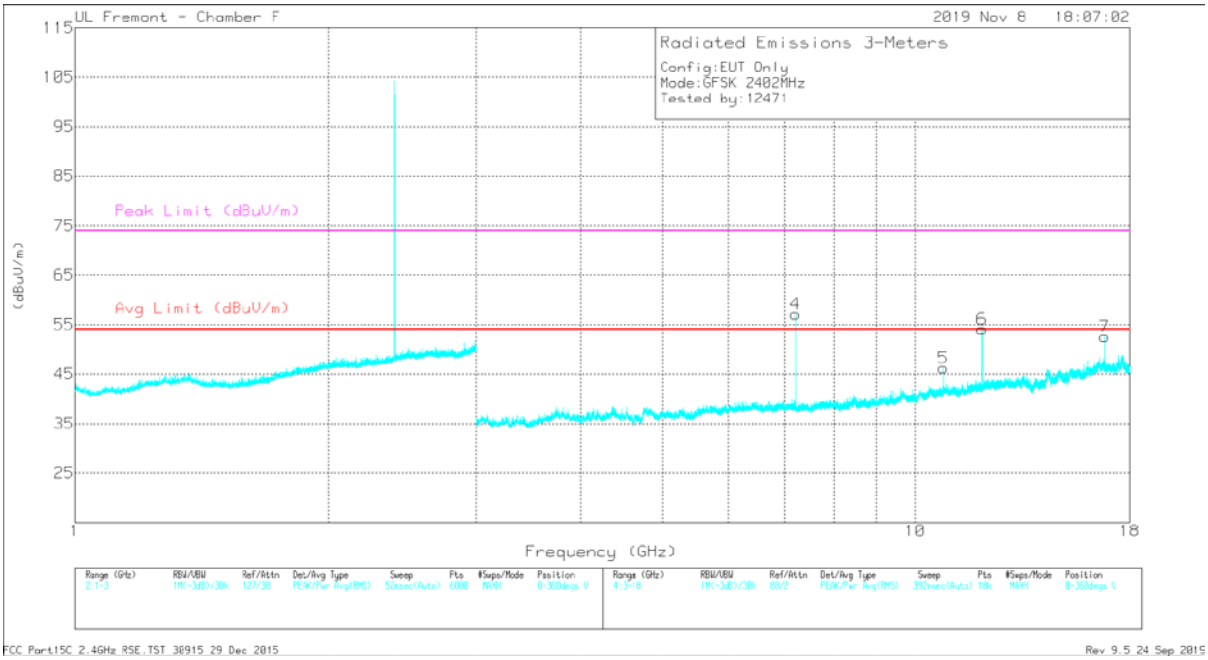
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	7.20542	67.03	PKFH	35.5	-41	61.53	74	-12.47	157	100	H
2	* 10.8084	55.32	PKFH	38	-39	54.32	74	-19.68	225	207	H
3	* 12.00922	55.49	PKFH	38.8	-39.2	55.09	74	-18.91	275	100	H
4	7.20558	63.26	PKFH	35.5	-41	57.76	74	-16.24	309	289	V
5	* 10.80849	53.56	PKFH	38	-39	52.56	74	-21.44	77	221	V
6	* 12.01061	56.99	PKFH	38.8	-39.2	56.59	74	-17.41	0	100	V
7	16.81482	54.13	PKFH	41.8	-38.3	57.63	74	-16.37	2	106	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RBW=1MHz VBW=3 x RBW, Peak

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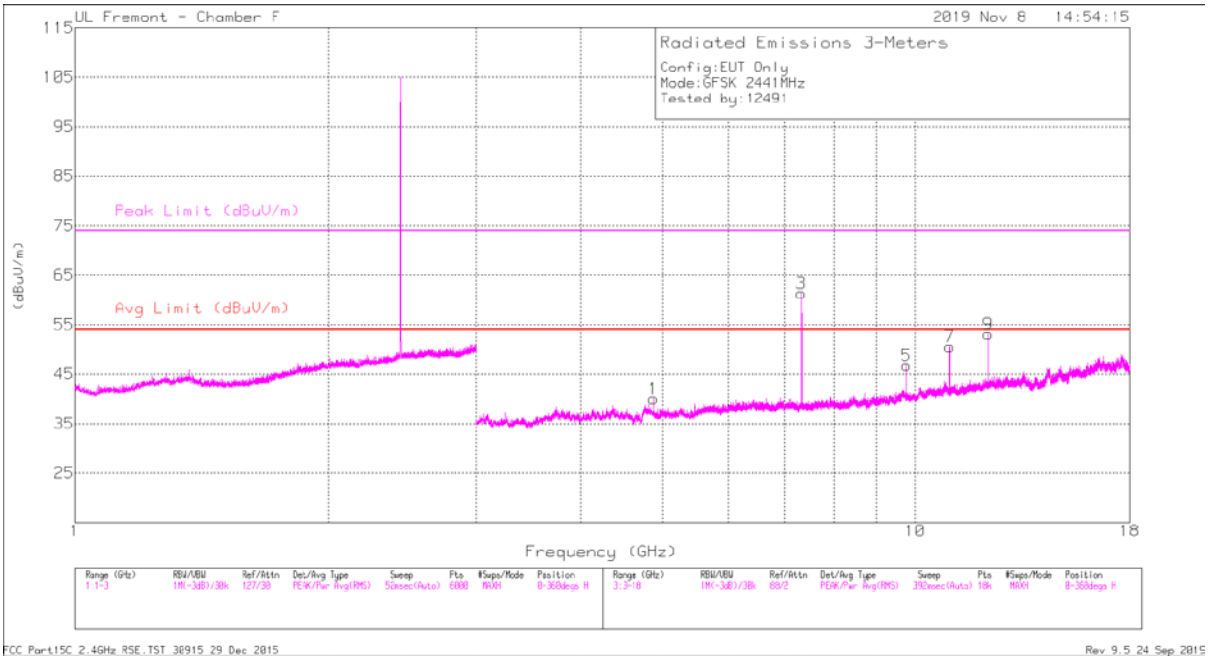
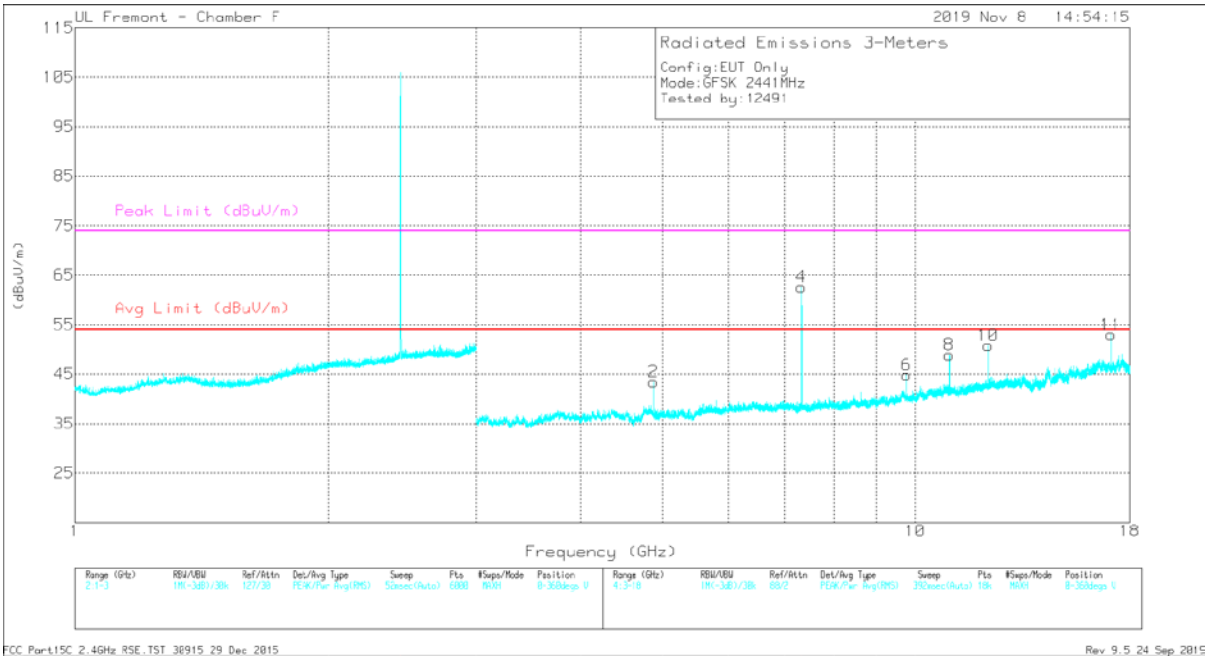
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88226	54.64	PKFH	34	-43.4	45.24	74	-28.76	250	243	H
3	* 7.32358	66.66	PKFH	35.6	-40.4	61.86	74	-12.14	263	104	H
5	9.76423	53.57	PKFH	37	-39.9	50.67	74	-20.33	113	121	H
7	* 10.98368	55.58	PKFH	37.9	-38.8	54.68	74	-19.32	78	162	H
9	* 12.20526	55.91	PKFH	39.1	-39.3	55.71	74	-18.29	42	103	H
2	* 4.88158	56.89	PKFH	34.1	-43.4	47.59	74	-26.41	261	106	V
4	* 7.32352	69.33	PKFH	35.6	-40.4	64.53	74	-9.47	147	101	V
6	9.76501	52.45	PKFH	36.9	-39.9	49.45	74	-24.55	136	101	V
8	* 10.98402	55.19	PKFH	37.9	-38.8	54.29	74	-19.71	120	224	V
10	* 12.20569	54.91	PKFH	39.1	-39.3	54.71	74	-19.29	233	103	V
11	17.08579	55.79	PKFH	41.3	-38.2	58.89	74	-15.11	217	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RBW=1MHz VBW=3 x RBW, Peak

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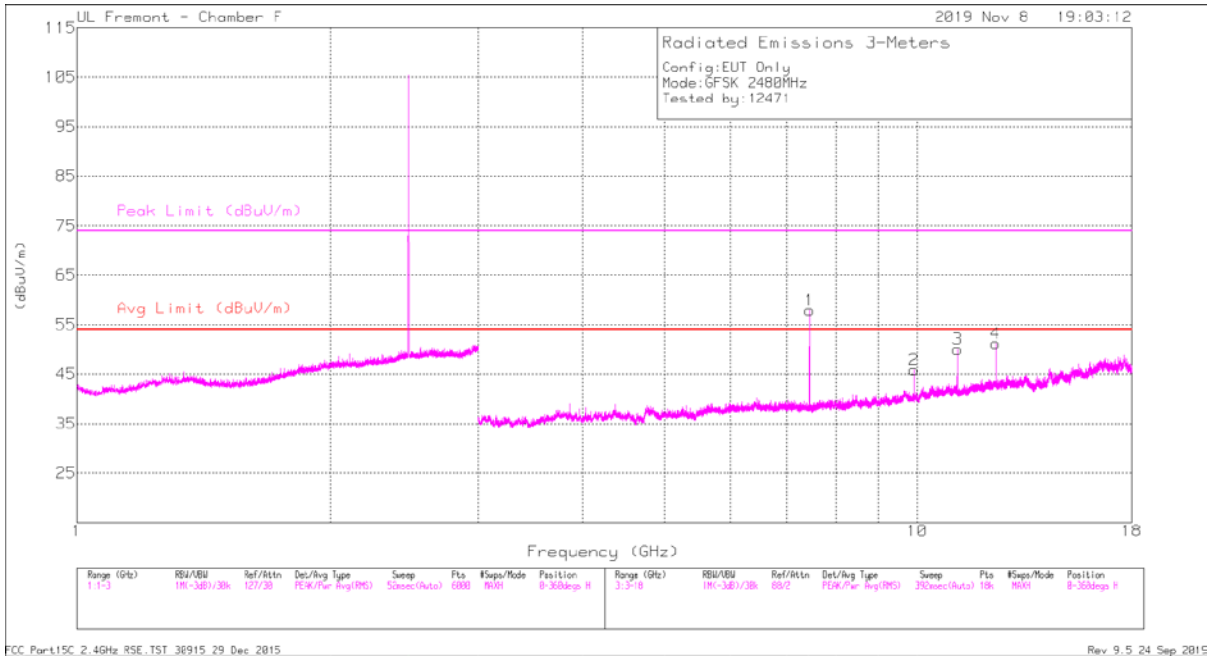
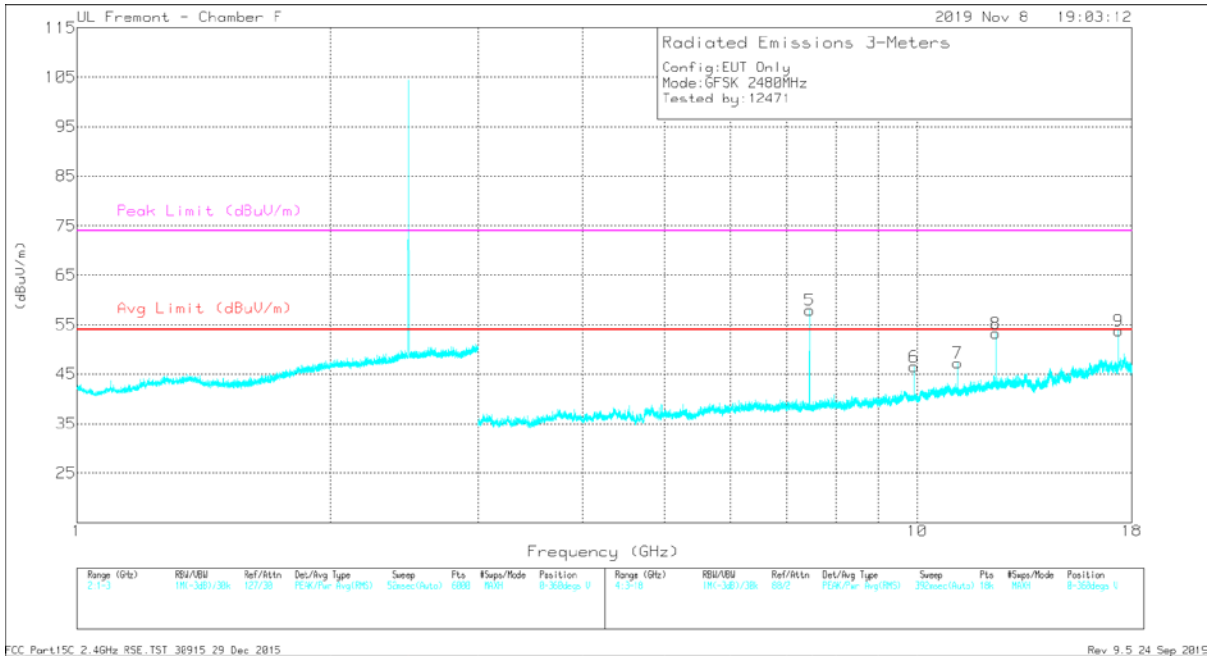
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 7.43957	65.43	PKFH	35.7	-40.7	60.43	74	-13.57	159	108	H
2	9.91938	54.83	PKFH	36.9	-39.9	51.83	74	-22.17	229	352	H
3	* 11.15933	55.57	PKFH	38	-38.5	55.07	74	-18.93	272	101	H
4	* 12.40075	54.94	PKFH	39.1	-39.1	54.94	74	-19.06	277	101	H
5	* 7.44039	64.34	PKFH	35.6	-40.7	59.24	74	-14.76	357	106	V
6	9.91934	53.88	PKFH	36.9	-39.9	50.88	74	-23.12	76	211	V
7	* 11.16045	53.21	PKFH	38	-38.6	52.61	74	-21.39	285	312	V
8	* 12.39907	57.08	PKFH	39.1	-39.1	57.08	74	-16.92	2	100	V
9	17.35895	54.88	PKFH	41.4	-37.7	58.58	74	-15.42	8	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RBW=1MHz VBW=3 x RBW, Peak

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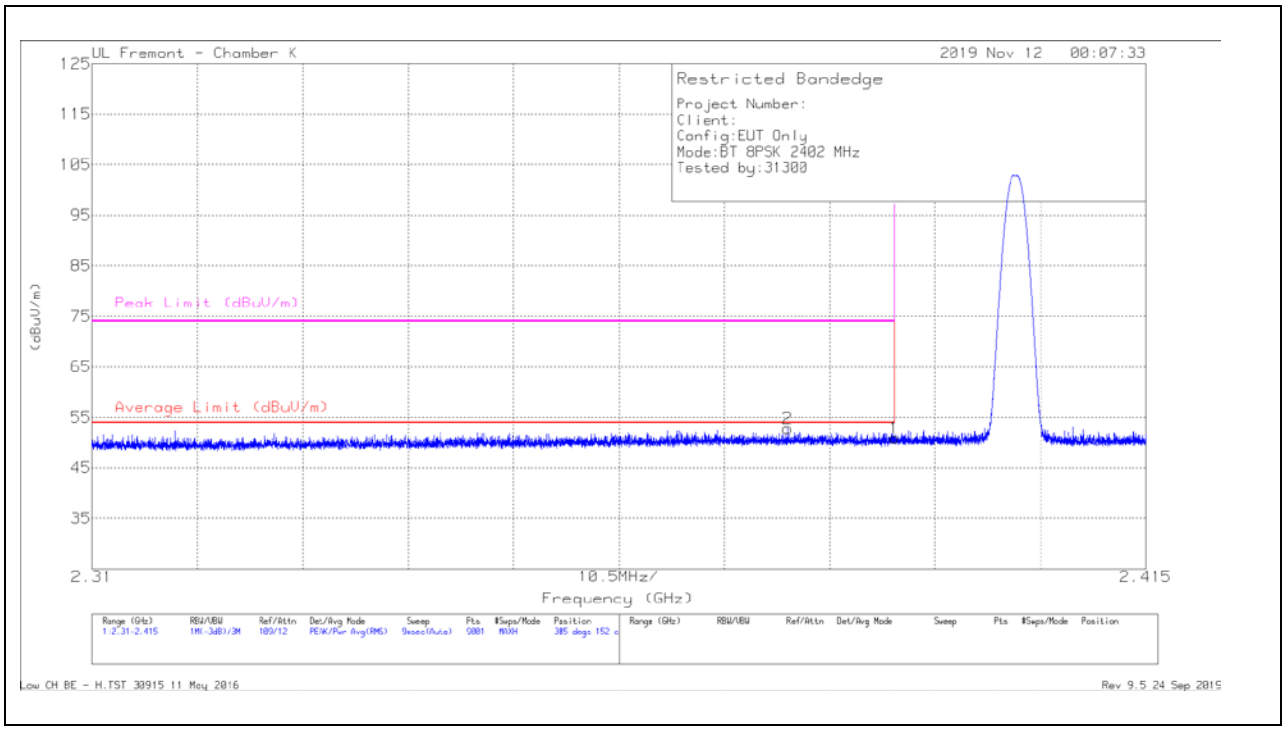
9.1.2. BLUETOOTH BASIC DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	33.13	Pk	31.9	-14.1	50.93	74	-23.07	305	152	H
2	* 2.37931	35.02	Pk	31.9	-14.1	52.82	74	-21.18	305	152	H

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

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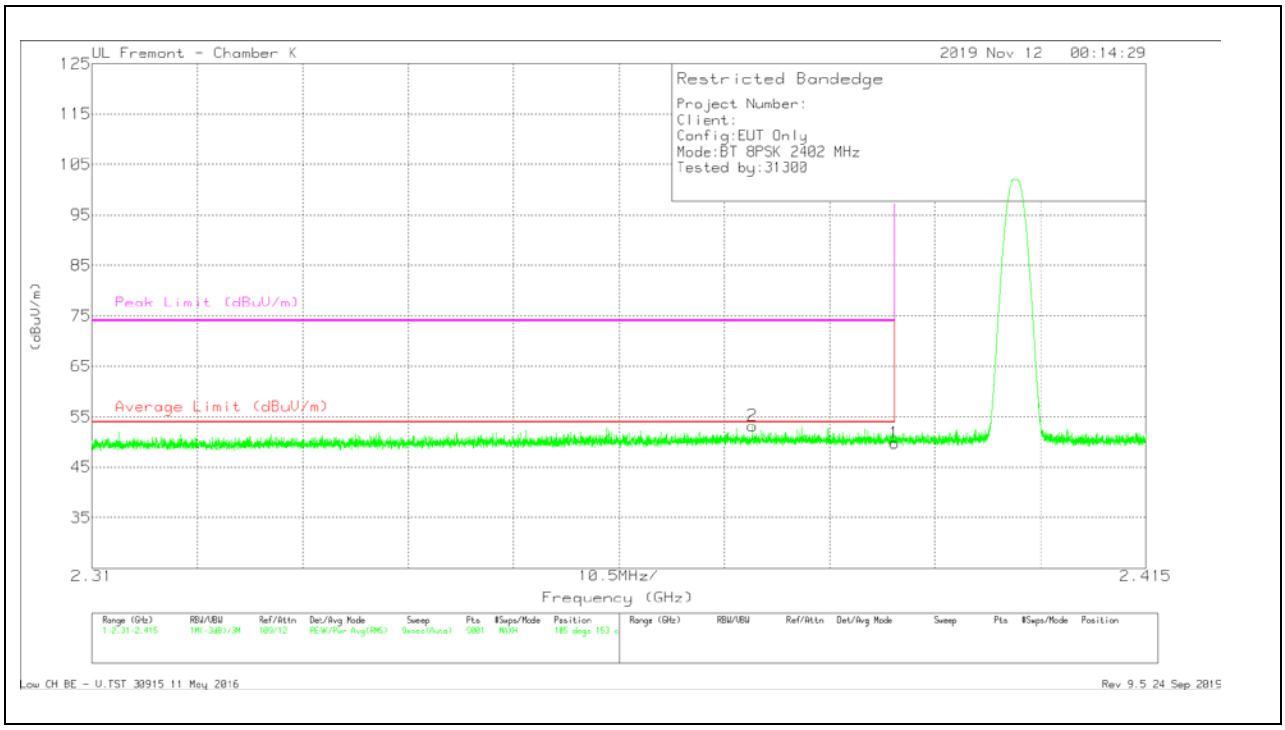
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	32.05	Pk	31.9	-14.1	49.85	74	-24.15	105	153	V
2	* 2.37581	35.51	Pk	31.9	-14.2	53.21	74	-20.79	105	153	V

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

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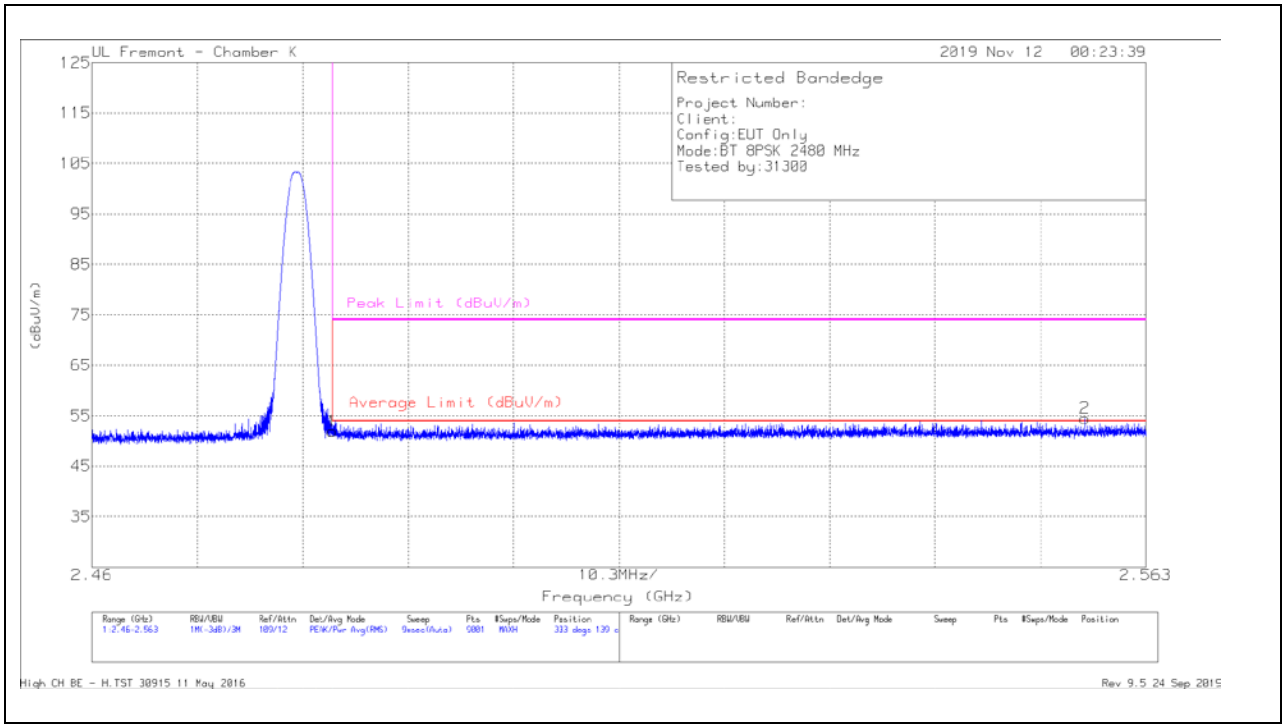
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	33.5	Pk	32.5	-14.1	51.9	74	-22.1	333	139	H
2	2.55707	35.95	Pk	32.4	-13.8	54.55	74	-19.45	333	139	H

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

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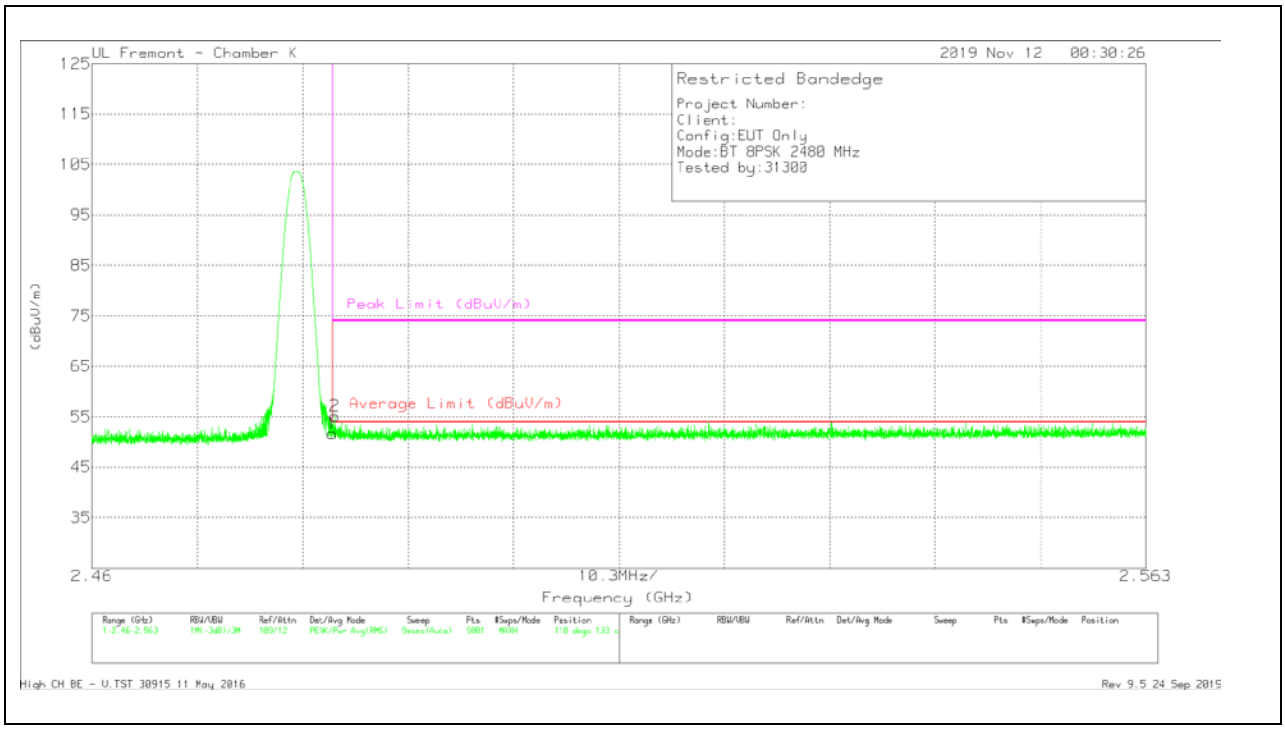
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/ Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	33.24	Pk	32.5	-14.1	51.64	74	-22.36	110	133	V
2	* 2.48373	36.73	Pk	32.5	-14.1	55.13	74	-18.87	110	133	V

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

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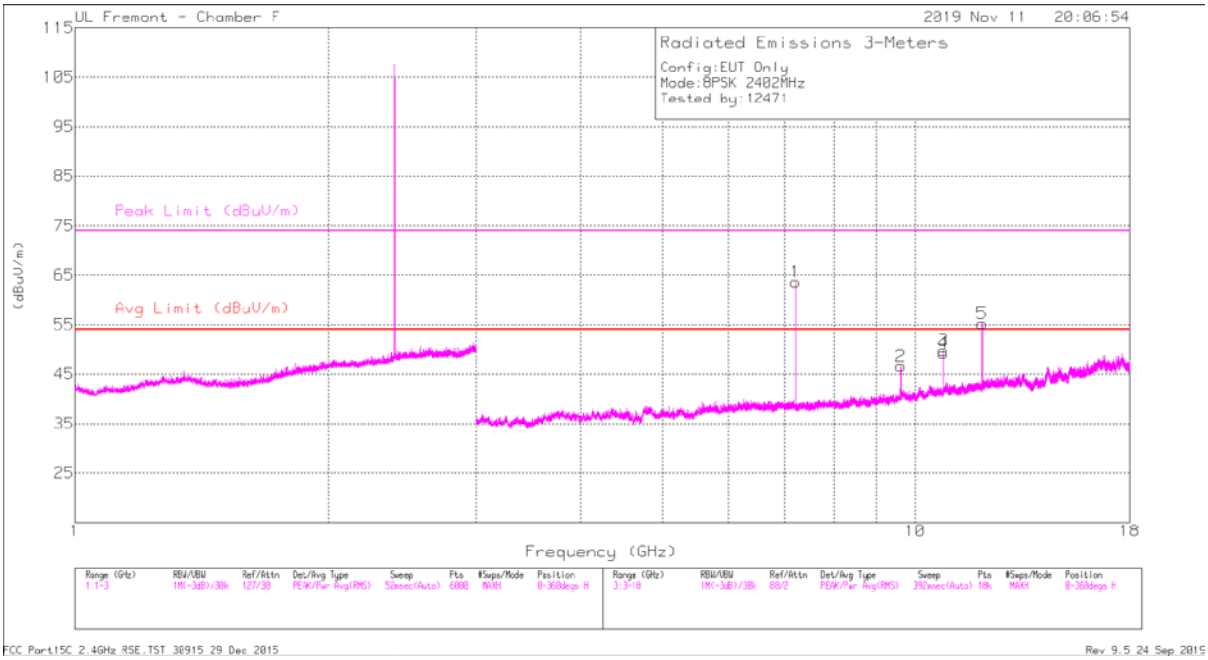
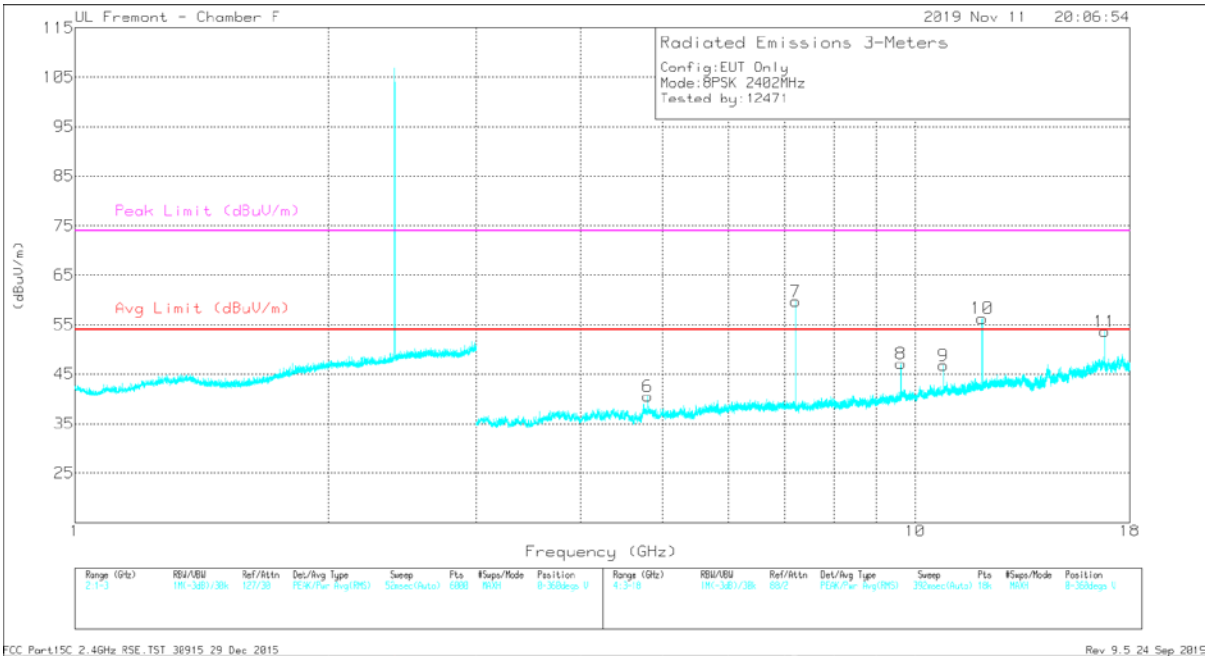
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	7.2065	70.5	PKFH	35.5	-41	65	74	-9.00	343	102	H
2	9.60845	53.04	PKFH	36.8	-39.8	50.04	74	-23.96	238	393	H
3	* 10.79834	51.24	PKFH	38	-39	50.24	74	-23.76	19	121	H
4	* 10.80974	55.12	PKFH	38	-39	54.12	74	-19.88	22	116	H
5	* 12.01077	58.77	PKFH	38.8	-39.3	58.27	74	-15.73	87	100	H
6	* 4.80441	55.29	PKFH	34.2	-44.3	45.19	74	-28.81	260	114	V
7	7.20656	66.88	PKFH	35.5	-41	61.38	74	-12.62	170	105	V
8	9.60777	52.27	PKFH	36.8	-39.8	49.27	74	-24.73	266	248	V
9	* 10.80895	53.79	PKFH	38	-38.9	52.89	74	-21.11	294	113	V
10	* 12.00913	59.47	PKFH	38.8	-39.2	59.07	74	-14.93	170	101	V
11	16.81303	55.51	PKFH	41.9	-38.3	59.11	74	-14.89	185	112	V

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

PKFH FHSS/BT RB=100k for Frequencies<1GHz / RBW=1MHz for Frequencies>1GHz, VBW=3 x RB, Peak

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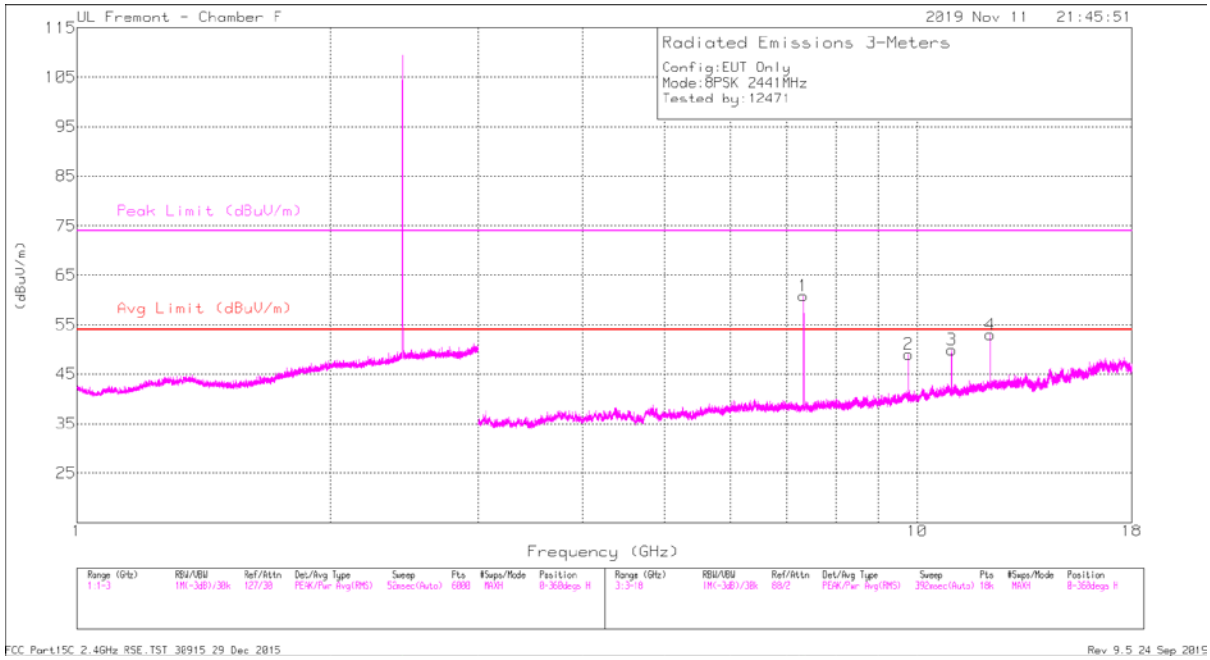
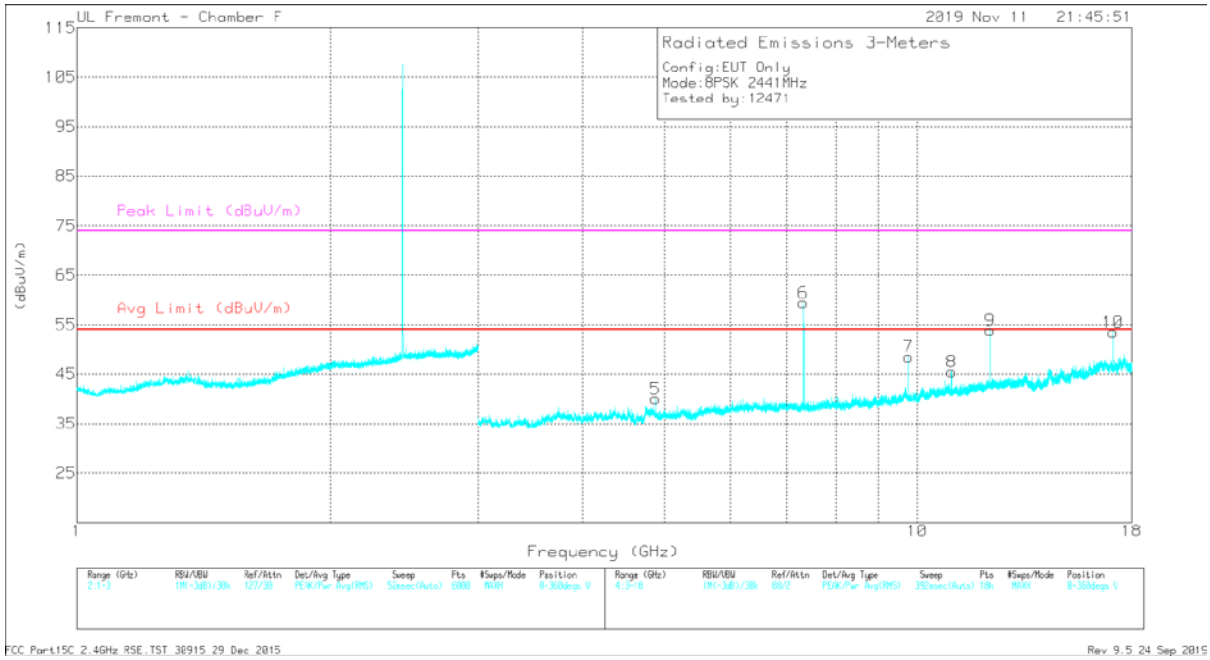
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 7.32256	67.47	PKFH	35.6	-40.3	62.77	74	-11.23	226	100	H
2	9.76293	56.2	PKFH	36.9	-39.9	53.20	74	-20.80	41	347	H
3	* 10.98498	55.09	PKFH	37.9	-38.8	54.19	74	-19.81	31	107	H
4	* 12.20565	58.16	PKFH	39.1	-39.3	57.96	74	-16.04	100	100	H
5	* 4.88228	53.97	PKFH	34	-43.4	44.57	74	-29.43	335	230	V
6	* 7.32349	65.91	PKFH	35.6	-40.4	61.11	74	-12.89	169	109	V
7	9.76424	55.68	PKFH	37	-39.9	52.78	74	-21.22	254	205	V
8	* 10.98454	52.42	PKFH	37.9	-38.8	51.52	74	-22.48	298	104	V
9	* 12.2058	58.83	PKFH	39.1	-39.3	58.63	74	-15.37	173	111	V
10	17.08572	55.07	PKFH	41.3	-38.2	58.17	74	-15.83	179	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RBW=1MHz for Frequencies>1GHz, VBW=3 x RB, Peak

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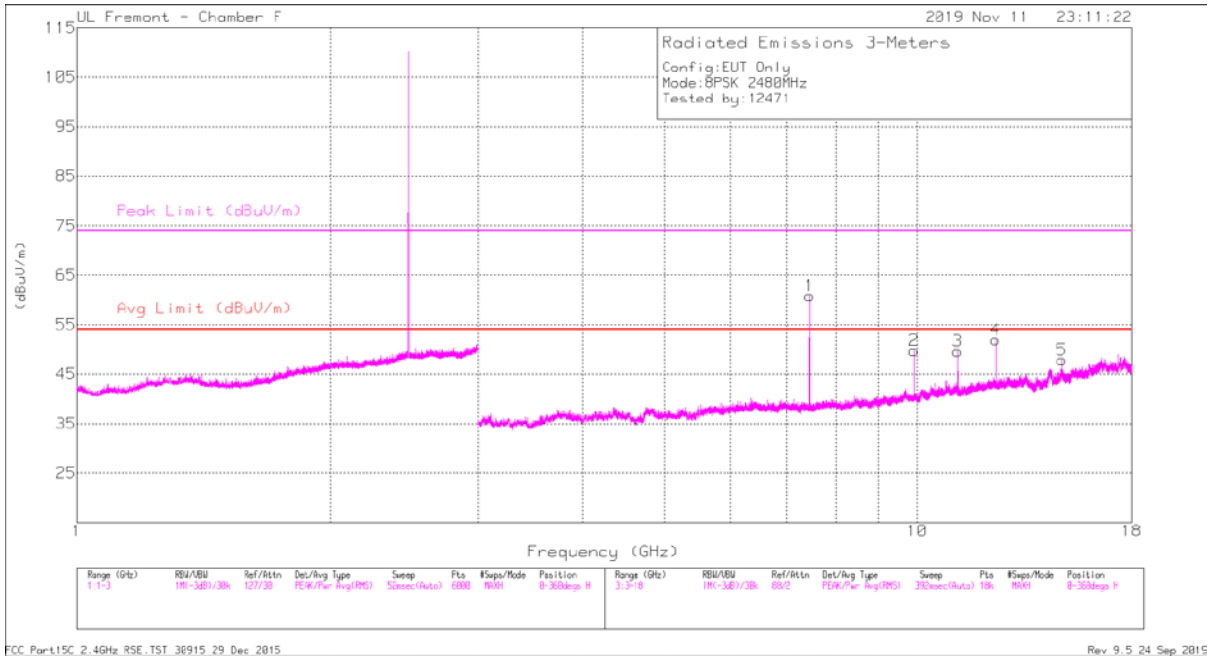
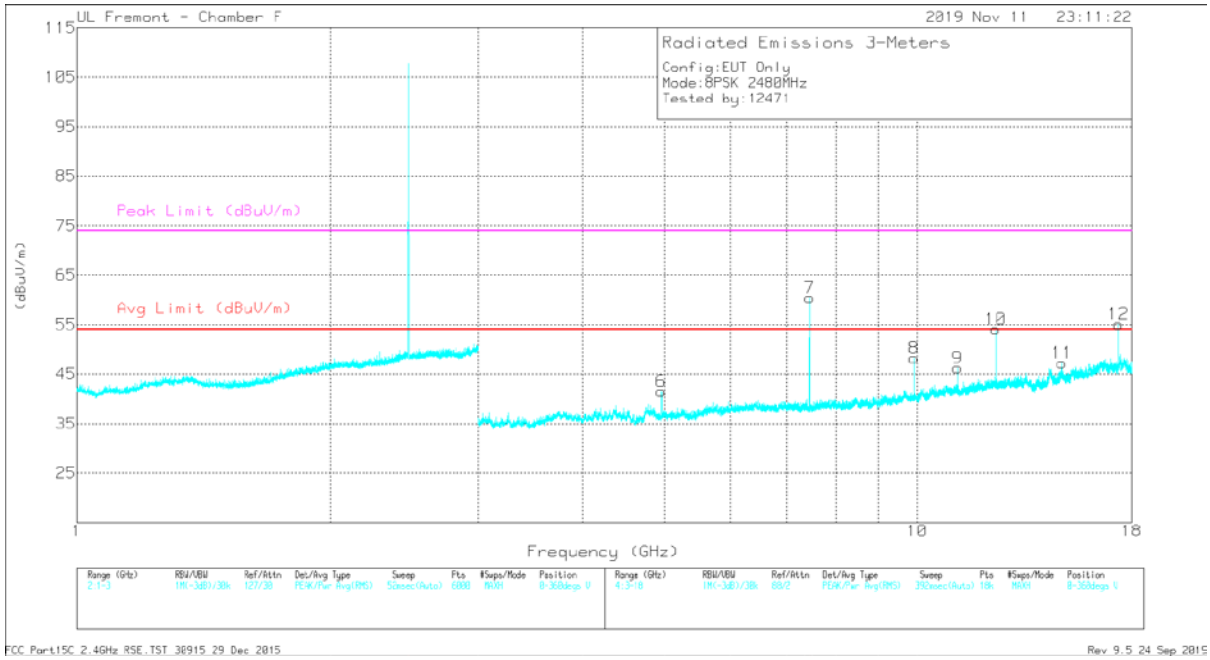
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 7.43948	67.64	PKFH	35.7	-40.7	62.64	74	-11.36	342	101	H
2	9.92081	56.95	PKFH	36.9	-39.9	53.95	74	-20.05	79	117	H
3	* 11.15917	54.42	PKFH	38	-38.6	53.82	74	-20.18	26	113	H
4	* 12.40071	56.75	PKFH	39.1	-39.1	56.75	74	-17.25	102	101	H
5	14.88022	52.35	PKFH	39.7	-37.6	54.45	74	-19.55	324	104	H
6	* 4.96003	54.17	PKFH	34.1	-43.9	44.37	74	-29.63	246	107	V
7	* 7.44028	65.51	PKFH	35.6	-40.7	60.41	74	-13.59	170	100	V
8	9.91907	55.41	PKFH	36.9	-39.9	52.41	74	-21.59	242	119	V
9	* 11.15908	52.4	PKFH	38	-38.6	51.80	74	-22.2	302	108	V
10	* 12.40083	58.21	PKFH	39.1	-39.1	58.21	74	-15.79	173	105	V
11	14.88035	51.82	PKFH	39.7	-37.7	53.82	74	-20.18	181	100	V
12	17.36103	56.24	PKFH	41.3	-37.7	59.84	74	-14.16	175	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RBW=1MHz for Frequencies>1GHz, VBW=3 x RB, Peak

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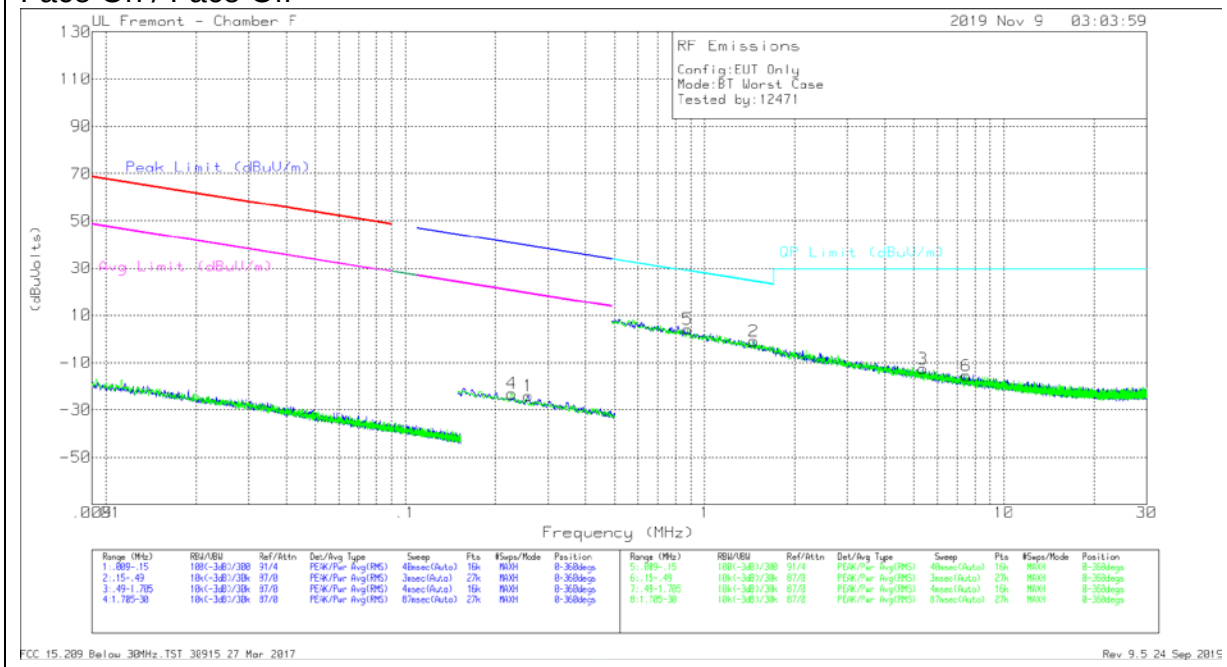
9.2. WORST CASE BELOW 30MHZ

Face On / Face Off



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.25735	44.68	Pk	11.2	.1	-80	-24.02	39.4	-63.42	19.4	-43.42	0-360
4	.22701	45.64	Pk	11.3	.1	-80	-22.96	40.5	-63.46	20.5	-43.46	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	1.45835	28.19	Pk	10.8	.1	-40	-.91	24.35	-25.26	0-360
3	5.36042	16.3	Pk	10.8	.3	-40	-12.6	29.5	-42.1	0-360
5	.88045	33.13	Pk	10.8	.1	-40	4.03	28.72	-24.69	0-360
6	7.47581	13.41	Pk	10.7	.3	-40	-15.59	29.5	-45.09	0-360

Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 27 Mar 2017
Rev 9.5 24 Sep 2019

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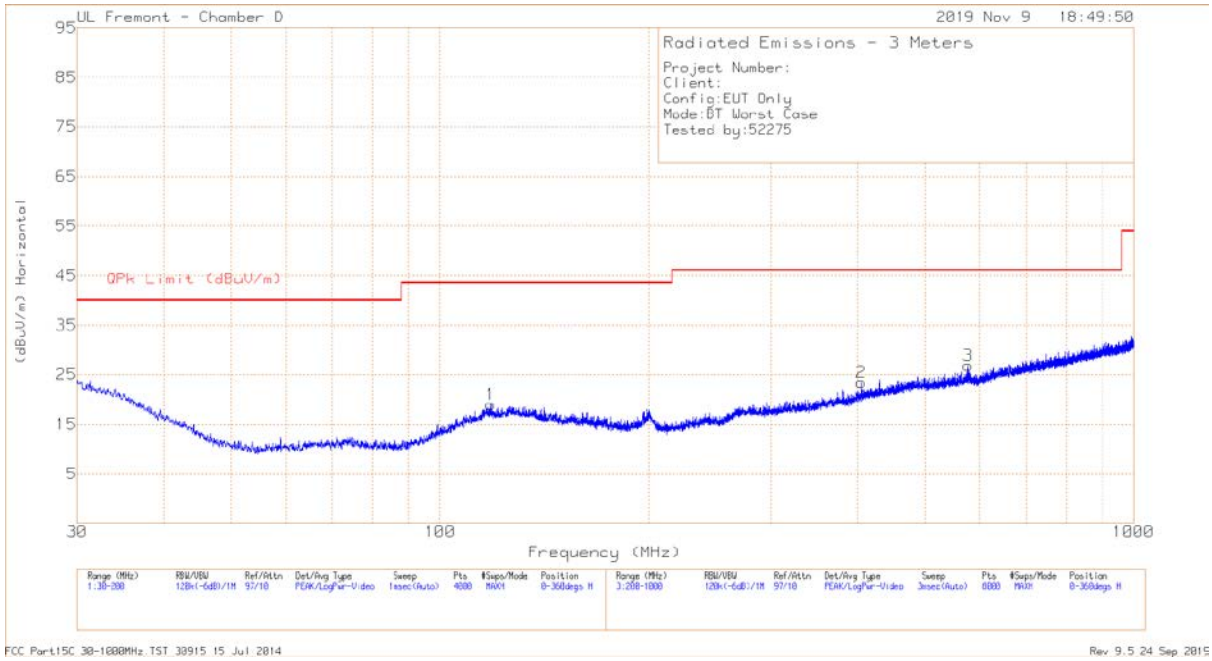
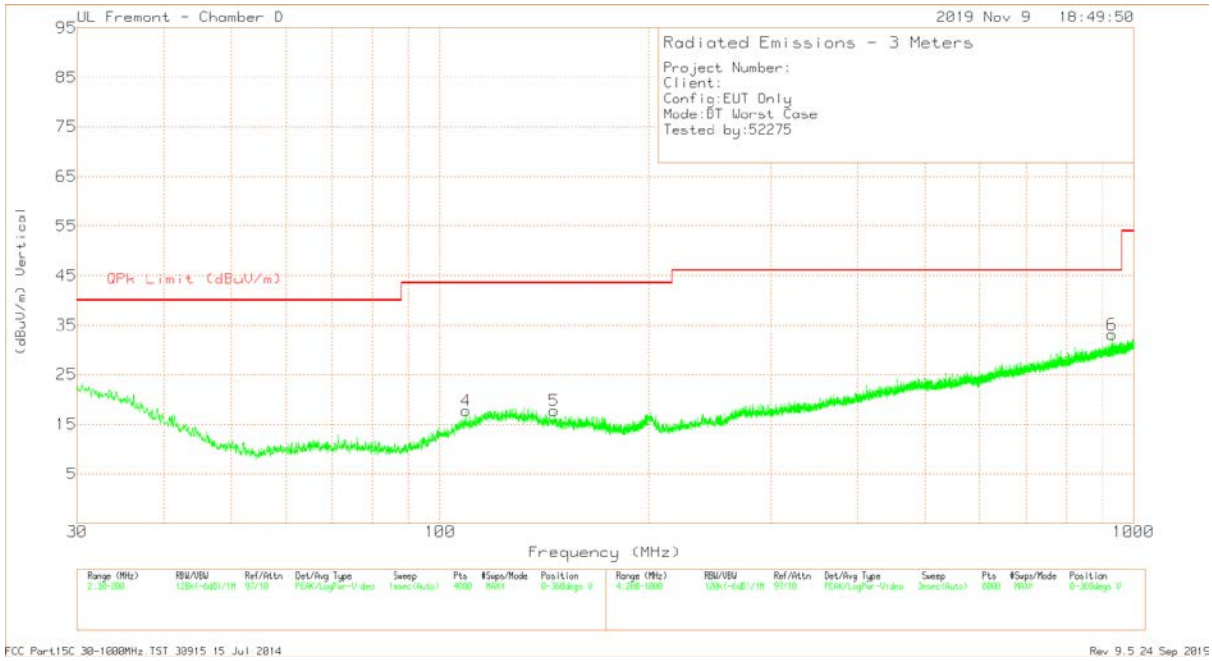
9.3. WORST CASE BELOW 1 GHZ



HORIZONTAL



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Below 1GHz Data

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
* 118.3351	21.57	Qp	19.6	-30.8	10.37	43.52	-33.15	298	195	H
* 109.0005	21.59	Qp	18.3	-30.9	8.99	43.52	-34.53	98	191	V
146.4072	21.34	Qp	18.5	-30.6	9.24	43.52	-34.28	195	350	V
* 405.4749	26.74	Qp	21.7	-29.1	19.34	46.02	-26.68	134	245	H
577.5025	24.6	Qp	24.6	-28.4	20.8	46.02	-25.22	8	191	H
932.0189	19.47	Qp	28.5	-26.4	21.57	46.02	-24.45	257	187	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Qp - Quasi-Peak detector

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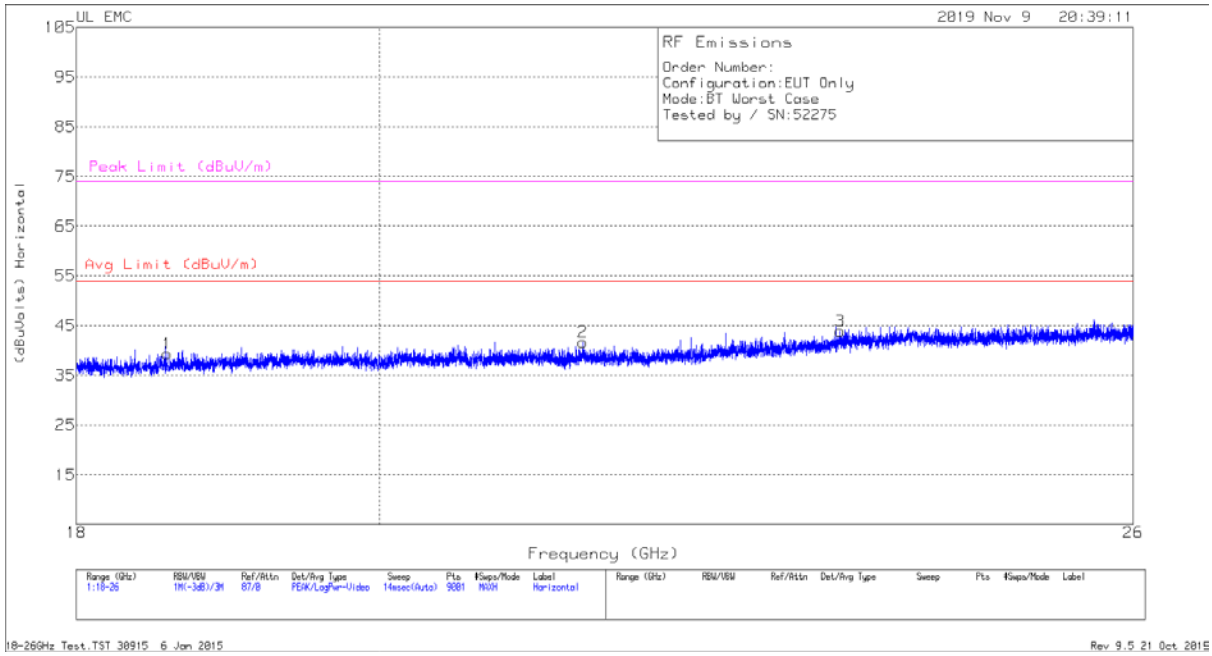
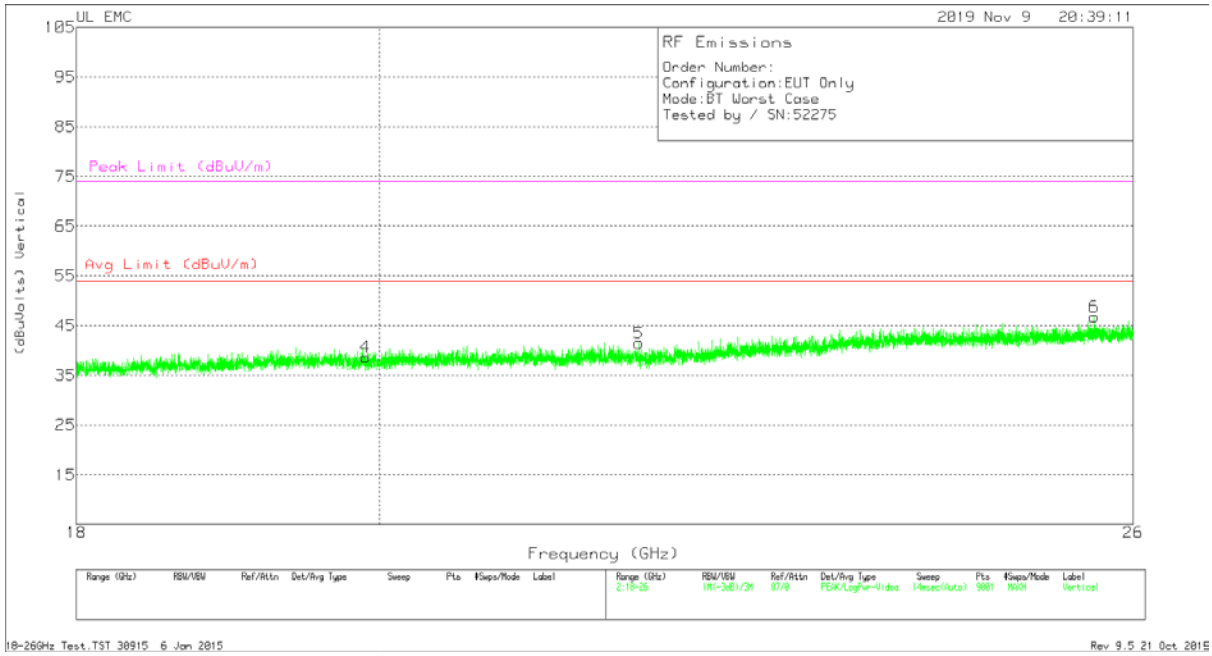
9.4. WORST CASE 18-26 GHZ



HORIZONTAL



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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 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	18.57778	38.25	Pk	32.4	-21.8	-9.5	39.35	54	-14.65	74	-34.65
2	21.46844	39.06	Pk	33.1	-21	-9.5	41.66	54	-12.34	74	-32.34
3	23.47733	39.31	Pk	34	-19.9	-9.5	43.91	54	-10.09	74	-30.09
4	19.90489	36.95	Pk	32.7	-21.5	-9.5	38.65	54	-15.35	74	-35.35
5	21.89067	38.68	Pk	33.2	-20.9	-9.5	41.48	54	-12.52	74	-32.52
6	25.648	41.95	Pk	34.4	-20.1	-9.5	46.75	54	-7.25	74	-27.25

Pk - 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

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 NEUTRAL and HOT lines.

RESULTS

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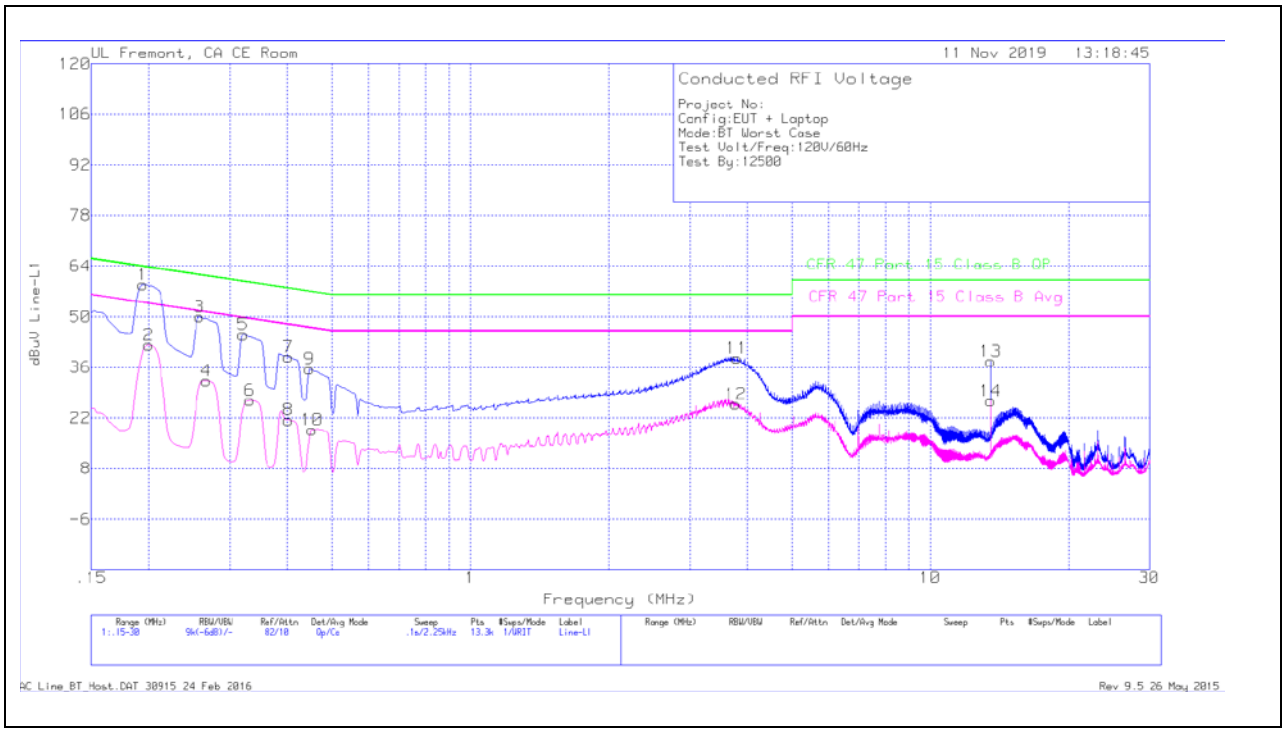
10.1. AC Power Line Host

LINE 1 RESULTS



DATA

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.19388	48.73	Qp	0	0	10.1	58.83	63.87	-5.04	-	-
2	.1995	32	Ca	0	0	10.1	42.1	-	-	53.63	-11.53
3	.258	39.86	Qp	0	0	10.1	49.96	61.5	-11.54	-	-
4	.267	22.24	Ca	0	0	10.1	32.34	-	-	51.21	-18.87
5	.321	34.95	Qp	0	0	10.1	45.05	59.68	-14.63	-	-
6	.33225	16.73	Ca	0	0	10.1	26.83	-	-	49.39	-22.56
7	.402	28.84	Qp	0	0	10.1	38.94	57.81	-18.87	-	-
8	.402	11.31	Ca	0	0	10.1	21.41	-	-	47.81	-26.4
9	.447	25.41	Qp	0	0	10.1	35.51	56.93	-21.42	-	-
10	.45375	8.68	Ca	0	0	10.1	18.78	-	-	46.81	-28.03
11	3.804	28.31	Qp	0	.1	10.1	38.51	56	-17.49	-	-
12	3.7815	15.66	Ca	0	.1	10.1	25.86	-	-	46	-20.14
13	13.56	27.15	Qp	.1	.2	10.2	37.65	60	-22.35	-	-
14	13.56	16.2	Ca	.1	.2	10.2	26.7	-	-	50	-23.3

Qp - Quasi-Peak detector
Ca - CISPR average detection

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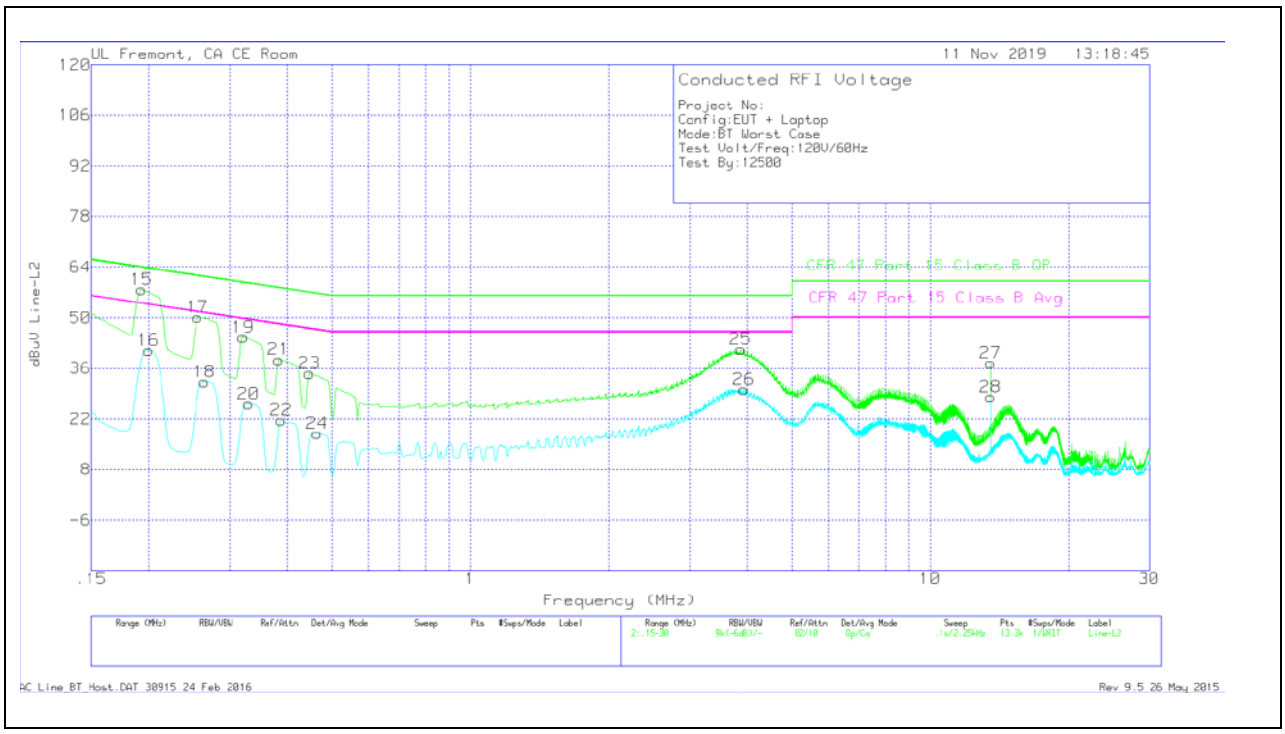
LINE 2 RESULTS



DATA

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
15	.19275	47.65	Qp	0	0	10.1	57.75	63.92	-6.17	-	-
16	.1995	30.94	Ca	0	0	10.1	41.04	-	-	53.63	-12.59
17	.25575	40.15	Qp	0	0	10.1	50.25	61.57	-11.32	-	-
18	.26475	22.23	Ca	0	0	10.1	32.33	-	-	51.28	-18.95
19	.321	34.55	Qp	0	0	10.1	44.65	59.68	-15.03	-	-
20	.33	16.16	Ca	0	0	10.1	26.26	-	-	49.45	-23.19
21	.384	28.34	Qp	0	0	10.1	38.44	58.19	-19.75	-	-
22	.3885	11.53	Ca	0	0	10.1	21.63	-	-	48.1	-26.47
23	.447	24.52	Qp	0	0	10.1	34.62	56.93	-22.31	-	-
24	.465	7.87	Ca	0	0	10.1	17.97	-	-	46.6	-28.63
25	3.87375	31.1	Qp	0	.1	10.1	41.3	56	-14.7	-	-
26	3.9435	19.98	Ca	0	.1	10.1	30.18	-	-	46	-15.82
27	13.56	27.04	Qp	.1	.2	10.2	37.54	60	-22.46	-	-
28	13.56	17.61	Ca	.1	.2	10.2	28.11	-	-	50	-21.89

Qp - Quasi-Peak detector
Ca - CISPR average detection

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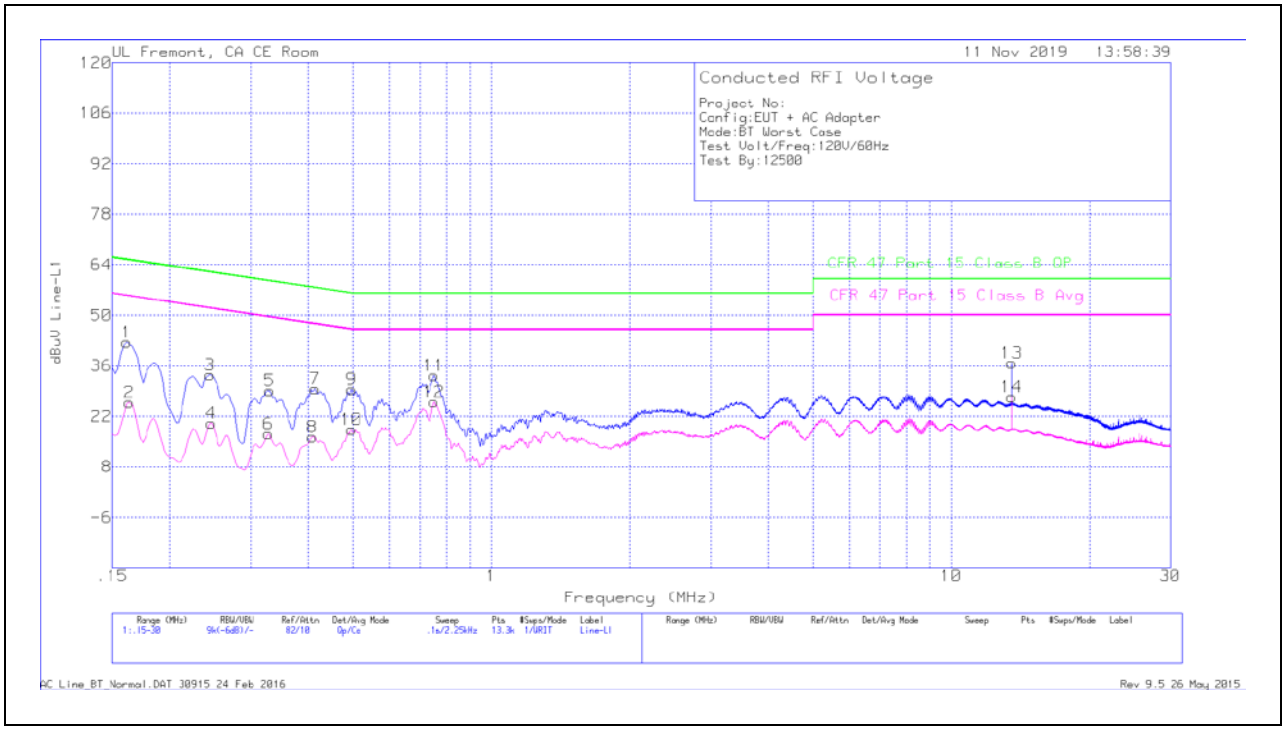
10.2. AC Power Line Norm

LINE 1 RESULTS



DATA

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.16125	32.39	Qp	.1	0	10.1	42.59	65.4	-22.81	-	-
2	.1635	15.71	Ca	.1	0	10.1	25.91	-	-	55.28	-29.37
3	.2445	23.31	Qp	0	0	10.1	33.41	61.94	-28.53	-	-
4	.24563	10.01	Ca	0	0	10.1	20.11	-	-	51.9	-31.79
5	.33	19.05	Qp	0	0	10.1	29.15	59.45	-30.3	-	-
6	.32775	7.11	Ca	0	0	10.1	17.21	-	-	49.51	-32.3
7	.41325	19.52	Qp	0	0	10.1	29.62	57.58	-27.96	-	-
8	.40875	6.2	Ca	0	0	10.1	16.3	-	-	47.67	-31.37
9	.4965	19.33	Qp	0	0	10.1	29.43	56.06	-26.63	-	-
10	.4965	8.22	Ca	0	0	10.1	18.32	-	-	46.06	-27.74
11	.75075	23.2	Qp	0	0	10.1	33.3	56	-22.7	-	-
12	.75075	15.84	Ca	0	0	10.1	25.94	-	-	46	-20.06
13	13.56	26.36	Qp	.1	.2	10.2	36.86	60	-23.14	-	-
14	13.56	16.88	Ca	.1	.2	10.2	27.38	-	-	50	-22.62

Qp - Quasi-Peak detector
Ca - CISPR average detection

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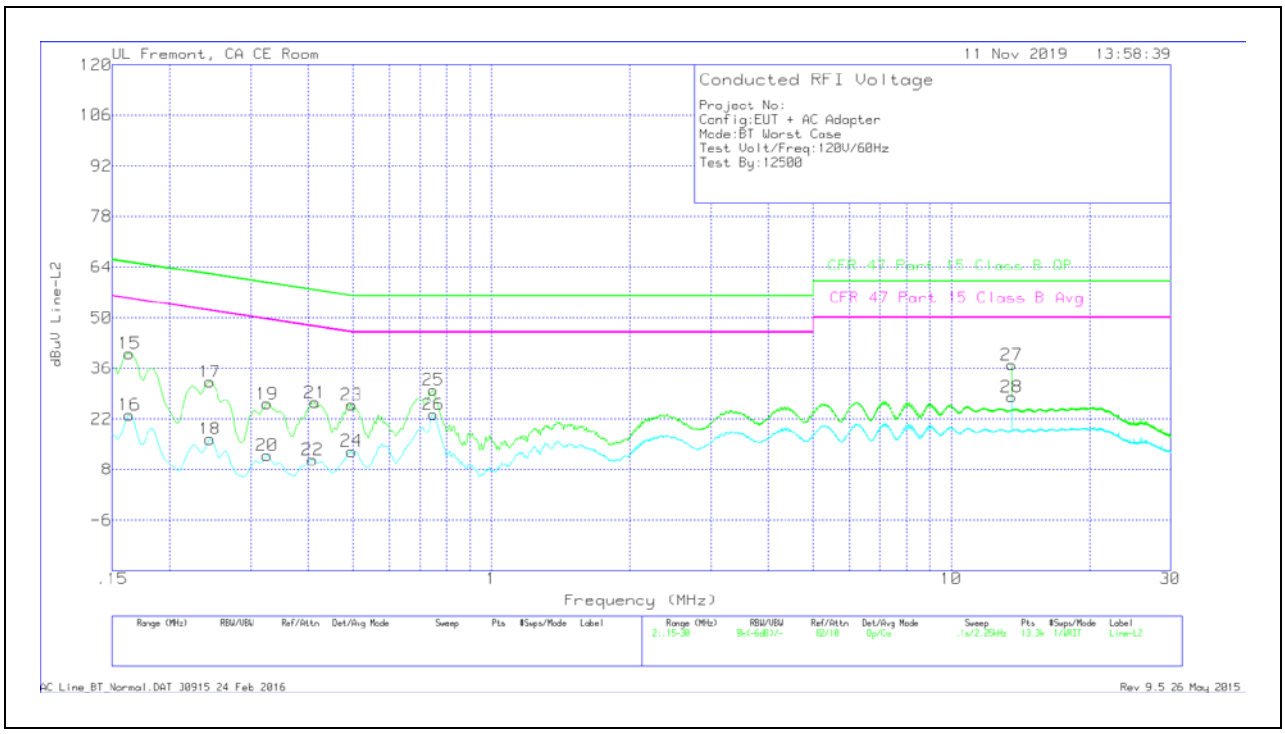
LINE 2 RESULTS



DATA

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
15	.1635	29.97	Qp	.1	0	10.1	40.17	65.28	-25.11	-	-
16	.1635	12.94	Ca	.1	0	10.1	23.14	-	-	55.28	-32.14
17	.2445	22.18	Qp	0	0	10.1	32.28	61.94	-29.66	-	-
18	.2445	6.27	Ca	0	0	10.1	16.37	-	-	51.94	-35.57
19	.3255	16.1	Qp	0	0	10.1	26.2	59.57	-33.37	-	-
20	.3255	1.79	Ca	0	0	10.1	11.89	-	-	49.57	-37.68
21	.41325	16.43	Qp	0	0	10.1	26.53	57.58	-31.05	-	-
22	.40875	.64	Ca	0	0	10.1	10.74	-	-	47.67	-36.93
23	.4965	15.82	Qp	0	0	10.1	25.92	56.06	-30.14	-	-
24	.4965	2.96	Ca	0	0	10.1	13.06	-	-	46.06	-33
25	.7485	19.86	Qp	0	0	10.1	29.96	56	-26.04	-	-
26	.7485	13.09	Ca	0	0	10.1	23.19	-	-	46	-22.81
27	13.56	26.4	Qp	.1	.2	10.2	36.9	60	-23.1	-	-
28	13.56	17.55	Ca	.1	.2	10.2	28.05	-	-	50	-21.95

Qp - Quasi-Peak detector
Ca - CISPR average detection

END OF TEST REPORT

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11. SETUP PHOTOS

Please refer to 12750204-EP1V1 for setup photos

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