



CERTIFICATION TEST REPORT

Report Number. : 12742033-E5V4

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

Model : A2048

FCC ID : BCGA2048

IC : 579C-A2048

EUT Description : RIGHT EARBUD

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:

April 17, 2019

Prepared by:

UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/10/2019	Initial Issue	Tony Li
V2	4/11/2019	Fixed FCC ID	Chin Pang
V3	4/16/2019	Addressed TCB Questions	Tony Li
V4	4/17/2019	Addressed TCB Questions	Chin Pang

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. SAMPLE CALCULATION	7
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. EUT DESCRIPTION	8
5.2. MAXIMUM OUTPUT POWER	8
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. SOFTWARE AND FIRMWARE	8
5.5. WORST-CASE CONFIGURATION AND MODE	8
5.6. DESCRIPTION OF TEST SETUP	9
6. TEST AND MEASUREMENT EQUIPMENT	16
7. MEASUREMENT METHODS	17
8. ANTENNA PORT TEST RESULTS	18
8.1. DUTY CYCLE	18
8.2. 20 dB AND 99% BANDWIDTH	19
8.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	20
8.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	21
8.3. HOPPING FREQUENCY SEPARATION	22
8.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	23
8.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	23
8.4. NUMBER OF HOPPING CHANNELS	24
8.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	25
8.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	27
8.5. AVERAGE TIME OF OCCUPANCY	29
8.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	30
8.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	32
8.6. OUTPUT POWER	34
8.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION	35
8.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	35

8.6.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	35
8.7.	AVERAGE POWER	36
8.7.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	37
8.7.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	37
8.7.3.	BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION	37
8.8.	CONDUCTED SPURIOUS EMISSIONS	38
8.8.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	39
8.8.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	41
9.	RADIATED TEST RESULTS	43
9.1.	TRANSMITTER ABOVE 1 GHz	45
9.1.1.	BLUETOOTH BASIC DATA RATE GFSK MODULATION	45
9.1.2.	BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION	55
9.2.	WORST CASE BELOW 1 GHZ	65
9.3.	WORST CASE 18-26 GHZ	67
10.	AC POWER LINE CONDUCTED EMISSIONS	69
10.1.1.	AC Power Line Host	70
10.1.2.	AC Power Line Norm	72
11.	SETUP PHOTOS	74

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: RIGHT EARBUD

MODEL: A2048

SERIAL NUMBER: CC2YC01YLYY5 (Conducted), CC2YC09HLYY5 (Radiated)

DATE TESTED: MARCH 22 – APRIL 4, 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
UL Verification Services Inc. By:



Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Tony Li
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 5, KDB558074 D01v05r02 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
<input type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input type="checkbox"/> Chamber I (ISED:2324A-5)
<input type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input type="checkbox"/> Chamber J (ISED:2324A-6)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input type="checkbox"/> Chamber F (ISED:22541-3)	<input type="checkbox"/> Chamber K (ISED:2324A-1)
	<input checked="" type="checkbox"/> Chamber G (ISED:22541-4)	<input type="checkbox"/> Chamber L (ISED:2324A-3)
	<input checked="" type="checkbox"/> Chamber H (ISED:22541-5)	

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

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:

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Final Voltage (dBuV)} &= \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \\ &\text{LISN Insertion Loss.} \\ 36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} &= 46.6 \text{ dBuV} \end{aligned}$$

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	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%.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

A2048 is a Bluetooth earbud for the right ear. It has an integral battery, microphone and antenna. It can charge via bottom contacts with charging case.

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	12.68	18.54
2402 - 2480	Enhanced DQPSK	12.01	15.89
2402 - 2480	Enhanced 8PSK	13.42	21.98

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

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	-4.90

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 1A610

5.5. WORST-CASE CONFIGURATION AND MODE

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

Radiated emissions below 30MHz, below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario. There were no emissions found below 30MHz within 20dB of the limit.

The fundamental of the Y(Landscape) orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation.

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

GFSK mode: DH5
8PSK mode: 3-DH5

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	Macbook Pro	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
Charger Case	Apple	A2078	CC2909500NDLYY13N	579C-A2078
10dB Fixed Attenuator	Pasternack	PE7087-10	Label ID: 178584	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	2	N/A
2	USB	1	Lightning	Shielded	1	N/A
3	Antenna	1	SMA	Un-Shielded	0.3	To spectrum Analyzer / Power Meter

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						

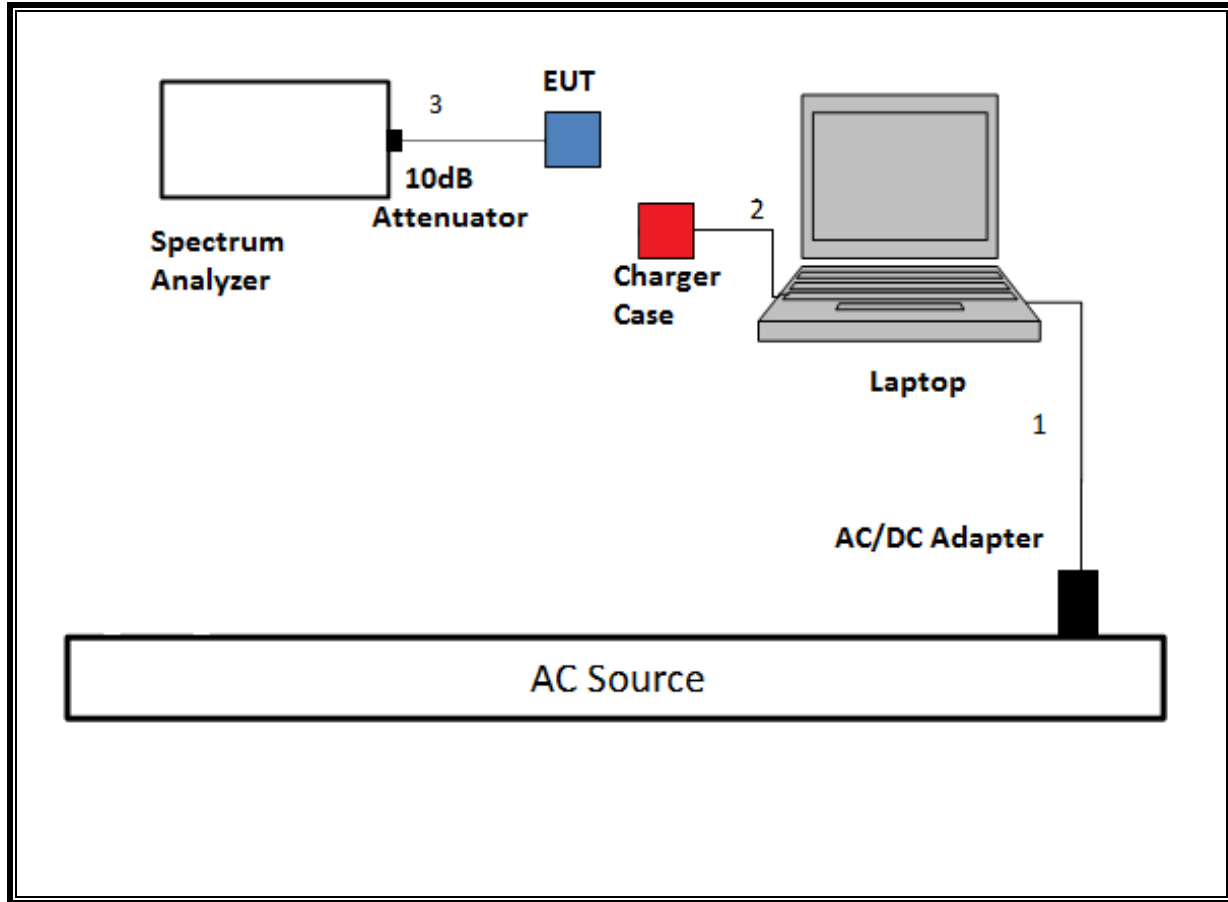
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

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

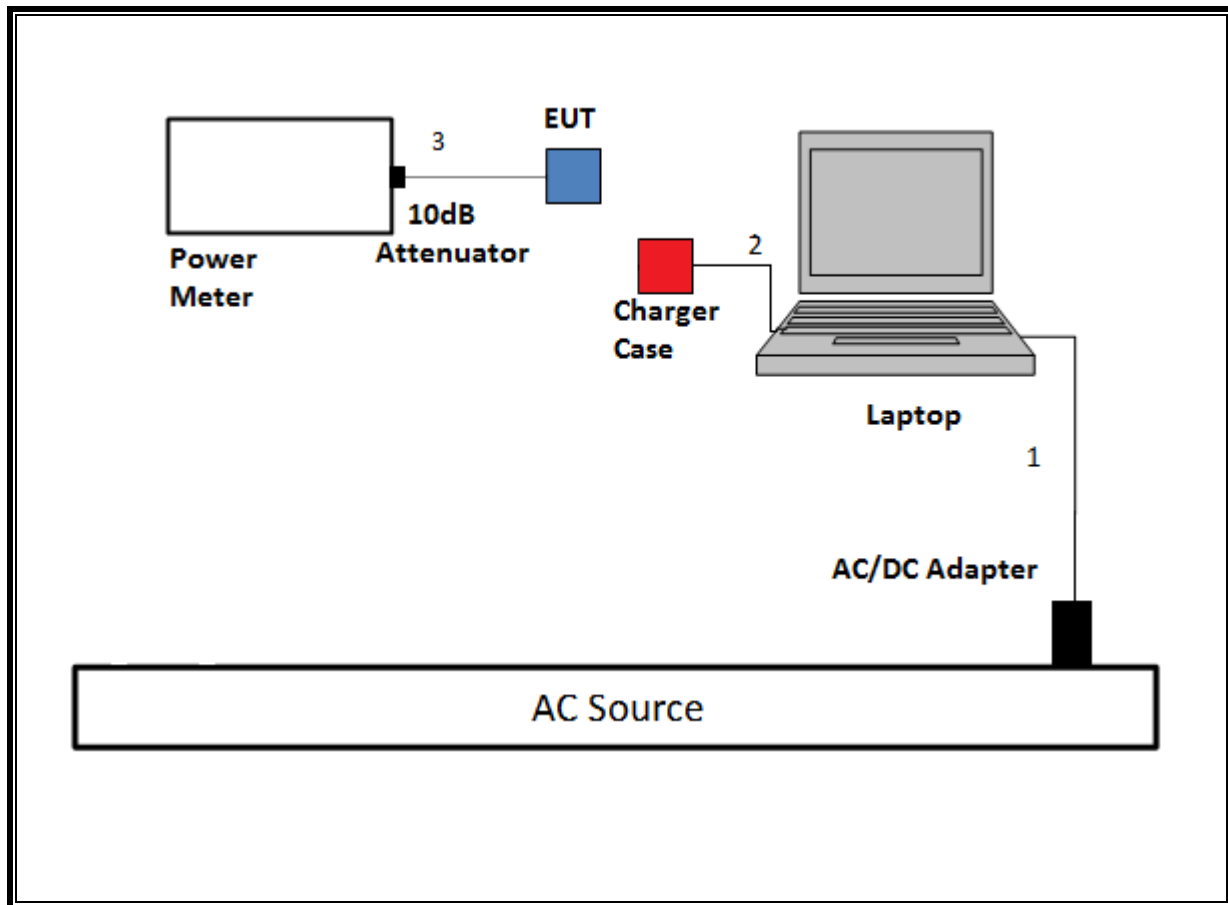
TEST SETUP

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

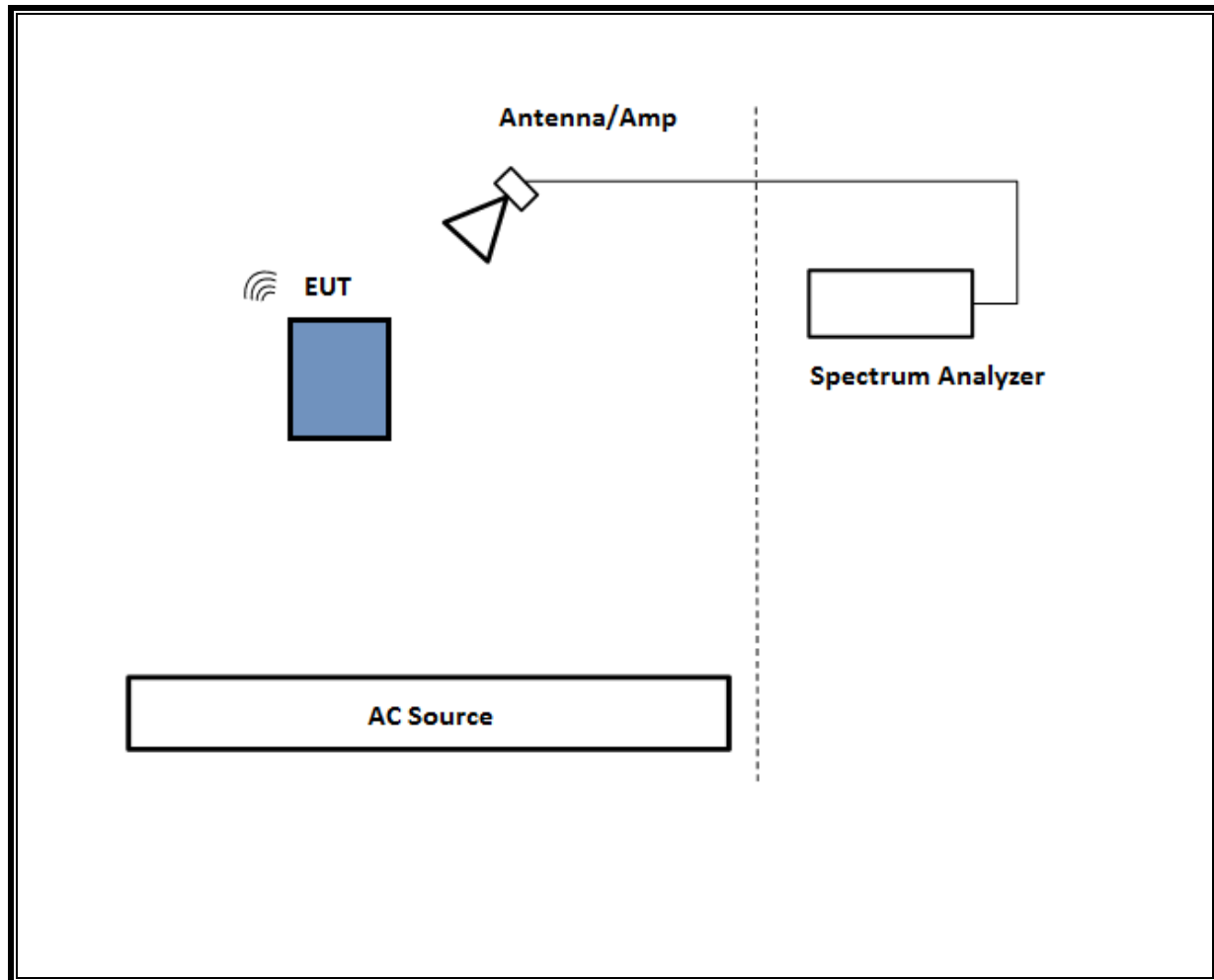
SETUP DIAGRAM FOR CONDUCTED TESTS



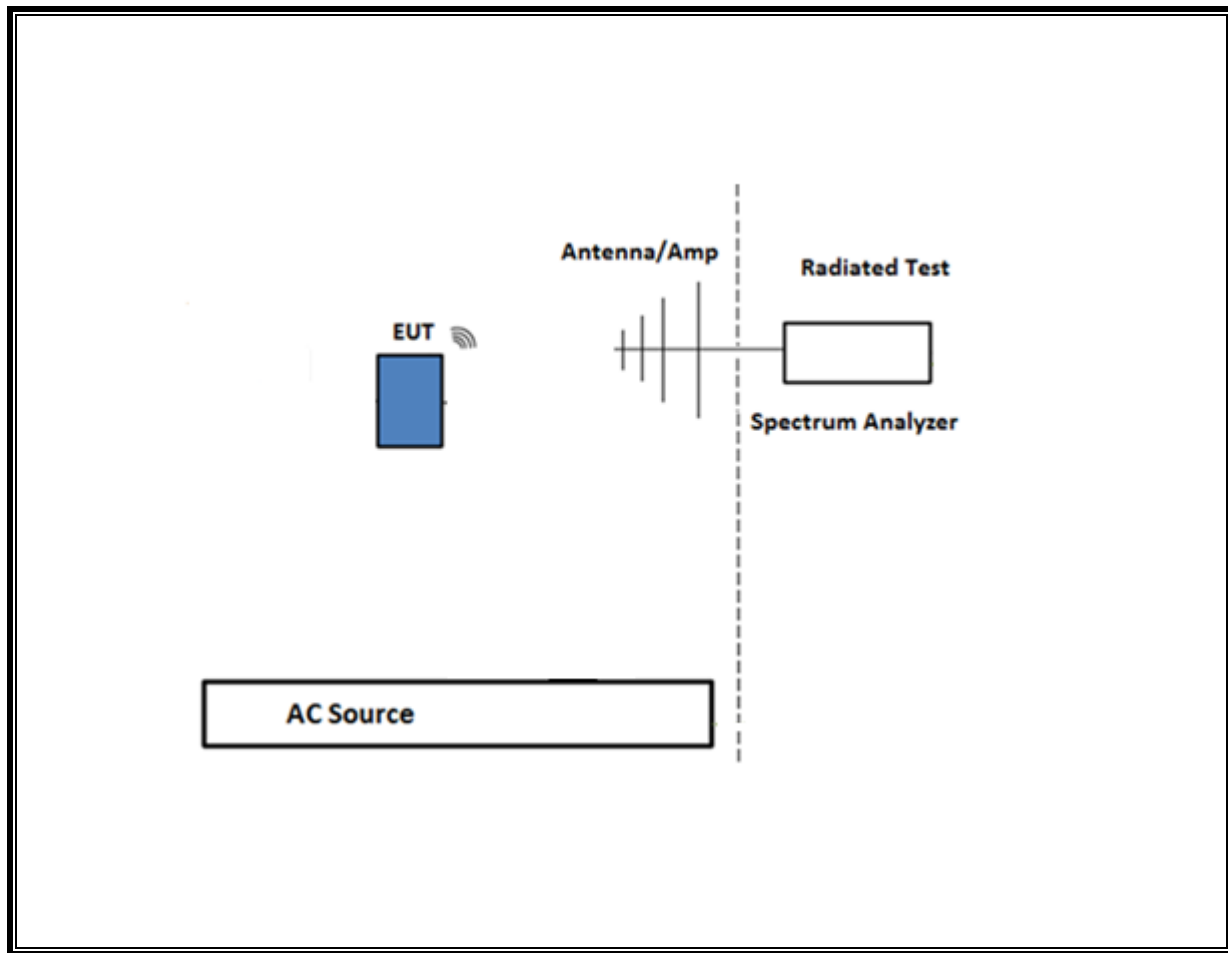
SETUP DIAGRAM FOR CONDUCTED TESTS: POWER METER CONFIGURATION



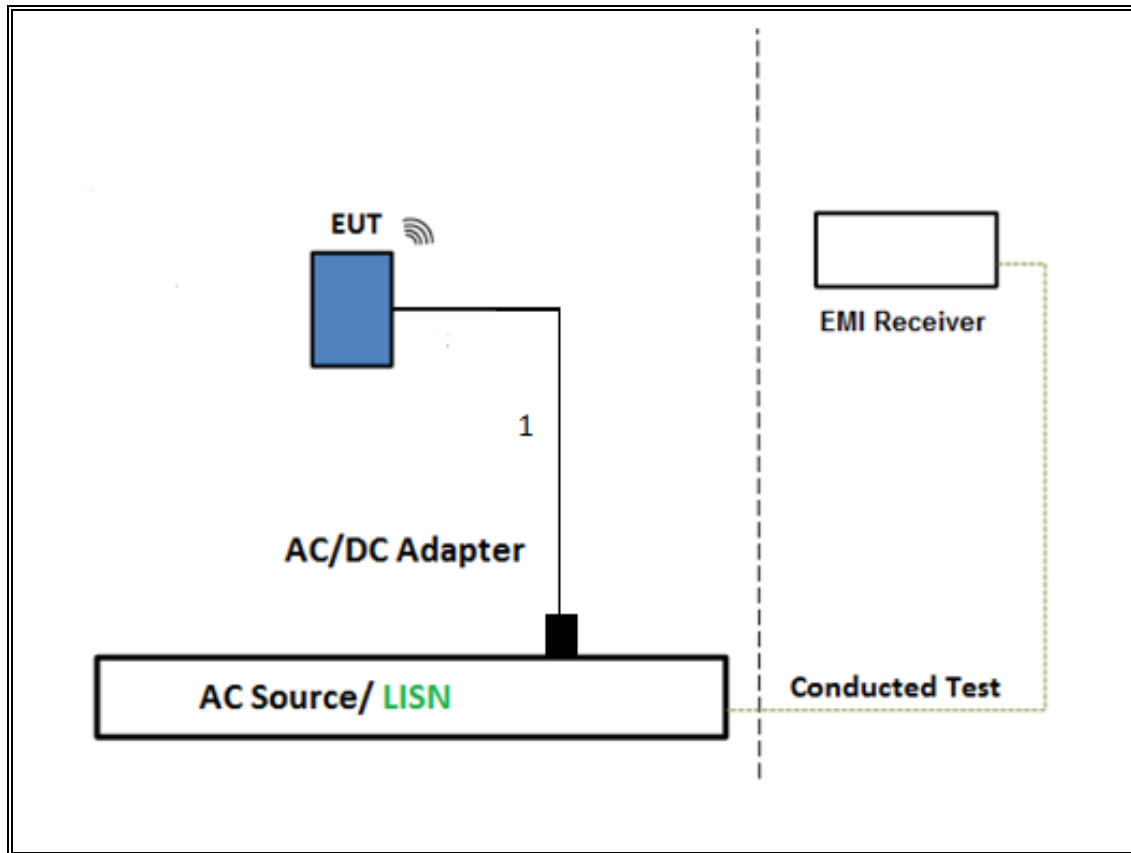
SETUP DIAGRAM FOR RADIATED TESTS ABOVE 1GHz



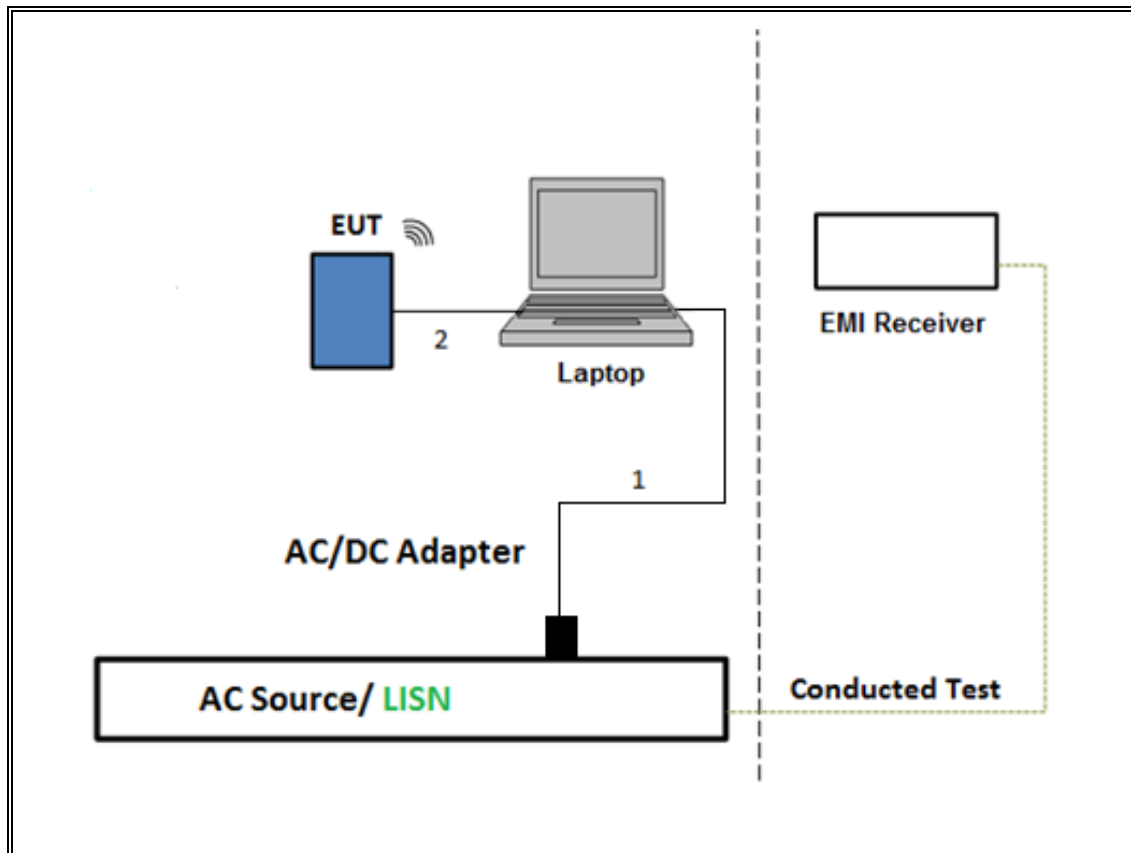
SETUP DIAGRAM FOR BELOW 1GHz



TEST SETUP- AC LINE CONDUCTED: CHARGER CONFIGURATION



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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
Amplifier, 1 – 18GHz	MITEQ	AFS42-00101800-25-S-42	T491	05/19/2019
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25-S-42	T1567	01/26/2020
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T1616	10/18/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB1	T185	04/19/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T120	07/02/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma Instrument Co.	310N	T834	06/04/2019
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T898	05/19/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T136	07/02/2019
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	03/23/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	06/16/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T227	10/29/2019
Power Sensor	Power Sensor	Keysight	T1226	02/06/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T340	01/22/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T1113	01/22/2020
Thermometer	Control Company	14-650-118, 15557603	T1817	05/01/2019

AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/23/2020
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/19/2019
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

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

8. ANTENNA PORT TEST RESULTS

8.1. DUTY CYCLE

PROCEDURE

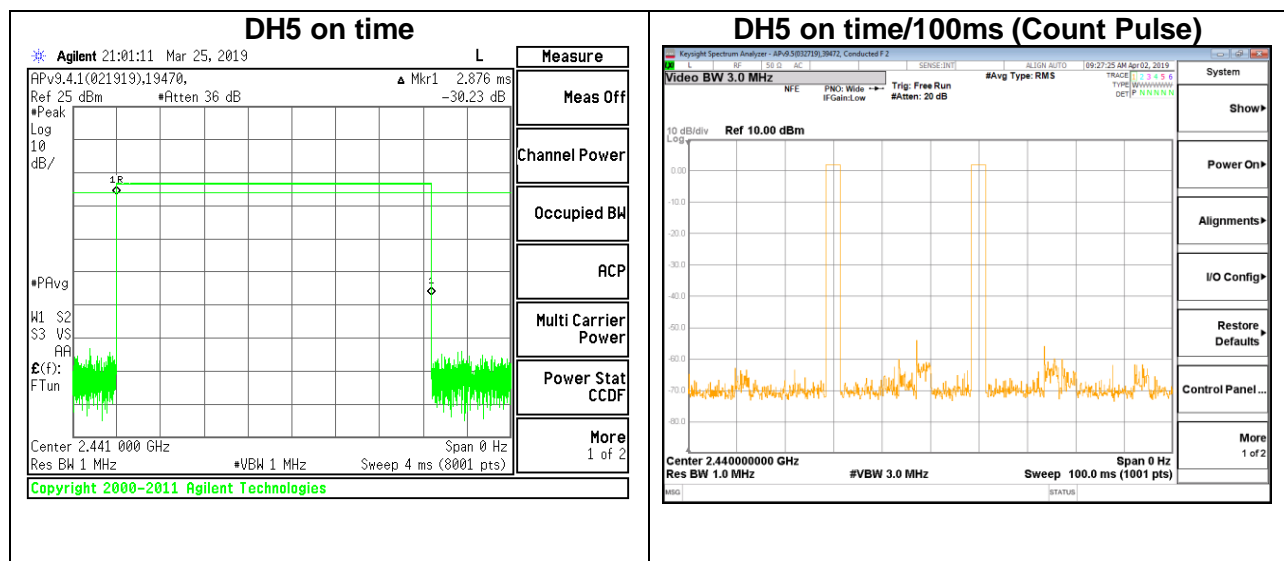
KDB558074 D01v05r02 and RSS-247 Issue 2

ON TIME AND DUTY CYCLE RESULTS

Duty cycle correction factor(dB) = $20\log(\text{duty cycle})$

Duty cycle=on time/100 milliseconds

On time = dwell time * hopping number in 100ms



Note: Duty Cycle = on time/100 milliseconds = $2 \times 2.876 / 100 = 5.752\%$

Duty cycle correction factor = $20 \times \log(\text{Duty cycle}) = -24.80 \text{ dB}$

8.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

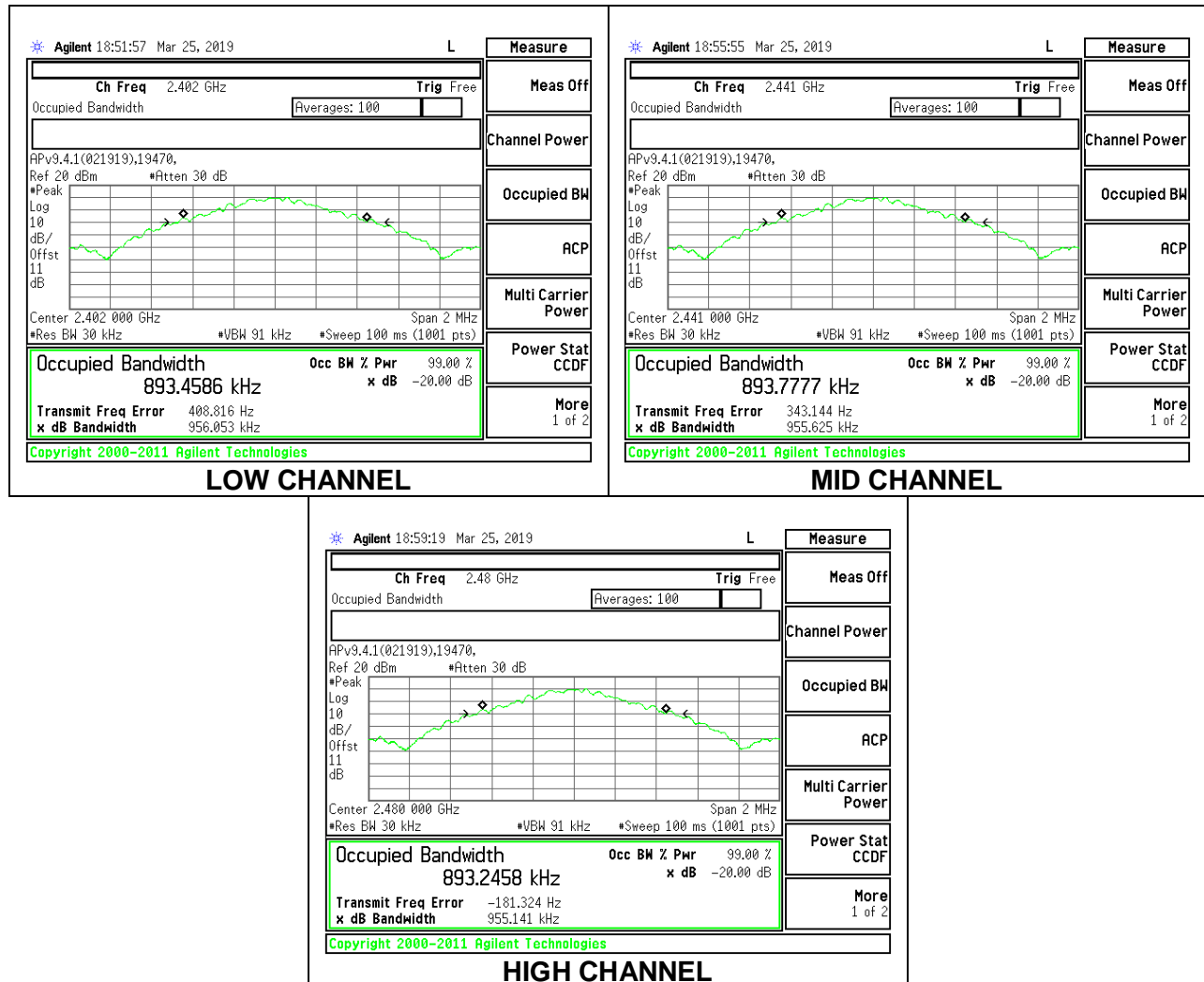
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

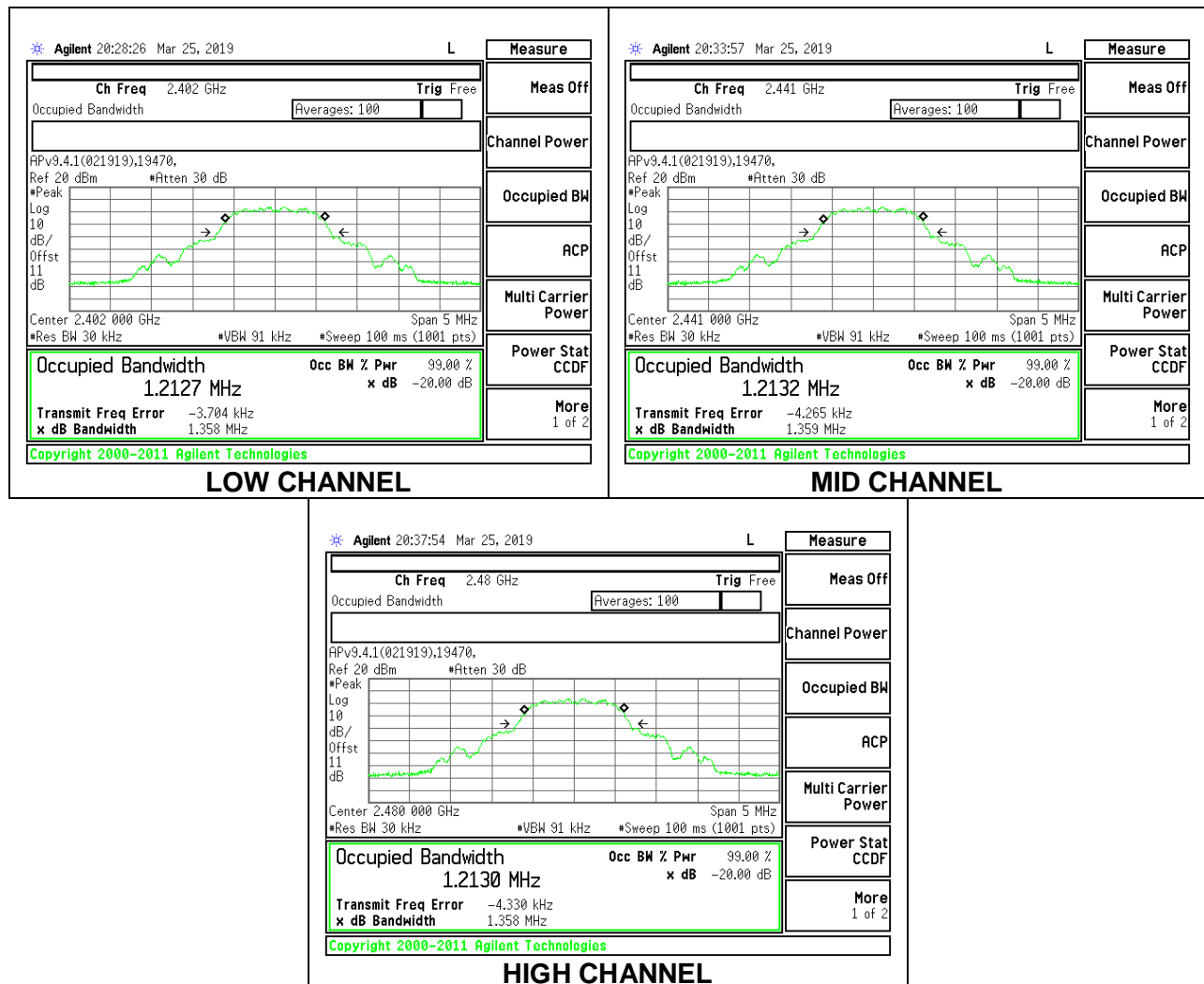
8.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.956	0.893
Mid	2441	0.956	0.894
High	2480	0.955	0.893



8.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.358	1.213
Mid	2441	1.359	1.213
High	2480	1.358	1.213



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 hopping channel, whichever is greater.

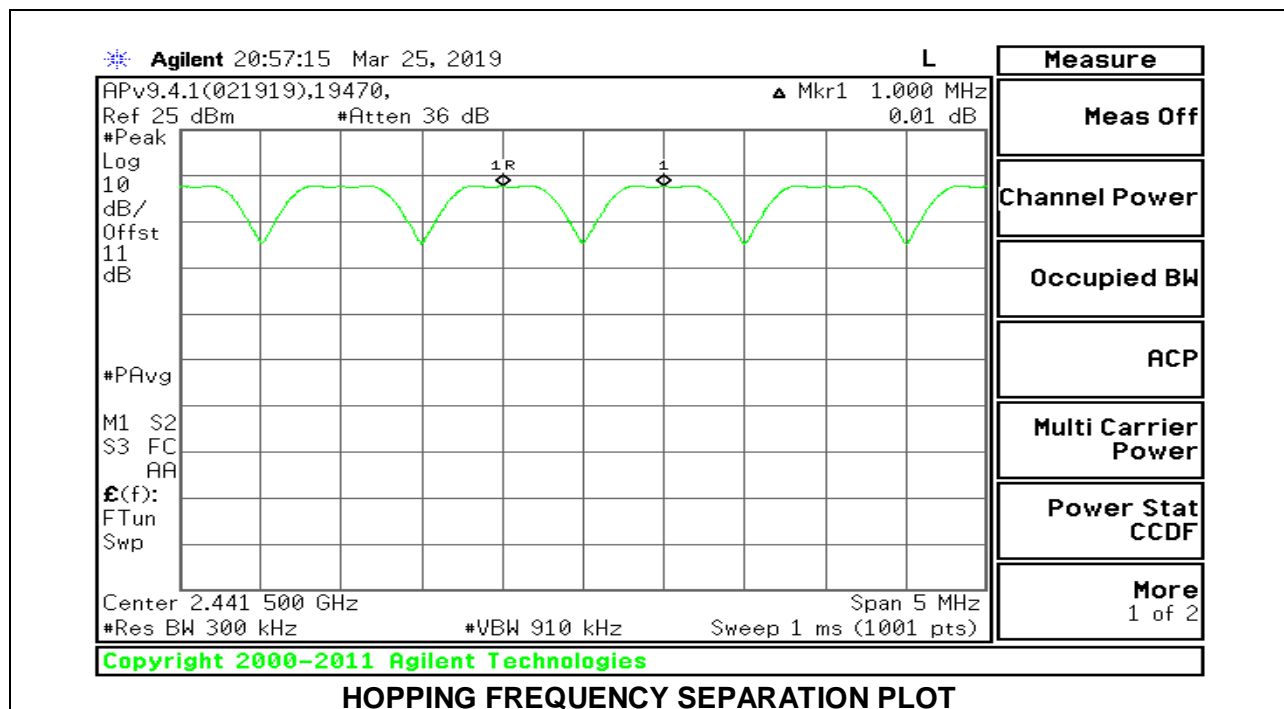
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

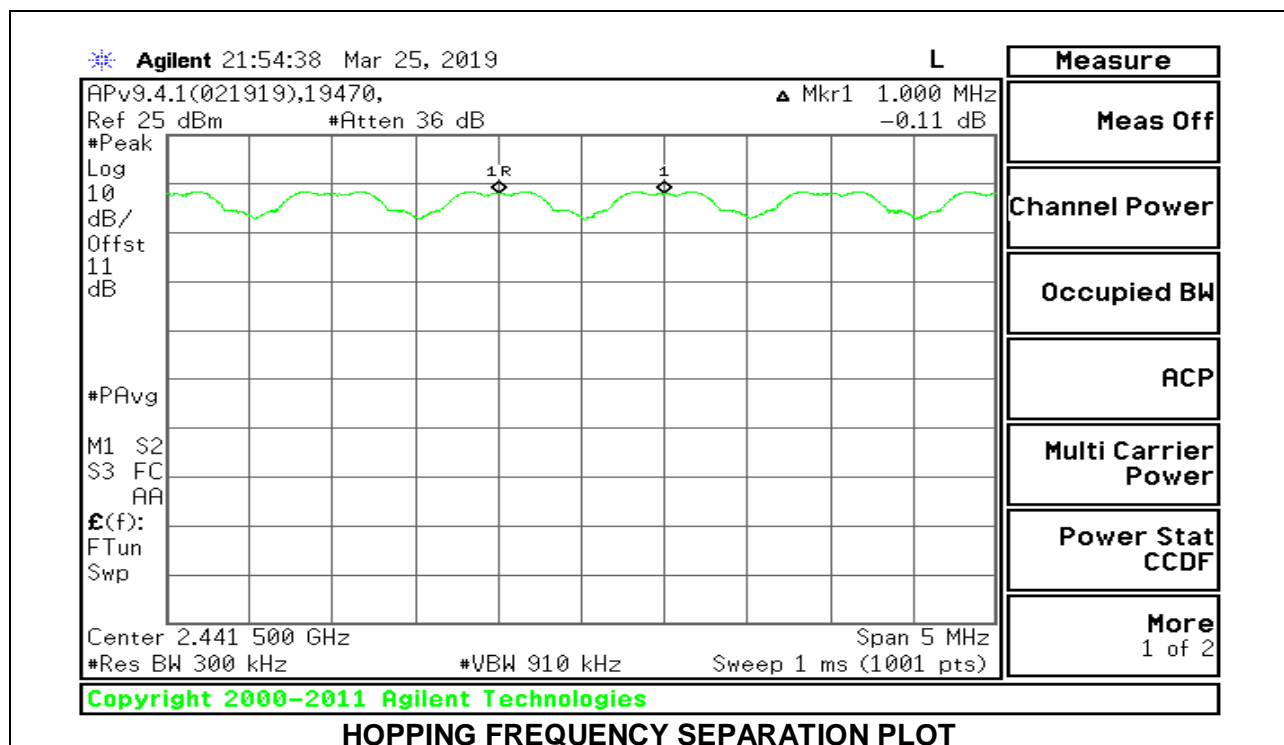
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 3x RBW. The sweep time is coupled.

RESULTS

8.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



8.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



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.

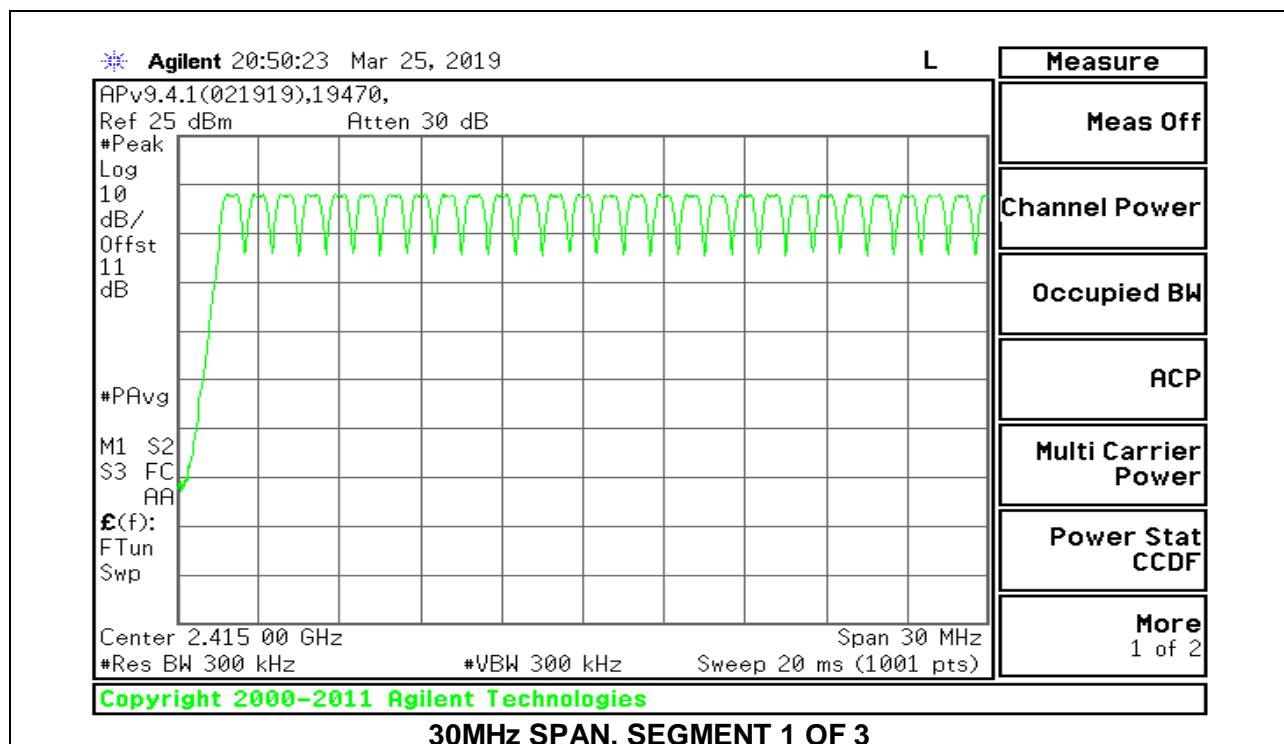
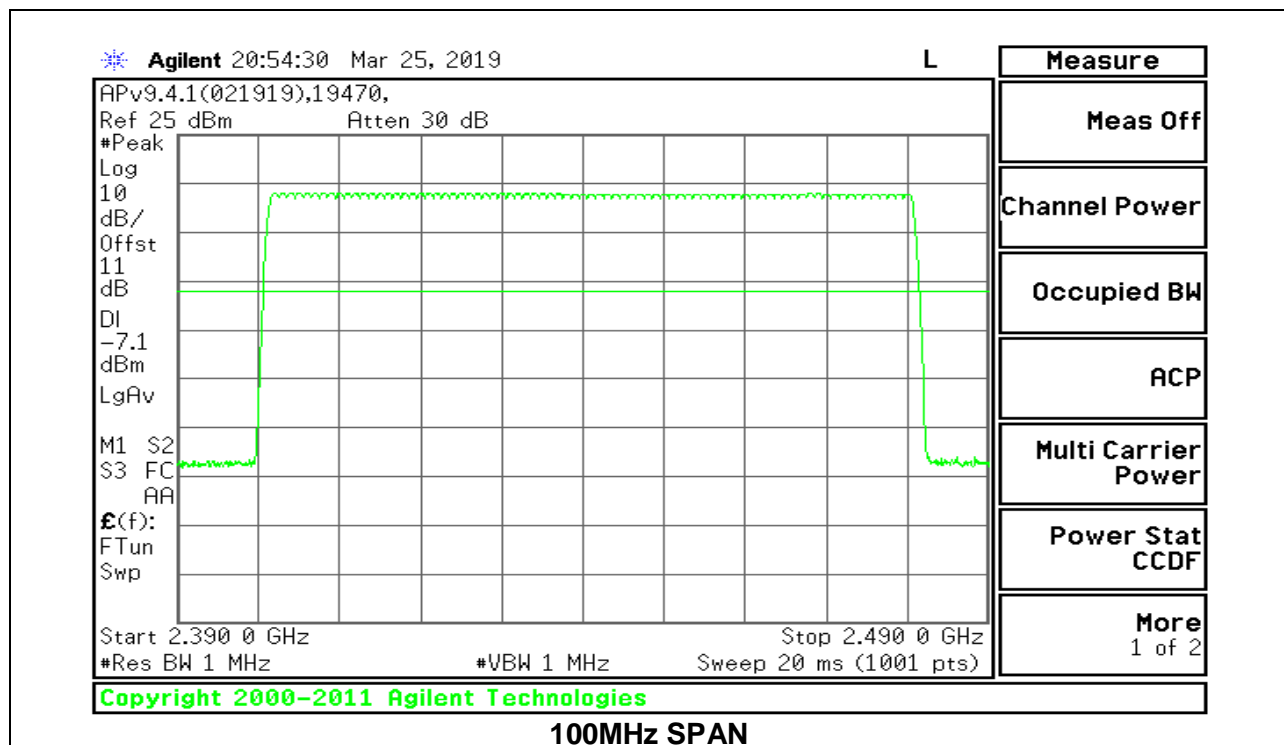
TEST PROCEDURE

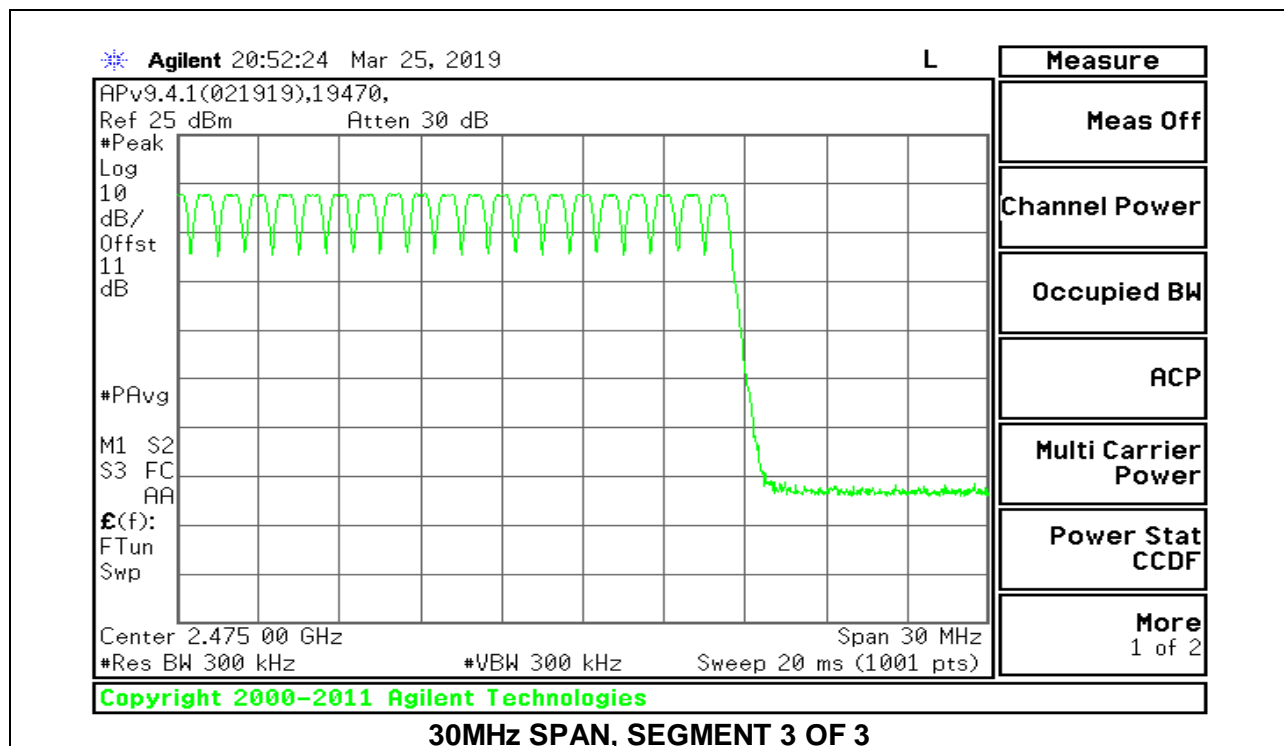
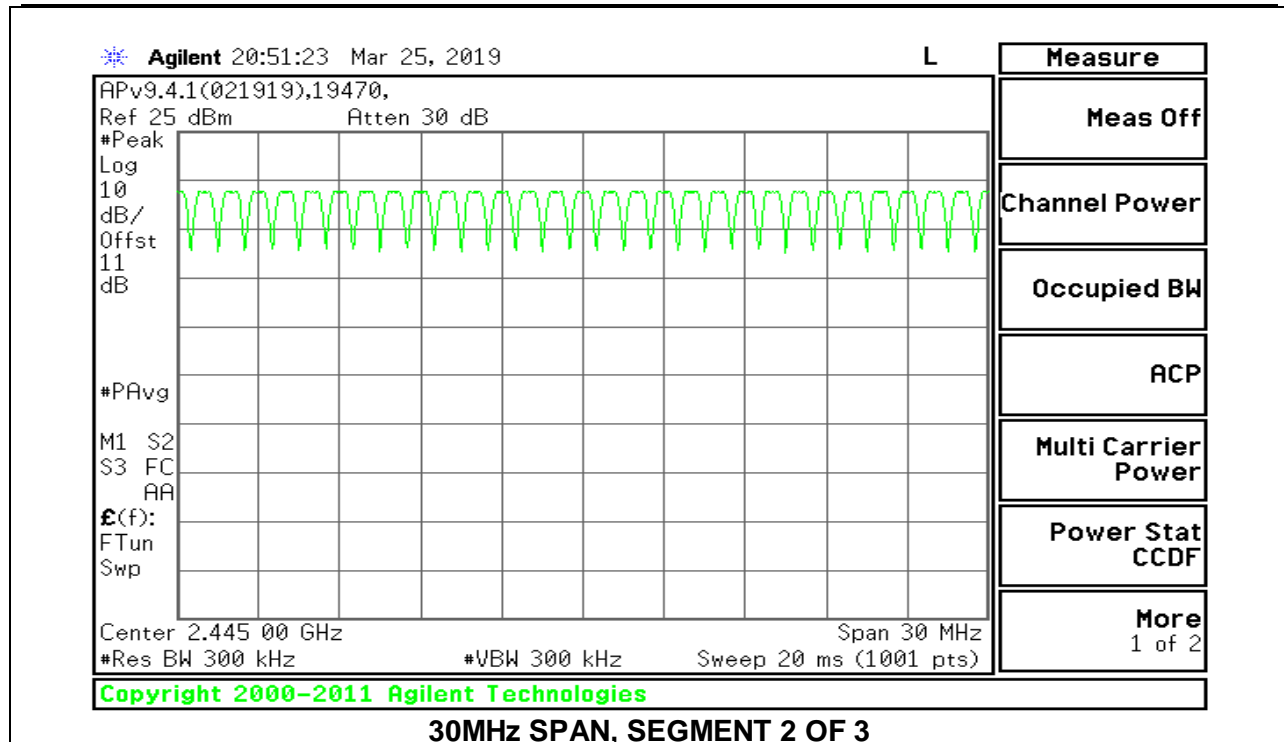
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

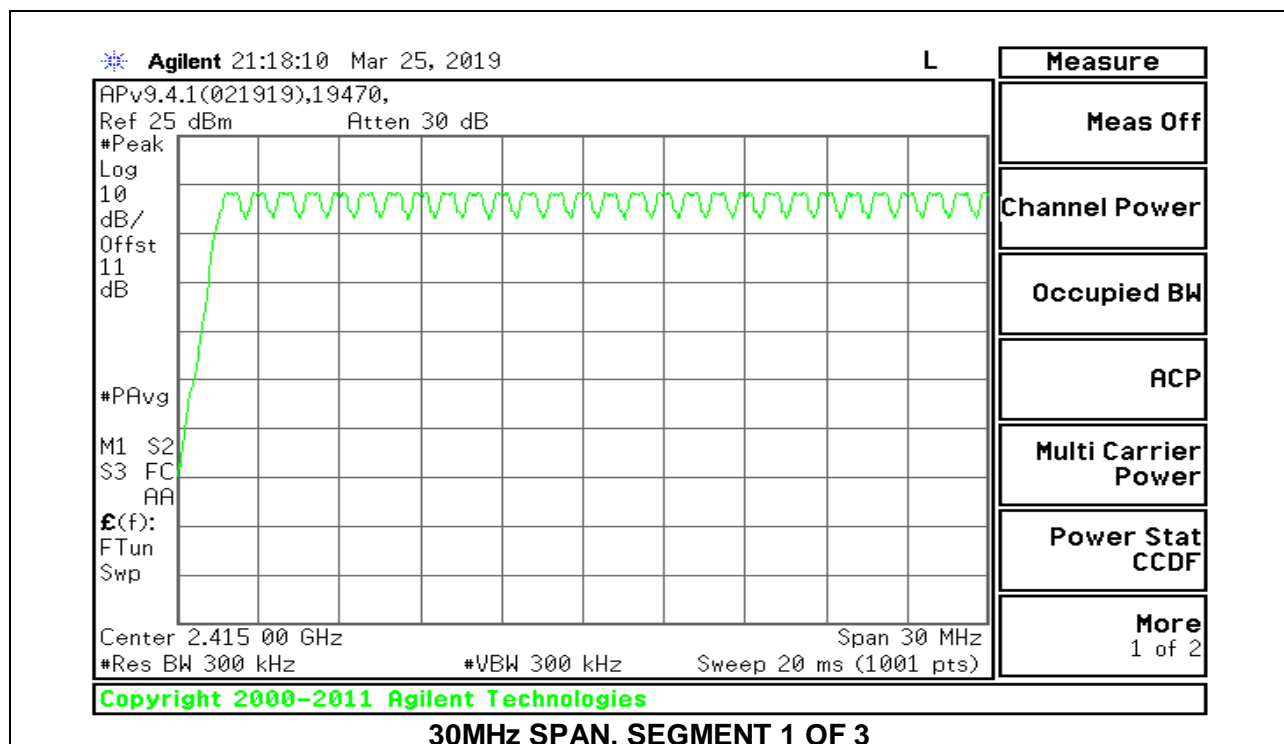
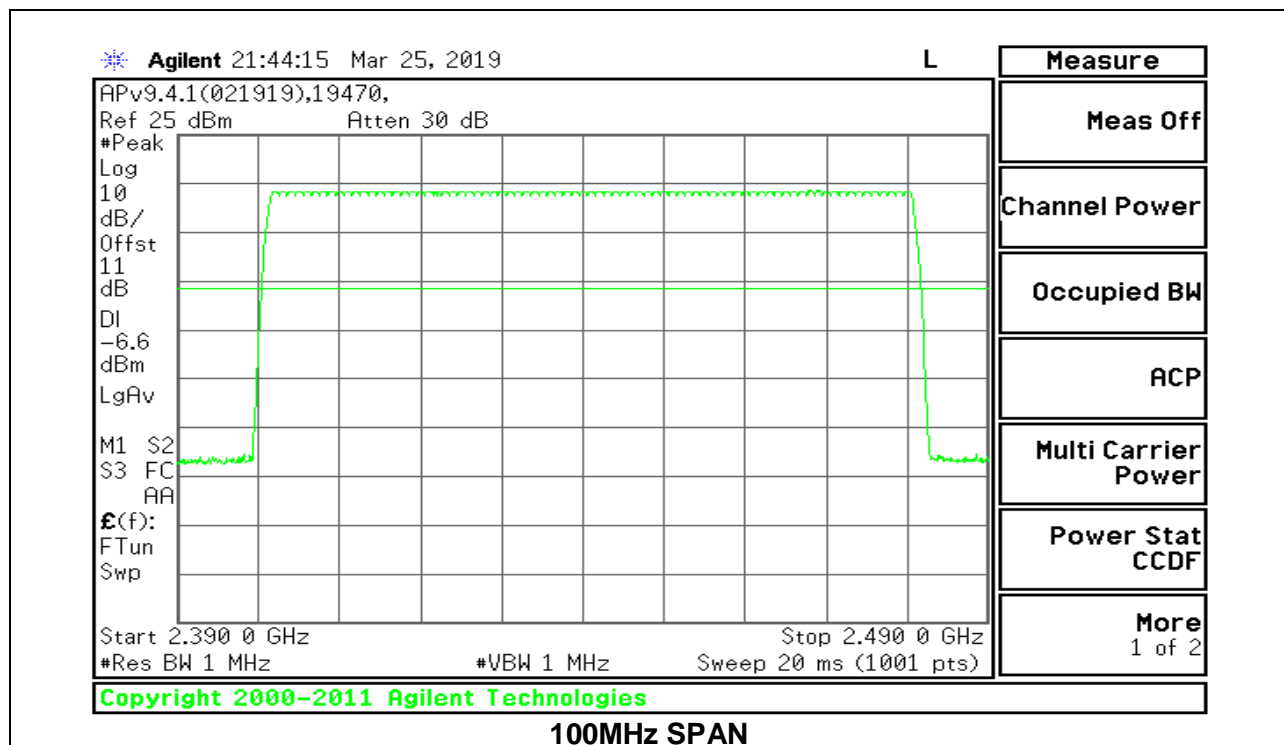
Normal Mode: All Channels Observed

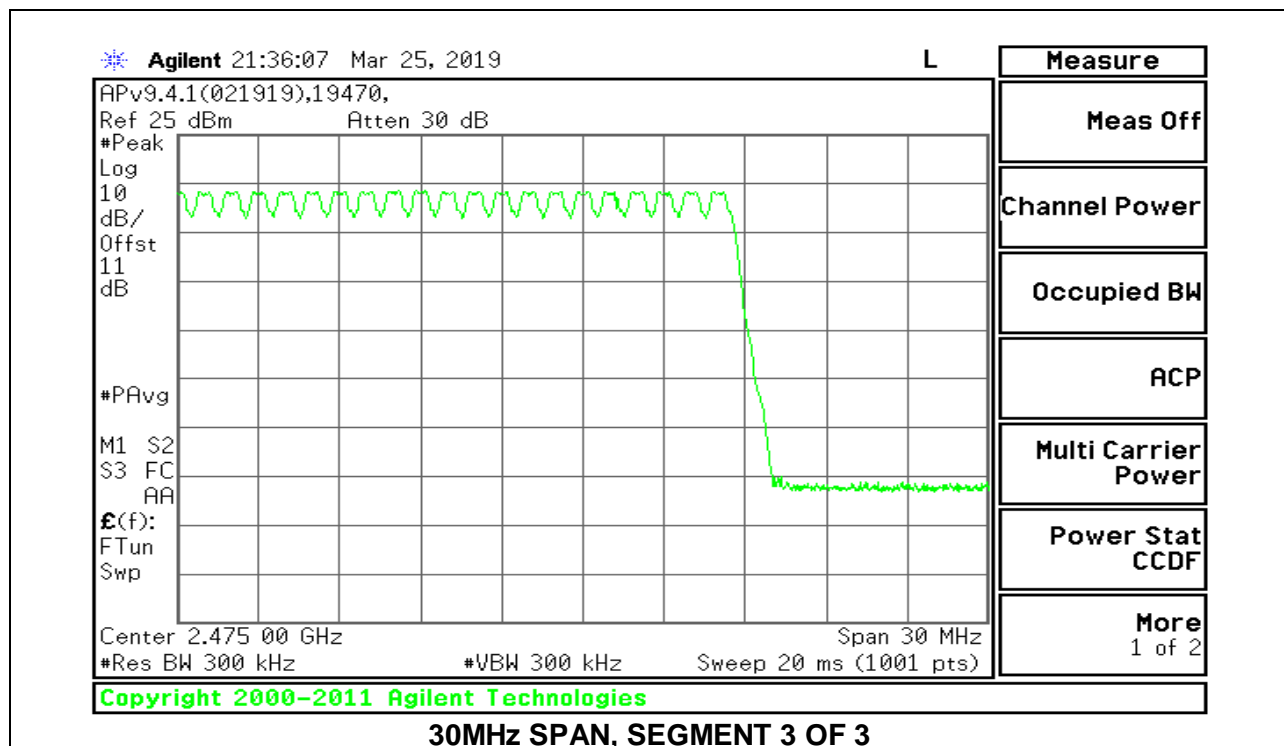
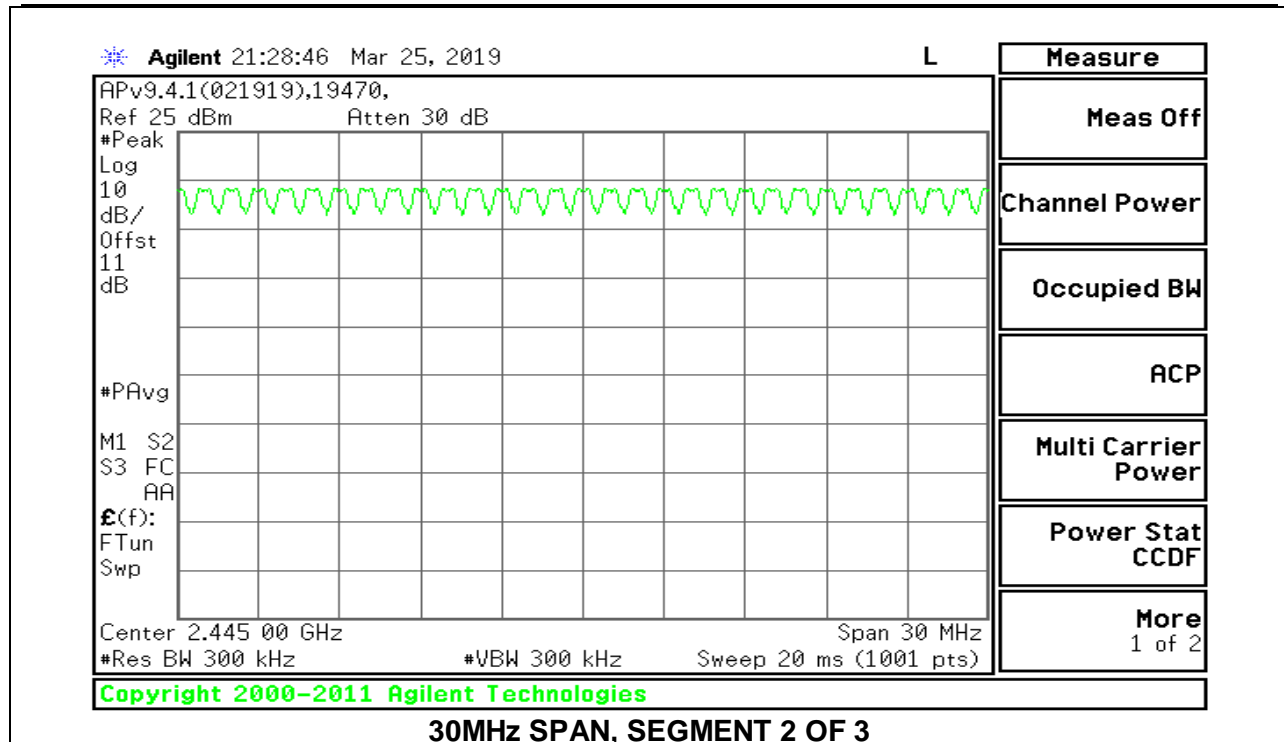
8.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





8.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





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.

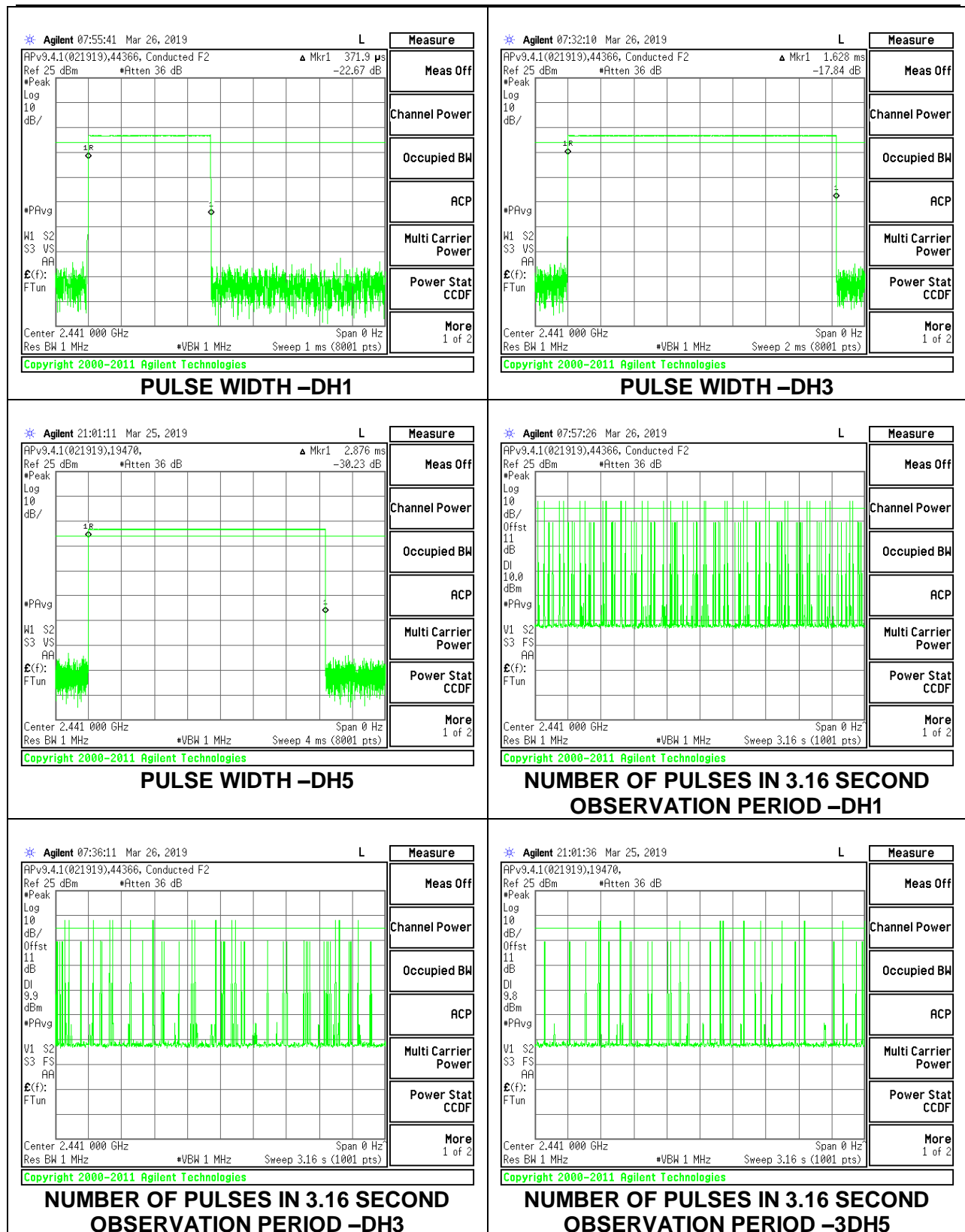
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

RESULTS

8.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

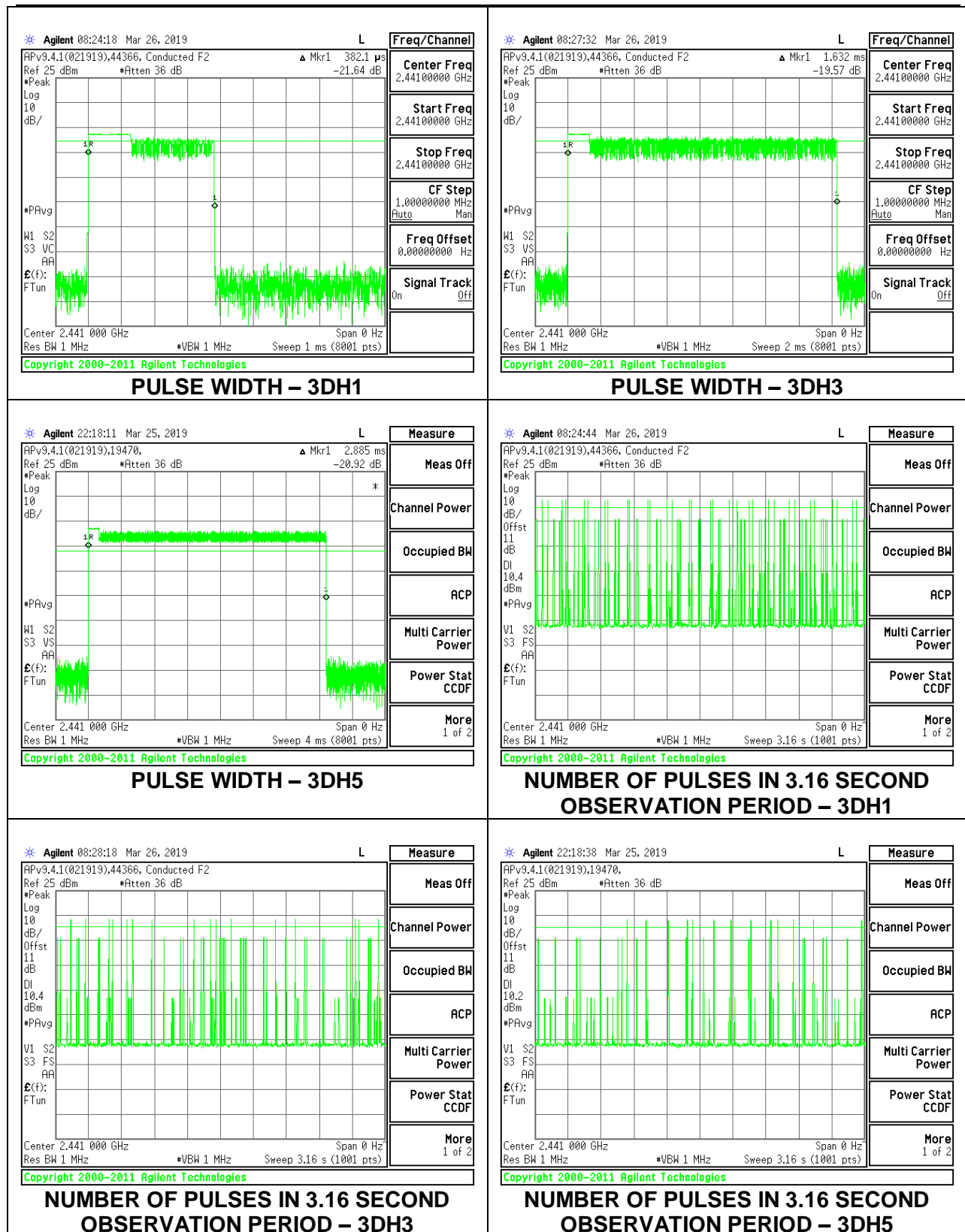
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.372	32	0.1190	0.4	-0.2810
DH3	1.628	15	0.2442	0.4	-0.1558
DH5	2.876	12	0.3451	0.4	-0.0549
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.372	8	0.02976	0.4	-0.3702
DH3	1.628	3.75	0.06105	0.4	-0.3390
DH5	2.876	3	0.08628	0.4	-0.3137



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	0.382	32	0.12224	0.4	-0.2778
3DH3	1.632	16	0.26112	0.4	-0.1389
3DH5	2.885	13	0.37505	0.4	-0.025

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.



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.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

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 a gated peak reading of power.

RESULTS

8.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	44366
Date:	3/26/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.64	30	-17.36
Middle	2441	12.68	30	-17.32
High	2480	12.67	30	-17.33

8.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	44366
Date:	3/26/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.16	21	-7.84
Middle	2441	13.42	21	-7.58
High	2480	13.03	21	-7.97

8.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	44366
Date:	4/4/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.01	21	-8.99
Middle	2441	11.71	21	-9.29
High	2480	10.43	21	-10.57

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

RESULTS

8.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	44366
Date	3/26/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	12.41
Middle	2441	12.49
High	2480	12.43

8.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	44366
Date	3/26/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.96
Middle	2441	9.98
High	2480	9.91

8.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	44366
Date	4/4/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.36
Middle	2441	9.04
High	2480	7.80

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.

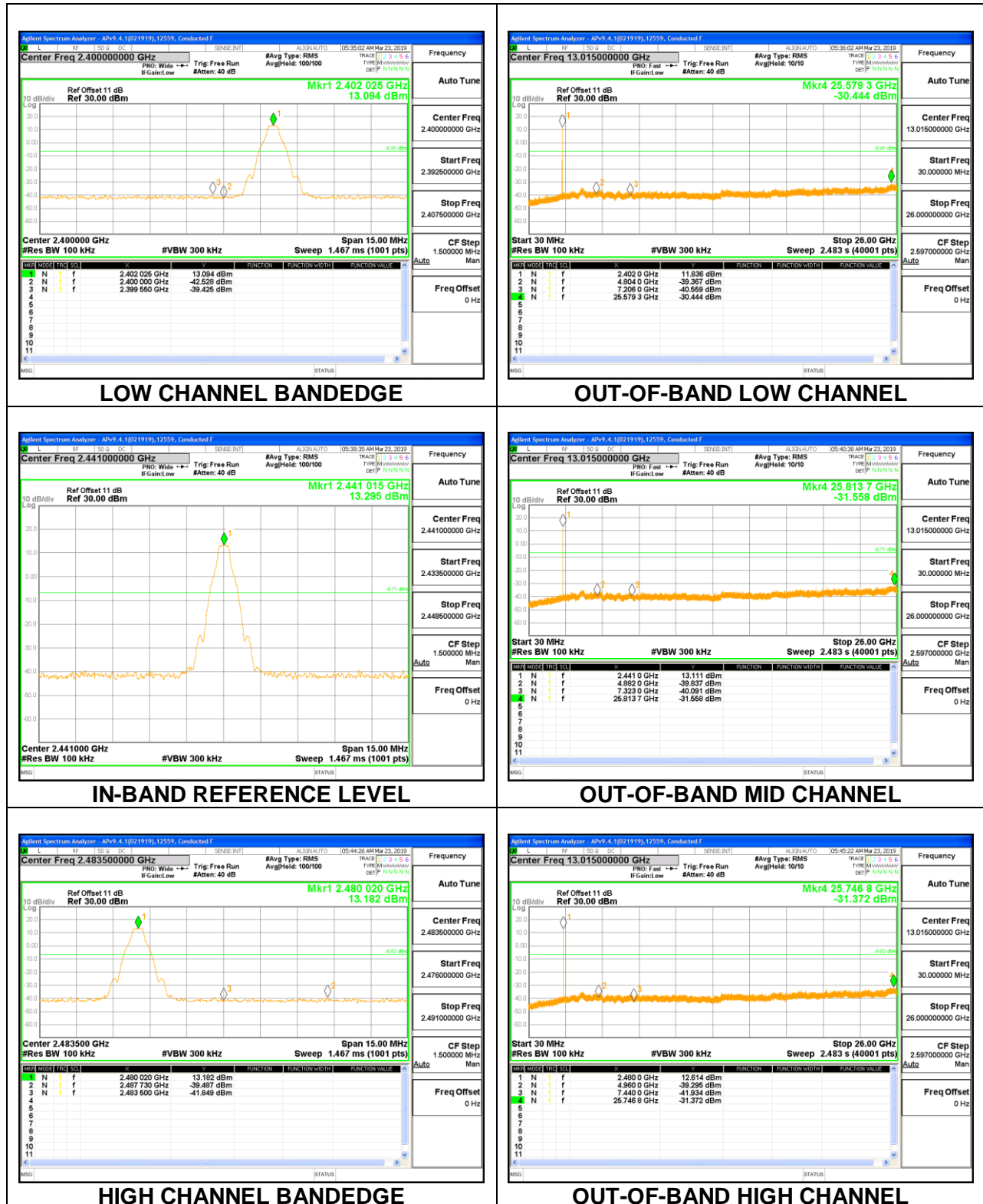
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

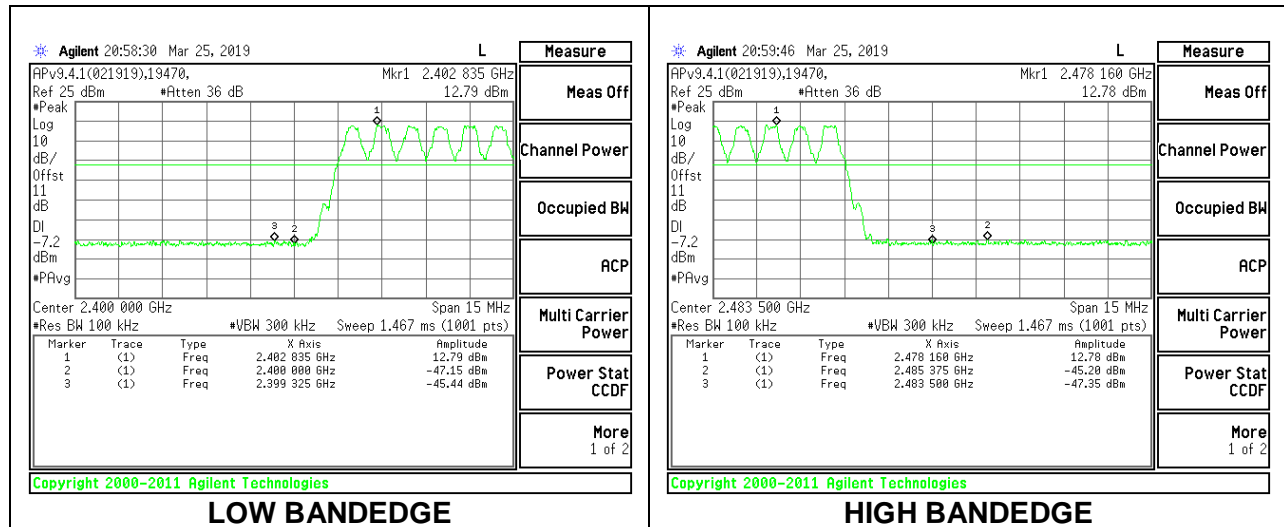
RESULTS

8.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

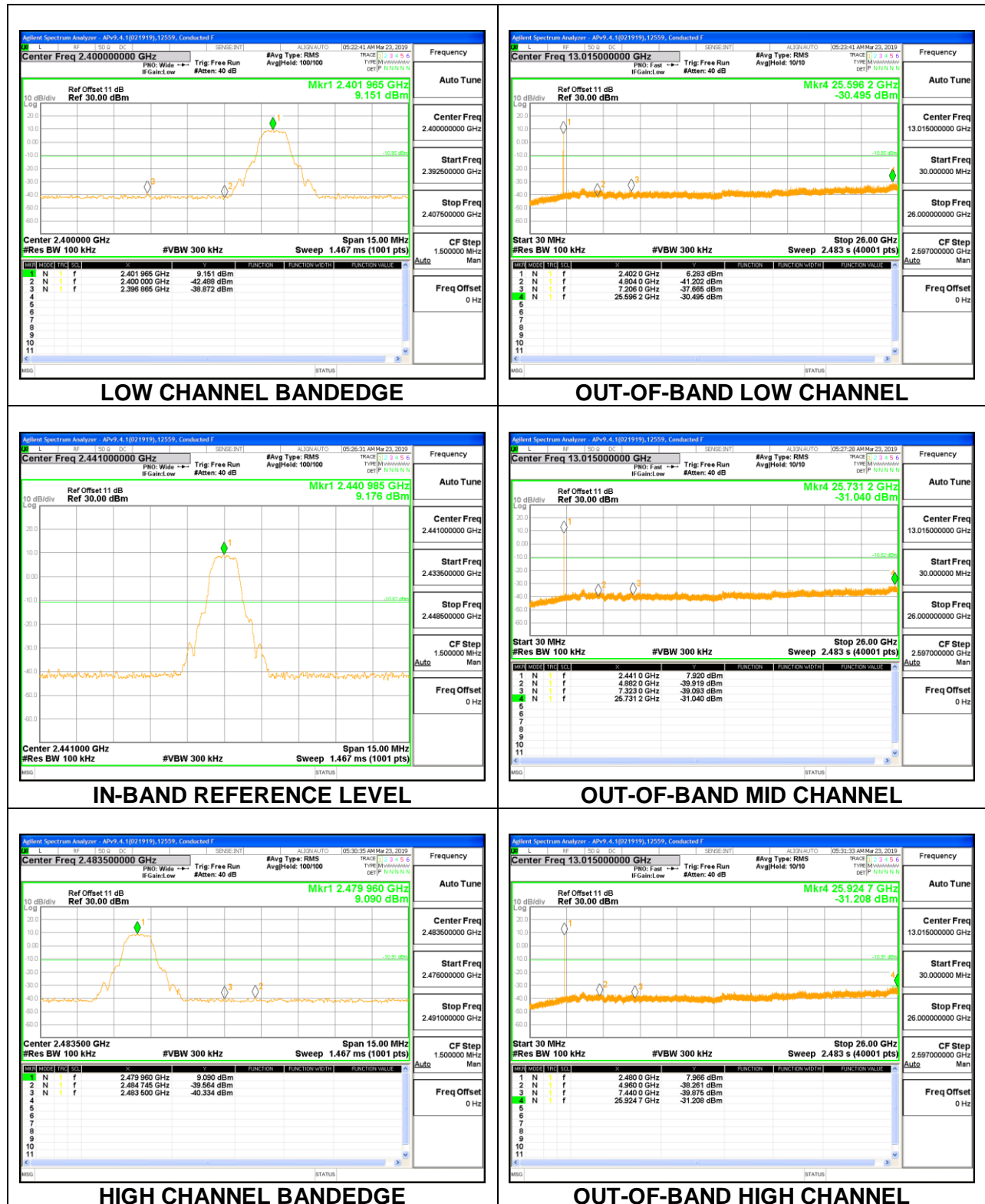


Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

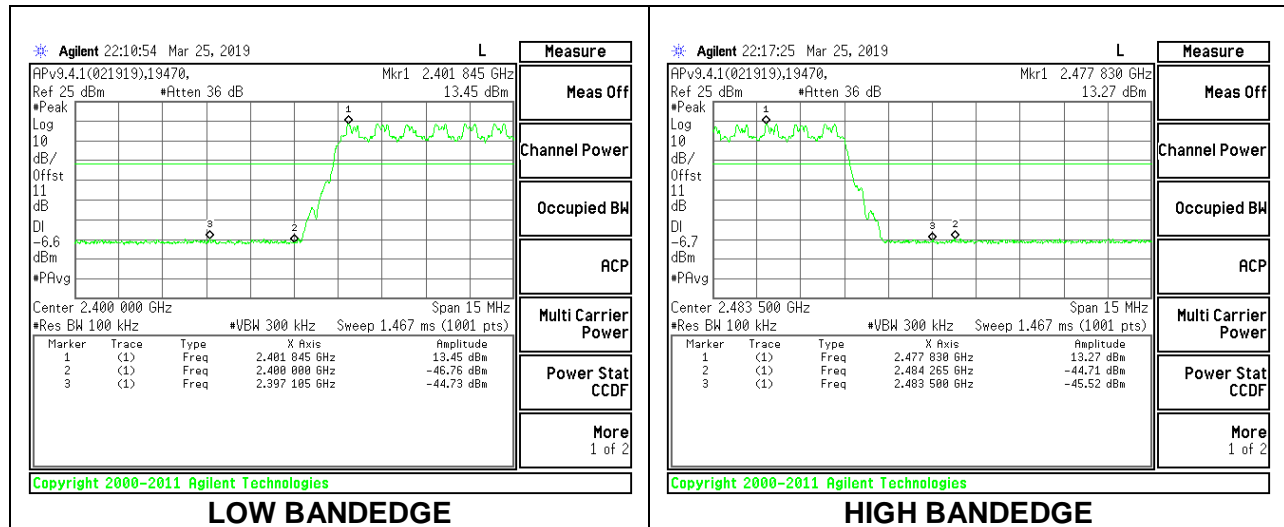


8.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

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 $20 \log (\text{ON time}/100 \text{ milliseconds})$ and greater than 20dB.

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.

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.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed 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 v05r01

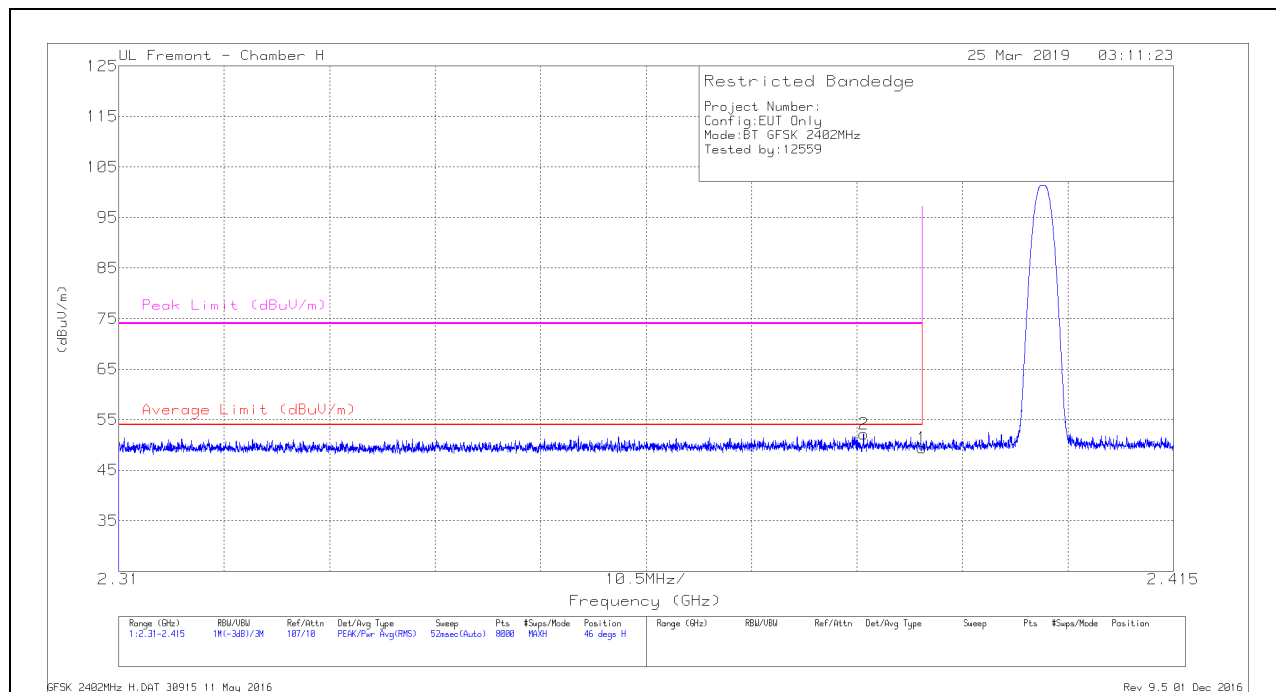
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can 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 100 msec transmission period.

9.1. TRANSMITTER ABOVE 1 GHz

9.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

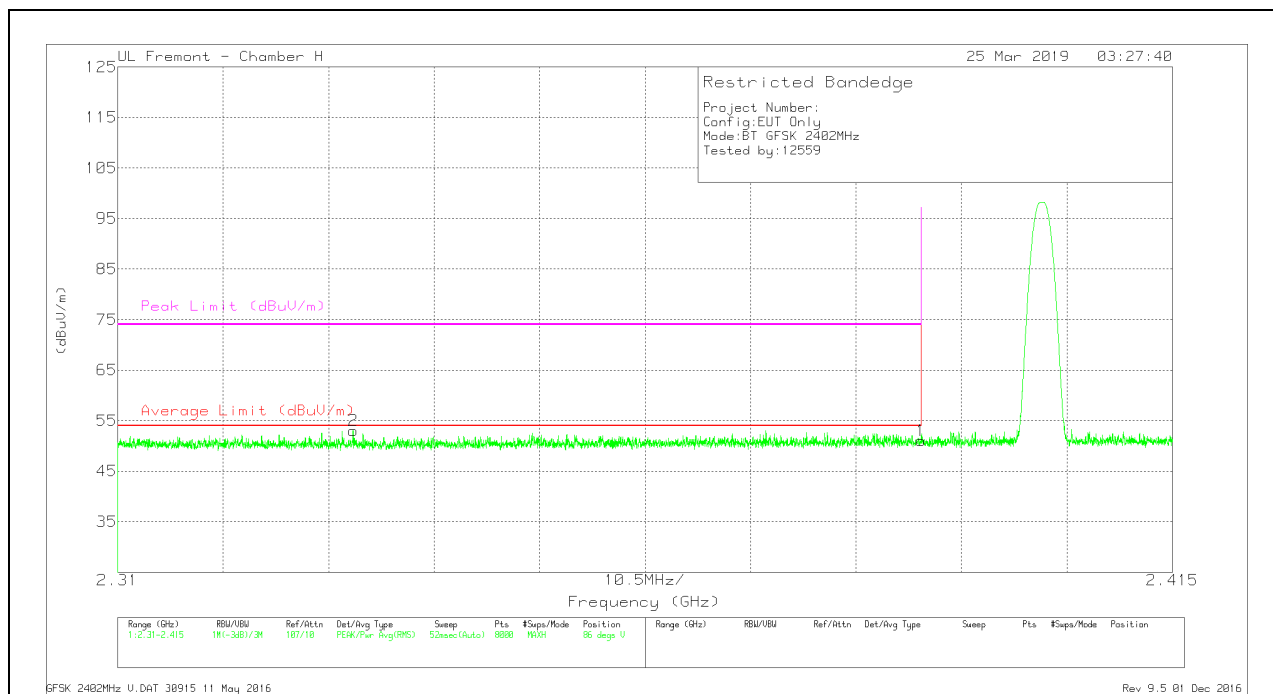


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.79	Pk	31.9	-22.3	49.39	74	-24.61	46	101	H
2	* 2.384	42.55	Pk	31.9	-22.3	52.15	74	-21.85	46	101	H

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

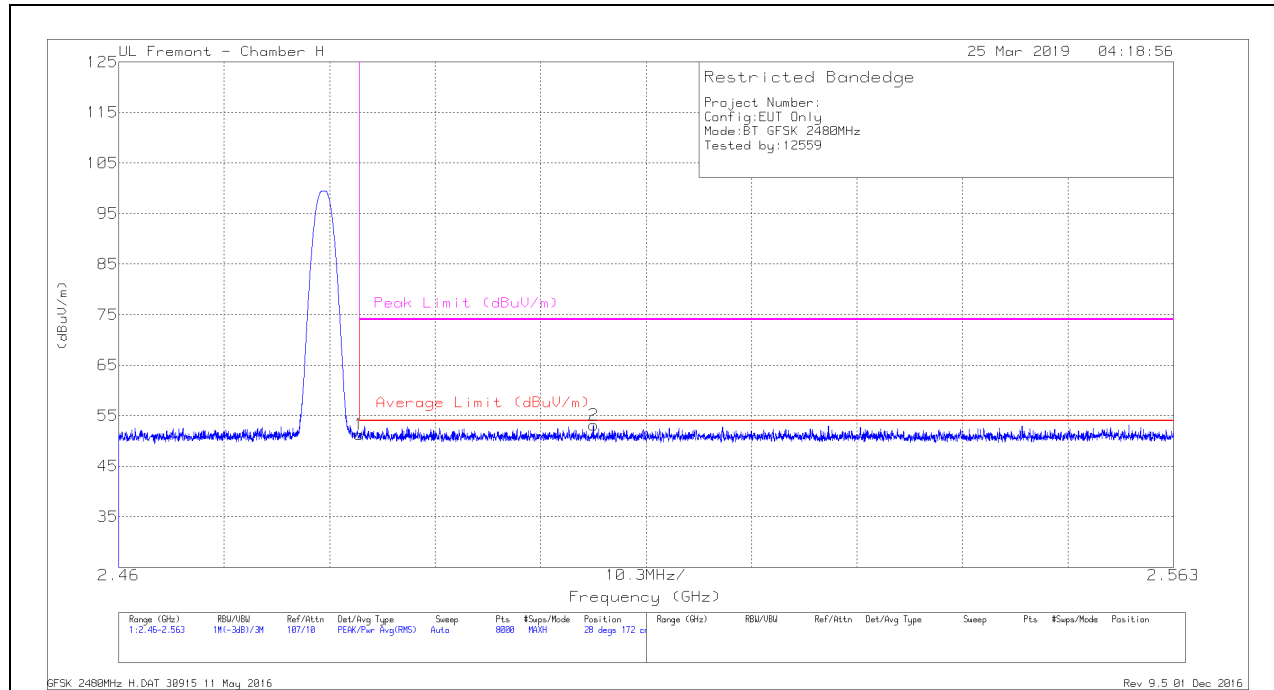
Pk - Peak detector

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.39	Pk	31.9	-22.3	50.99	74	-23.01	86	388	V
2	* 2.333	43.85	Pk	31.6	-22.4	53.05	74	-20.95	86	388	V

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

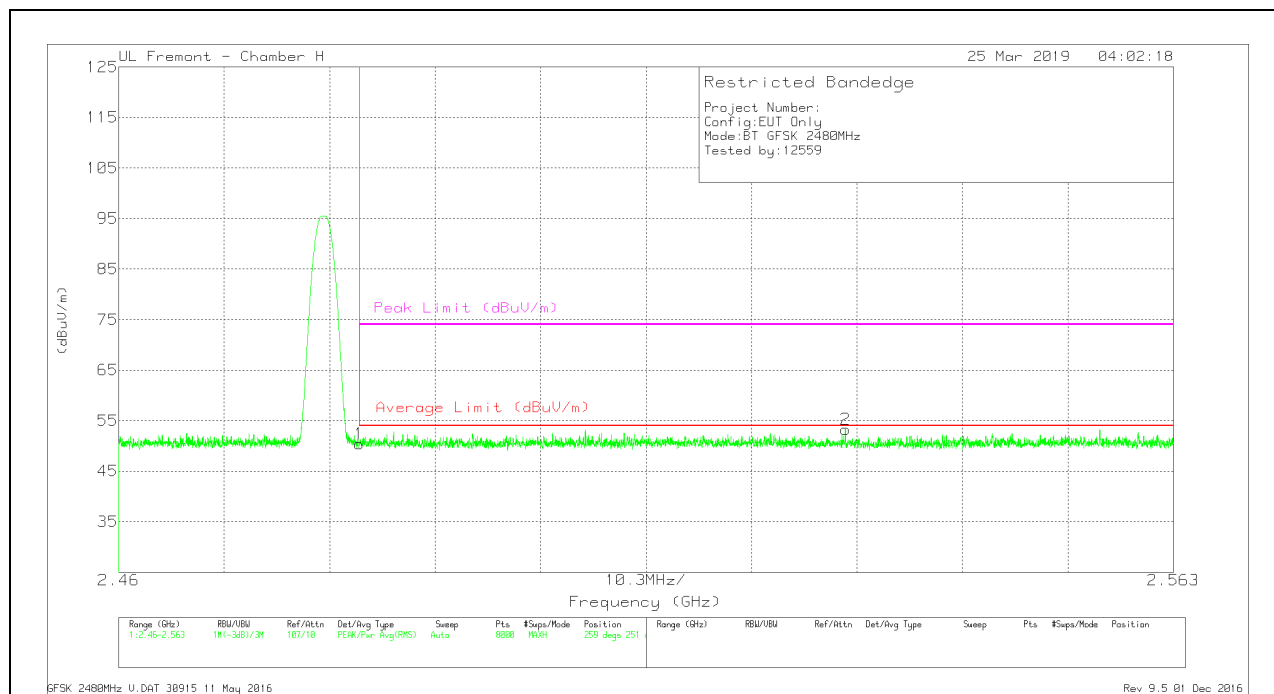
BANDEDGE (HIGH CHANNEL)**HORIZONTAL RESULT**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filt/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.23	Pk	32.4	-22.3	51.33	74	-22.67	28	172	H
2	2.506	43.07	Pk	32.4	-22.3	53.17	74	-20.83	28	172	H

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

Pk - Peak detector

VERTICAL RESULT



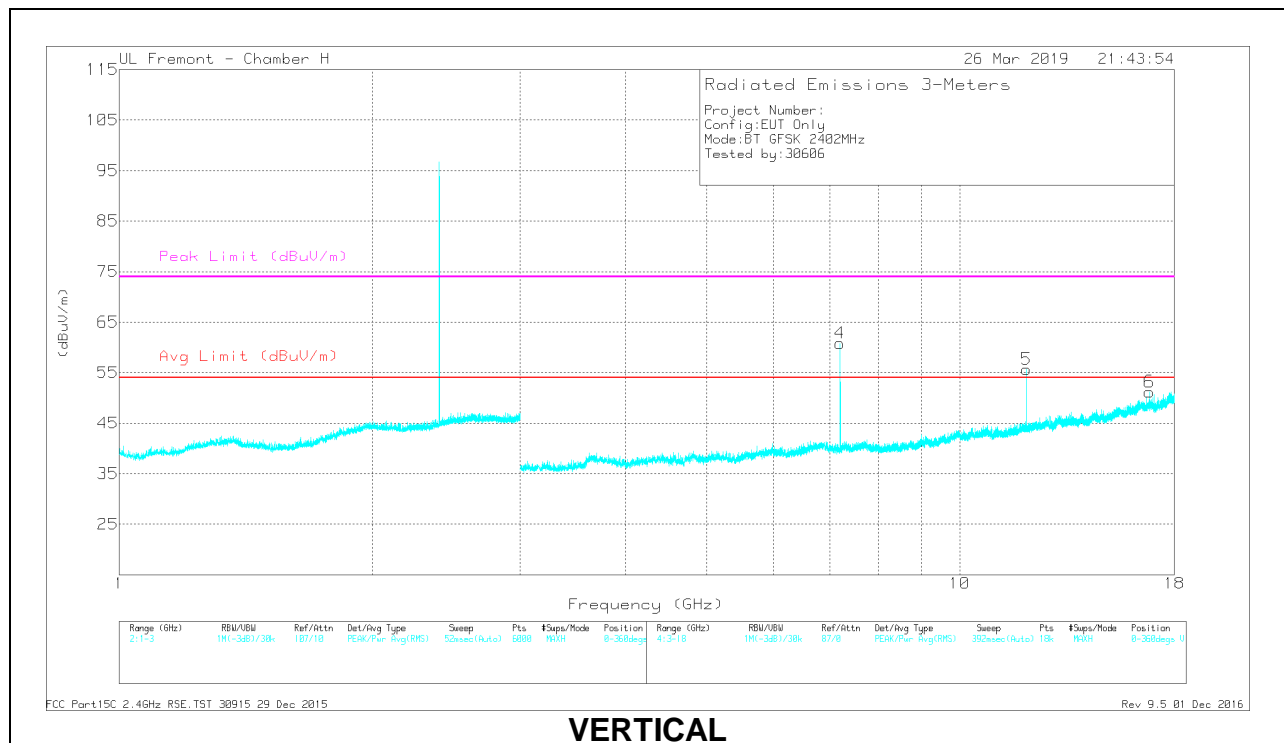
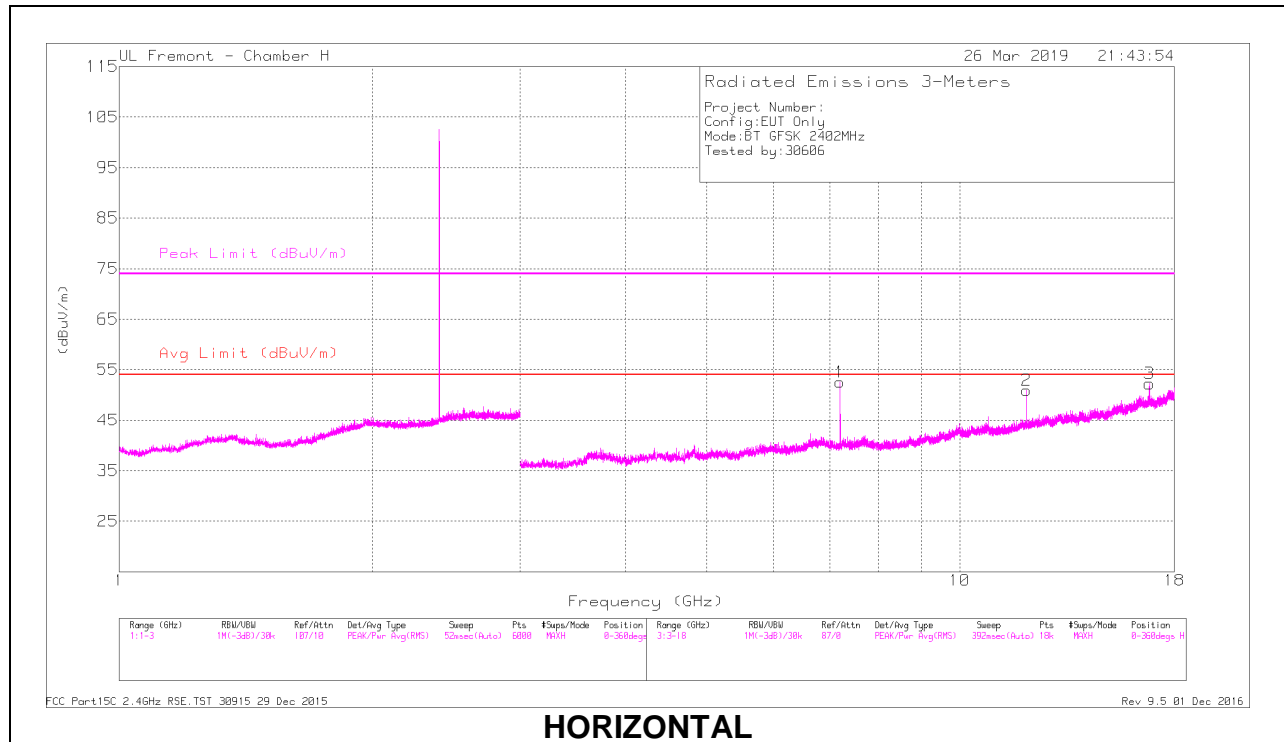
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.32	Pk	32.4	-22.3	50.42	74	-23.58	259	251	V
2	2.531	43.2	Pk	32.4	-22.3	53.3	74	-20.7	259	251	V

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

Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

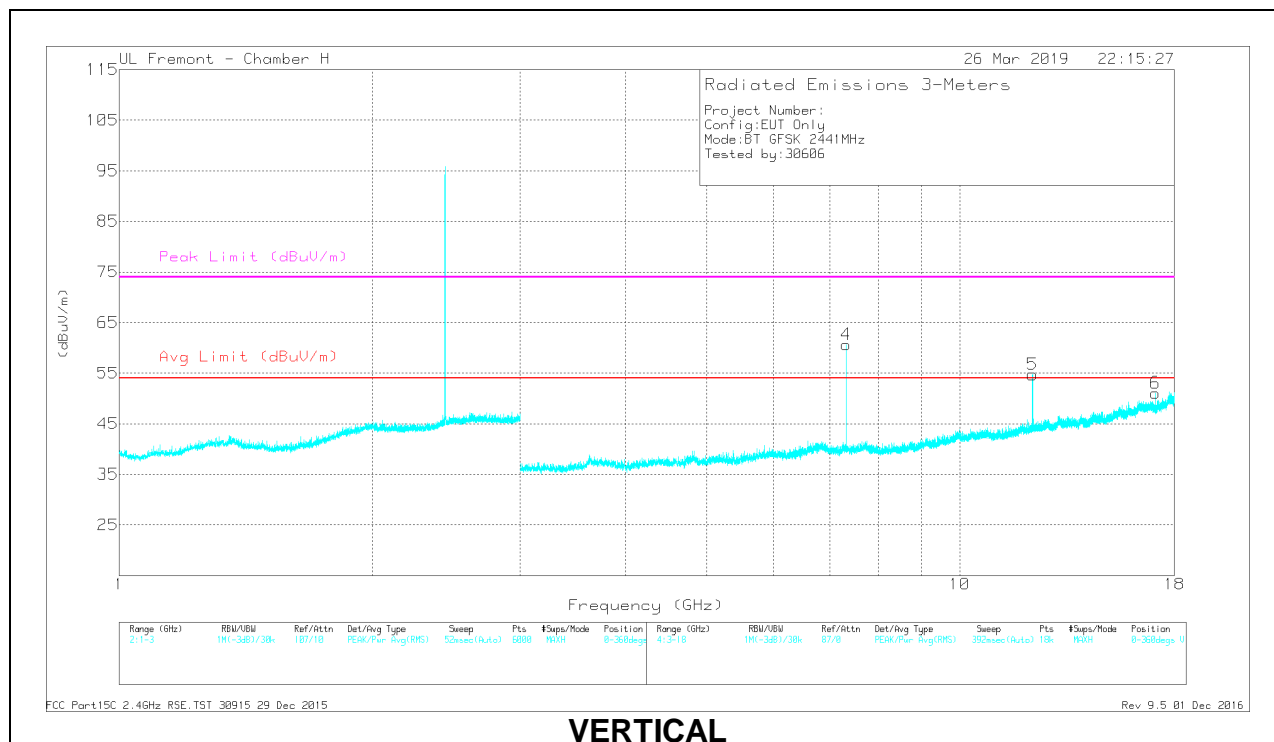
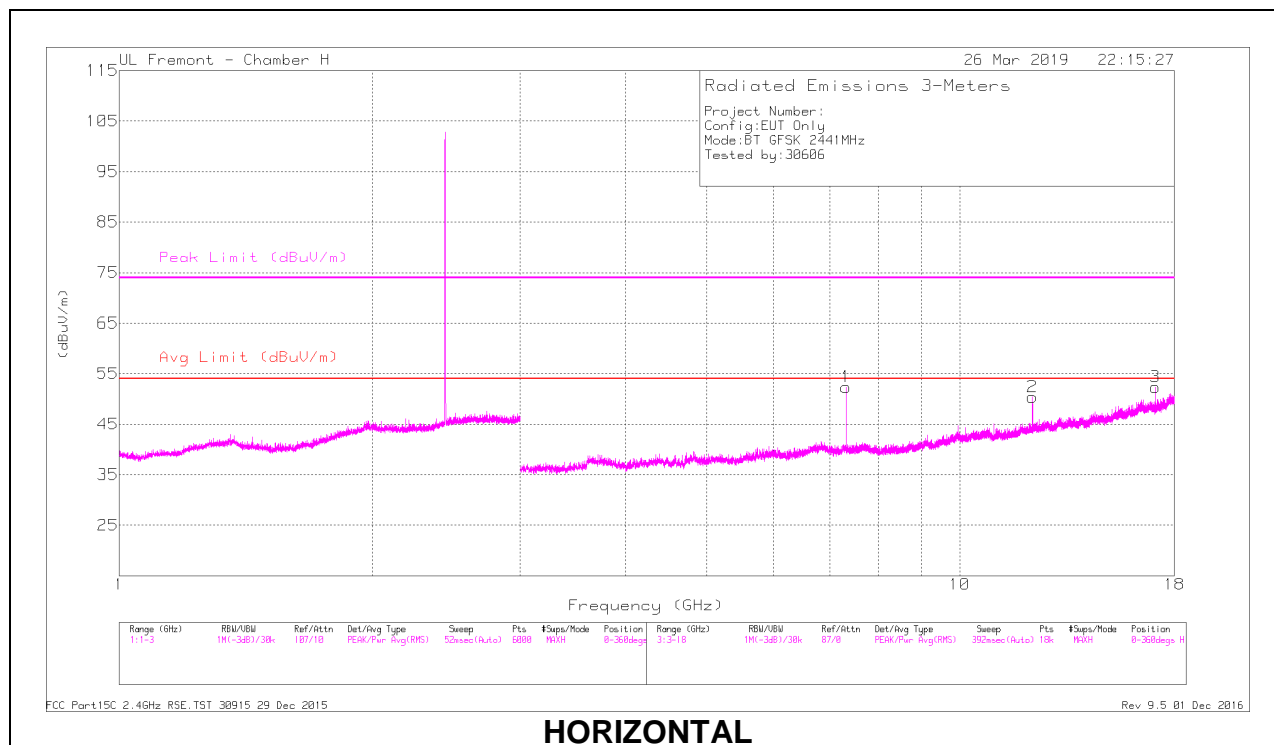


RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	7.206	48.76	PKFH	36.3	-28	57.06	-	-	335	315	H
2	* 12.011	40.52	PKFH	38.9	-23.2	56.22	74	-17.78	42	108	H
3	16.815	38.22	PKFH	41.6	-21.1	58.72	-	-	341	118	H
4	7.206	53.78	PKFH	36.3	-28	62.08	-	-	277	112	V
5	* 12.011	43.29	PKFH	38.9	-23.2	58.99	74	-15.01	184	113	V
6	16.815	36.6	PKFH	41.6	-21.1	57.1	-	-	152	117	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

MID CHANNEL RESULTS

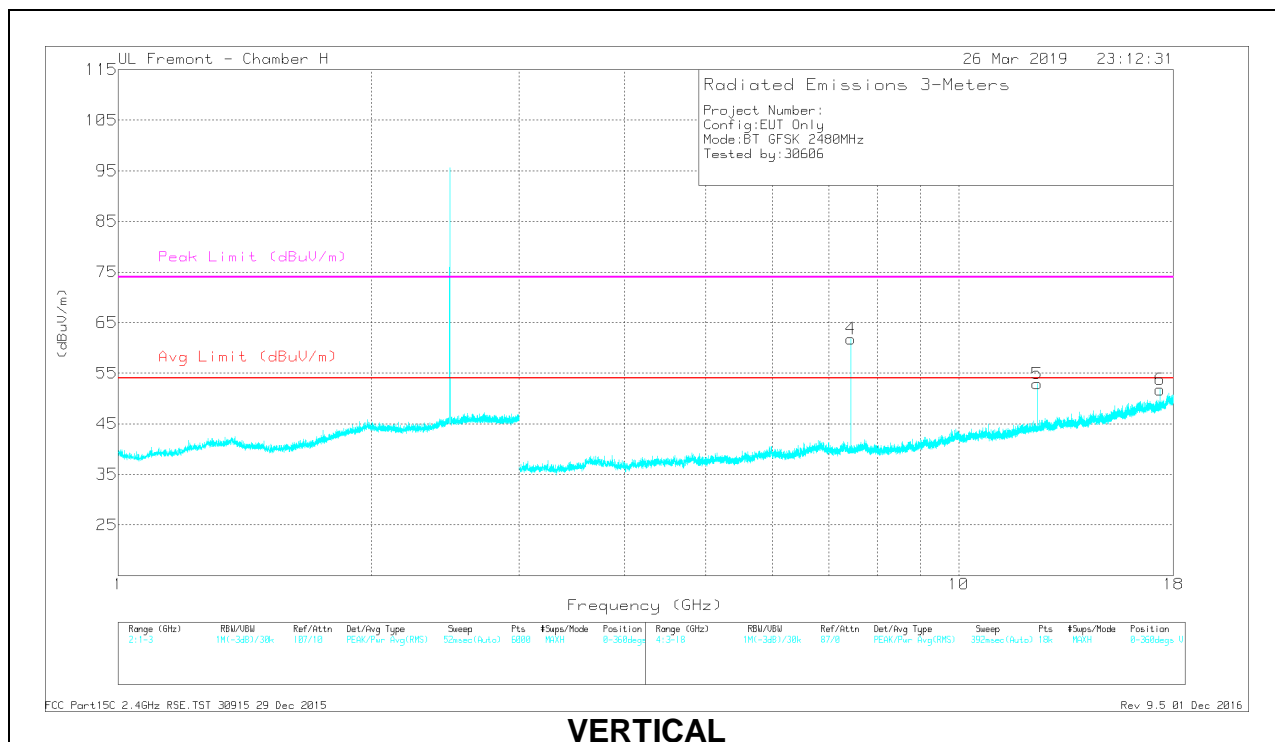
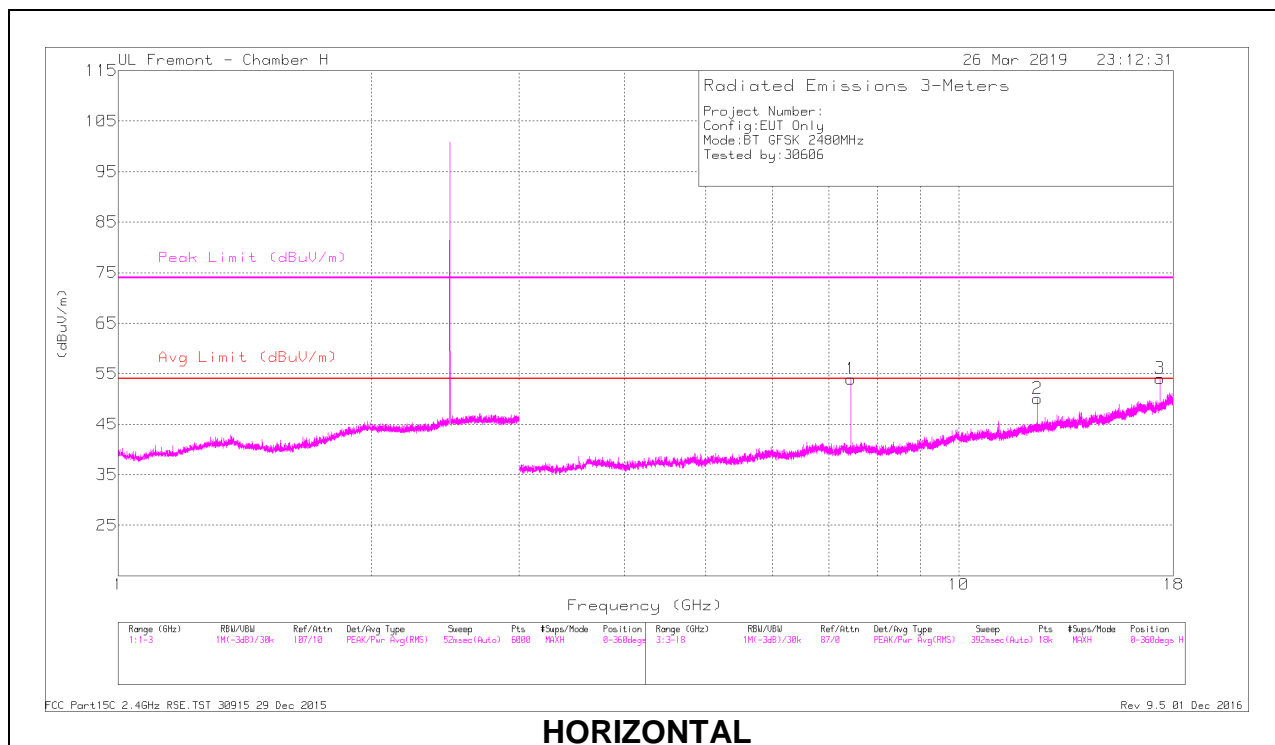


RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Fitr/P ad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 7.323	45.61	PKFH	36.4	-26.6	55.41	74	-18.59	64	100	H
2	* 12.206	39.39	PKFH	39.1	-23	55.49	74	-18.51	48	367	H
3	17.088	38.63	PKFH	41.4	-21	59.03	-	-	164	118	H
4	* 7.323	52.72	PKFH	36.4	-26.5	62.62	74	-11.38	108	143	V
5	* 12.206	41.74	PKFH	39.1	-23	57.84	74	-16.16	24	108	V
6	17.088	38.82	PKFH	41.4	-21	59.22	-	-	334	118	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

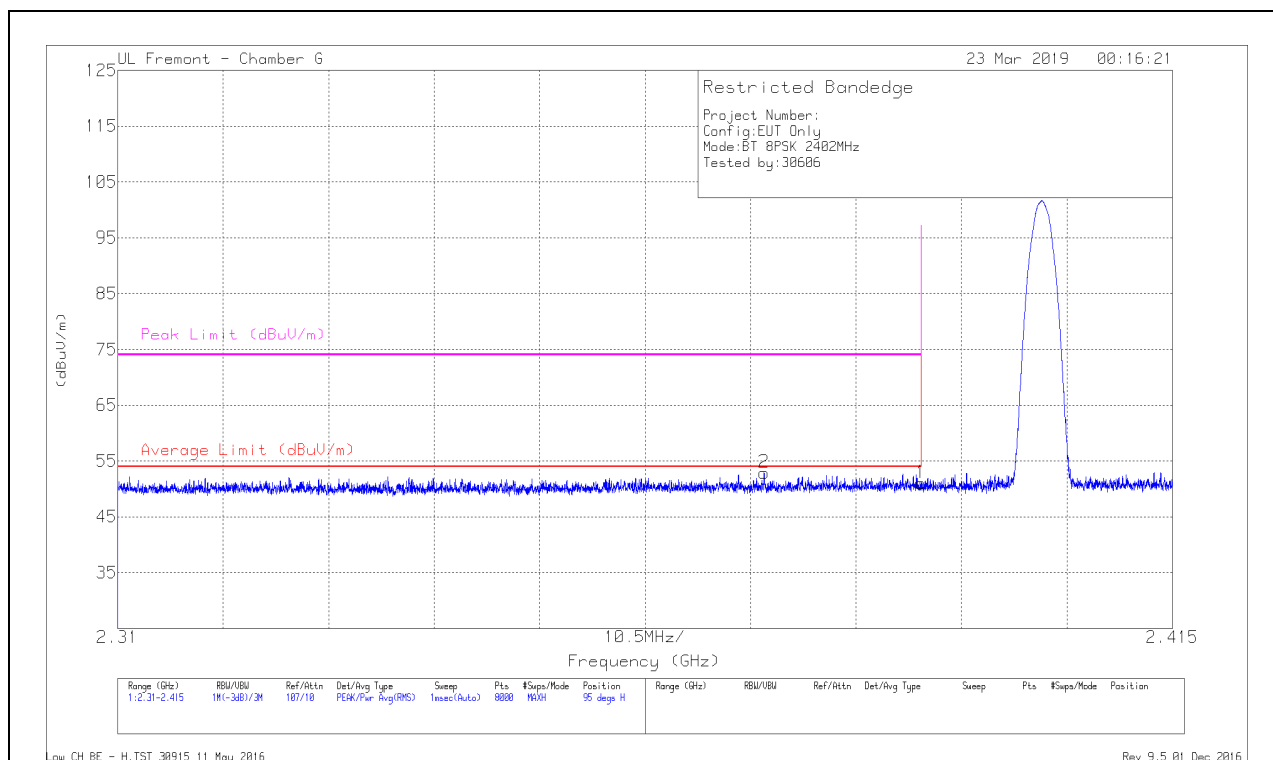
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 7.441	47.12	PKFH	36.5	-27.3	56.32	74	-17.68	224	115	H
2	* 12.401	39.92	PKFH	39.1	-23.2	55.82	74	-18.18	323	362	H
3	17.361	38.63	PKFH	41.1	-20.4	59.33	-	-	329	109	H
4	* 7.44	53.35	PKFH	36.5	-27.3	62.55	74	-11.45	304	102	V
5	* 12.399	41.14	PKFH	39.1	-23.2	57.04	74	-16.96	166	118	V
6	17.359	36.85	PKFH	41.1	-20.4	57.55	-	-	160	221	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

9.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

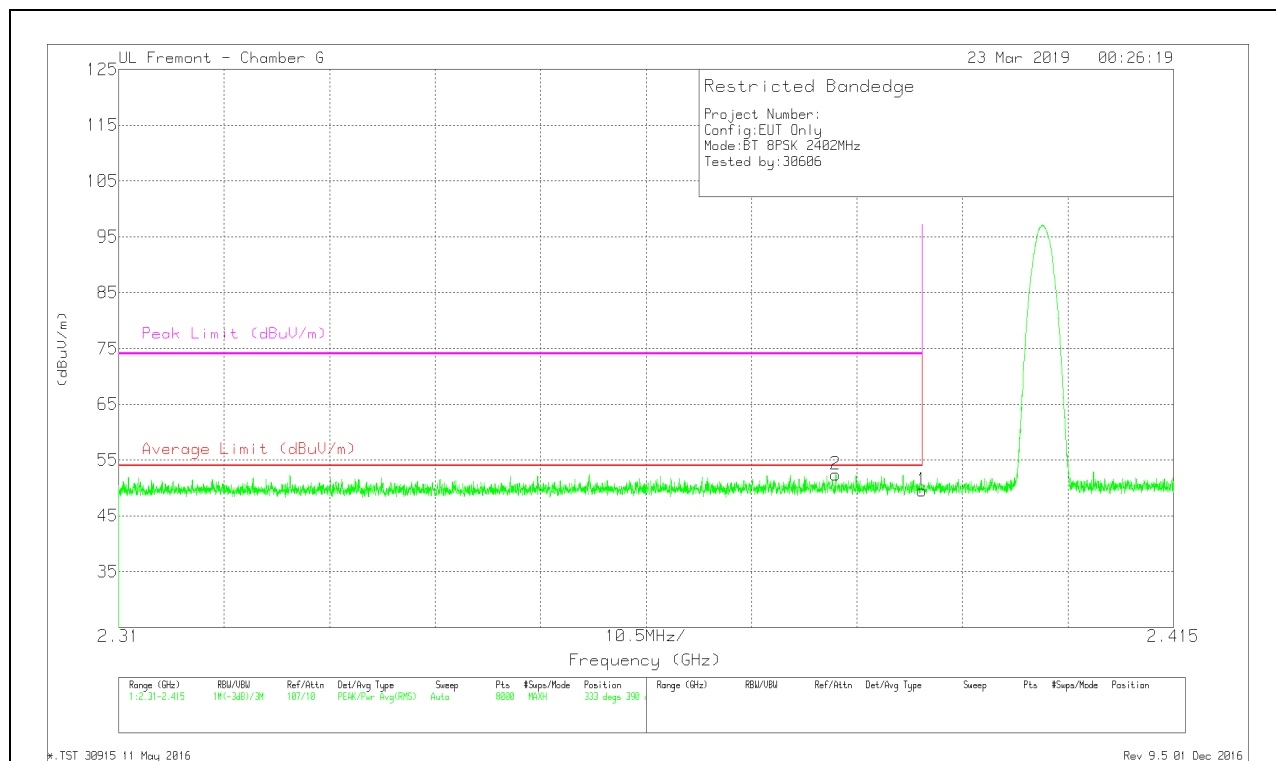
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filt/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.38	Pk	31.9	-22.3	50.98	74	-23.02	95	303	H
2	* 2.374	43.45	Pk	31.8	-22.3	52.95	74	-21.05	95	303	H

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

VERTICAL RESULT

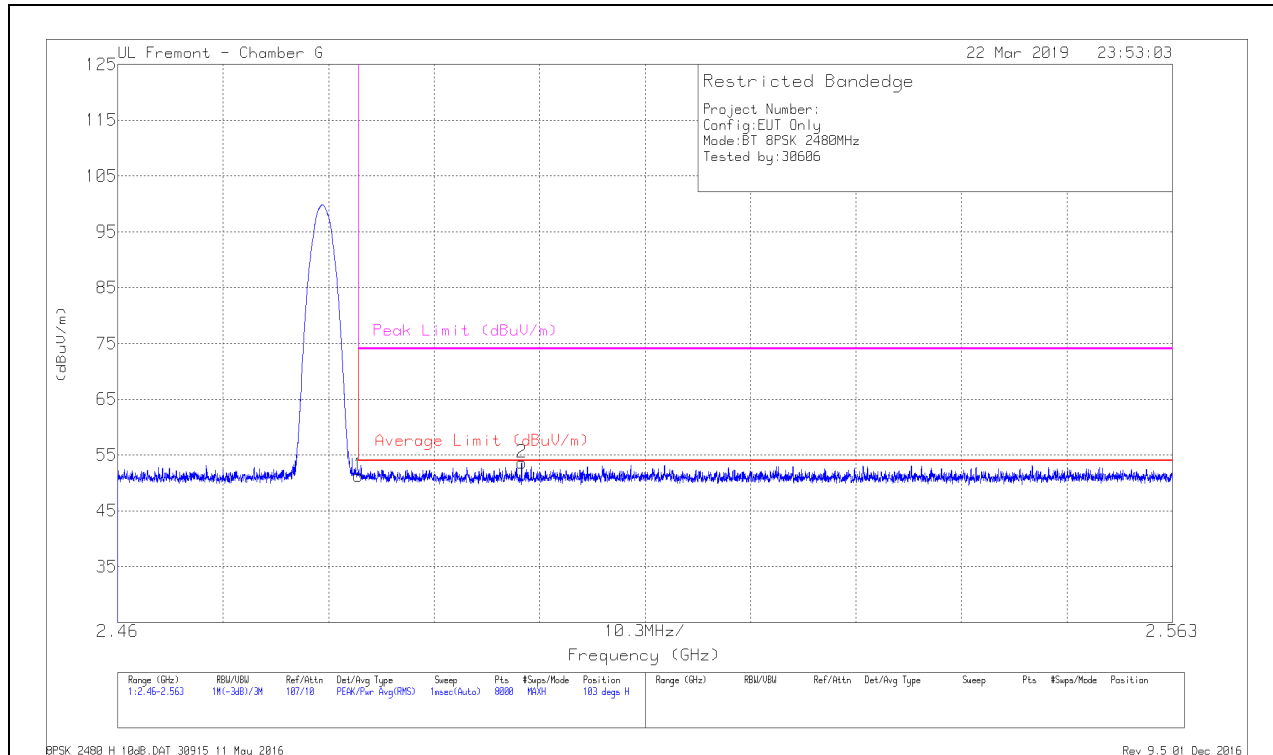


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/CbI/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40	Pk	31.9	-22.3	49.6	74	-24.4	333	390	V
2	* 2.381	42.91	Pk	31.8	-22.3	52.41	74	-21.59	333	390	V

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

BANDEDGE (HIGH CHANNEL)

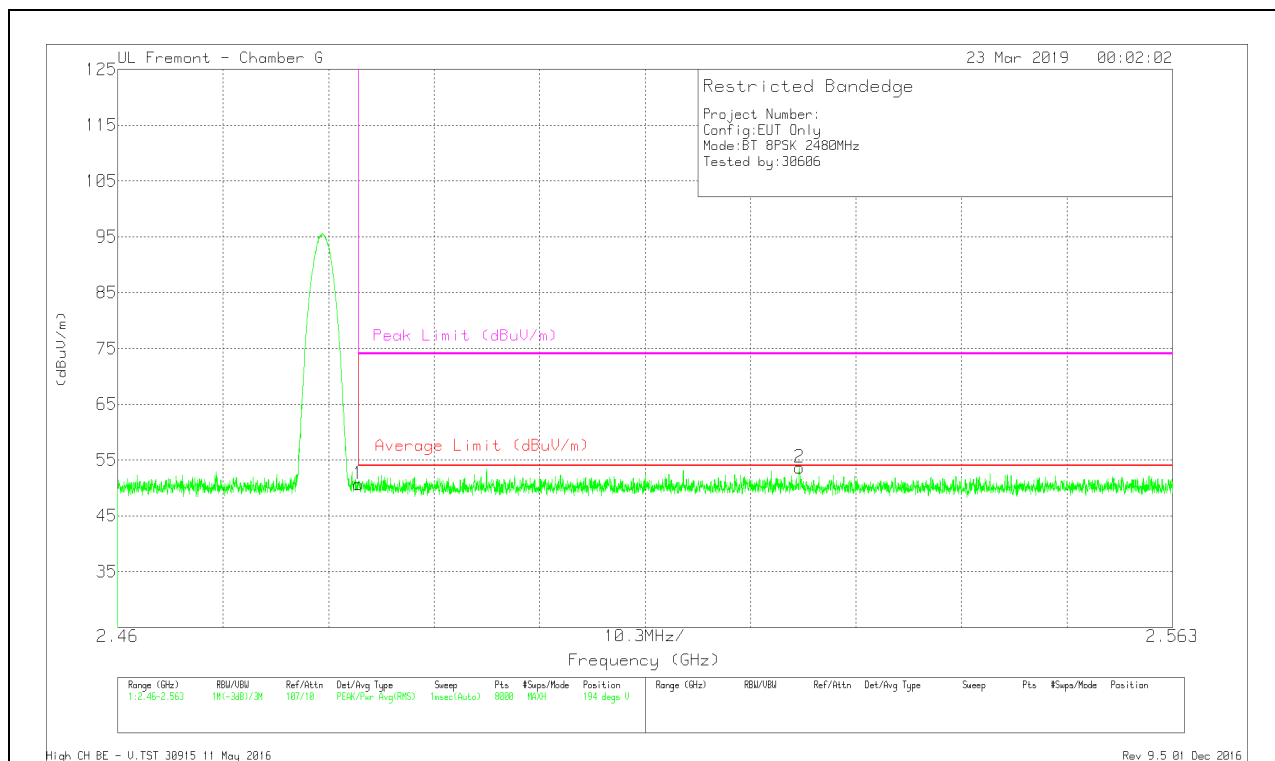
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/CbL/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.17	Pk	32.4	-22.3	51.27	74	-22.73	103	101	H
2	* 2.499	43.49	Pk	32.4	-22.3	53.59	74	-20.41	103	101	H

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

VERTICAL RESULT



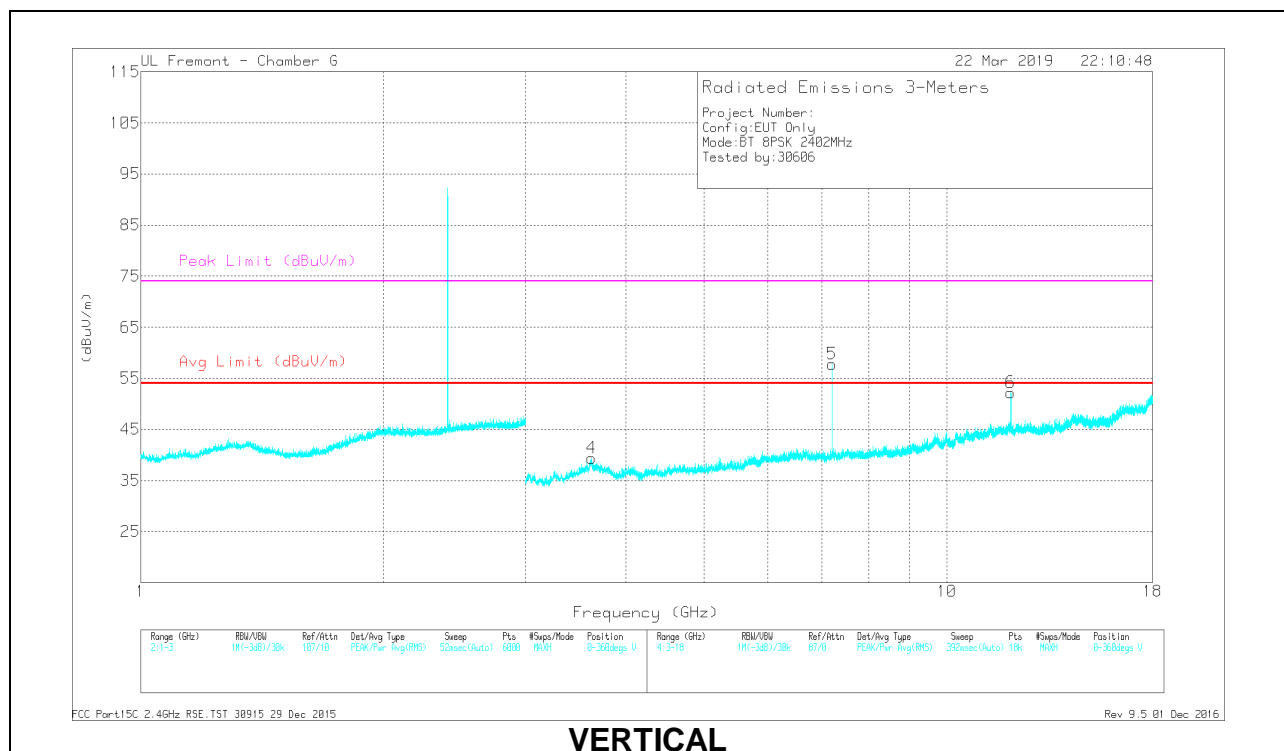
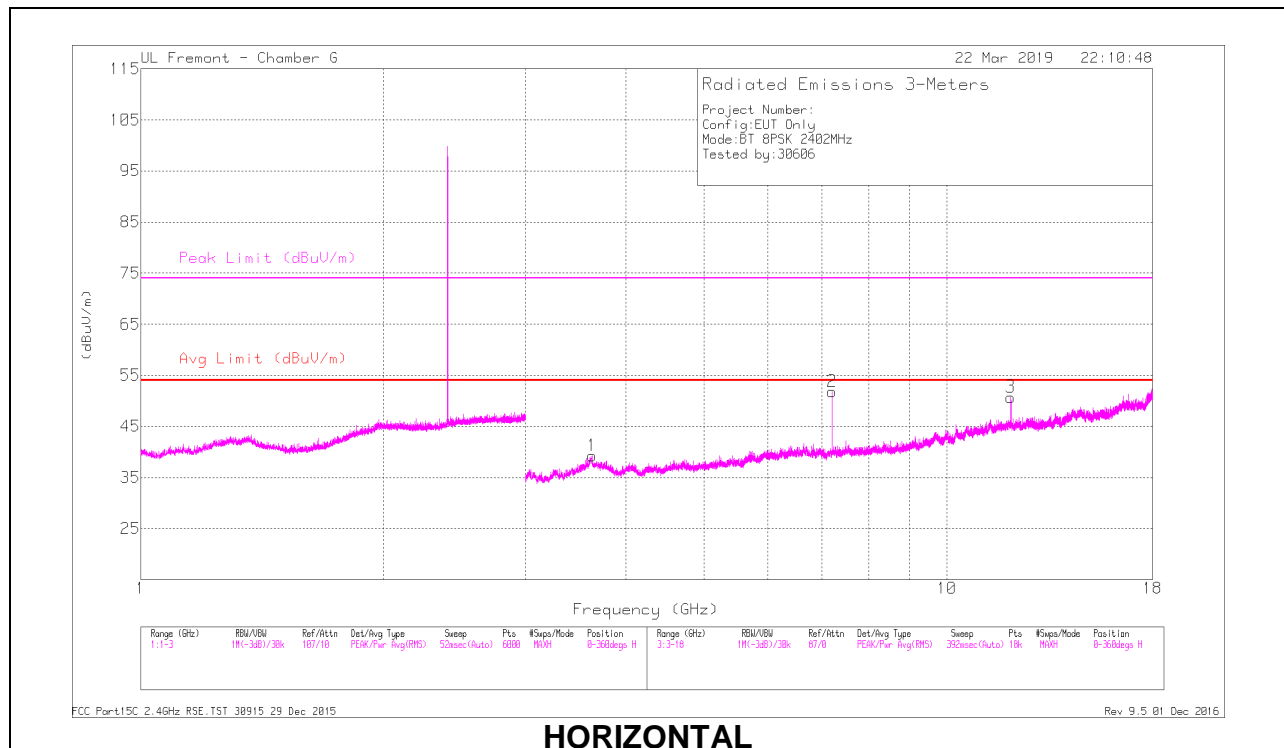
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbll/Ftr/Pa d (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.62	Pk	32.4	-22.3	50.72	74	-23.28	194	403	V
2	2.527	43.52	Pk	32.4	-22.3	53.62	74	-20.38	194	403	V

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

Pk - Peak detector

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

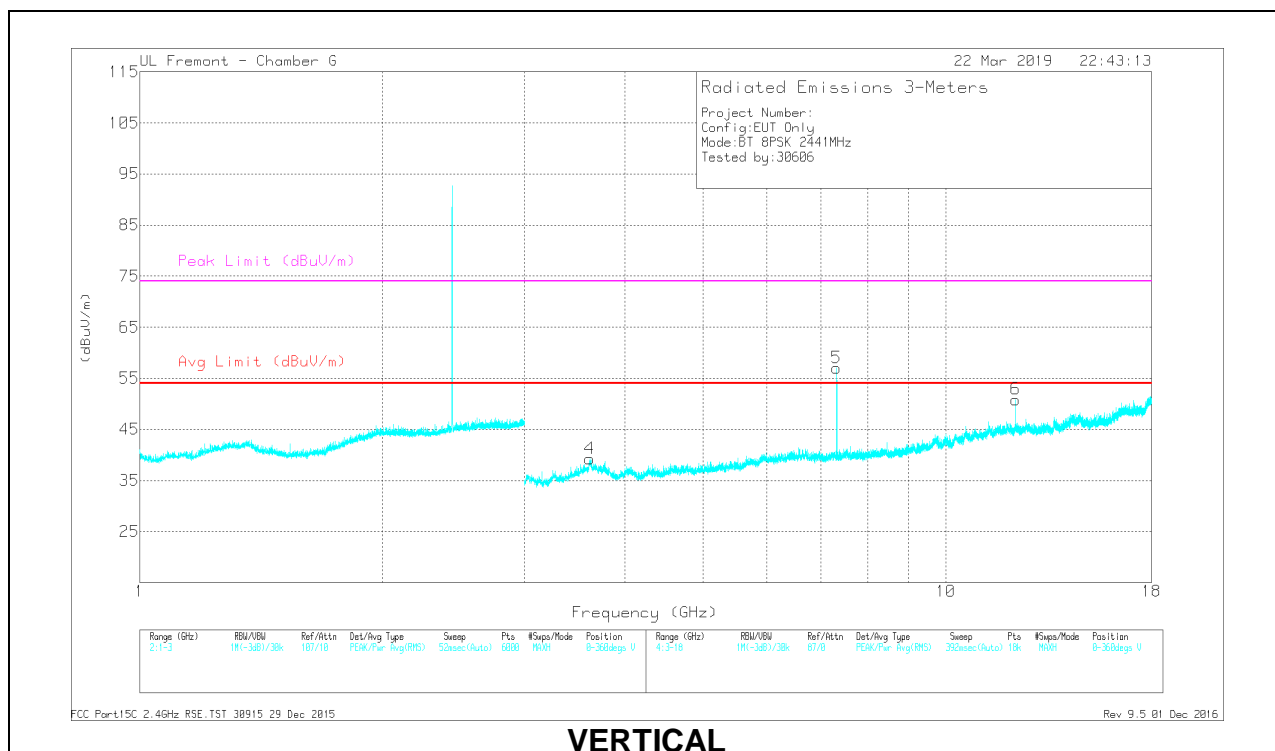
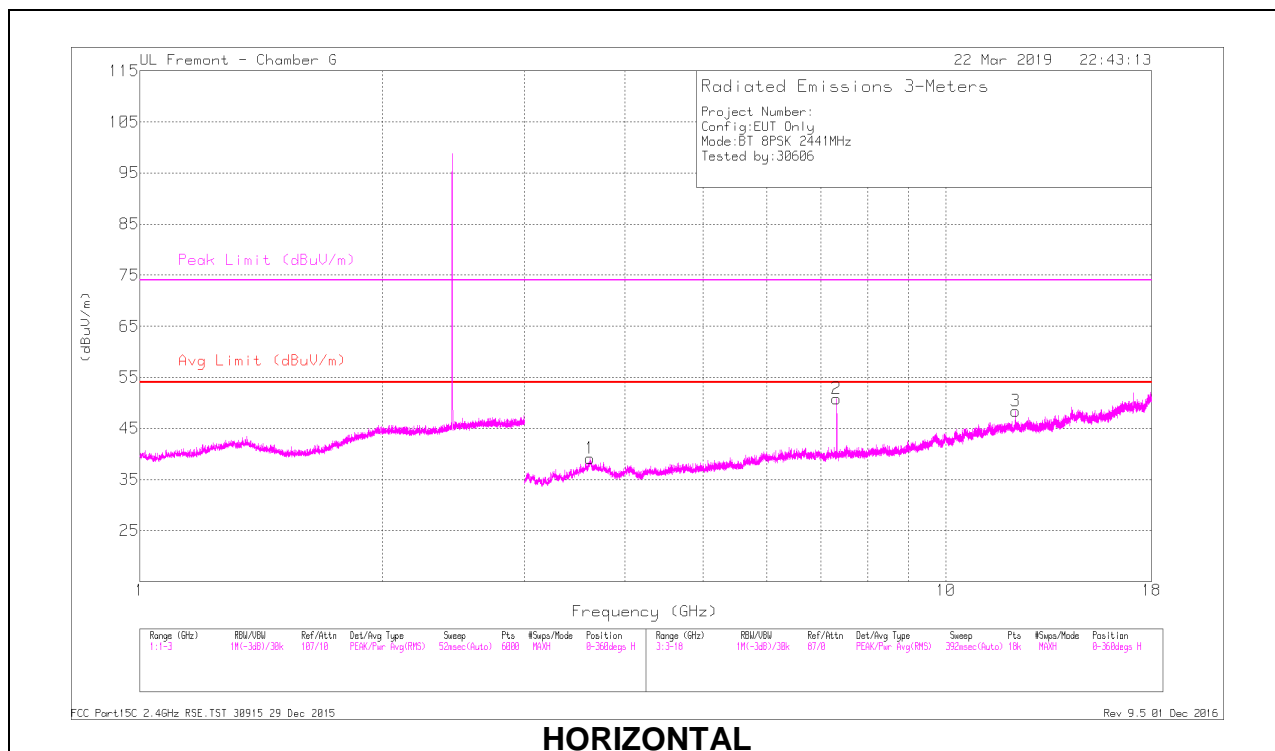


RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.634	40.37	PKFH	34.8	-29.8	45.37	74	-28.63	85	397	H
2	7.206	47.66	PKFH	35.8	-27.8	55.66	-	-	95	101	H
3	* 12.009	41.01	PKFH	39.5	-22.9	57.61	74	-16.39	263	106	H
4	* 3.624	40.11	PKFH	35.5	-30.1	45.51	74	-28.49	104	367	V
6	* 12.011	41.48	PKFH	39.5	-23	57.98	74	-16.02	45	130	V
5	7.206	53.45	PKFH	35.8	-27.8	61.45	-	-	122	211	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

MID CHANNEL RESULTS

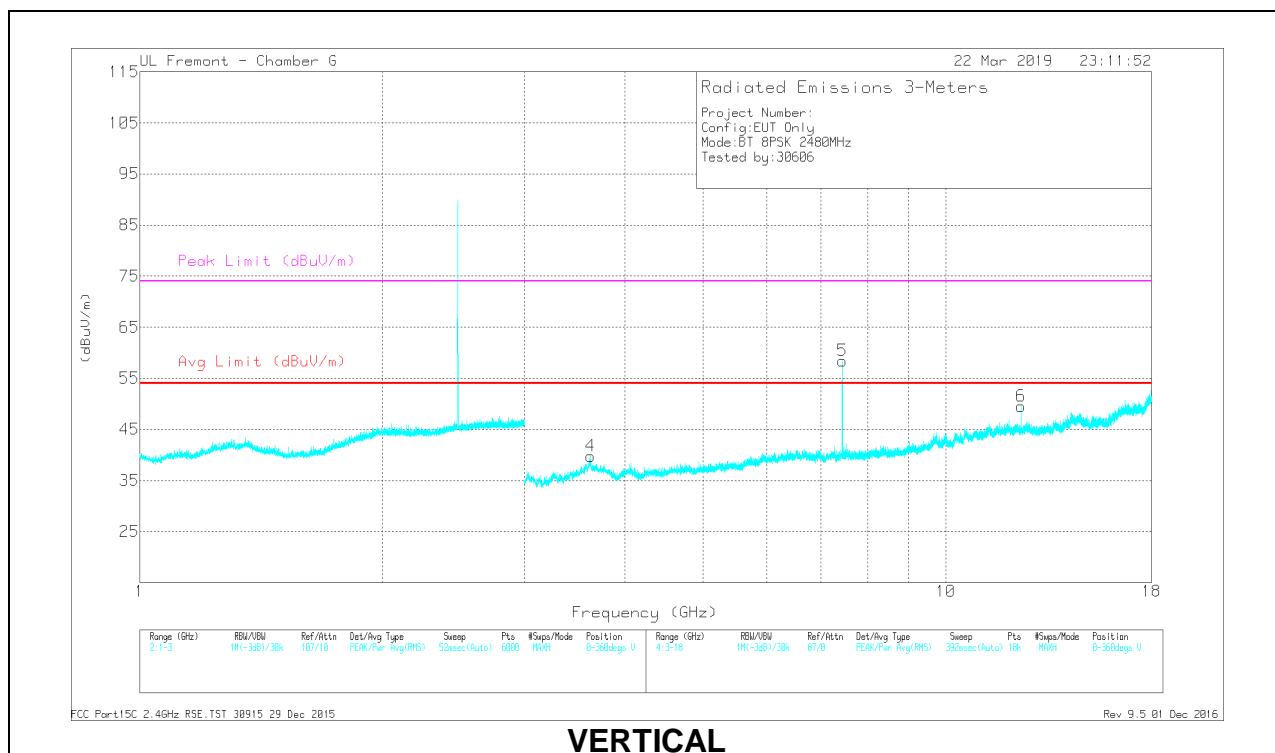
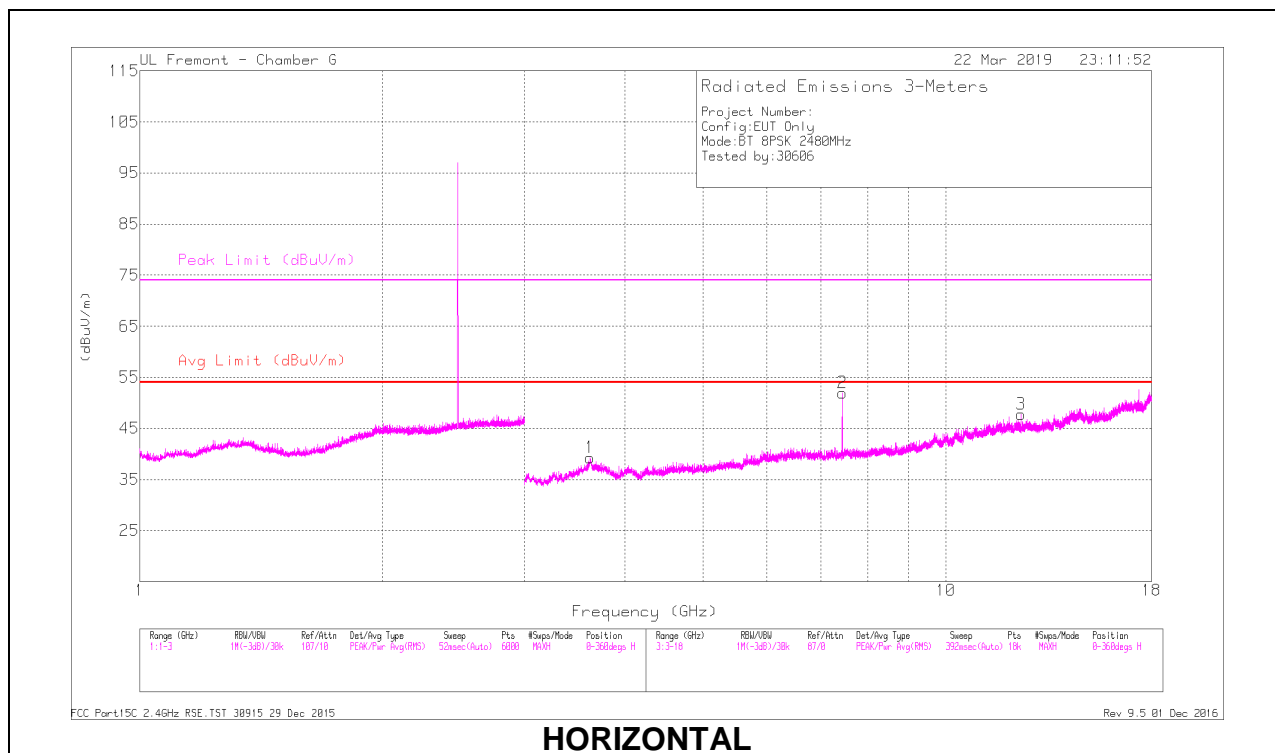


RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.621	40.36	PKFH	35.7	-30.2	45.86	74	-28.14	326	165	H
2	* 7.323	46.04	PKFH	35.9	-27.6	54.34	74	-19.66	82	105	H
3	* 12.204	38.28	PKFH	39.6	-22.9	54.98	74	-19.02	181	313	H
4	* 3.618	39.77	PKFH	35.7	-30.3	45.17	74	-28.83	119	265	V
5	* 7.323	53.02	PKFH	35.9	-27.6	61.32	74	-12.68	97	265	V
6	* 12.205	40.34	PKFH	39.5	-22.9	56.94	74	-17.06	36	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

HIGH CHANNEL RESULTS



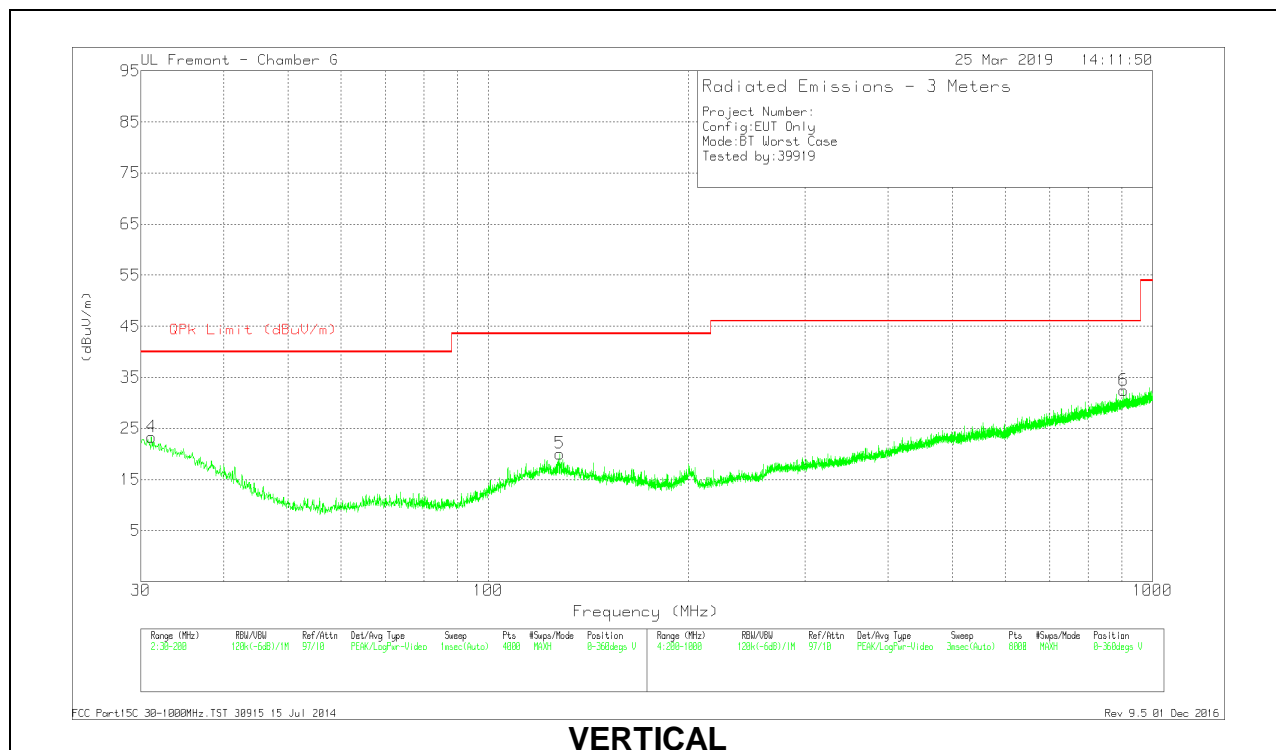
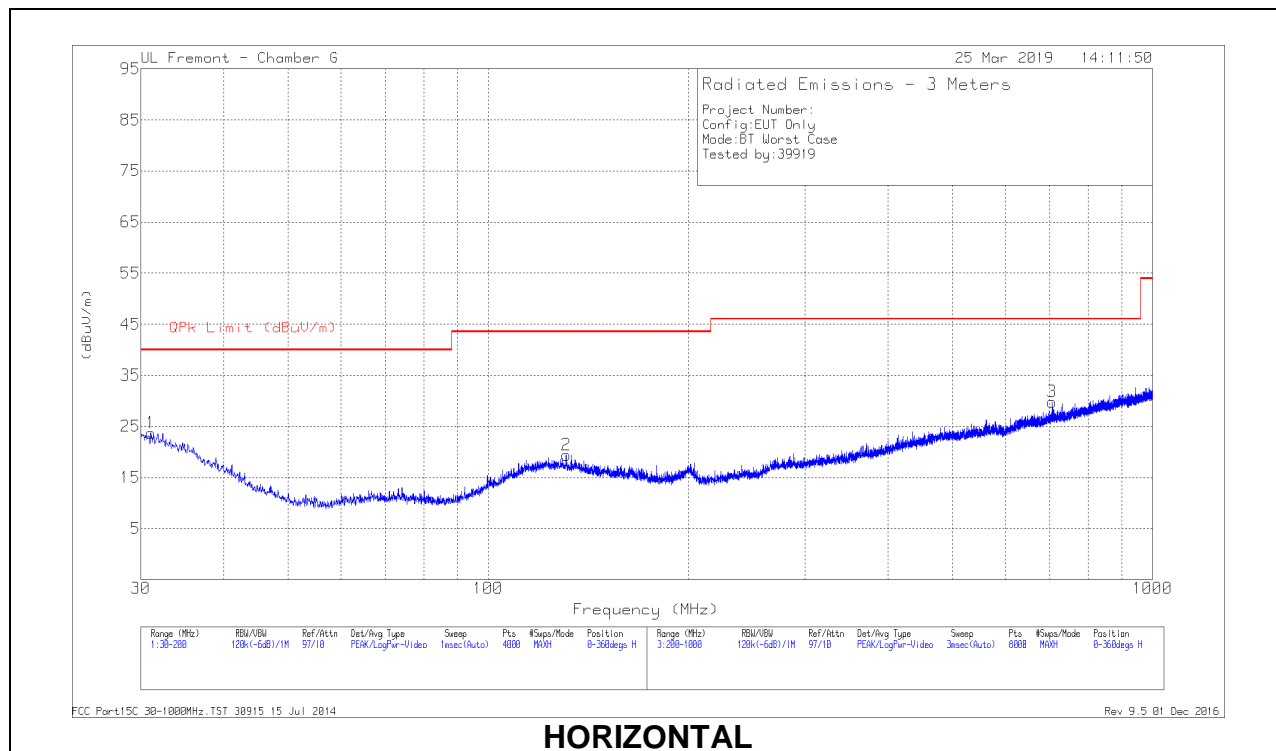
RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.616	40.2	PKFH	35.6	-30.3	45.5	74	-28.5	257	156	H
2	* 7.44	48.93	PKFH	36	-27.9	57.03	74	-16.97	282	102	H
3	* 12.4	39.02	PKFH	39.5	-23.6	54.92	74	-19.08	292	285	H
4	* 3.621	39.12	PKFH	35.7	-30.2	44.62	74	-29.38	51	202	V
5	* 7.44	54.13	PKFH	36	-27.9	62.23	74	-11.77	3	126	V
6	* 12.399	39.58	PKFH	39.5	-23.6	55.48	74	-18.52	248	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

9.2. WORST CASE BELOW 1 GHZ

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

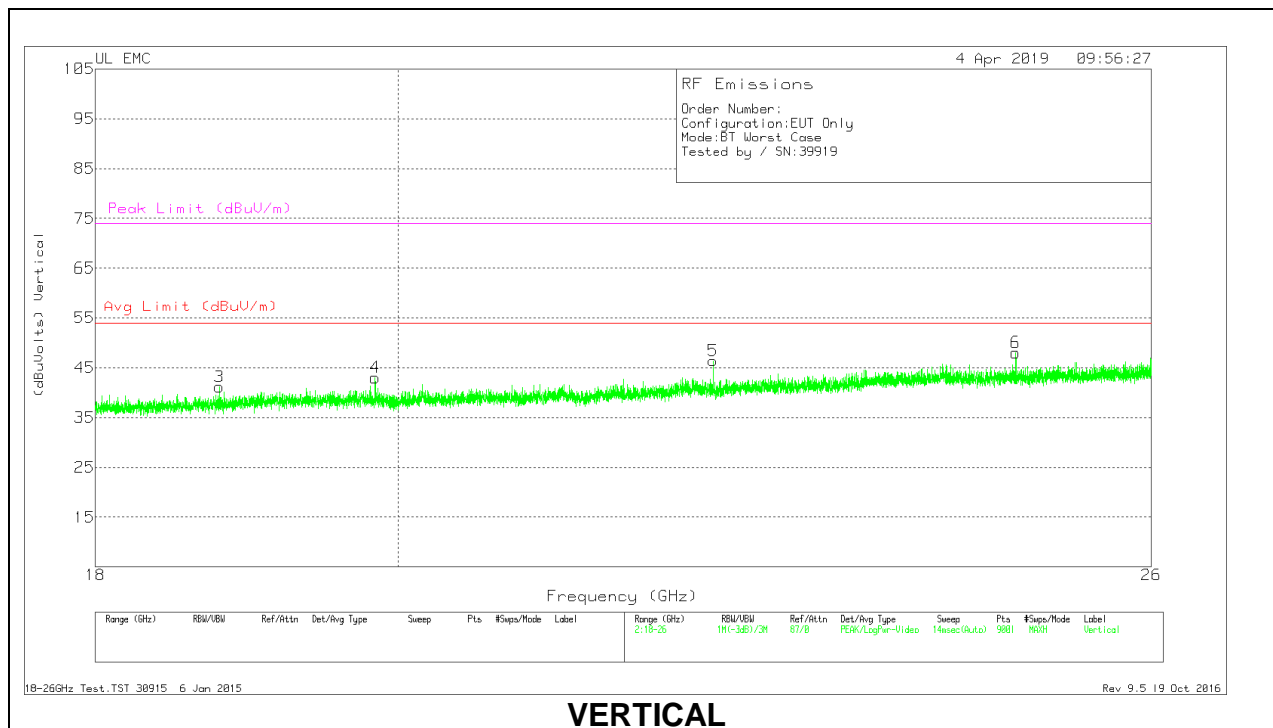
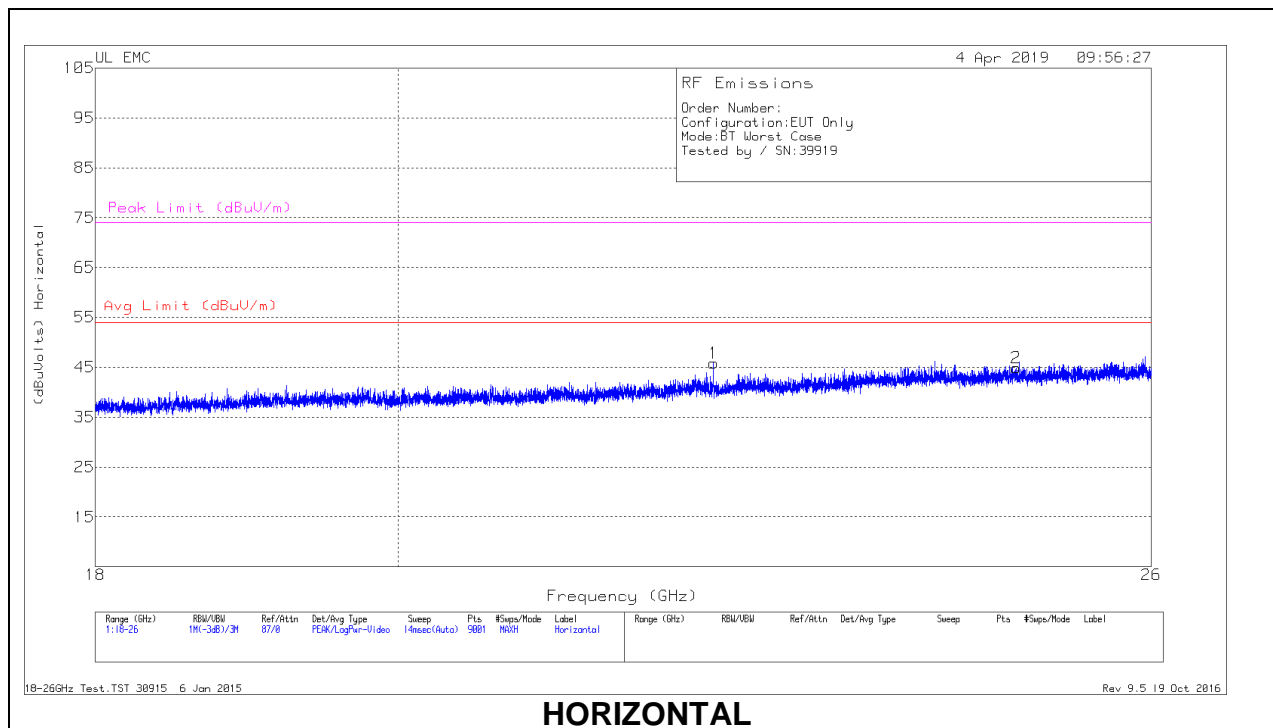


Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.0628	28.92	Pk	26	-31.2	23.72	40	-16.28	0-360	300	H
2	* 131.0061	29.67	Pk	19.8	-30.1	19.37	43.52	-24.15	0-360	300	H
3	705.6657	30.79	Pk	26.2	-27.2	29.79	46.02	-16.23	0-360	100	H
4	31.1265	28.5	Pk	26	-31.2	23.3	40	-16.7	0-360	100	V
5	* 128.0729	30.38	Pk	19.9	-30.2	20.08	43.52	-23.44	0-360	100	V
6	905.3917	30.09	Pk	28.3	-25.9	32.49	46.02	-13.53	0-360	100	V

9.3. WORST CASE 18-26 GHZ

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



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	22.322	42.25	Pk	33.5	-20.4	-9.5	45.85	54	-8.15	74	-28.15
2	24.804	39.49	Pk	34.4	-19.5	-9.5	44.89	54	-9.11	74	-29.11
3	18.793	40.17	Pk	32.4	-21.9	-9.5	41.17	54	-12.83	74	-32.83
4	19.841	41.31	Pk	32.7	-21.5	-9.5	43.01	54	-10.99	74	-30.99
5	22.319	42.83	Pk	33.5	-20.4	-9.5	46.43	54	-7.57	74	-27.57
6	24.799	42.62	Pk	34.4	-19.5	-9.5	48.02	54	-5.98	74	-25.98

Pk - Peak detector

10. 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

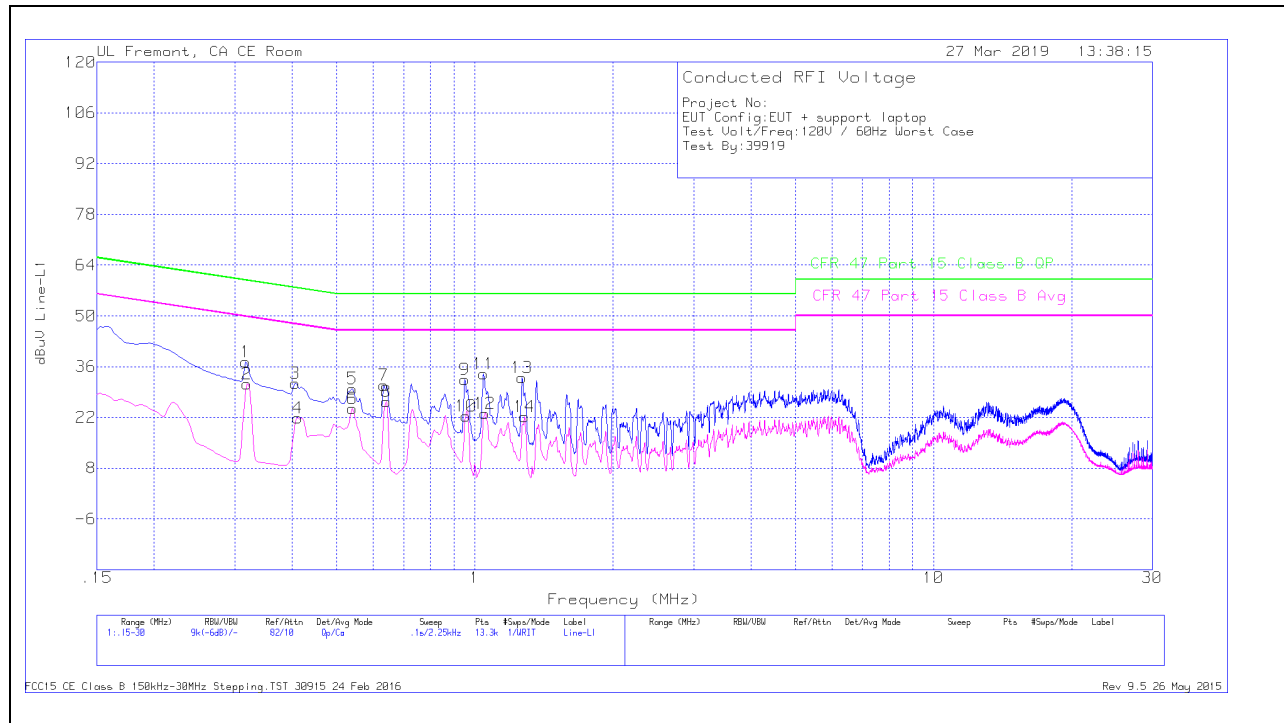
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

10.1.1. AC Power Line Host

LINE 1 RESULTS



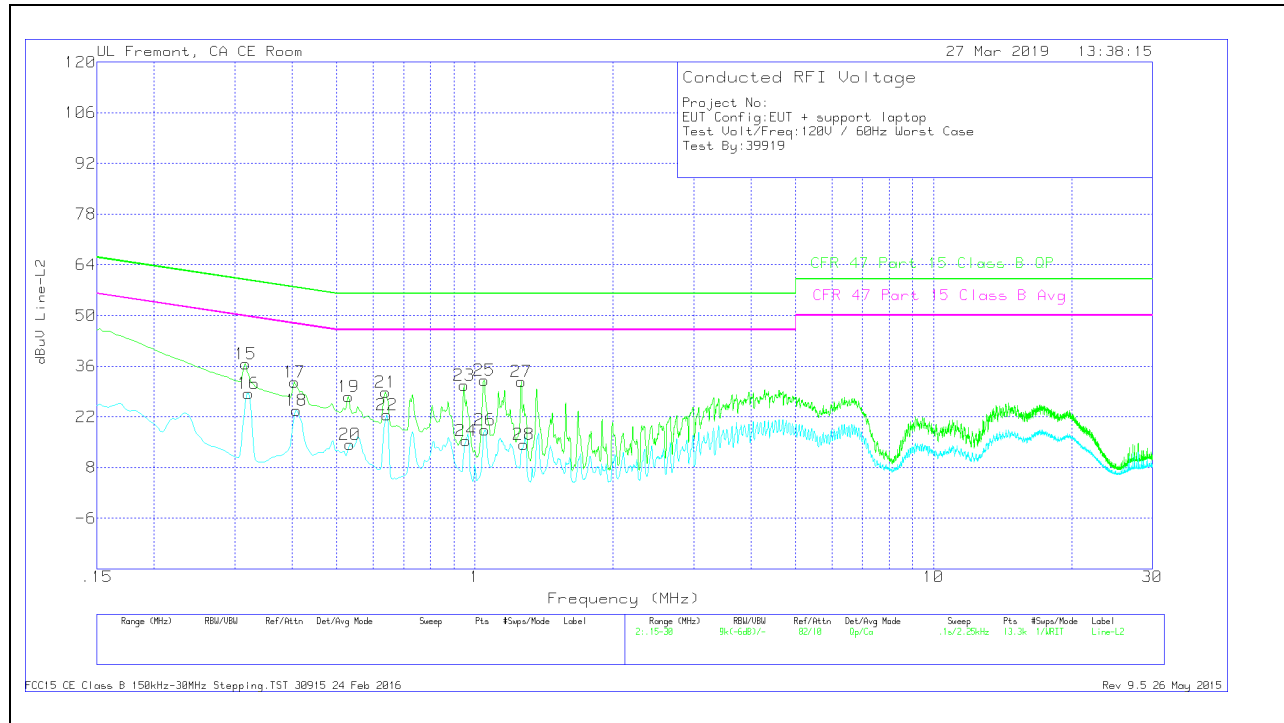
Range 1: Line-L1 .15 - 30MHz

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	.3165	27.2	Qp	0	0	10.1	37.3	59.8	-22.5	-	-
2	.31875	21.16	Ca	0	0	10.1	31.26	-	-	49.74	-18.48
3	.4065	21.3	Qp	0	0	10.1	31.4	57.72	-26.32	-	-
4	.411	11.73	Ca	0	0	10.1	21.83	-	-	47.63	-25.8
5	.5415	19.82	Qp	0	0	10.1	29.92	56	-26.08	-	-
6	.5415	14.27	Ca	0	0	10.1	24.37	-	-	46	-21.63
7	.63375	20.7	Qp	0	0	10.1	30.8	56	-25.2	-	-
8	.6405	16.28	Ca	0	0	10.1	26.38	-	-	46	-19.62
9	.951	22.3	Qp	0	.1	10.1	32.5	56	-23.5	-	-
10	.9555	12.22	Ca	0	.1	10.1	22.42	-	-	46	-23.58
11	1.0455	23.84	Qp	0	.1	10.1	34.04	56	-21.96	-	-
12	1.05225	12.82	Ca	0	.1	10.1	23.02	-	-	46	-22.98
13	1.26825	22.75	Qp	0	.1	10.1	32.95	56	-23.05	-	-
14	1.284	11.93	Ca	0	.1	10.1	22.13	-	-	46	-23.87

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

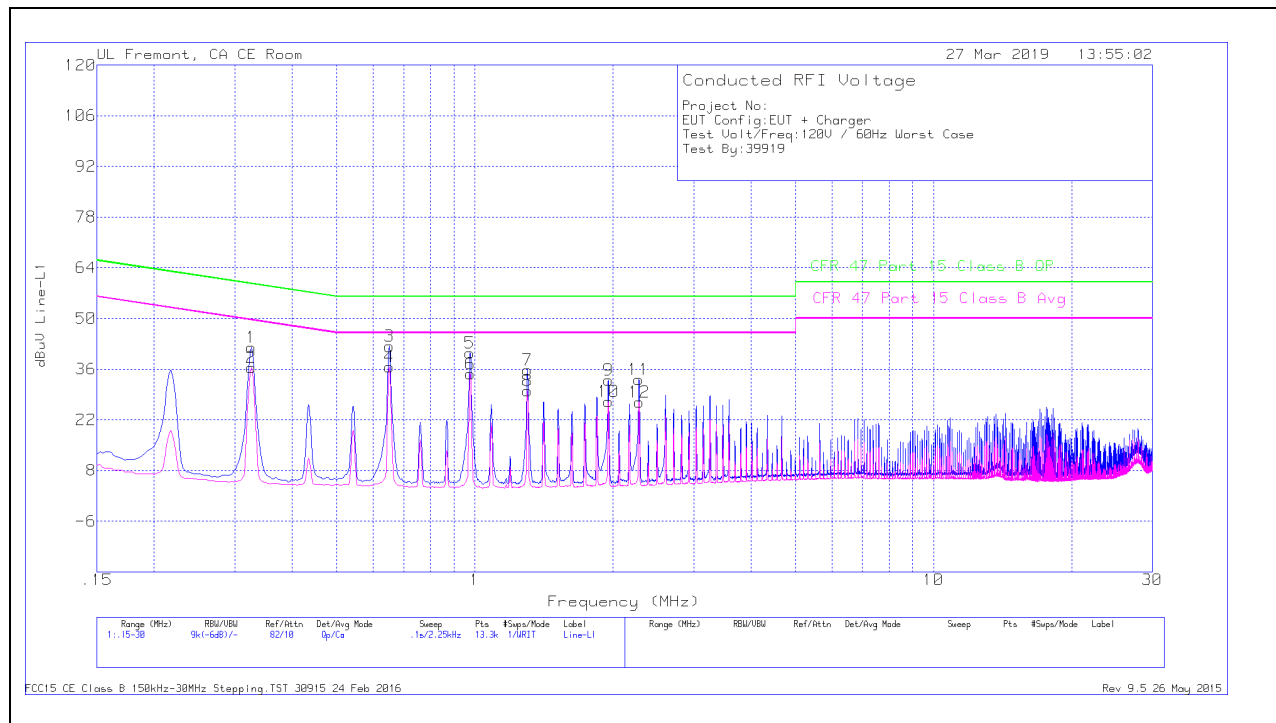
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
15	.3165	26.56	Qp	0	0	10.1	36.66	59.8	-23.14	-	-
16	.321	18.36	Ca	0	0	10.1	28.46	-	-	49.68	-21.22
17	.40425	21.48	Qp	0	0	10.1	31.58	57.77	-26.19	-	-
18	.40875	13.73	Ca	0	0	10.1	23.83	-	-	47.67	-23.84
19	.53025	17.55	Qp	0	0	10.1	27.65	56	-28.35	-	-
20	.53475	4.33	Ca	0	0	10.1	14.43	-	-	46	-31.57
21	.63825	18.71	Qp	0	0	10.1	28.81	56	-27.19	-	-
22	.64275	12.45	Ca	0	0	10.1	22.55	-	-	46	-23.45
23	.9465	20.47	Qp	0	.1	10.1	30.67	56	-25.33	-	-
24	.9555	5.21	Ca	0	.1	10.1	15.41	-	-	46	-30.59
25	1.04775	21.95	Qp	0	.1	10.1	32.15	56	-23.85	-	-
26	1.05225	8.24	Ca	0	.1	10.1	18.44	-	-	46	-27.56
27	1.2615	21.53	Qp	0	.1	10.1	31.73	56	-24.27	-	-
28	1.27725	4.09	Ca	0	.1	10.1	14.29	-	-	46	-31.71

Qp - Quasi-Peak detector

Ca - CISPR average detection

10.1.2. AC Power Line Norm

LINE 1 RESULTS



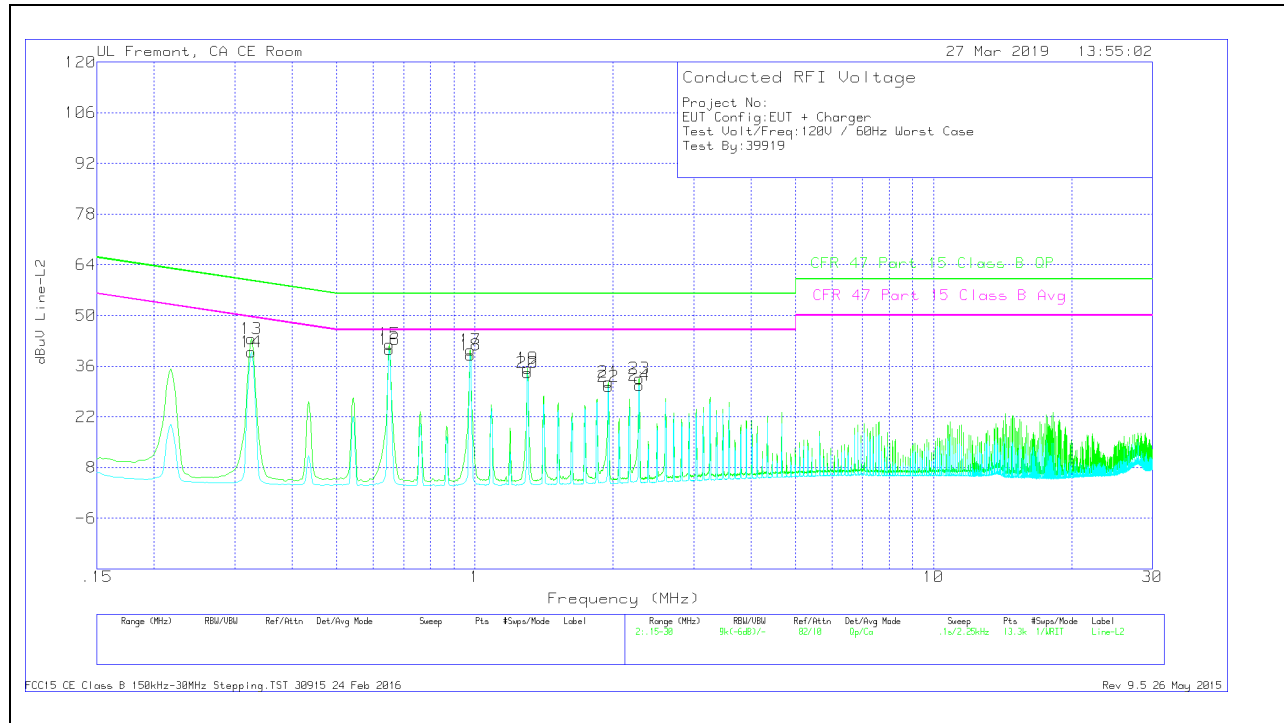
Range 1: Line-L1 .15 - 30MHz

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	.3255	31.95	Qp	0	0	10.1	42.05	59.57	-17.52	-	-
2	.3255	26.39	Ca	0	0	10.1	36.49	-	-	49.57	-13.08
3	.65175	32.17	Qp	0	0	10.1	42.27	56	-13.73	-	-
4	.65175	26.44	Ca	0	0	10.1	36.54	-	-	46	-9.46
5	.97575	30.27	Qp	0	.1	10.1	40.47	56	-15.53	-	-
6	.978	24.5	Ca	0	.1	10.1	34.7	-	-	46	-11.3
7	1.302	25.6	Qp	0	.1	10.1	35.8	56	-20.2	-	-
8	1.302	19.76	Ca	0	.1	10.1	29.96	-	-	46	-16.04
9	1.9545	22.76	Qp	0	.1	10.1	32.96	56	-23.04	-	-
10	1.9545	16.81	Ca	0	.1	10.1	27.01	-	-	46	-18.99
11	2.2785	22.92	Qp	0	.1	10.1	33.12	56	-22.88	-	-
12	2.28075	16.65	Ca	0	.1	10.1	26.85	-	-	46	-19.15

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



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)
13	.3255	33.42	Qp	0	0	10.1	43.52	59.57	-16.05	-	-
14	.3255	29.77	Ca	0	0	10.1	39.87	-	-	49.57	-9.7
15	.65175	31.99	Qp	0	0	10.1	42.09	56	-13.91	-	-
16	.65175	30.44	Ca	0	0	10.1	40.54	-	-	46	-5.46
17	.978	30.27	Qp	0	.1	10.1	40.47	56	-15.53	-	-
18	.978	28.87	Ca	0	.1	10.1	39.07	-	-	46	-6.93
19	1.302	25.19	Qp	0	.1	10.1	35.39	56	-20.61	-	-
20	1.302	23.96	Ca	0	.1	10.1	34.16	-	-	46	-11.84
21	1.9545	21.42	Qp	0	.1	10.1	31.62	56	-24.38	-	-
22	1.9545	20.15	Ca	0	.1	10.1	30.35	-	-	46	-15.65
23	2.28075	22.46	Qp	0	.1	10.1	32.66	56	-23.34	-	-
24	2.28075	20.49	Ca	0	.1	10.1	30.69	-	-	46	-15.31

Qp - Quasi-Peak detector

Ca - CISPR average detection

11. SETUP PHOTOS

Please refer to 12742033-EP2V1 for setup photos

END OF TEST REPORT