TEST REPORT

Report Number. : 13211873-E2V1

Applicant	:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
Model	:	SM-A715W
FCC ID	:	A3LSMA715W
EUT Description	:	GSM/WCDMA/LTE Phablet with BT/BLE, DTS/UNII a/b/g/n/ac, NFC and ANT+
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
February 25, 2020

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2/25/2020	Initial Issue	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
EUT DESCRIPTION:	GSM/WCDMA/LTE Phablet with BT/BLE, DTS/UNII a/b/g/n/ac, NFC and ANT+
MODEL:	SM-A715W
SERIAL NUMBER:	Conducted (Original): R38M60J9VBM Radiated (Original): R38M808E5AH Radiated (Spot Check): R38N108PFHB
DATE TESTED:	November 13, 2019 –December 03, 2019 (Original) February 11, 2020 - February 13, 2020 (Spot Check)

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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.

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2. INTRODUCTION OF TEST DATA REUSE

2.1. INTRODUCTION

According to the manufacturer, FCC ID: A3LSMA715F and FCC ID: A3LSMA715W non-licensed radios are electrically identical. The FCC ID: A3LSMA715F test data shall remain representative of FCC ID: A3LSMA715W.

The applicant takes full responsibility that the test data as referenced in this section represents compliance for this FCC ID.

2.2. DIFFERENCES

The FCC ID: A3LSMA715F, shares the same enclosure and circuit board as FCC ID: A3LSMA715W. The BT antennas and surrounding circuitry and layout are identical between two models.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG715F remains representative of FCC ID: A3LSMA715W. The test data of FCC ID: A3LSMG715F being submitted for this application to cover BT features.

2.3. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device A3LSMA715W for radiated harmonic spurious and radiated band-edge. The data from the application has been verified through appropriate spot checks to demonstrate compliance for this device in accordance to FCC public KDB 484596 D01 as shown in the summary below.

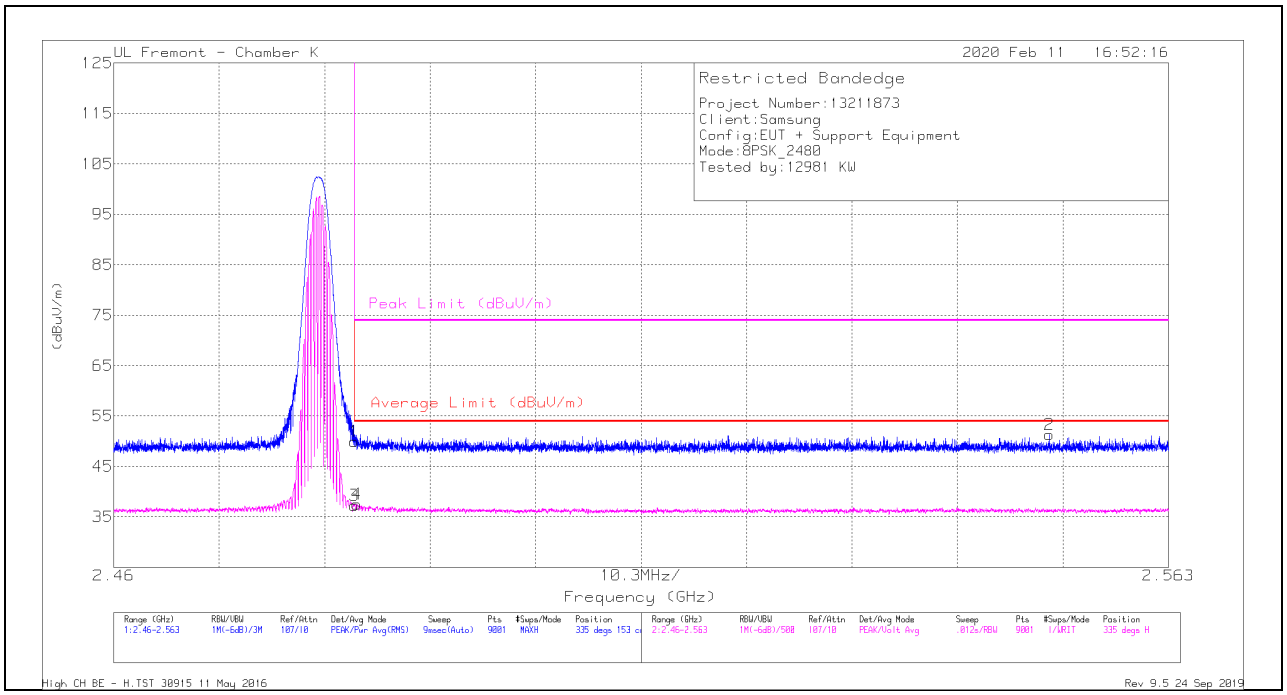
A3LSMA705W SPOT CHECK RESULTS										
Technology	Mode	Test Item	Channel	Measured	Original model		Spot check model		Delta (dB)	
					SM-A715F		SM-A715W			
					A3LSMA715F		A3LSMA715W			
				Frequency	Peak	Ave	Peak	Ave	Peak	Ave
BT	8PSK	RBE	78	2483.5MHz	50.89	38.03	51.24	36.84	0.35	-1.19
	8PSK	RSE	0	2723.45MHz	51.69	38.24	53.31	40.11	1.62	1.87

Comparison of the models, upper deviation is within 3dB range and all tests are under FCC Technical Limits.

SPOT CHECK DATA

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

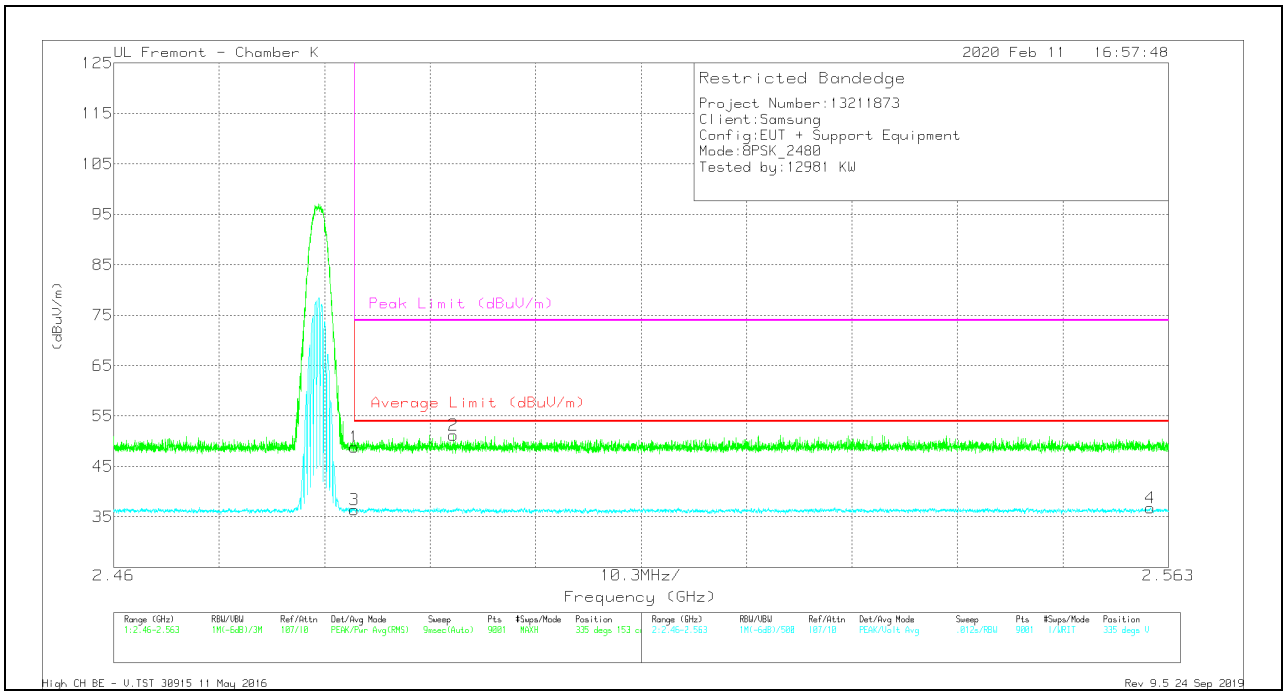


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	42.01	Pk	32.5	-24.6	49.91	-	-	74	-24.09	335	153	H
2	2.55137	43.51	Pk	32.4	-24.6	51.31	-	-	74	-22.69	335	153	H
3	* 2.48351	29.4	VA1T	32.5	-24.6	37.3	54	-16.7	-	-	335	153	H
4	* 2.48377	29.63	VA1T	32.5	-24.6	37.53	54	-16.47	-	-	335	153	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL RESULT



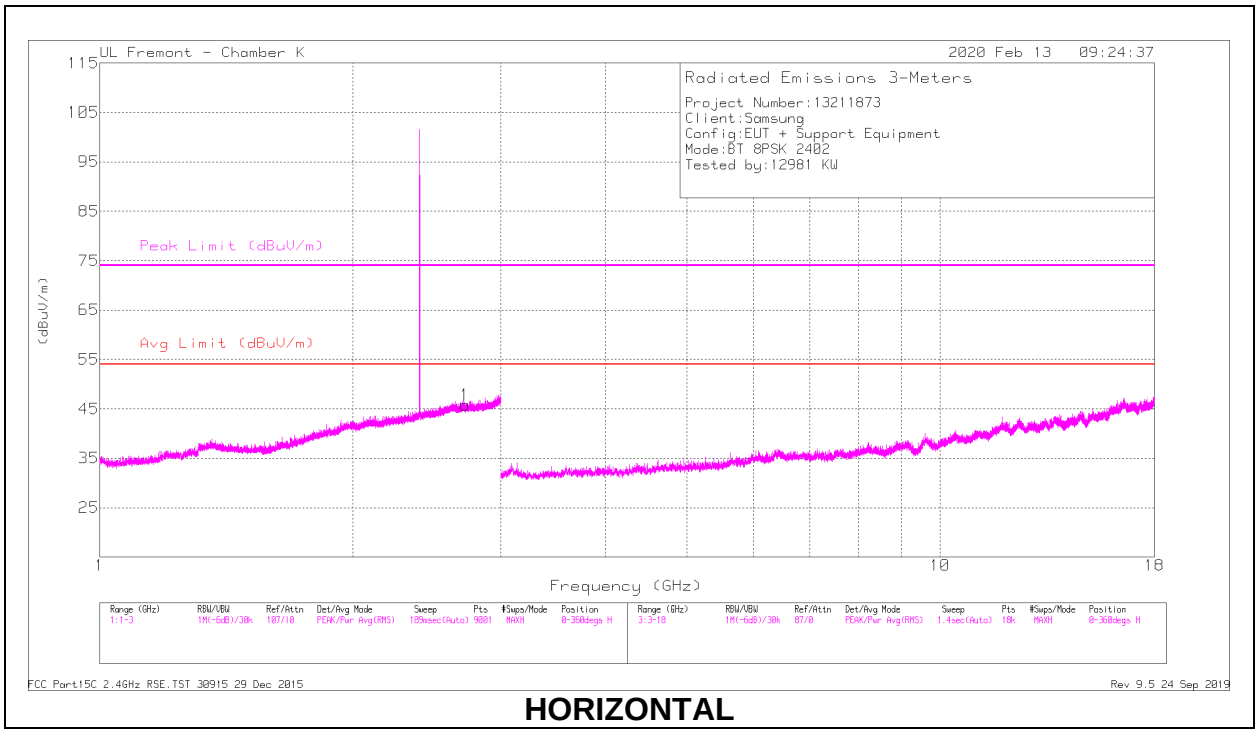
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	40.95	Pk	32.5	-24.6	48.85	-	-	74	-25.15	335	153	V
2	* 2.49315	43.34	Pk	32.5	-24.6	51.24	-	-	74	-22.76	335	153	V
3	* 2.48351	28.52	VA1T	32.5	-24.6	36.42	54	-17.58	-	-	335	153	V
4	2.56122	28.94	VA1T	32.5	-24.6	36.84	54	-17.16	-	-	335	153	V

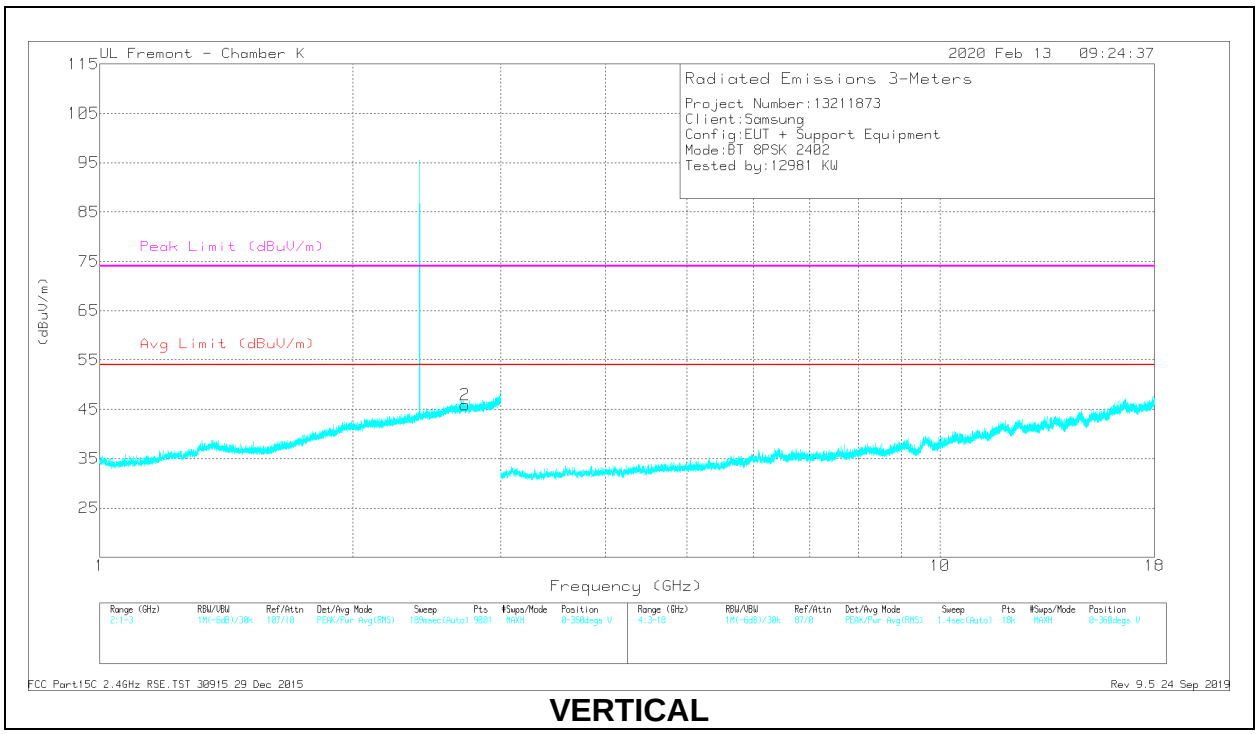
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.72165	33.31	PKFH	32.6	-12.6	53.31	-	-	74	-20.69	228	236	H
* 2.72383	22.97	VA1T	32.6	-12.6	40.11	54	-13.89	-	-	228	236	H
* 2.71994	32.68	PKFH	32.7	-12.5	52.88	-	-	74	-21.12	85	317	V
* 2.72127	23.13	VA1T	32.6	-12.6	39.58	54	-14.42	-	-	85	317	V

PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak.
VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

2.4. REFERENCE DETAIL

Reference application that contains the reused reference data

Equipment Class	Reference FCC ID	Type Grant/ Permissive Change	Reference Application	Folder Test/RF Exposure	Report Title/Section
DSS	A3LSMA715F	Grant	13096868-E2	Test	FCC Report BT / All sections

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3. 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, KDB 414788 D01 Radiated Test Site v01r01, and KDB 484596 D01 Referencing Test Data v01.

4. 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	☐ Chamber D	☒ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☒ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

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: 2324A.

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

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5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. 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

5.3. MEASUREMENT UNCERTAINTY

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.).

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%.

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE Phablet with BT/BLE, DTS/UNII a/b/g/n/ac, NFC and ANT+. The test report addresses the BT operational mode.

6.2. 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	10.5	11.22
2402 - 2480	Enhanced DQPSK	10.3	10.72
2402 - 2480	Enhanced 8PSK	10.5	11.22

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 8.5.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum peak gain of -7.52 dBi.

6.4. SOFTWARE

The test utility software used during testing was A715F.001.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Worst-case data rates as provided by the client were:
GFSK mode: DH5
8PSK mode: 3-DH5

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Samsung	EP-TA800	R37M3531XX1SE3	N/A
Earphone	Samsung	N/A	N/A	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	Antenna	1	RF	Shielded	0.2	To PSA and BT Tester
2	USB	1	USB	Un-shielded	1	EUT to AC Mains

I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	Shielded	1	N/A
2	earphone	1	3.5mm	Un-shielded	1	N/A

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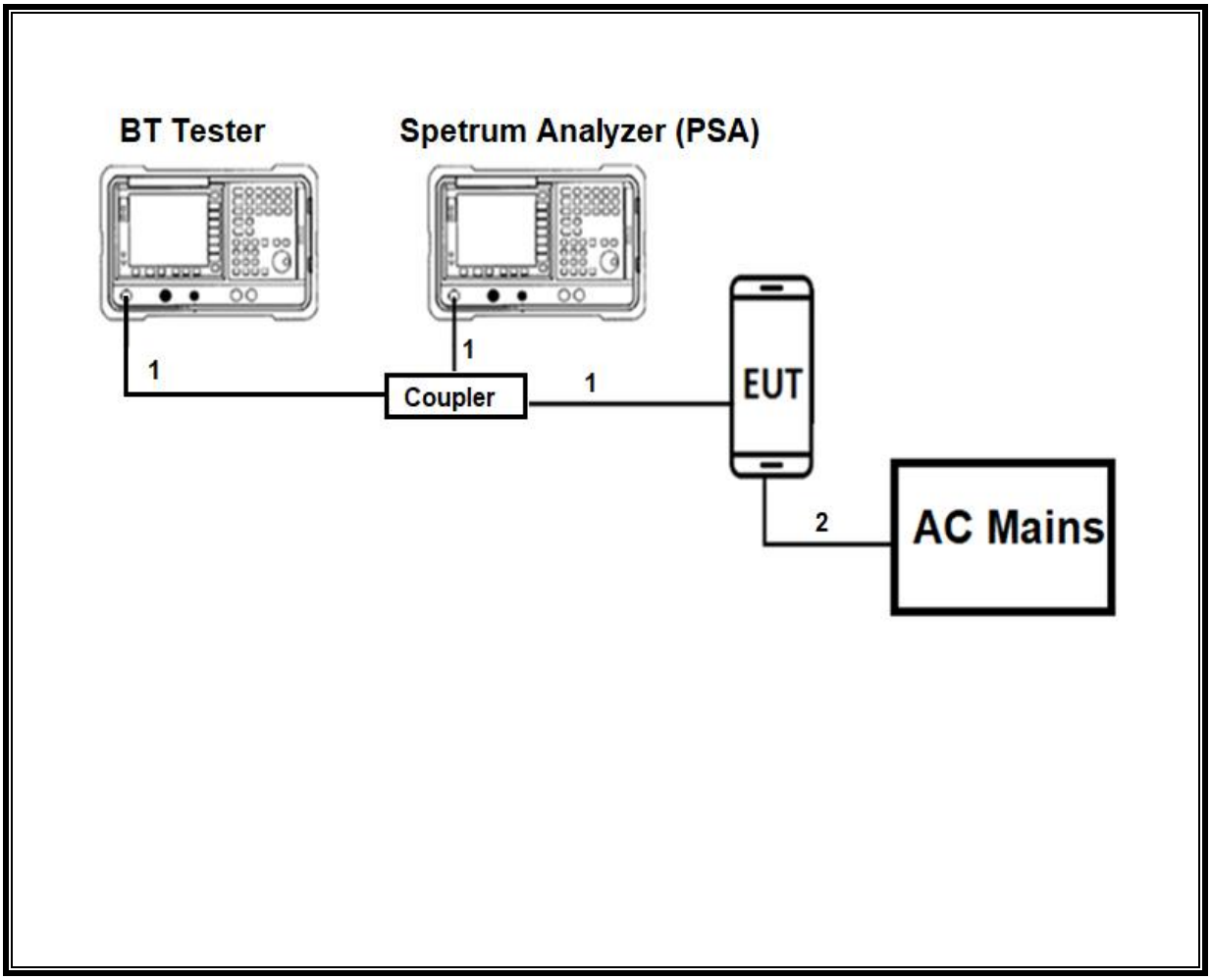
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

For conducted tests: the EUT was stand alone. The test software exercises the radio.

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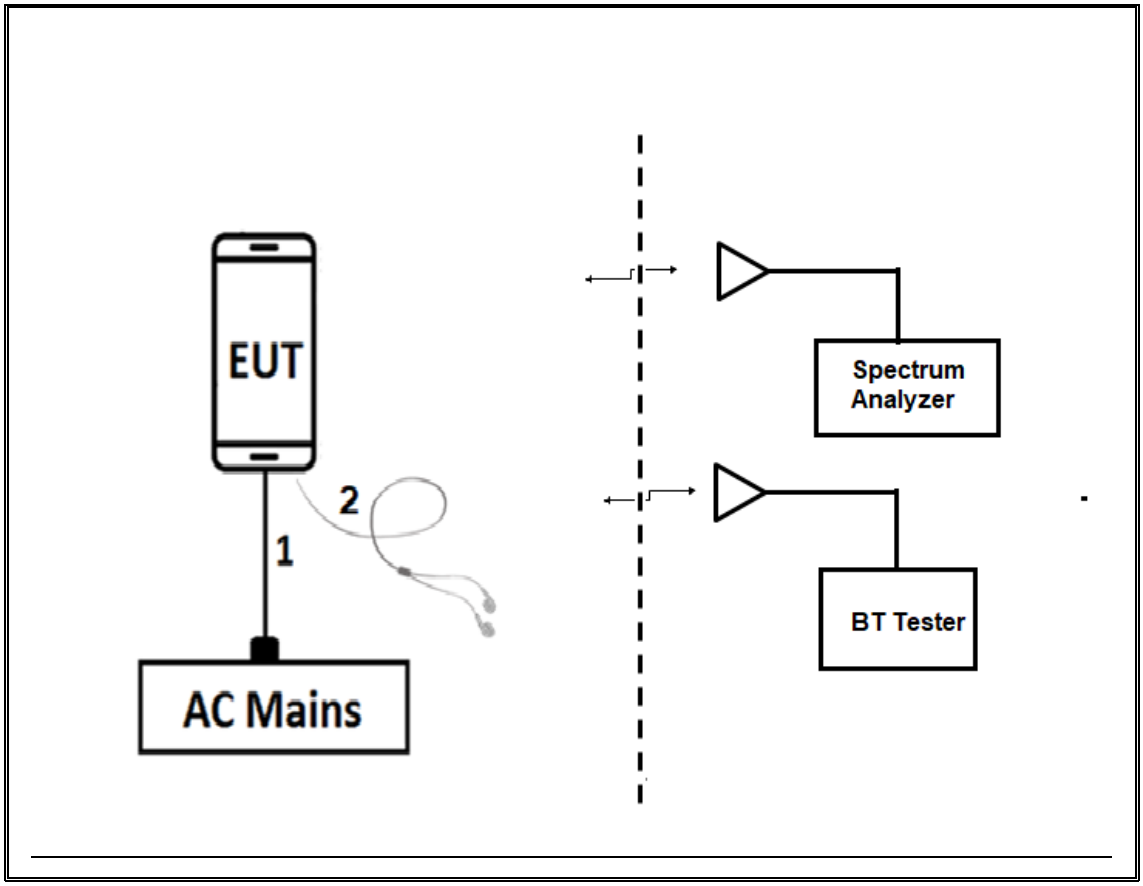
RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT is connected to earphone. The test software exercises the radio.

7. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179466	05/31/2020
Antenna, Passive Loop 100KHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179468	05/31/2020
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	PRE0186650	12/13/2019
Bluetooth Tester	Rohde&Schwarz	CBT	T258	02/14/2020
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	06/05/2020
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	PRE0181078	08/24/2020
Antenna, Broadband Hybrid, 30MHz to 2GHz	Sunol Sciences	JB3	T899	08/23/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	06/01/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	E9030A	T917	01/24/2020
Antenna Horn, 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2020
Pre-Amp 1-26.5 GHz	AMPLICAL	AMP18G26.5-60	PRE0181238	05/01/2020
EMI Test Receiver	Rohde&Schwarz	ESW44	PRE0179367	05/16/2020
EMI Test Receiver	Rohde&Schwarz	ESW44	PRE0179376	02/14/2020
EMI Test Receiver	Rohde&Schwarz	ESW44	PRE0179372	02/16/2020
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T229	01/31/2020
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1226	02/06/2020
AC Line Conducted				
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, June 15, 2019	
Antenna Port Software	UL	UL RF	Ver 11.13, Nov 13, 2019	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

SPOTCHECK TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Horn 1-18GHz	ETS Lindgren	3117	EMC4249 / PRE0100034	06/14/2020
Amplifier, 1 to 18GHz	Amplical	AMP1G18-35	T1569	01/30/2021
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, June 15, 2019	

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

8. 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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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

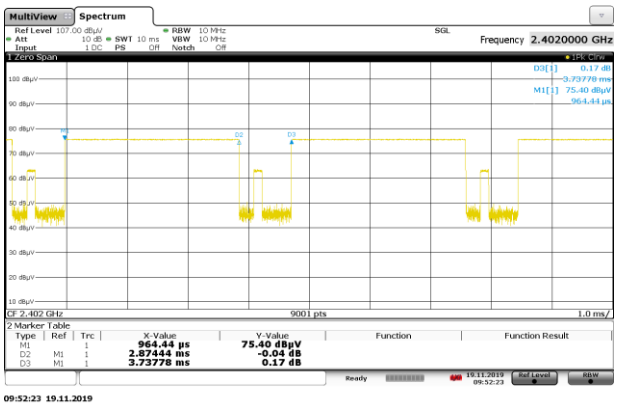
ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

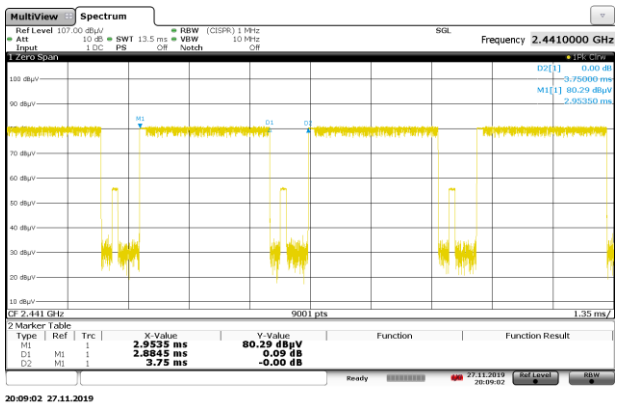
Tested By:	23653 DC
Date:	11/19/2019

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
Bluetooth GFSK	2.874	3.738	0.769	76.886	1.14	0.348
Bluetooth 8PSK	2.885	3.750	0.769	76.933	1.14	0.347

DUTY CYCLE PLOTS



BLUETOOTH GFSK



BLUETOOTH 8PSK

9.2. 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 ≥ RBW. The sweep time is coupled.

RESULTS

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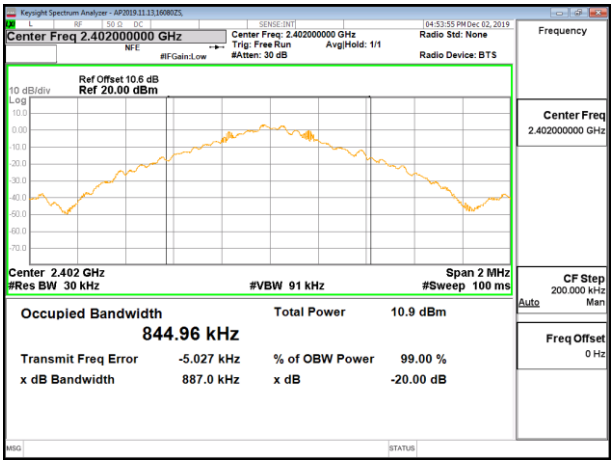
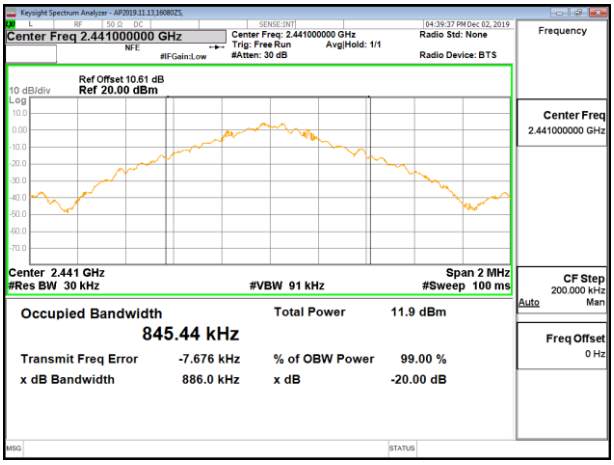
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

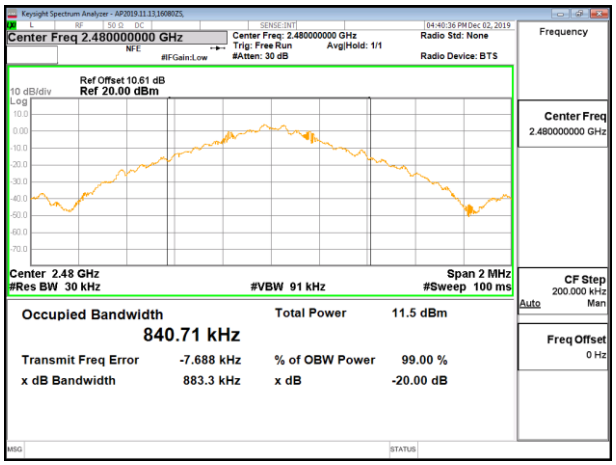
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.887	0.845
Mid	2441	0.886	0.845
High	2480	0.883	0.841



LOW CHANNEL



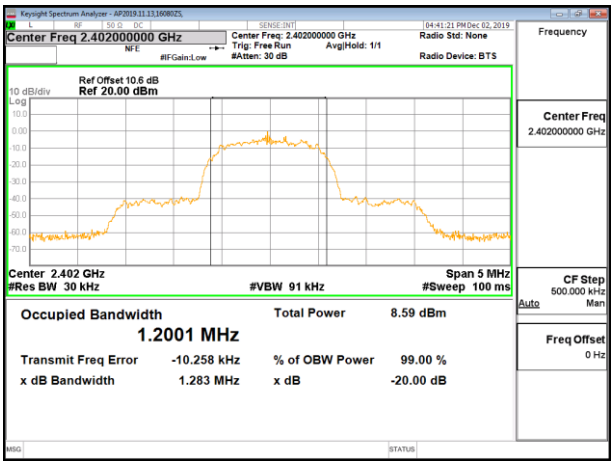
MID CHANNEL



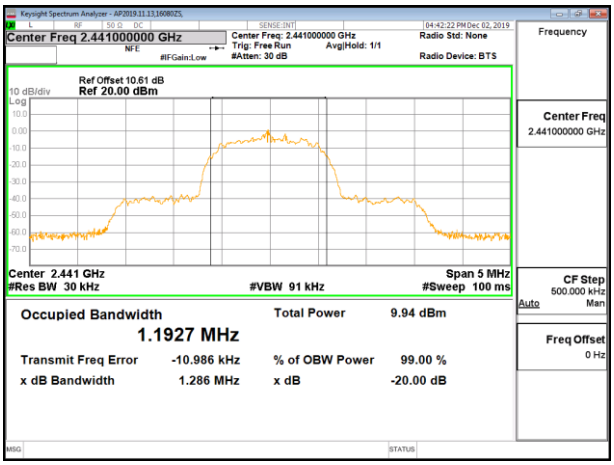
HIGH CHANNEL

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

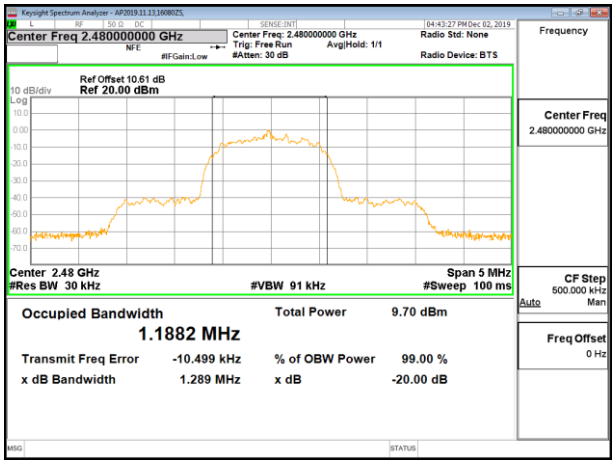
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.283	1.200
Mid	2441	1.286	1.193
High	2480	1.289	1.188



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

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.

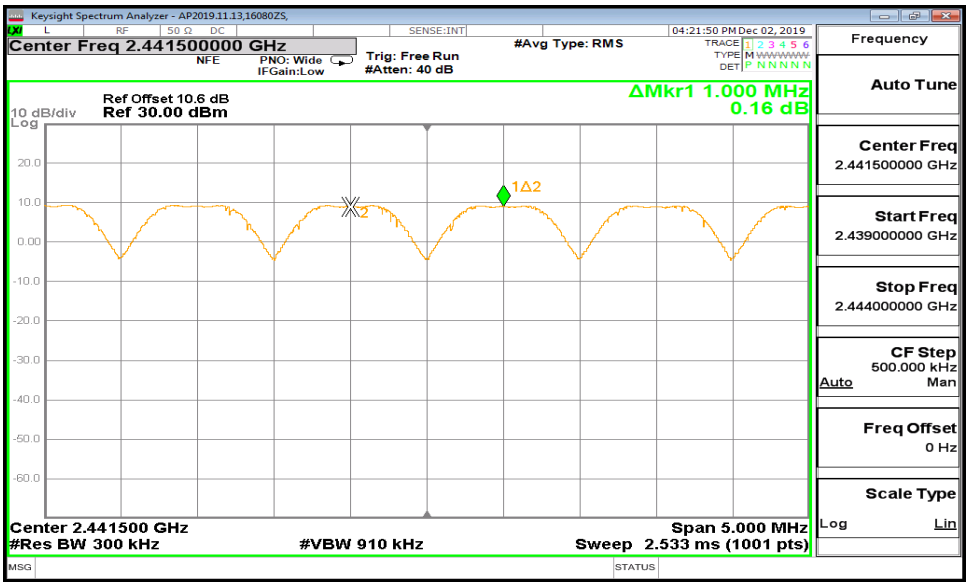
TEST PROCEDURE

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

RESULTS

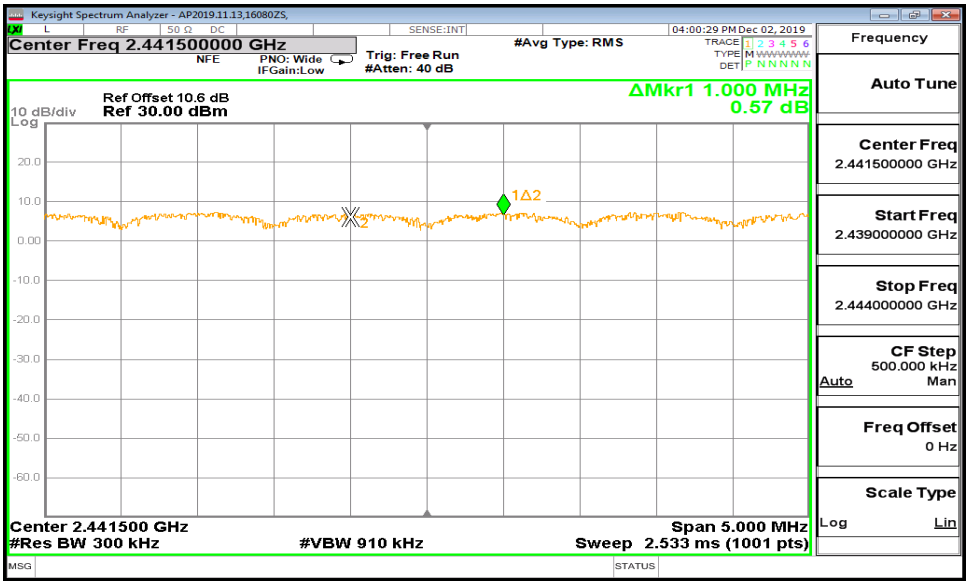
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



HOPPING FREQUENCY SEPARATION PLOT

9.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

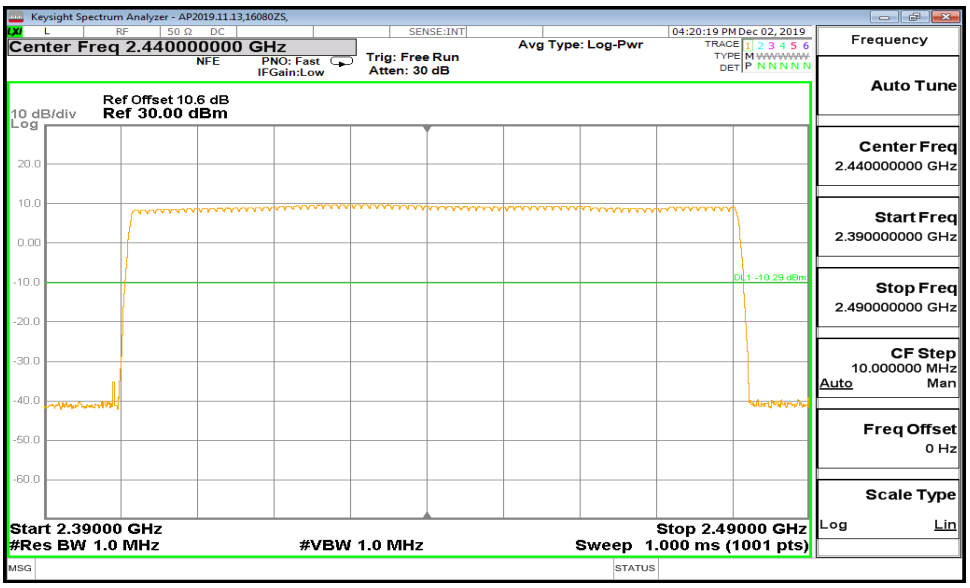
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

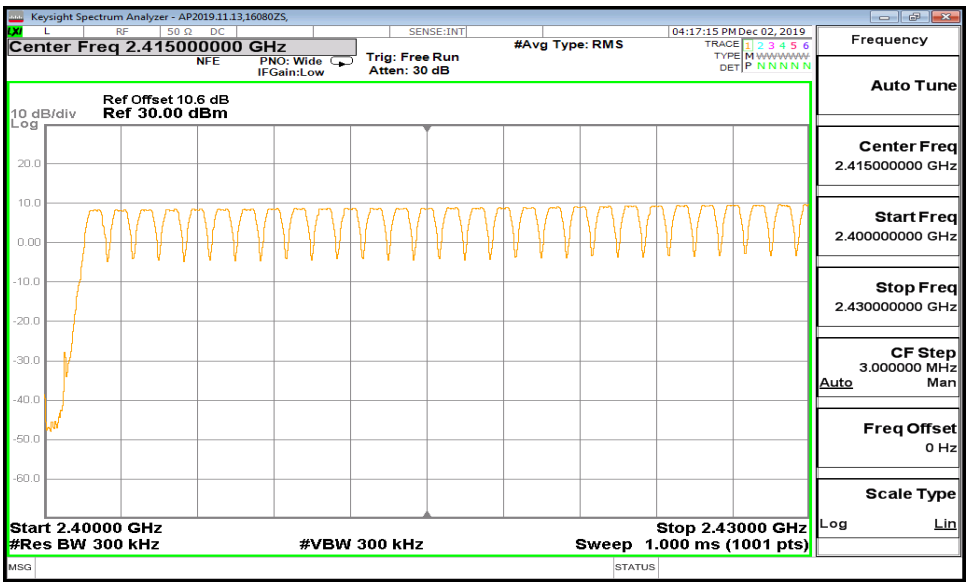
Normal Mode: 79 Channels Observed

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

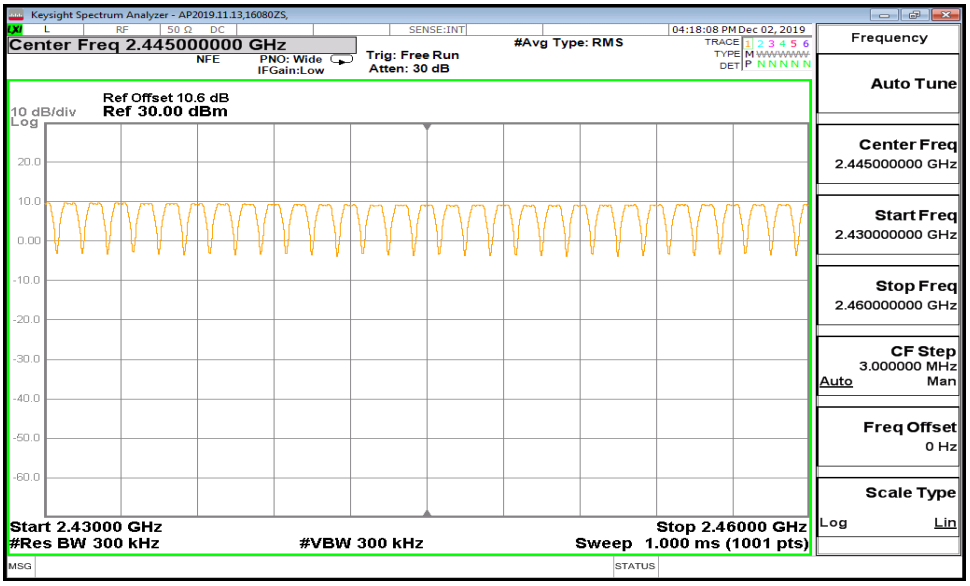
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



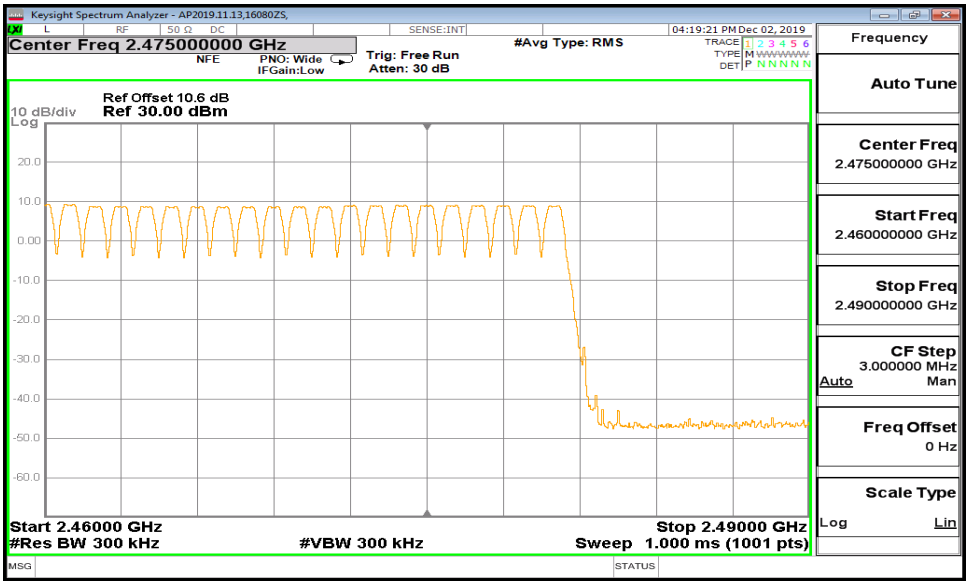
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



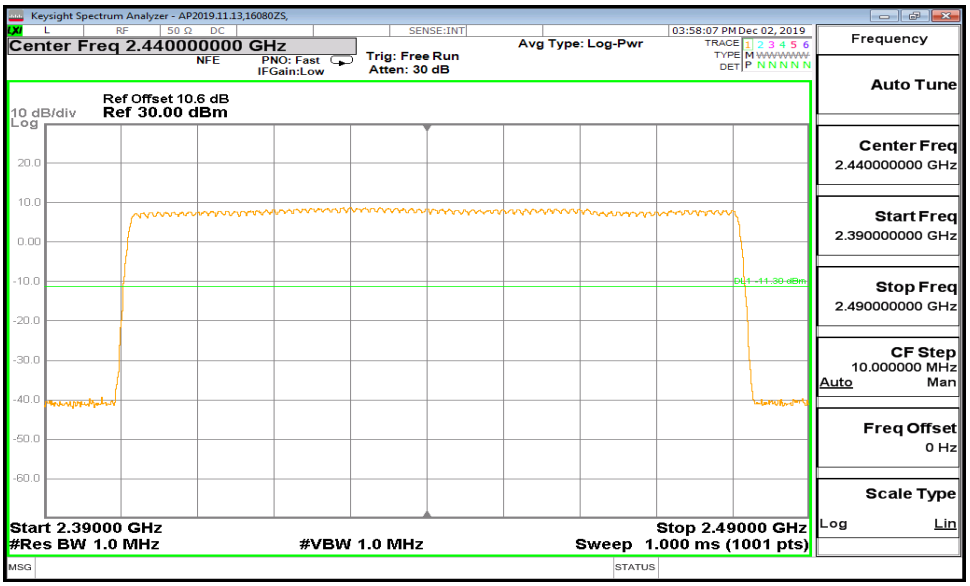
30MHz SPAN, SEGMENT 2 OF 3



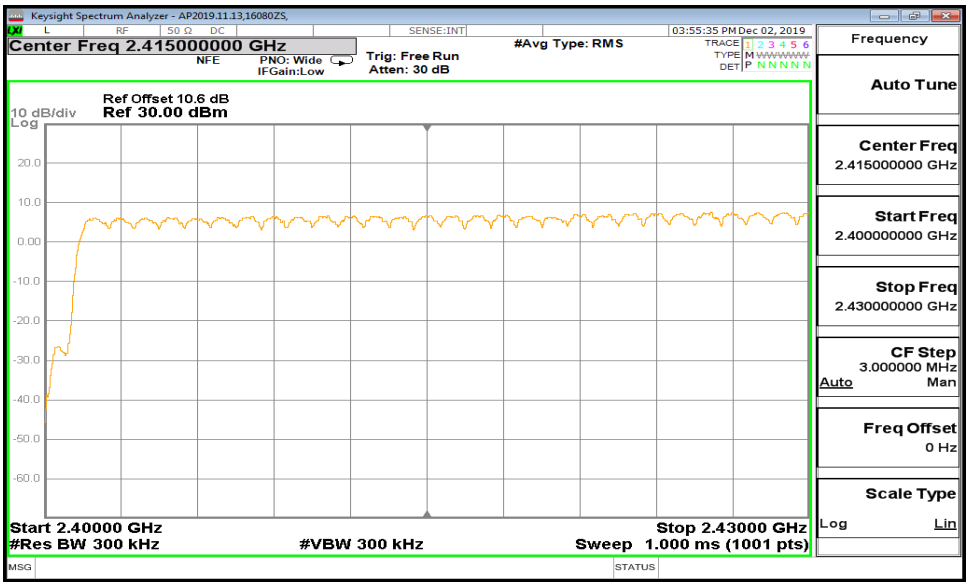
30MHz SPAN, SEGMENT 3 OF 3

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

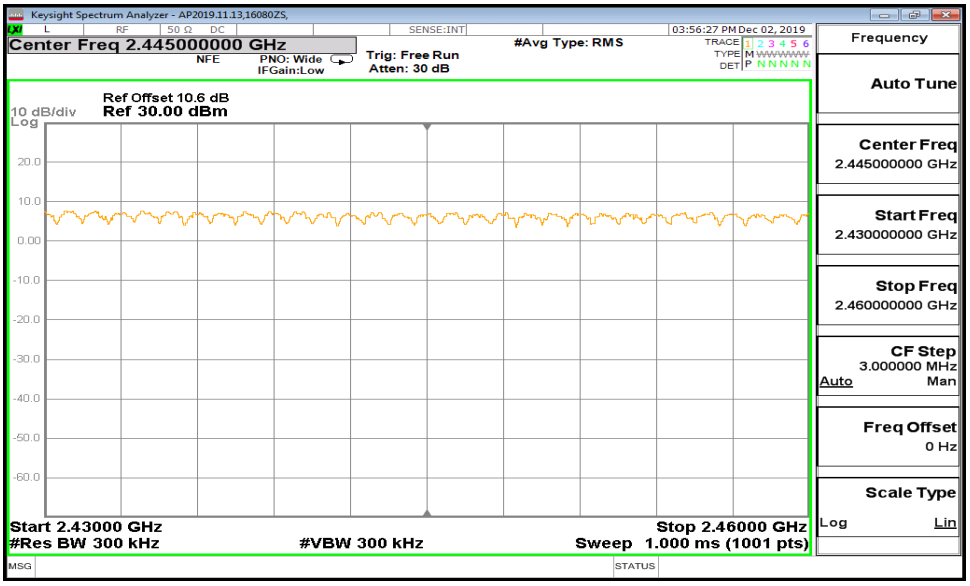
9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



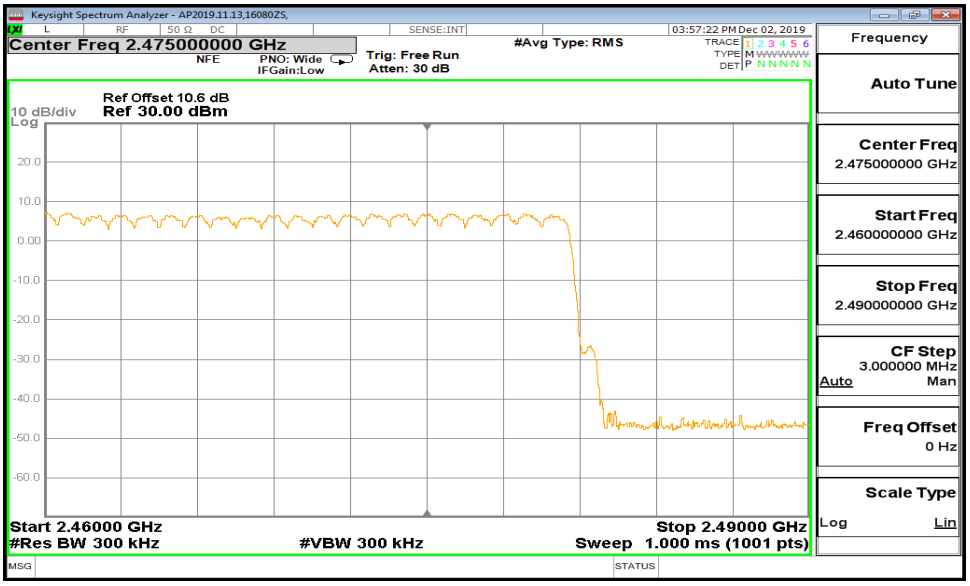
100MHz SPAN



30MHz SPAN, SEGMENT 1 OF 3



30MHz SPAN, SEGMENT 2 OF 3



30MHz SPAN, SEGMENT 3 OF 3

9.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

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.

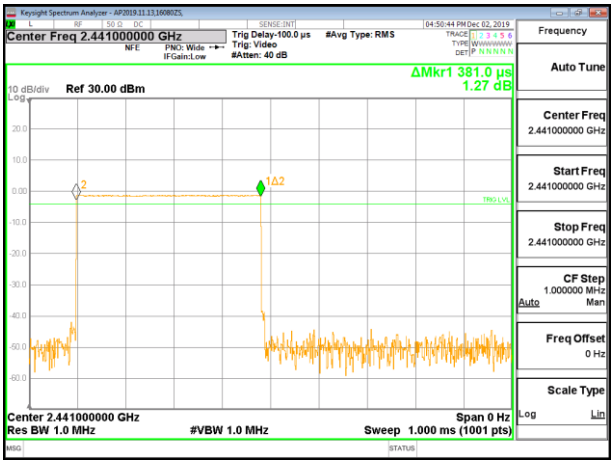
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

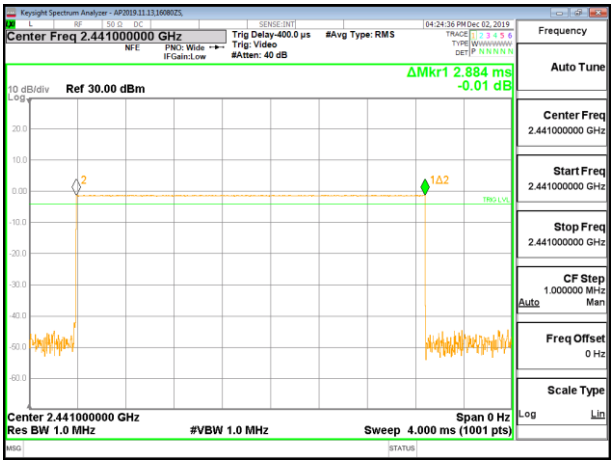
9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

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	0.381	32	0.1219	0.4	-0.2781
DH3	1.636	12	0.1963	0.4	-0.2037
DH5	2.884	8	0.2307	0.4	-0.1693
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	0.381	8	0.03048	0.4	-0.3695
DH3	1.636	3	0.04908	0.4	-0.3509
DH5	2.884	2	0.05768	0.4	-0.3423

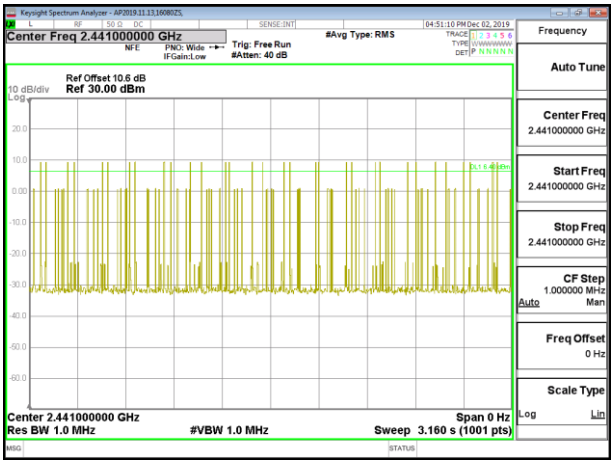


PULSE WIDTH – DH1

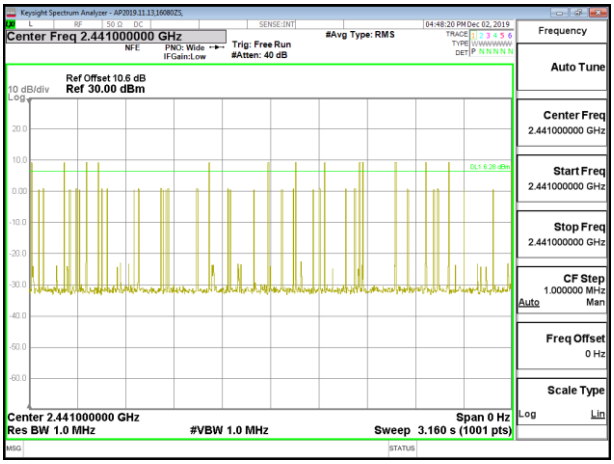
PULSE WIDTH – DH3



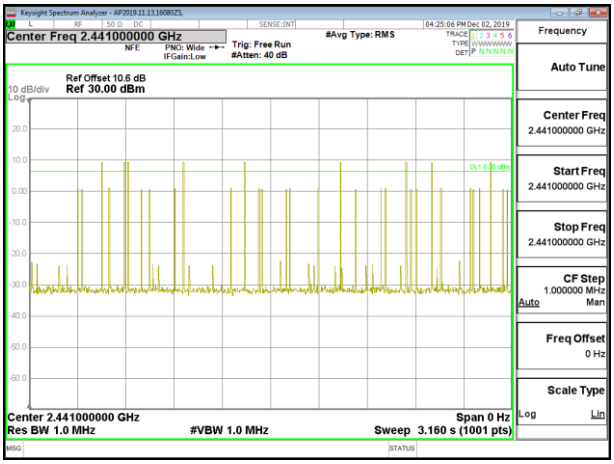
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

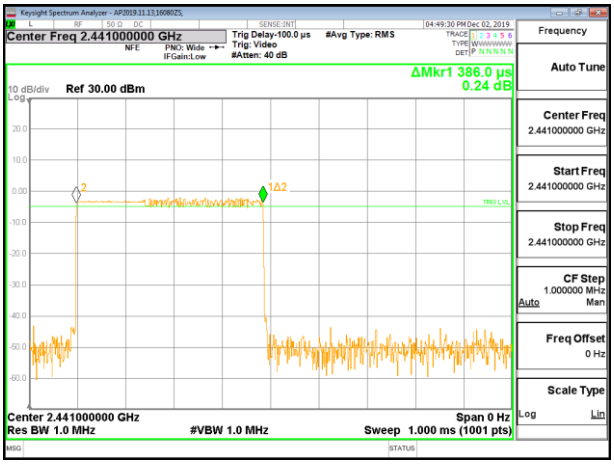


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

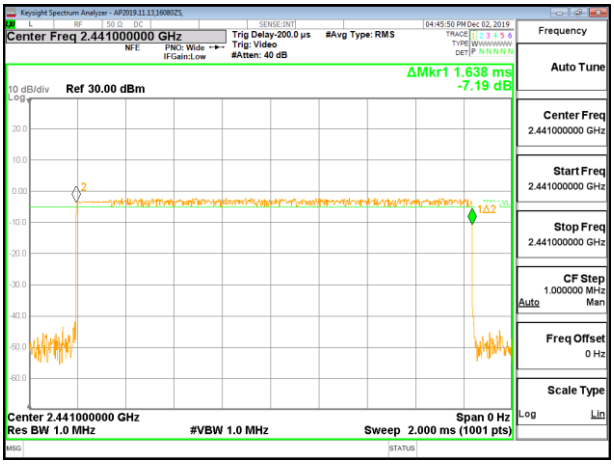
9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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	0.386	32	0.12352	0.4	-0.27648
3DH3	1.638	18	0.29484	0.4	-0.10516
3DH5	2.888	8	0.23104	0.4	-0.16896

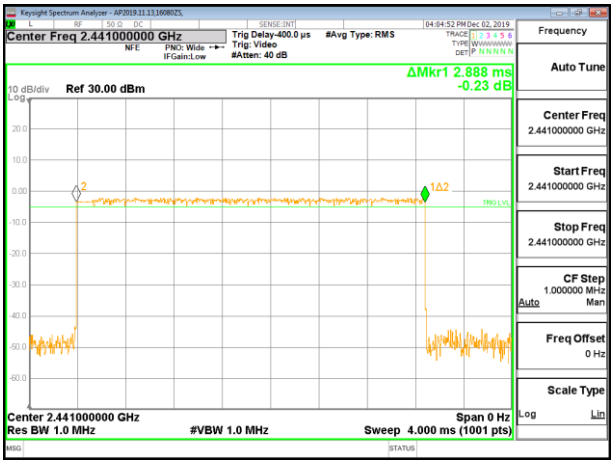
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



PULSE WIDTH – 3DH1

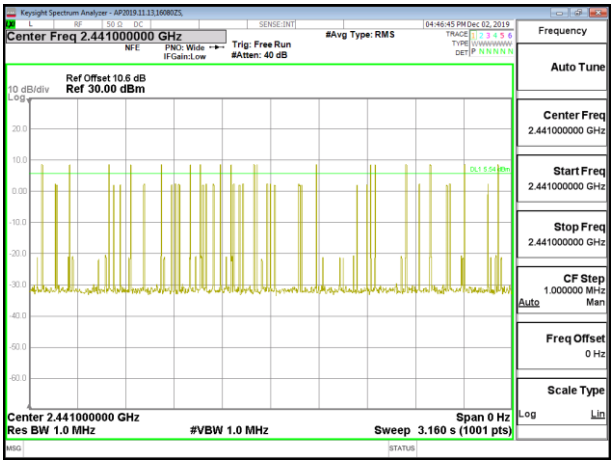


PULSE WIDTH – 3DH3

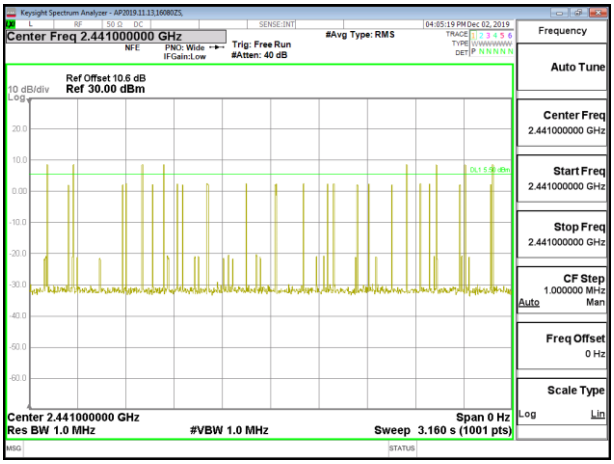


PULSE WIDTH – 3DH5

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

9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

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 was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date:	11/13/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.4	21	-11.6
Middle	2441	9.8	21	-11.2
High	2480	10.5	21	-10.5

9.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date:	11/13/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.1	21	-11.9
Middle	2441	9.3	21	-11.7
High	2480	10.3	21	-10.7

9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date:	11/13/2019

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.3	21	-11.7
Middle	2441	9.6	21	-11.4
High	2480	10.5	21	-10.5

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date	11/13/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.0
Middle	2441	9.4
High	2480	10.0

9.7.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date	11/13/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.7
Middle	2441	6.9
High	2480	8.0

9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date	11/13/2019

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.8
Middle	2441	6.9
High	2480	8.1

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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.

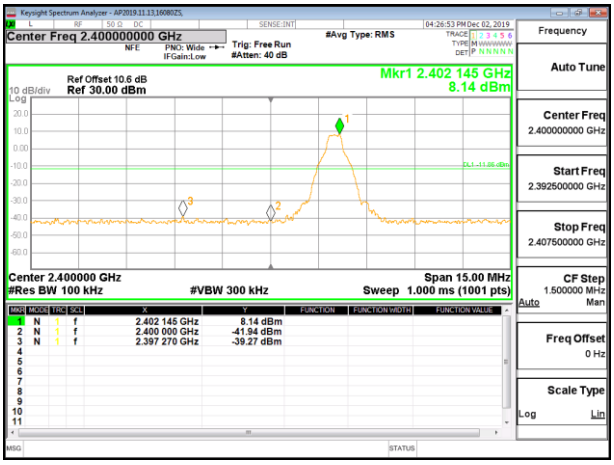
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

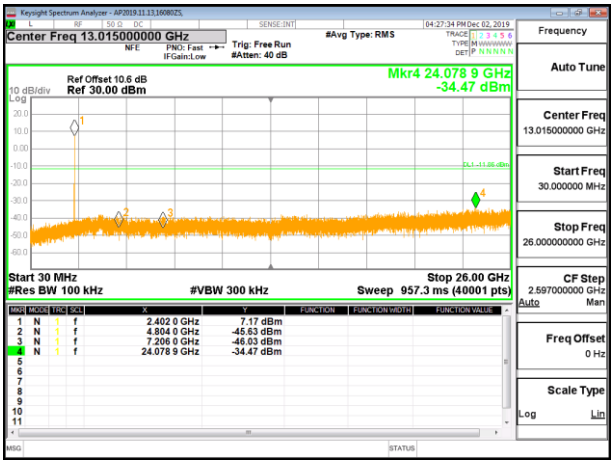
UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

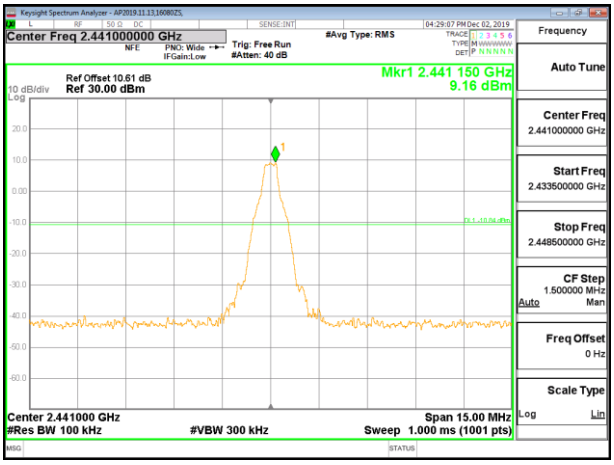
SPURIOUS EMISSIONS, NON-HOPPING



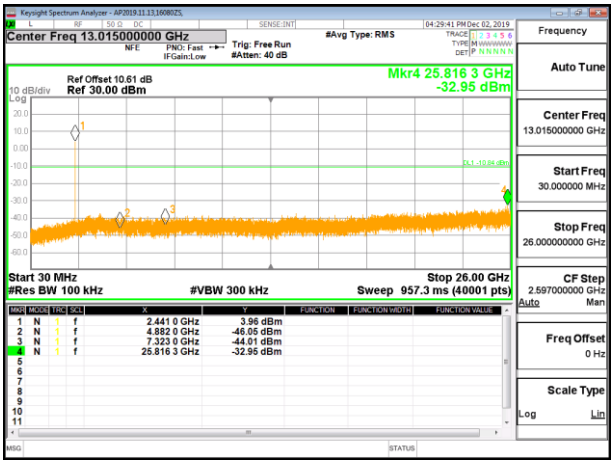
LOW CHANNEL BANDEDGE



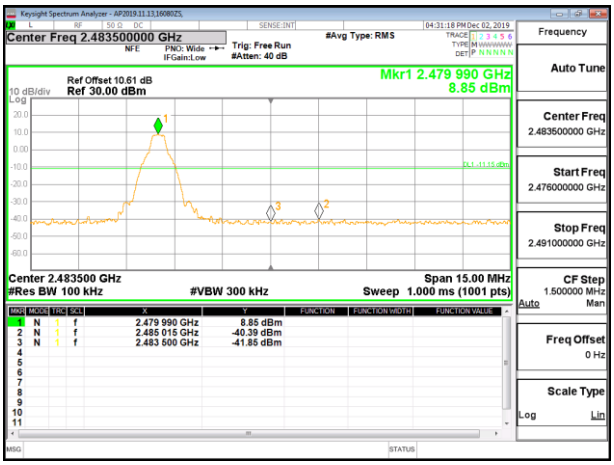
OUT-OF-BAND LOW CHANNEL



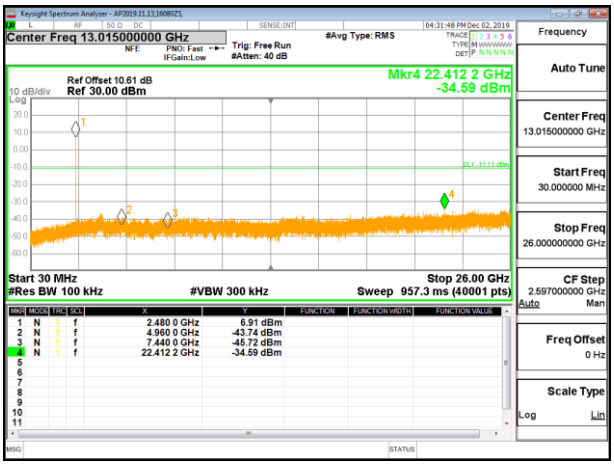
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



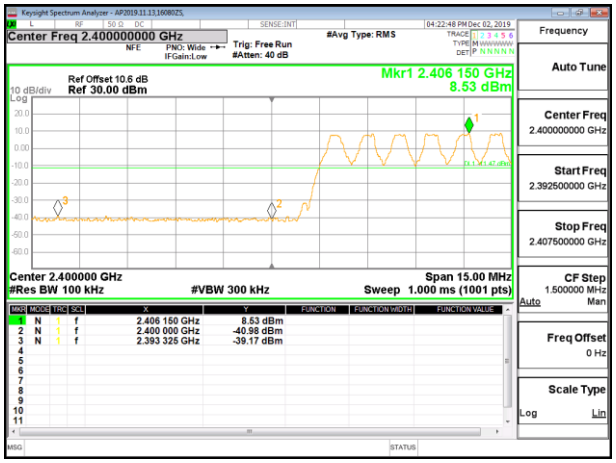
HIGH CHANNEL BANDEDGE



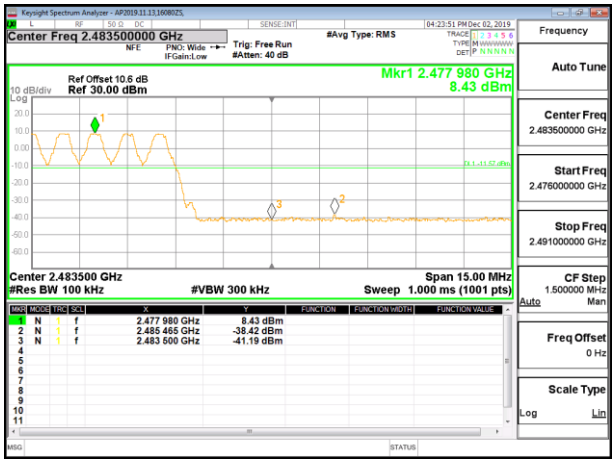
OUT-OF-BAND HIGH CHANNEL

UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



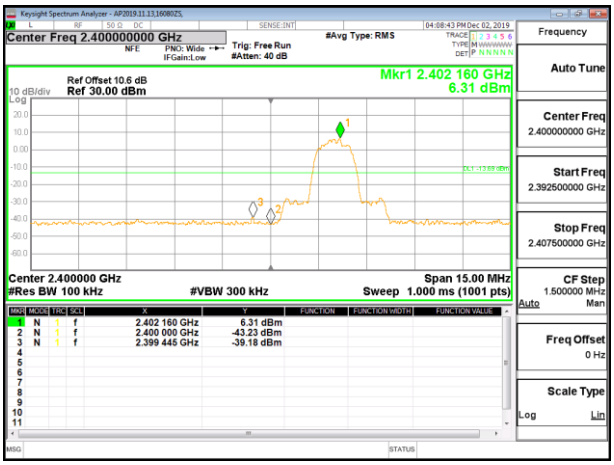
LOW BANDEDGE



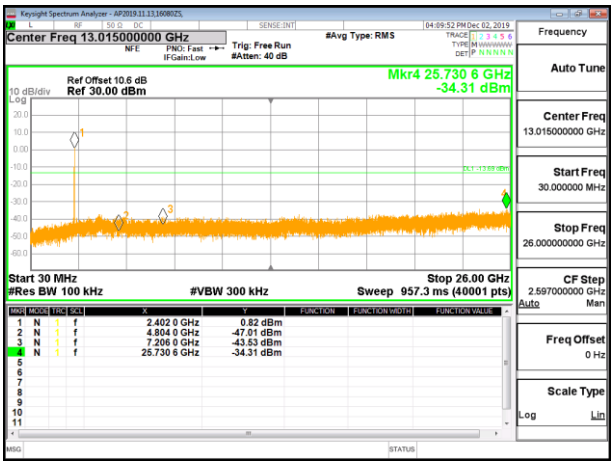
HIGH BANDEDGE

9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

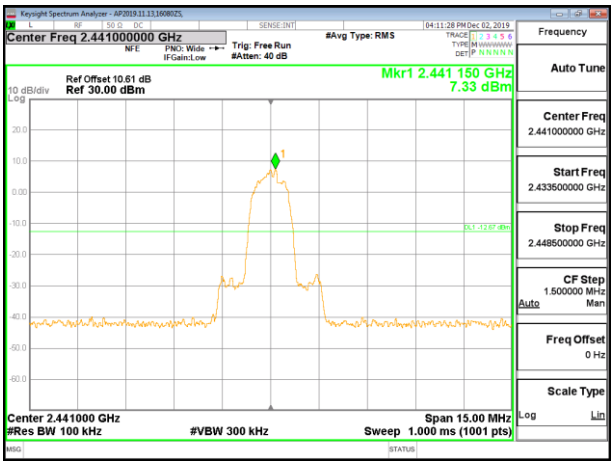
SPURIOUS EMISSIONS, NON-HOPPING



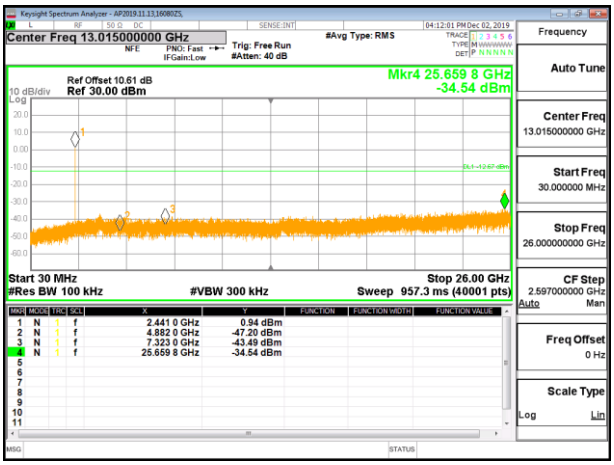
LOW CHANNEL BANDEDGE



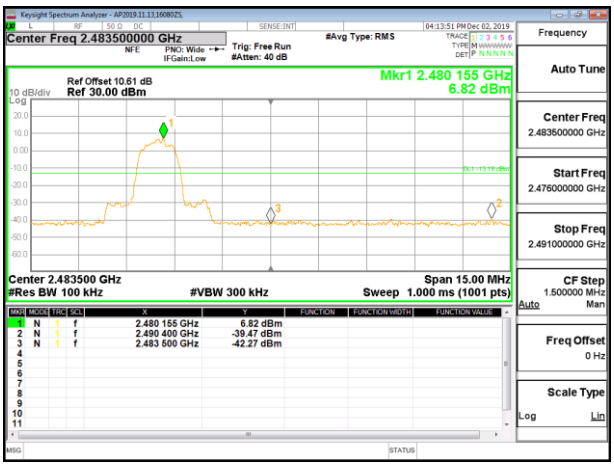
OUT-OF-BAND LOW CHANNEL



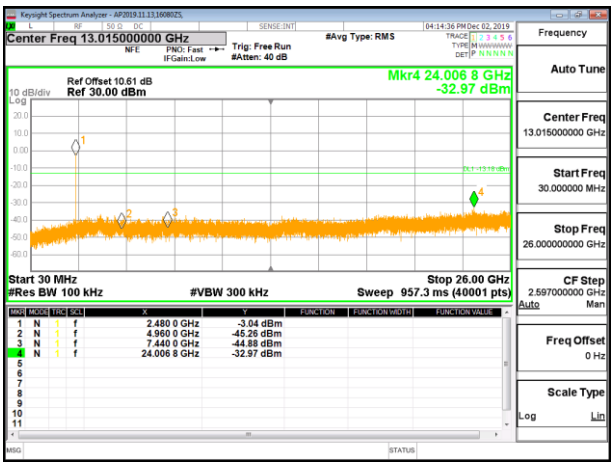
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

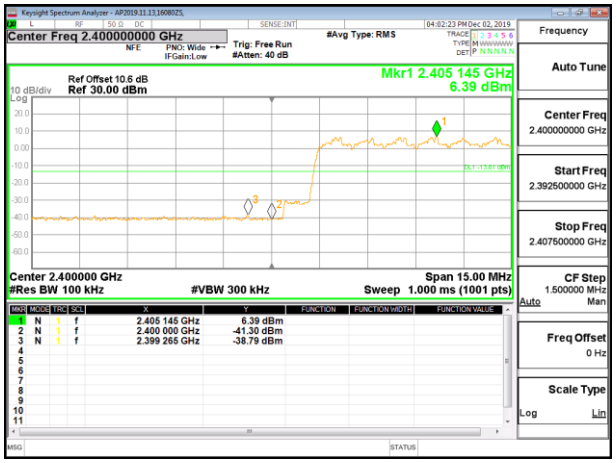


HIGH CHANNEL BANDEDGE

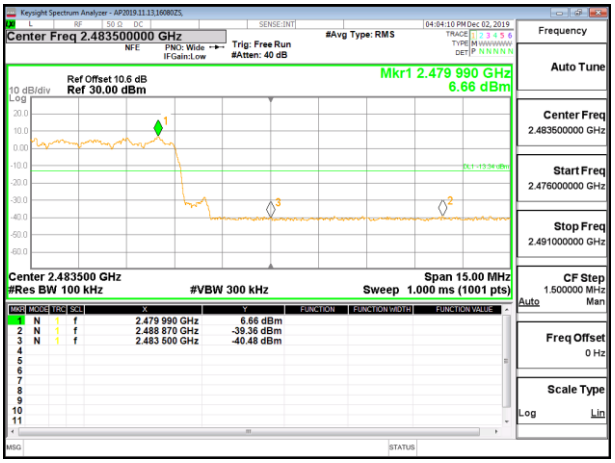


OUT-OF-BAND HIGH CHANNEL

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



HIGH BANDEDGE

10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

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 and 1 MHz resolution bandwidth with 1/T 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.

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.

2D antenna use - 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.

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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.

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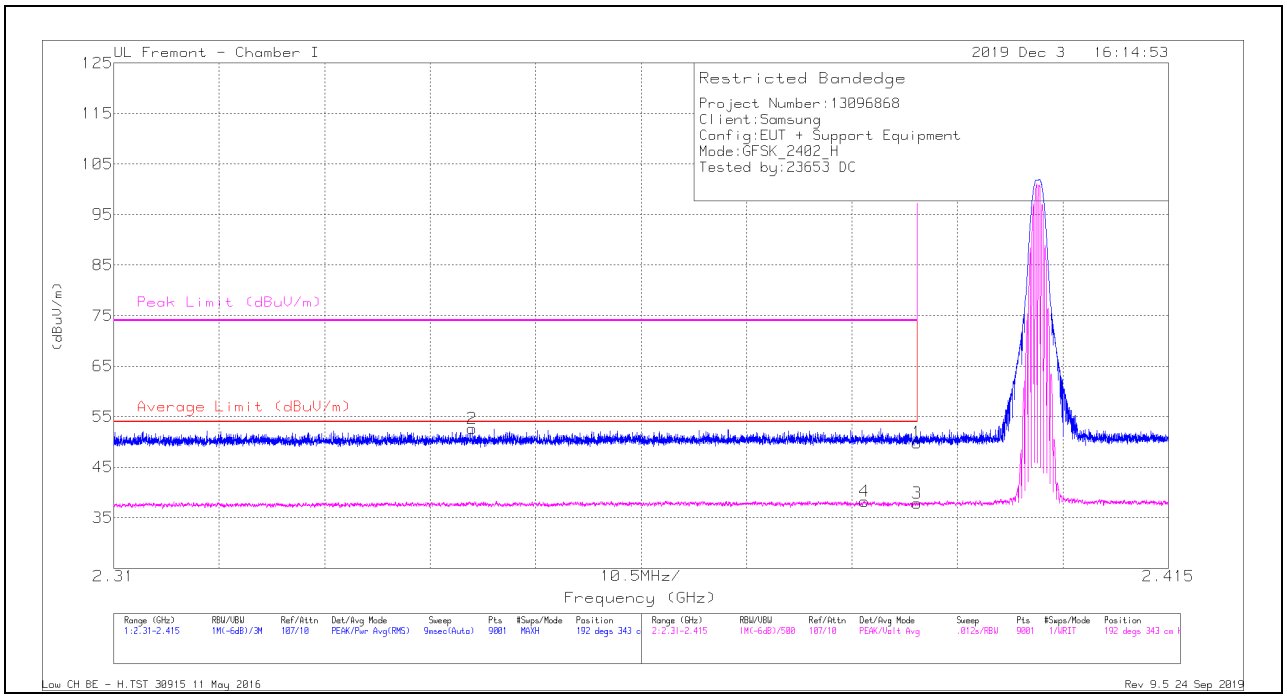
10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

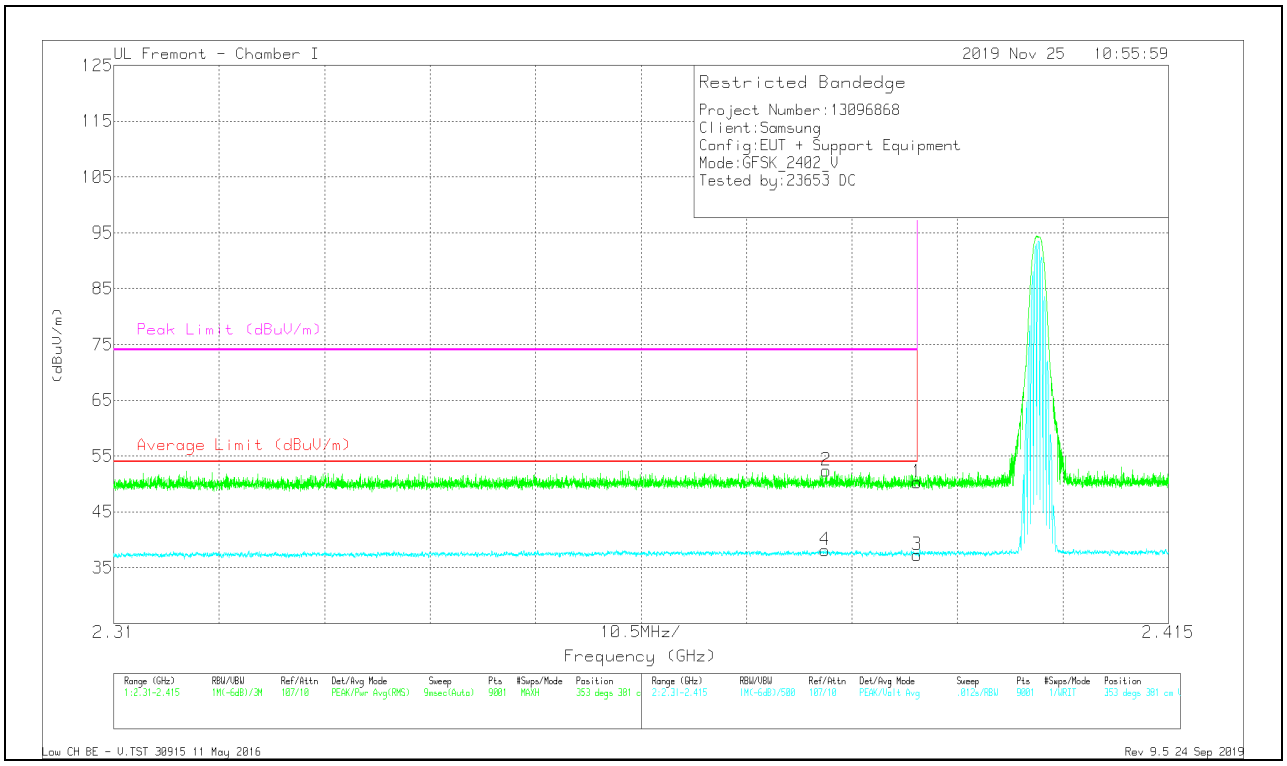


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.38999	37.66	Pk	31.9	-19.7	49.86	-	-	74	-24.14	192	343	H
2	2.34568	40.46	Pk	31.7	-19.5	52.66	-	-	74	-21.34	192	343	H
3	2.38999	25.63	VA1T	31.9	-19.7	37.83	54	-16.17	-	-	192	343	H
4	2.38475	25.99	VA1T	31.9	-19.6	38.29	54	-15.71	-	-	192	343	H

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

VERTICAL RESULT



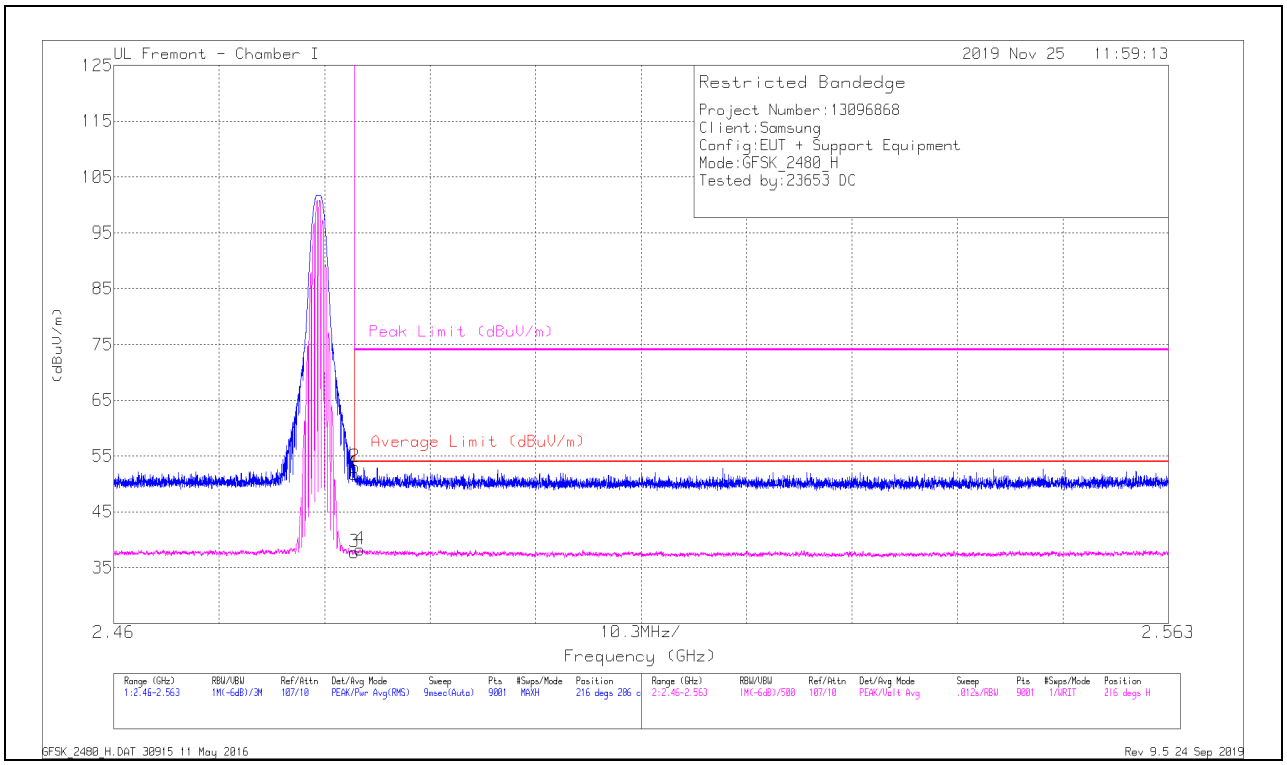
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.38999	38.1	Pk	31.9	-19.7	50.3	-	-	74	-23.7	353	381	V
2	2.38096	40.01	Pk	31.9	-19.5	52.41	-	-	74	-21.59	353	381	V
3	2.38999	25.11	VA1T	31.9	-19.7	37.31	54	-16.69	-	-	353	381	V
4	2.38081	25.76	VA1T	31.9	-19.5	38.16	54	-15.84	-	-	353	381	V

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



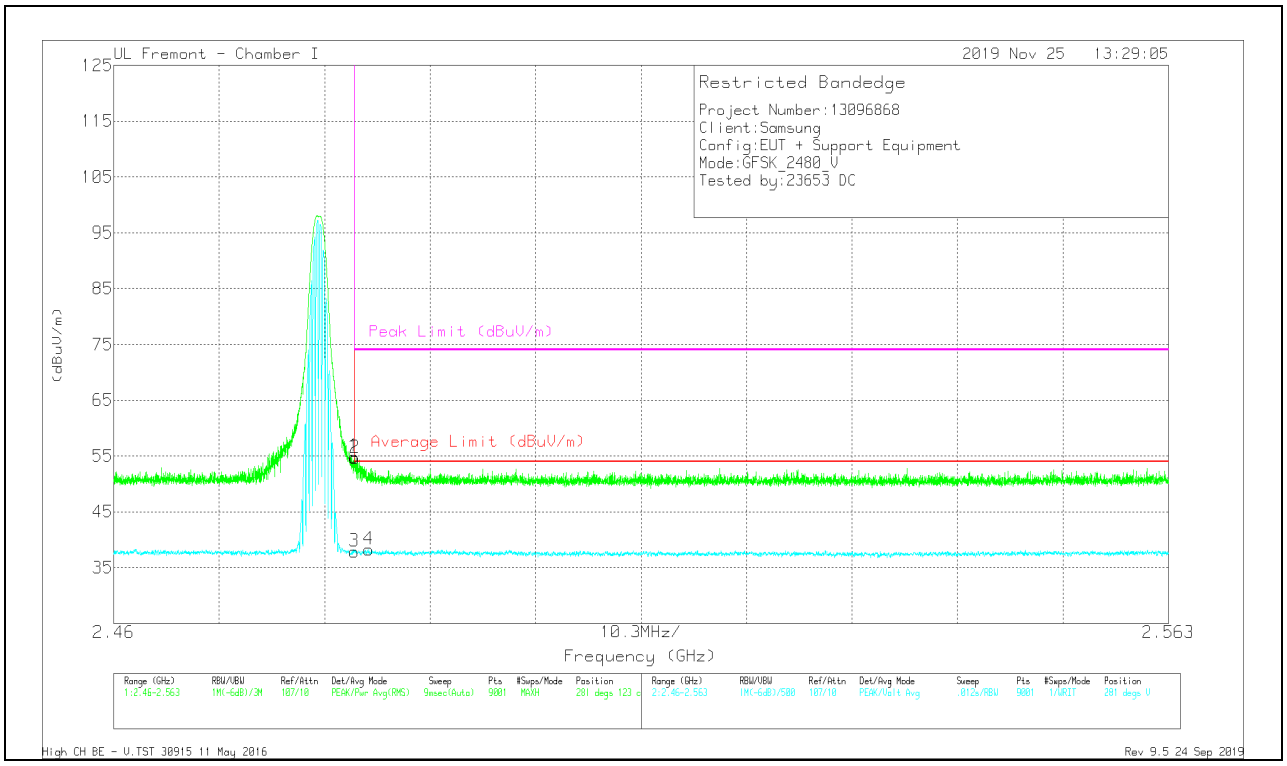
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	39.44	Pk	32.4	-20	51.84	-	-	74	-22.16	216	286	H
2	* 2.48356	40.65	Pk	32.4	-20	53.05	-	-	74	-20.95	216	286	H
3	* 2.48351	25.38	VA1T	32.4	-20	37.78	54	-16.22	-	-	216	286	H
4	* 2.48402	25.83	VA1T	32.4	-20	38.23	54	-15.77	-	-	216	286	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	42.45	Pk	32.4	-20	54.85	-	-	74	-19.15	281	123	V
2	* 2.48357	42.27	Pk	32.4	-20	54.67	-	-	74	-19.33	281	123	V
3	* 2.48351	25.49	VA1T	32.4	-20	37.89	54	-16.11	-	-	281	123	V
4	* 2.48489	25.83	VA1T	32.4	-20	38.23	54	-15.77	-	-	281	123	V

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

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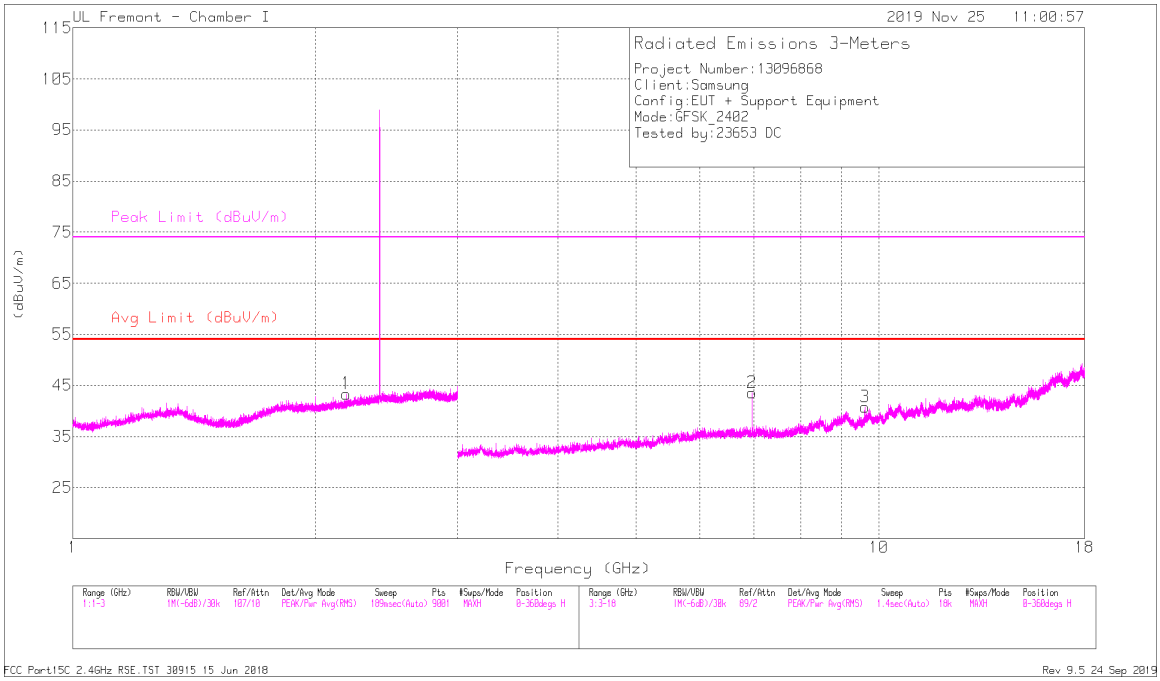
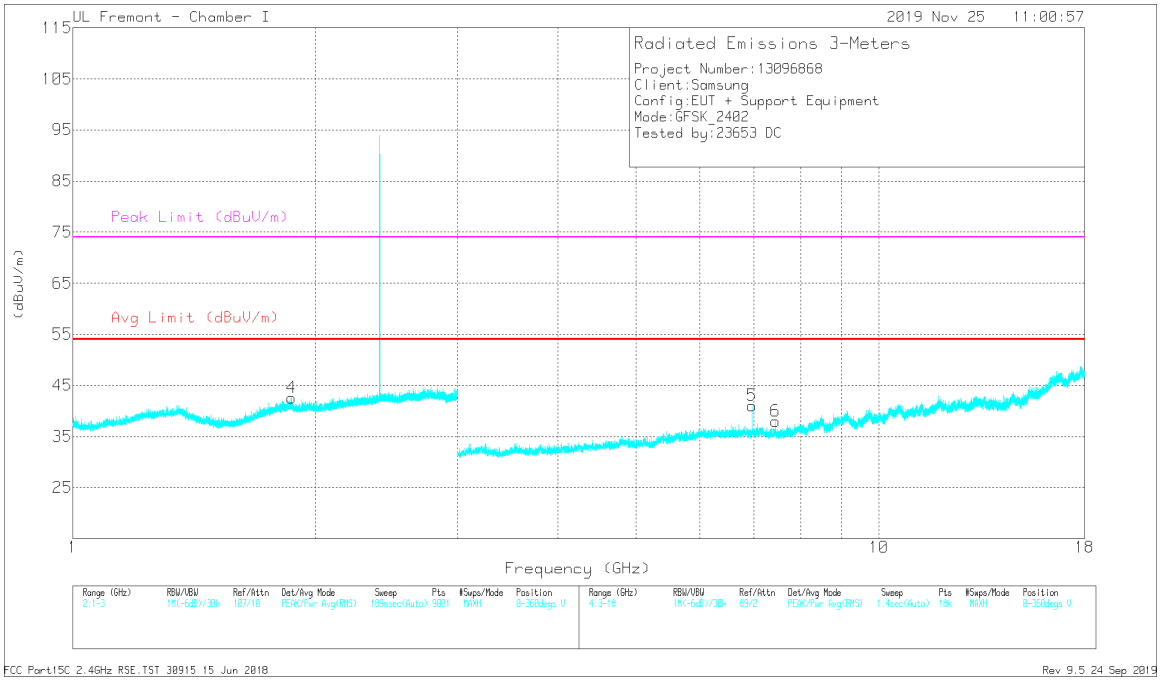
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



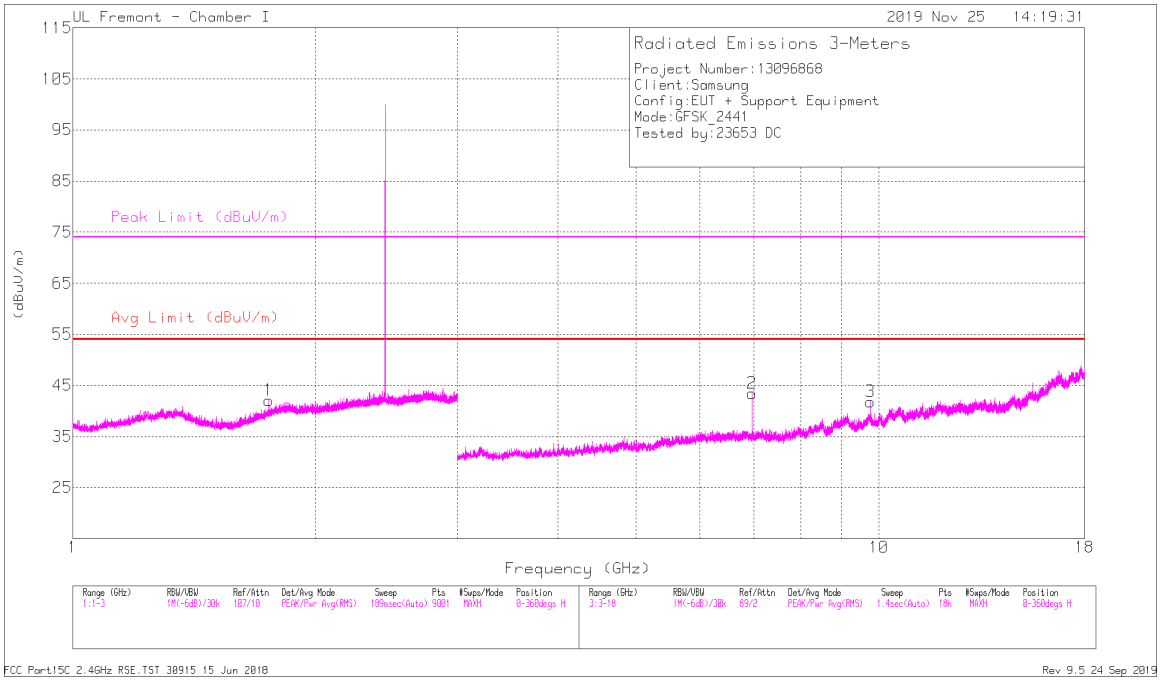
VERTICAL

RADIATED EMISSIONS

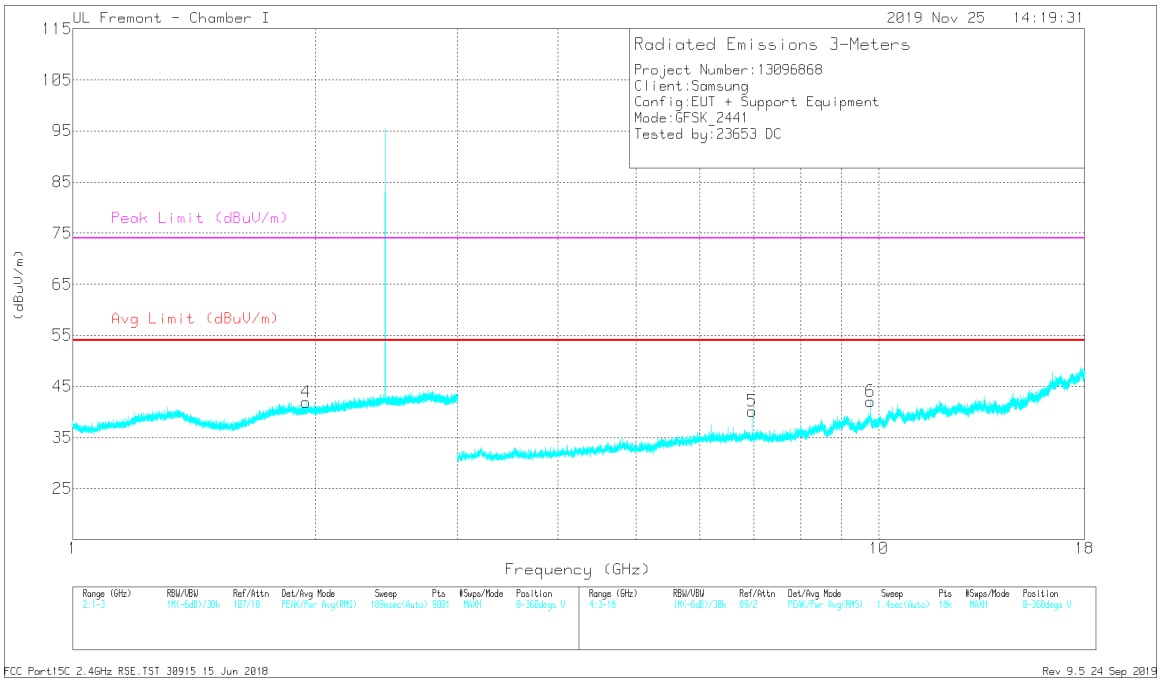
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.18541	38.7	PKFH	31.2	-19.9	50	-	-	-	-	14	208	H
1.86651	38.68	PKFH	30.8	-20.2	49.28	-	-	-	-	3	199	V
6.96007	37.31	PKFH	35.6	-24.4	48.51	-	-	-	-	216	136	H
9.60752	33.08	PKFH	36.7	-20.6	49.18	-	-	-	-	207	119	H
* 7.44456	31.77	PKFH	35.5	-23	44.27	-	-	74	-29.73	35	189	V
* 7.44694	18.91	VA1T	35.5	-23.1	31.31	54	-22.69	-	-	35	189	V
6.95993	34.78	PKFH	35.6	-24.4	45.98	-	-	-	-	229	114	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak.
VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.75015	37.22	PKFH	29.9	-20.1	47.02	-	-	-	-	84	169	H
1.94511	39.52	PKFH	30.8	-20.7	49.62	-	-	-	-	281	119	V
6.95997	36.76	PKFH	35.6	-24.4	47.96	-	-	-	-	213	102	H
9.7636	32.01	PKFH	36.9	-19.2	49.71	-	-	-	-	201	114	H
6.95998	34.83	PKFH	35.6	-24.4	46.03	-	-	-	-	235	195	V
9.76431	31.57	PKFH	36.9	-19.2	49.27	-	-	-	-	188	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak.
VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

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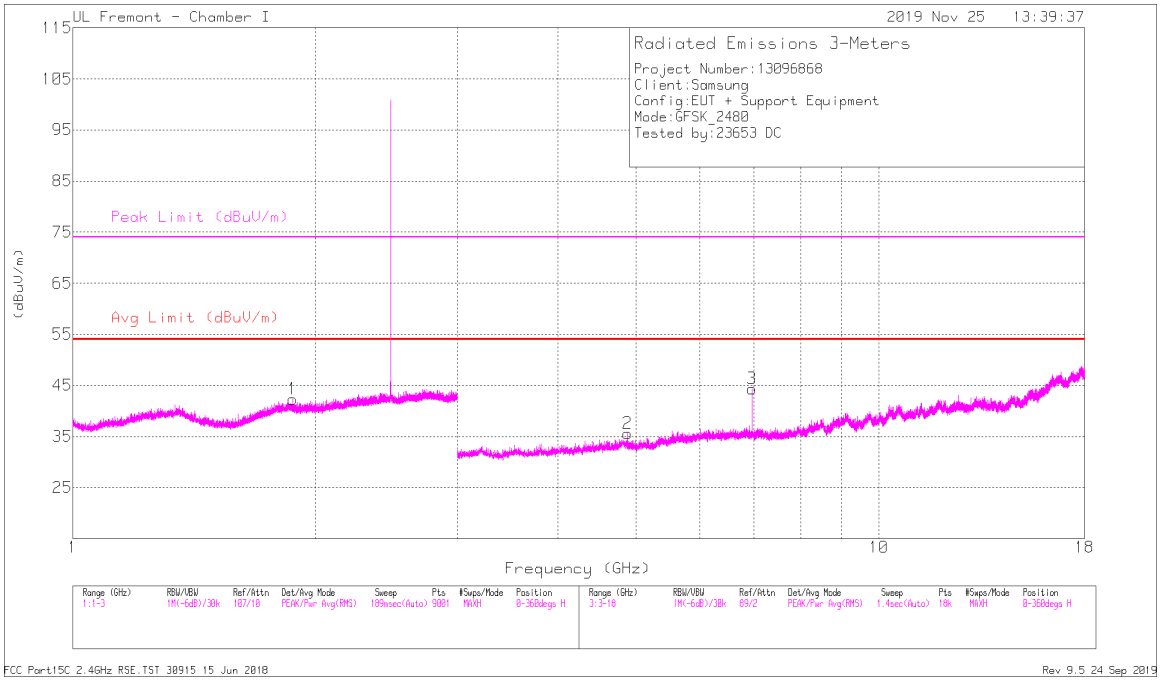
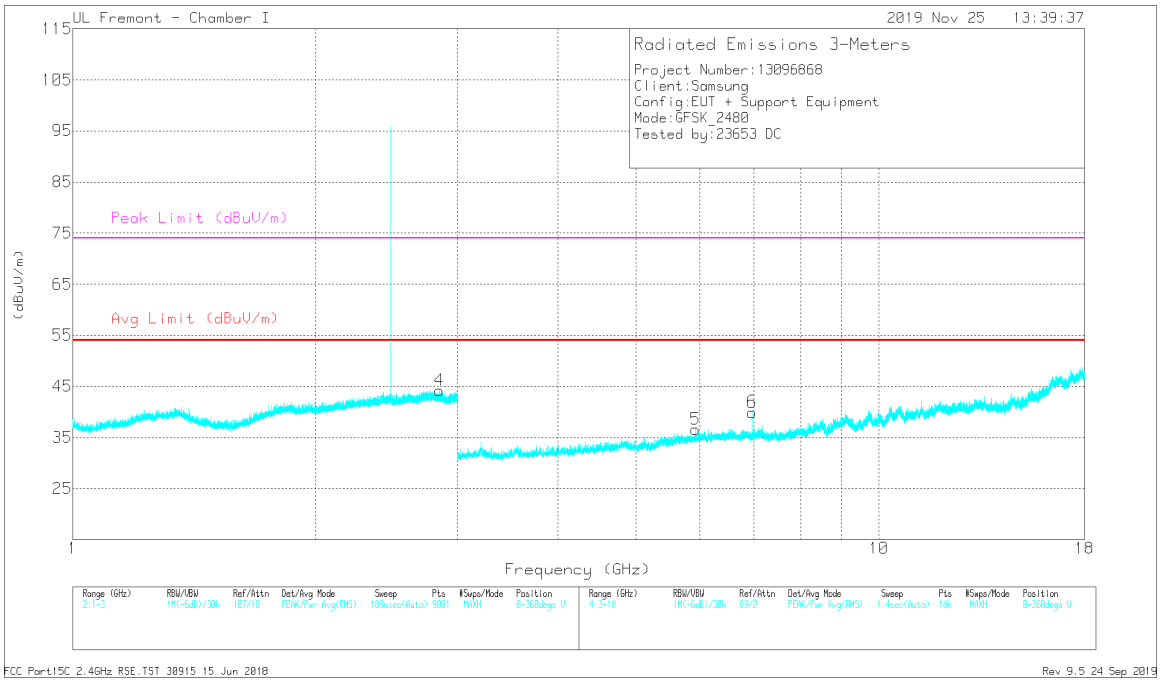
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.87265	38.82	PKFH	30.9	-20.3	49.42	-	-	-	-	113	397	H
* 2.8517	38	PKFH	32.1	-19	51.1	-	-	74	-22.9	241	176	V
* 2.84891	25.15	VA1T	32.1	-19.1	38.15	54	-15.85	-	-	241	176	V
6.95983	36.96	PKFH	35.6	-24.4	48.16	-	-	-	-	219	120	H
* 4.88236	33.28	PKFH	34.1	-26.4	40.98	-	-	74	-33.02	28	193	H
* 4.88122	20.83	VA1T	34.1	-26.3	28.63	54	-25.37	-	-	28	193	H
5.91924	32.69	PKFH	35.1	-24.5	43.29	-	-	-	-	165	365	V
6.95985	34.68	PKFH	35.6	-24.4	45.88	-	-	-	-	238	106	V

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

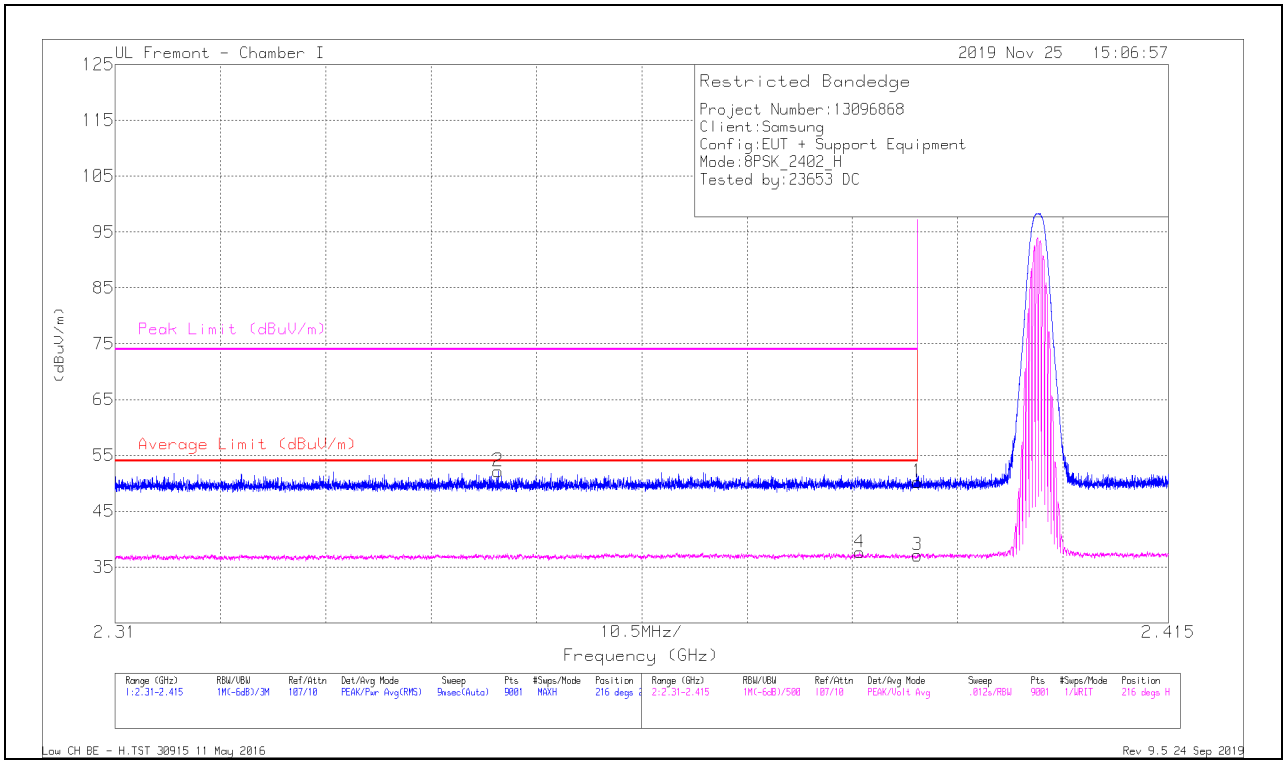
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak.

VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



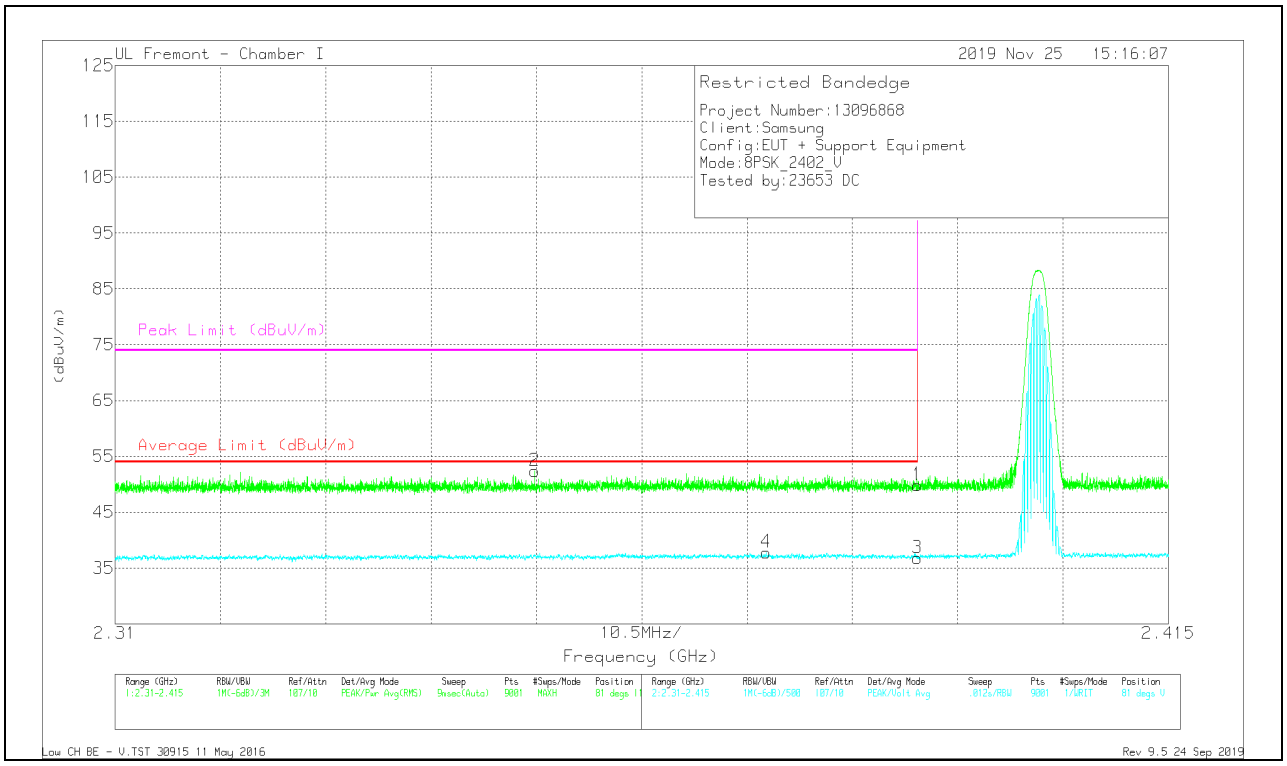
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	38.02	Pk	31.9	-19.7	50.22	-	-	74	-23.78	216	239	H
2	* 2.34817	39.96	Pk	31.7	-19.5	52.16	-	-	74	-21.84	216	239	H
3	* 2.38999	24.93	VA1T	31.9	-19.7	37.13	54	-16.87	-	-	216	239	H
4	* 2.38421	25.32	VA1T	31.9	-19.6	37.62	54	-16.38	-	-	216	239	H

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

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	37.64	Pk	31.9	-19.7	49.84	-	-	74	-24.16	81	114	V
2	* 2.35183	40.16	Pk	31.7	-19.5	52.36	-	-	74	-21.64	81	114	V
3	* 2.38999	24.58	VA1T	31.9	-19.7	36.78	54	-17.22	-	-	81	114	V
4	* 2.37492	25.48	VA1T	31.9	-19.6	37.78	54	-16.22	-	-	81	114	V

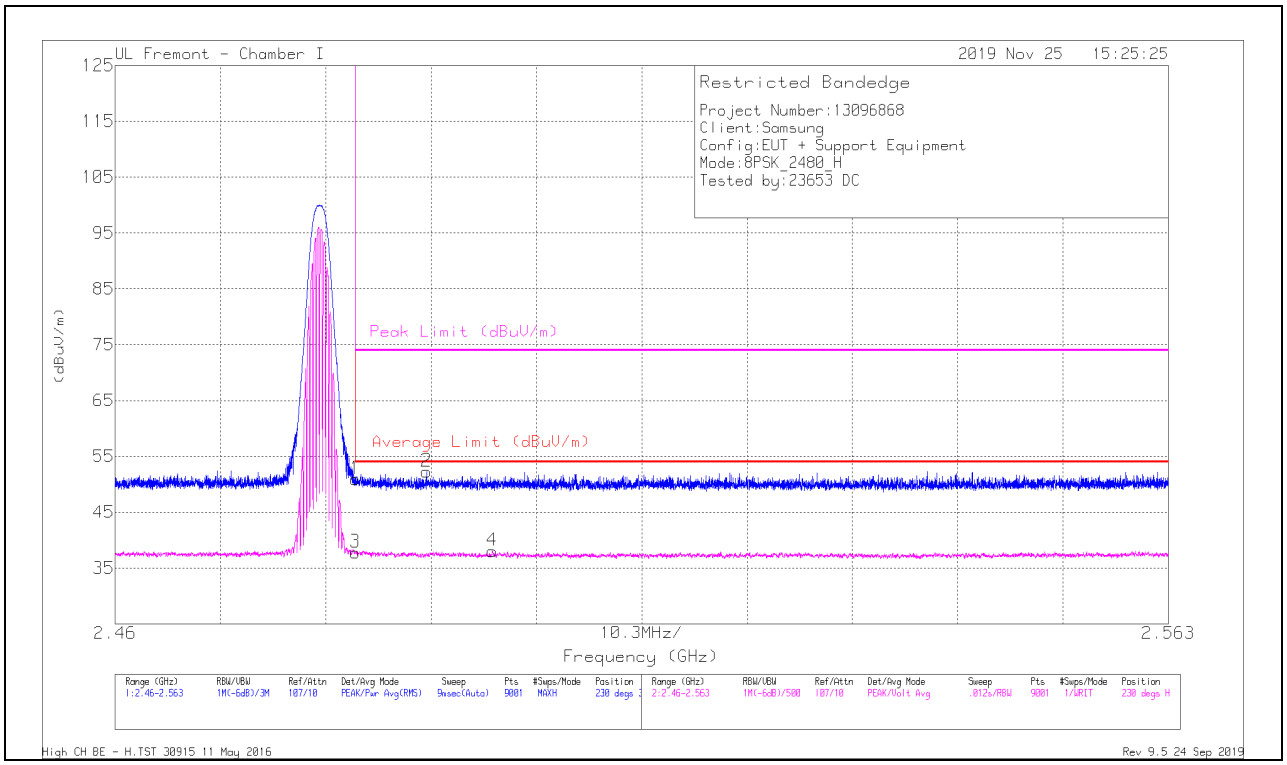
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



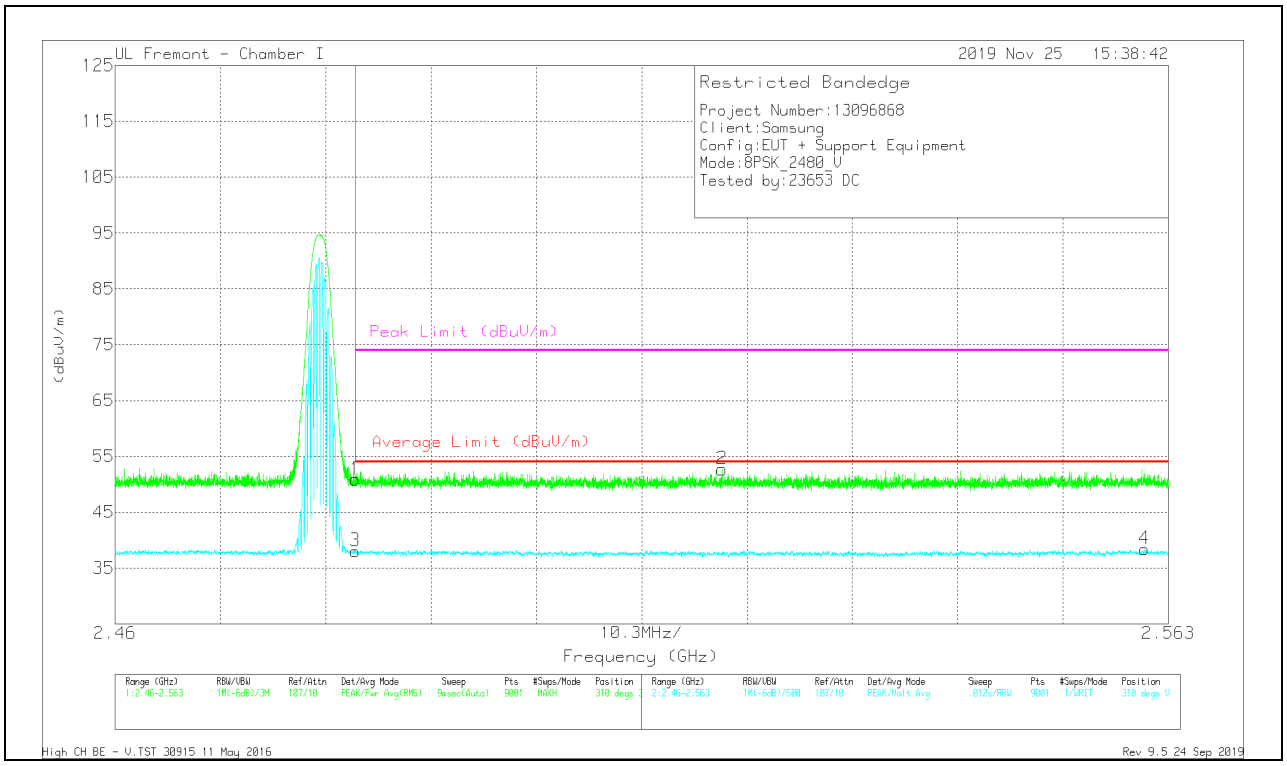
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	38.55	Pk	32.4	-20	50.95	-	-	74	-23.05	230	325	H
2	* 2.49045	40.09	Pk	32.3	-20.1	52.29	-	-	74	-21.71	230	325	H
3	* 2.48351	25.42	VA1T	32.4	-20	37.82	54	-16.18	-	-	230	325	H
4	* 2.49688	25.87	VA1T	32.3	-20.1	38.07	54	-15.93	-	-	230	325	H

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

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	38.49	Pk	32.4	-20	50.89	-	-	74	-23.11	310	396	V
2	2.51935	40.5	Pk	32.3	-20.1	52.7	-	-	74	-21.3	310	396	V
3	* 2.48351	25.63	VA1T	32.4	-20	38.03	54	-15.97	-	-	310	396	V
4	2.56068	26.09	VA1T	32.3	-20	38.39	54	-15.61	-	-	310	396	V

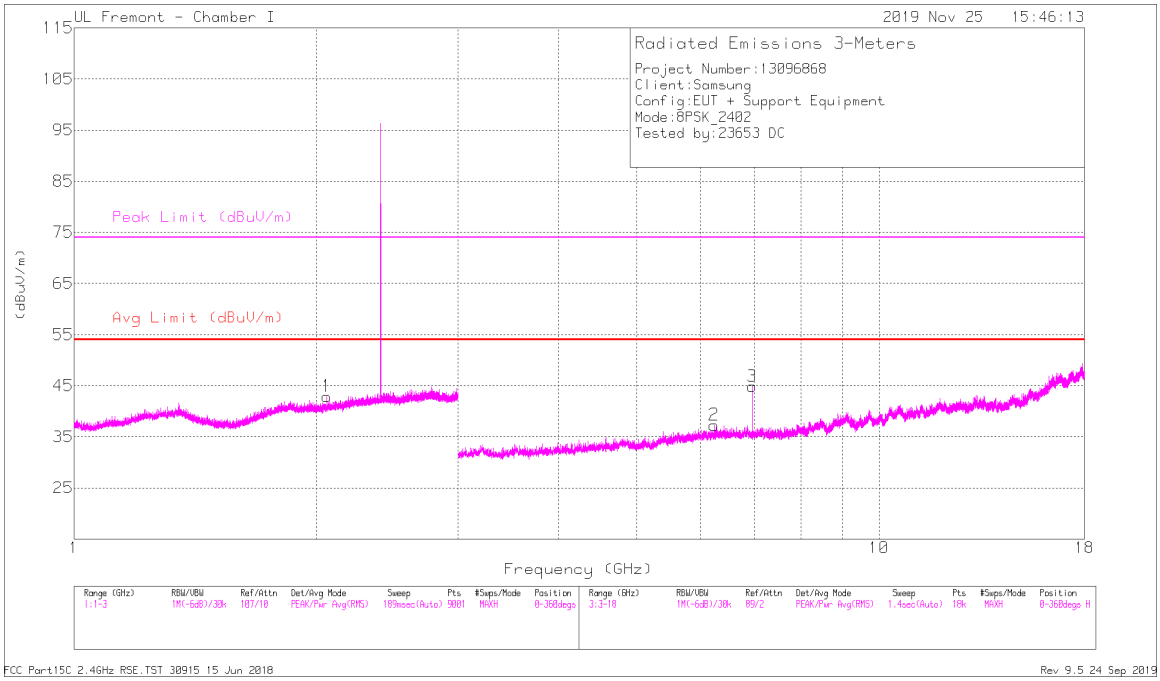
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

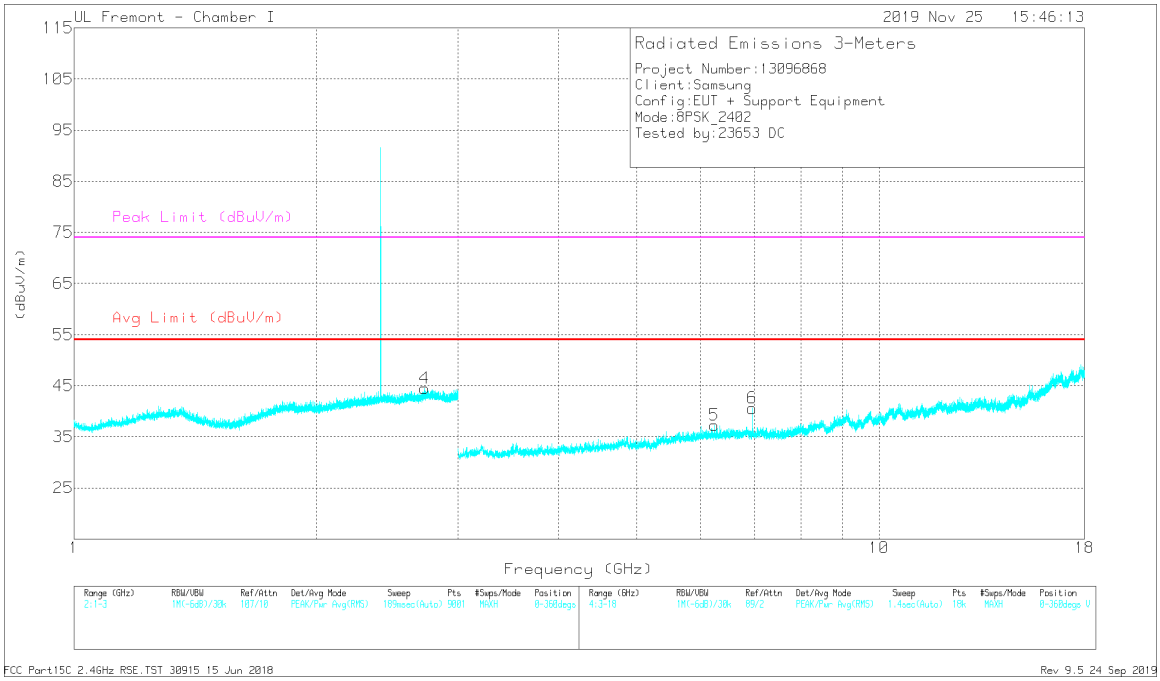
VA1T - FHSS: Linear Voltage Average VB=1/Ton (in Hz) where Ton is the transmit duration.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.06225	39.31	PKFH	31.1	-20.8	49.61	-	-	-	-	160	229	H
* 2.72345	38.39	PKFH	32.5	-19.2	51.69	-	-	74	-22.31	187	247	V
* 2.72675	24.94	VA1T	32.5	-19.2	38.24	54	-15.76	-	-	187	247	V
6.23966	32.4	PKFH	35.6	-24.5	43.5	-	-	-	-	160	229	H
6.95998	37.5	PKFH	35.6	-24.4	48.7	-	-	-	-	217	101	H
6.24421	32.86	PKFH	35.6	-24.5	43.96	-	-	-	-	160	229	V
6.95979	36.37	PKFH	35.6	-24.4	47.57	-	-	-	-	238	102	V

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

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

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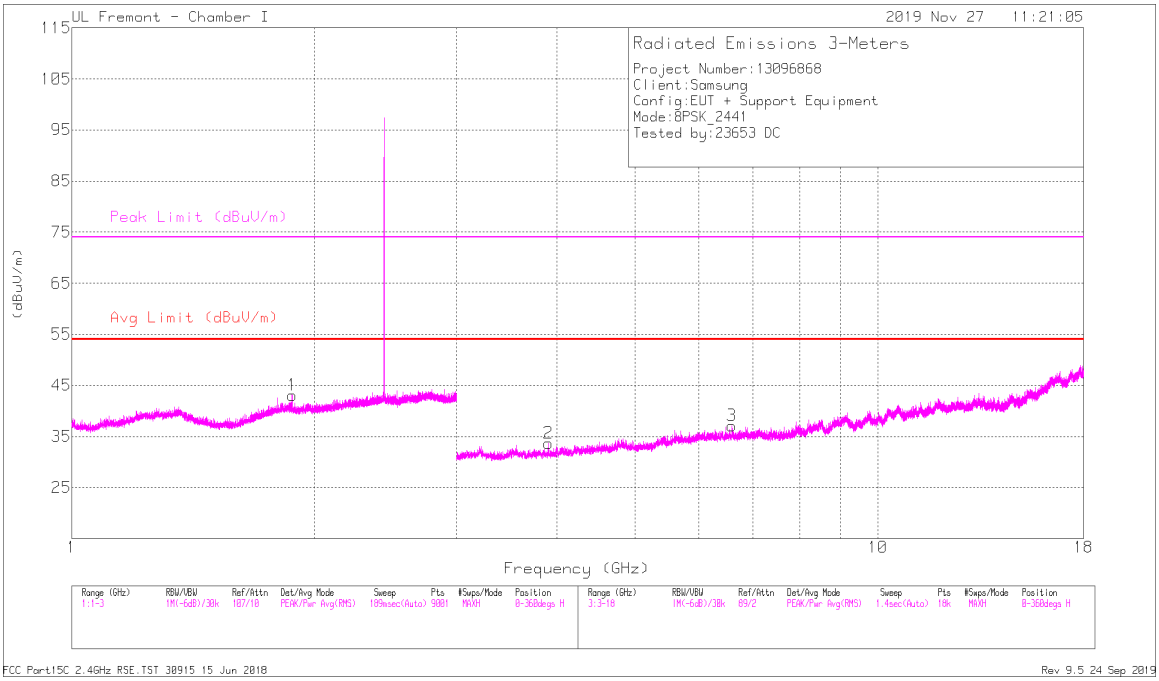
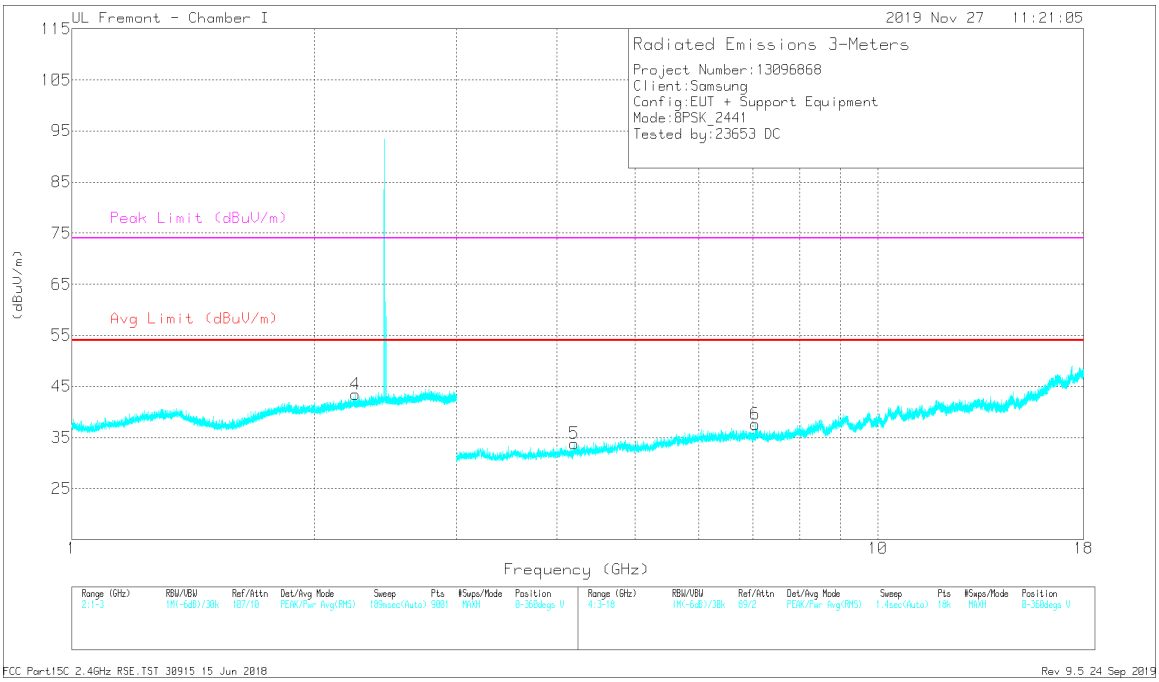
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.87795	38.6	PKFH	30.7	-20.4	48.9	-	-	-	-	298	138	H
* 2.24939	37.92	PKFH	31.4	-19.6	49.72	-	-	74	-24.28	270	102	V
* 2.24834	25.35	VA1T	31.4	-19.6	37.15	54	-16.85	-	-	270	102	V
6.59017	31.91	PKFH	35.7	-23.7	43.91	-	-	-	-	297	136	H
* 3.90162	35.14	PKFH	33.2	-28	40.34	-	-	74	-33.66	174	152	H
* 3.89919	22.06	VA1T	33.2	-28	27.26	54	-26.74	-	-	174	152	H
7.05266	33.3	PKFH	35.6	-24.3	44.6	-	-	-	-	297	143	V
* 4.20482	33.84	PKFH	33.4	-27	40.24	-	-	74	-33.76	96	156	V
* 4.2026	21.48	VA1T	33.4	-27	27.88	54	-26.12	-	-	96	156	V

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

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

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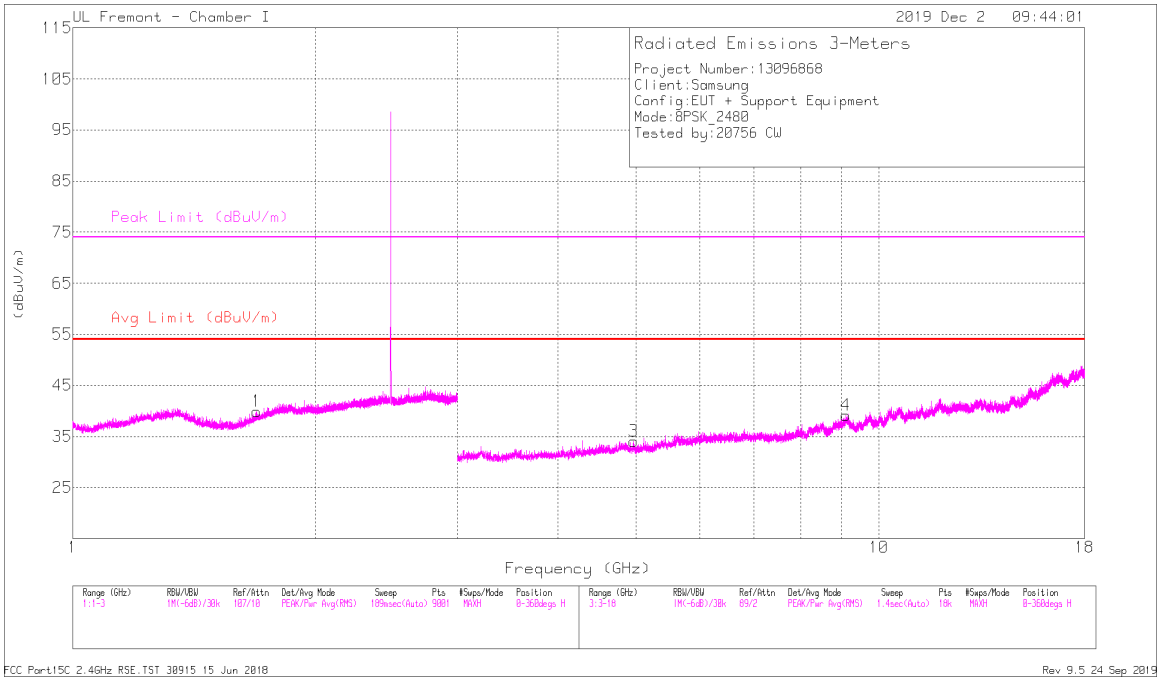
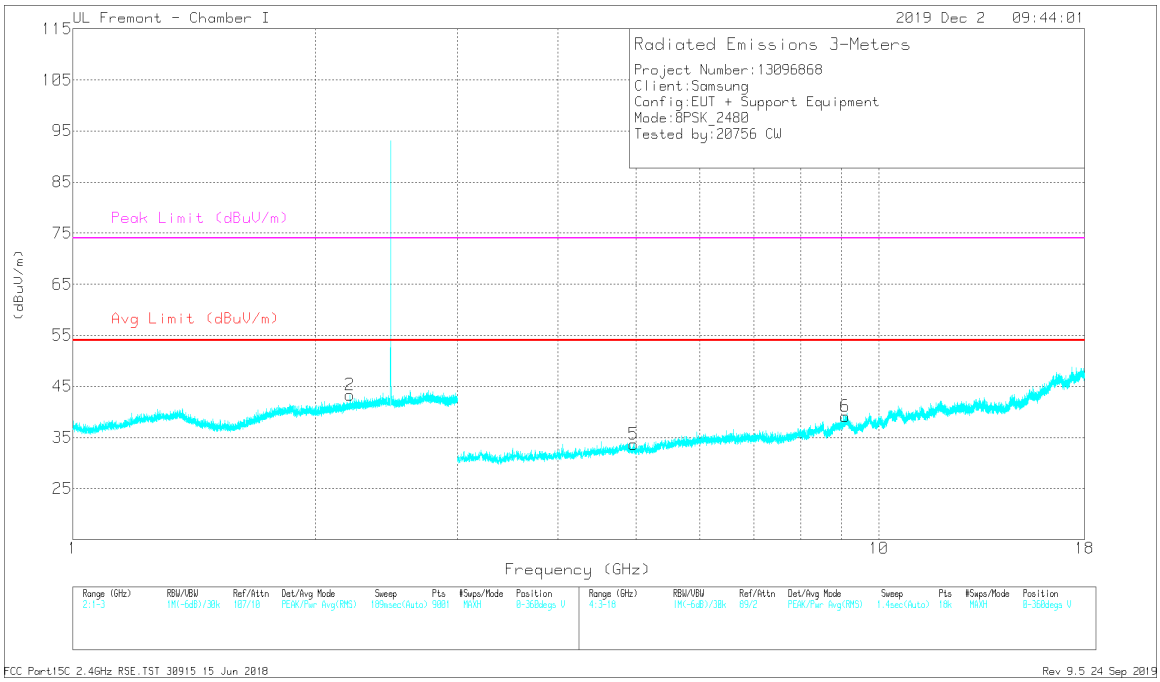
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.68851	37.62	PKFH	29.1	-20.5	46.22	-	-	74	-27.78	262	235	H
* 1.69184	25.39	VA1T	29.1	-20.4	34.09	54	-19.91	-	-	262	235	H
* 2.20502	37.34	PKFH	31.3	-19.8	48.84	-	-	74	-25.16	100	295	V
* 2.20461	24.83	VA1T	31.3	-19.8	36.33	54	-17.67	-	-	100	295	V
* 4.95988	32.76	PKFH	34.2	-26.7	40.26	-	-	74	-33.74	33	137	H
* 4.96007	20.73	VA1T	34.2	-26.7	28.23	54	-25.77	-	-	33	137	H
* 9.10538	28.45	PKFH	36.3	-19.7	45.05	-	-	74	-28.95	326	178	H
* 9.10545	16.84	VA1T	36.3	-19.7	33.44	54	-20.56	-	-	326	178	H
* 4.96394	33.85	PKFH	34.1	-26.9	41.05	-	-	74	-32.95	179	148	V
* 4.96344	20.52	VA1T	34.1	-26.8	27.82	54	-26.18	-	-	179	148	V
* 9.0919	27.16	PKFH	36.3	-19.8	43.66	-	-	74	-30.34	324	171	V
* 9.0922	16.69	VA1T	36.3	-19.8	33.19	54	-20.81	-	-	324	171	V

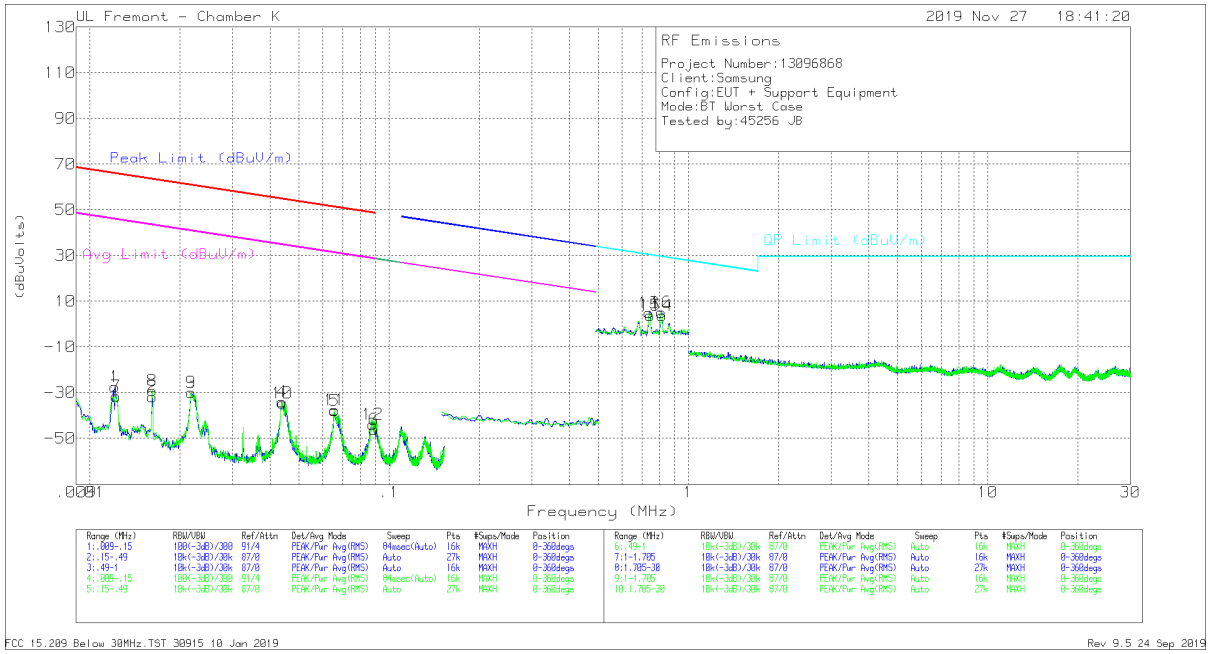
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

VA1T - FHSS: Linear Voltage Average VB=1/Ton where Ton is the transmit duration

10.2. WORST CASE BELOW 30MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01213	24.46	Pk	59.9	-31.8	-80	-27.44	65.91	-93.35	45.91	-73.35	0-360
2	.01614	20.71	Pk	59.3	-31.9	-80	-31.89	63.43	-95.32	43.43	-75.32	0-360
3	.02175	23.67	Pk	58.6	-32.1	-80	-29.83	60.83	-90.66	40.83	-70.66	0-360
4	.04382	21.33	Pk	57	-32.2	-80	-33.87	54.75	-88.62	34.75	-68.62	0-360
5	.06579	18.6	Pk	55.9	-32.2	-80	-37.7	51.22	-88.92	31.22	-68.92	0-360
6	.08886	10.49	Pk	55.6	-32.2	-80	-46.11	48.61	-94.72	28.61	-74.72	0-360
7	.01224	20.37	Pk	59.9	-31.8	-80	-31.53	65.83	-97.36	45.83	-77.36	0-360
8	.01615	23.64	Pk	59.3	-31.9	-80	-28.96	63.42	-92.38	43.42	-72.38	0-360
9	.02177	23.55	Pk	58.6	-32.1	-80	-29.95	60.83	-90.78	40.83	-70.78	0-360
10	.04393	20.59	Pk	57	-32.2	-80	-34.61	54.73	-89.34	34.73	-69.34	0-360
11	.06578	18.74	Pk	55.9	-32.2	-80	-37.56	51.22	-88.78	31.22	-68.78	0-360
12	.08801	12.77	Pk	55.6	-32.2	-80	-43.83	48.69	-92.52	28.69	-72.52	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
13	.73829	21.02	Pk	56.1	-32.1	-40	5.02	30.25	-25.23	0-360
14	.81589	19.69	Pk	56.1	-32.1	-40	3.69	29.38	-25.69	0-360
15	.74446	19.89	Pk	56.1	-32.1	-40	3.89	30.18	-26.29	0-360
16	.81197	21.11	Pk	56.1	-32.1	-40	5.11	29.43	-24.32	0-360

Pk - Peak detector

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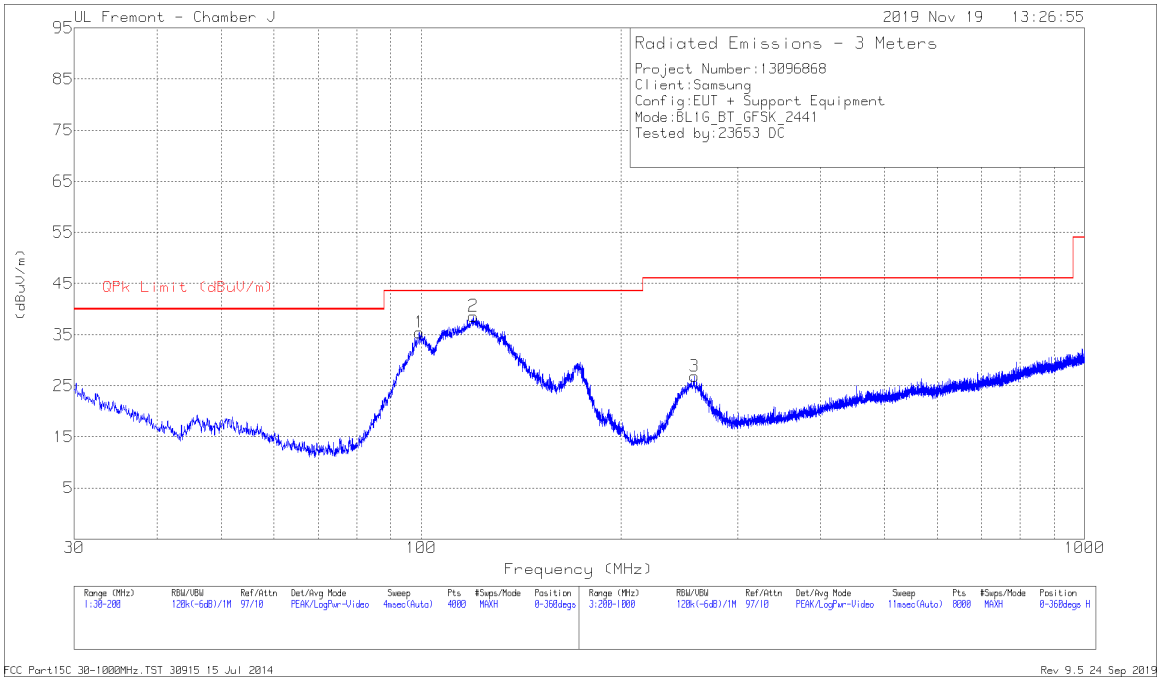
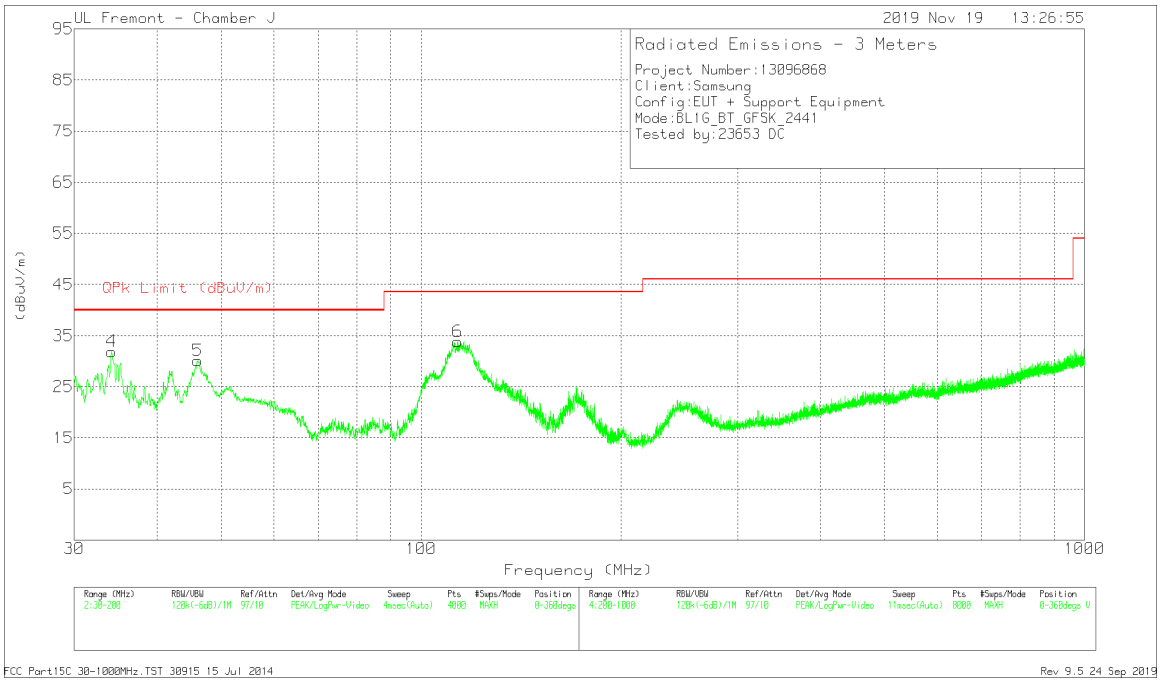
10.3. WORST CASE BELOW 1 GHz

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	99.378	50.41	Pk	16	-31	35.41	43.52	-8.11	0-360	298	H
2	* 119.9108	50.01	Pk	19.5	-30.9	38.61	43.52	-4.91	0-360	298	H
4	34.1661	38.88	Pk	24.5	-31.5	31.88	40	-8.12	0-360	101	V
5	46.0692	45.79	Pk	15.7	-31.4	30.09	40	-9.91	0-360	101	V
6	* 113.5766	45.72	Pk	19	-30.9	33.82	43.52	-9.7	0-360	101	V
3	* 258.3076	39.35	Pk	17.7	-30.2	26.85	46.02	-19.17	0-360	101	H

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

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 120.0966	47.06	Qp	19.5	-30.9	35.66	43.52	-7.86	259	235	H

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

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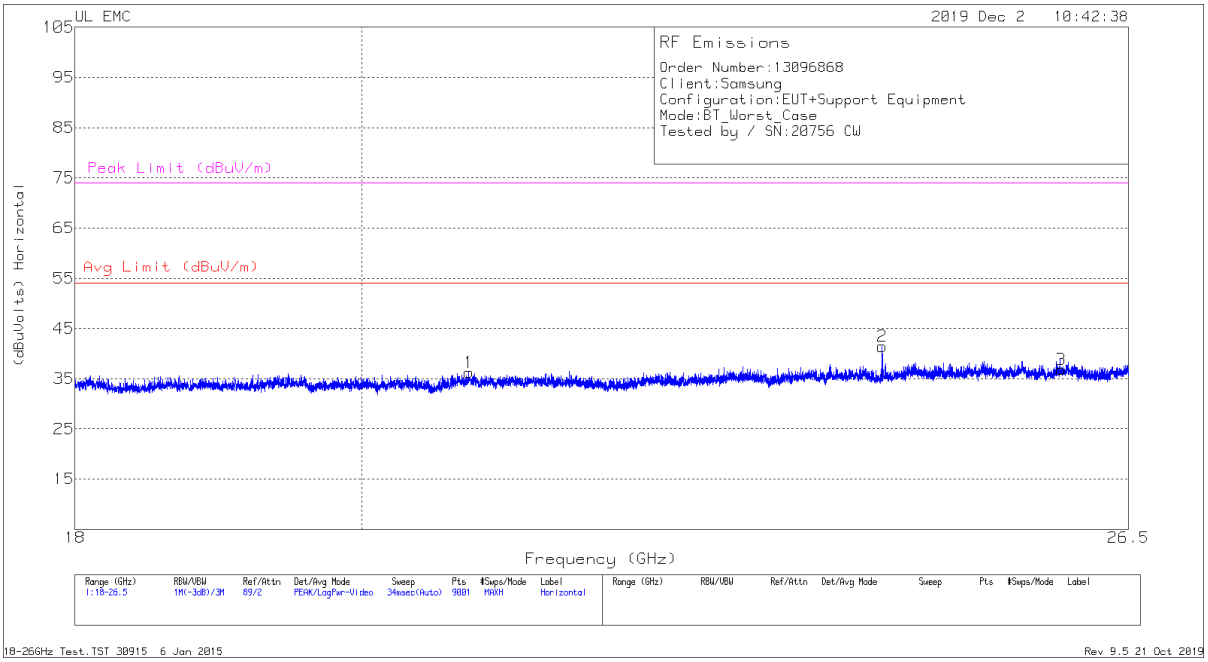
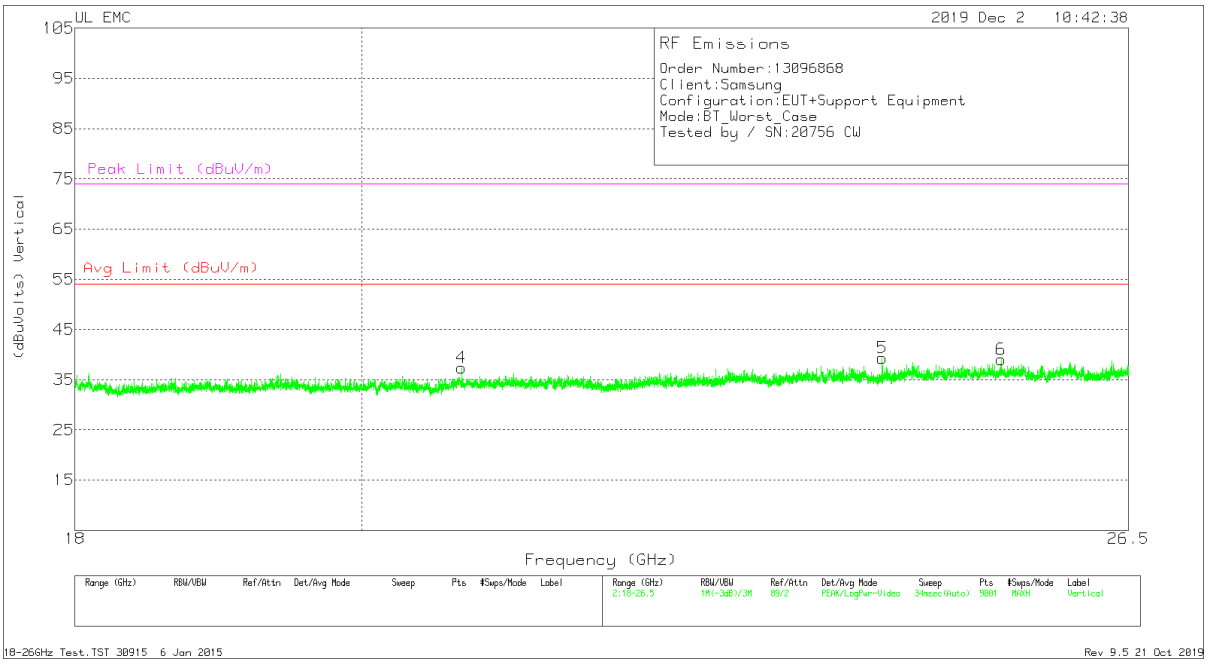
10.4. WORST CASE 18-26 GHz

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



HORIZONTAL



VERTICAL

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	20.79933	69.56	Pk	33.1	-56.9	-9.5	36.26	54	-17.74	74	-37.74
2	24.20877	73.7	Pk	34.2	-57	-9.5	41.4	54	-12.6	74	-32.6
3	25.85022	67.33	Pk	34.4	-55.4	-9.5	36.83	54	-17.17	74	-37.17
4	20.74455	70.59	Pk	33.1	-56.8	-9.5	37.39	54	-16.61	74	-36.61
5	24.20877	71.64	Pk	34.2	-57	-9.5	39.34	54	-14.66	74	-34.66
6	25.28827	69.11	Pk	34.6	-55.2	-9.5	39.01	54	-14.99	74	-34.99

Pk - Peak detector

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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 C63.4.

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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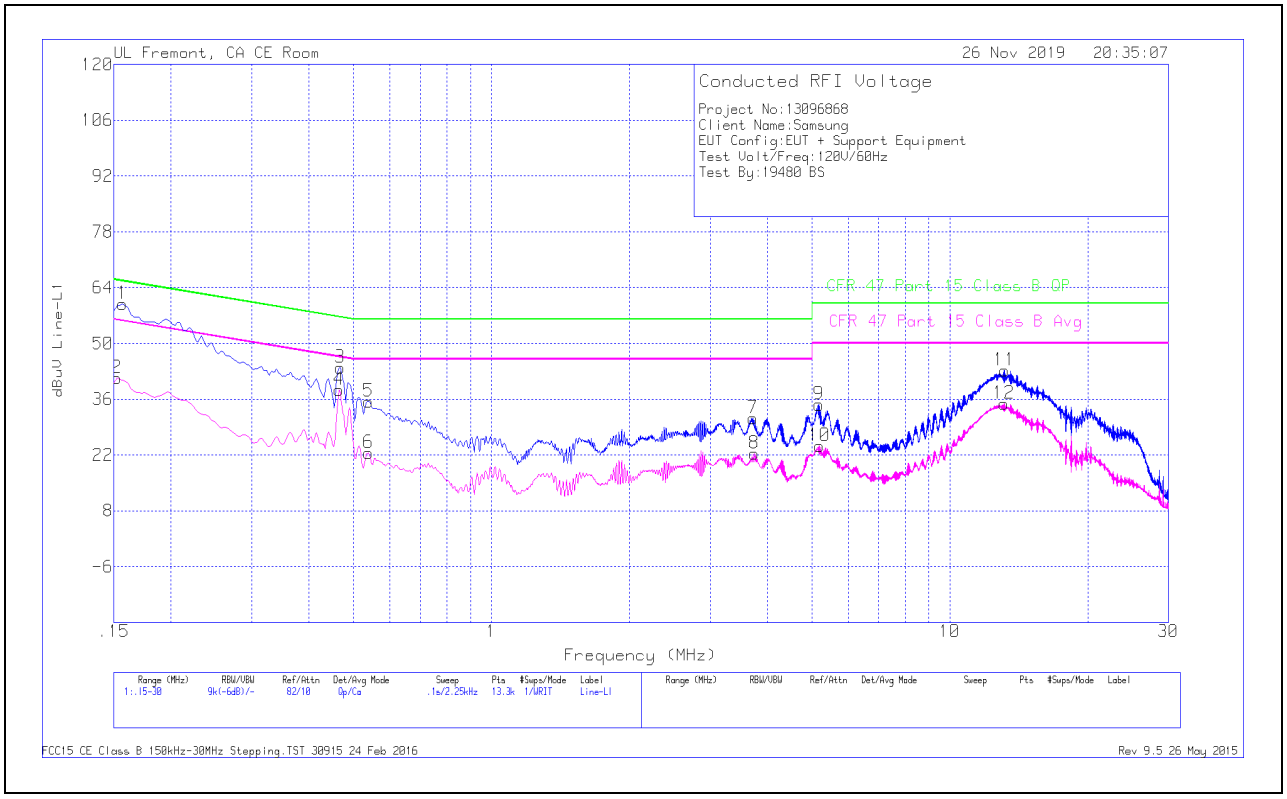
AC Power Line Norm

LINE 1 RESULTS

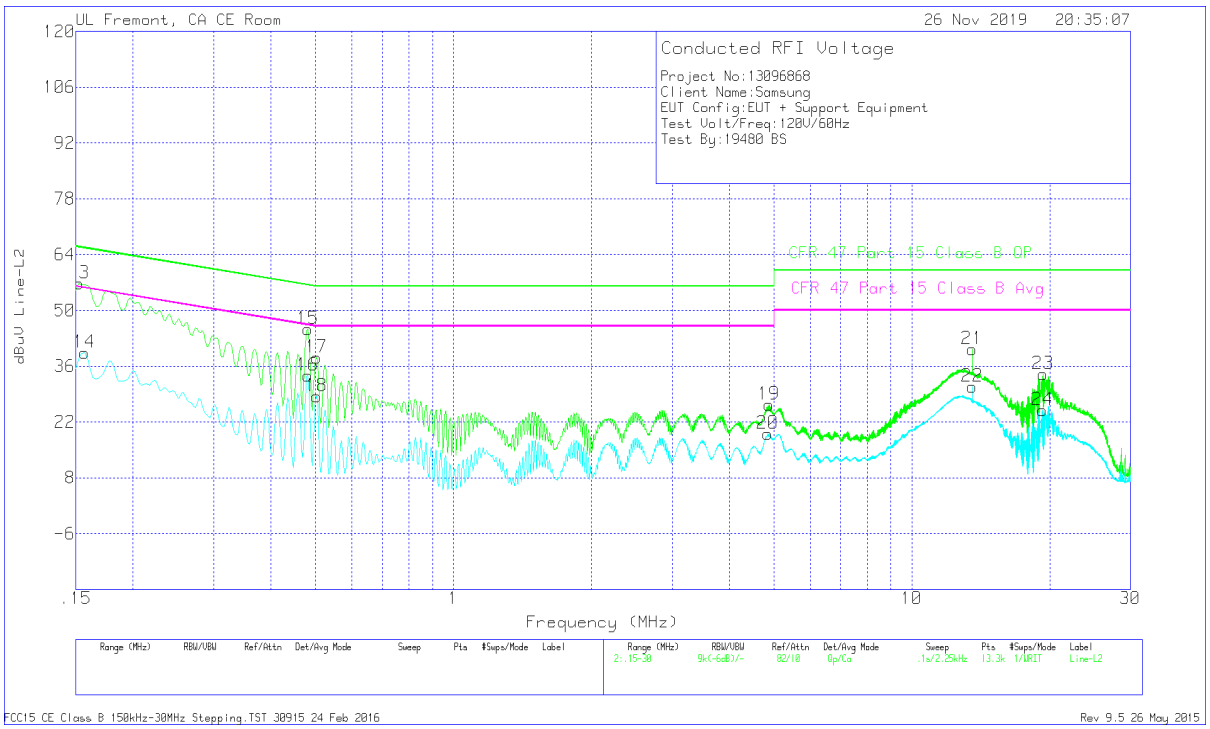


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.15675	49.65	Qp	.1	0	10.1	59.85	65.63	-5.78	-	-
2	.15225	31.14	Ca	.1	0	10.1	41.34	-	-	55.88	-14.54
3	.46725	33.88	Qp	0	0	10.1	43.98	56.56	-12.58	-	-
4	.465	28.3	Ca	0	0	10.1	38.4	-	-	46.6	-8.2
5	.53925	25.24	Qp	0	0	10.1	35.34	56	-20.66	-	-
6	.53925	12.38	Ca	0	0	10.1	22.48	-	-	46	-23.52
7	3.71625	20.96	Qp	0	.1	10.1	31.16	56	-24.84	-	-
8	3.74775	12.21	Ca	0	.1	10.1	22.41	-	-	46	-23.59
9	5.17425	24.42	Qp	0	.1	10.1	34.62	60	-25.38	-	-
10	5.20125	14.14	Ca	0	.1	10.1	24.34	-	-	50	-25.66
11	13.1595	32.71	Qp	.1	.2	10.2	43.21	60	-16.79	-	-
12	13.1347	24.44	Ca	.1	.2	10.2	34.94	-	-	50	-15.06

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	.15225	46.62	Qp	.1	0	10.1	56.82	65.88	-9.06	-	-
14	.15675	29.14	Ca	.1	0	10.1	39.34	-	-	55.63	-16.29
15	.48075	35.17	Qp	0	0	10.1	45.27	56.33	-11.06	-	-
16	.48075	23.62	Ca	0	0	10.1	33.72	-	-	46.33	-12.61
17	.50325	28.11	Qp	0	0	10.1	38.21	56	-17.79	-	-
18	.50325	18.32	Ca	0	0	10.1	28.42	-	-	46	-17.58
19	4.875	16.08	Qp	0	.1	10.1	26.28	56	-29.72	-	-
20	4.8525	8.9	Ca	0	.1	10.1	19.1	-	-	46	-26.9
21	13.56	29.77	Qp	.1	.2	10.2	40.27	60	-19.73	-	-
22	13.56	20.41	Ca	.1	.2	10.2	30.91	-	-	50	-19.09
23	19.3222	23.23	Qp	.1	.3	10.3	33.93	60	-26.07	-	-
24	19.2975	14.22	Ca	.1	.3	10.3	24.92	-	-	50	-25.08

Qp - Quasi-Peak detector

Ca - CISPR average detection

NOTE: Markers 21 and 22, 13.56MHz is an external NFC signal unrelated to the EUT.