



CERTIFICATION TEST REPORT

Report Number. : 12563993-E2V2

Applicant : Samsung Electronics Co., Ltd.
129 Samsung-Ro, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, 16677, Korea

Model : SM-G970N

FCC ID : A3LSMG970KOR

EUT Description : GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE
20/40/80, ANT+ and NFC

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
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Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888



NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	1/24/2019	Initial Issue	
V2	1/29/2019	Updated Section 2.1, 2.2, 2.3, add section 2.4	Dan Corona

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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 phone with BT, DTS/UNII a/b/g/n/ac/11ax HE
20/40/80, ANT+ and NFC

MODEL: SM-G970N

SERIAL NUMBER: R38KA0H49TL (Conducted), R38KB05BJQB (Radiated) (Original)
R39KB0AHYCP, R39KB0AHYMF (Radiated) (Spot Check)

DATE TESTED: OCTOBER 30, 2018 TO DECEMBER 13, 2018 (ORIGINAL)
DECEMBER 13 TO 19, 2018 (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.

Approved & Released For
UL Verification Services Inc. By:



DAN CORONIA
Operations Leader
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



STEVEN TRAN
Project Engineer
Consumer Technology Division
UL Verification Services Inc.

2. INTRODUCTION OF TEST DATA REUSE

2.1. INTRODUCTION

According to the manufacturer, FCC ID: A3LSMG970F and FCC ID: A3LSMG970KOR non-licensed radios are electrically identical. The FCC ID: A3LSMG970F test data shall remain representative of FCC ID: A3LSMG970KOR.

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: A3LSMG970F, shares the same enclosure and circuit board as FCC ID: A3LSMG970KOR. 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: A3LSMG970F remains representative of FCC ID: A3LSMG970KOR. The test data of FCC ID: A3LSMG970F being submitted for this application to cover BT features.

2.3. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device A3LSMG970KOR 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 as shown in the summary below.

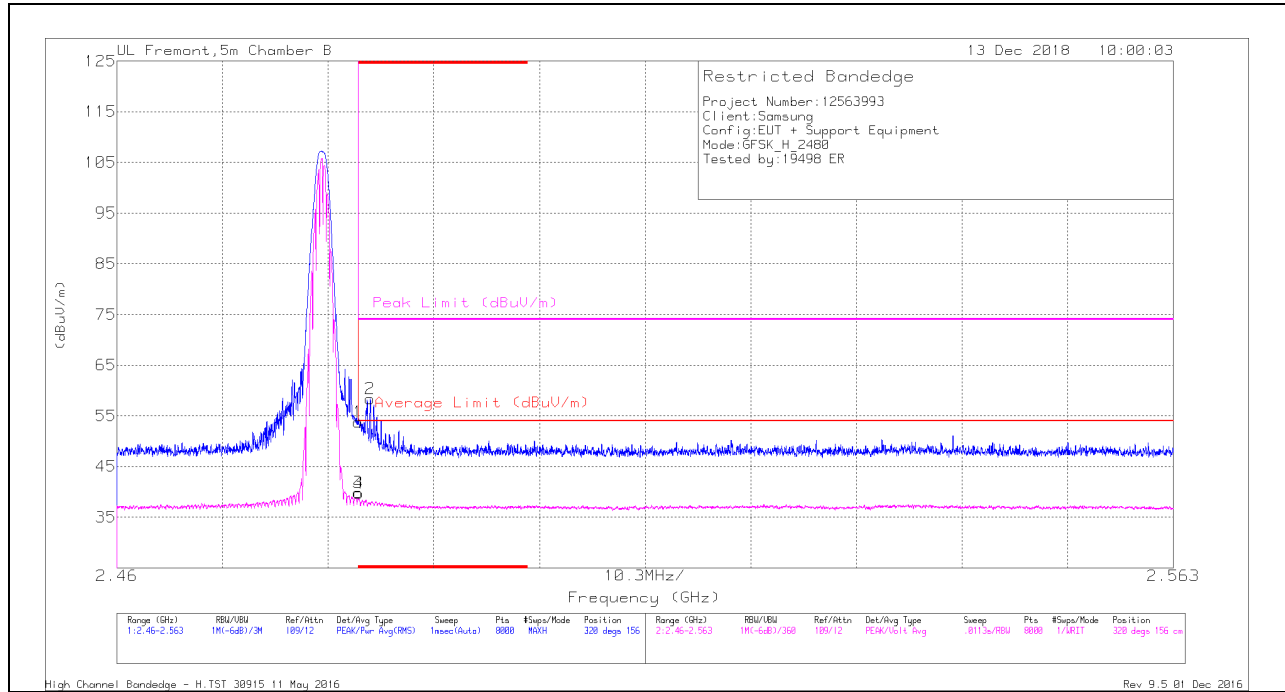
A3LSMG970KOR SPOT CHECK RESULTS										
Technology	Mode	Test Item	Channel	Measured Frequency	Original model		Spot check model		Delta (dB)	
					SM-G970F		SM-G970N			
					Peak	Ave	Peak	Ave	Peak	Ave
BT	GFSK	RBE	78	2484MHz	52.87	39.5	53.76	38.71	0.89	-0.79
	GFSK	RSE	0	12261MHz	49.36	38.34	50.36	37.67	1.0	-0.67

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

2.3.1. SPOT CHECK DATA

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

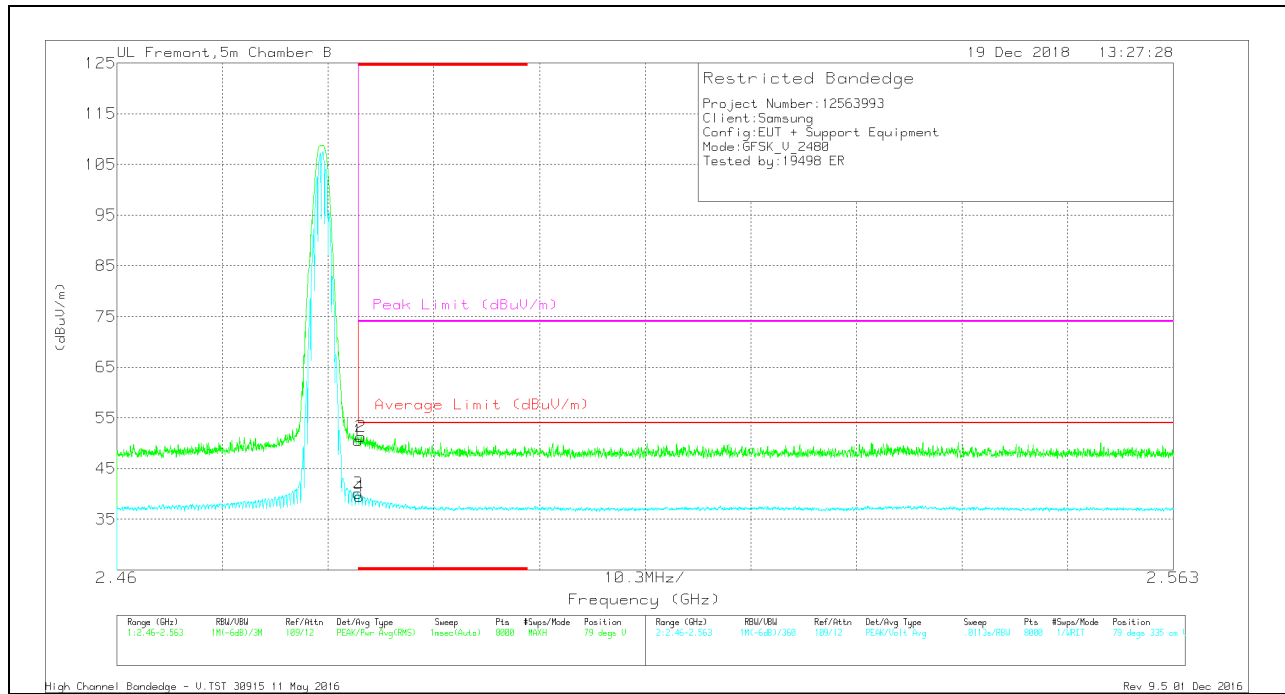
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ftr/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.46	Pk	32.6	-20.3	53.76	-	-	74	-20.24	320	156	H
3	* 2.484	26.41	VA1T	32.6	-20.3	38.71	54	-15.29	-	-	320	156	H
4	* 2.484	26.31	VA1T	32.6	-20.3	38.61	54	-15.39	-	-	320	156	H
2	* 2.485	46.14	Pk	32.6	-20.4	58.34	-	-	74	-15.66	320	156	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 T863 (dB/m)	Amp/Cb/Ftr/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.25	Pk	32.6	-20.3	50.55	-	-	74	-23.45	79	335	V
2	* 2.484	39.06	Pk	32.6	-20.4	51.26	-	-	74	-22.74	79	335	V
3	* 2.484	27.82	VA1T	32.6	-20.3	40.12	54	-13.88	-	-	79	335	V
4	* 2.484	27.22	VA1T	32.6	-20.3	39.52	54	-14.48	-	-	79	335	V

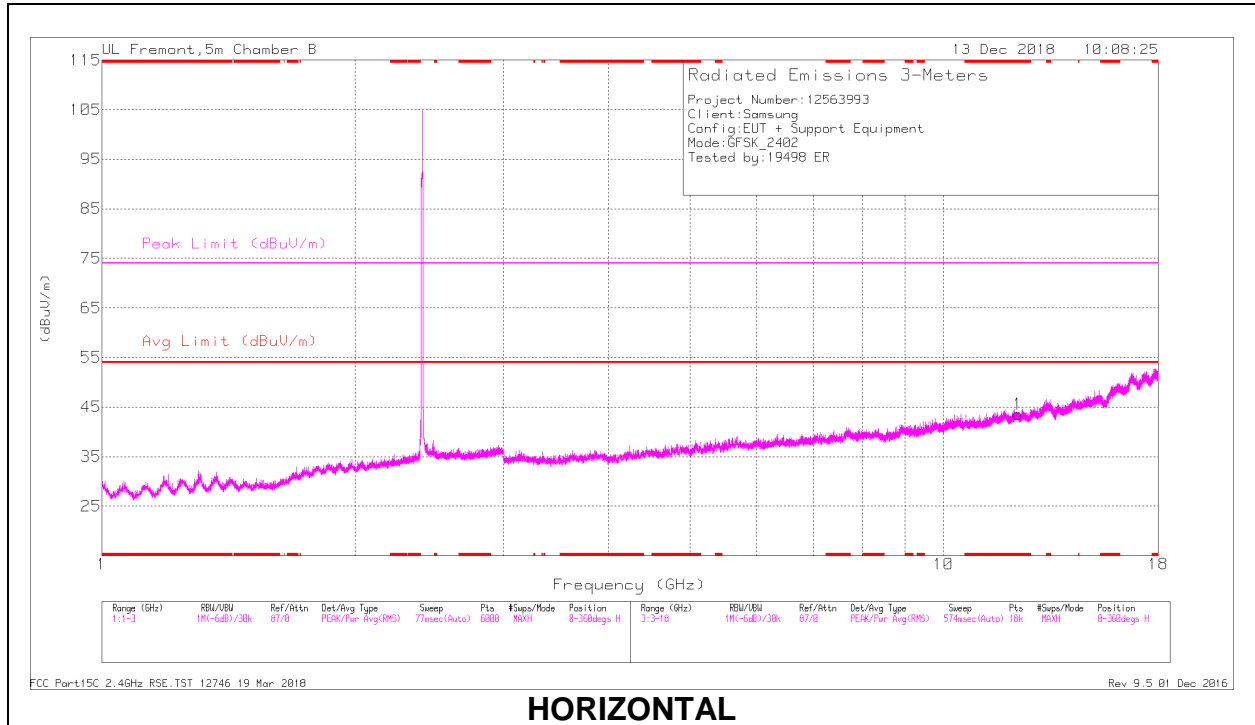
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

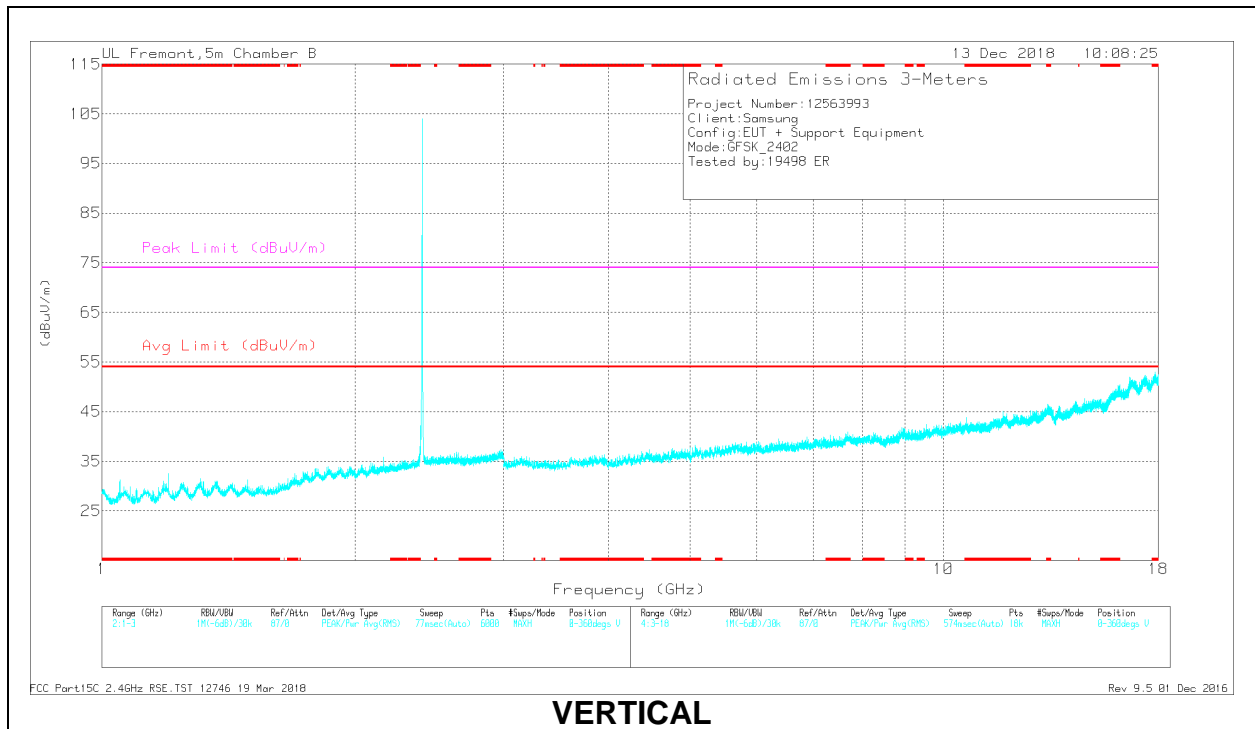
VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 12.262	33.06	PKFH	39.2	-21.9	50.36	-	-	74	-23.64	0	157	H
* 12.26	20.37	VA1T	39.2	-21.9	37.67	54	-16.33	-	-	0	157	H

* - indicates frequency in CFR47 Pt 15 Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is 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
PCE	A3LSMG970F	Grant	12563734-E1V6	Test	FCC Report WWAN / All sections except Appendix A
DSS	A3LSMG970F	Grant	12563734-E2V2	Test	FCC Report BT / All sections
DTS	A3LSMG970F	Grant	12563734-E3V3	Test	FCC Report BLE / All sections
			12563734-E4V4		FCC Report DTS WLAN / All sections
NII	A3LSMG970F	Grant	12563734-E5V3	Test	FCC Report UNII WLAN / All sections except DFS
DXX	A3LSMG970F	Grant	12563734-E7V3	Test	FCC Report ANT+ / All sections
			12563734-E8V3	Test	FCC Report NFC / All sections
DCD	A3LSMG970F	Grant	12563734-E9V3	Test	FCC Report Wireless Charging / All sections

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, and KDB 558074 D01 15.247 Meas Guidance v05.

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
<input checked="" type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input type="checkbox"/> Chamber I (ISED:2324A-5)
<input checked="" type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input type="checkbox"/> Chamber J (ISED:2324A-6)
<input checked="" type="checkbox"/> Chamber C (ISED:2324B-3)	<input type="checkbox"/> Chamber F (ISED:22541-3)	<input type="checkbox"/> Chamber K (ISED:2324A-1)
	<input type="checkbox"/> Chamber G (ISED:22541-4)	<input type="checkbox"/> Chamber L (ISED:2324A-3)
	<input 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

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)

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

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.

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE 20/40/80, ANT+ and NFC. 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	16.99	50.00
2402 - 2480	Enhanced DQPSK	12.35	17.18
2402 - 2480	Enhanced 8PSK	12.97	19.82

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 4.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -1.21 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was G970N.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 X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

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

GFSK mode: DH5
8PSK mode: 3-DH5

All radios that can be transmitted simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung	EP-TA300	R3KB5B01S1SE3	N/A
USB Data Caba	Samsung	N/A	N/A	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

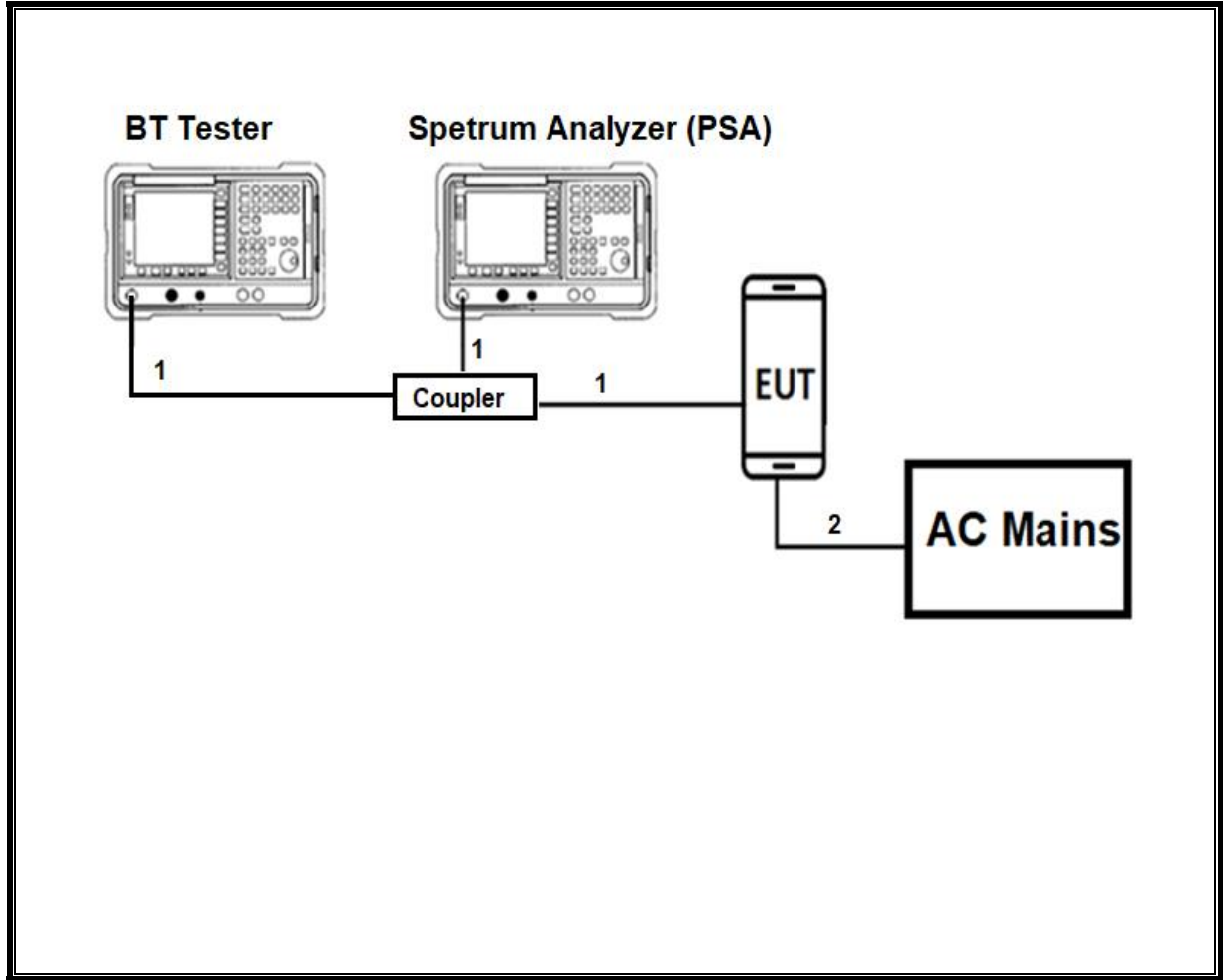
I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

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

TEST SETUP

The EUT is a standalone. Test software exercised the radio card.

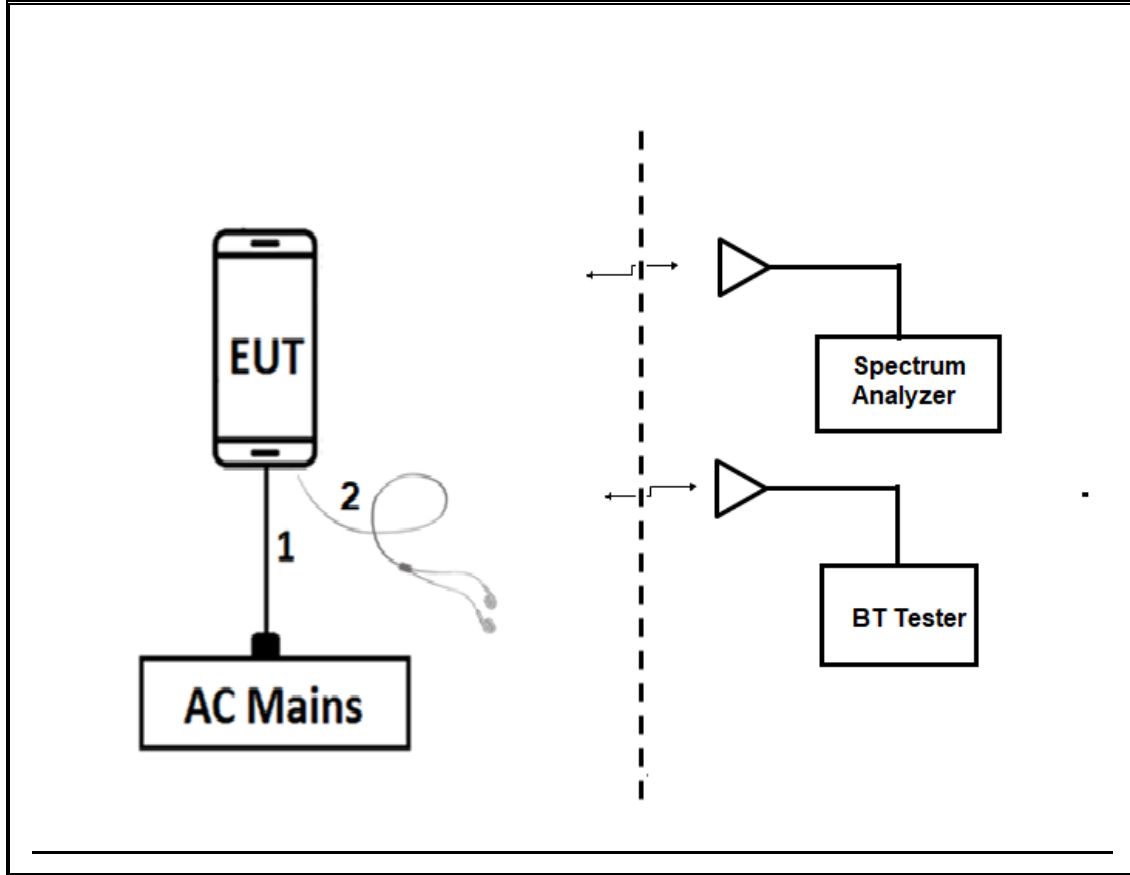
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

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

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT has support equipment. 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	ID Num	Cal Due	Last Cal
Amplifier, 100KHz to 1GHz,32dB	SONOMA INSTRUMENT	310N	T300	12/11/2019	12/11/2019
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T493	10/13/2019	10/13/2018
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	10/20/2019	10/20/2018
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2019	023/09/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T900	06/18/2019	06/18/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T345	04/25/2019	04/25/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	06/21/2019	06/21/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	05/24/2019	05/24/2018
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	PRE0165308	12/13/2018	12/13/2017
18 - 26.5 GHz Horn Antenna	ARA	MWH-1826/B	T477	06/16/2019	06/16/2018
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1271	07/26/2019	07/26/2018
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1224	10/09/2019	10/09/2018
EMI Reciever	Rohde & Schwarz	ESR	T1436	02/21/2019	02/21/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1113	12/21/2018	12/21/2017
Spectrum Analyzer	Agilent (Keysight) Technologies	E4446A	T146	08/13/2019	08/13/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/16/2019	04/16/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019	01/08/2018

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016
Antenna Port Software	UL	UL RF	Ver 9.0, Oct 31, 2018

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 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.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

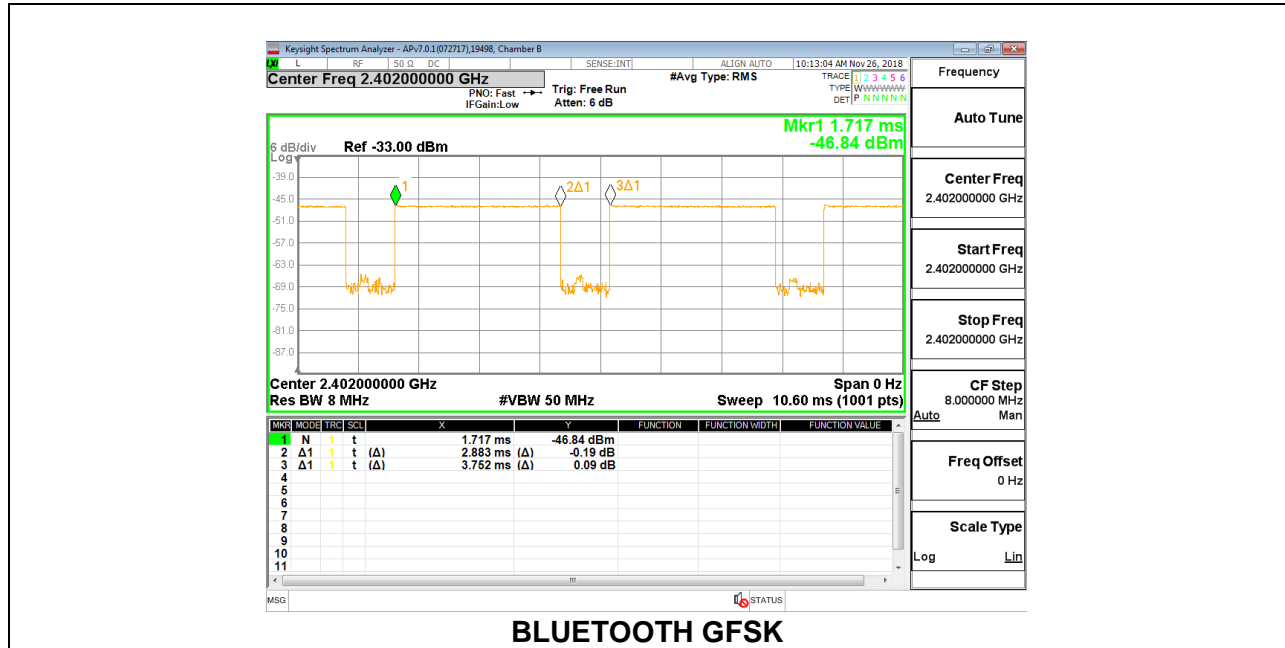
PROCEDURE

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

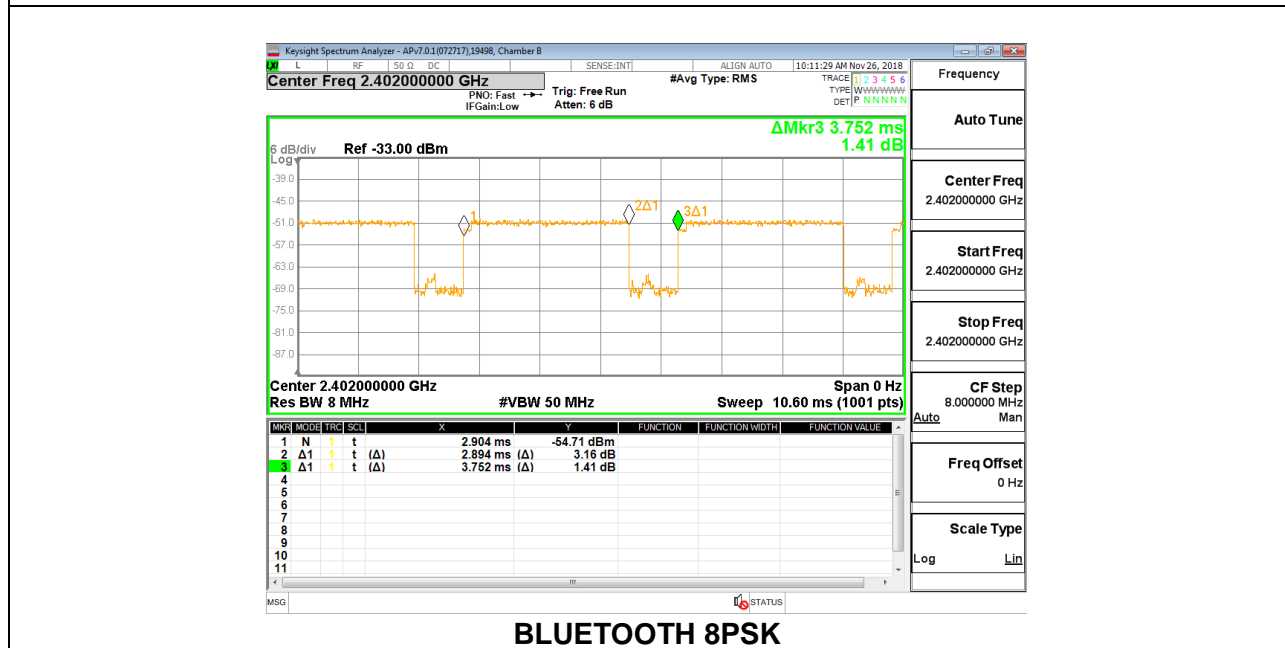
ON TIME AND DUTY CYCLE RESULTS

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	2.883	3.752	0.768	76.8%	1.14	0.347
Bluetooth 8PSK	2.894	3.749	0.772	77.2%	1.12	0.346

DUTY CYCLE PLOTS



BLUETOOTH GFSK



BLUETOOTH 8PSK

9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

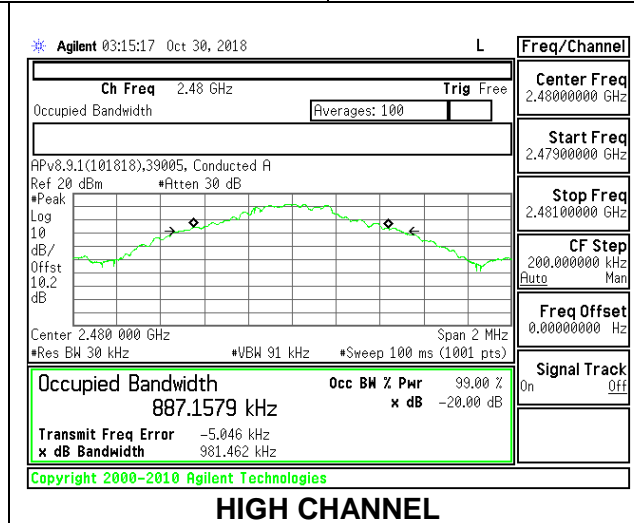
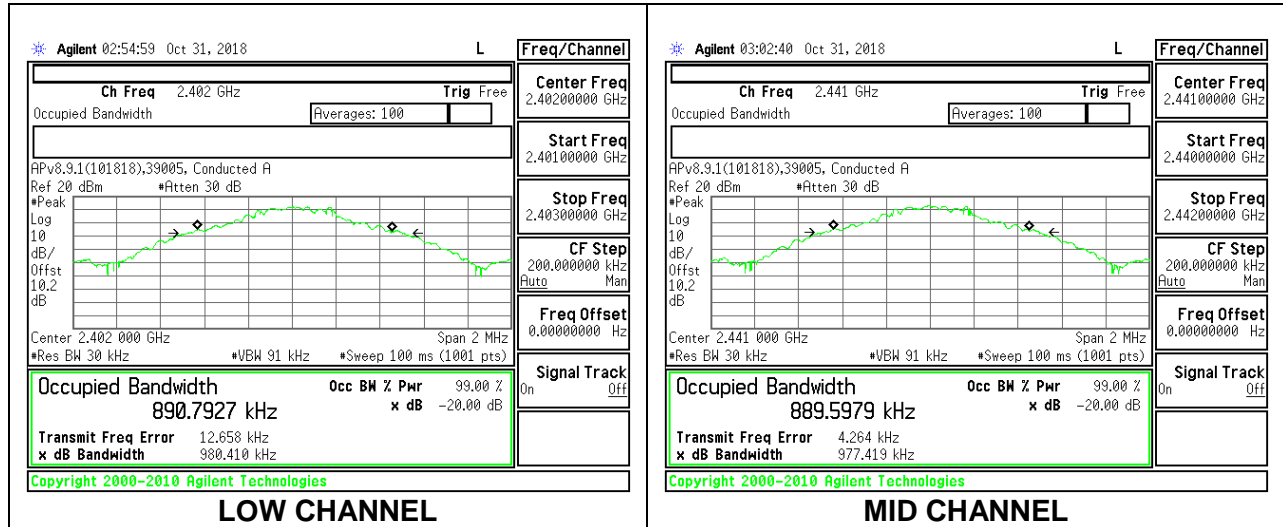
TEST PROCEDURE

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

RESULTS

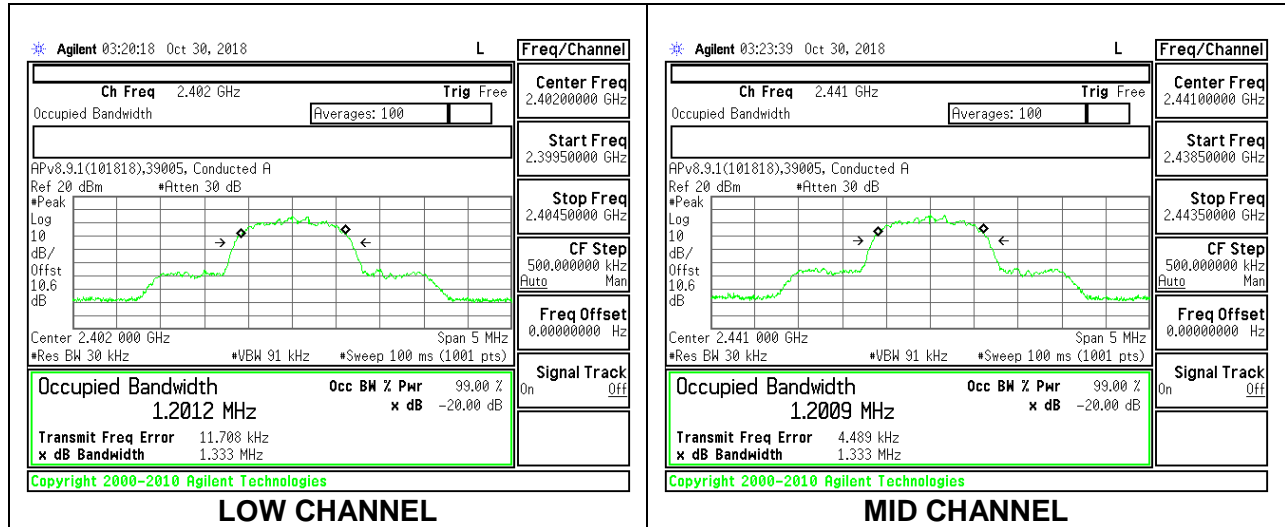
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.9804	0.8908
Mid	2441	0.9774	0.8896
High	2480	0.9815	0.8872



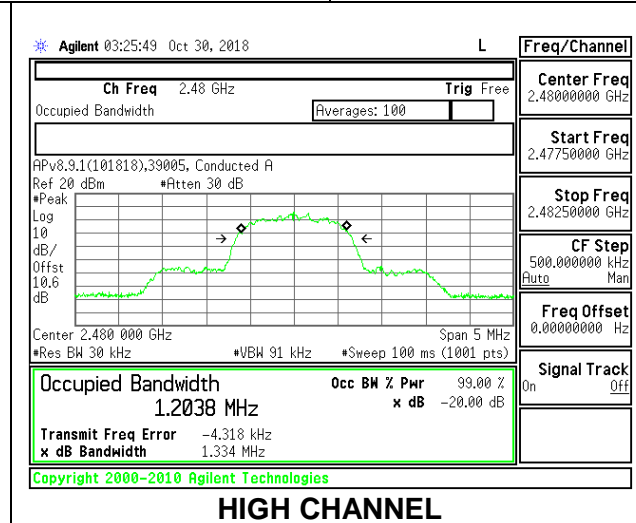
9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.333	1.2012
Mid	2441	1.333	1.2009
High	2480	1.334	1.2038



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 hopping channel, whichever is greater.

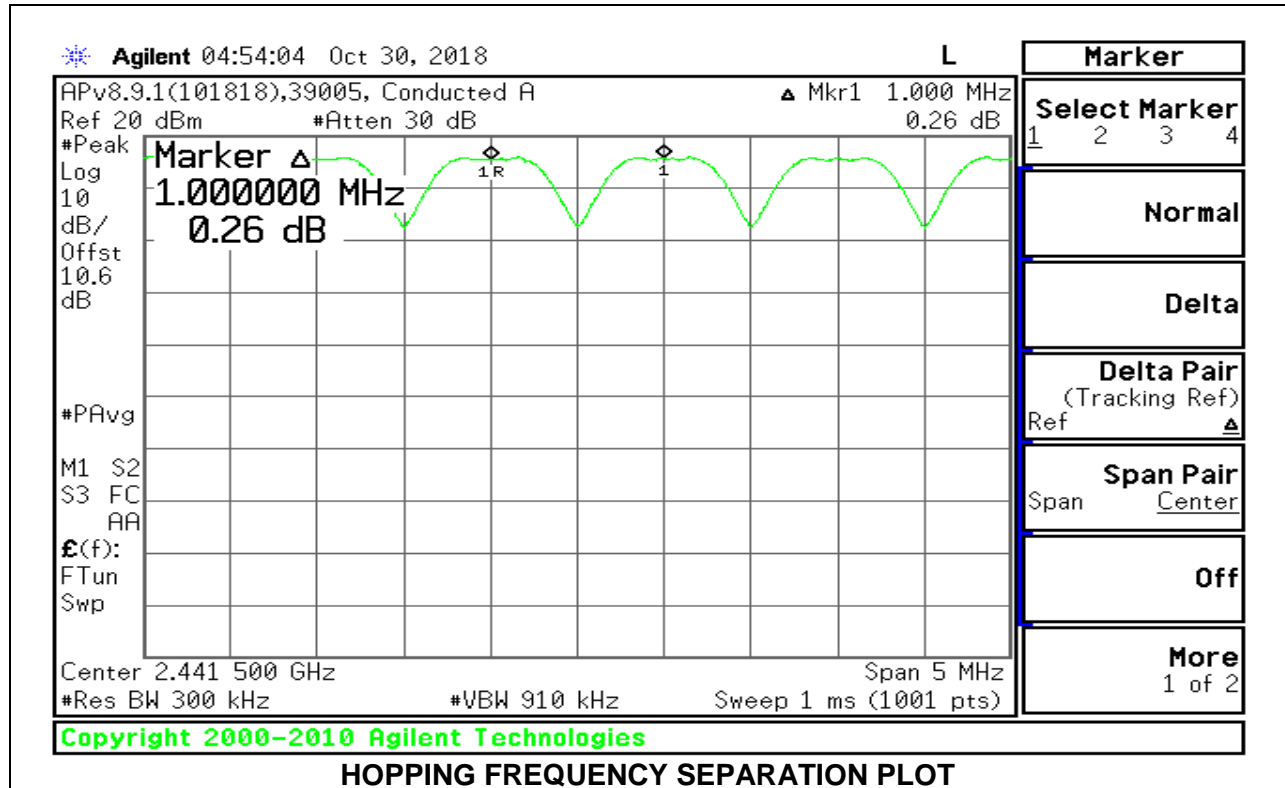
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

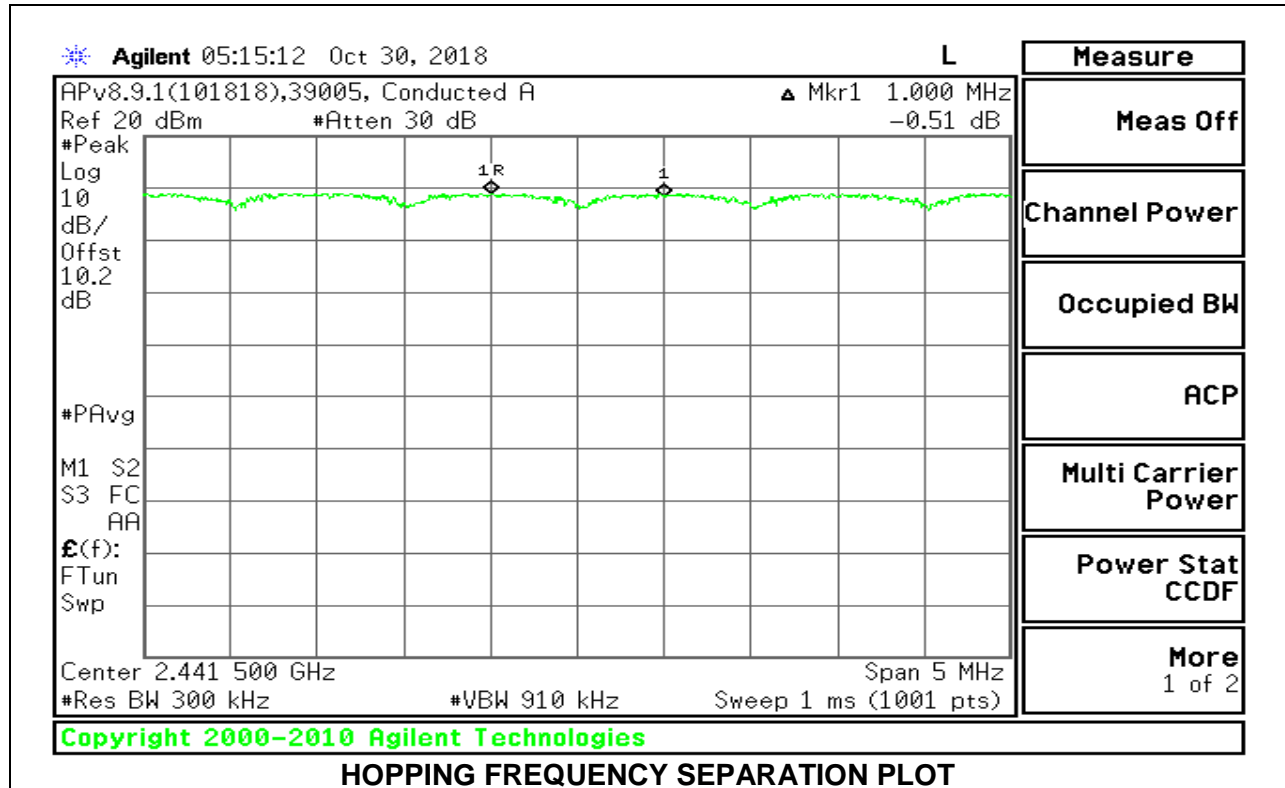
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



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.

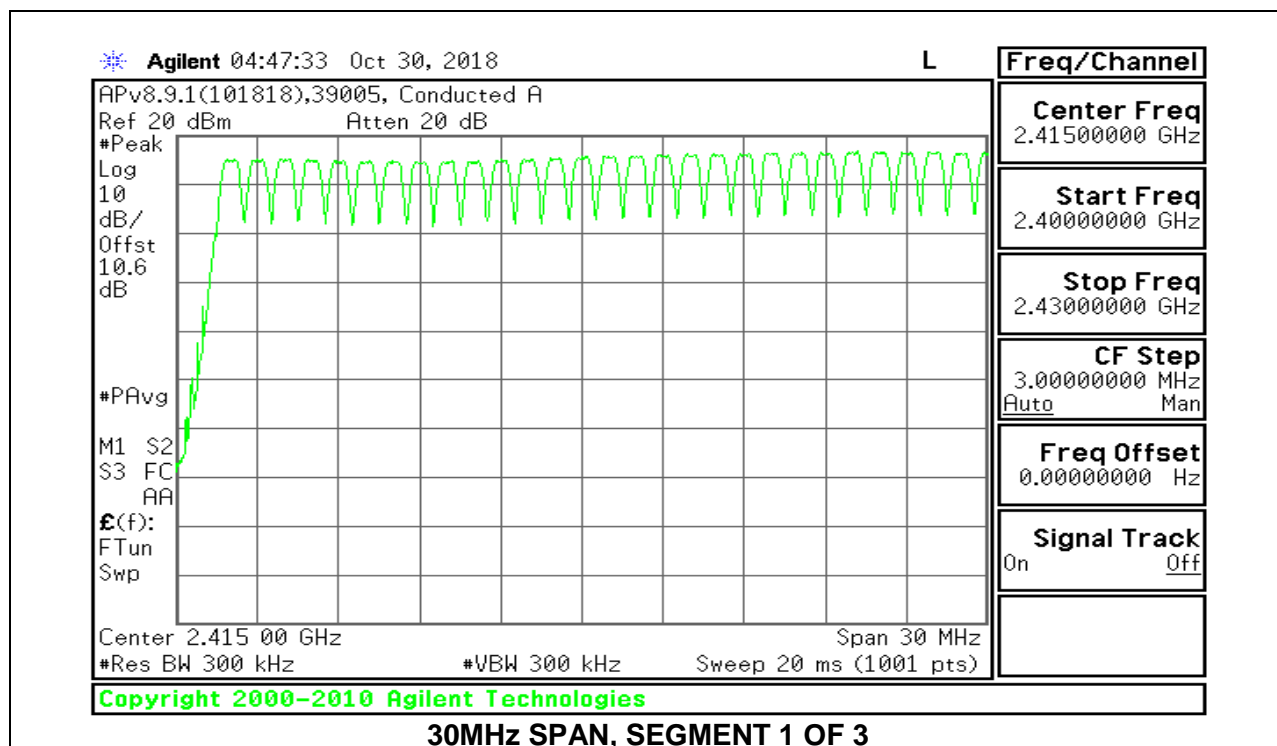
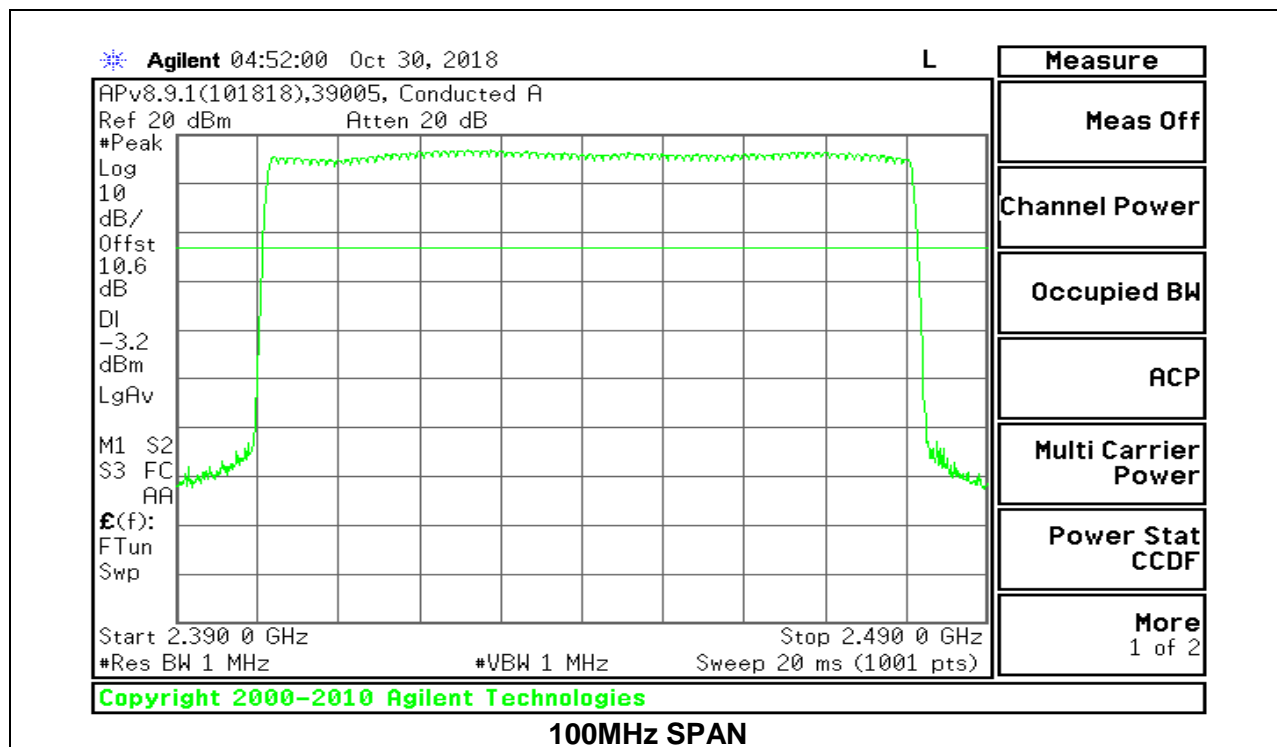
TEST PROCEDURE

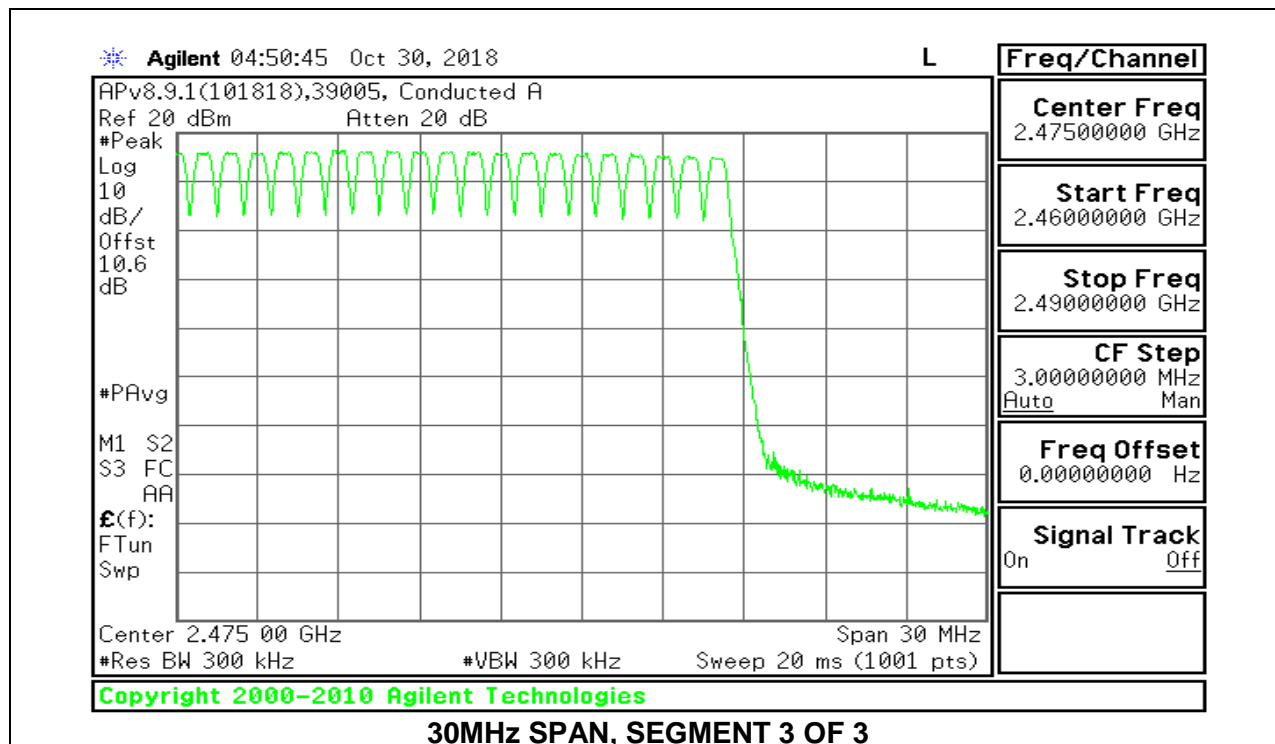
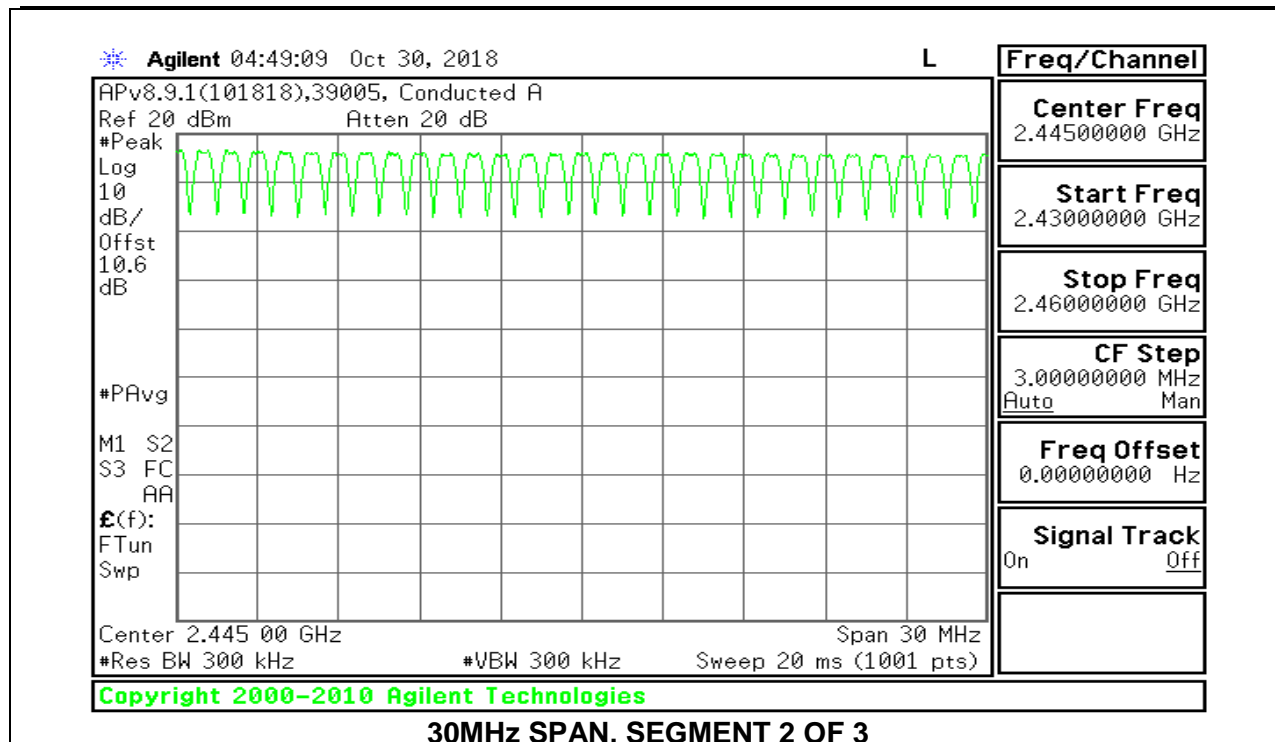
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

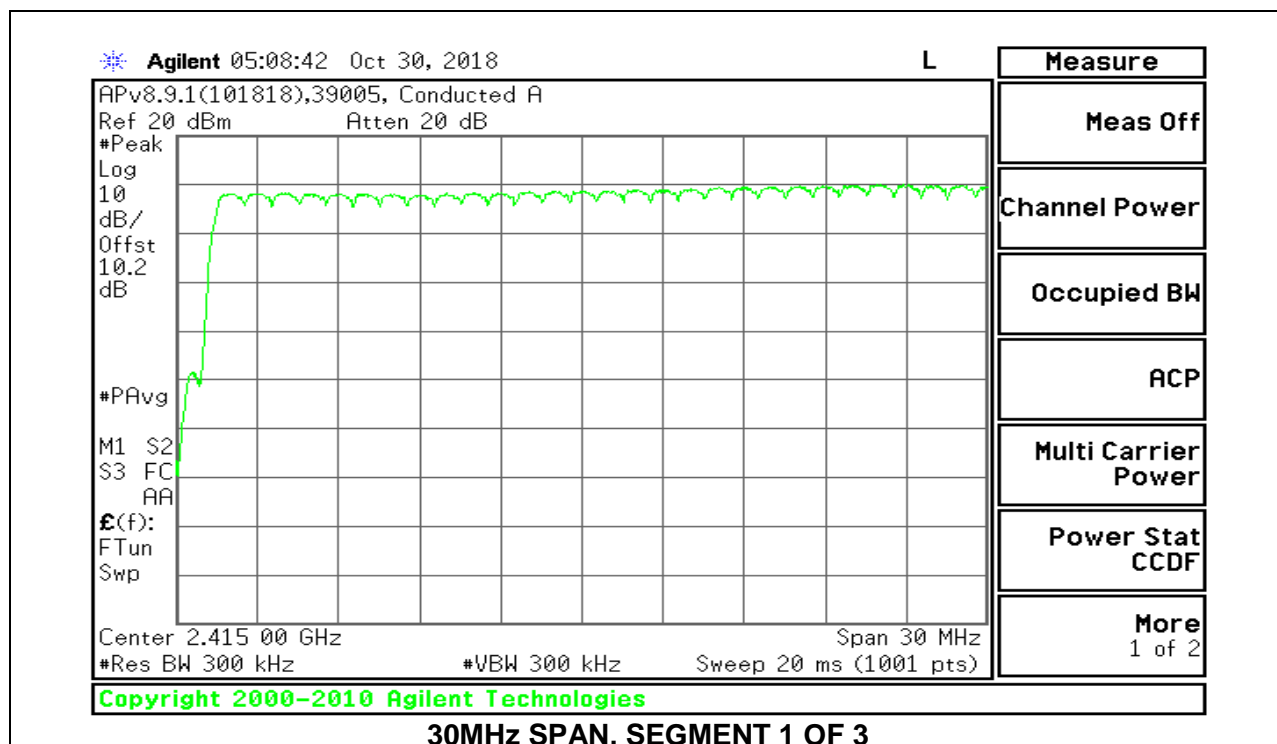
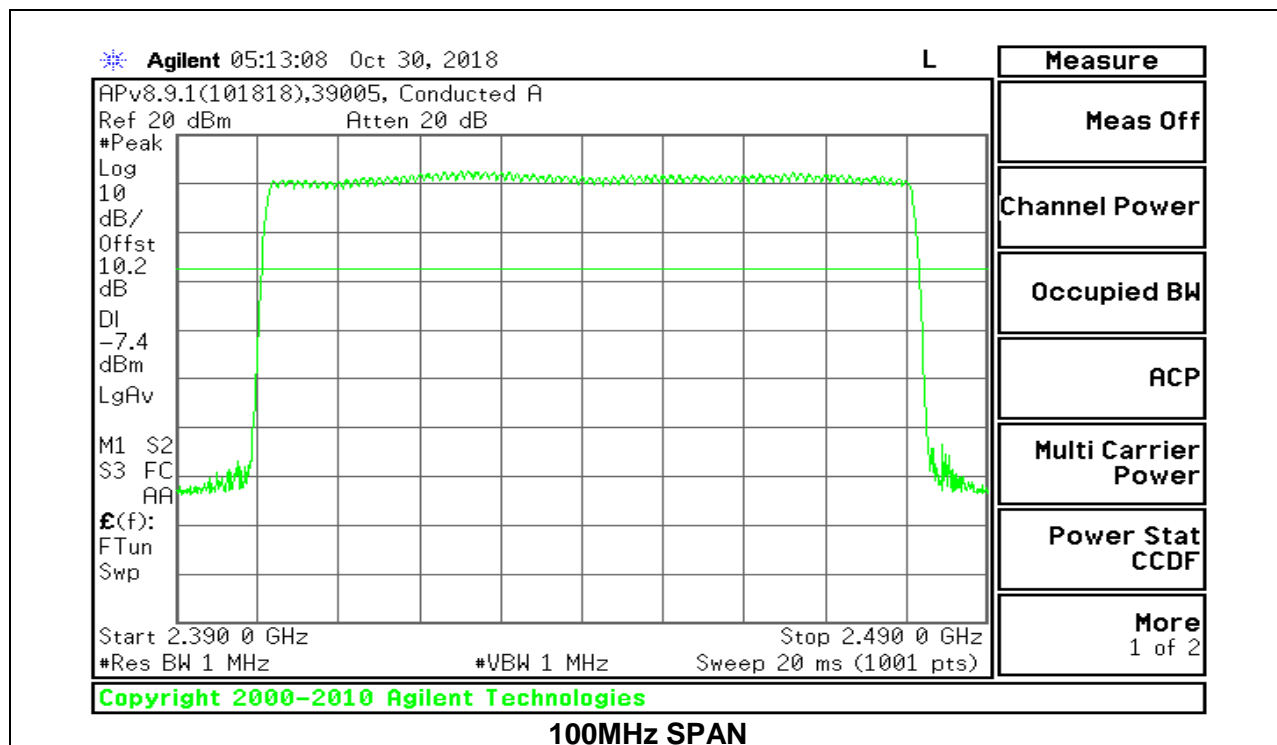
Normal Mode: 79 Channels Observed

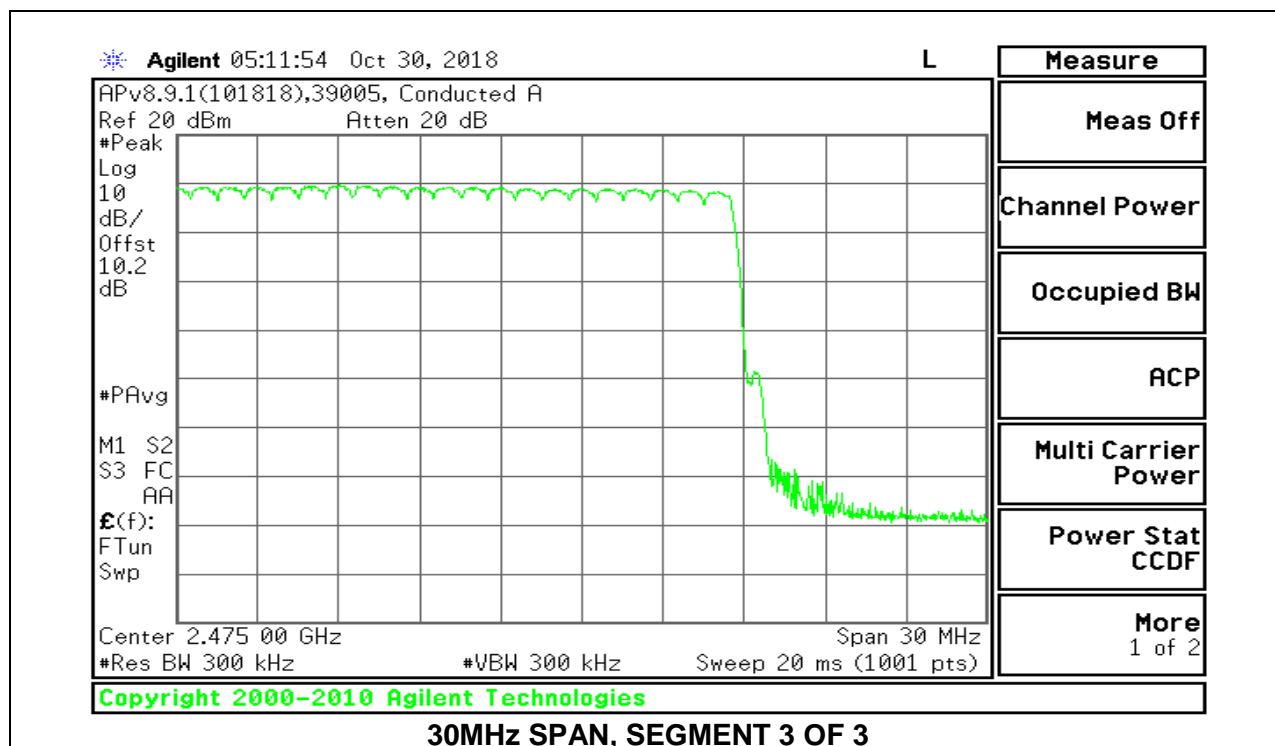
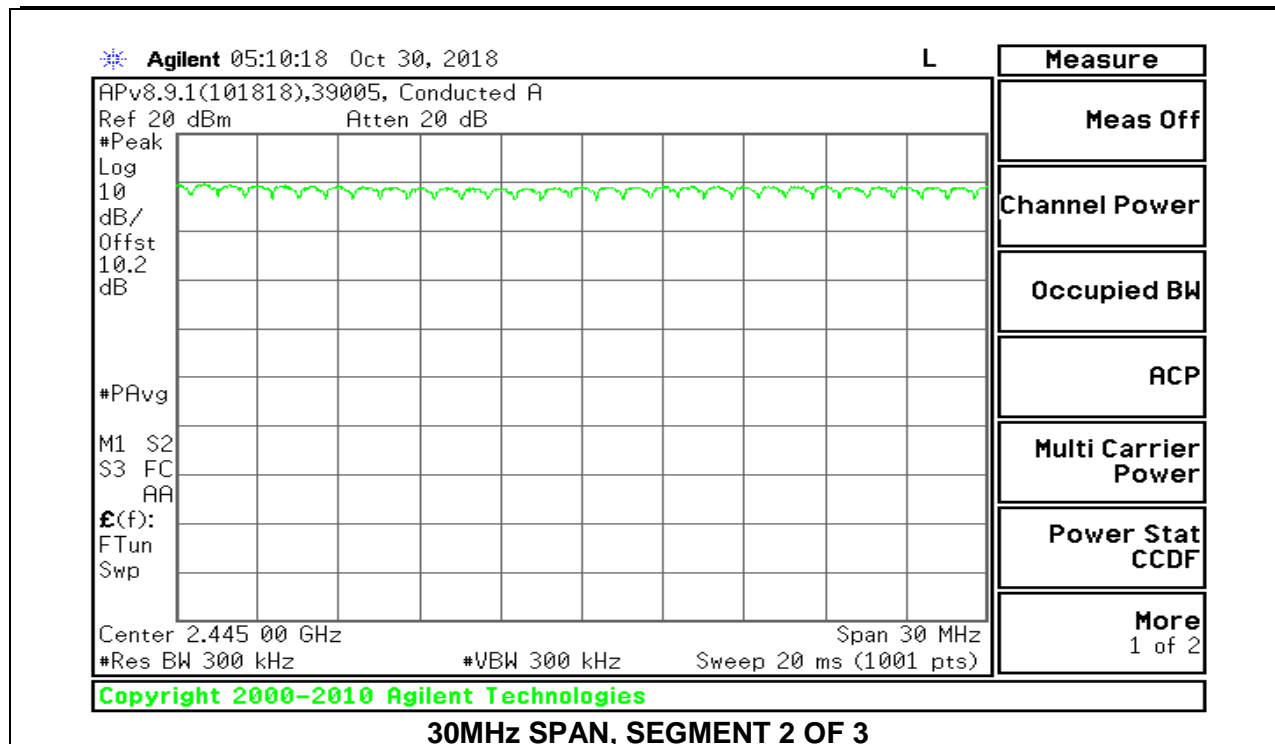
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





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.

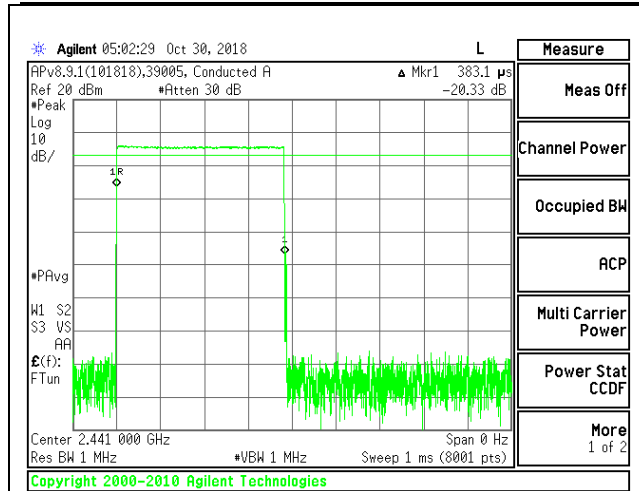
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

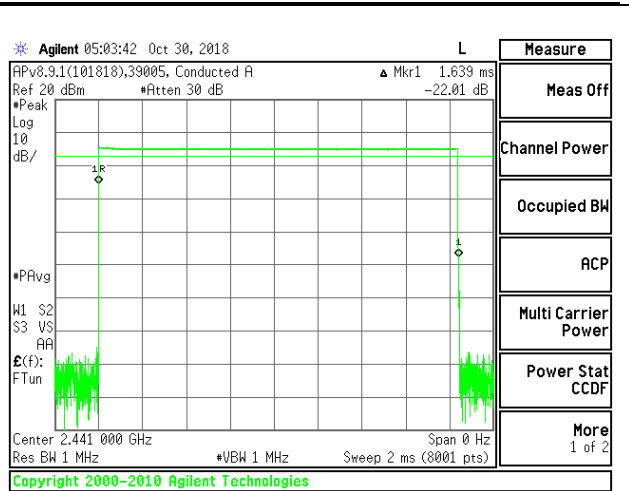
RESULTS

9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

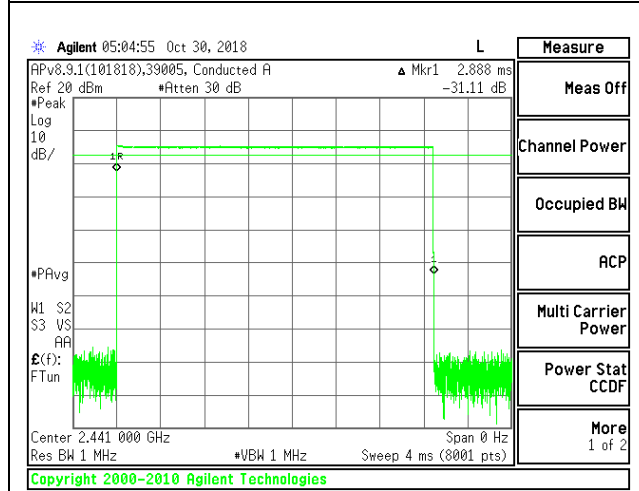
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3831	32	0.1226	0.4	-0.2774
DH3	1.639	18	0.2950	0.4	-0.1050
DH5	2.888	9	0.2599	0.4	-0.1401
GFSK AFH Mode					
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
3DH1	0.3831	8	0.03065	0.4	-0.3694
3DH3	1.639	4.5	0.07376	0.4	-0.3262
3DH5	2.888	2.25	0.06498	0.4	-0.3350



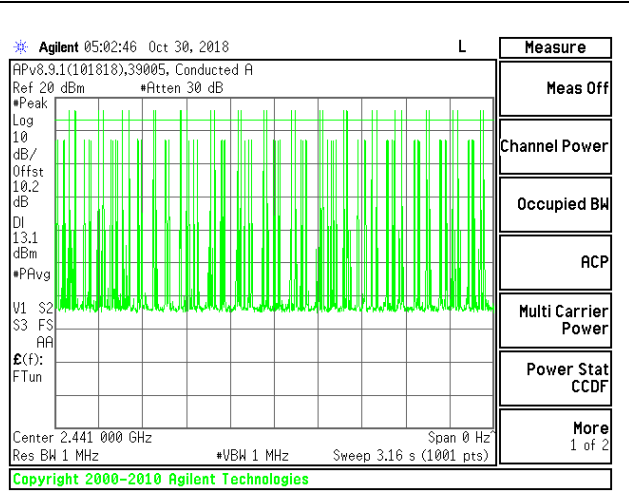
PULSE WIDTH – DH1



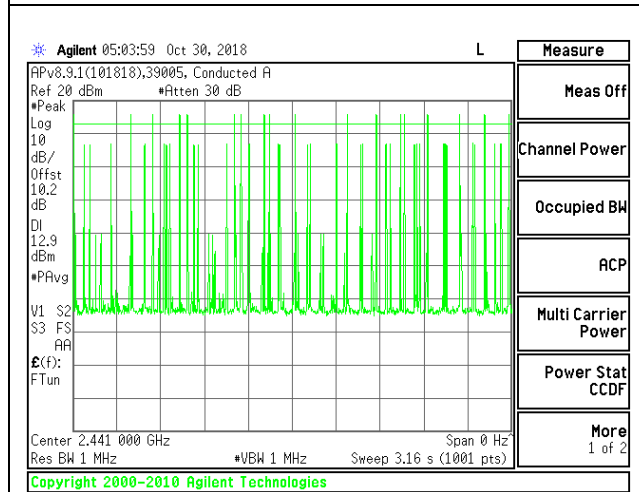
PULSE WIDTH – DH3



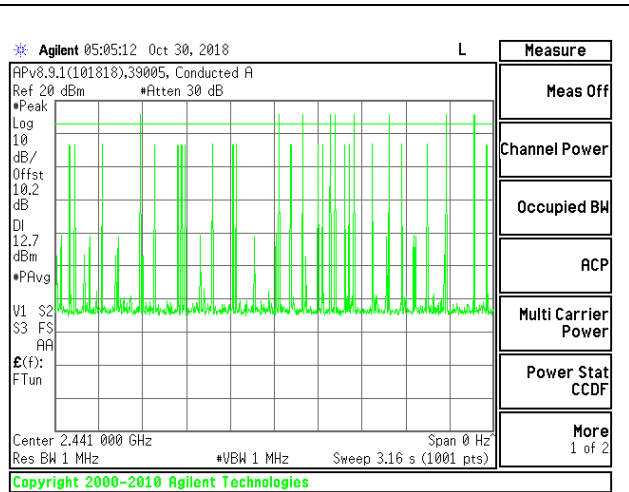
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

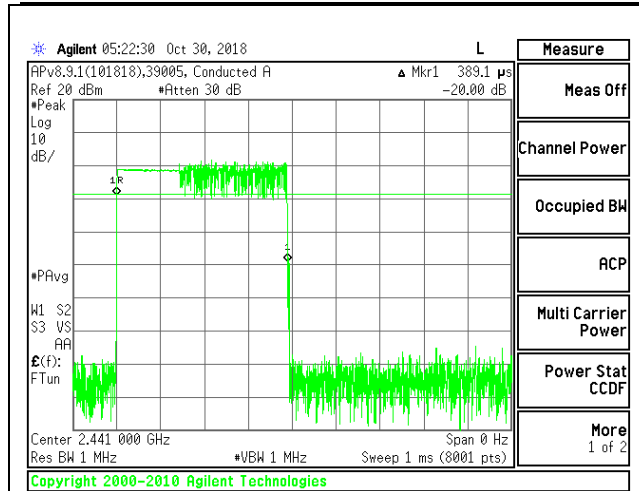


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

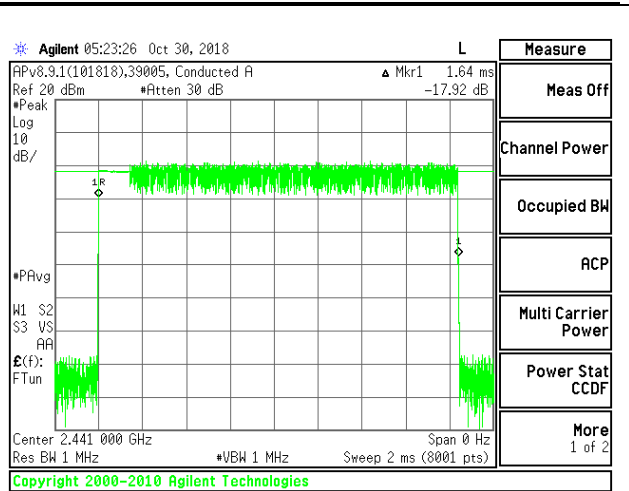
9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

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	0.3891	31	0.120621	0.4	-0.27938
3DH3	1.64	12	0.1968	0.4	-0.2032
3DH5	2.892	10	0.2892	0.4	-0.1108

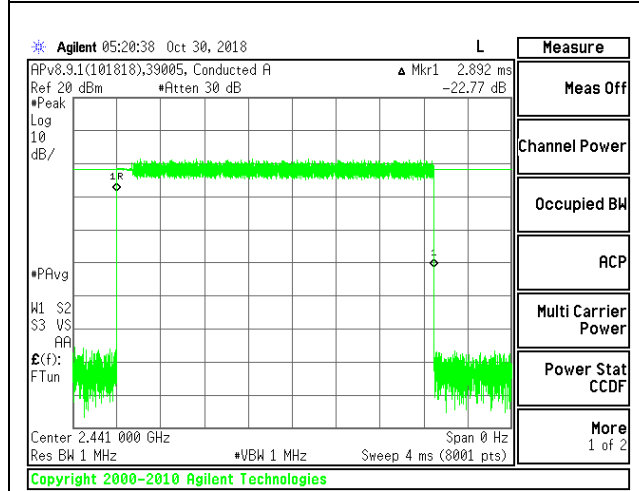
Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



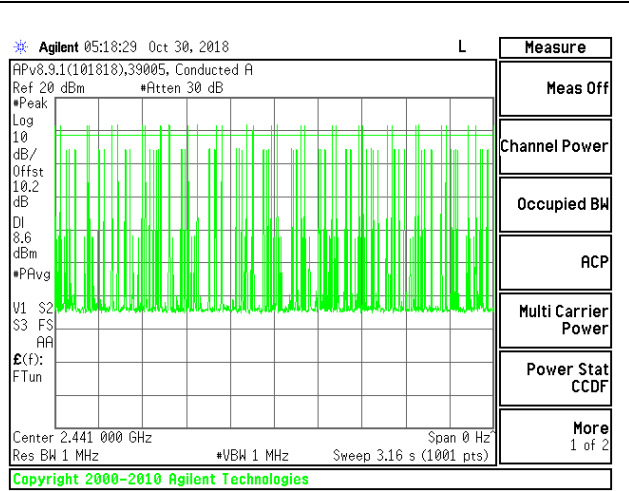
PULSE WIDTH - 3DH1



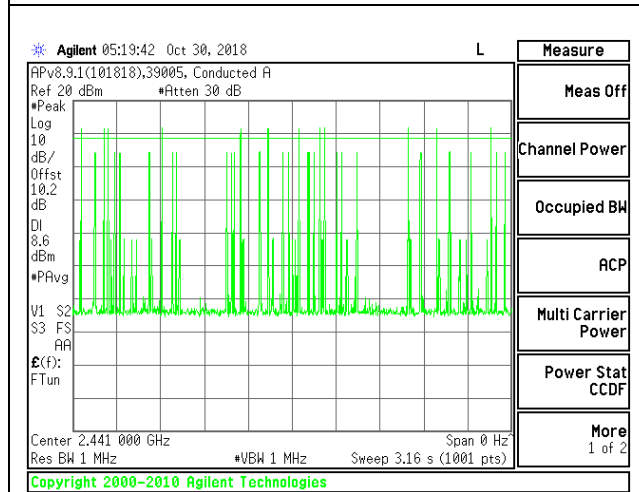
PULSE WIDTH - 3DH3



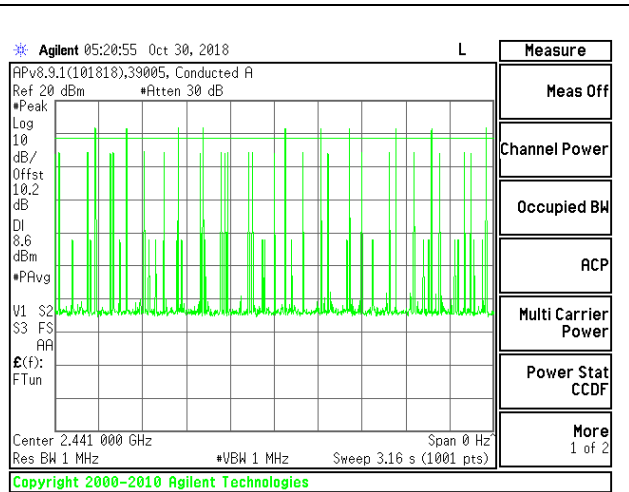
PULSE WIDTH - 3DH5



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.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated peak reading of power.

RESULTS

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	39005 RA
Date:	11/20/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.27	30	-13.73
Middle	2441	16.99	30	-13.01
High	2480	16.20	30	-13.8

9.6.2. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	39005 RA
Date:	11/20/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.66	21	-9.34
Middle	2441	12.35	21	-8.65
High	2480	11.77	21	-9.23

9.6.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	39005 RA
Date:	11/20/2018

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.22	21	-8.78
Middle	2441	12.97	21	-8.03
High	2480	12.22	21	-8.78

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 was 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:	39005 RA
Date	11/20/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	15.87
Middle	2441	16.57
High	2480	15.62

9.7.2. BLUETOOTH BASIC DATA RATE DQPSK MODULATION

Tested By:	39005 RA
Date	11/20/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.55
Middle	2441	9.25
High	2480	8.87

9.7.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	39005 RA
Date	11/20/2018

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.87
Middle	2441	9.29
High	2480	8.89

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.

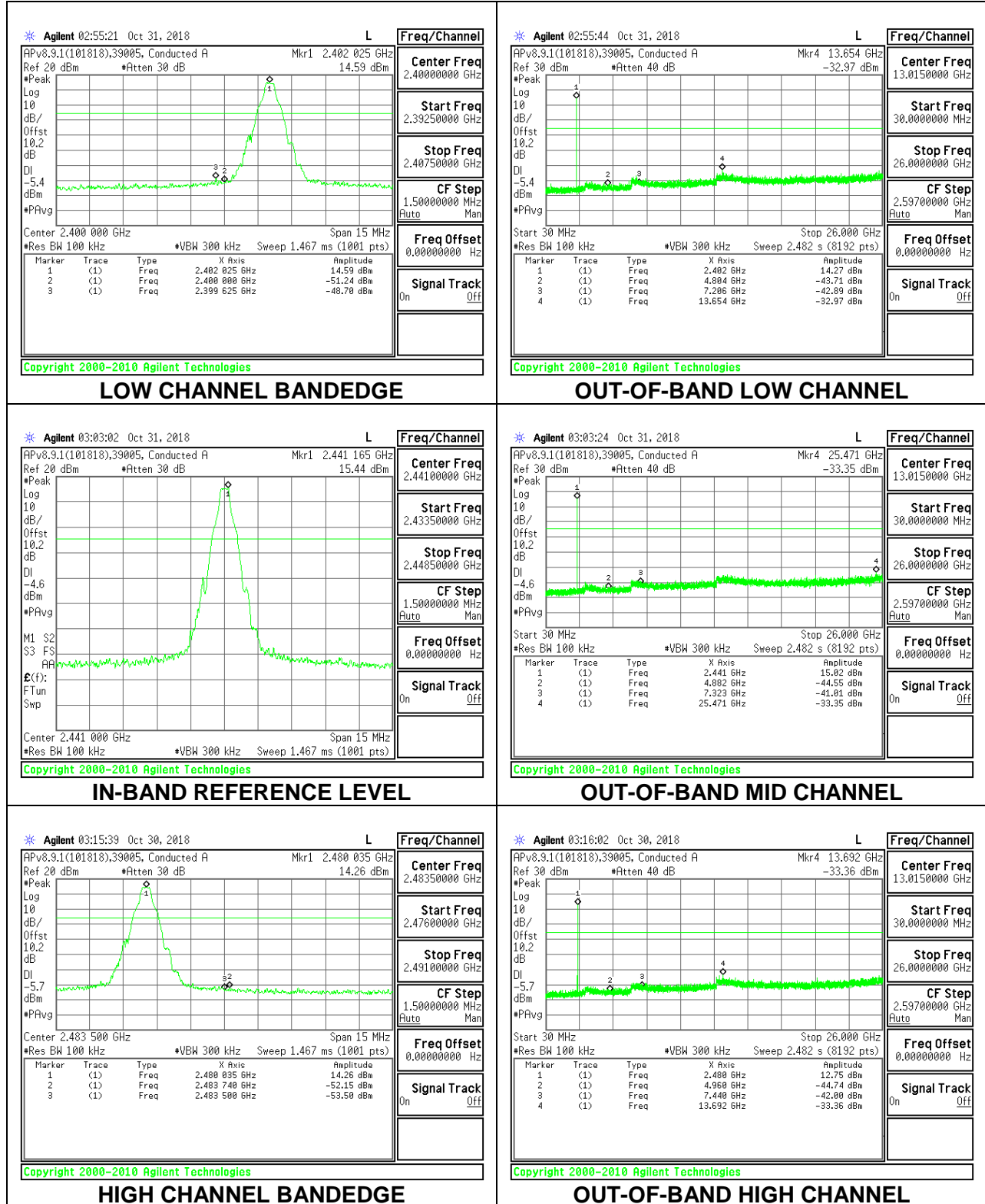
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

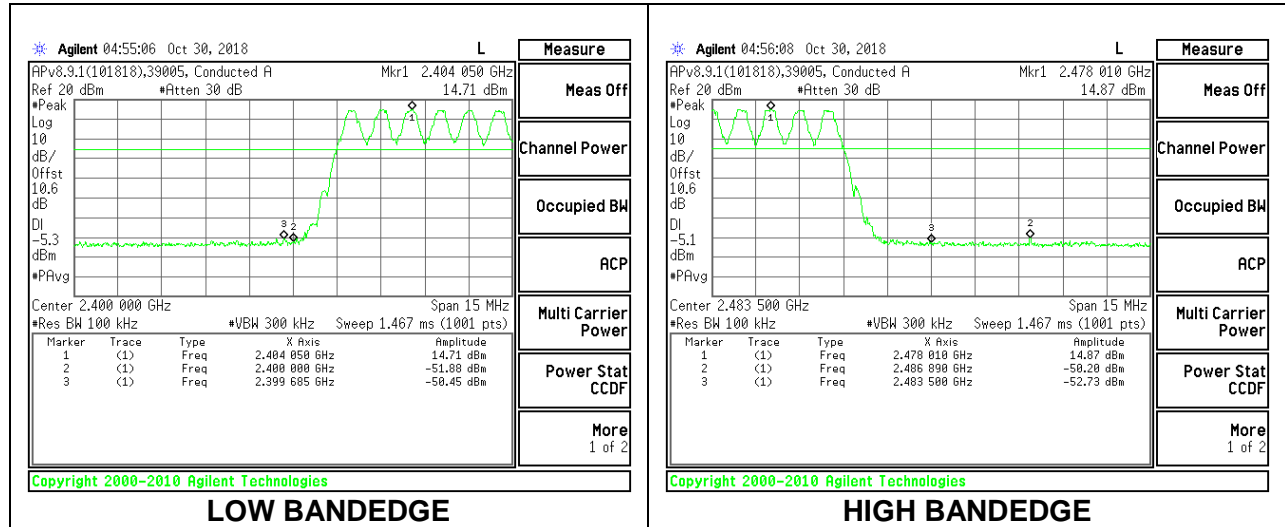
RESULTS

9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

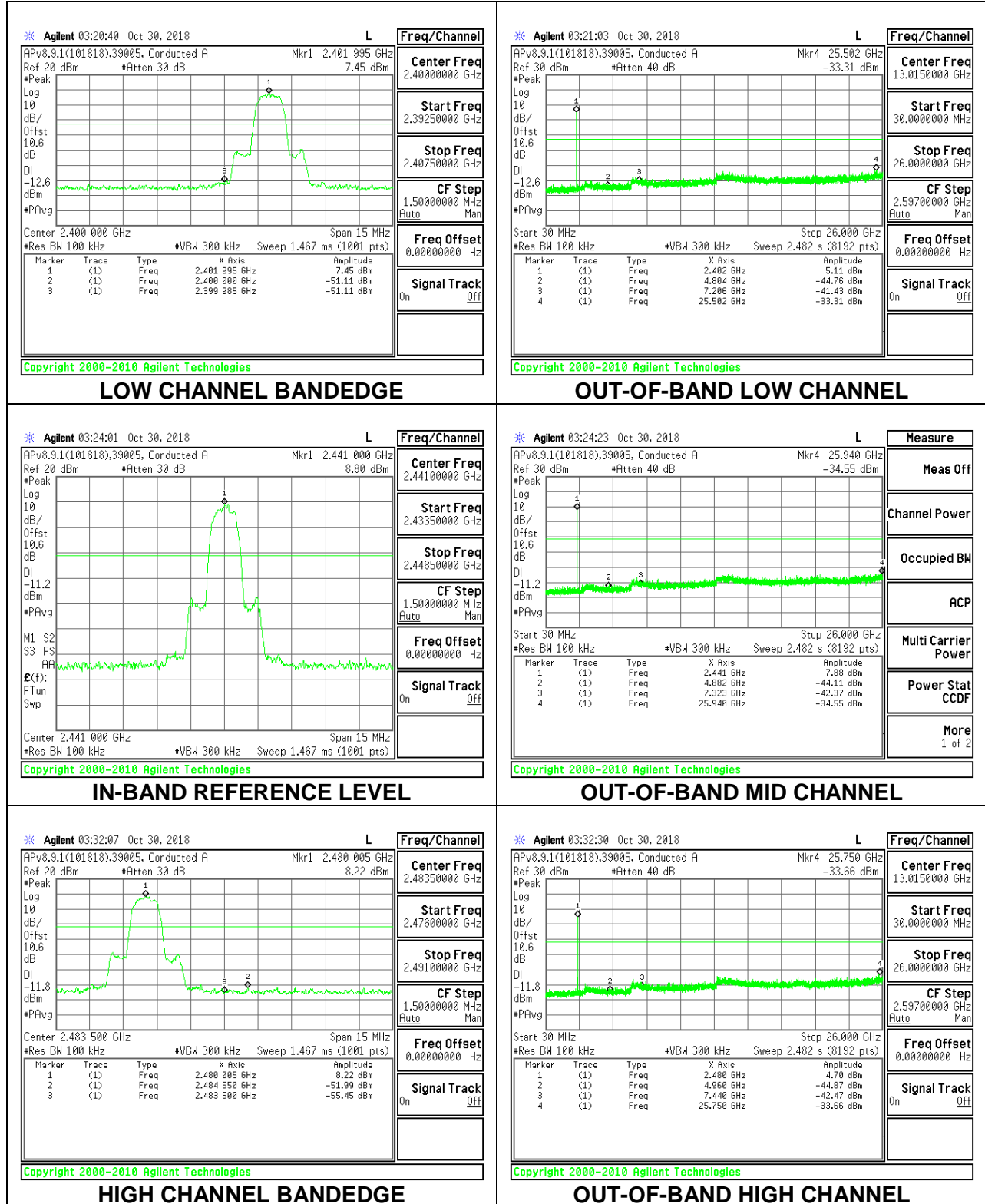


Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

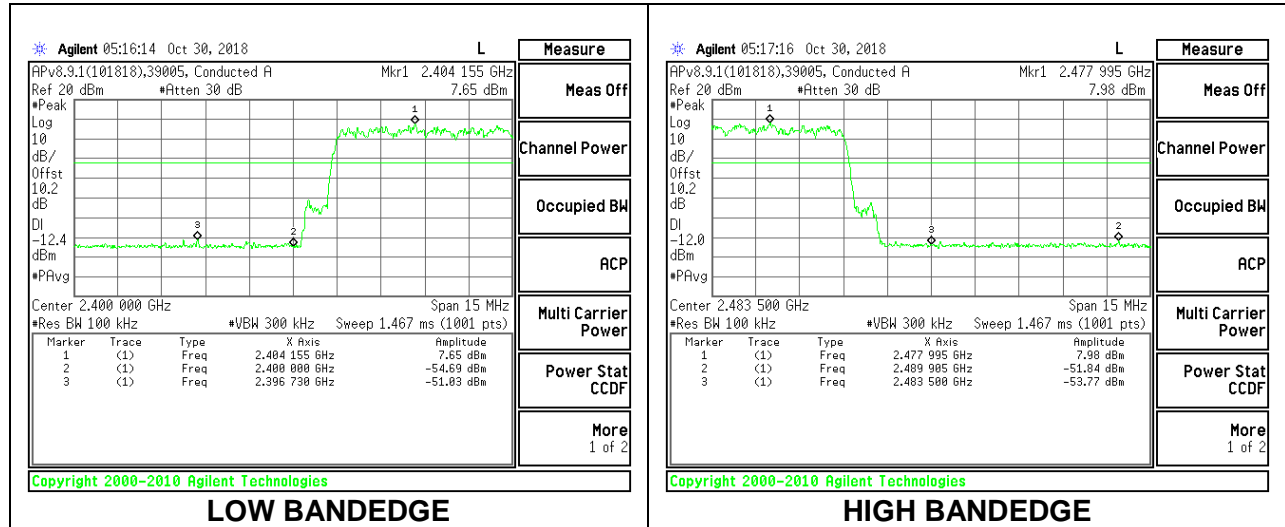


9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (360Hz) 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.

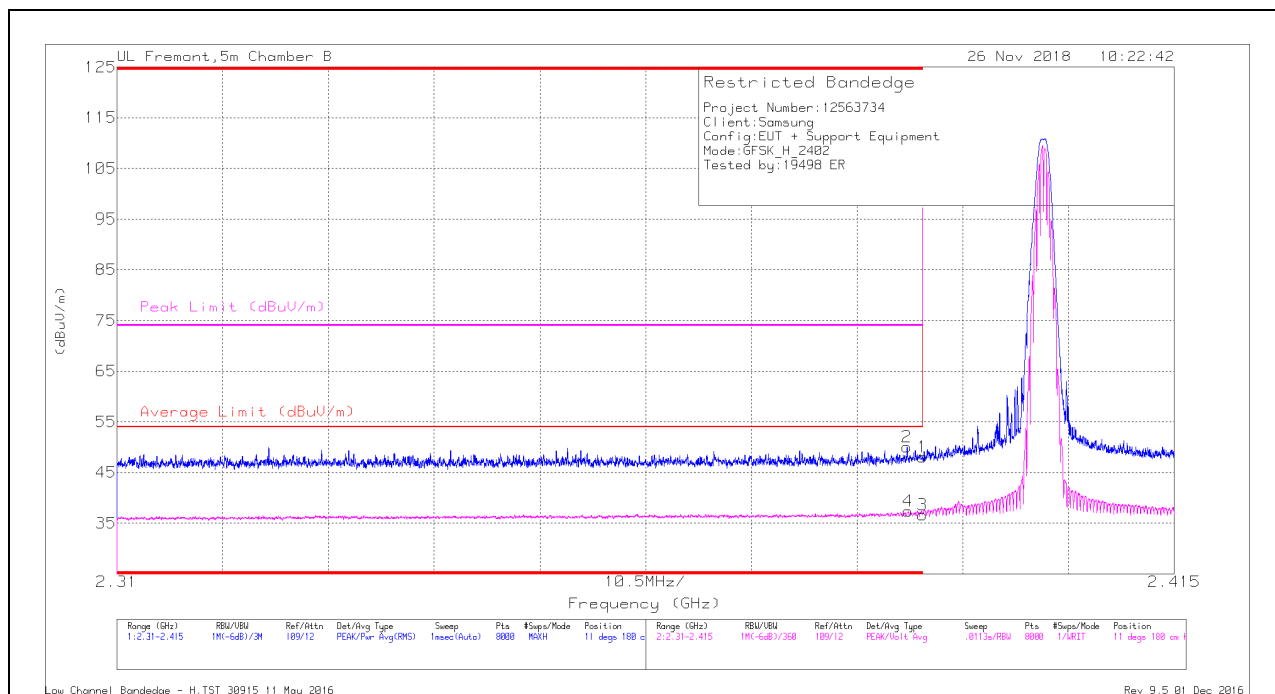
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ftr/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	* 2.39	36.46	Pk	32.3	-20.7	48.06	-	-	74	-25.94	11	180	H
2	* 2.388	38.46	Pk	32.3	-20.7	50.06	-	-	74	-23.94	11	180	H
3	* 2.39	25.09	VA1T	32.3	-20.7	36.69	54	-17.31	-	-	11	180	H
4	* 2.389	25.81	VA1T	32.3	-20.7	37.41	54	-16.59	-	-	11	180	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B=1/T_{on}$ where: T_{on} is transmit duration

VERTICAL RESULT



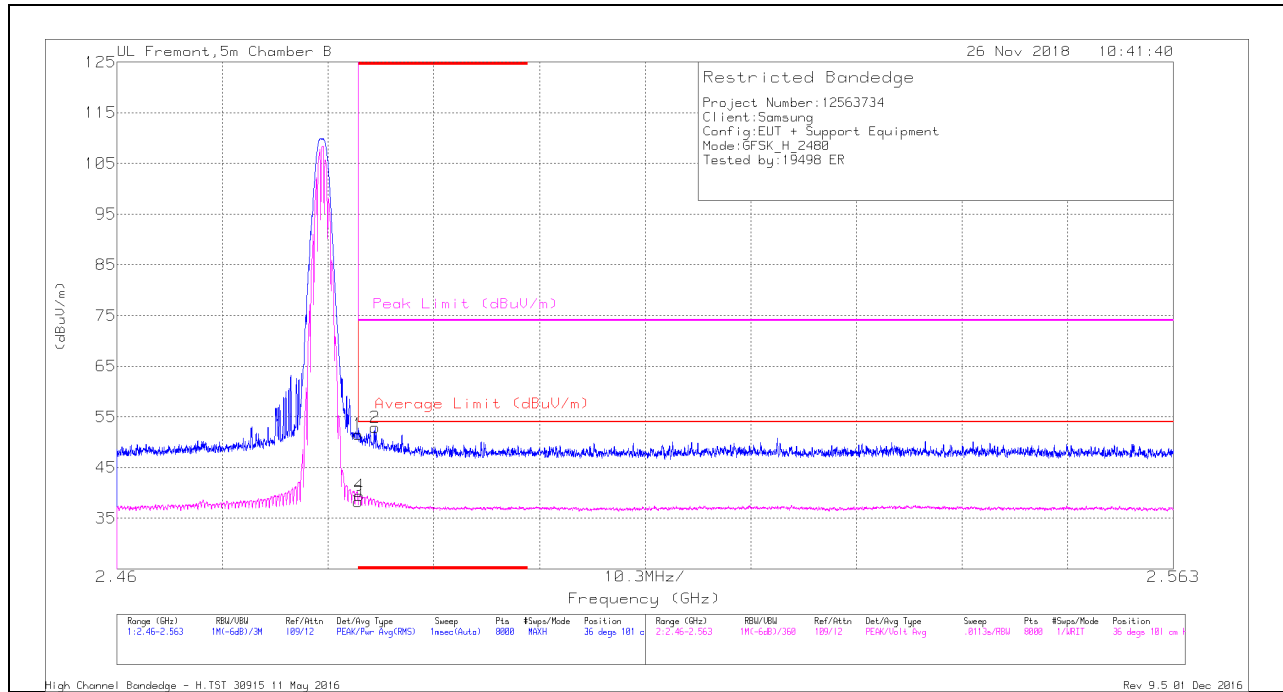
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 2.383	25.24	VA1T	32.3	-20.7	36.84	54	-17.16	-	-	260	303	V
2	* 2.385	38.26	Pk	32.3	-20.7	49.86	-	-	74	-24.14	260	303	V
1	* 2.39	35.2	Pk	32.3	-20.7	46.8	-	-	74	-27.2	260	303	V
3	* 2.39	24.94	VA1T	32.3	-20.7	36.54	54	-17.46	-	-	260	303	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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

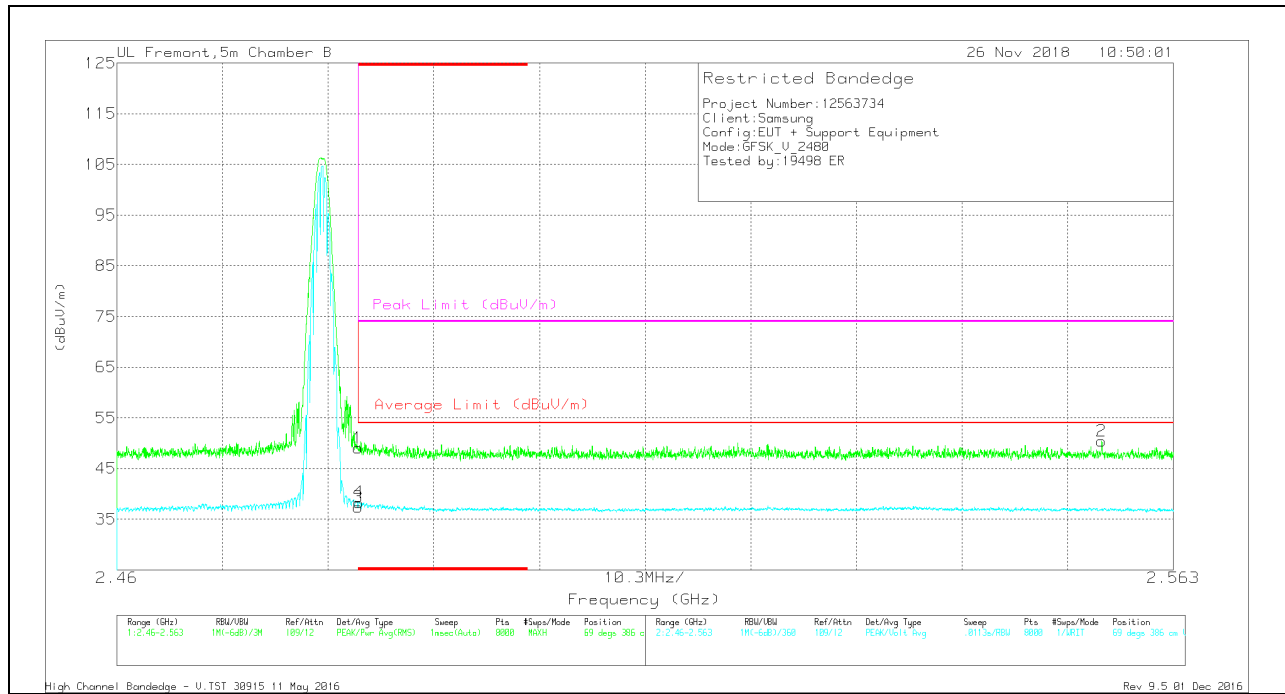
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.29	Pk	32.6	-20.3	51.59	-	-	74	-22.41	36	101	H
3	* 2.484	26	VA1T	32.6	-20.3	38.3	54	-15.7	-	-	36	101	H
4	* 2.484	27.2	VA1T	32.6	-20.3	39.5	54	-14.5	-	-	36	101	H
2	* 2.485	40.67	Pk	32.6	-20.4	52.87	-	-	74	-21.13	36	101	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 T863 (dB/m)	Amp/Cb/Filtr/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	* 2.484	36.72	Pk	32.6	-20.3	49.02	-	-	74	-24.98	69	386	V
3	* 2.484	25.11	VA1T	32.6	-20.3	37.41	54	-16.59	-	-	69	386	V
4	* 2.484	26.01	VA1T	32.6	-20.3	38.31	54	-15.69	-	-	69	386	V
2	2.556	38.19	Pk	32.7	-20.5	50.39	-	-	74	-23.61	69	386	V

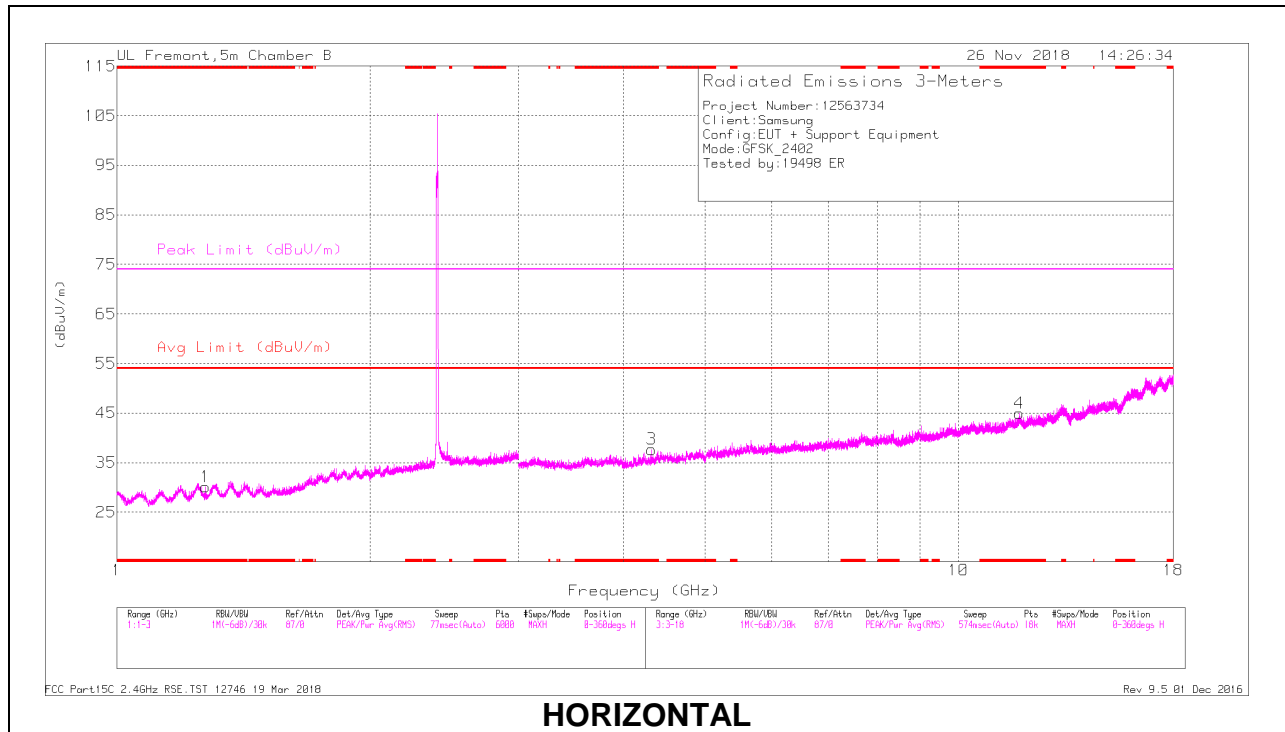
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

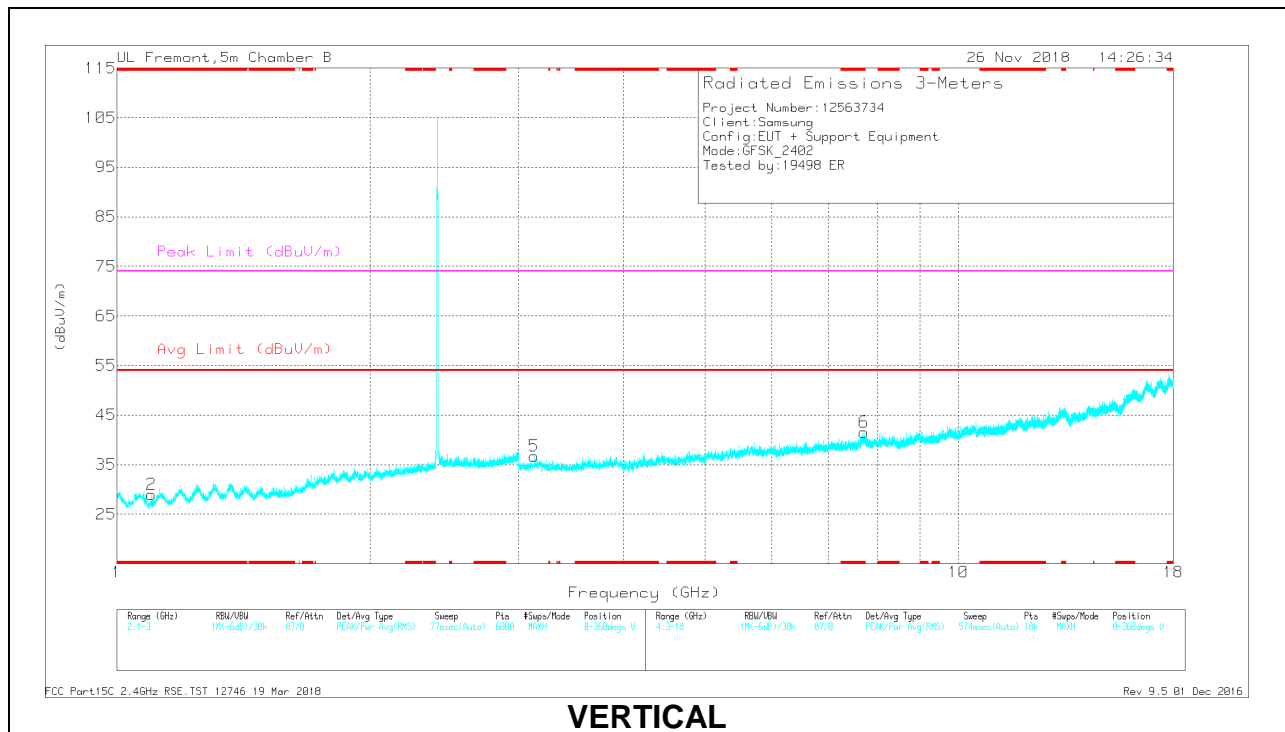
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

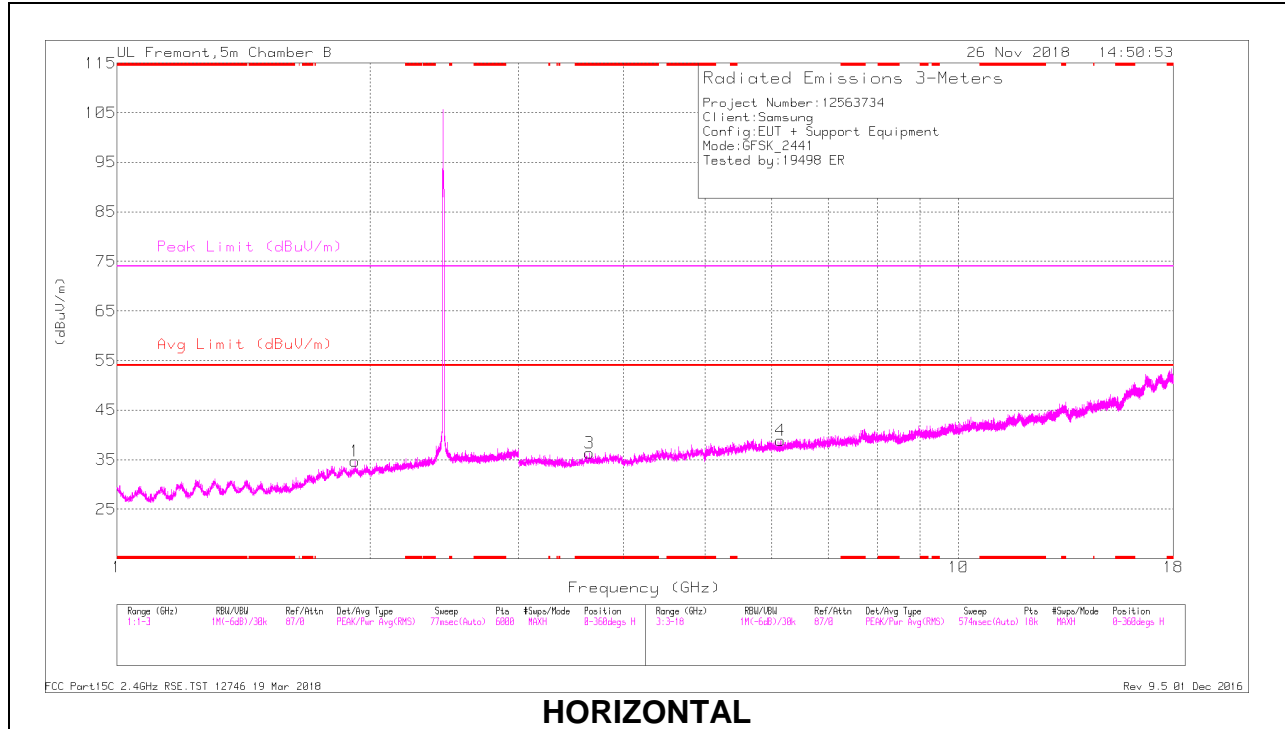
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.274	27.04	PKFH	28.4	-21.7	33.74	-	-	74	-40.26	302	120	H
	* 1.275	15.9	VA1T	28.4	-21.7	22.6	54	-31.4	-	-	302	120	H
2	* 1.101	28.19	PKFH	27.2	-22.5	32.89	-	-	74	-41.11	229	105	V
	* 1.098	16.72	VA1T	27.2	-22.6	21.32	54	-32.68	-	-	229	105	V
3	* 4.315	38.27	PKFH	33.7	-30.9	41.07	-	-	74	-32.93	146	145	H
	* 4.318	27.35	VA1T	33.7	-30.9	30.15	54	-23.85	-	-	146	145	H
4	* 11.8	31.56	PKFH	39.2	-21.4	49.36	-	-	74	-24.64	73	218	H
	* 11.8	20.44	VA1T	39.2	-21.3	38.34	54	-15.66	-	-	73	218	H
6	* 7.721	34.82	PKFH	36.5	-25.4	45.92	-	-	74	-28.08	324	394	V
	* 7.72	23.56	VA1T	36.5	-25.4	34.66	54	-19.34	-	-	324	394	V
5	3.131	27.07	VA1T	33.2	-30.4	29.87	-	-	-	-	154	187	V
	3.134	38.51	PKFH	33.2	-30.4	41.31	-	-	-	-	154	187	V

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

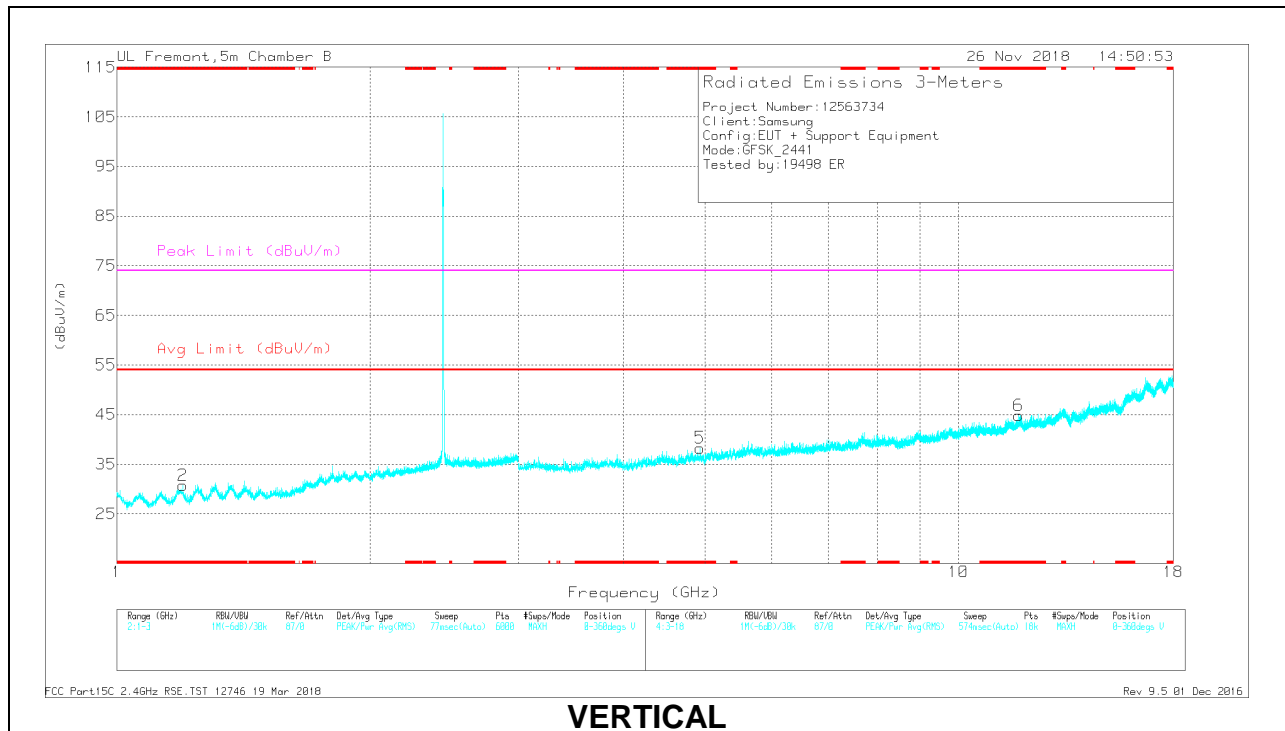
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

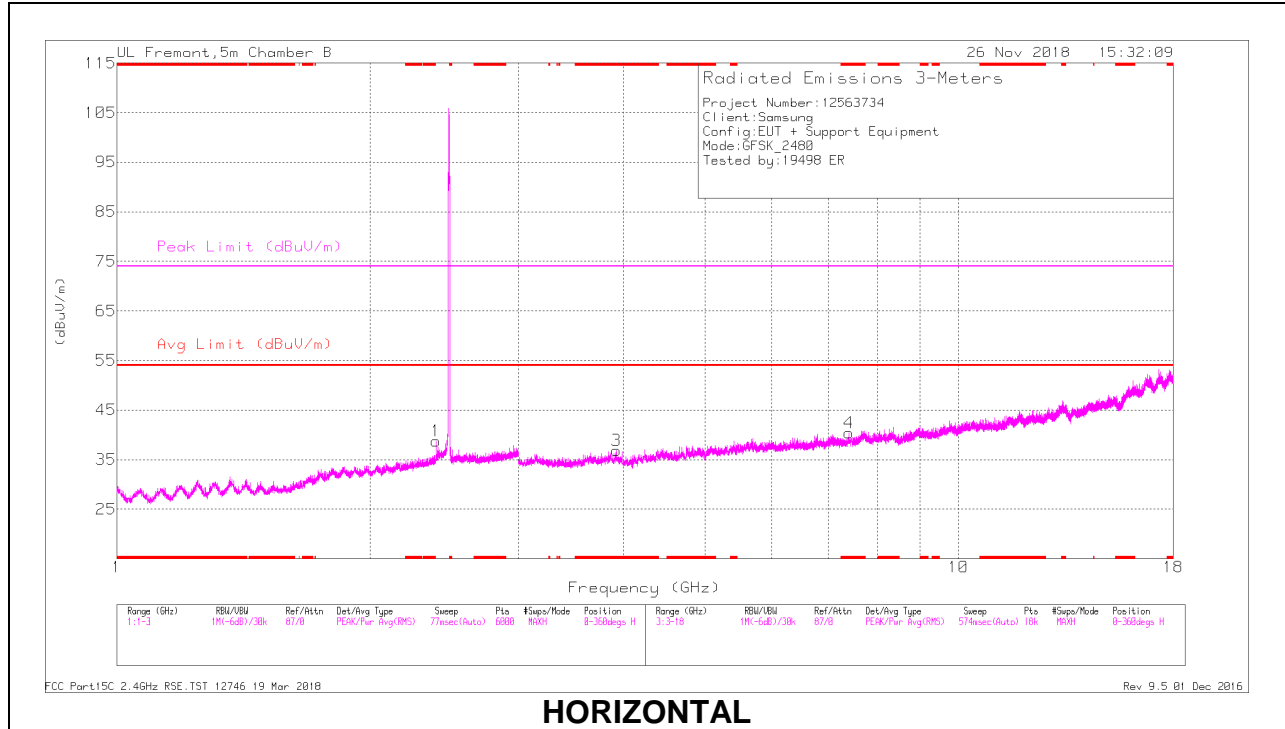
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.196	29.44	PKFH	28.2	-22.2	35.44	-	-	74	-38.56	141	189	V
	* 1.196	17.63	VA1T	28.2	-22.2	23.63	54	-30.37	-	-	141	189	V
3	* 3.647	38.25	PKFH	33.3	-30.3	41.25	-	-	74	-32.75	212	235	H
	* 3.646	26.78	VA1T	33.3	-30.2	29.88	54	-24.12	-	-	212	235	H
5	* 4.929	39.07	PKFH	34.4	-30	43.47	-	-	74	-30.53	103	176	V
	* 4.927	26.73	VA1T	34.4	-30	31.13	54	-22.87	-	-	103	176	V
6	* 11.789	30.61	PKFH	39.1	-21.4	48.31	-	-	74	-25.69	286	179	V
	* 11.791	20.25	VA1T	39.1	-21.4	37.95	54	-16.05	-	-	286	179	V
1	1.919	17.02	VA1T	31	-20.6	27.42	-	-	-	-	244	152	H
	1.92	28.24	PKFH	31	-20.6	38.64	-	-	-	-	244	152	H
4	6.146	36.32	PKFH	35.5	-28.9	42.92	-	-	-	-	44	210	H
	6.147	25.47	VA1T	35.5	-28.8	32.17	-	-	-	-	44	210	H

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

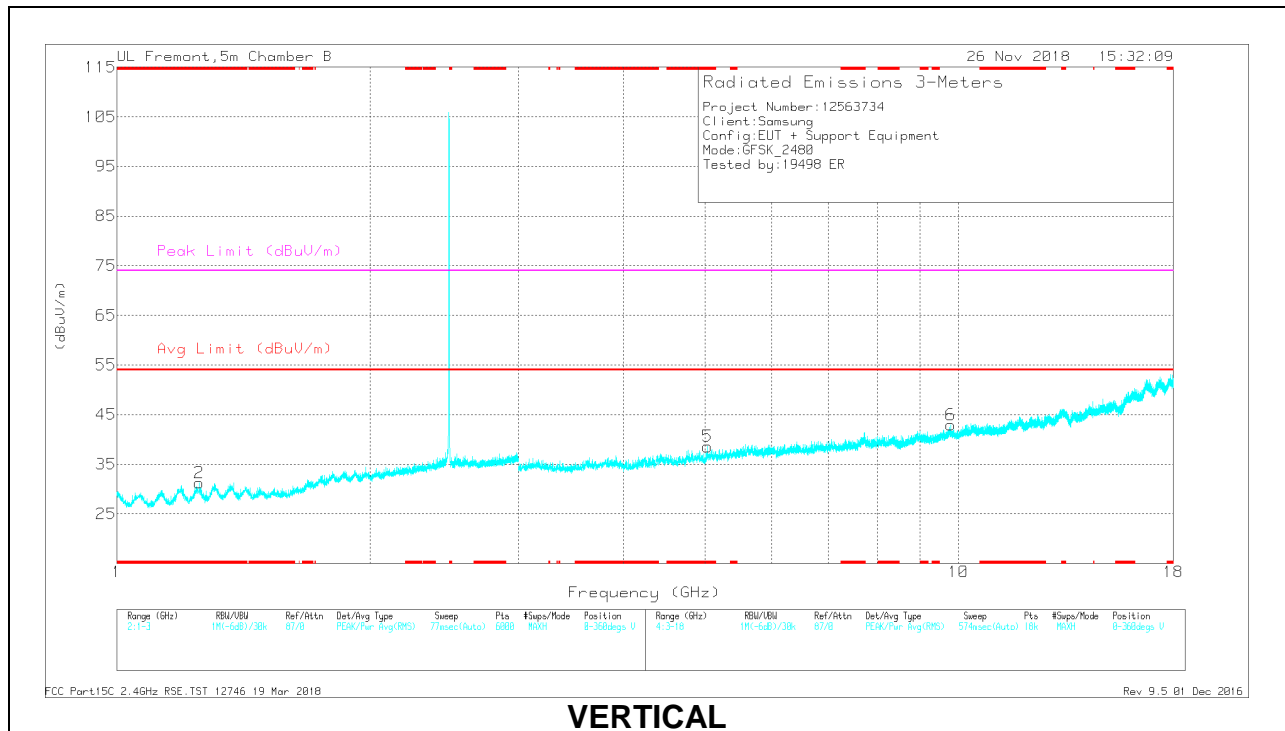
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/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	* 1.254	28.77	PKFH	28.3	-21.9	35.17	-	-	74	-38.83	248	153	V
	* 1.252	17.68	VA1T	28.3	-22.1	23.88	54	-30.12	-	-	248	153	V
3	* 3.921	37.82	PKFH	33.4	-29.5	41.72	-	-	74	-32.28	193	234	H
	* 3.918	26.51	VA1T	33.4	-29.4	30.51	54	-23.49	-	-	193	234	H
4	* 7.406	34.61	PKFH	36.2	-26.3	44.51	-	-	74	-29.49	130	191	H
	* 7.406	23.75	VA1T	36.2	-26.3	33.65	54	-20.35	-	-	130	191	H
5	* 5.034	35.19	PKFH	34.6	-28.8	40.99	-	-	74	-33.01	66	171	V
	* 5.034	25.1	VA1T	34.6	-28.8	30.9	54	-23.1	-	-	66	171	V
1	2.394	29.7	PKFH	32.4	-20.8	41.3	-	-	-	-	329	107	H
	2.394	20.4	VA1T	32.4	-20.8	32	-	-	-	-	329	107	H
6	9.796	32.75	PKFH	37.3	-22.9	47.15	-	-	-	-	199	211	V
	9.796	21.62	VA1T	37.3	-22.9	36.02	-	-	-	-	199	211	V

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

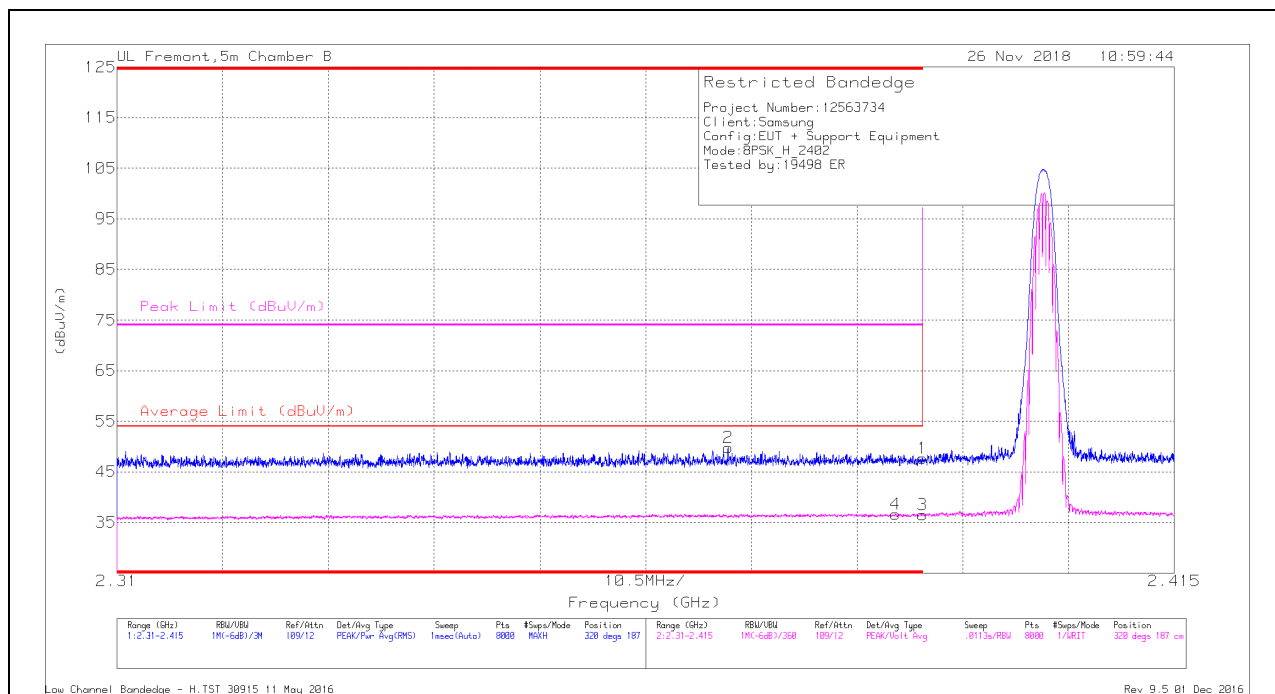
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.371	38.14	Pk	32.3	-20.7	49.74	-	-	74	-24.26	320	187	H
4	* 2.387	25.09	VA1T	32.3	-20.7	36.69	54	-17.31	-	-	320	187	H
1	* 2.39	36.07	Pk	32.3	-20.7	47.67	-	-	74	-26.33	320	187	H
3	* 2.39	24.93	VA1T	32.3	-20.7	36.53	54	-17.47	-	-	320	187	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 T863 (dB/m)	Amp/Cb/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.312	38.03	Pk	32	-20.6	49.43	-	-	74	-24.57	198	152	V
4	* 2.379	25.16	VA1T	32.3	-20.7	36.76	54	-17.24	-	-	198	151	V
1	* 2.39	35.98	Pk	32.3	-20.7	47.58	-	-	74	-26.42	198	152	V
3	* 2.39	24.85	VA1T	32.3	-20.7	36.45	54	-17.55	-	-	198	151	V

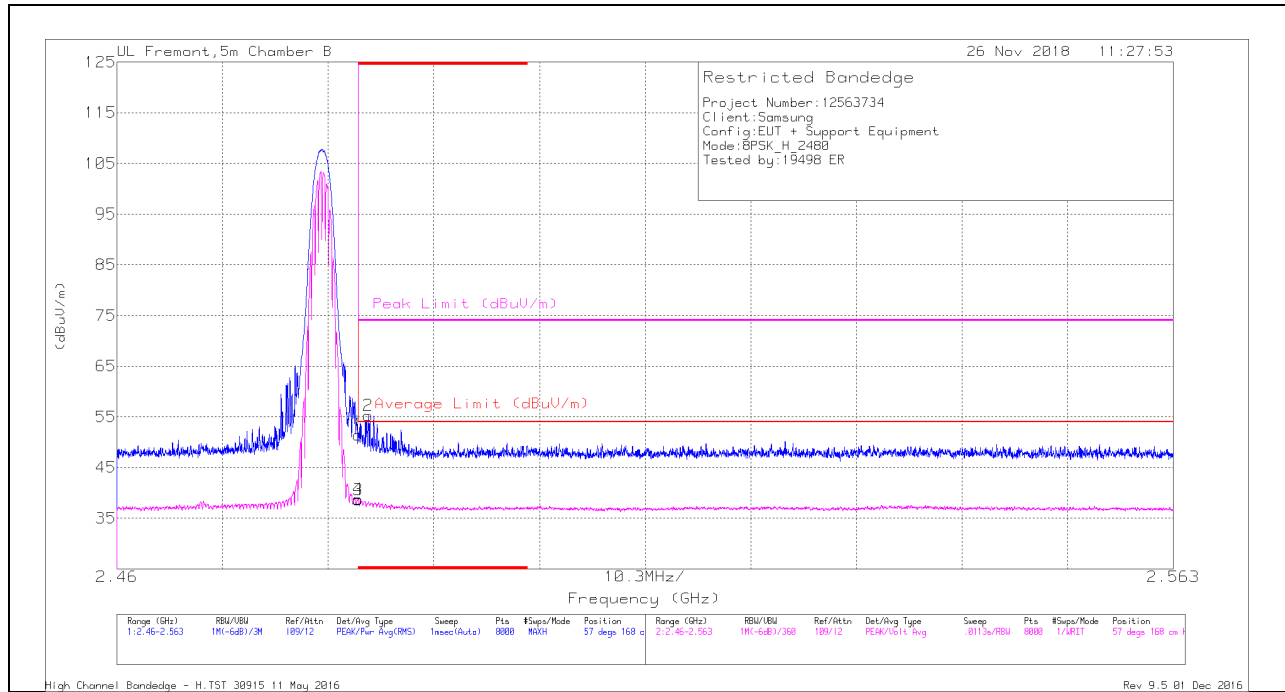
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

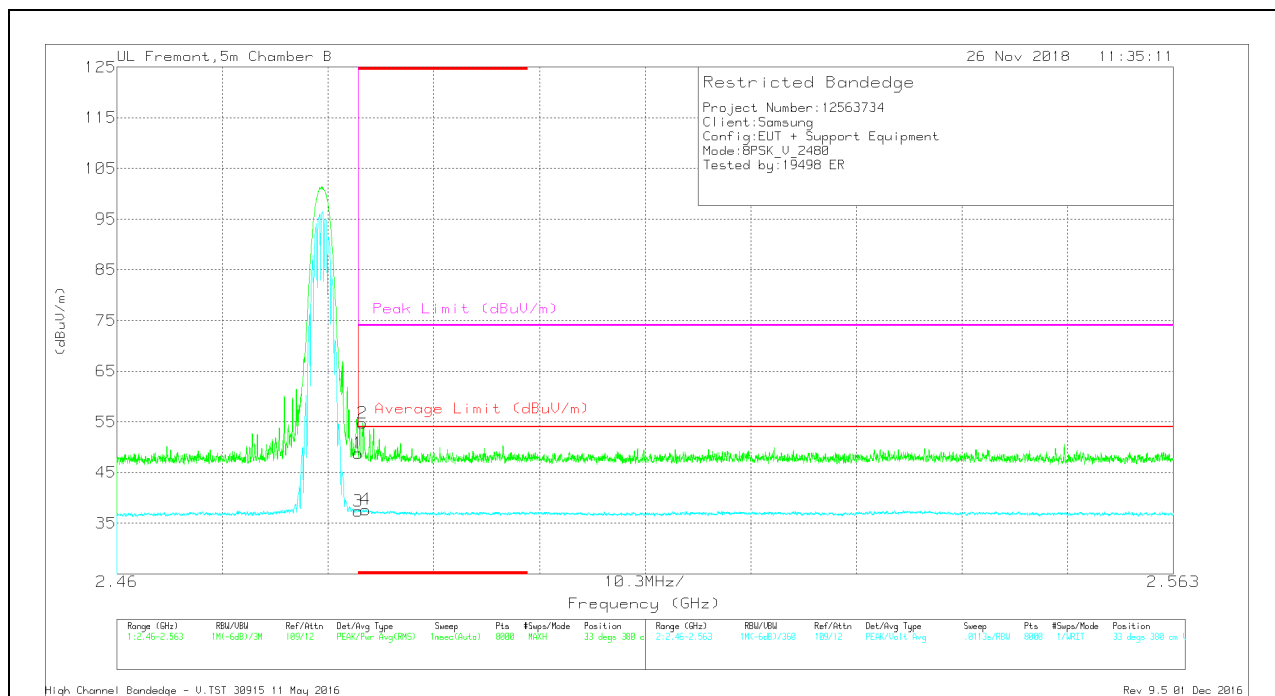
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.17	Pk	32.6	-20.3	51.47	-	-	74	-22.53	57	168	H
3	* 2.484	26.27	VA1T	32.6	-20.3	38.57	54	-15.43	-	-	57	168	H
4	* 2.484	26.49	VA1T	32.6	-20.3	38.79	54	-15.21	-	-	57	168	H
2	* 2.485	43.05	Pk	32.6	-20.4	55.25	-	-	74	-18.75	57	168	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 T863 (dB/m)	Amp/Cbl/Filtr/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	* 2.484	36.46	Pk	32.6	-20.3	48.76	-	-	74	-25.24	33	380	V
2	* 2.484	42.6	Pk	32.6	-20.4	54.8	-	-	74	-19.2	33	380	V
3	* 2.484	25.03	VA1T	32.6	-20.3	37.33	54	-16.67	-	-	33	380	V
4	* 2.484	25.49	VA1T	32.6	-20.4	37.69	54	-16.31	-	-	33	380	V

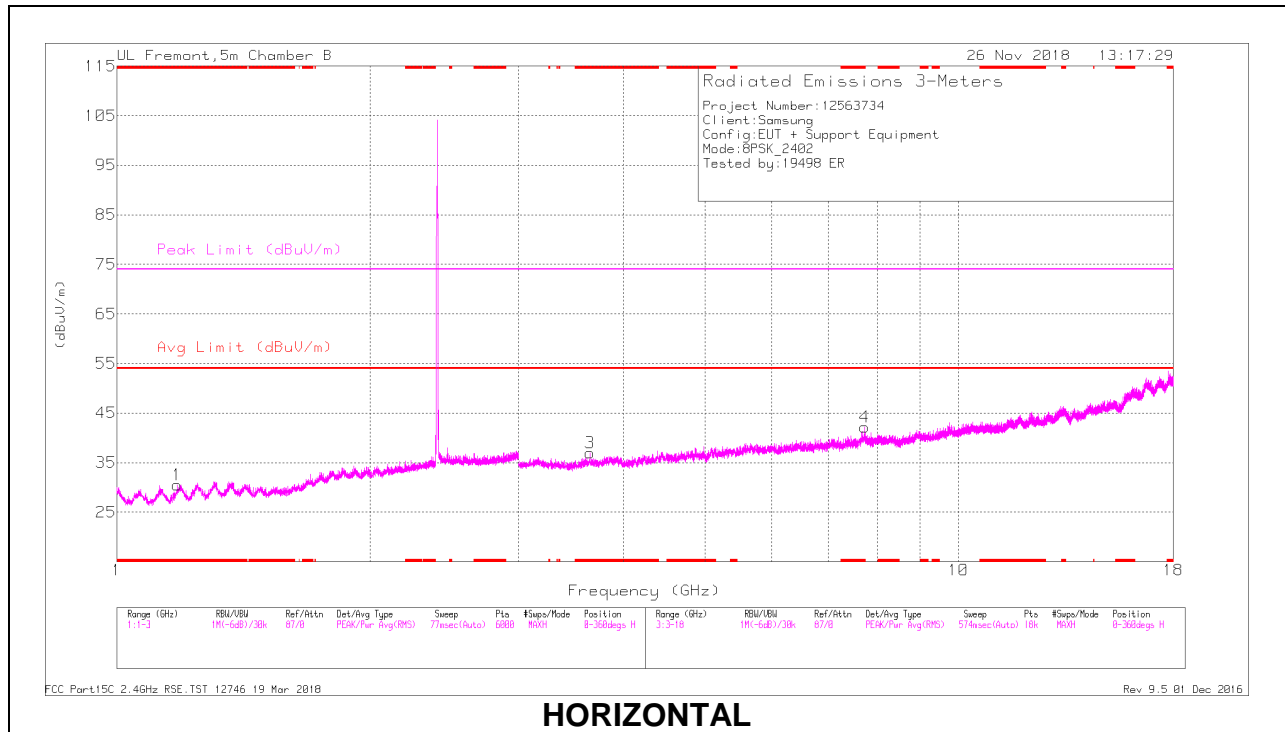
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

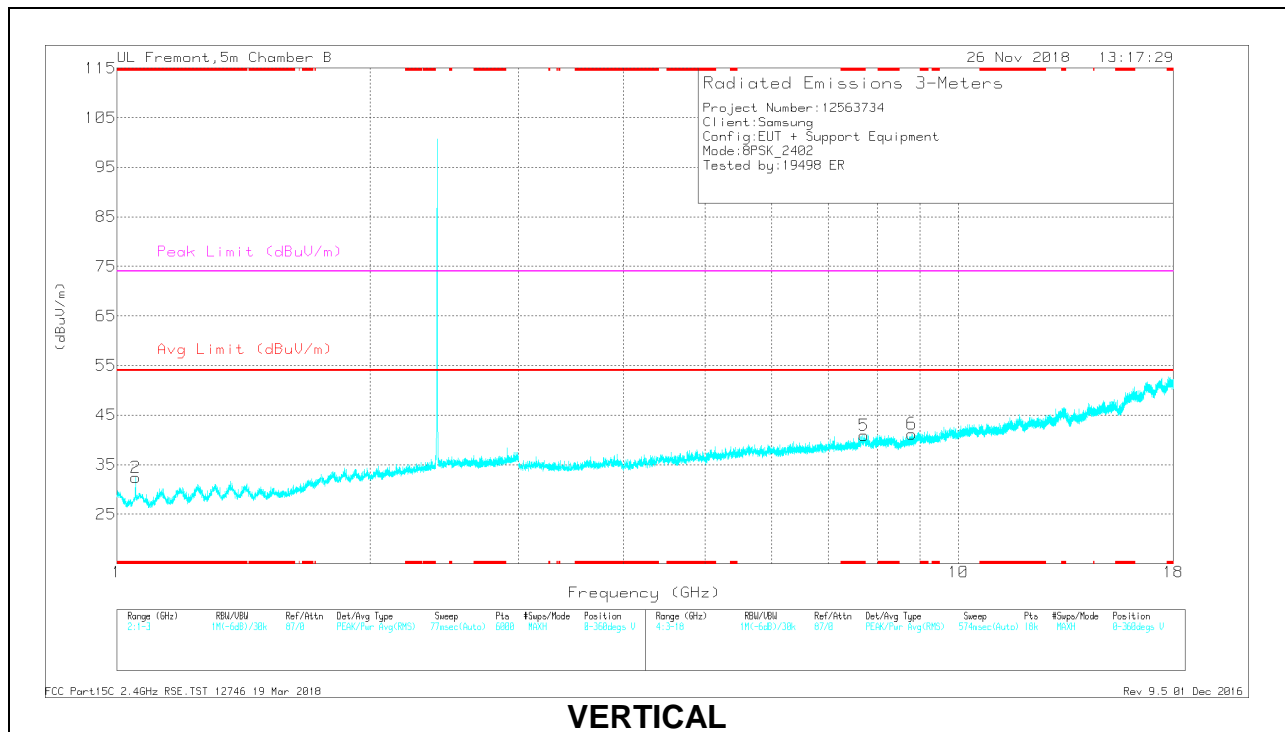
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

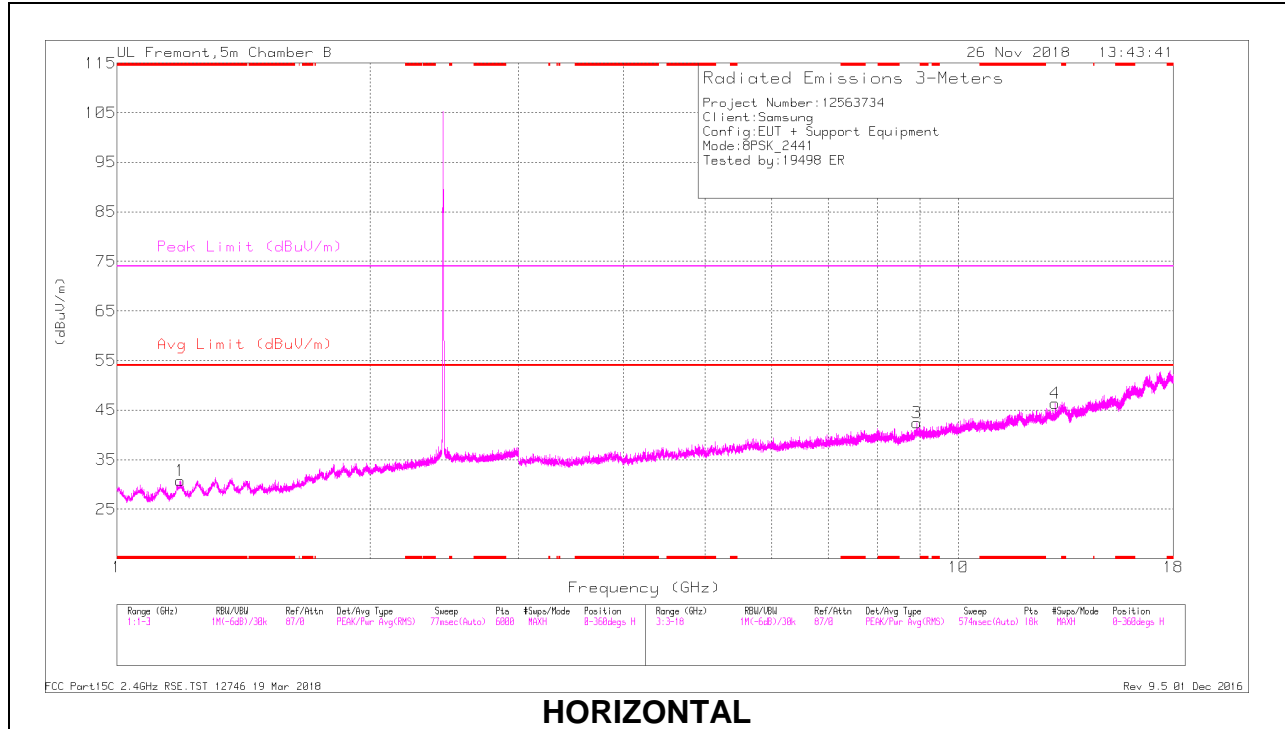
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.178	28.34	PKFH	28	-22.3	34.04	-	-	74	-39.96	198	137	H
	* 1.179	17.78	VA1T	28	-22.2	23.58	54	-30.42	-	-	198	137	H
2	* 1.054	29.04	PKFH	27.4	-22.9	33.54	-	-	74	-40.46	102	225	V
	* 1.052	18.05	VA1T	27.5	-22.8	22.75	54	-31.25	-	-	102	225	V
5	* 7.73	35.02	PKFH	36.5	-25.2	46.32	-	-	74	-27.68	257	173	H
	* 7.724	23.52	VA1T	36.5	-25.5	34.52	54	-19.48	-	-	257	173	H
3	* 3.649	37.81	PKFH	33.3	-30.4	40.71	-	-	74	-33.29	40	154	H
	* 3.654	27.34	VA1T	33.3	-30.5	30.14	54	-23.86	-	-	40	154	H
4	* 7.727	34.72	PKFH	36.5	-25.5	45.72	-	-	74	-28.28	129	122	V
	* 7.726	23.44	VA1T	36.5	-25.5	34.44	54	-19.56	-	-	129	122	V
6	8.805	34.72	PKFH	36.6	-25.5	45.82	-	-	-	-	243	209	V
	8.807	23	VA1T	36.6	-25.5	34.1	-	-	-	-	243	209	V

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

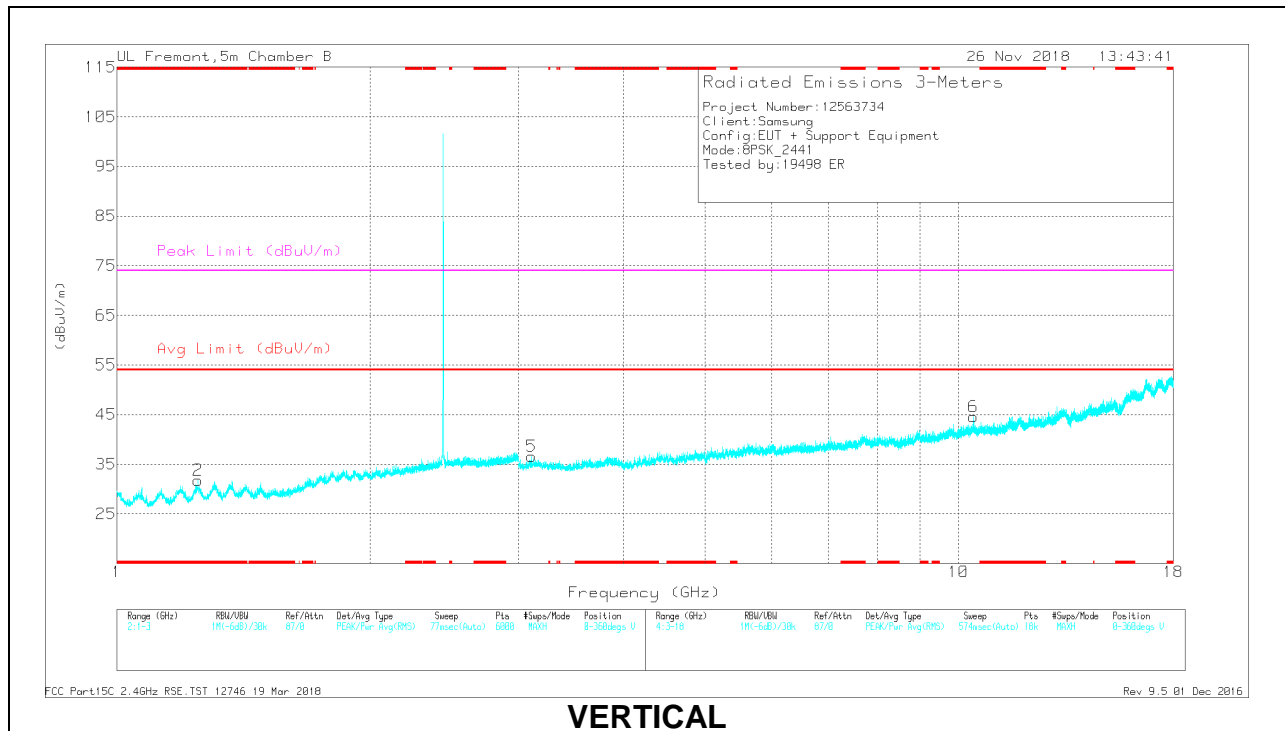
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

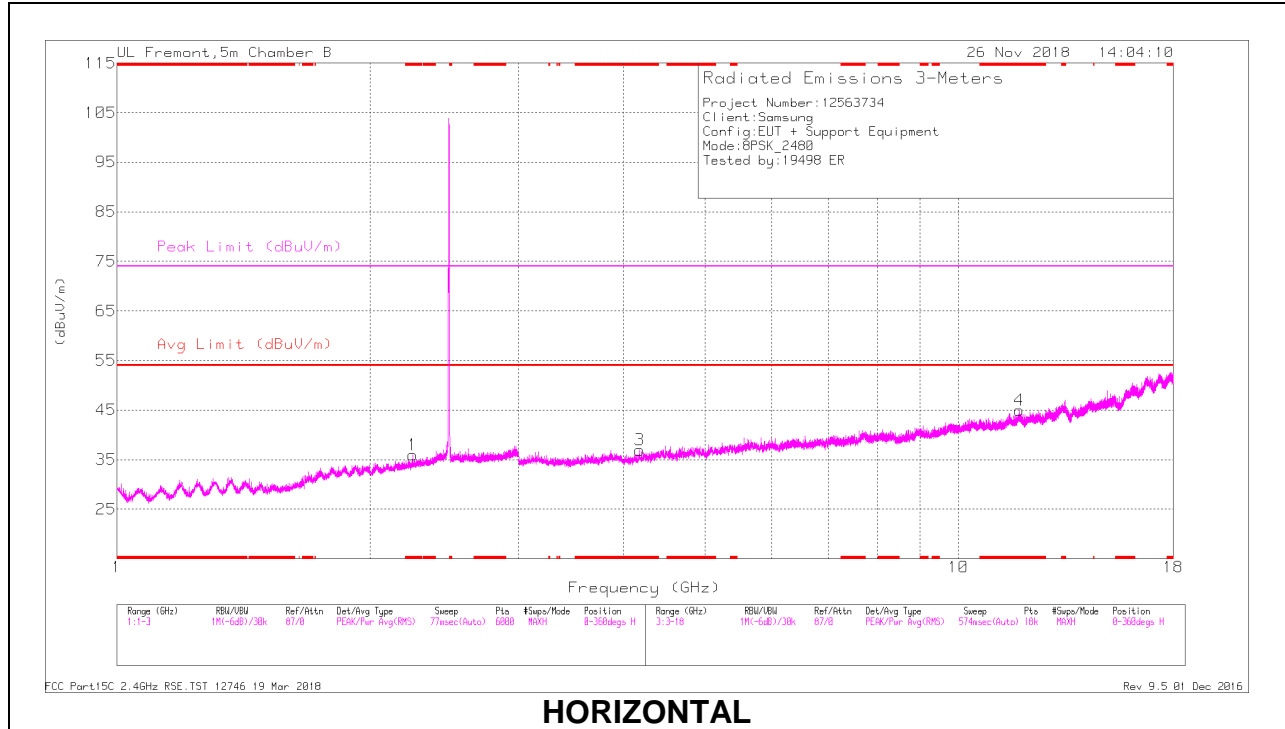
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.191	30.44	PKFH	28.1	-22.1	36.44	-	-	74	-37.56	295	127	H
	* 1.191	18.1	VA1T	28.1	-22.1	24.1	54	-29.9	-	-	295	127	H
2	* 1.246	28.89	PKFH	28.3	-22	35.19	-	-	74	-38.81	239	161	V
	* 1.246	18.16	VA1T	28.3	-22	24.46	54	-29.54	-	-	239	161	V
5	3.113	38.24	PKFH	33.3	-30.8	40.74	-	-	-	-	152	182	V
	3.114	27.12	VA1T	33.3	-30.8	29.62	-	-	-	-	152	182	V
3	8.922	22.17	VA1T	36.8	-24	34.97	-	-	-	-	140	141	H
	8.923	33.65	PKFH	36.8	-24	46.45	-	-	-	-	140	141	H
6	10.418	32.64	PKFH	37.9	-22.2	48.34	-	-	-	-	103	153	V
	10.42	20.97	VA1T	37.9	-22.2	36.67	-	-	-	-	103	153	V
4	13.032	30.45	PKFH	39.6	-21.1	48.95	-	-	-	-	74	247	H
	13.034	20.01	VA1T	39.6	-21.1	38.51	-	-	-	-	74	247	H

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

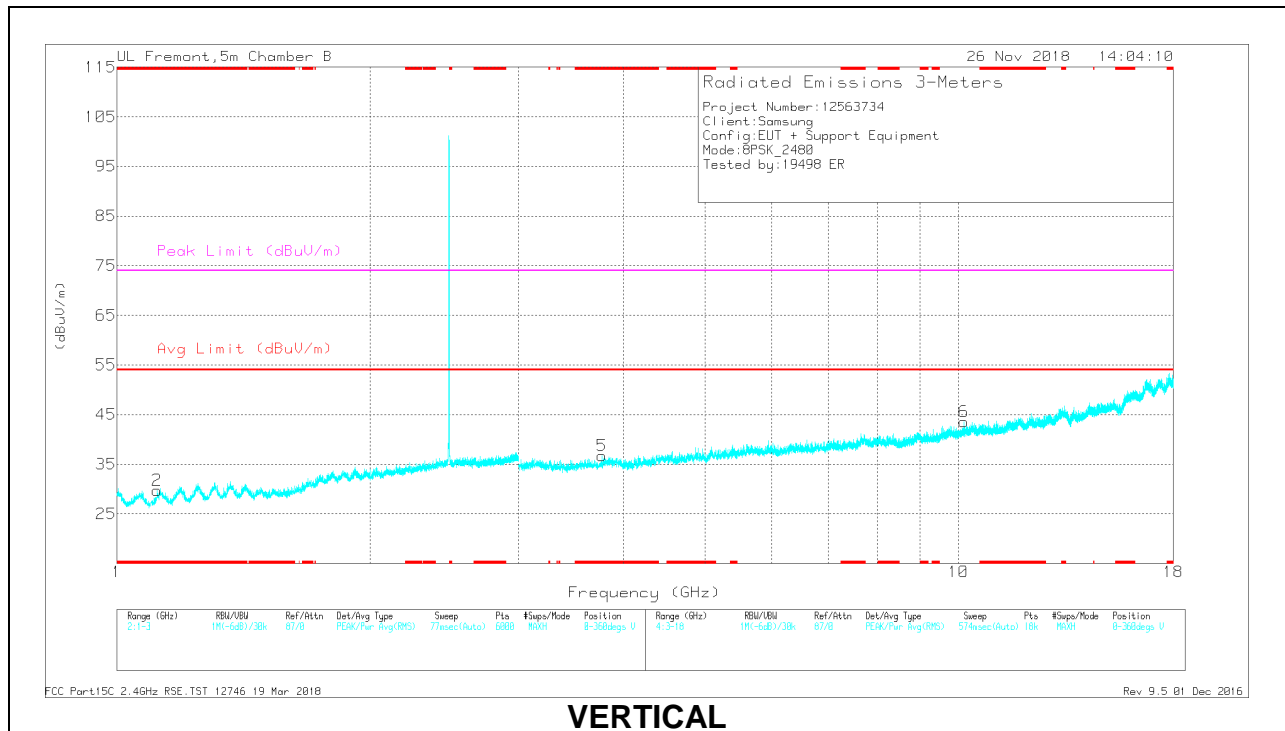
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/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	* 2.244	27.89	PKFH	31.7	-20.7	38.89	-	-	74	-35.11	65	114	H
	* 2.246	16.6	VA1T	31.7	-20.7	27.6	54	-26.4	-	-	65	114	H
2	* 1.117	29.36	PKFH	27.4	-22.4	34.36	-	-	74	-39.64	136	174	V
	* 1.117	17.6	VA1T	27.4	-22.4	22.6	54	-31.4	-	-	136	174	V
3	* 4.175	36.87	PKFH	33.6	-29.6	40.87	-	-	74	-33.13	221	141	H
	* 4.175	26.23	VA1T	33.6	-29.6	30.23	54	-23.77	-	-	221	141	H
4	* 11.817	31.08	PKFH	39.1	-21.2	48.98	-	-	74	-25.02	166	222	H
	* 11.816	20.32	VA1T	39.1	-21.2	38.22	54	-15.78	-	-	166	222	H
5	* 3.768	38.53	PKFH	33.4	-30.8	41.13	-	-	74	-32.87	290	274	V
	* 3.769	27.36	VA1T	33.4	-30.8	29.96	54	-24.04	-	-	290	274	V
6	10.152	32.69	PKFH	37.8	-23.5	46.99	-	-	-	-	323	134	V
	10.155	21.66	VA1T	37.8	-23.5	35.96	-	-	-	-	323	134	V

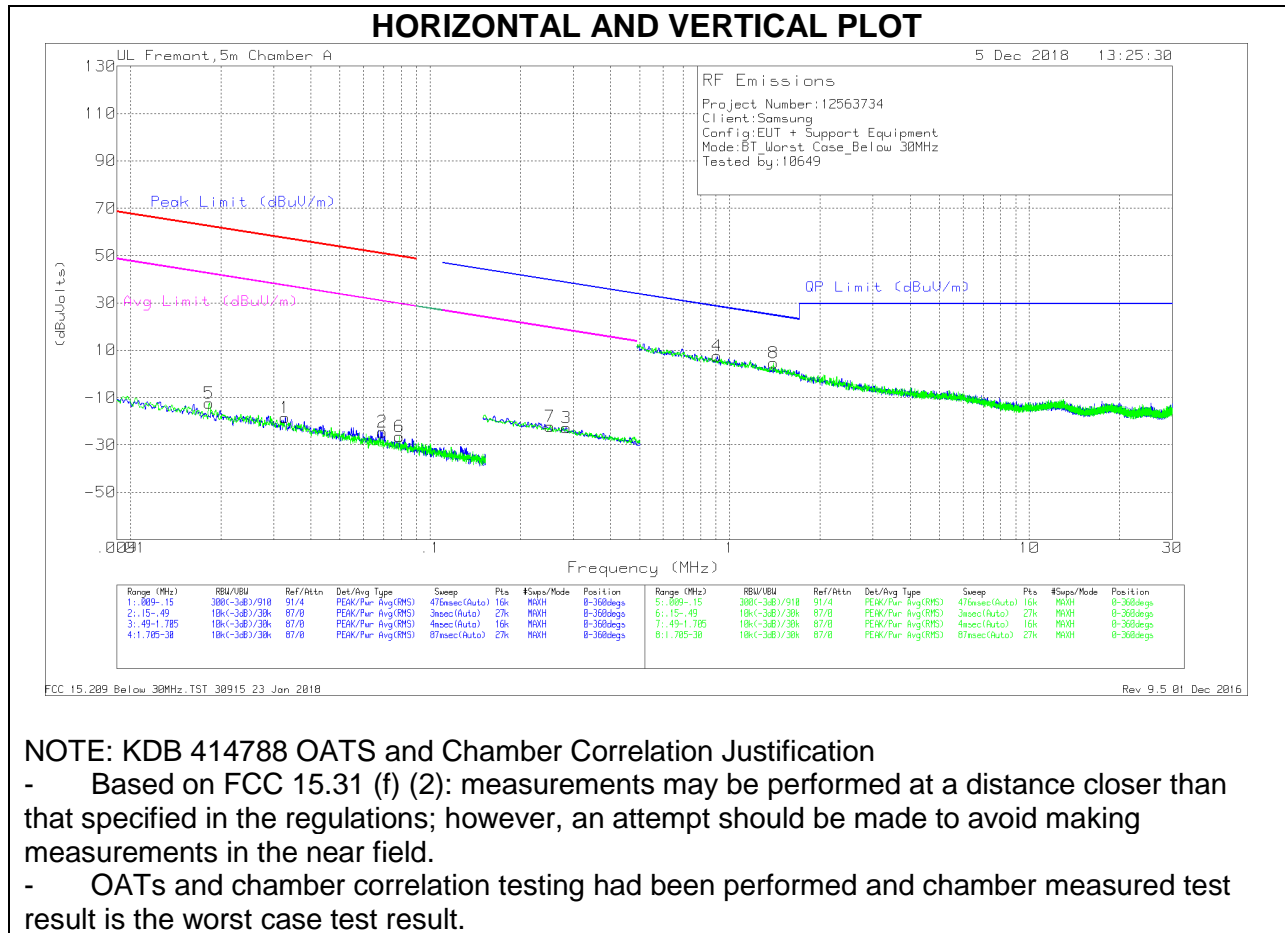
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

10.2. Worst Case Below 30 MHz

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)



NOTE: KDB 414788 OATS and Chamber Correlation Justification

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

Below 30 MHz Data

Trace Markers

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	.01831	53.11	Pk	14.6	0	-80	-12.29	62.33	-74.62	42.33	-54.62	-	-	-	-	0-360
1	.03285	46.41	Pk	15.2	0	-80	-18.39	57.25	-75.64	37.25	-55.64	-	-	-	-	0-360
2	.06916	41.42	Pk	14.1	0	-80	-24.48	50.79	-75.27	30.79	-55.27	-	-	-	-	0-360
6	.07885	39.43	Pk	14.1	0	-80	-26.47	49.65	-76.12	29.65	-56.12	-	-	-	-	0-360
7	.25145	44.07	Pk	13.7	.1	-80	-22.13	-	-	-	-	39.61	-61.74	19.61	-41.74	0-360
3	.28495	43.42	Pk	13.7	.1	-80	-22.78	-	-	-	-	38.52	-61.3	18.52	-41.3	0-360

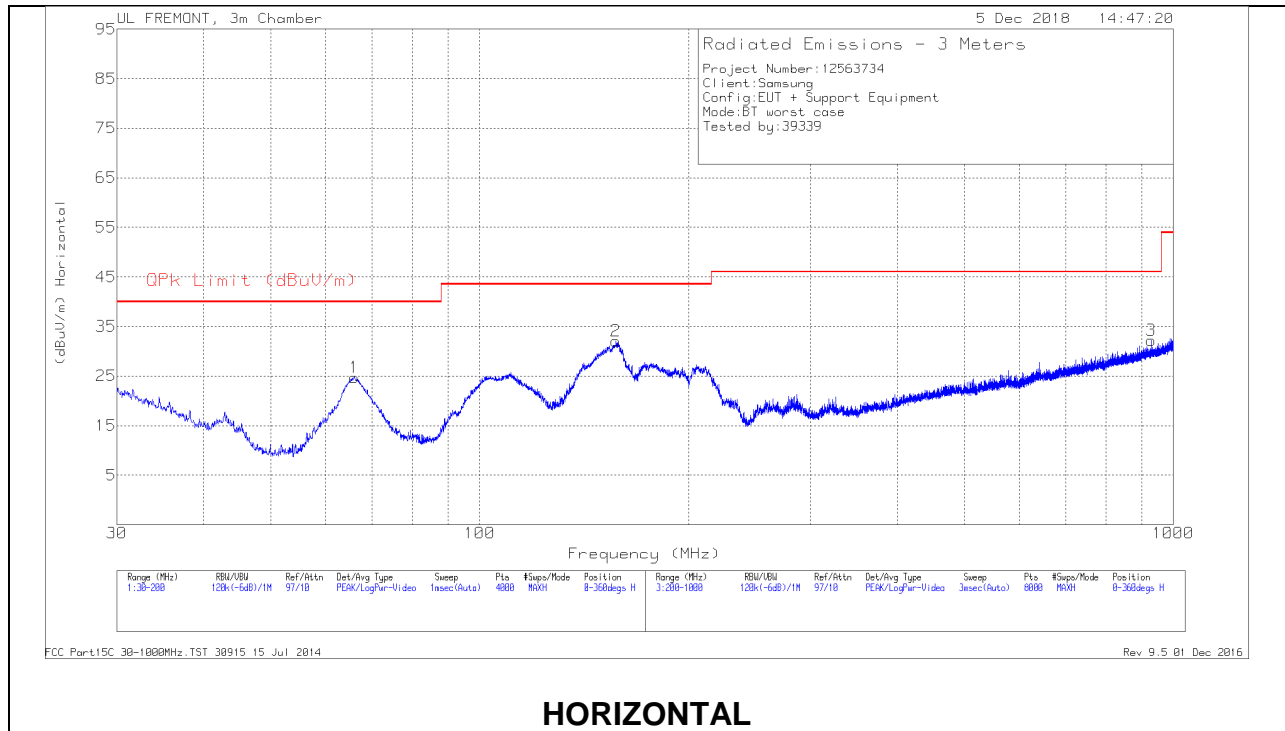
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.9069	33.34	Pk	14	.1	-40	7.44	28.47	-21.03	0-360
8	1.39976	30.12	Pk	14.2	.2	-40	4.52	24.71	-20.19	0-360

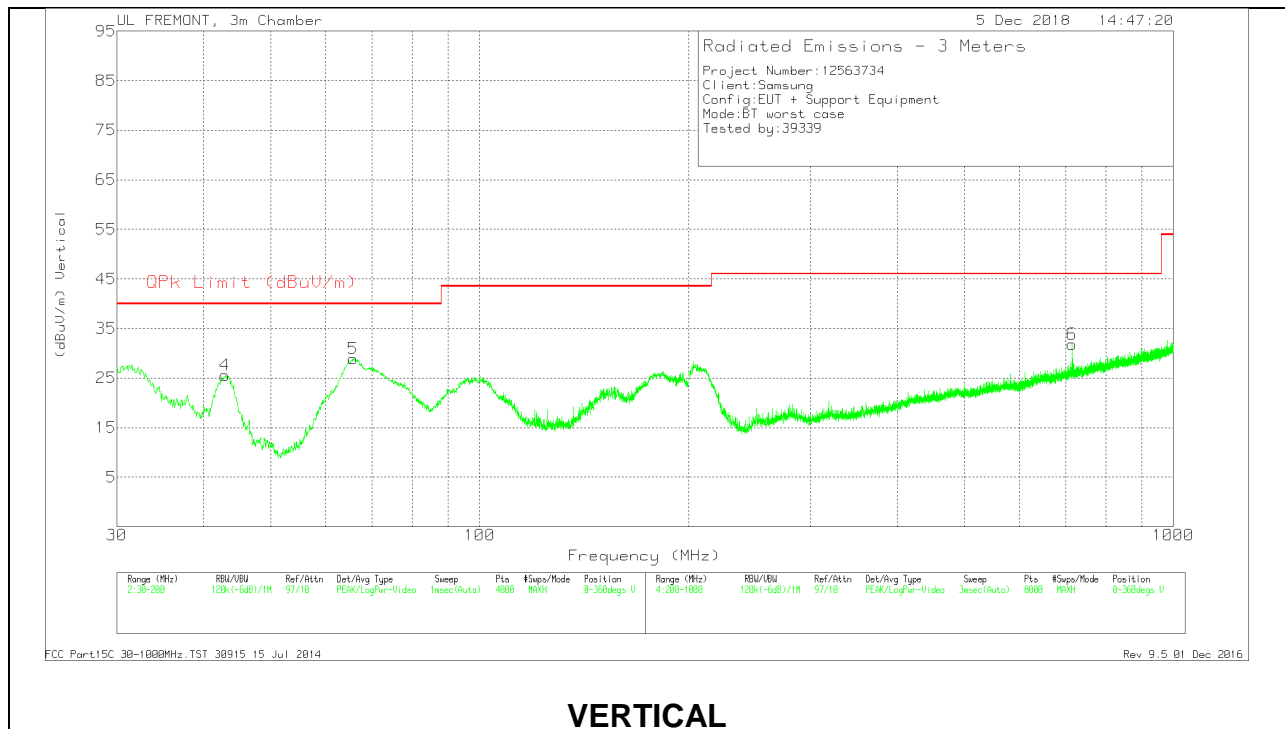
Pk - Peak detector

10.3. Worst Case Below 1 GHz

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	42.9659	40.64	Pk	15.8	-30.9	25.54	40	-14.46	0-360	100	V
5	65.7305	47.52	Pk	12	-30.6	28.92	40	-11.08	0-360	100	V
1	65.9643	43.3	Pk	12	-30.6	24.7	40	-15.3	0-360	400	H
2	157.1504	45.49	Pk	16.3	-29.7	32.09	43.52	-11.43	0-360	200	H
6	714.8669	34.54	Pk	24.4	-27.1	31.84	46.02	-14.18	0-360	100	V
3	929.7949	30.85	Pk	26.7	-25.4	32.15	46.02	-13.87	0-360	300	H

Pk - Peak detector

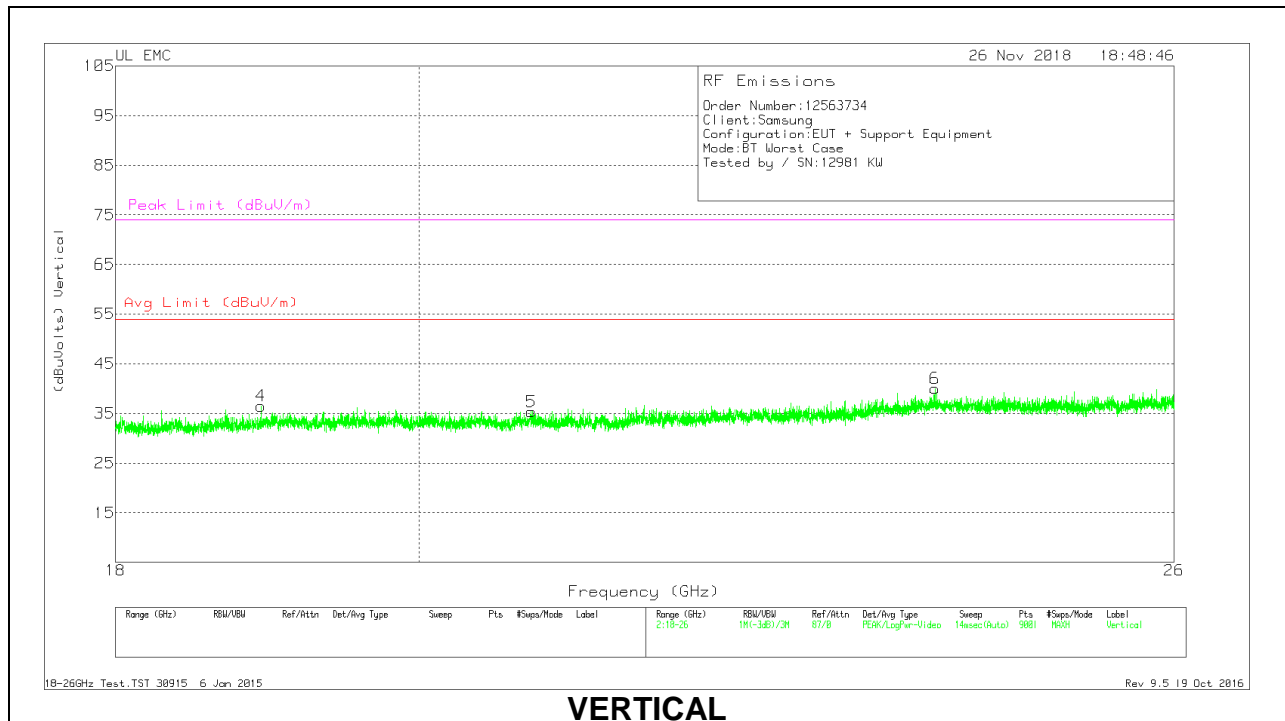
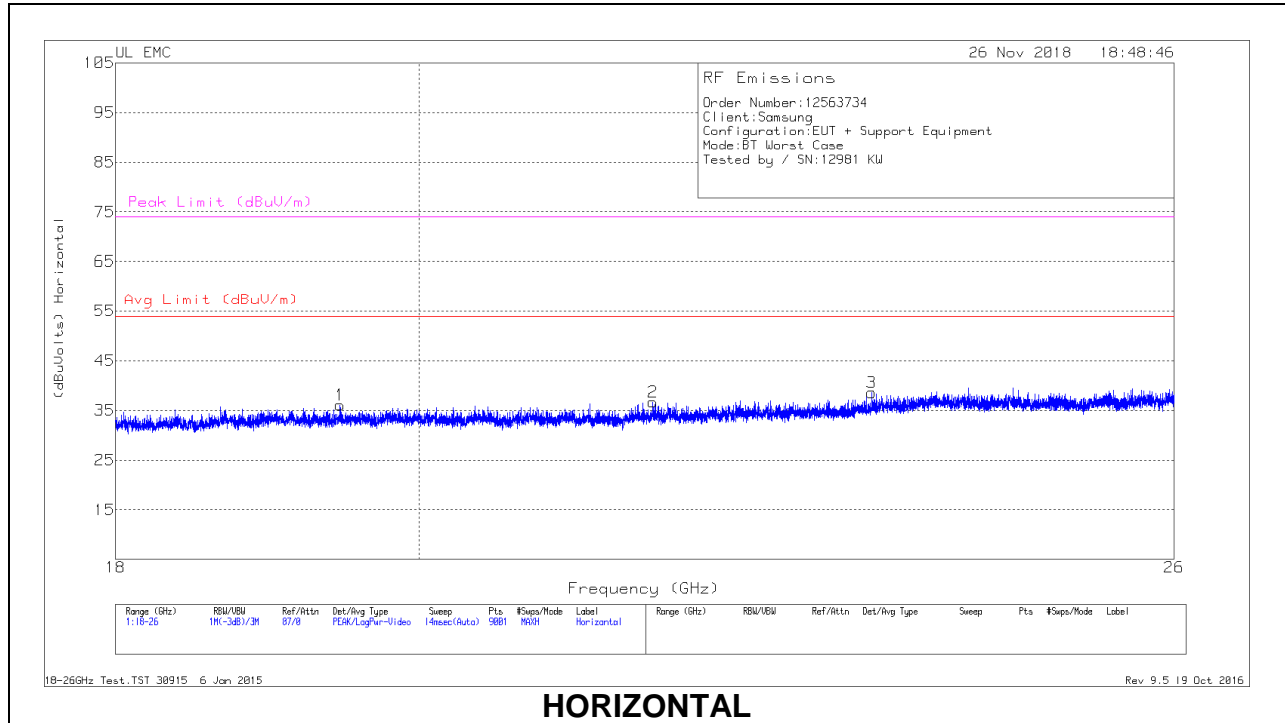
Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
65.8961	44.95	Qp	12	-30.6	26.35	40	-13.65	261	112	V

Qp - Quasi-Peak detector

10.4. 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	19.46	37.35	Pk	32.8	-24.6	-9.5	36.05	54	-17.95	74	-37.95
2	21.692	37.68	Pk	33.1	-24.6	-9.5	36.68	54	-17.32	74	-37.32
3	23.406	38.6	Pk	33.9	-24.4	-9.5	38.6	54	-15.4	74	-35.4
4	18.932	38.79	Pk	32.5	-25.3	-9.5	36.49	54	-17.51	74	-37.51
5	20.795	36.84	Pk	33	-25	-9.5	35.34	54	-18.66	74	-38.66
6	23.926	39.2	Pk	34.3	-24	-9.5	40	54	-14	74	-34

Pk - Peak detector

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 C63.10.

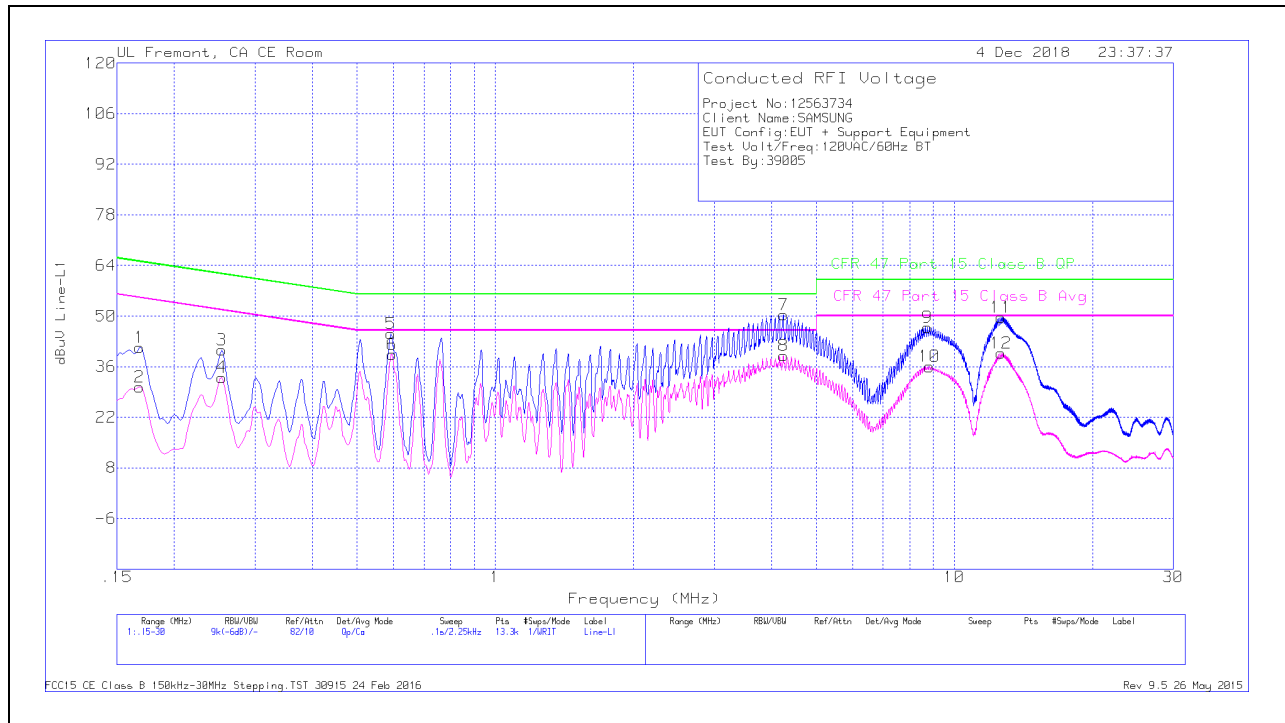
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

11.1.1.AC Power Line Norm

LINE 1 RESULTS

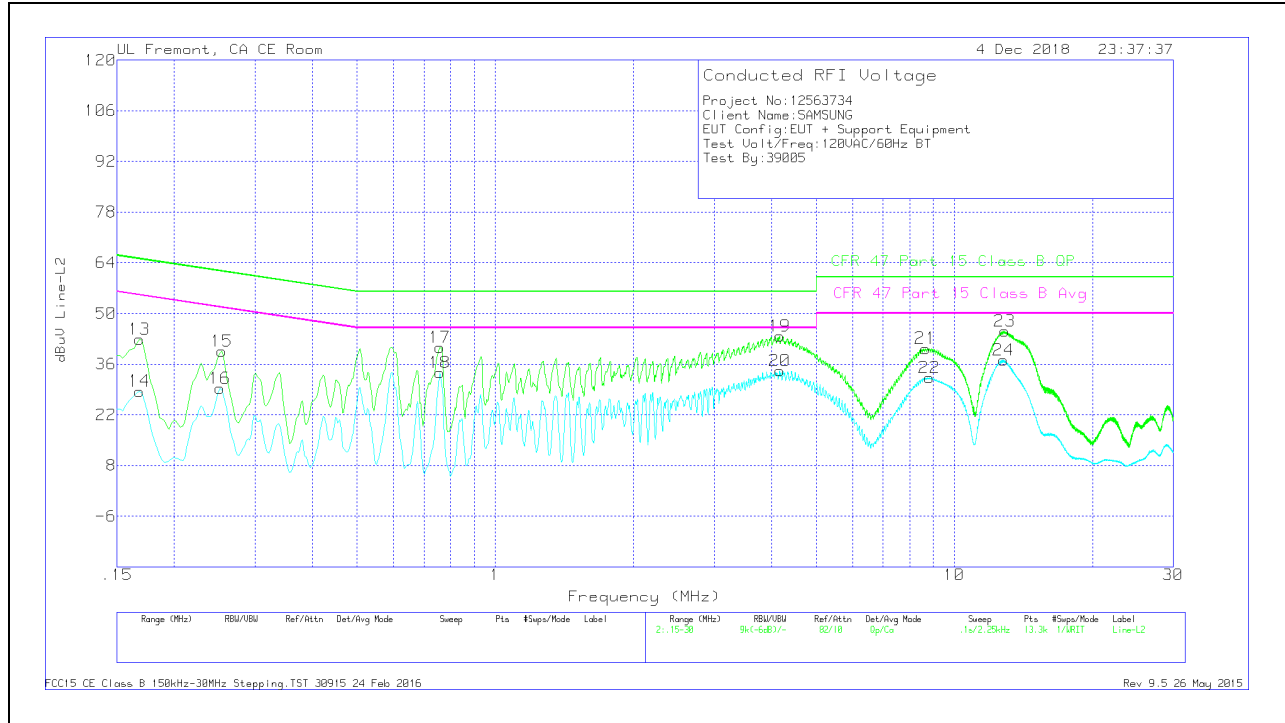


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.168	31.08	Qp	.1	0	10.1	41.28	65.06	-23.78	-	-
2	.168	20.18	Ca	.1	0	10.1	30.38	-	-	55.06	-24.68
3	.2535	30.46	Qp	0	0	10.1	40.56	61.64	-21.08	-	-
4	.2535	22.95	Ca	0	0	10.1	33.05	-	-	51.64	-18.59
5	.59325	35.04	Qp	0	0	10.1	45.14	56	-10.86	-	-
6	.5955	29.34	Ca	0	0	10.1	39.44	-	-	46	-6.56
7	4.24275	40.13	Qp	0	.1	10.1	50.33	56	-5.67	-	-
8	4.24275	28.81	Ca	0	.1	10.1	39.01	-	-	46	-6.99
9	8.74275	36.44	Qp	0	.2	10.2	46.84	60	-13.16	-	-
10	8.826	25.61	Ca	0	.2	10.2	36.01	-	-	50	-13.99
11	12.642	39.16	Qp	.1	.2	10.2	49.66	60	-10.34	-	-
12	12.64875	29.24	Ca	.1	.2	10.2	39.74	-	-	50	-10.26

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	.168	32.64	Qp	.1	0	10.1	42.84	65.06	-22.22	-	-
14	.168	18.33	Ca	.1	0	10.1	28.53	-	-	55.06	-26.53
15	.2535	29.48	Qp	0	0	10.1	39.58	61.64	-22.06	-	-
16	.25125	19.15	Ca	0	0	10.1	29.25	-	-	51.72	-22.47
17	.7575	30.58	Qp	0	0	10.1	40.68	56	-15.32	-	-
18	.7575	23.54	Ca	0	0	10.1	33.64	-	-	46	-12.36
19	4.16625	33.55	Qp	0	.1	10.1	43.75	56	-12.25	-	-
20	4.164	23.92	Ca	0	.1	10.1	34.12	-	-	46	-11.88
21	8.6685	29.95	Qp	0	.2	10.2	40.35	60	-19.65	-	-
22	8.8215	21.88	Ca	0	.2	10.2	32.28	-	-	50	-17.72
23	12.8895	34.56	Qp	.1	.2	10.2	45.06	60	-14.94	-	-
24	12.8085	26.64	Ca	.1	.2	10.2	37.14	-	-	50	-12.86

Qp - Quasi-Peak detector

Ca - CISPR average detection