CERTIFICATION TEST REPORT

Report Number. : 4789230288-E6V1

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-G981B/DS, SM-G981B
FCC ID	:	A3LSMG981B
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
December 23, 2019

Prepared by:
UL Korea, Ltd.
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Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/23/19	Initial issue	Hyunsik Yun

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT
MODEL NUMBER:	SM-G981B/DS, SM-G981B
SERIAL NUMBER:	397147485c1f7ece, 39989048ab1f7ece (CONDUCTED) R3CMA0D7LSP, R3CMA0D84RA (RADIATED);
DATE TESTED:	OCT 31, 2019 – NOV 22, 2019;

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

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Hyunsik Yun
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02
4. ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☐ Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/wp-content/uploads/2017/05/TL-637.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT. This test report addresses the DSS (BT) operational mode.

This report covers the Samsung models SM-G981B/DS and SM-G981B.
These models are identical in hardware except SM-G981B has single SIM tray.
With some pre-scan, model SM-G981B/DS was set for final test.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2 402 ~ 2 480	Basic GFSK	Average	17.417	55.17
		Peak	17.818	60.51
	Enhanced Pi/4-DPSK	Average	11.326	13.57
		Peak	13.897	24.53
	Enhanced 8PSK	Average	11.358	13.67
		Peak	14.488	28.11

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -3.80 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

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

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

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

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 9.5. All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

5.5.DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37M5WSB411SE3	N/A
Data Cable	SAMSUNG	EP-DG977	N/A	N/A

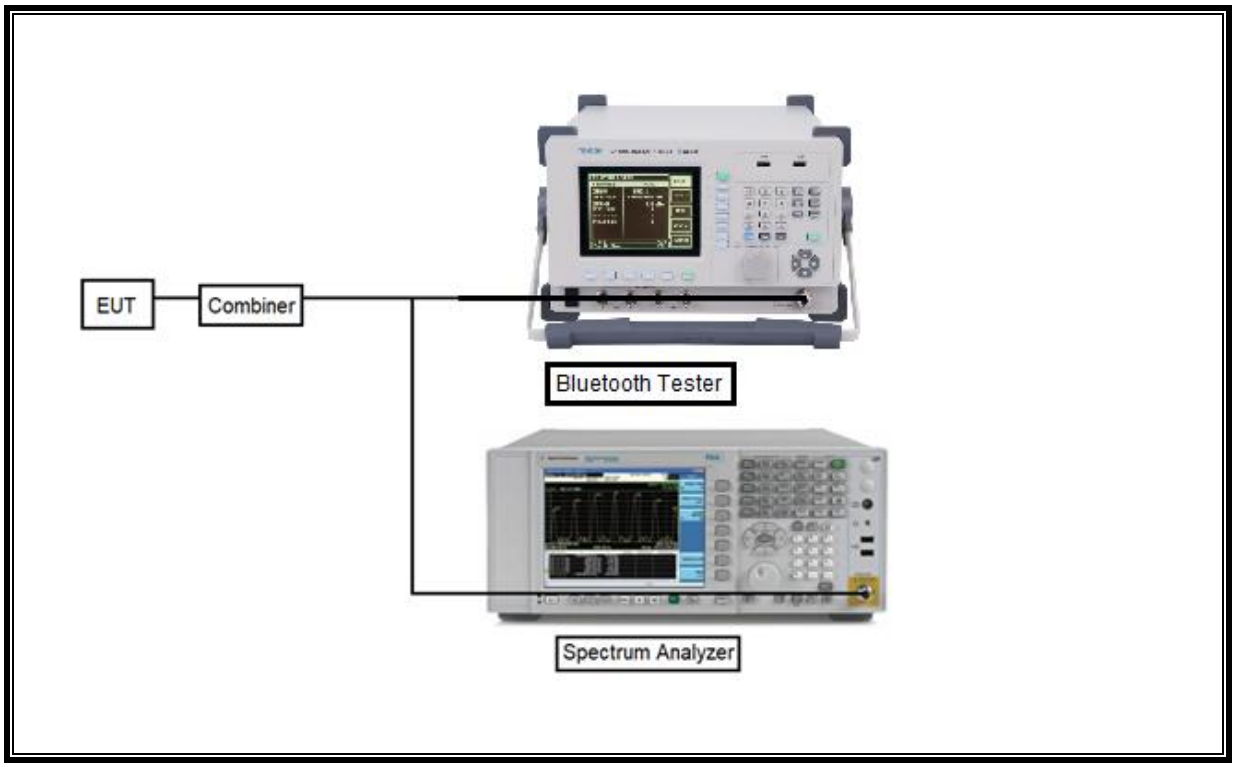
I/O CABLE

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0m	N/A

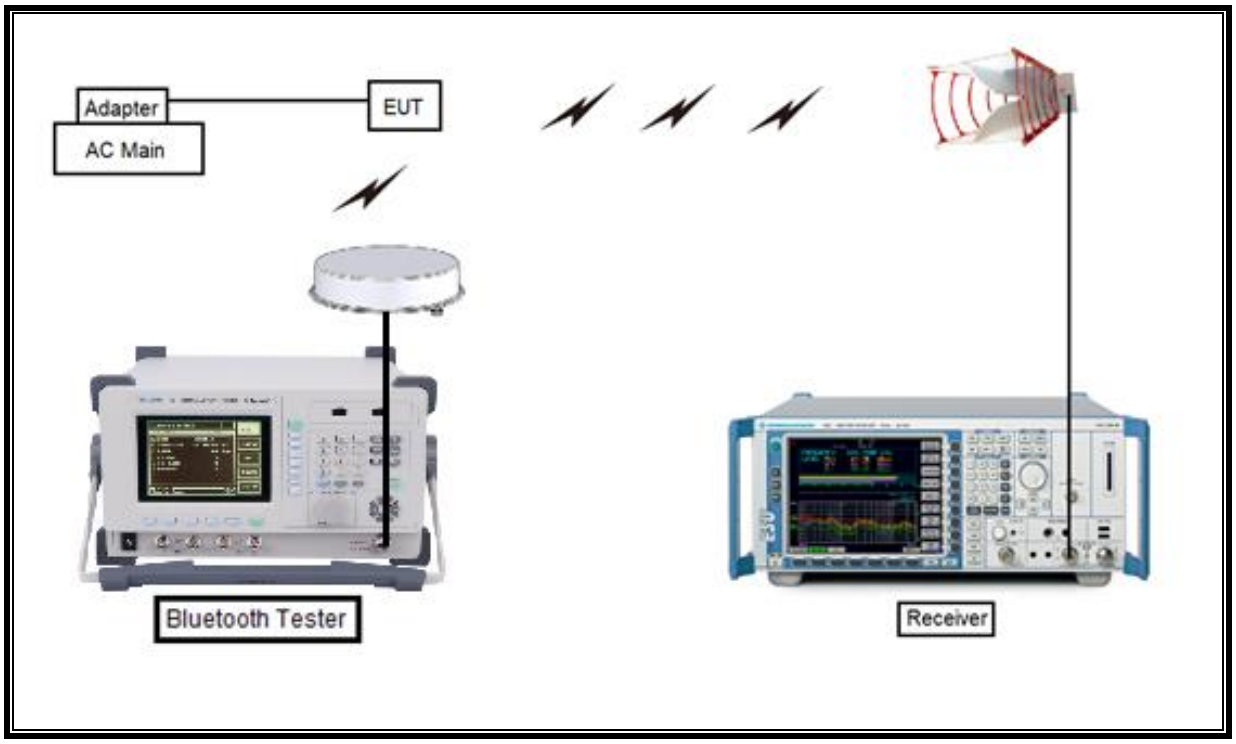
TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.
Test software enable BT communications.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

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

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**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-07-20
Combiner	WEINCHEL	1575	2150	08-08-20
Attenuator	PASTERNACK	PE7087-10	A001	08-08-20
Attenuator	PASTERNACK	PE7087-10	A008	08-08-20
Attenuator	PASTERNACK	PE7087-10	2	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Termination	WEINSCHEL	M1406A	T01	08-08-20

UL Software			
Description	**Manufacturer**	**Model**	**Version**
Radiated software	UL	UL EMC	Ver 9.5
AC Line Conducted software	UL	UL EMC	Ver 9.5

8. REFERENCE MEASUREMENT RESULTS

8.1. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None: for reporting purposes only.

Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
BT	2.885	3.750	0.769	76.9%	1.14	0.347

8.2.20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

RESULTS

8.2.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [kHz]
Low	2 402	1.028	894.120
Mid	2 440	1.034	866.130
High	2 480	1.043	867.970
Worst		1.043	894.120

8.2.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [kHz]
Low	2 402	1.336	1.167
Mid	2 440	1.326	1.194
High	2 480	1.335	1.164
Worst		1.336	1.194

8.2.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [kHz]
Low	2 402	1.296	1.164
Mid	2 440	1.280	1.165
High	2 480	1.323	1.194
Worst		1.323	1.194

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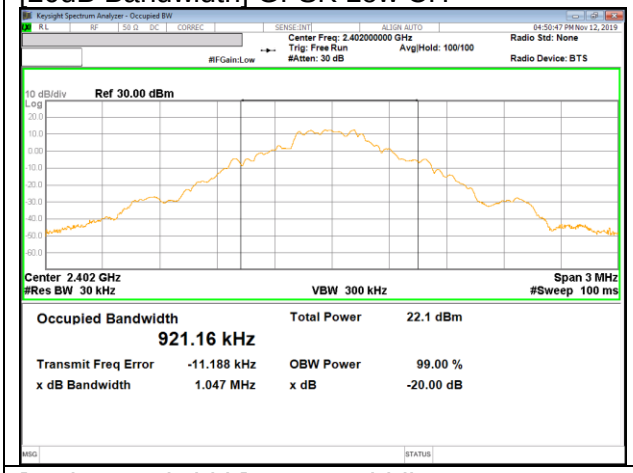
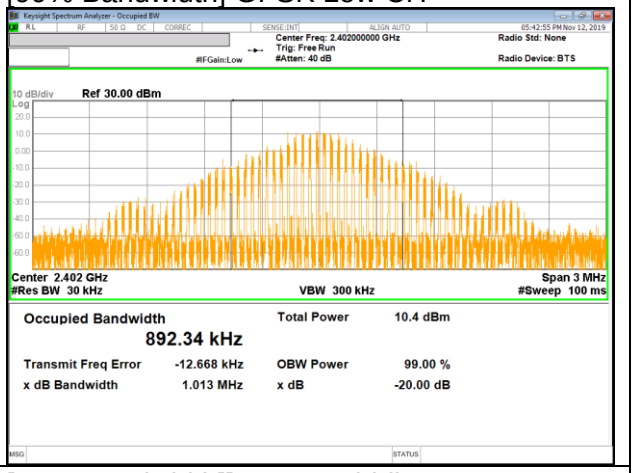
8.2.4. 20 dB AND 99% BANDWIDTH PLOTS

GFSK BANDWIDTH

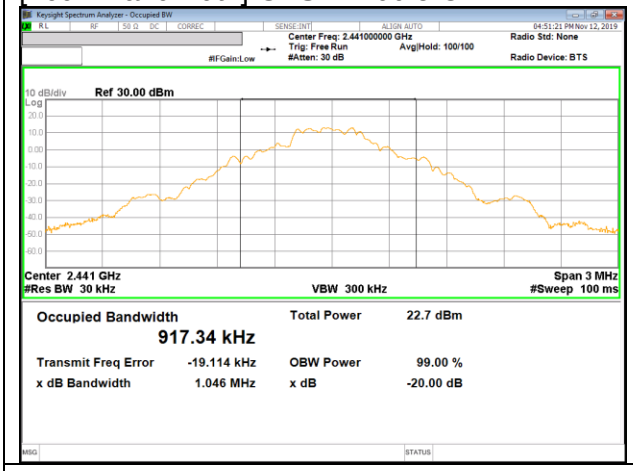
[20dB Bandwidth] GFSK Low CH



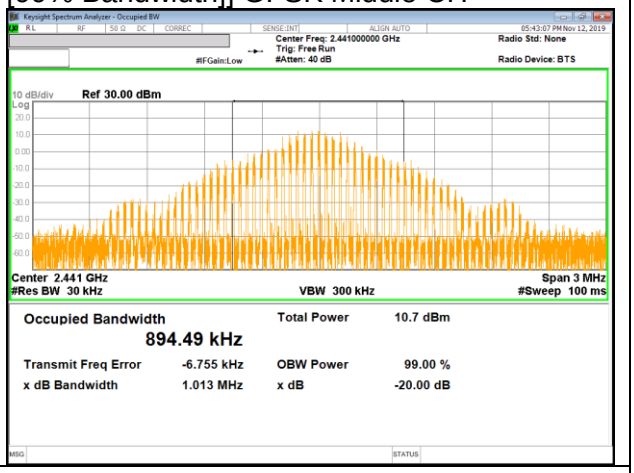
[99% Bandwidth] GFSK Low CH



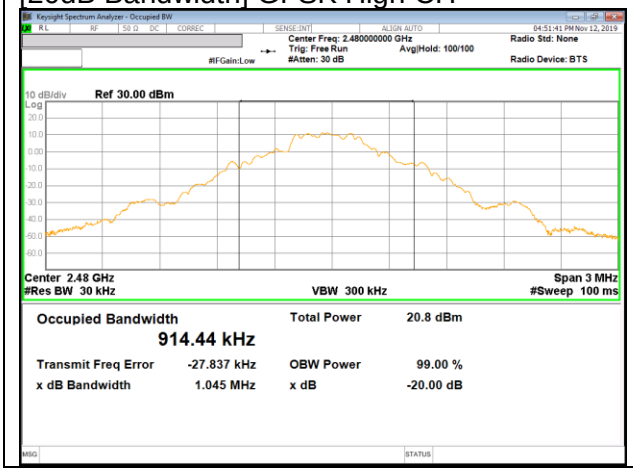
[20dB Bandwidth] GFSK Middle CH



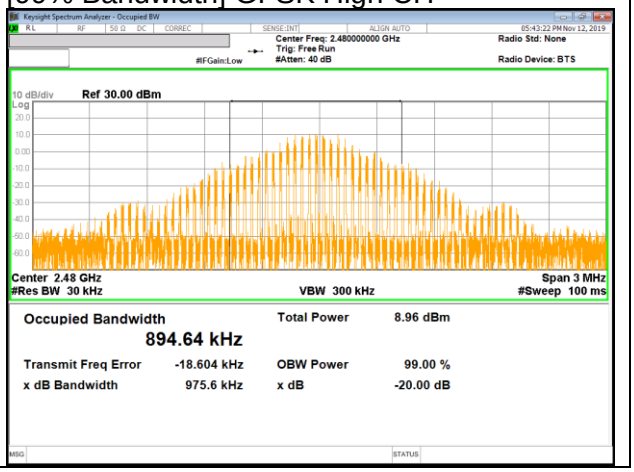
[99% Bandwidth]] GFSK Middle CH



[20dB Bandwidth] GFSK High CH

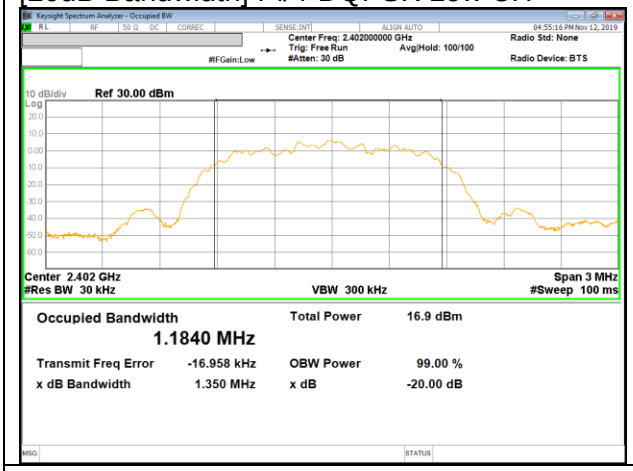


[99% Bandwidth] GFSK High CH

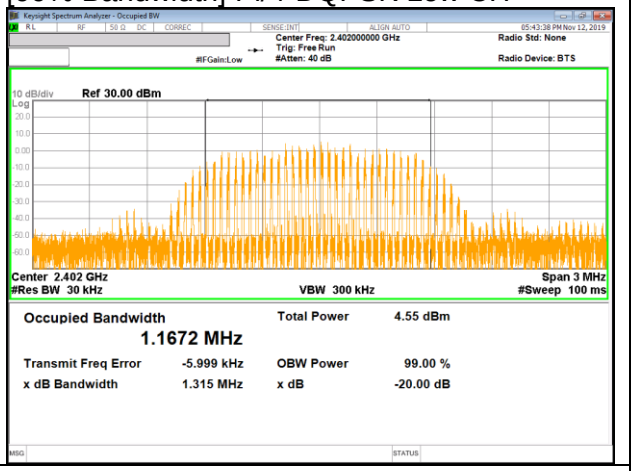


Pi/4-DQPSK BANDWIDTH

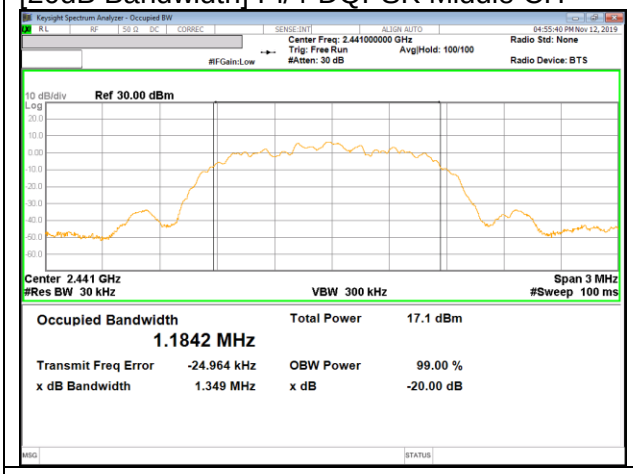
[20dB Bandwidth] Pi/4-DQPSK Low CH



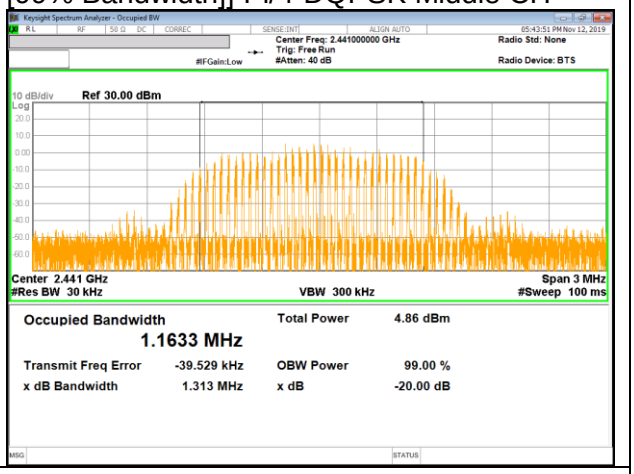
[99% Bandwidth] Pi/4-DQPSK Low CH



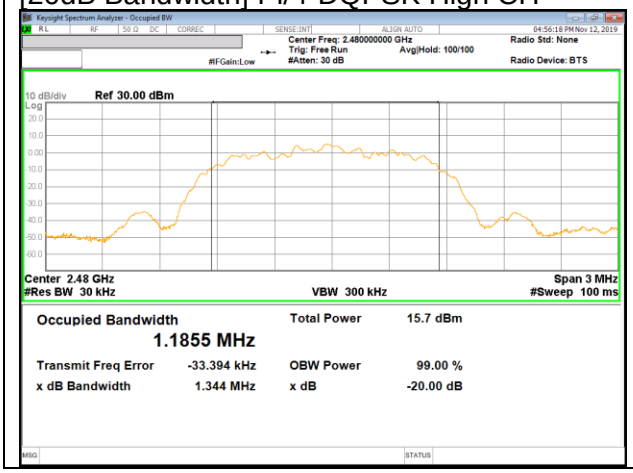
[20dB Bandwidth] Pi/4-DQPSK Middle CH



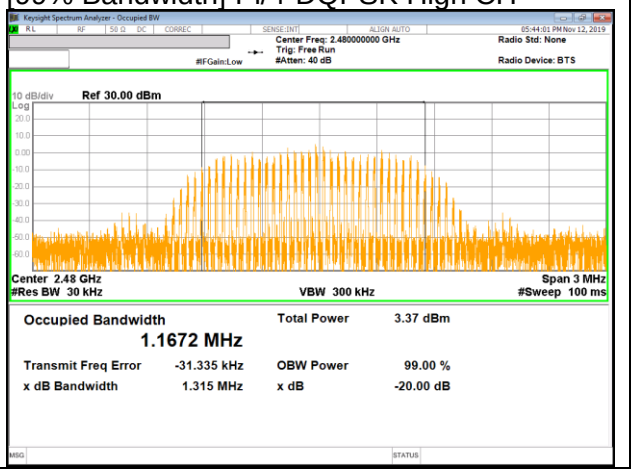
[99% Bandwidth]] Pi/4-DQPSK Middle CH



[20dB Bandwidth] Pi/4-DQPSK High CH

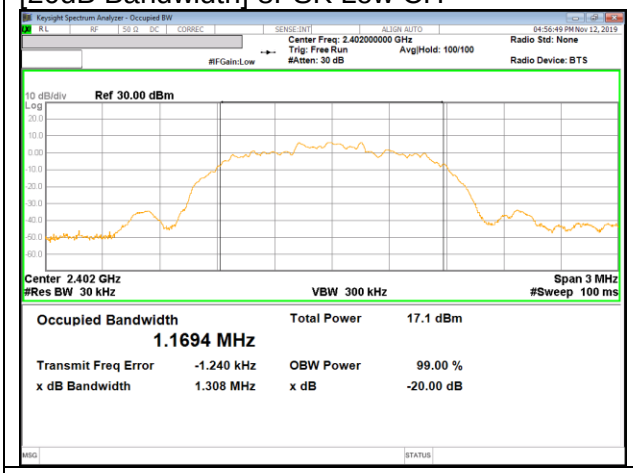


[99% Bandwidth] Pi/4-DQPSK High CH

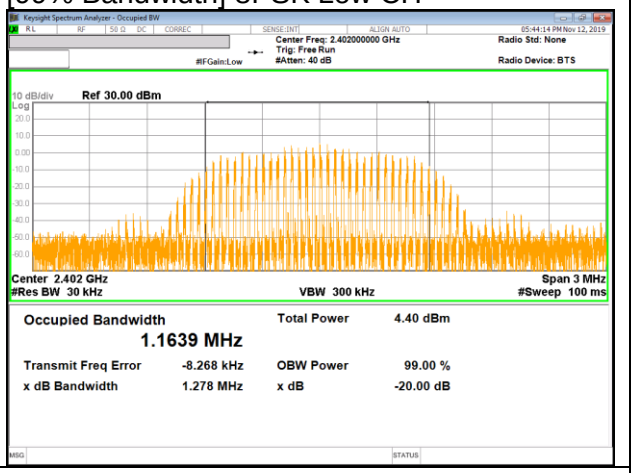


8PSK BANDWIDTH

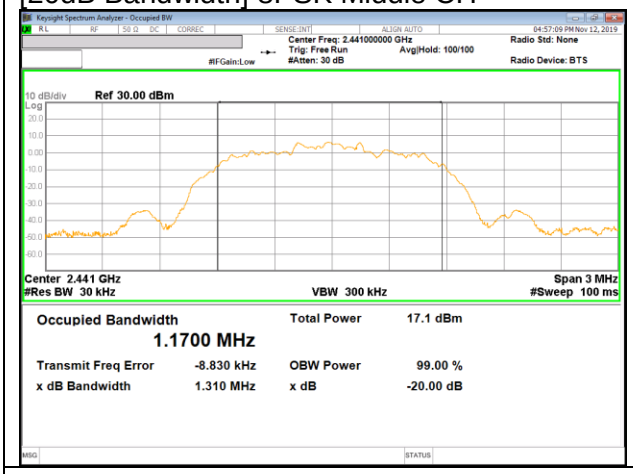
[20dB Bandwidth] 8PSK Low CH



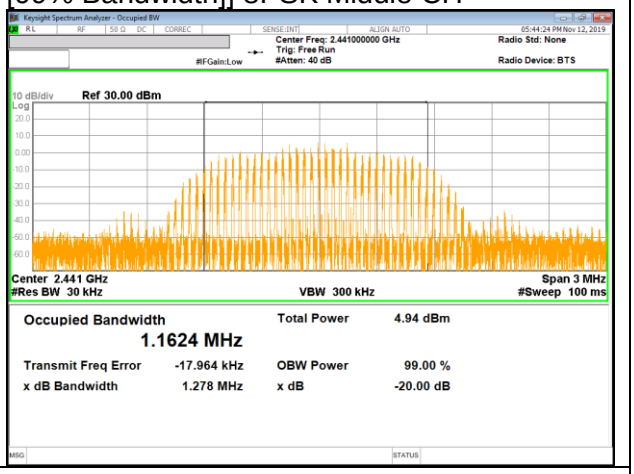
[99% Bandwidth] 8PSK Low CH



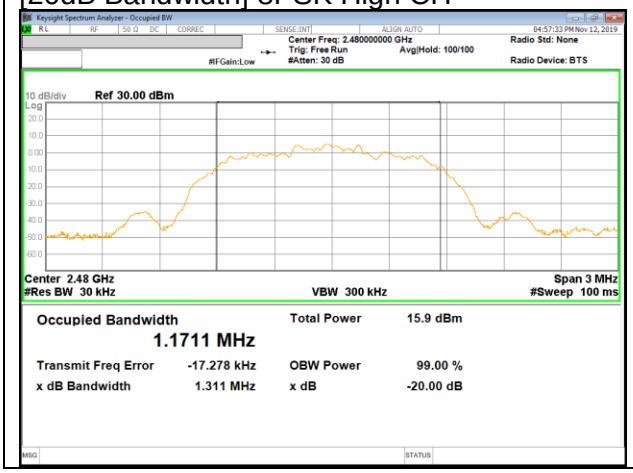
[20dB Bandwidth] 8PSK Middle CH



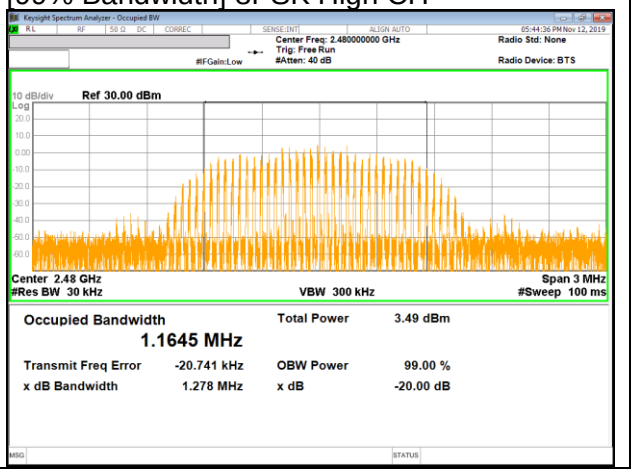
[99% Bandwidth]] 8PSK Middle CH



[20dB Bandwidth] 8PSK High CH



[99% Bandwidth] 8PSK High CH



9. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc	Conducted	Pass
15.247 (b)(1)	TX conducted output power	<21dBm		Pass
15.247 (a)(1)	Hopping frequency separation	> two-thirds of the 20 dB bandwidth		Pass
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		Pass
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

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10. ANTENNA PORT TEST RESULTS

10.1. HOPPING FREQUENCY SEPARATION

LIMIT

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.

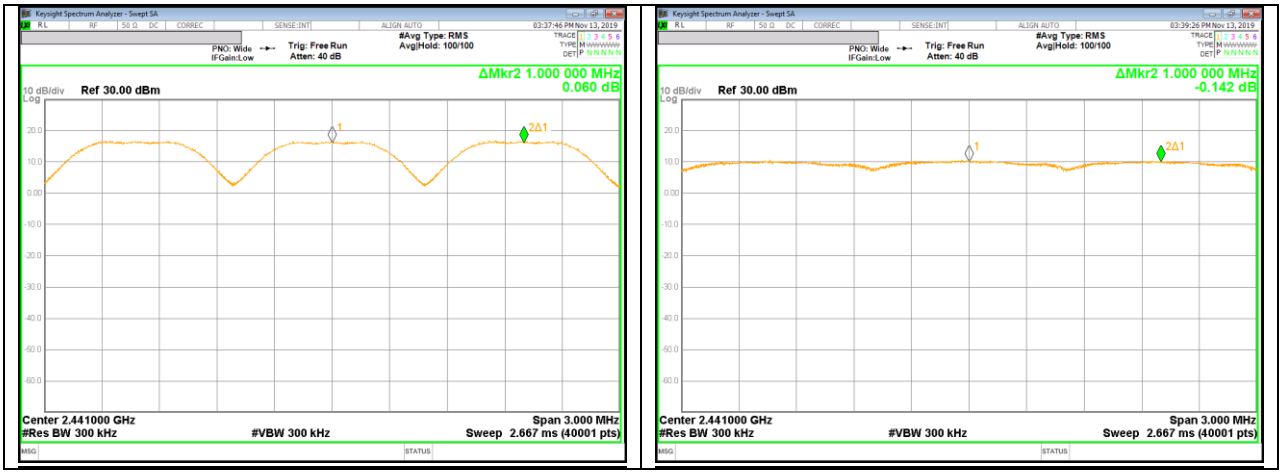
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

Span = wide enough to capture the peaks of two adjacent channels
RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = Max hold

RESULTS

HOPPING FREQUENCY SEPARATION PLOT



[GFSK] **[8PSK]**

10.2. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

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

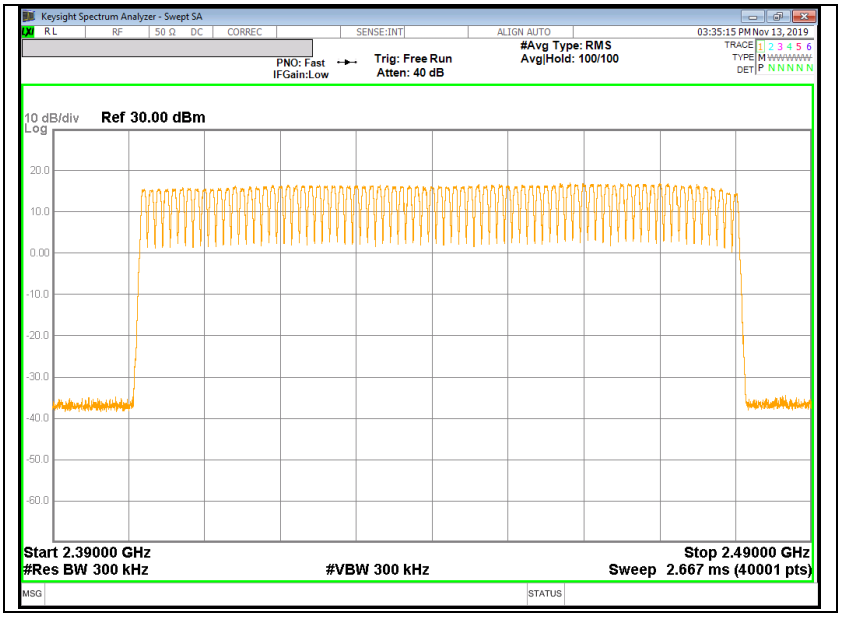
TEST PROCEDURE

RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW ≥ RBW
Sweep = Auto
Detector function = Peak
Trace = Max hold

RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



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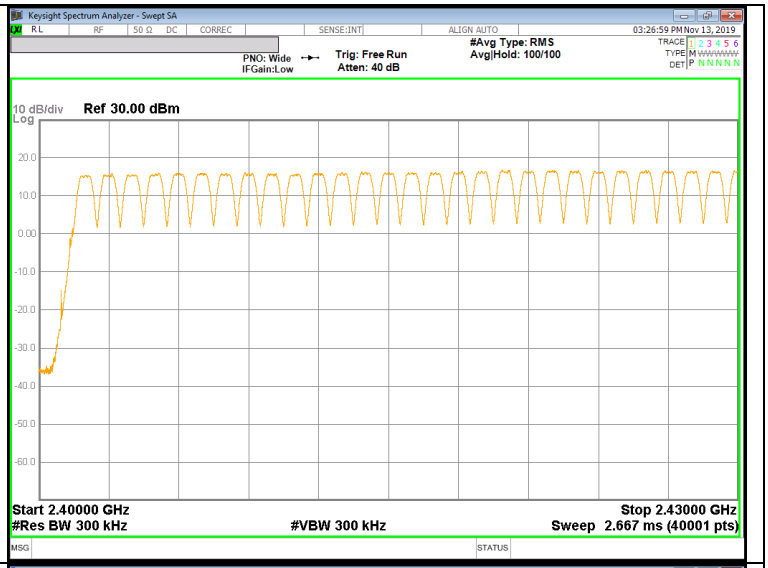
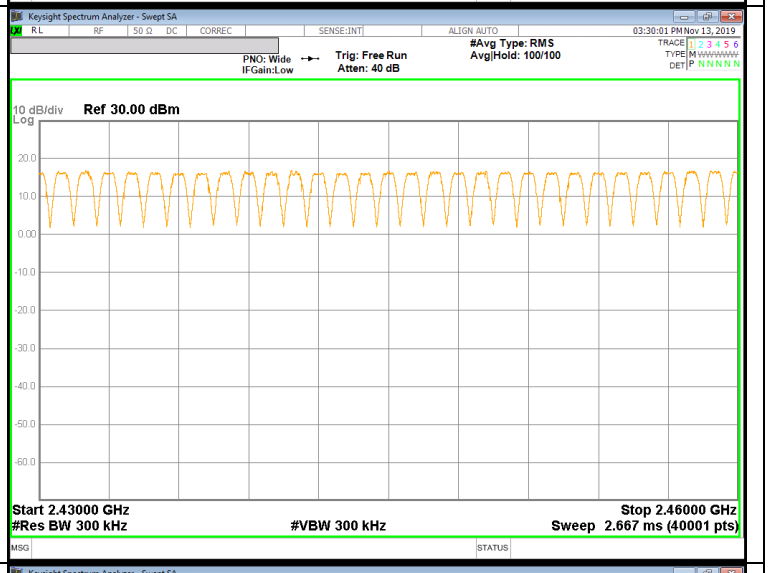
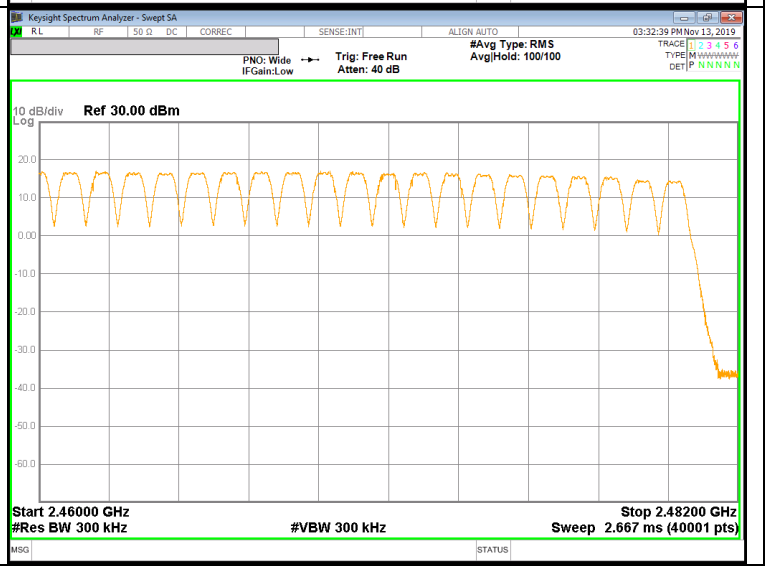
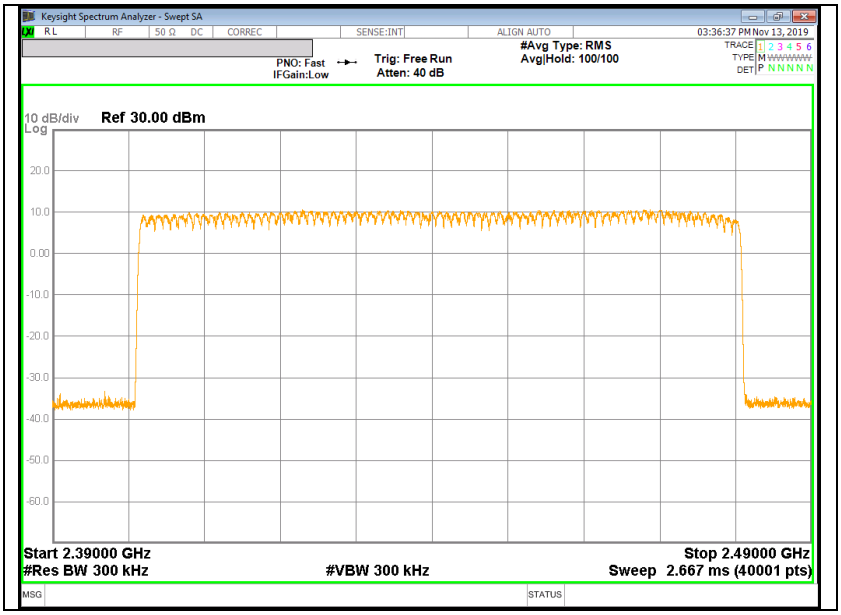
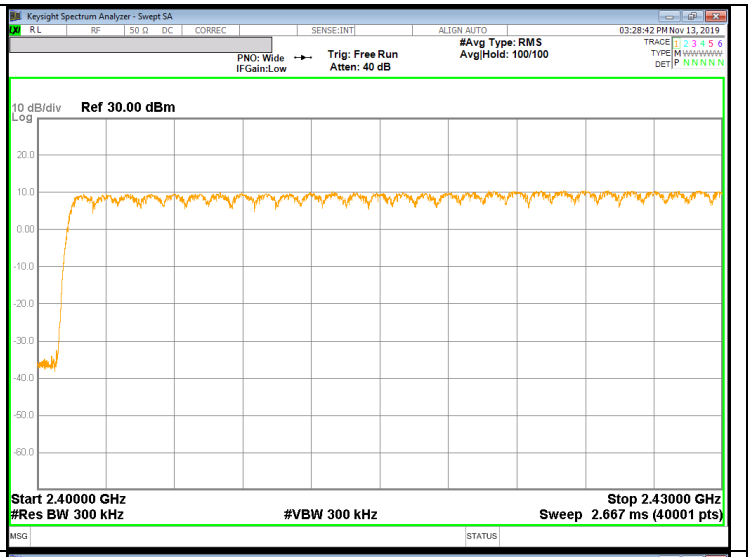
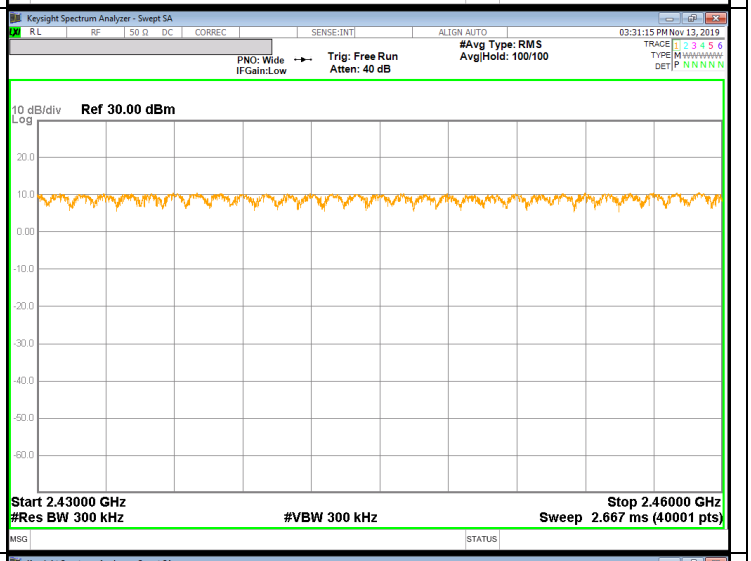
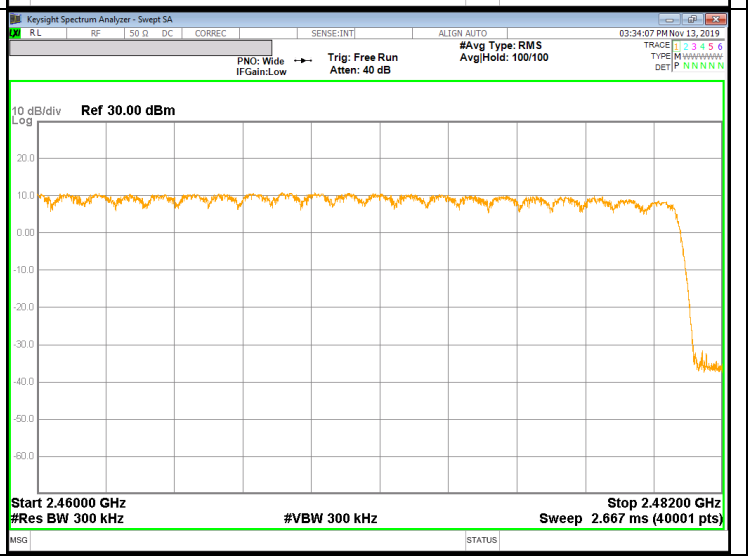
1st SEGMENT 2400 to 2430 MHz	
2nd SEGMENT 2430 to 2460 MHz	
3rd SEGMENT 2460 to 2482 MHz	

NUMBER OF HOPPING CHANNELS PLOTS[8PSK]

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



1st SEGMENT 2400 to 2430 MHz	
2nd SEGMENT 2430 to 2460 MHz	
3rd SEGMENT 2460 to 2482 MHz	

10.3. AVERAGE TIME OF OCCUPANCY

LIMIT

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.

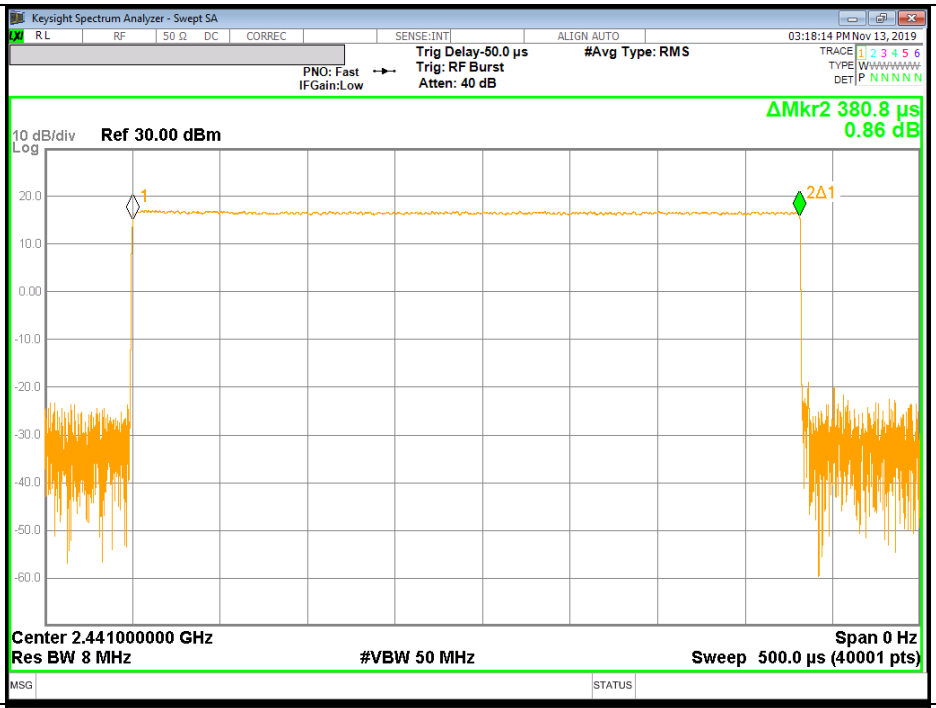
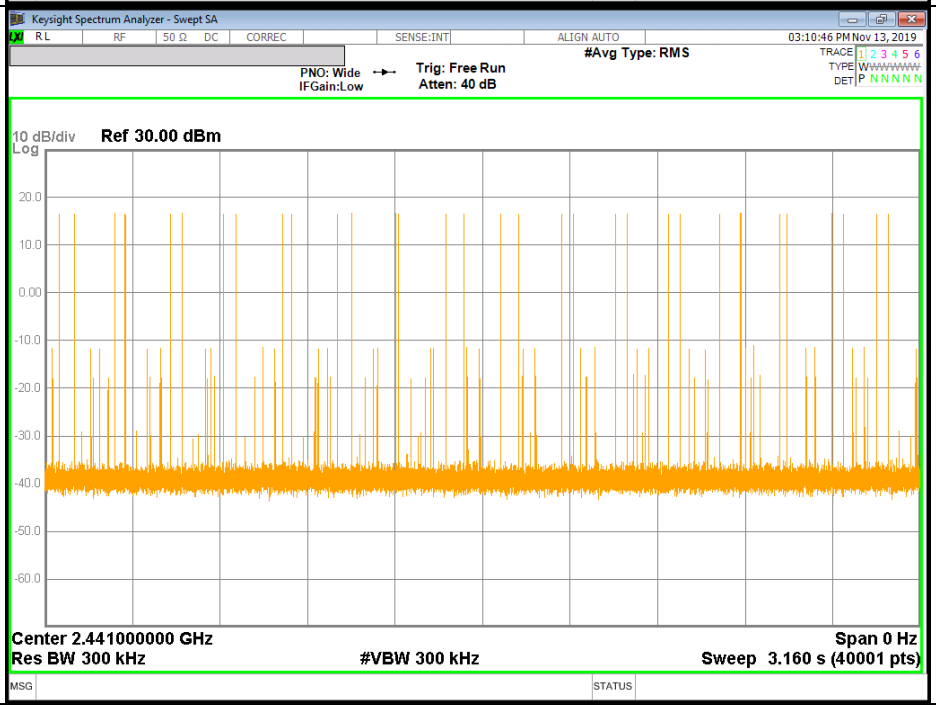
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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.

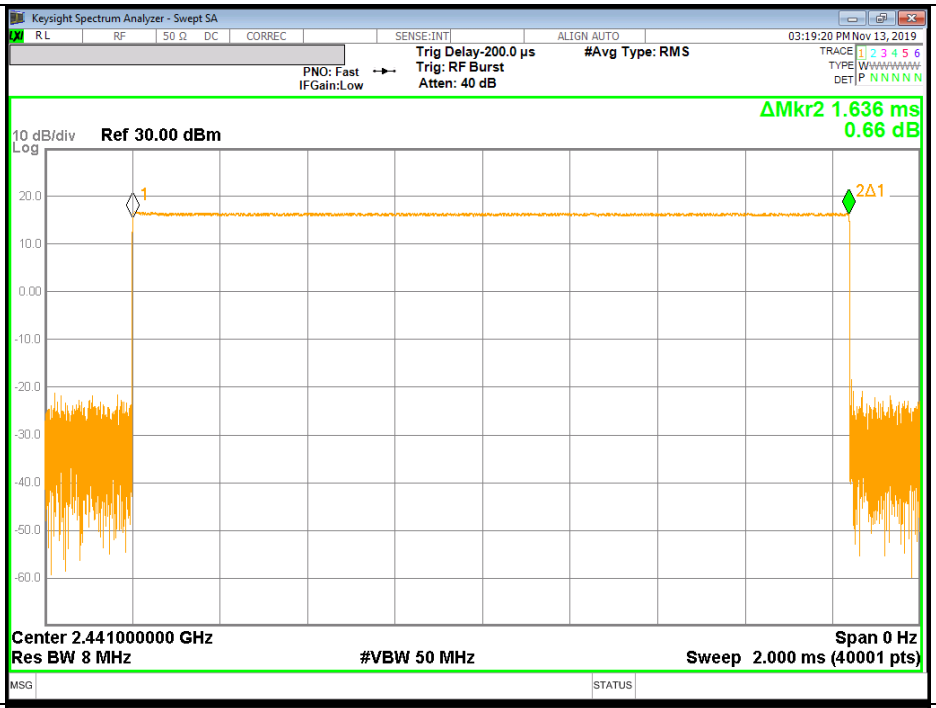
RESULTS[GFSK]

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.381	32	0.121856	0.4	-0.2781
DH3	1.636	16	0.261760	0.4	-0.1382
DH5	2.884	12	0.346080	0.4	-0.0539
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
GFSK AFH					
DH1	0.381	8	0.030464	0.4	-0.3695
DH3	1.636	4	0.065440	0.4	-0.3346
DH5	2.884	3	0.086520	0.4	-0.3135

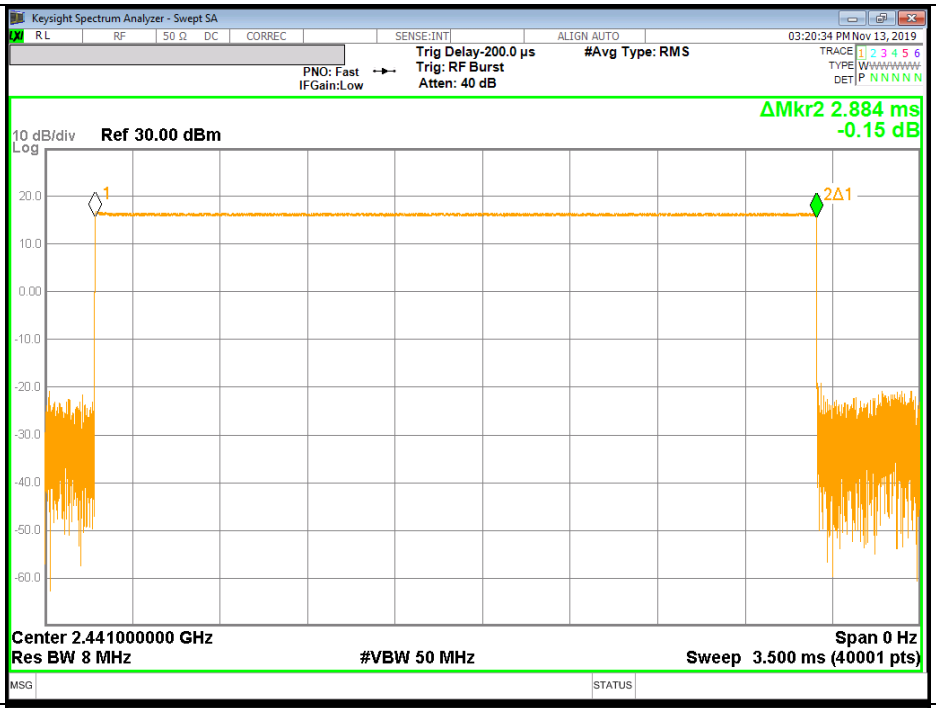
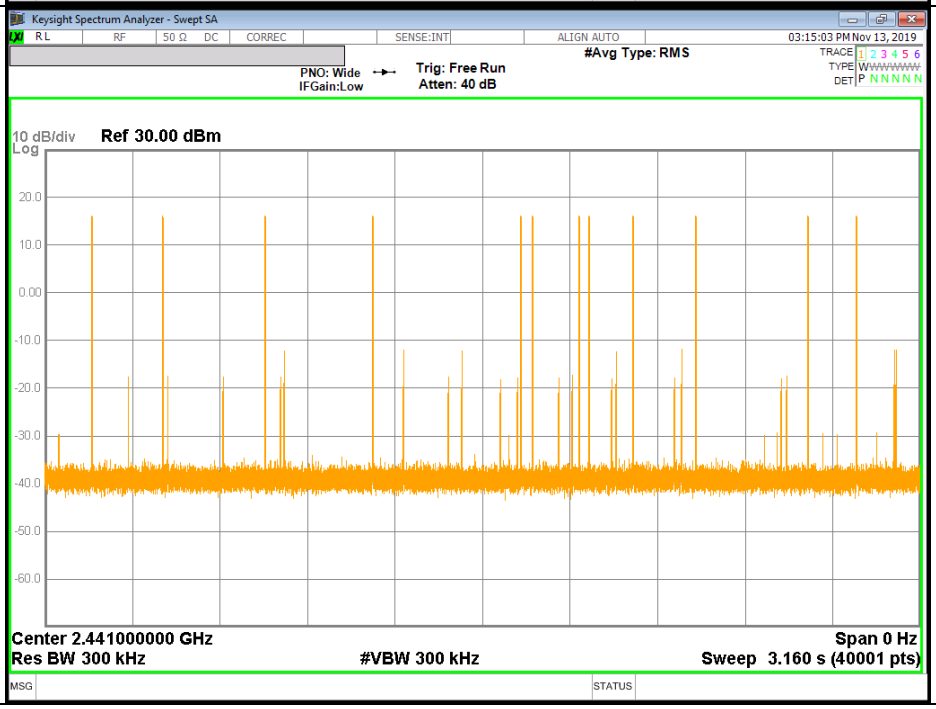
DH1

DH1 Pulse Width	
DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

DH3

DH3 Pulse Width	
DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

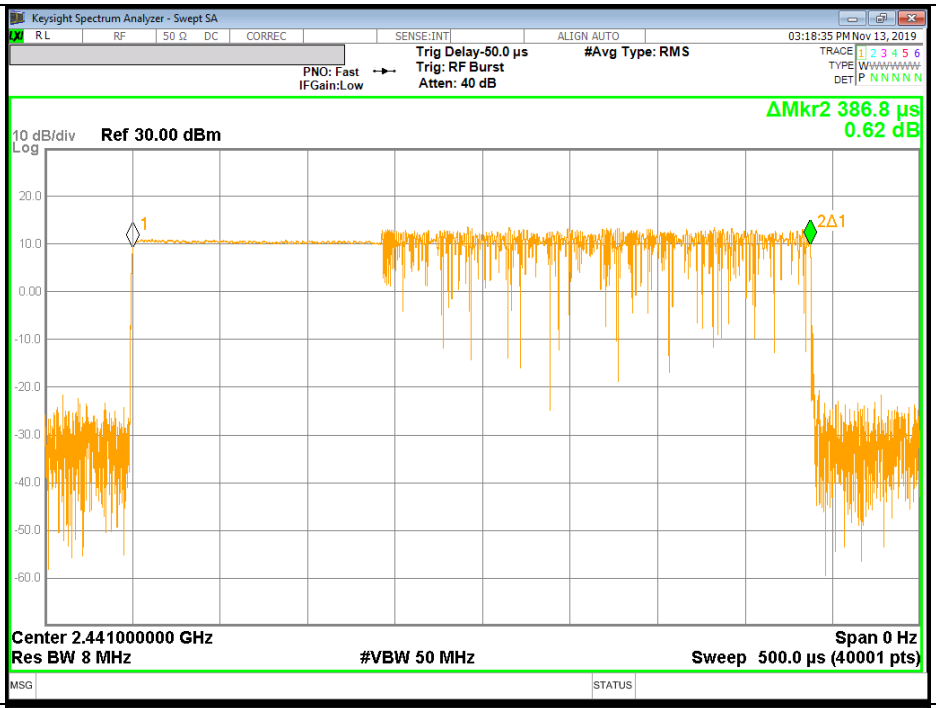
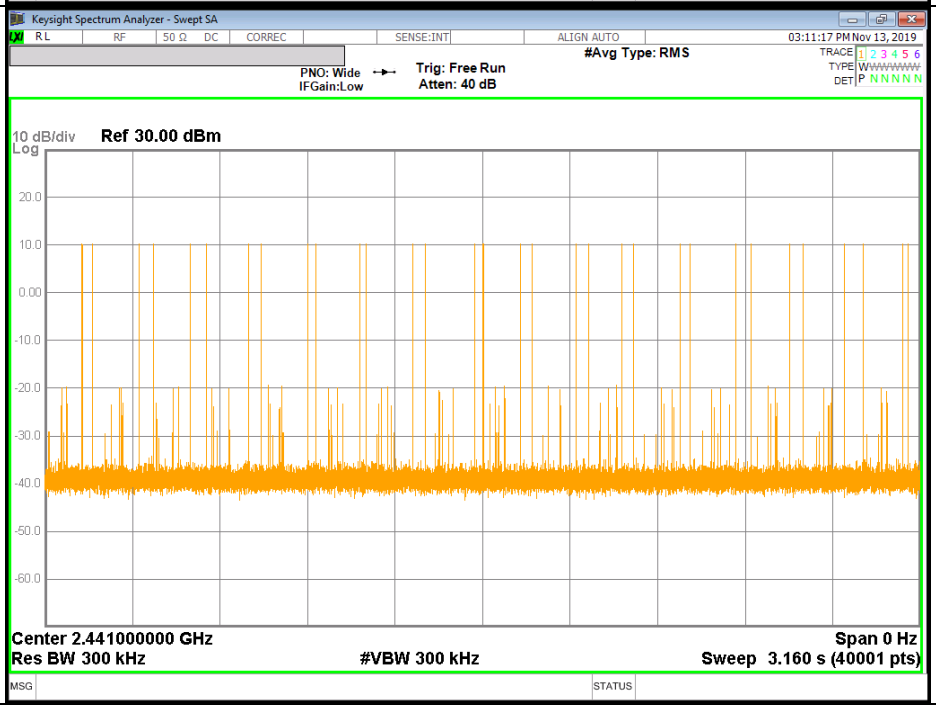
DH5

DH5 Pulse Width	
DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

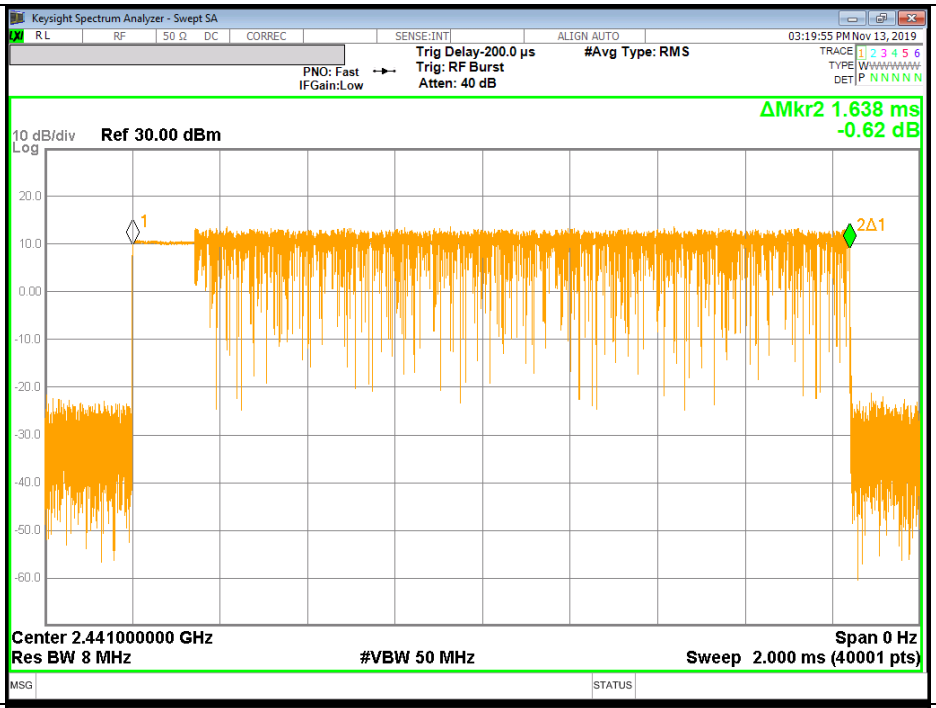
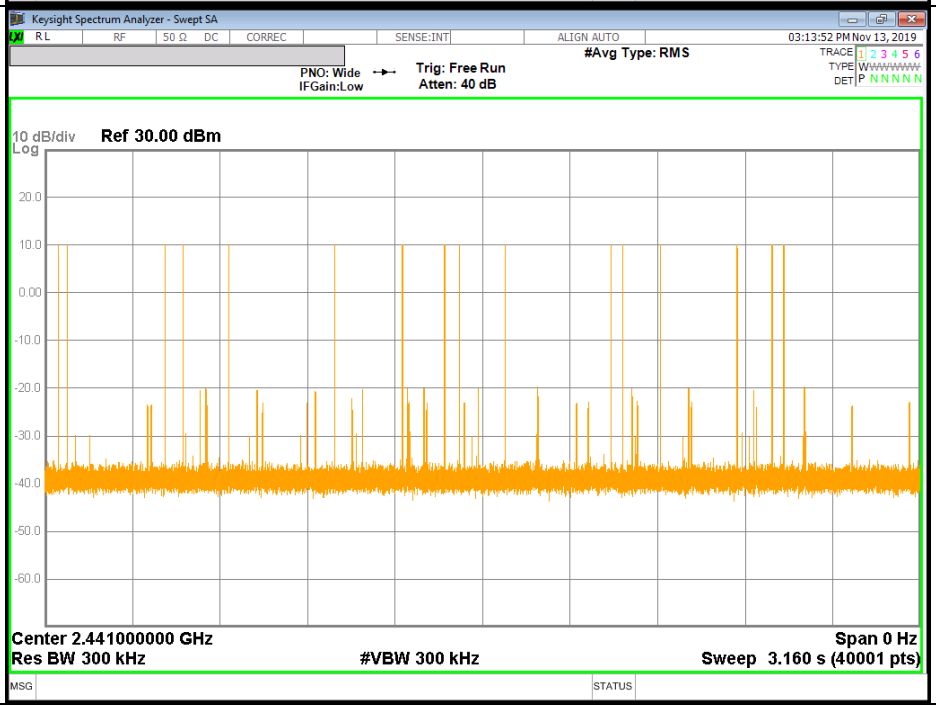
RESULTS[8PSK]

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.387	32	0.123776	0.4	-0.2762
DH3	1.638	16	0.262080	0.4	-0.1379
DH5	2.888	12	0.346560	0.4	-0.0534
DH Packet	**Pulse Width [msec]**	**Number of Pulses in 0.8 seconds**	**Average Time of Occupancy [sec]**	**Limit [sec]**	**Margin [sec]**
GFSK AFH					
DH1	0.387	8	0.030944	0.4	-0.369056
DH3	1.638	4	0.065520	0.4	-0.33448
DH5	2.888	3	0.086640	0.4	-0.31336

DH1

DH1 Pulse Width	
DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

DH3

DH3 Pulse Width	
DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

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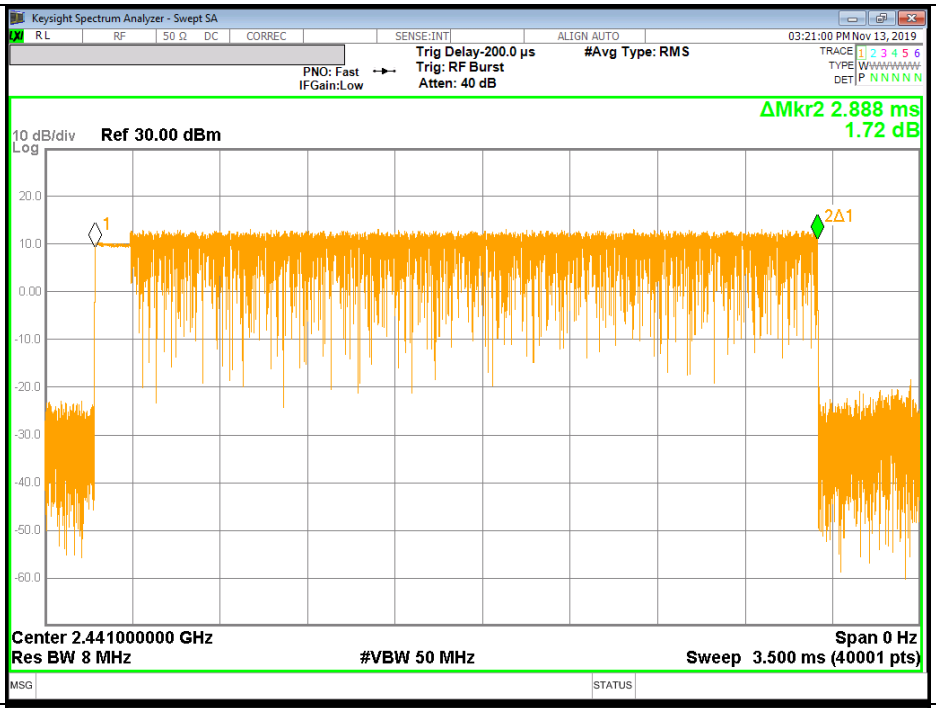
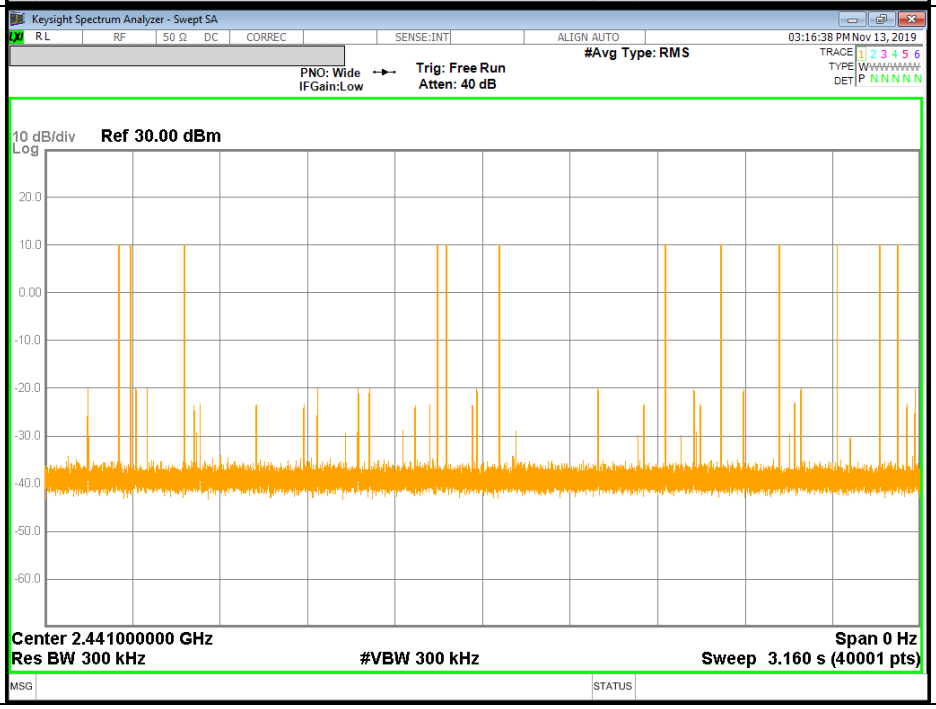
DH5

DH5 Pulse Width	
DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

10.4. OUTPUT POWER

LIMIT

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

10.4.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2 402	16.298	21.000	-4.702
Mid	2 441	**17.818**	**21.000**	**-3.182**
High	2 480	16.341	21.000	-4.659
Worst		17.818	21.000	-3.182

10.4.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

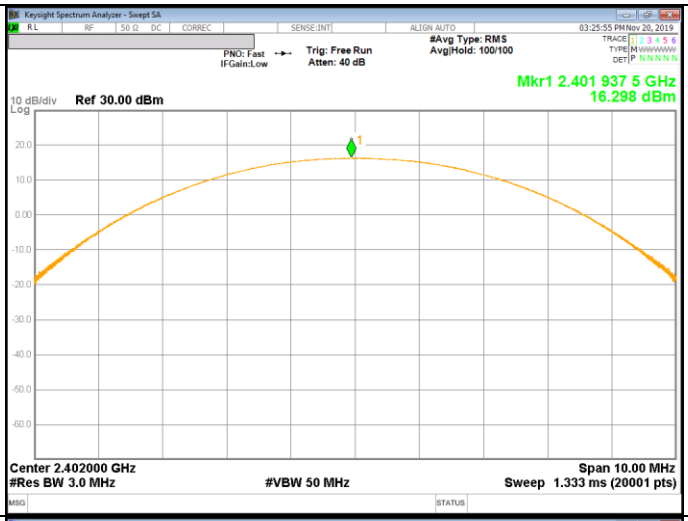
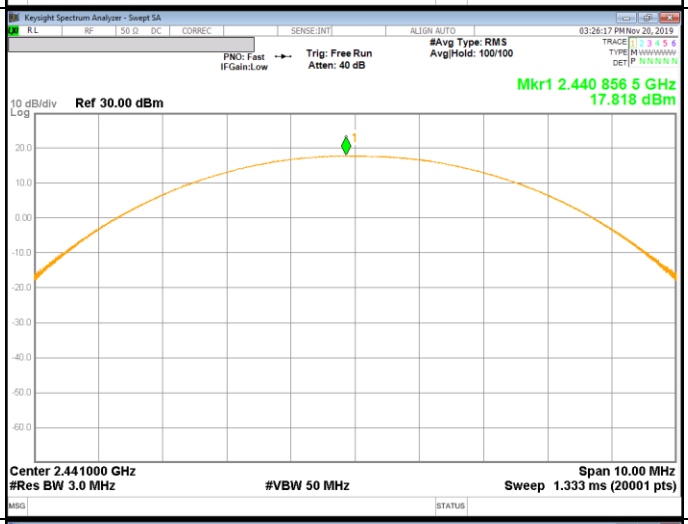
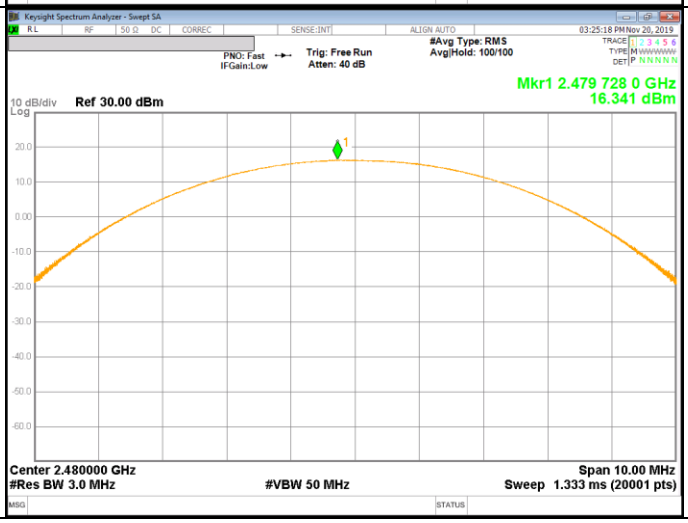
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2 402	12.404	21.000	-8.596
Mid	2 441	**13.897**	**21.000**	**-7.103**
High	2 480	12.491	21.000	-8.509
Worst		13.897	21.000	-7.103

10.4.3. ENHANCED DATA RATE 8PSK MODULATION

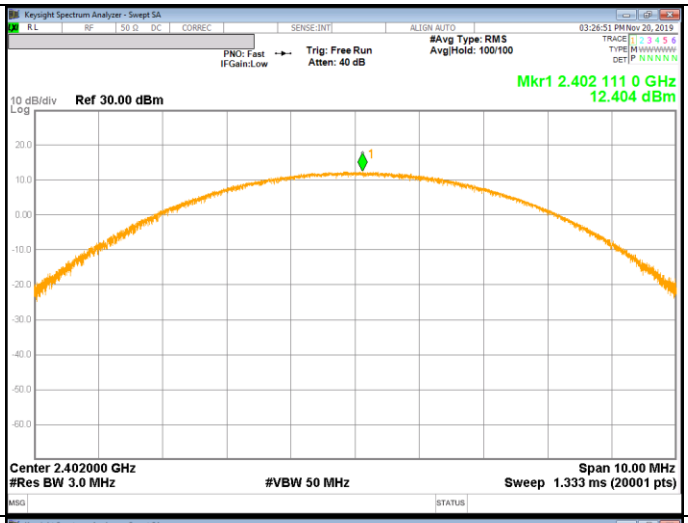
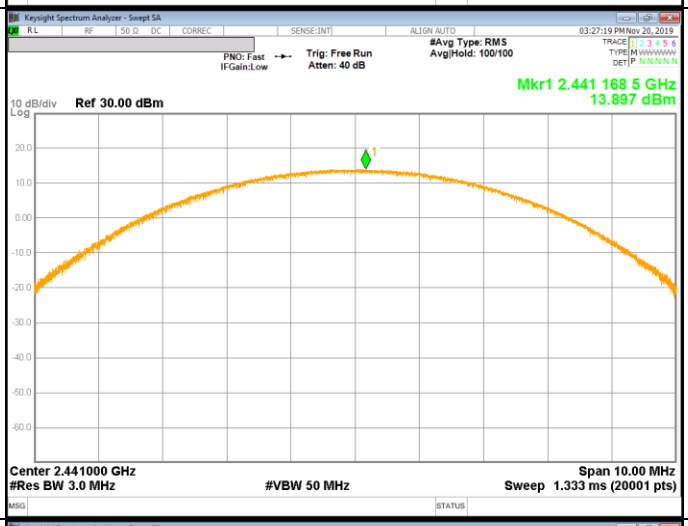
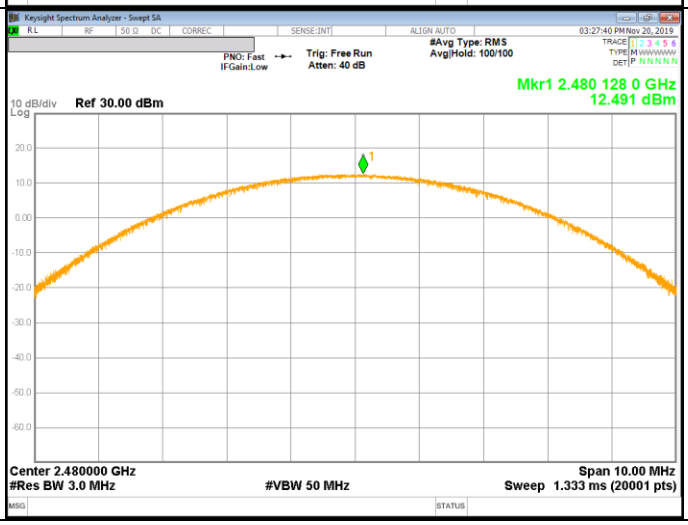
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2 402	12.800	21.000	-8.200
Mid	2 441	**14.488**	**21.000**	**-6.512**
High	2 480	12.955	21.000	-8.045
Worst		14.488	21.000	-6.512

10.4.4. OUTPUT POWER PLOTS

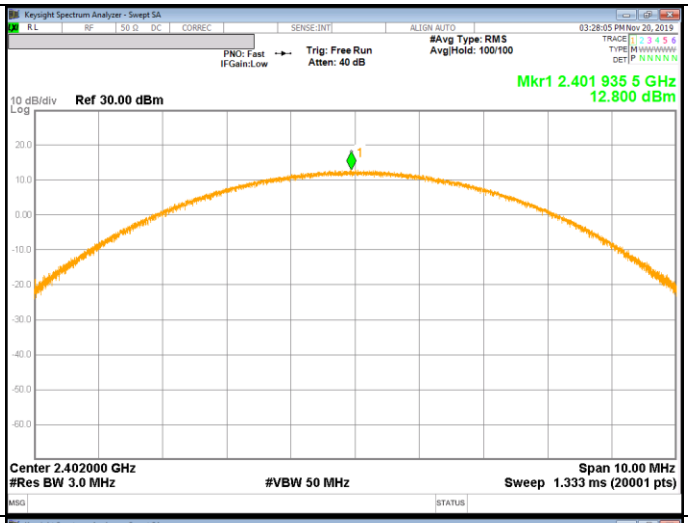
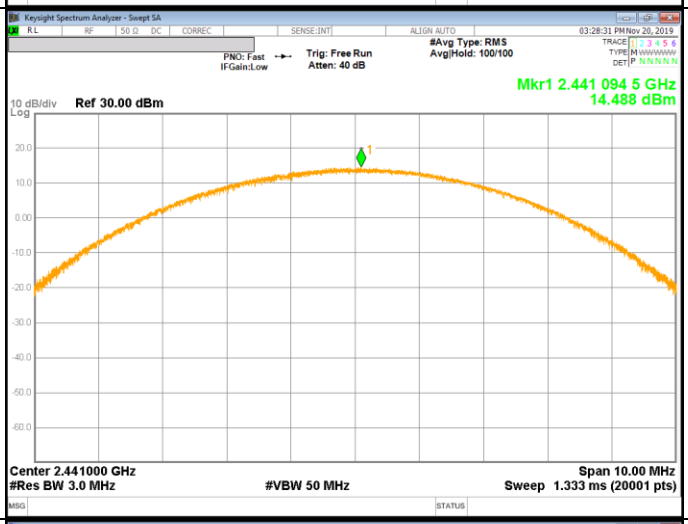
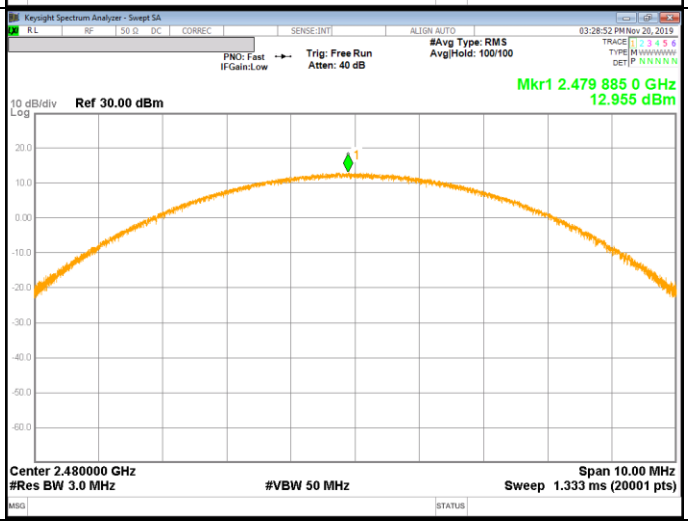
GFSK OUTPUT POWER

GFSK Low CH	
GFSK Middle CH	
GFSK High CH	

Pi/4-DPSK OUTPUT POWER

Pi/4-DPSK Low CH		
Pi/4-DPSK Middle CH		
Pi/4-DPSK High CH		

8PSK OUTPUT POWER

8PSK Low CH		
8PSK Middle CH		
8PSK High CH		

10.5. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

10.5.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2 402	15.877	38.699
Middle	2 441	**17.417**	**55.170**
High	2 480	15.794	37.966

10.5.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2 402	9.846	9.652
Middle	2 441	**11.326**	**13.571**
High	2 480	9.889	9.747

10.5.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2 402	9.721	9.377
Middle	2 441	**11.358**	**13.671**
High	2 480	9.919	9.814

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10.6. 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.

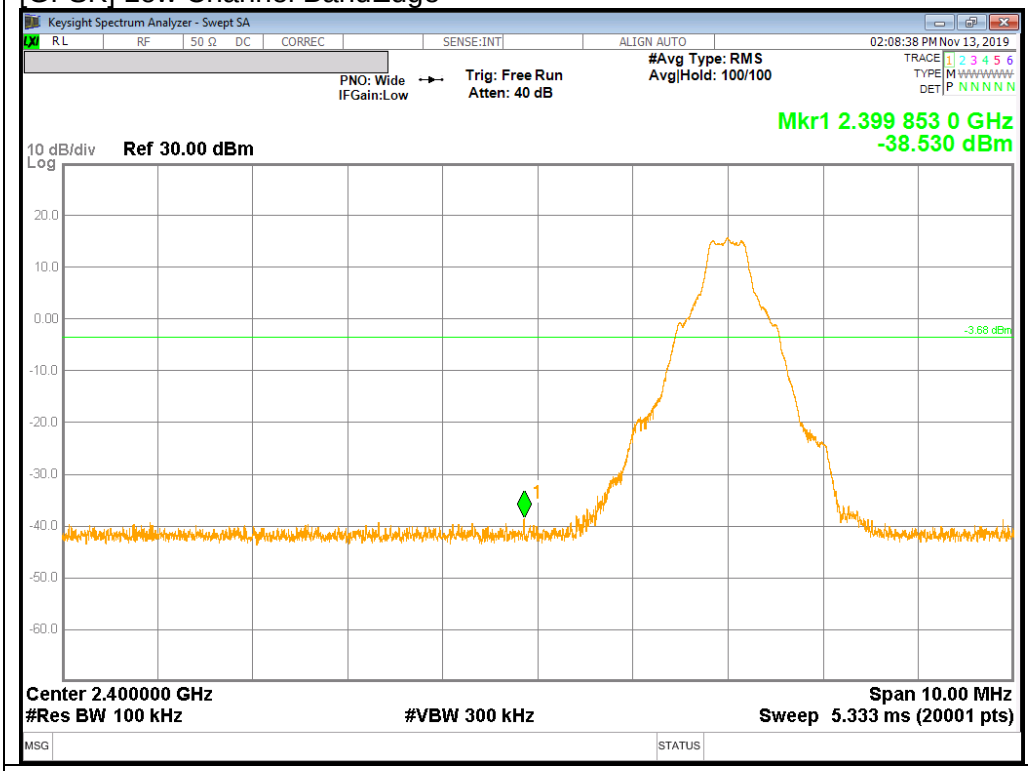
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

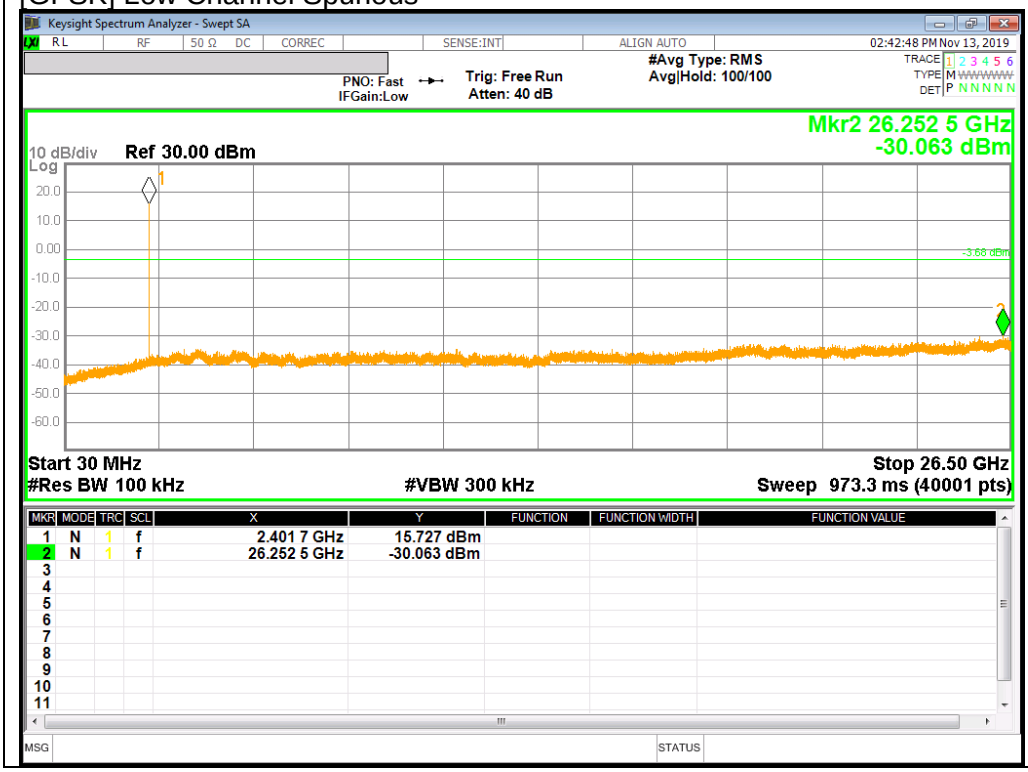
10.6.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

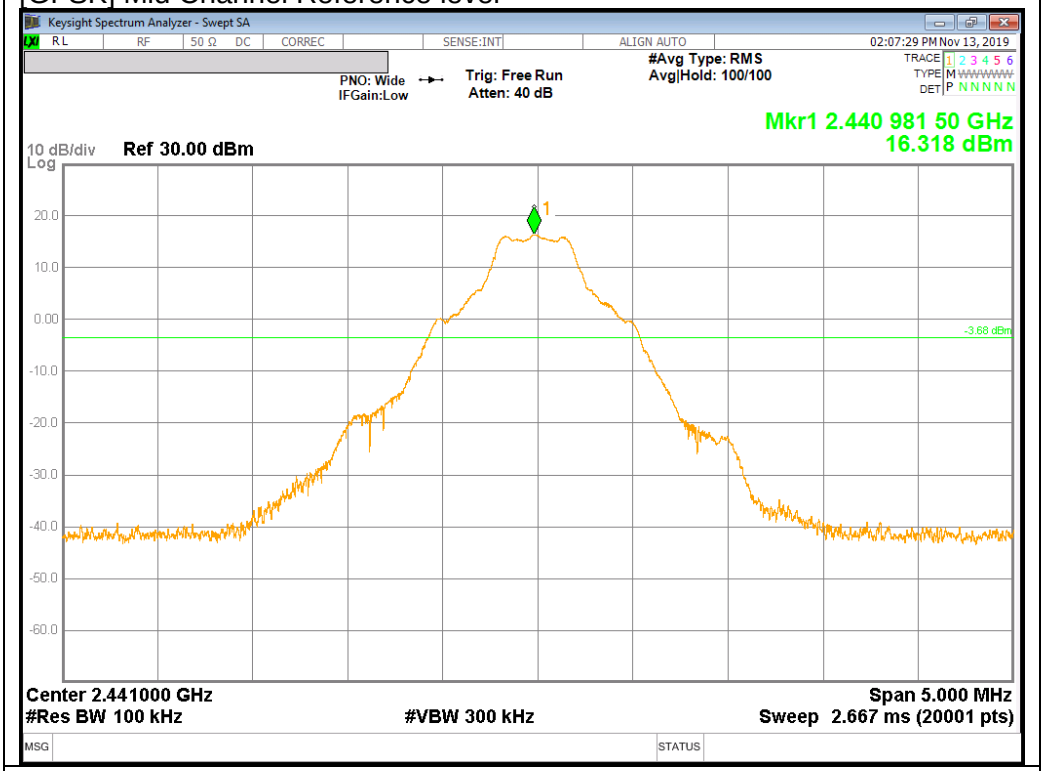
[GFSK] Low Channel BandEdge



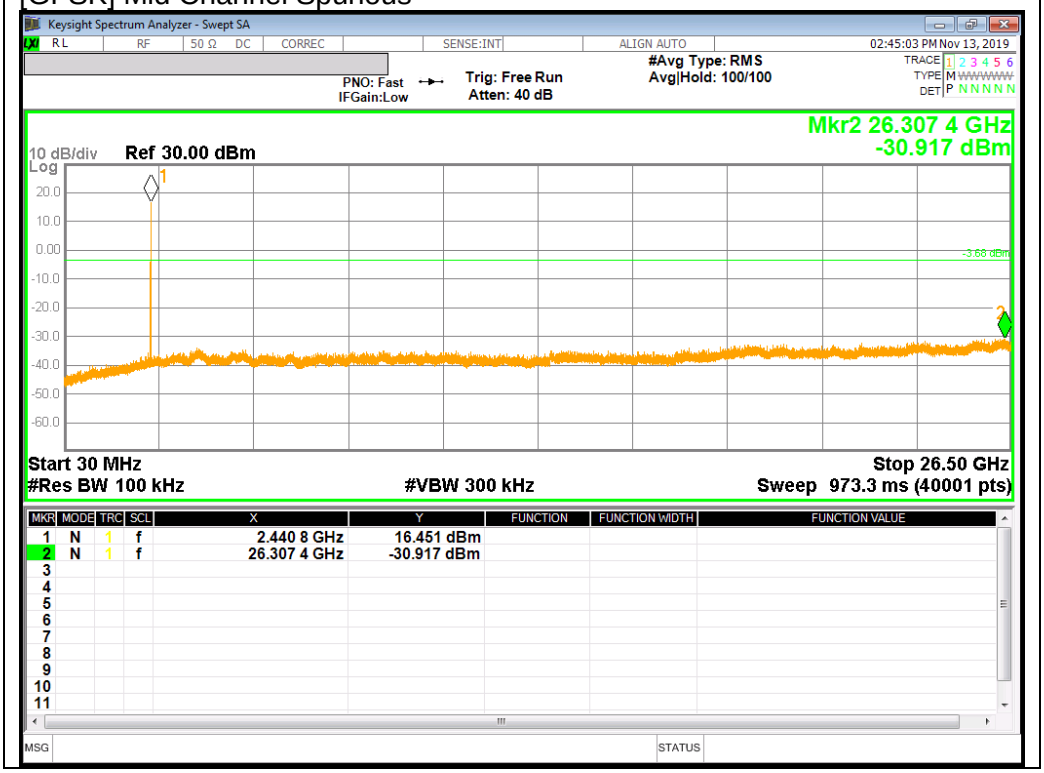
[GFSK] Low Channel Spurious



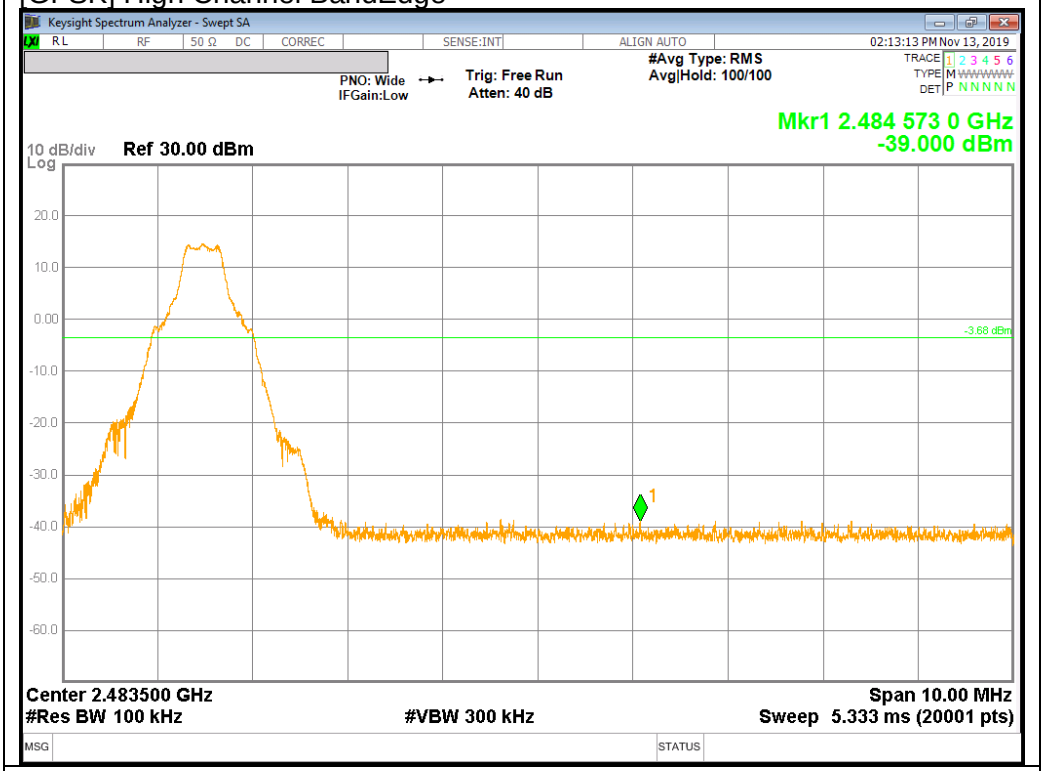
[GFSK] Mid Channel Reference level



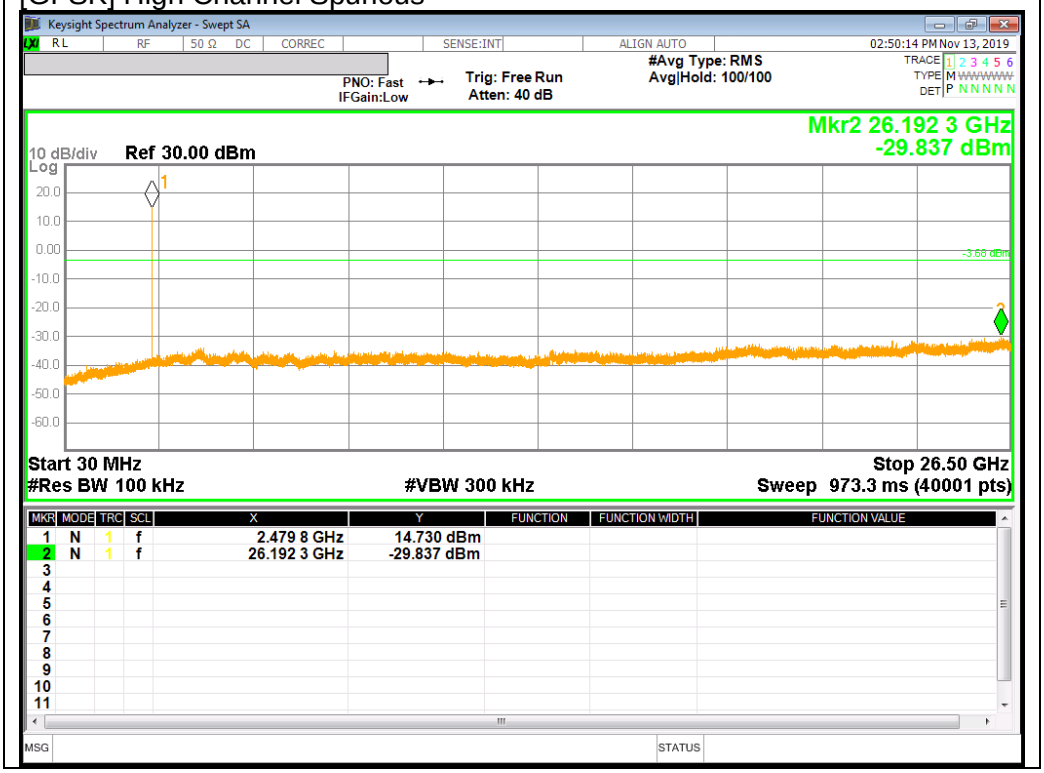
[GFSK] Mid Channel Spurious



[GFSK] High Channel BandEdge

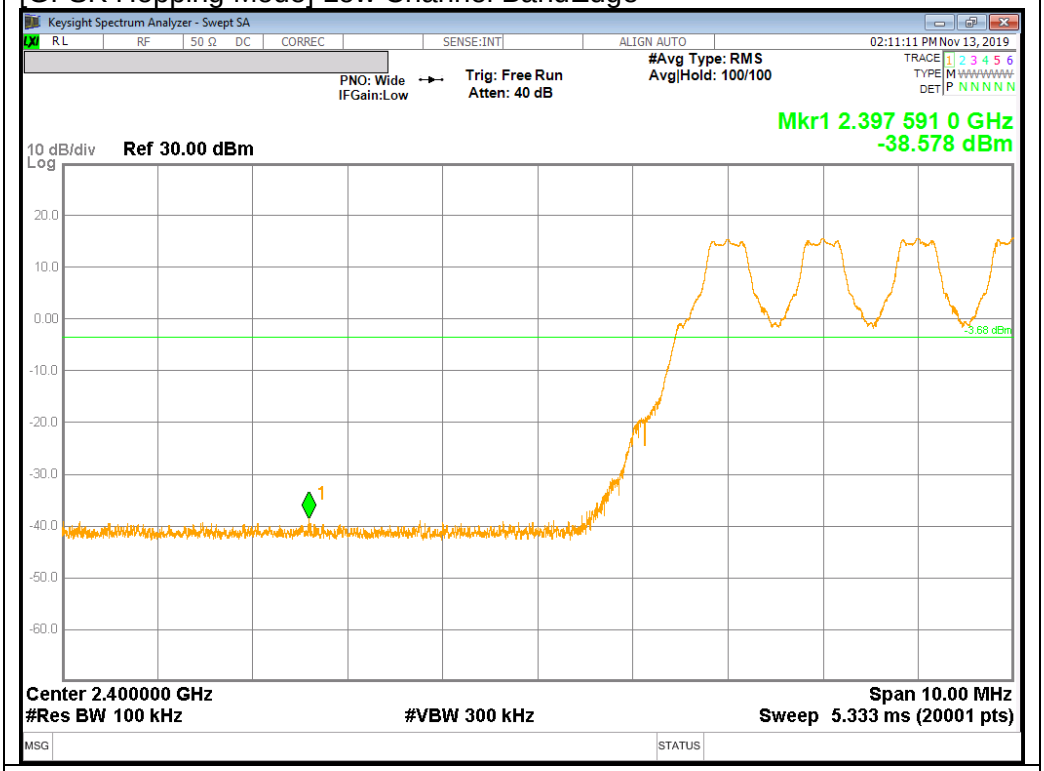


[GFSK] High Channel Spurious

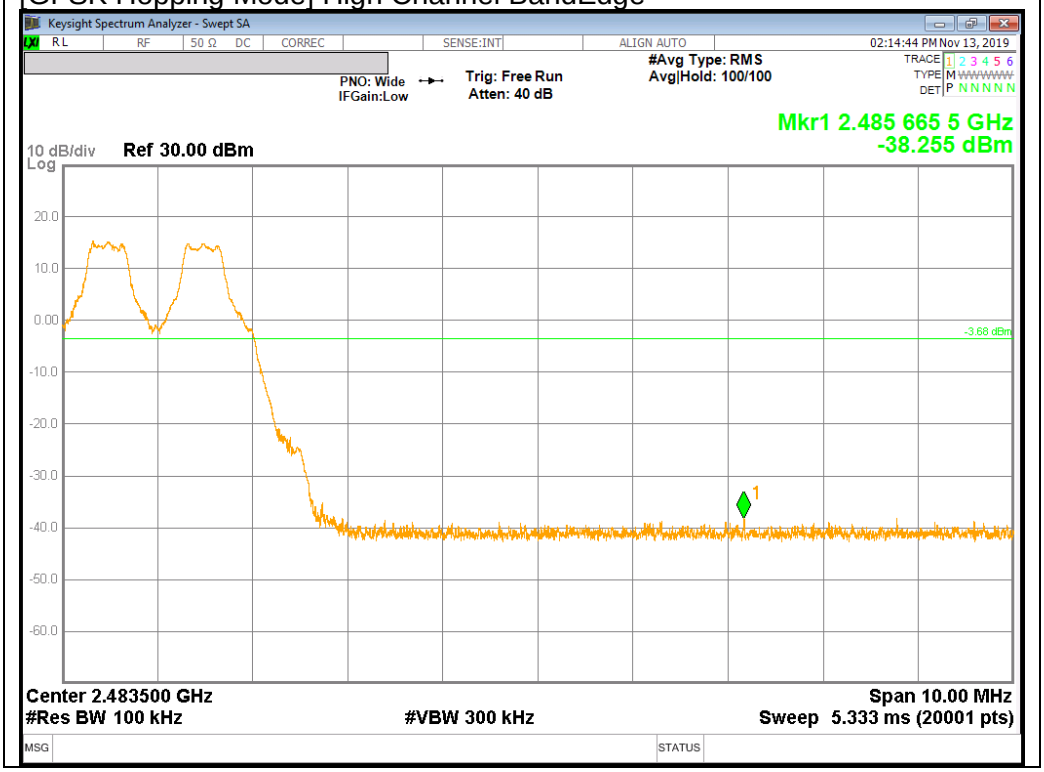


BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge



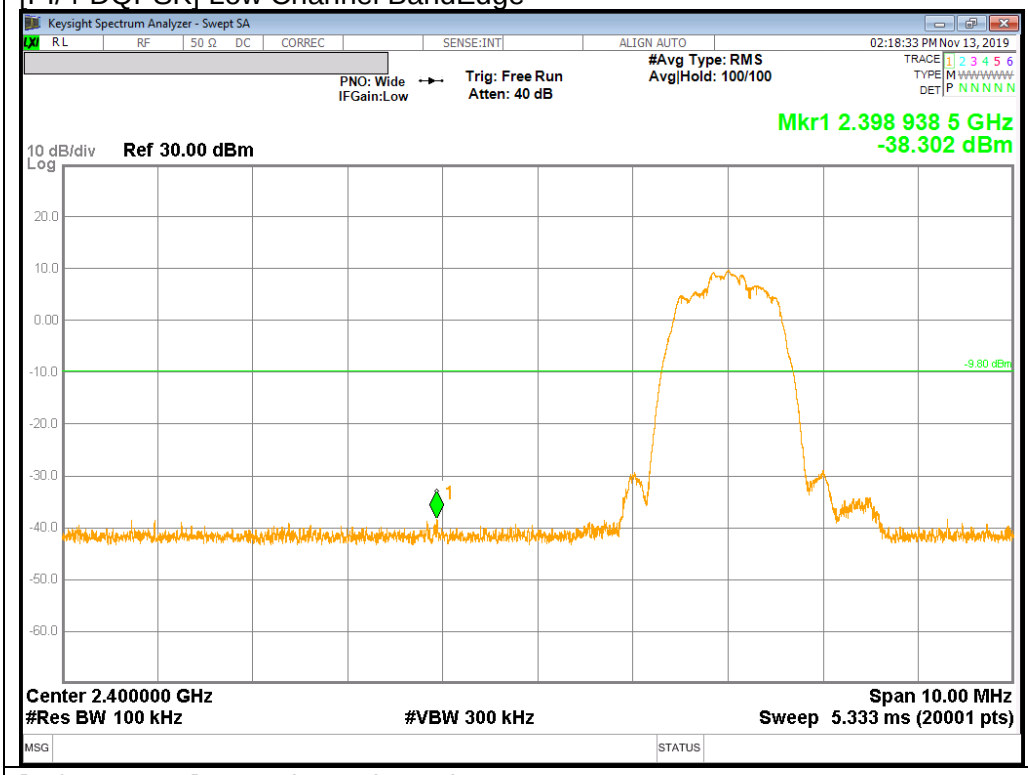
[GFSK Hopping Mode] High Channel BandEdge



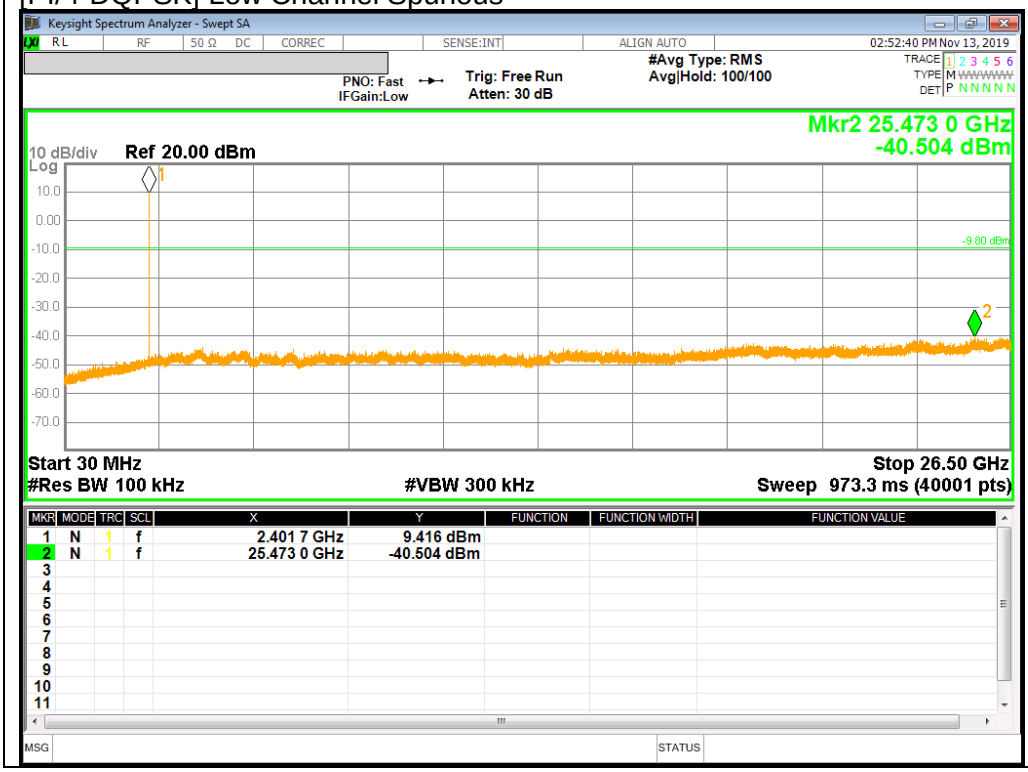
10.6.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

PI/4-DQPSK Mode

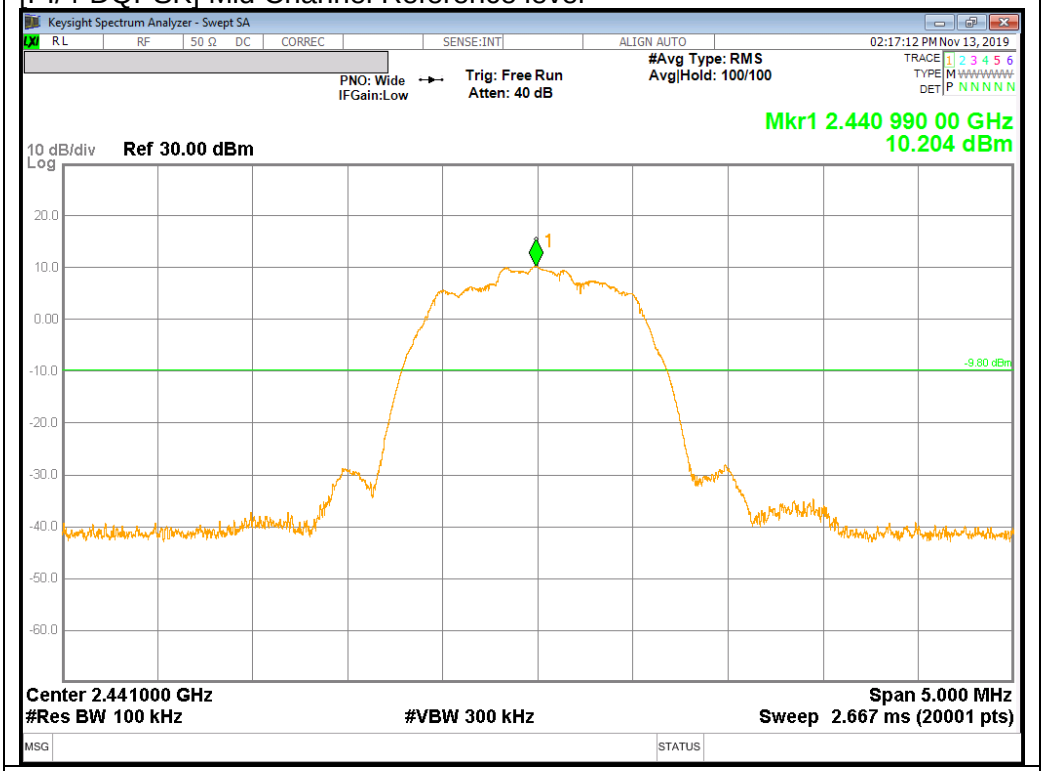
[PI/4-DQPSK] Low Channel BandEdge



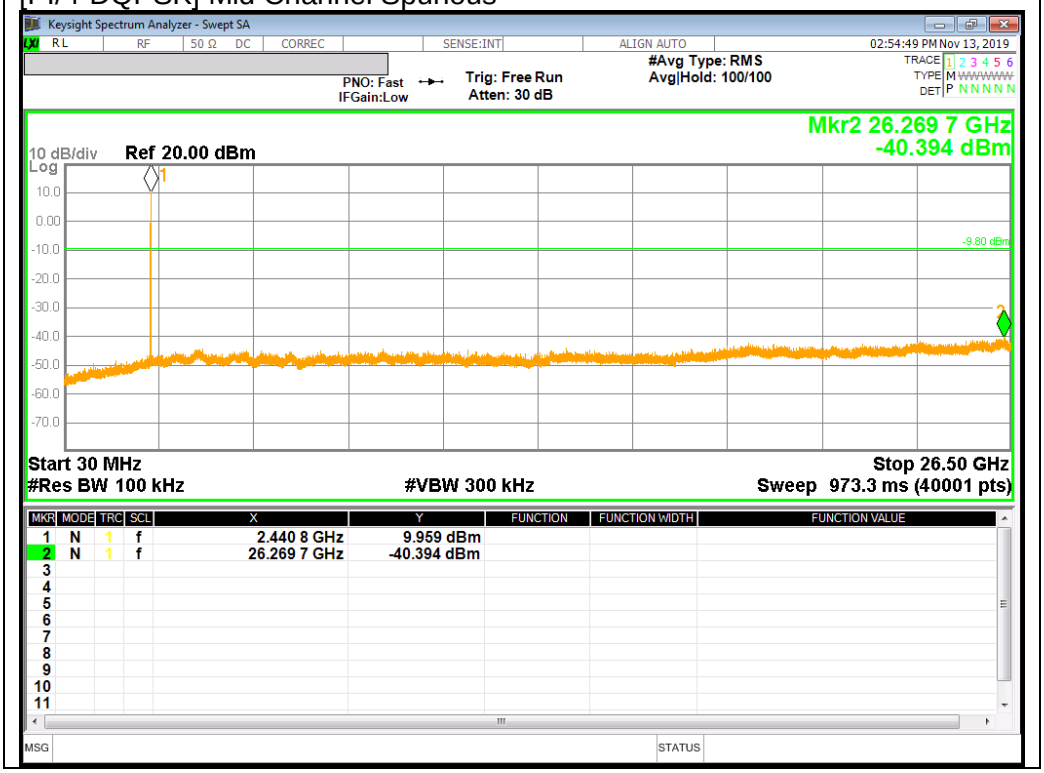
[PI/4-DQPSK] Low Channel Spurious



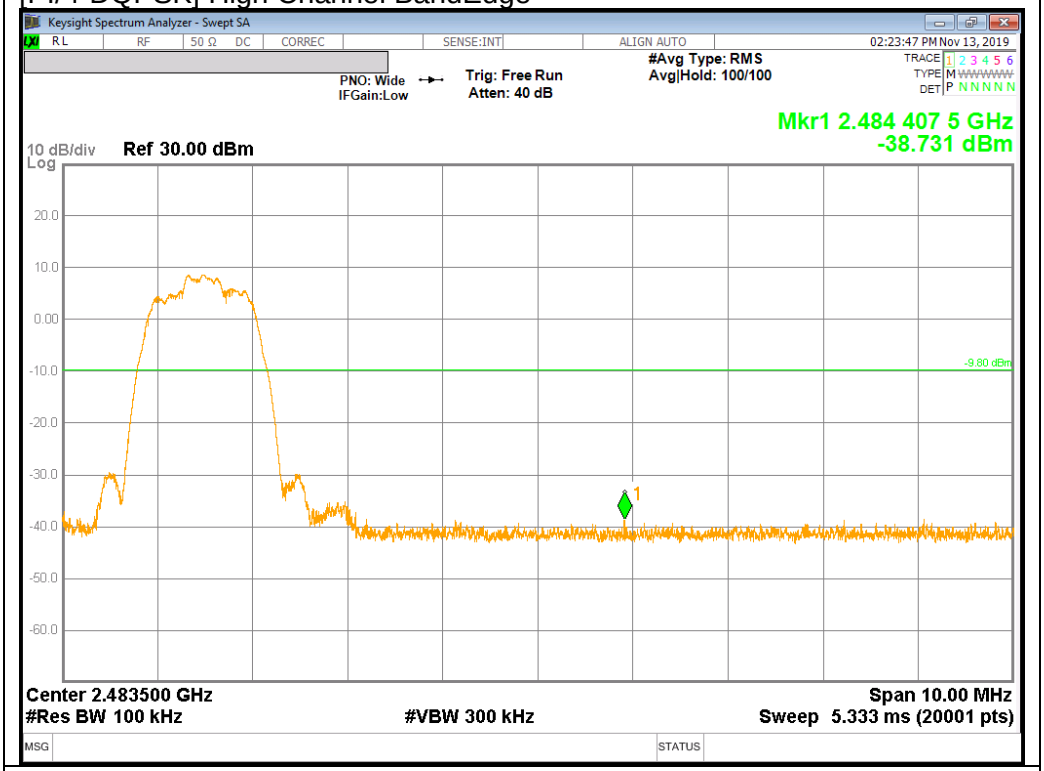
[PI/4-DQPSK] Mid Channel Reference level



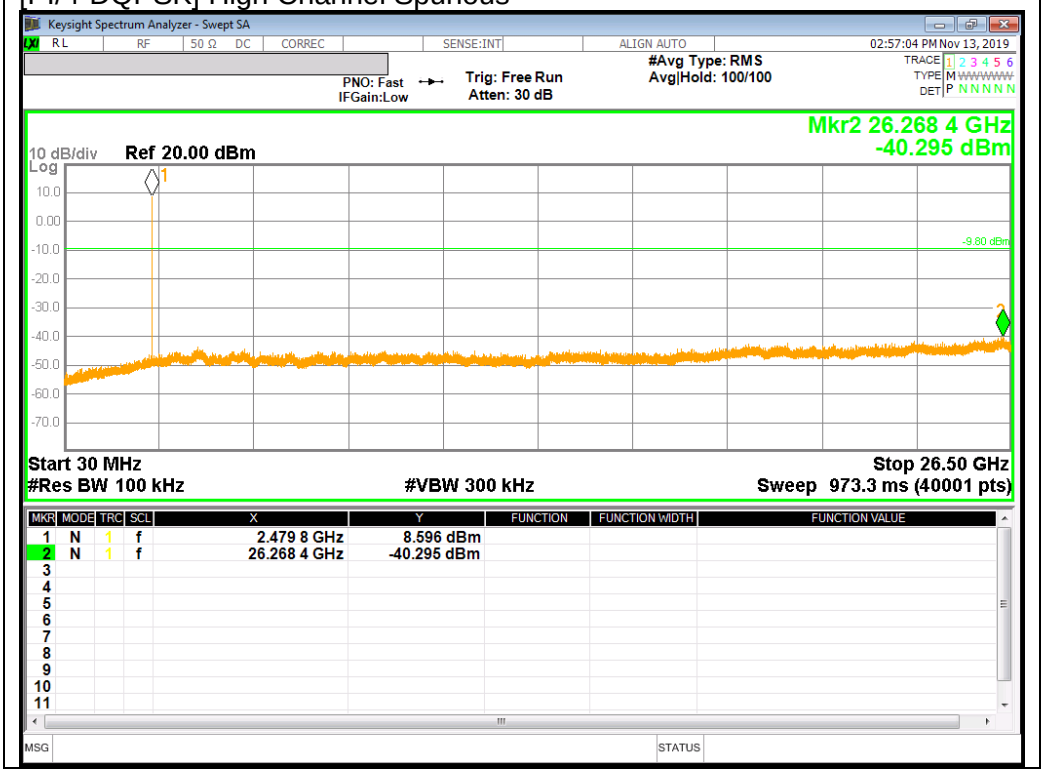
[PI/4-DQPSK] Mid Channel Spurious



[PI/4-DQPSK] High Channel BandEdge

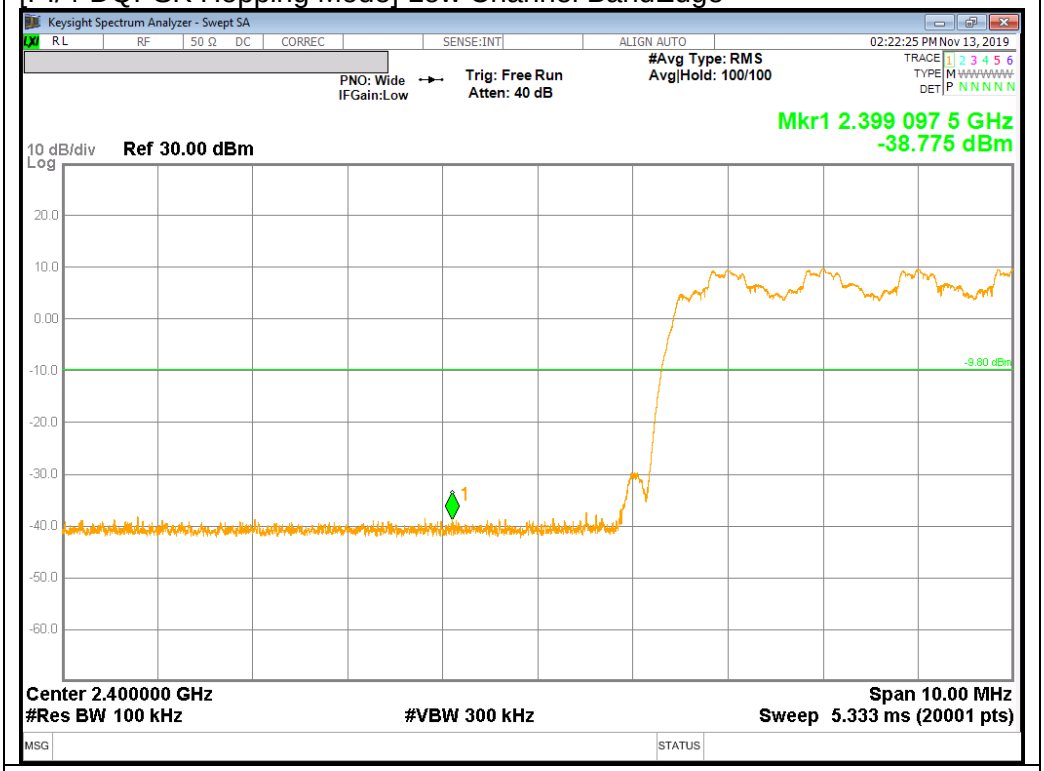


[PI/4-DQPSK] High Channel Spurious

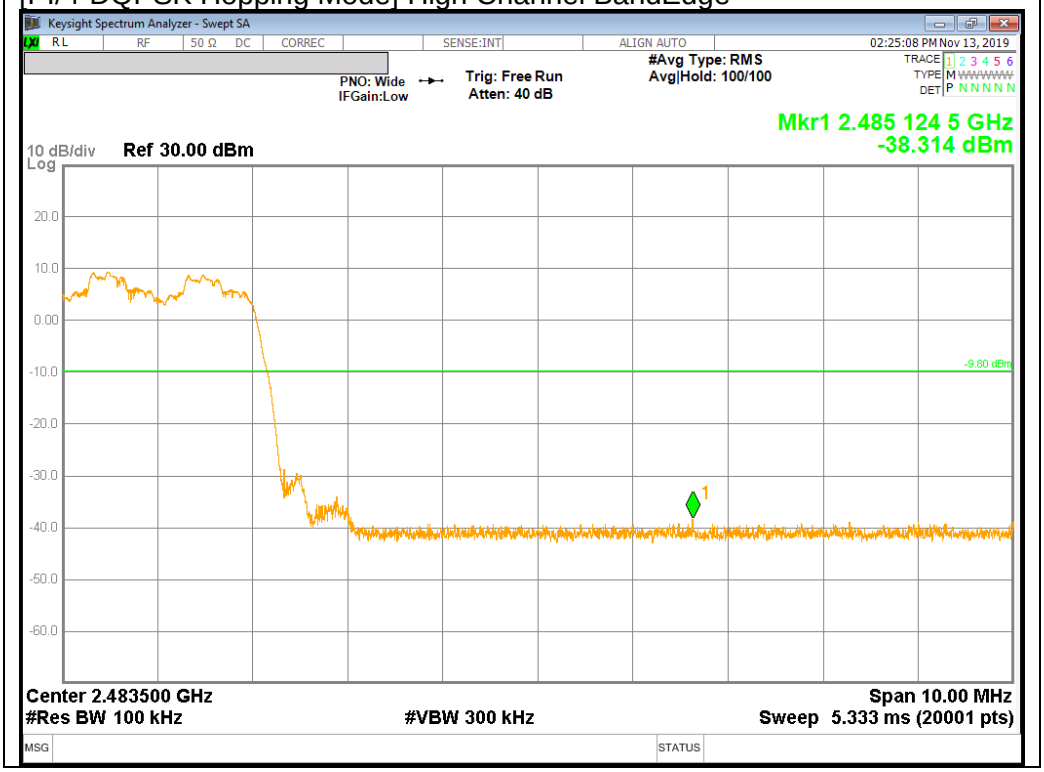


BandEdge Emission at PI/4-DQPSK Hopping Mode

[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



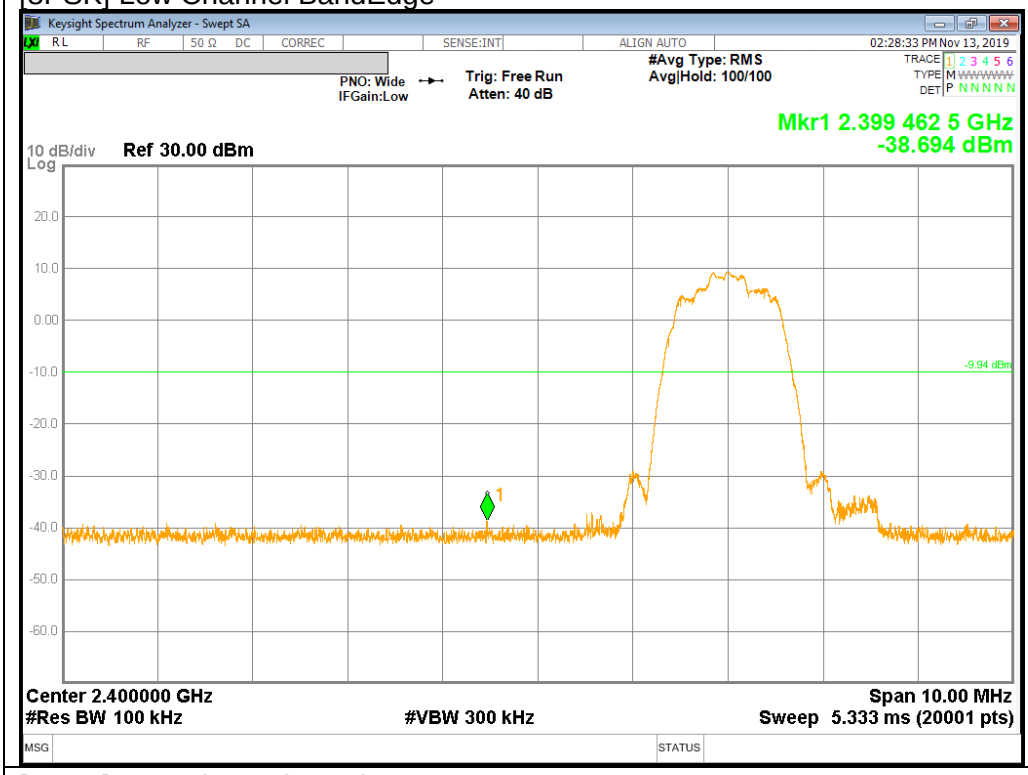
[PI/4-DQPSK Hopping Mode] High Channel BandEdge



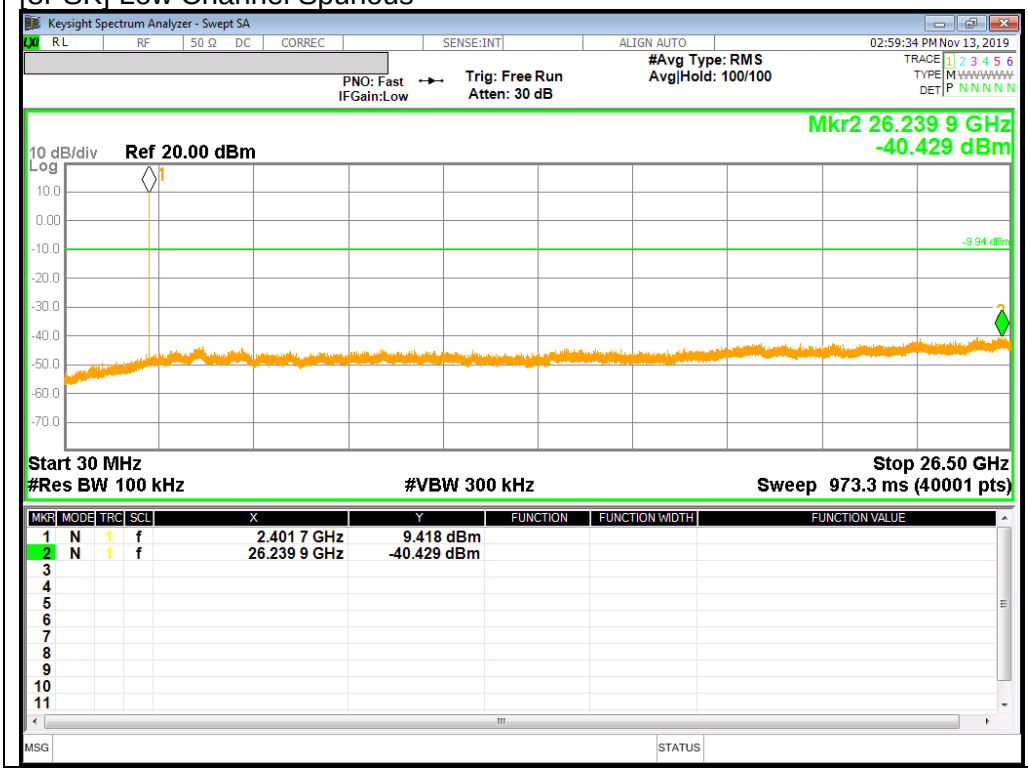
10.6.3. ENHANCED DATA RATE 8PSK MODULATION

8PSK Mode

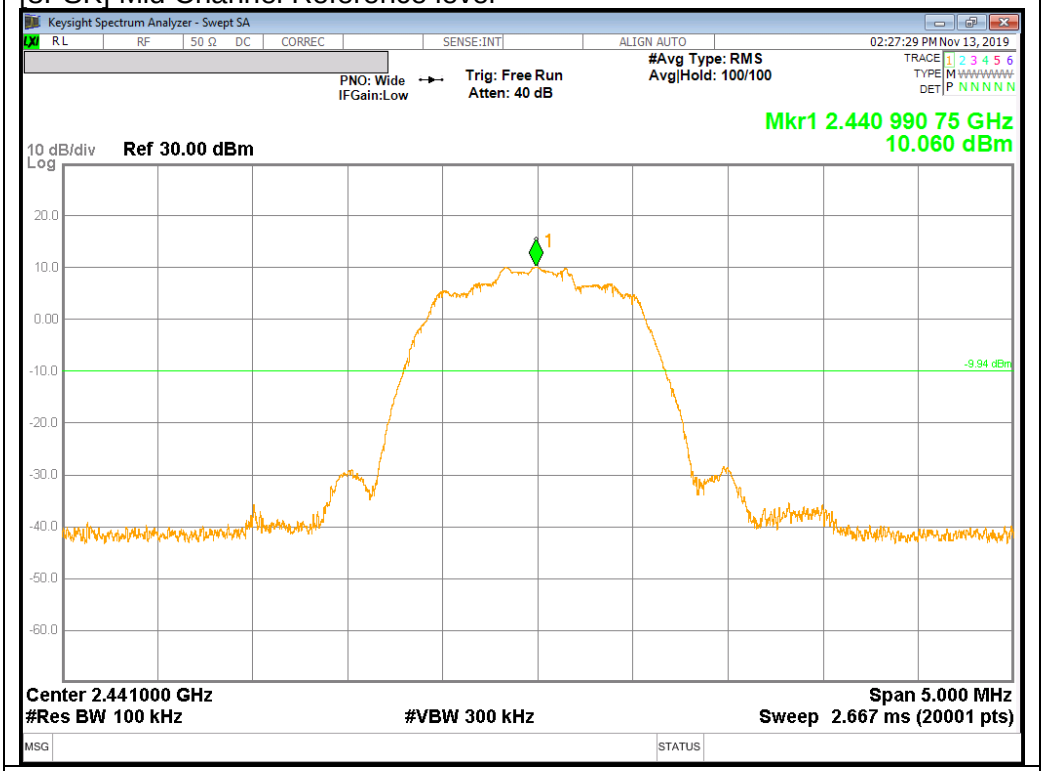
[8PSK] Low Channel BandEdge



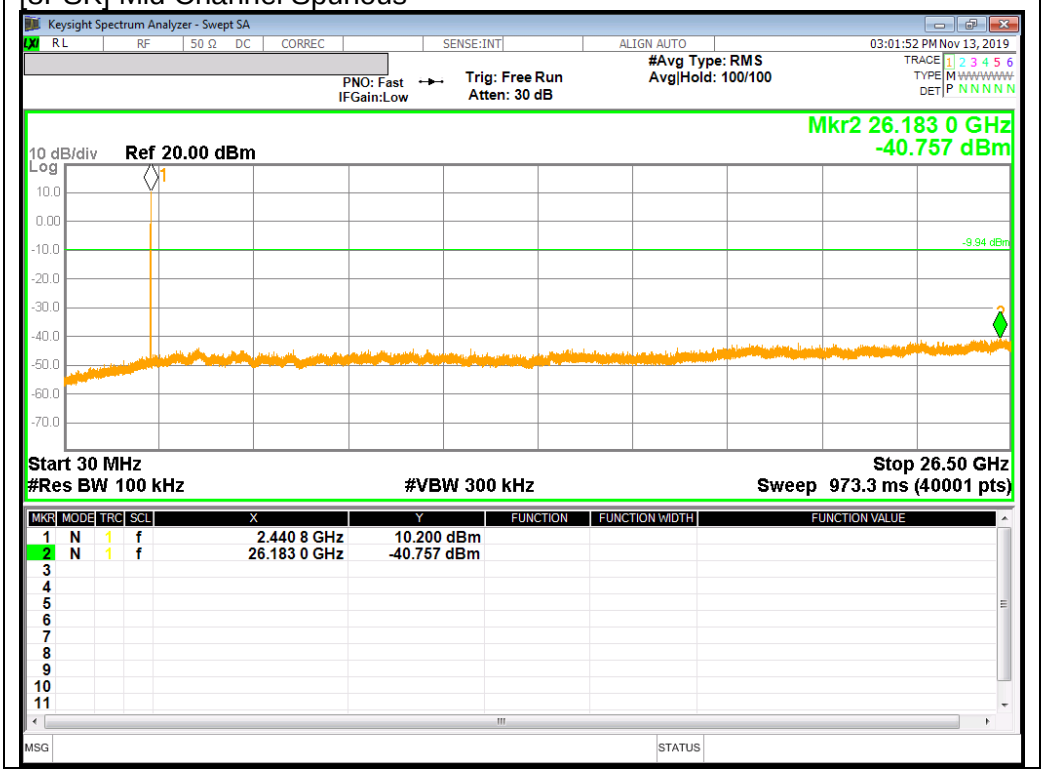
[8PSK] Low Channel Spurious



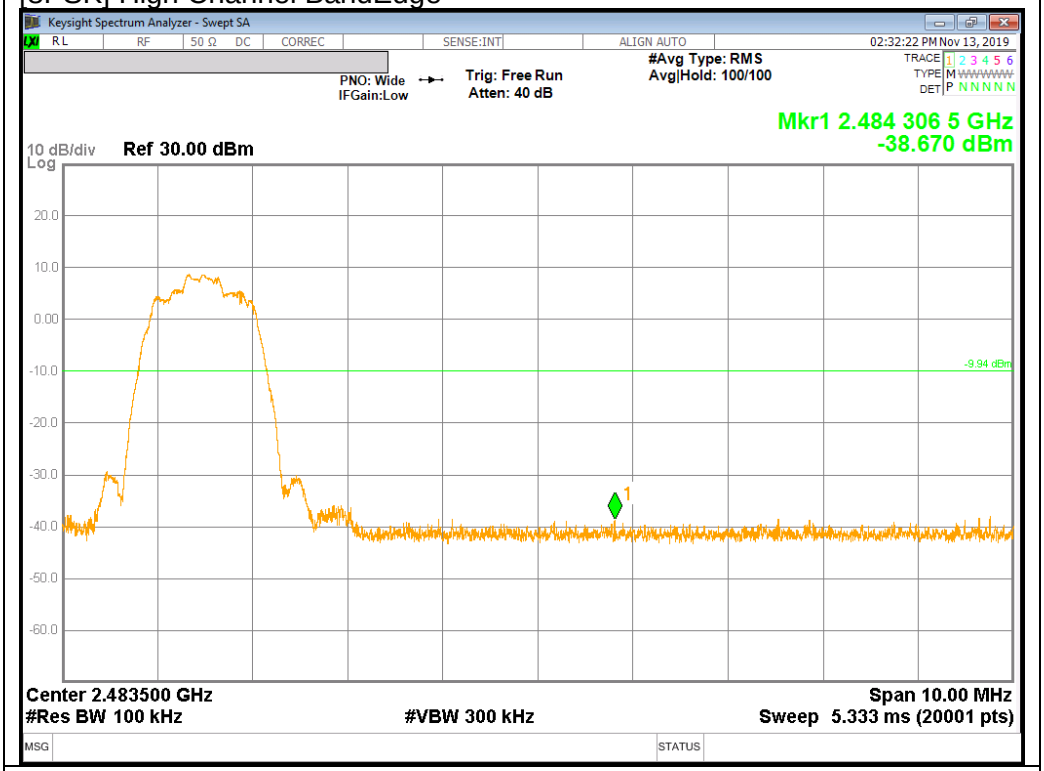
[8PSK] Mid Channel Reference level



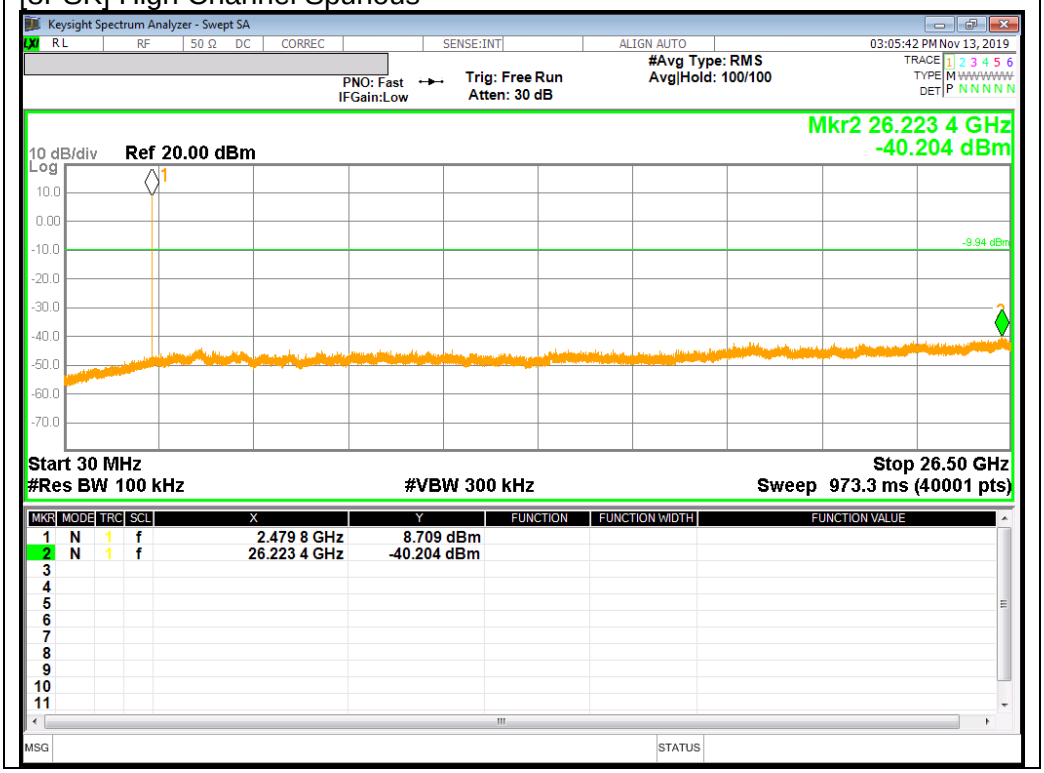
[8PSK] Mid Channel Spurious



[8PSK] High Channel BandEdge

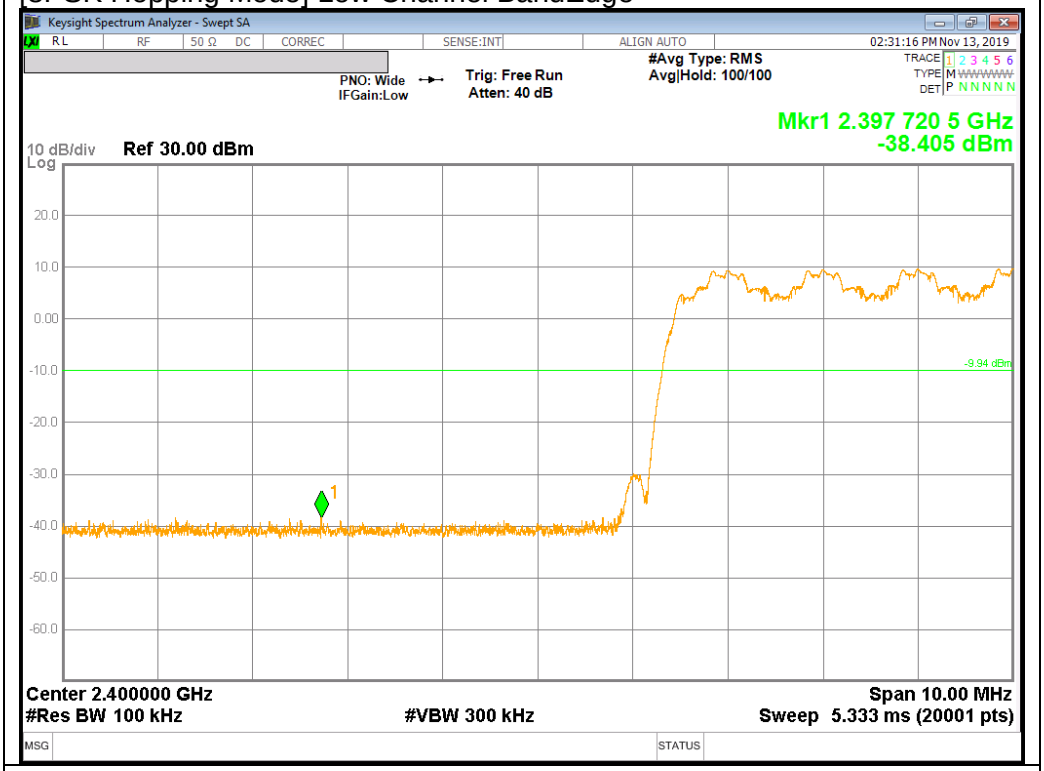


[8PSK] High Channel Spurious

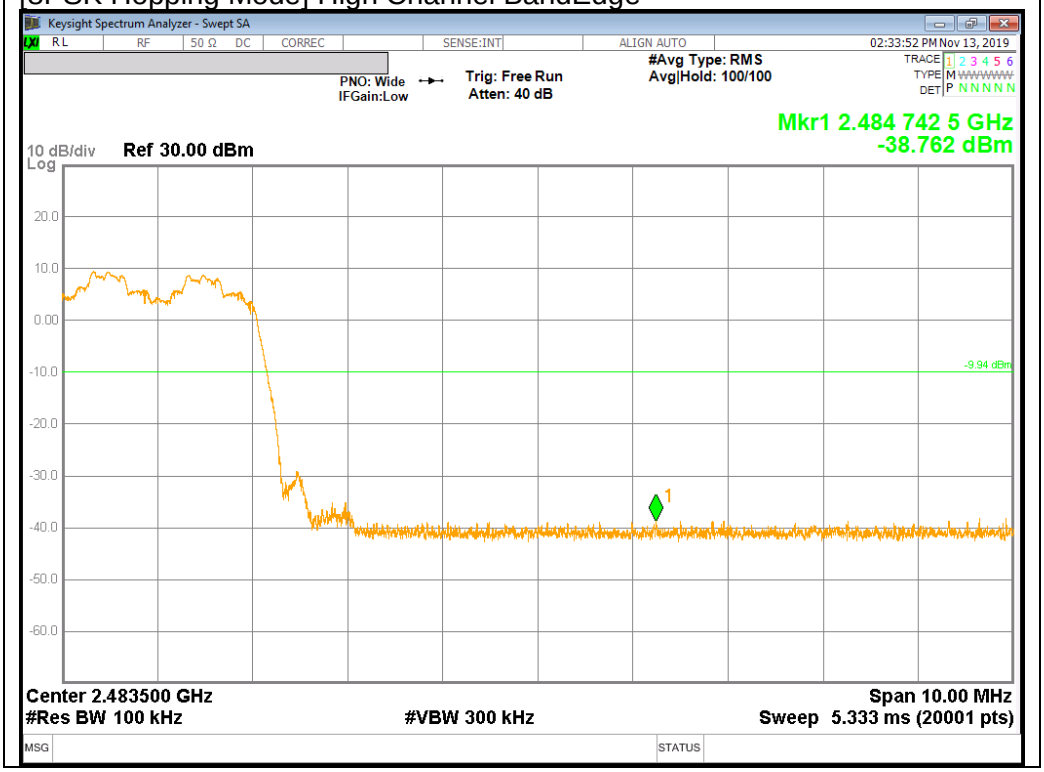


BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge



[8PSK Hopping Mode] High Channel BandEdge



11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (μV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. 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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.(Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.)

For band edge 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/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.002885S = 347Hz.

The minimum VBW was 347Hz, but test receiver(ESU40) couldn't set value 347Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

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.

Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.

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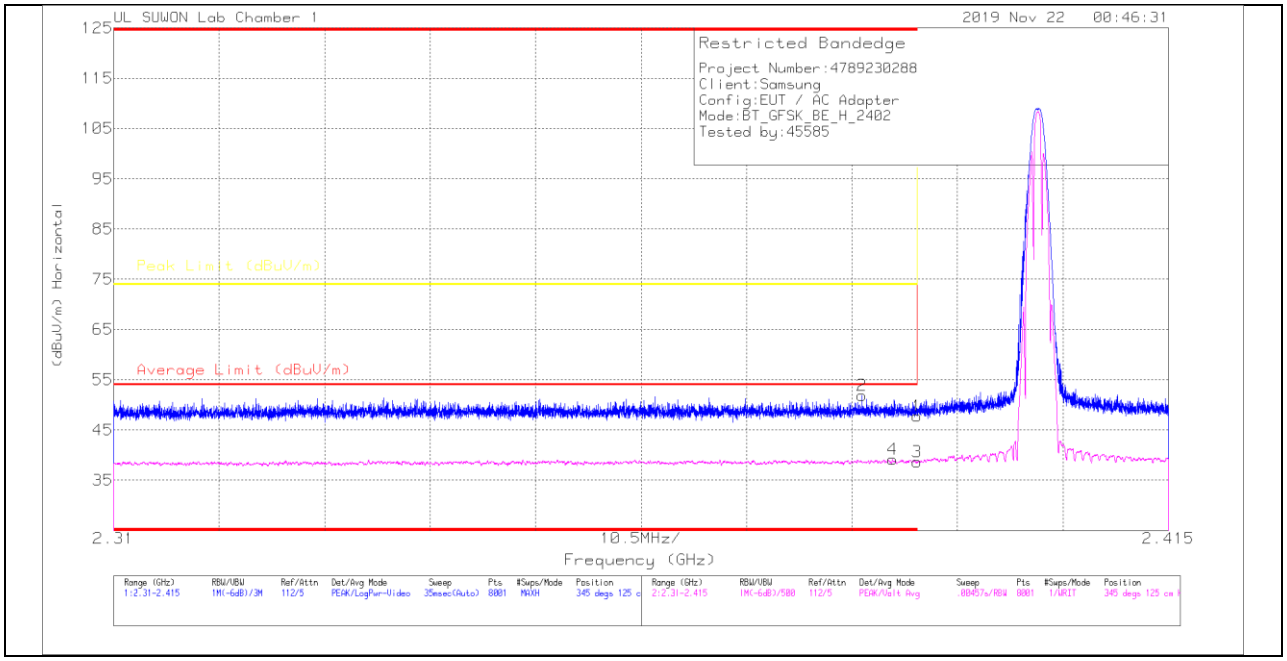
11.2. TRANSMITTER ABOVE 1 GHz

11.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



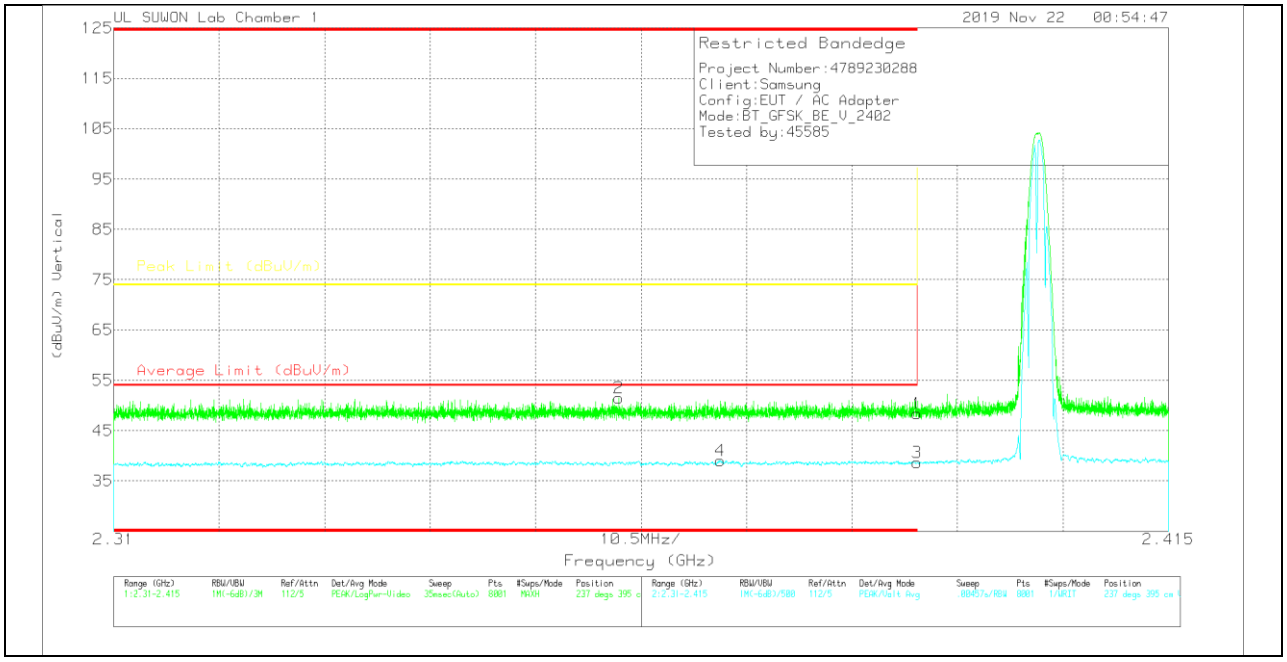
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	41.61	Pk	31.7	-25.5	47.81	-	-	74	-26.19	345	125	H
2	* 2.38448	45.7	Pk	31.7	-25.5	51.9	-	-	74	-22.1	345	125	H
3	* 2.39	32.52	VA1T	31.7	-25.5	38.72	54	-15.28	-	-	345	125	H
4	* 2.38753	32.94	VA1T	31.7	-25.5	39.14	54	-14.86	-	-	345	125	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 PEAK AND AVERAGE PLOT



VERTICAL DATA

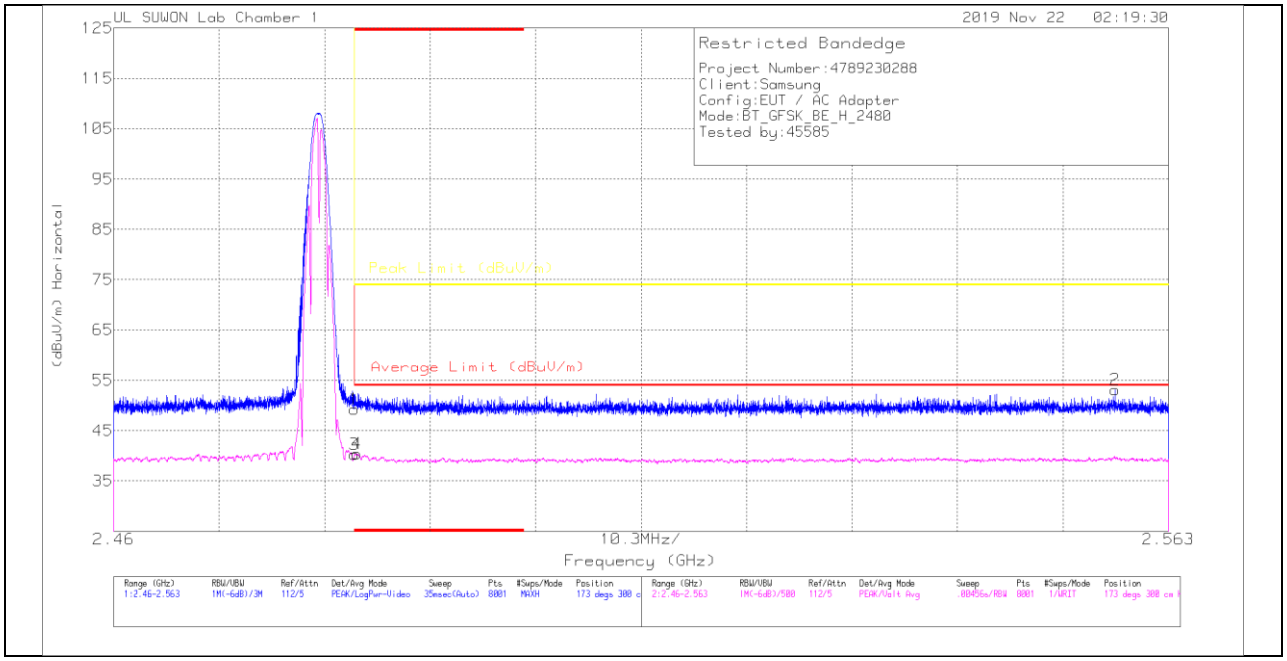
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	42.24	Pk	31.7	-25.5	48.44	-	-	74	-25.56	237	395	V
2	* 2.3603	45.51	Pk	31.6	-25.6	51.51	-	-	74	-22.49	237	395	V
3	* 2.39	32.48	VA1T	31.7	-25.5	38.68	54	-15.32	-	-	237	395	V
4	* 2.37039	32.98	VA1T	31.6	-25.5	39.08	54	-14.92	-	-	237	395	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

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



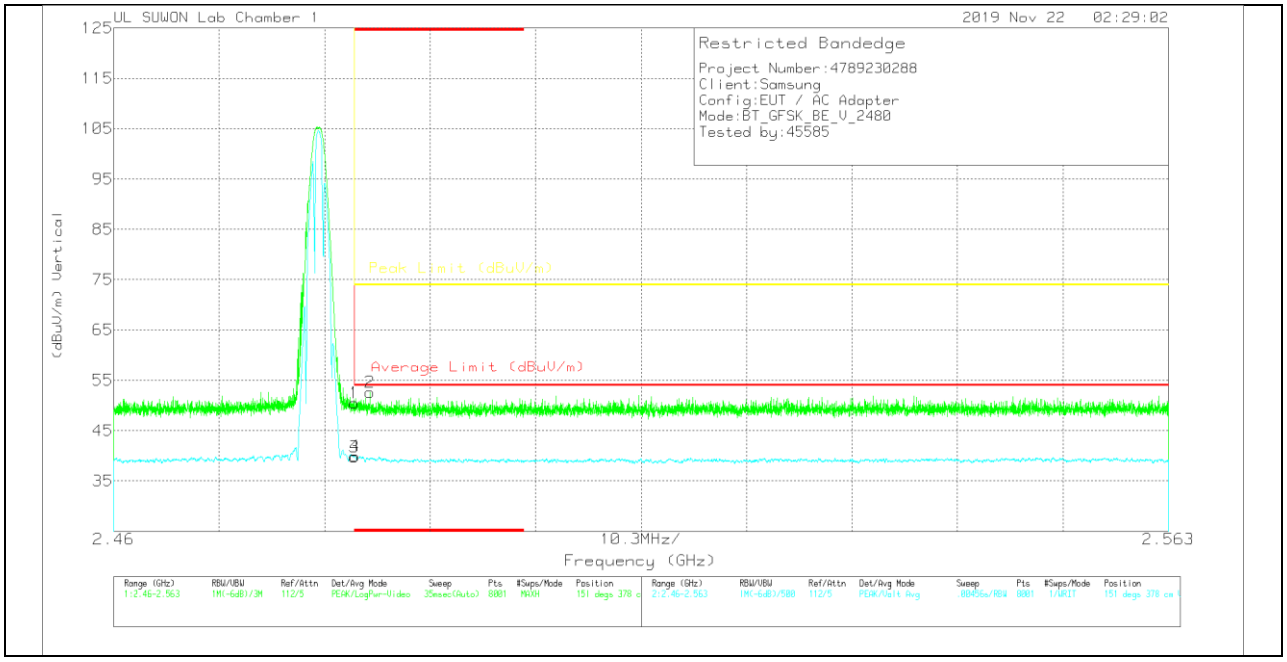
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	42.55	Pk	31.9	-25.2	49.25	-	-	74	-24.75	173	300	H
2	2.55781	46.1	Pk	32	-25	53.1	-	-	74	-20.9	173	300	H
3	* 2.48351	33.54	VA1T	31.9	-25.2	40.24	54	-13.76	-	-	173	300	H
4	* 2.48373	33.68	VA1T	31.9	-25.2	40.38	54	-13.62	-	-	173	300	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 PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	43.82	Pk	31.9	-25.2	50.52	-	-	74	-23.48	151	378	V
2	* 2.48503	45.92	Pk	31.9	-25.2	52.62	-	-	74	-21.38	151	378	V
3	* 2.48351	33.08	VA1T	31.9	-25.2	39.78	54	-14.22	-	-	151	378	V
4	* 2.48355	33.24	VA1T	31.9	-25.2	39.94	54	-14.06	-	-	151	378	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

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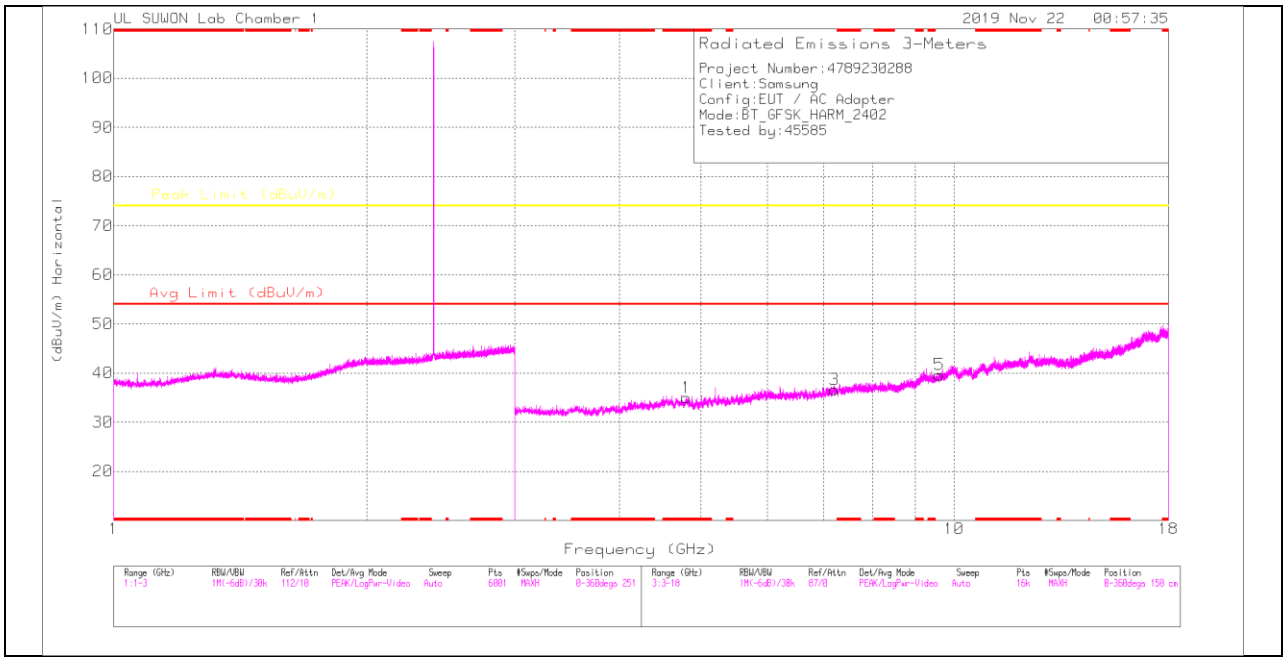
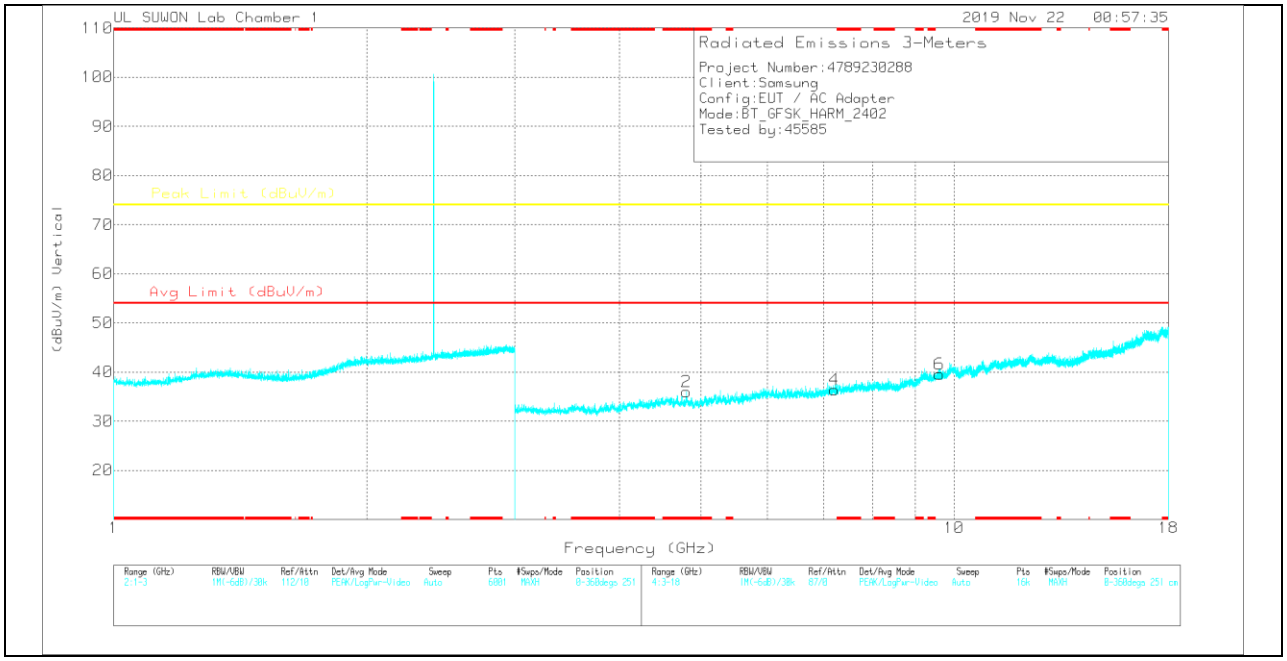
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80364	32.26	PK	34.2	-31.5	34.96	-	-	74	-39.04	0-360	250	H
3	7.20724	28.66	PK	35.8	-27.8	36.66	-	-	74	-37.34	0-360	150	H
5	9.60802	25.83	PK	37	-23.2	39.63	-	-	74	-34.37	0-360	150	H
2	* 4.80364	33.29	PK	34.2	-31.5	35.99	-	-	74	-38.01	0-360	149	V
4	7.20724	28.39	PK	35.8	-27.8	36.39	-	-	74	-37.61	0-360	149	V
6	9.60802	25.79	PK	37	-23.2	39.59	-	-	74	-34.41	0-360	251	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

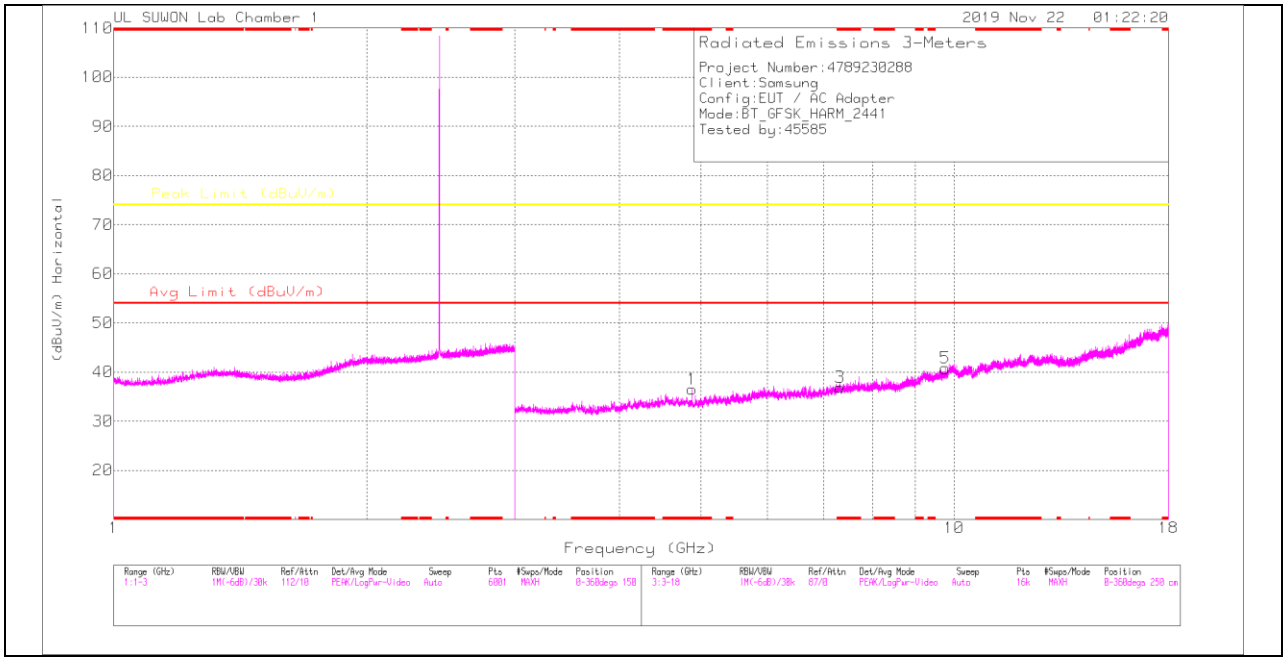
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80381	39.74	PKFH	34.2	-31.5	42.44	-	-	74	-31.56	360	100	H
* 4.80424	39.76	PKFH	34.2	-31.5	42.46	-	-	74	-31.54	360	100	V
7.20516	35.31	PKFH	35.8	-27.8	43.31	-	-	74	-30.69	360	100	H
7.20496	36.26	PKFH	35.8	-27.8	44.26	-	-	74	-29.74	360	100	V
9.60972	32.99	PKFH	37	-23.2	46.79	-	-	74	-27.21	360	100	H
9.60898	32.96	PKFH	37	-23.2	46.76	-	-	74	-27.24	360	100	V

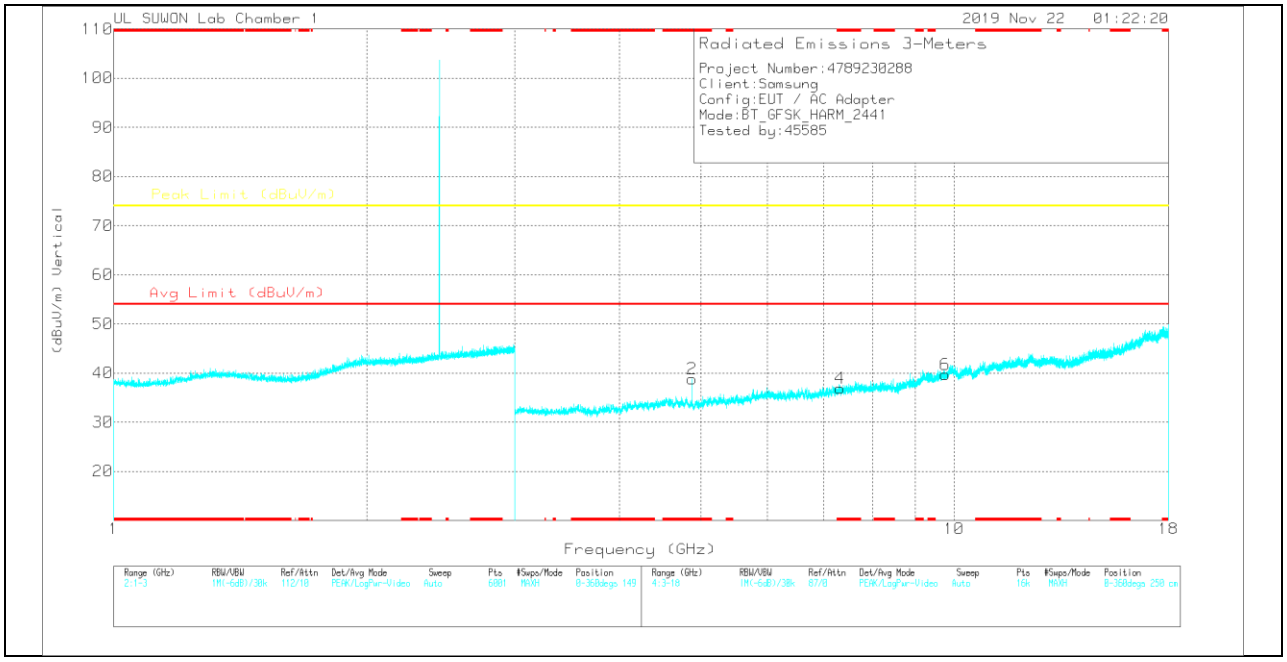
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88144	33.93	PK	34.2	-31.6	36.53	-	-	74	-37.47	0-360	149	H
3	* 7.31973	28.28	PK	35.8	-27.2	36.88	-	-	74	-37.12	0-360	250	H
5	9.76551	27.48	PK	37.2	-23.9	40.78	-	-	74	-33.22	0-360	250	H
2	* 4.88144	36.2	PK	34.2	-31.6	38.8	-	-	74	-35.2	0-360	250	V
4	* 7.3216	28.31	PK	35.8	-27.2	36.91	-	-	74	-37.09	0-360	250	V
6	9.76364	26.54	PK	37.2	-24	39.74	-	-	74	-34.26	0-360	150	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88212	41.43	PKFH	34.2	-31.6	44.03	-	-	74	-29.97	126	122	H
* 4.88182	33.3	VA1T	34.2	-31.6	35.9	54	-18.1	-	-	126	122	H
* 4.88244	43.44	PKFH	34.2	-31.6	46.04	-	-	74	-27.96	133	100	V
* 4.88197	37.84	VA1T	34.2	-31.6	40.44	54	-13.56	-	-	133	100	V
* 7.31837	35.56	PKFH	35.8	-27.3	44.06	-	-	74	-29.94	360	100	H
* 7.31945	35.86	PKFH	35.8	-27.3	44.36	-	-	74	-29.64	360	100	V
9.76701	34.25	PKFH	37.3	-24	47.55	-	-	74	-26.45	360	100	H
9.76546	32.69	PKFH	37.2	-23.9	45.99	-	-	74	-28.01	360	100	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 transmit duration

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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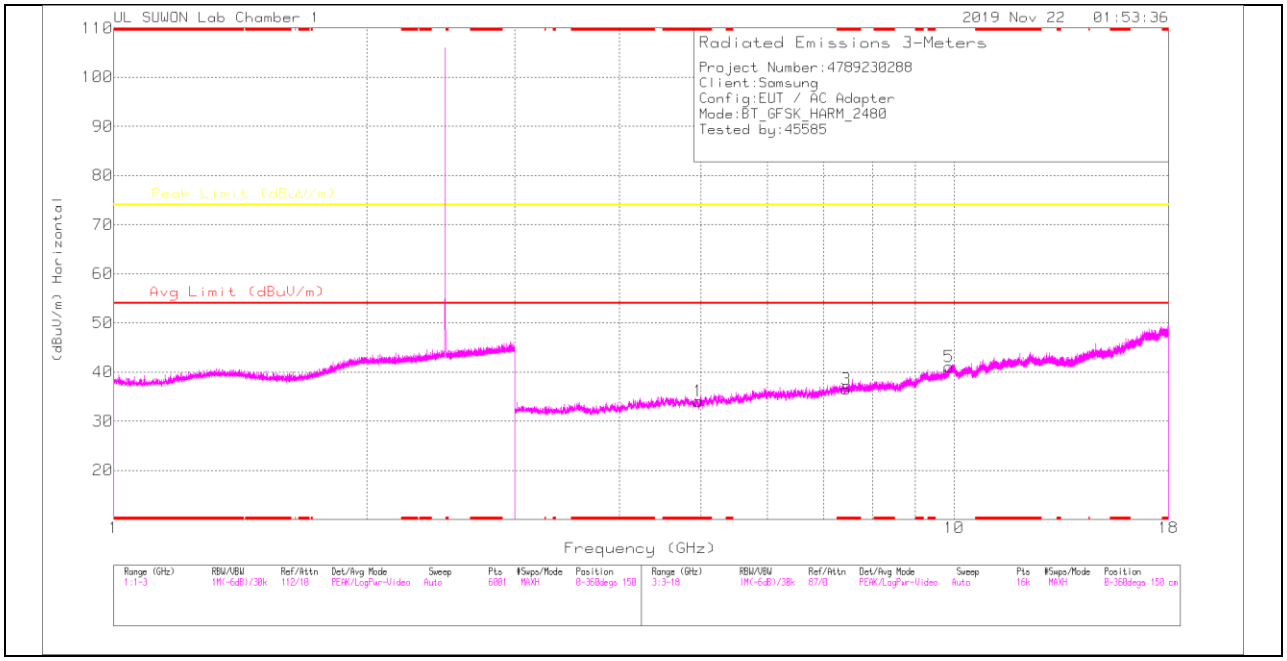
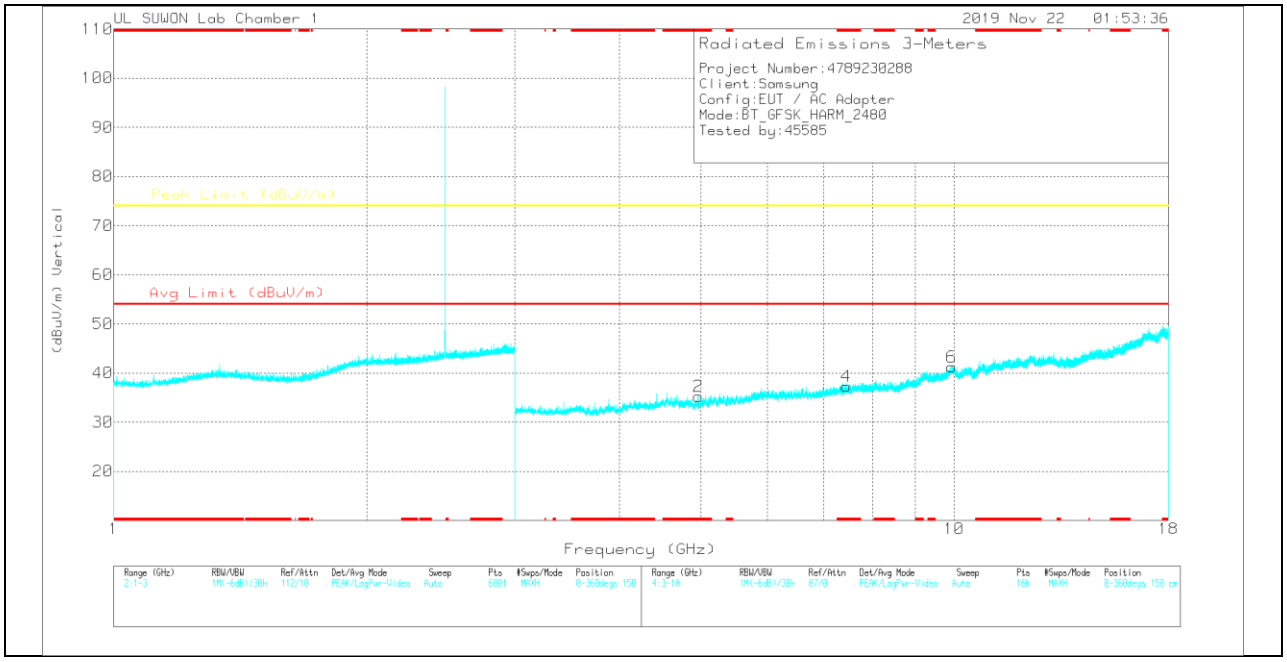
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96019	31.54	PK	34.2	-31.6	34.14	-	-	74	-39.86	0-360	150	H
3	* 7.44066	27.79	PK	35.8	-27.1	36.49	-	-	74	-37.51	0-360	250	H
5	9.87425	26.2	PK	37.4	-22.5	41.1	-	-	74	-32.9	0-360	250	H
2	* 4.96019	32.6	PK	34.2	-31.6	35.2	-	-	74	-38.8	0-360	150	V
4	* 7.43972	28.58	PK	35.8	-27.1	37.28	-	-	74	-36.72	0-360	250	V
6	9.92863	25.37	PK	37.5	-21.7	41.17	-	-	74	-32.83	0-360	150	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

Radiated Emissions

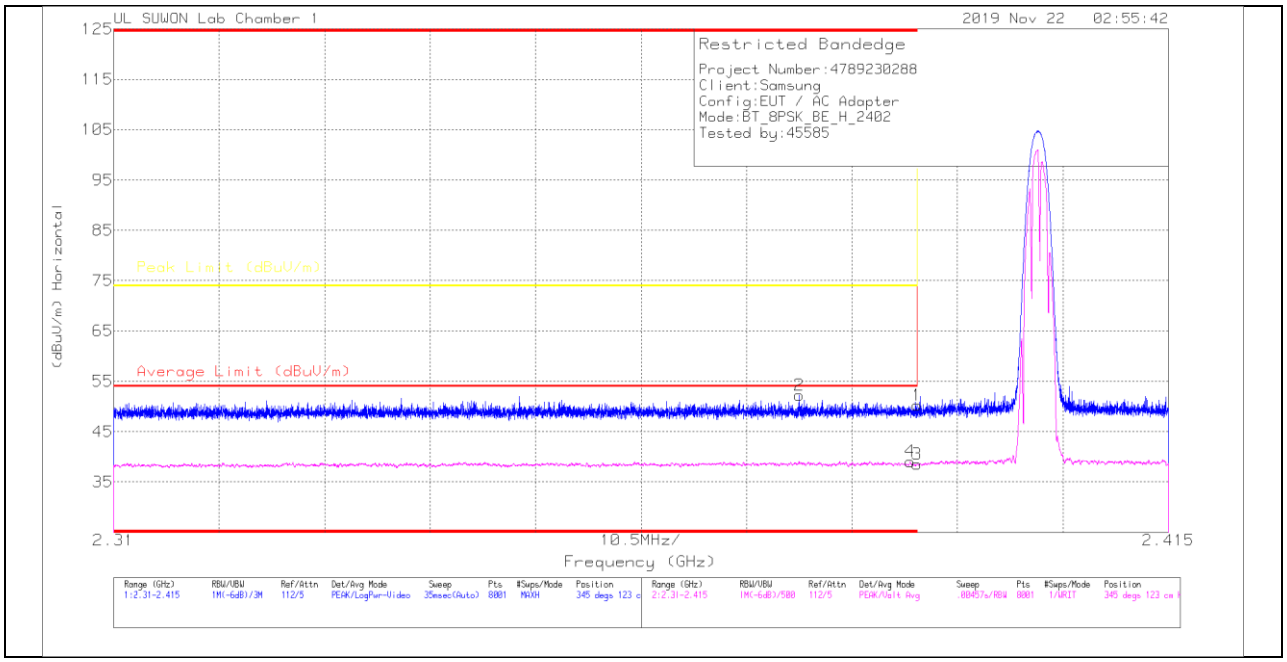
Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.95852	39.14	PKFH	34.2	-31.6	41.74	-	-	74	-32.26	360	100	H
* 4.96039	38.54	PKFH	34.2	-31.6	41.14	-	-	74	-32.86	360	100	V
* 7.44146	36.14	PKFH	35.8	-27.1	44.84	-	-	74	-29.16	360	100	H
* 7.44187	36.07	PKFH	35.8	-27.1	44.77	-	-	74	-29.23	360	100	V
9.87454	33.09	PKFH	37.4	-22.5	47.99	-	-	74	-26.01	360	100	V
9.87484	32.1	PKFH	37.4	-22.5	47	-	-	74	-27	360	100	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

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

11.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



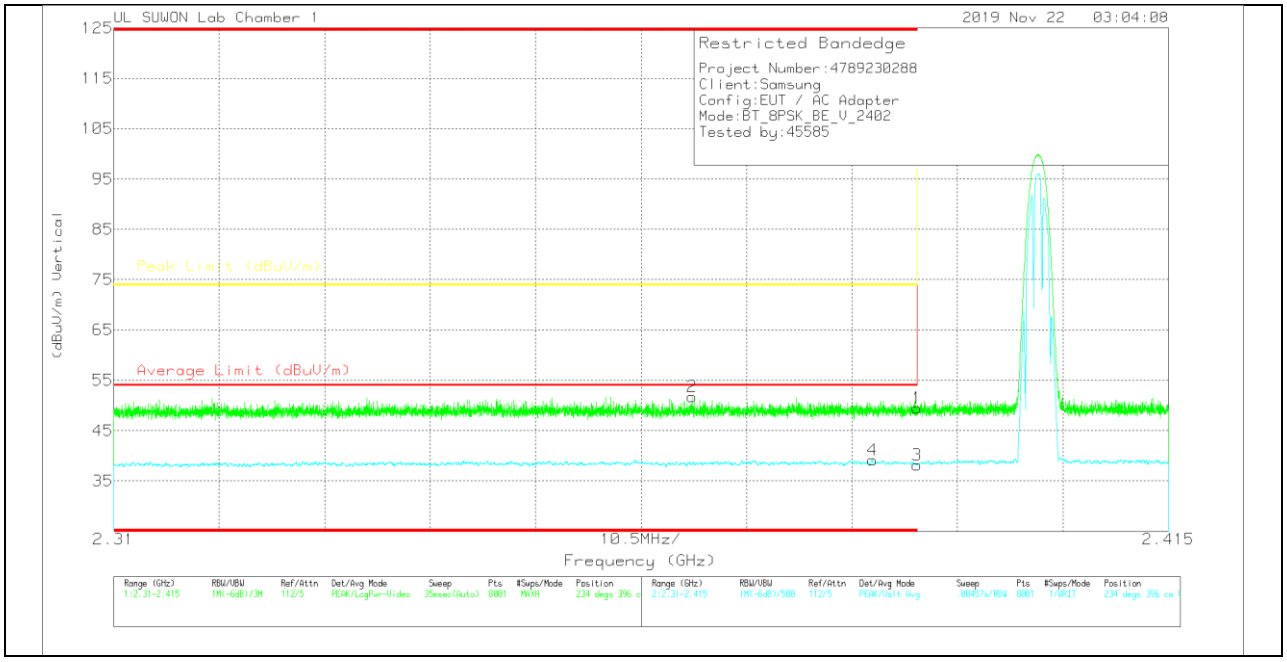
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	44.03	Pk	31.7	-25.5	50.23	-	-	74	-23.77	345	123	H
2	* 2.37822	46.2	Pk	31.6	-25.5	52.3	-	-	74	-21.7	345	123	H
3	* 2.39	32.32	VA1T	31.7	-25.5	38.52	54	-15.48	-	-	345	123	H
4	* 2.38929	33	VA1T	31.7	-25.6	39.1	54	-14.9	-	-	345	123	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
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

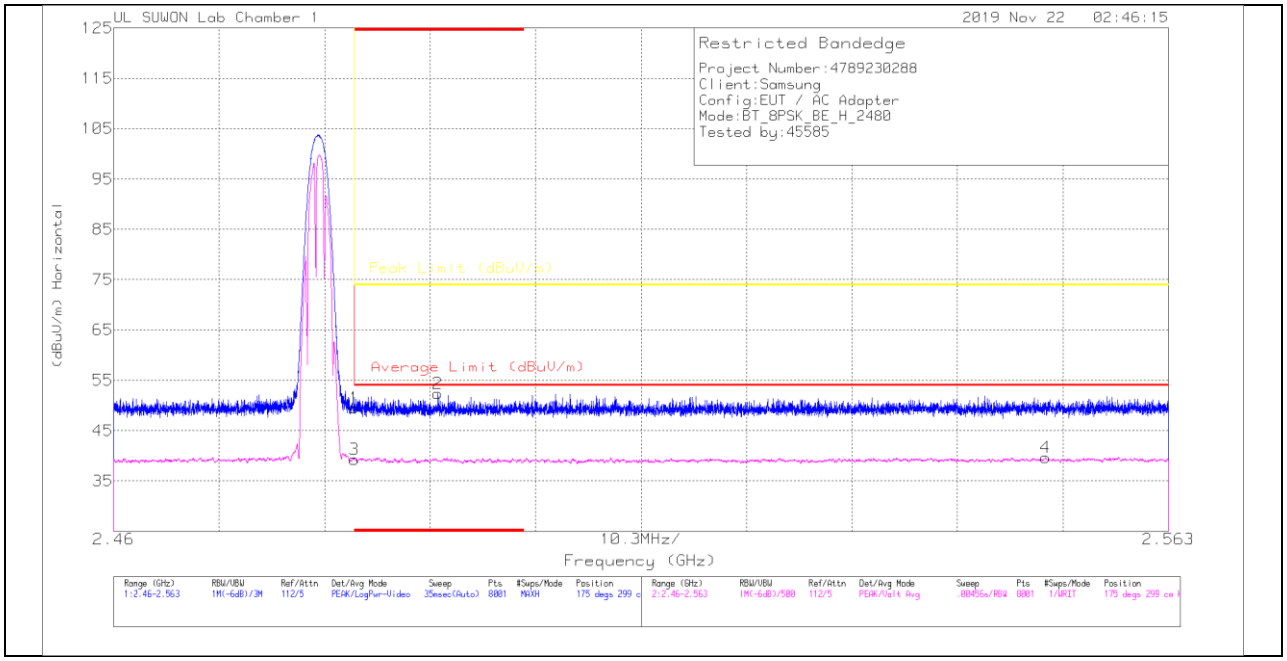
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	43.28	Pk	31.7	-25.5	49.48	-	-	74	-24.52	234	396	V
2	* 2.36759	45.74	Pk	31.6	-25.6	51.74	-	-	74	-22.26	234	396	V
3	* 2.39	31.98	VA1T	31.7	-25.5	38.18	54	-15.82	-	-	234	396	V
4	* 2.38552	32.99	VA1T	31.7	-25.5	39.19	54	-14.81	-	-	234	396	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

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	42.81	Pk	31.9	-25.2	49.51	-	-	74	-24.49	175	299	H
2	* 2.49165	45.69	Pk	31.9	-25.2	52.39	-	-	74	-21.61	175	299	H
3	* 2.48351	32.62	VA1T	31.9	-25.2	39.32	54	-14.68	-	-	175	299	H
4	2.55101	32.77	VA1T	32	-25.1	39.67	54	-14.33	-	-	175	299	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

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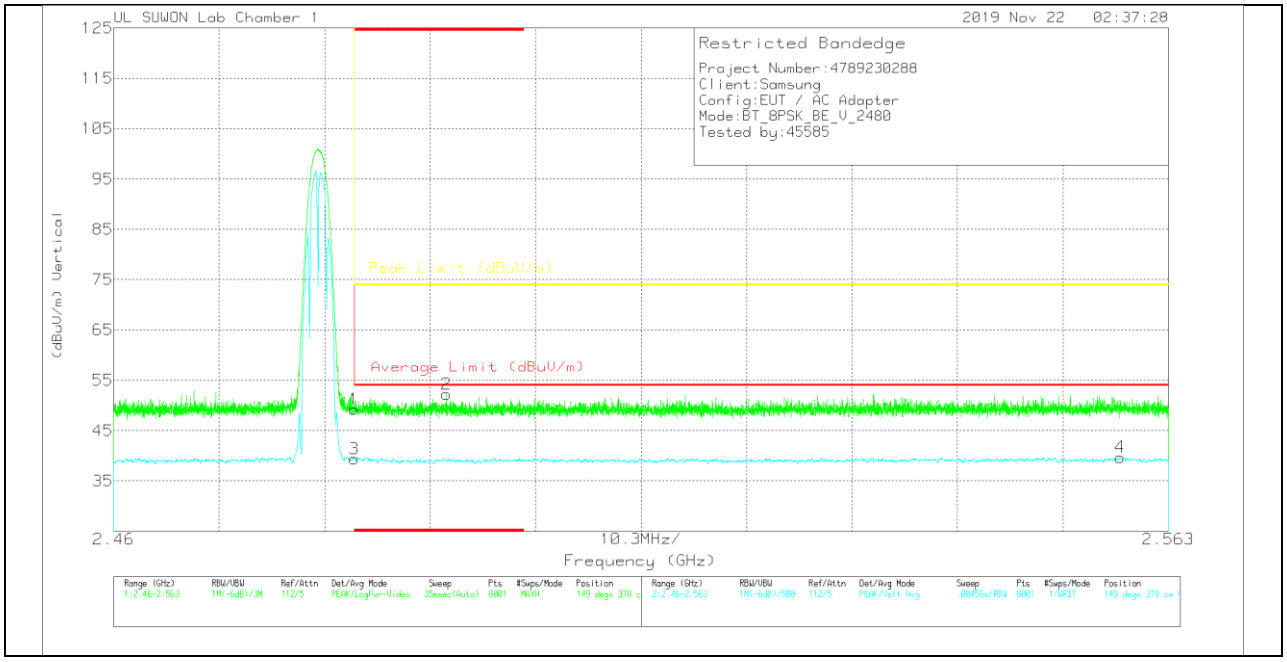
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[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	42.6	Pk	31.9	-25.2	49.3	-	-	74	-24.7	149	378	V
2	* 2.49247	45.54	Pk	31.9	-25.2	52.24	-	-	74	-21.76	149	378	V
3	* 2.48351	32.76	VA1T	31.9	-25.2	39.46	54	-14.54	-	-	149	378	V
4	2.55829	32.72	VA1T	32	-25	39.72	54	-14.28	-	-	149	378	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

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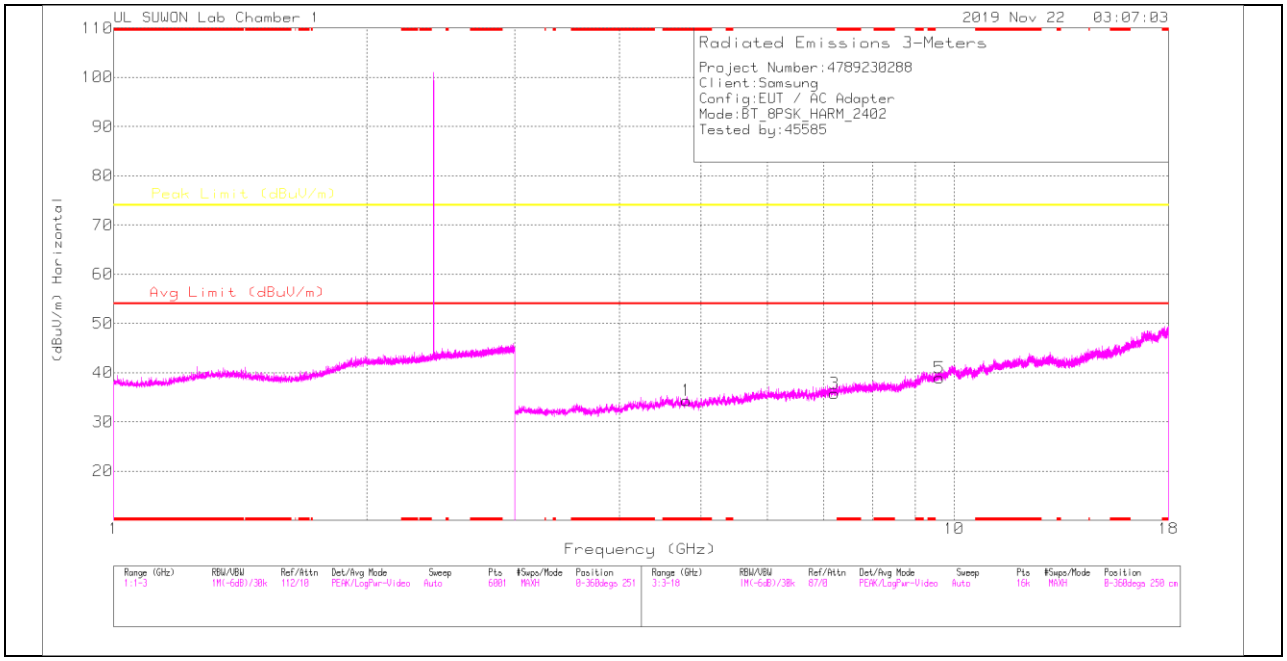
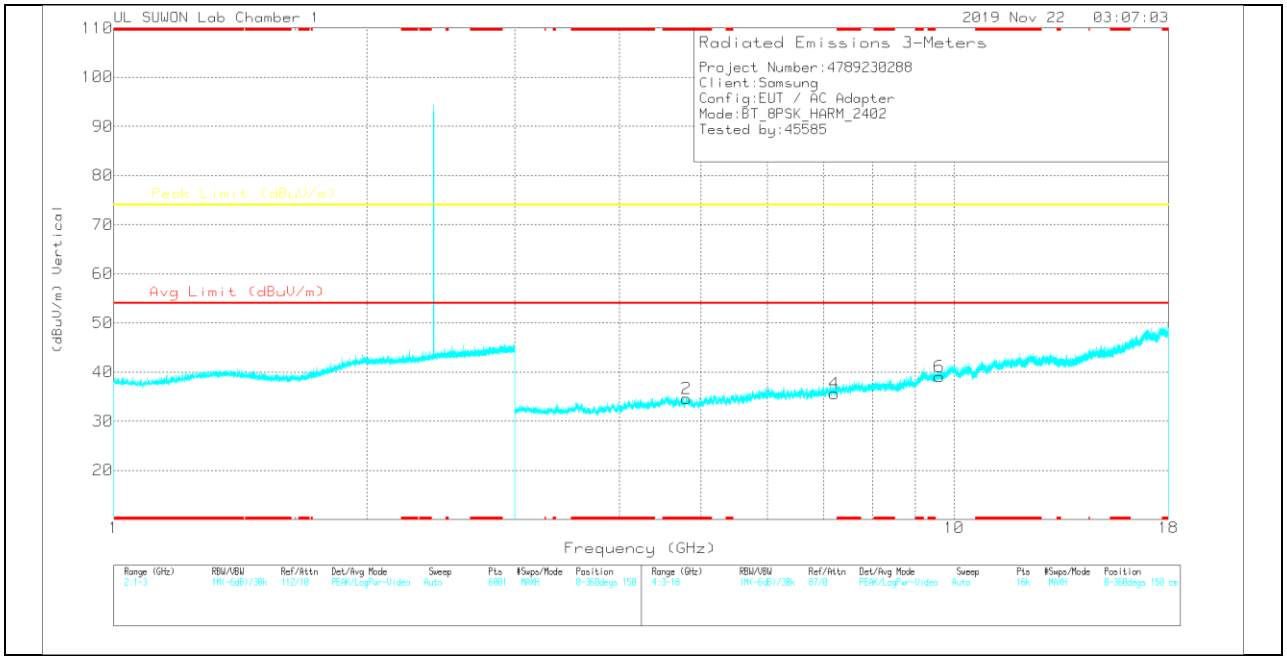
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80457	31.67	PK	34.2	-31.5	34.37	-	-	74	-39.63	0-360	150	H
3	7.2063	27.69	PK	35.8	-27.8	35.69	-	-	74	-38.31	0-360	150	H
5	9.60802	25.12	PK	37	-23.2	38.92	-	-	74	-35.08	0-360	250	H
2	* 4.80457	31.95	PK	34.2	-31.5	34.65	-	-	74	-39.35	0-360	150	V
4	7.2063	27.63	PK	35.8	-27.8	35.63	-	-	74	-38.37	0-360	150	V
6	9.60802	25.28	PK	37	-23.2	39.08	-	-	74	-34.92	0-360	150	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

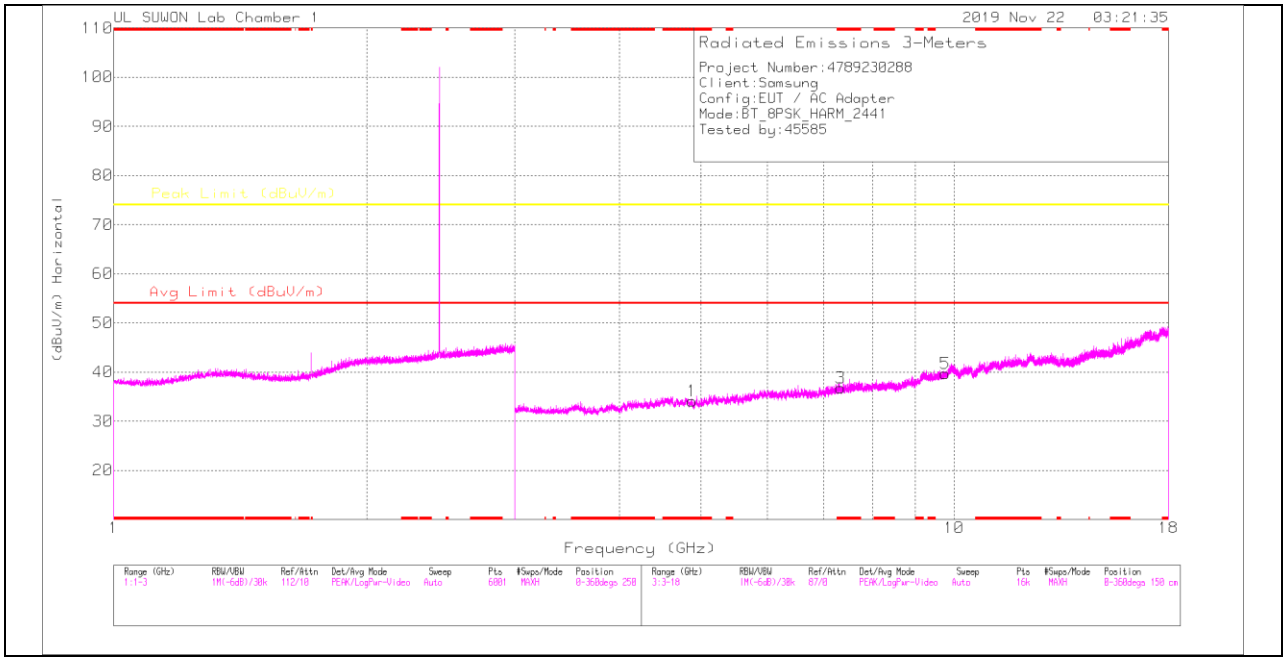
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.80273	39.48	PKFH	34.2	-31.5	42.18	-	-	74	-31.82	360	100	H
* 4.80512	39.58	PKFH	34.2	-31.5	42.28	-	-	74	-31.72	360	100	V
7.20563	35.6	PKFH	35.8	-27.8	43.6	-	-	74	-30.4	360	100	H
7.20708	35.09	PKFH	35.8	-27.8	43.09	-	-	74	-30.91	360	100	V
9.60828	33.48	PKFH	37	-23.2	47.28	-	-	74	-26.72	360	100	H
9.60609	33.44	PKFH	37	-23.3	47.14	-	-	74	-26.86	360	100	V

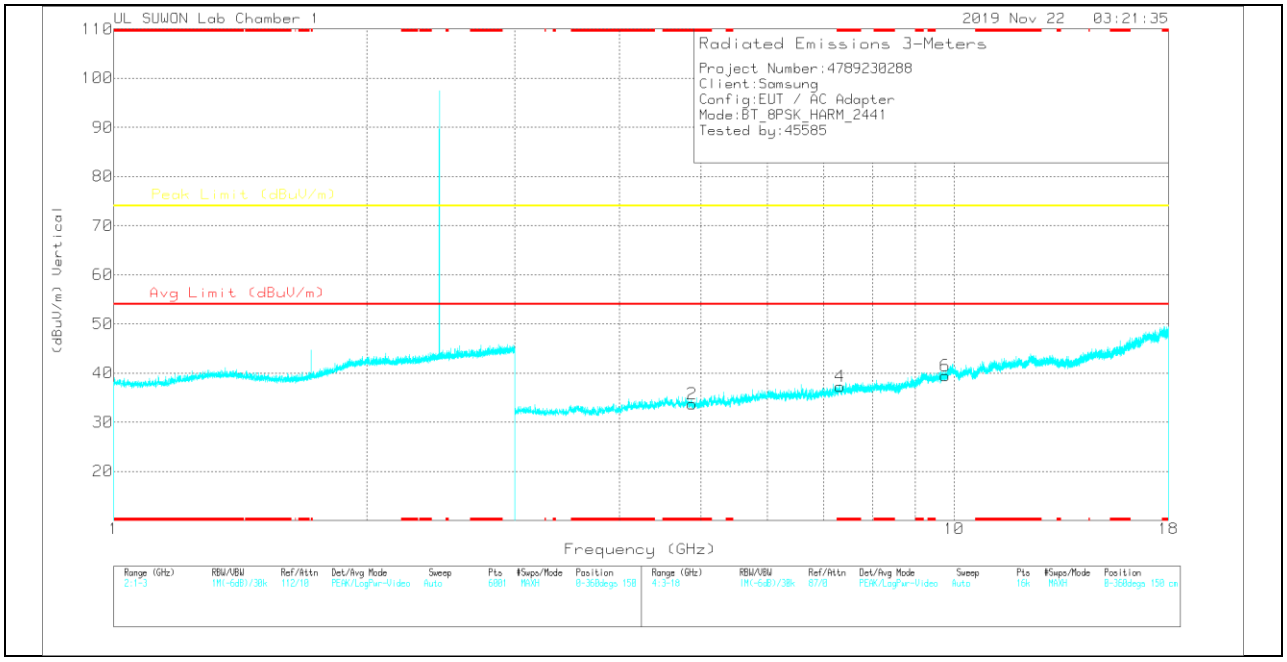
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88238	31.52	PK	34.2	-31.6	34.12	-	-	74	-39.88	0-360	150	H
3	* 7.32535	28.29	PK	35.8	-27.3	36.79	-	-	74	-37.21	0-360	250	H
5	9.76457	26.42	PK	37.2	-23.9	39.72	-	-	74	-34.28	0-360	250	H
2	* 4.88238	31.07	PK	34.2	-31.6	33.67	-	-	74	-40.33	0-360	150	V
4	* 7.3216	28.63	PK	35.8	-27.2	37.23	-	-	74	-36.77	0-360	150	V
6	9.76457	26.19	PK	37.2	-23.9	39.49	-	-	74	-34.51	0-360	150	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88416	39.2	PKFH	34.2	-31.6	41.8	-	-	74	-32.2	360	100	H
* 4.88404	39.24	PKFH	34.2	-31.6	41.84	-	-	74	-32.16	360	100	V
* 7.32661	35.64	PKFH	35.8	-27.3	44.14	-	-	74	-29.86	360	100	H
* 7.32697	36.76	PKFH	35.8	-27.3	45.26	-	-	74	-28.74	360	100	V
9.76305	32.67	PKFH	37.2	-23.9	45.97	-	-	74	-28.03	360	100	H
9.76558	33.29	PKFH	37.2	-23.9	46.59	-	-	74	-27.41	360	100	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

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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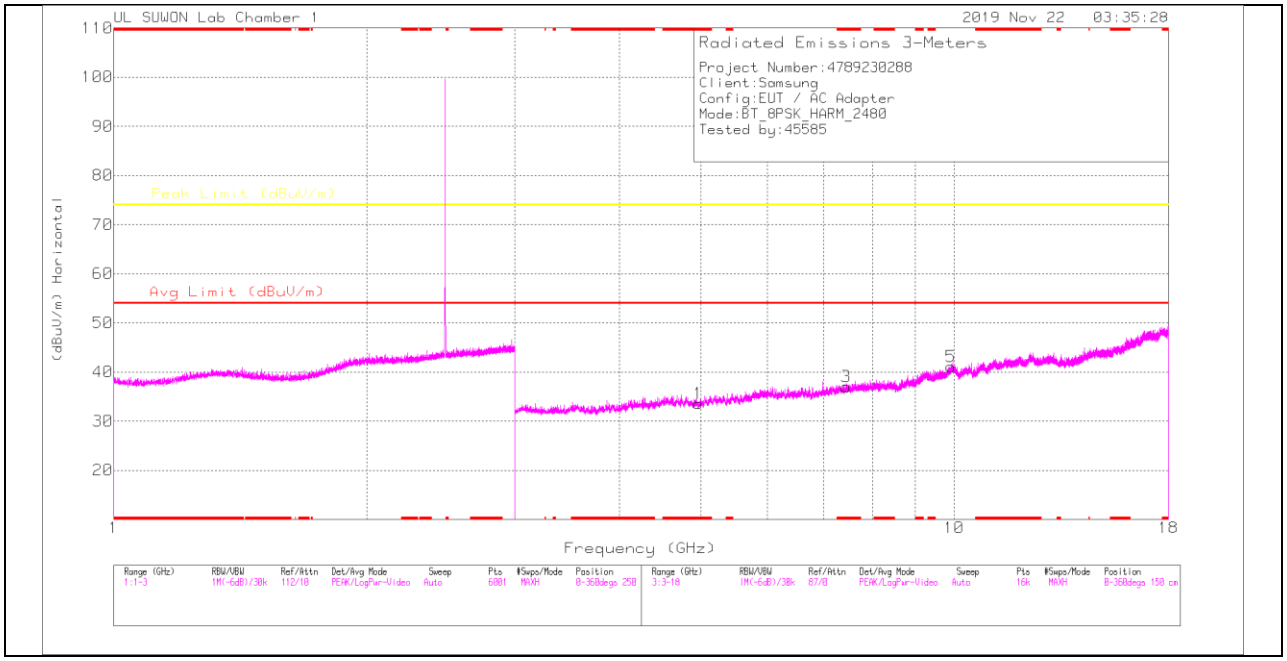
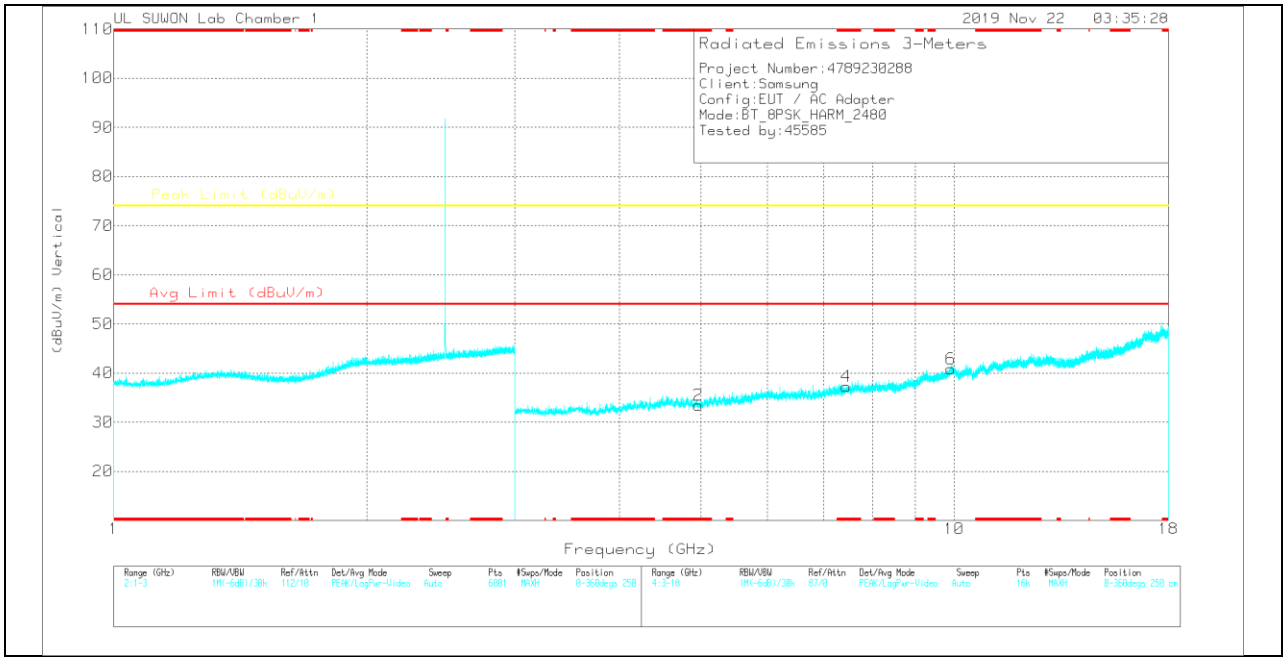
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96206	30.9	PK	34.2	-31.5	33.6	-	-	74	-40.4	0-360	250	H
3	* 7.43972	28.32	PK	35.8	-27.1	37.02	-	-	74	-36.98	0-360	250	H
5	9.91831	25.71	PK	37.5	-22.1	41.11	-	-	74	-32.89	0-360	150	H
2	* 4.96206	30.72	PK	34.2	-31.5	33.42	-	-	74	-40.58	0-360	250	V
4	* 7.43972	28.58	PK	35.8	-27.1	37.28	-	-	74	-36.72	0-360	150	V
6	9.91738	25.46	PK	37.5	-22.1	40.86	-	-	74	-33.14	0-360	150	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96028	38.06	PKFH	34.2	-31.6	40.66	-	-	74	-33.34	360	100	H
* 4.96221	38.85	PKFH	34.2	-31.5	41.55	-	-	74	-32.45	360	100	V
* 7.43971	35.83	PKFH	35.8	-27.1	44.53	-	-	74	-29.47	360	100	H
* 7.43981	35.75	PKFH	35.8	-27.1	44.45	-	-	74	-29.55	360	100	V
9.9189	31.65	PKFH	37.5	-22.1	47.05	-	-	74	-26.95	360	100	H
9.9196	32.19	PKFH	37.5	-22	47.69	-	-	74	-26.31	360	100	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

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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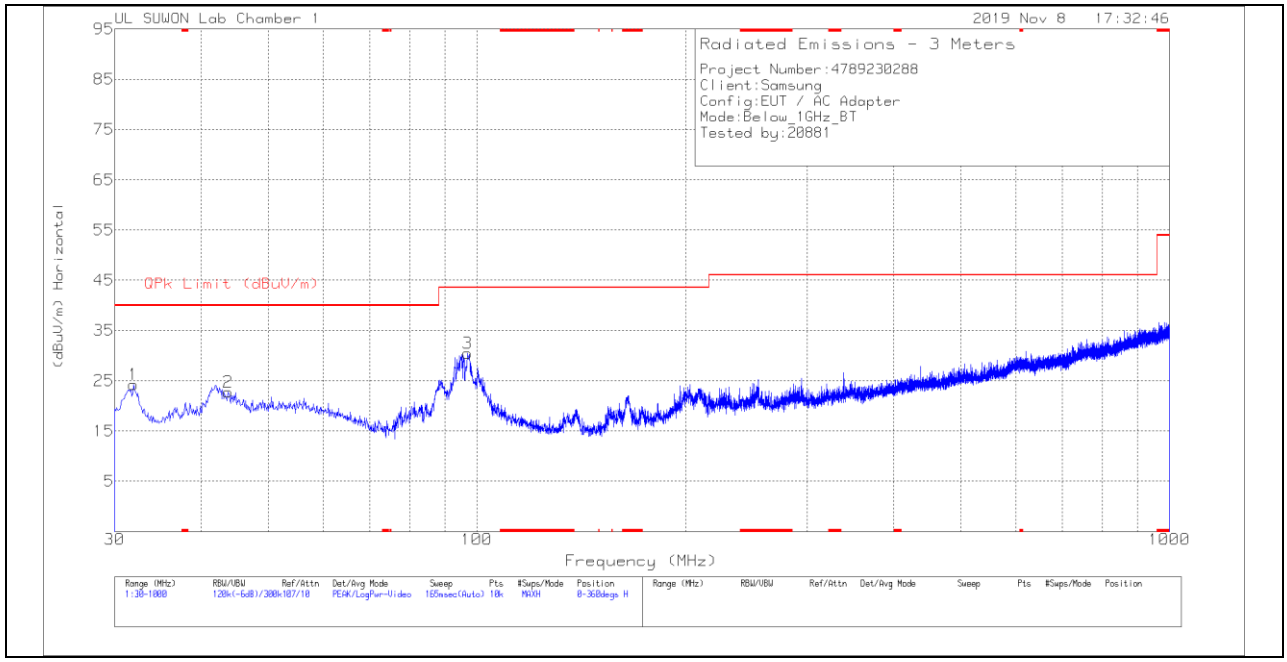
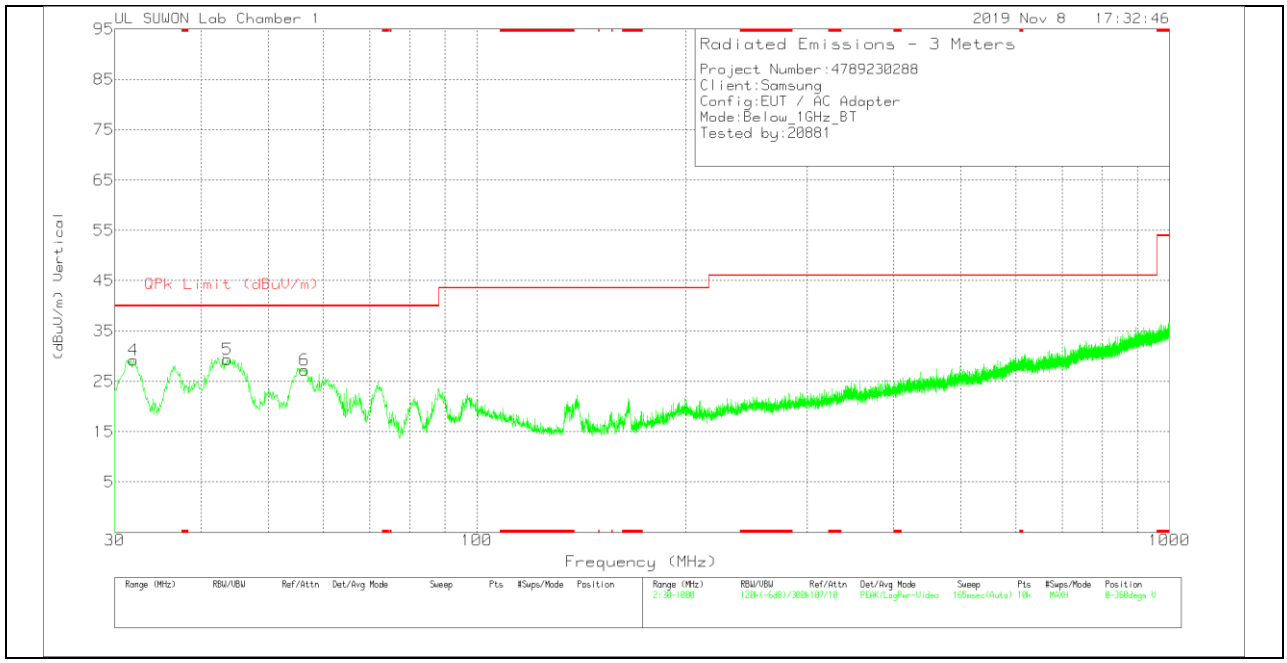
11.3. WORST-CASE BELOW 1 GHz

GFSK SPURIOUS EMISSIONS 30 TO 1000 MHz

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750	Below_1G[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.94	38.78	Pk	15.6	-30.1	24.28	40	-15.72	0-360	400	H
2	43.774	32.99	Pk	19.5	-29.7	22.79	40	-17.21	0-360	400	H
3	97.027	41.59	Pk	17.6	-28.7	30.49	43.52	-13.03	0-360	300	H
4	31.94	43.72	Pk	15.6	-30.1	29.22	40	-10.78	0-360	100	V
5	43.677	39.51	Pk	19.5	-29.7	29.31	40	-10.69	0-360	100	V
6	56.4325	37.47	Pk	19.1	-29.3	27.27	40	-12.73	0-360	100	V

Pk - Peak detector

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12. 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.

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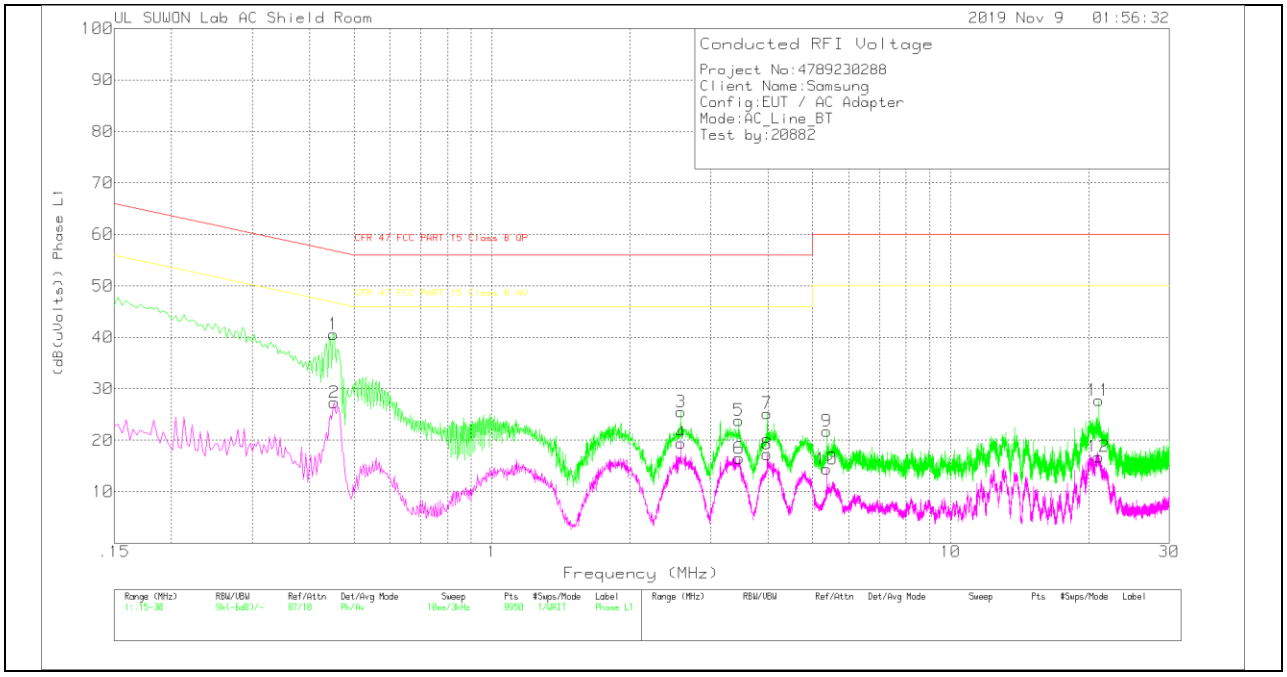
RESULTS

WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

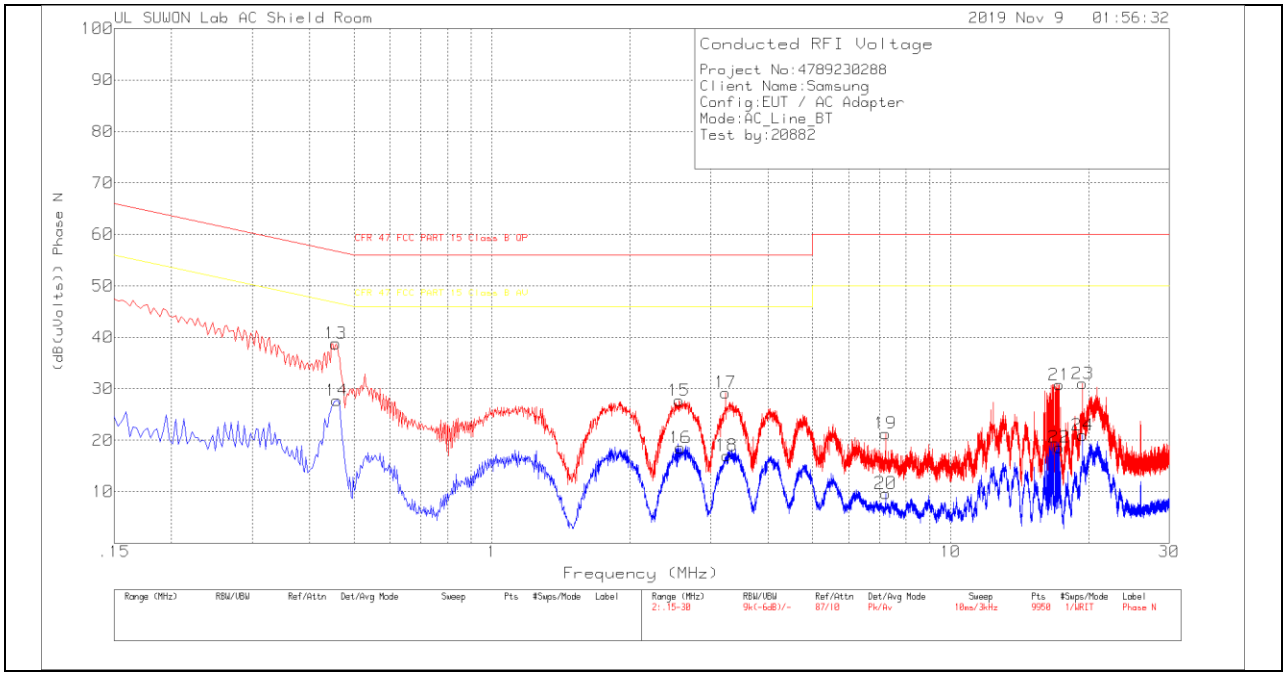
Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With Ex_L1[dB]	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.4515	30.48	Pk	9.9	.2	40.58	56.85	-16.27	-	-
2	.453	17.23	Av	9.9	.2	27.33	-	-	46.82	-19.49
3	2.58	15.42	Pk	9.8	.3	25.52	56	-30.48	-	-
4	2.583	9.33	Av	9.8	.3	19.43	-	-	46	-26.57
5	3.453	13.76	Pk	9.8	.3	23.86	56	-32.14	-	-
6	3.459	6.4	Av	9.8	.3	16.5	-	-	46	-29.5
7	3.984	15.11	Pk	9.8	.3	25.21	56	-30.79	-	-
8	3.984	7.18	Av	9.8	.3	17.28	-	-	46	-28.72
9	5.373	11.67	Pk	9.8	.3	21.77	60	-38.23	-	-
10	5.373	4.31	Av	9.8	.3	14.41	-	-	50	-35.59
11	21.039	17.04	Pk	10.3	.4	27.74	60	-32.26	-	-
12	21.033	6.09	Av	10.3	.4	16.79	-	-	50	-33.21

Pk - Peak detector
Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_With EX_N[dB]	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
13	.456	28.7	Pk	9.9	.2	38.8	56.77	-17.97	-	-
14	.459	17.62	Av	9.9	.2	27.72	-	-	46.71	-18.99
15	2.556	17.62	Pk	9.8	.3	27.72	56	-28.28	-	-
16	2.577	8.41	Av	9.8	.3	18.51	-	-	46	-27.49
17	3.231	19.16	Pk	9.8	.3	29.26	56	-26.74	-	-
18	3.249	6.9	Av	9.8	.3	17	-	-	46	-29
19	7.215	11.1	Pk	9.9	.3	21.3	60	-38.7	-	-
20	7.218	-.55	Av	9.9	.3	9.65	-	-	50	-40.35
21	17.271	20.17	Pk	10.2	.4	30.77	60	-29.23	-	-
22	17.274	8.02	Av	10.2	.4	18.62	-	-	50	-31.38
23	19.425	20.33	Pk	10.3	.4	31.03	60	-28.97	-	-
24	19.425	10.27	Av	10.3	.4	20.97	-	-	50	-29.03

Pk - Peak detector
Av - Average detection

END OF REPORT

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