FCC CFR47 PART 15 SUBPART C

Bluetooth

CERTIFICATION TEST REPORT

FOR

Bluetooth/BLE, DTS b/g/n WATCH

MODEL NUMBER : SM-R732

FCC ID: A3LSMR732DG

REPORT NUMBER: 16K23469-E3V1

ISSUE DATE: JUN 07, 2016

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	06/07/16	Initial issue	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	Bluetooth/BLE and DTS b/g/n WATCH
MODEL NUMBER:	SM-R732
SERIAL NUMBER:	R3AG900E4PP, R3AG900E50X (RADIATED); R732XXE2CPD1 (CONDUCTED)
DATE TESTED:	MAY 13, 2016 - JUN 07, 2016

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:

CY Choi
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

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

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4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

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	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth/BLE and DTS b/g/n WATCH.
This test report addresses the DSS (BT) operational mode.

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]
2402 - 2480	Basic GFSK	Average	12.17	16.49
		Peak	12.60	18.20
	Enhanced Pi/4-DPSK	Average	8.03	6.35
		Peak	10.69	11.71
	Enhanced 8PSK	Average	8.05	6.38
		Peak	11.15	13.03

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 8.6.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -2.45 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

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

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

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Adapter	SAMSUNG	ETA0U60JBE	DK1G725HS/7-E	N/A
Wireless Charger	SAMSUNG	EP-OR720	N/A	N/A
Data Cable	SAMSUNG	ECB-DU6ABE	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	Mini-USB	Shielded	0.8m	N/A

TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.
EUT was set in the Hidden menu mode to enable BT communications.

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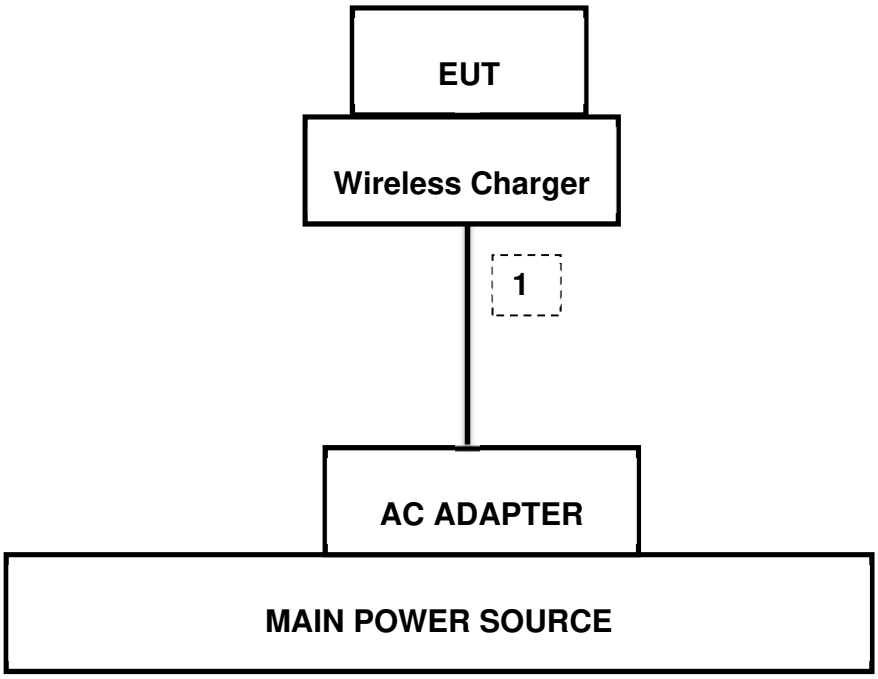
SETUP DIAGRAM FOR TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	11-17-16
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	09-20-16
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-18-16
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-18-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-19-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-19-16
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-16
Average Power Sensor	R&S	NRZ-Z91	102681	08-18-16
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-18-16
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-19-16
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-19-16
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-19-16
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	009	08-18-16
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	015	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	009	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	010	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	016	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	015	08-18-16
LISN	R&S	ENV-216	101836	08-19-16
LISN	R&S	ENV-216	101837	08-19-16
Combiner	WEINSCHEL	1575	2152	08-20-16

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass	1.201 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-39.194 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	12.601 dBm (Peak)
15.247 (a)(1)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		Pass	0.34632 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	42.67 dBuV (PK)
15.205, 15.209	Radiated Spurious Emission	< 40dBuV/m	Radiated	Pass	33.91 dBuV/m (PK)

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8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: 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

8.1.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [KHz]
Low	2402	1.051	902.890
Mid	2441	1.052	902.220
High	2480	1.050	902.030
Worst		1.052	902.890

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.356	1.168
Mid	2441	1.356	1.201
High	2480	1.356	1.199
Worst		1.356	1.201

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.320	1.198
Mid	2441	1.315	1.168
High	2480	1.326	1.168
Worst		1.326	1.198

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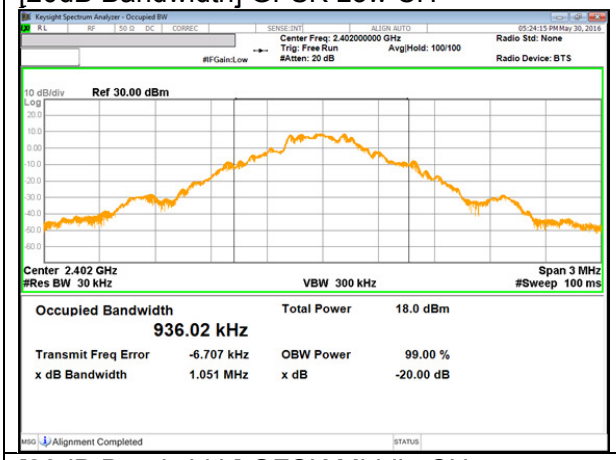
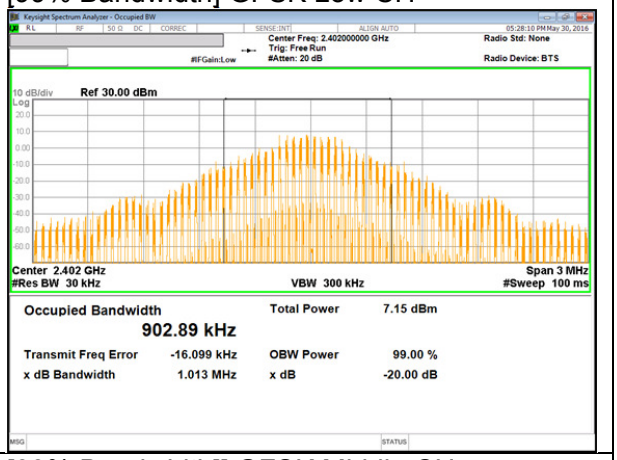
8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

GFSK BANDWIDTH

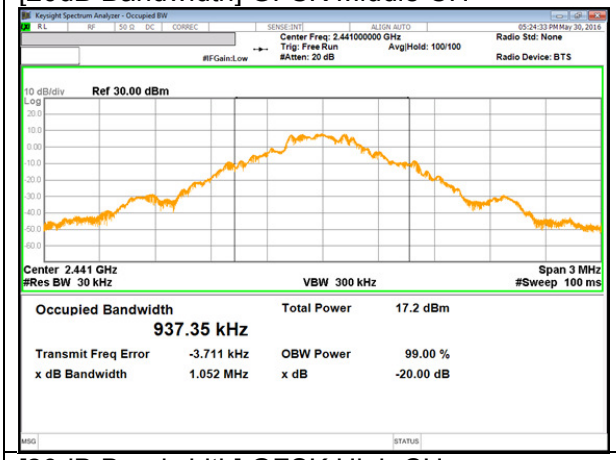
[20dB Bandwidth] GFSK Low CH



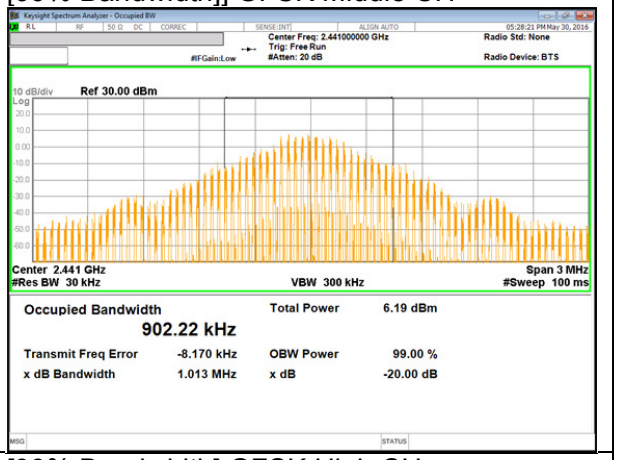
[99% Bandwidth] GFSK Low CH



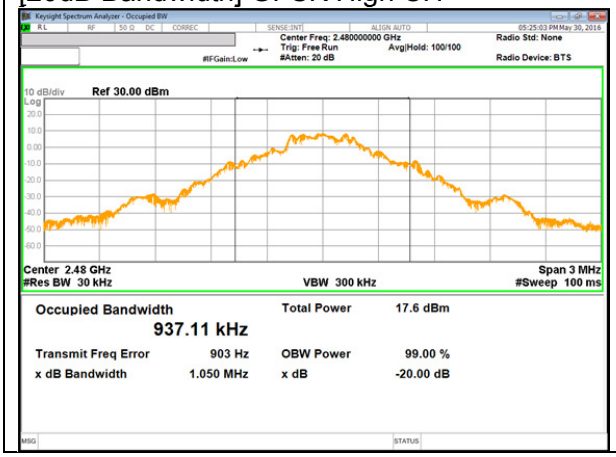
[20dB Bandwidth] GFSK Middle CH



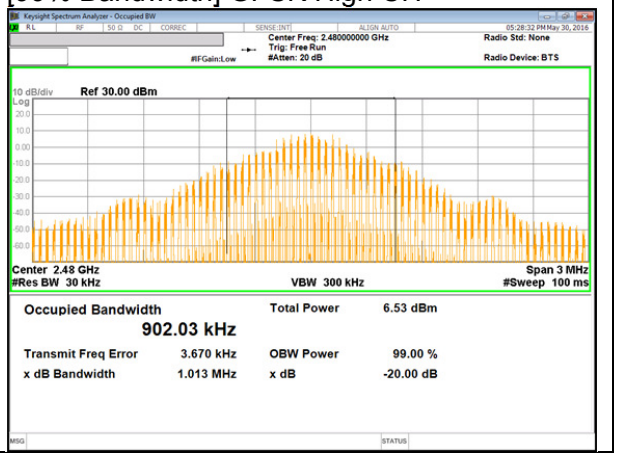
[99% Bandwidth]] GFSK Middle CH



[20dB Bandwidth] GFSK High CH



[99% Bandwidth] GFSK High CH



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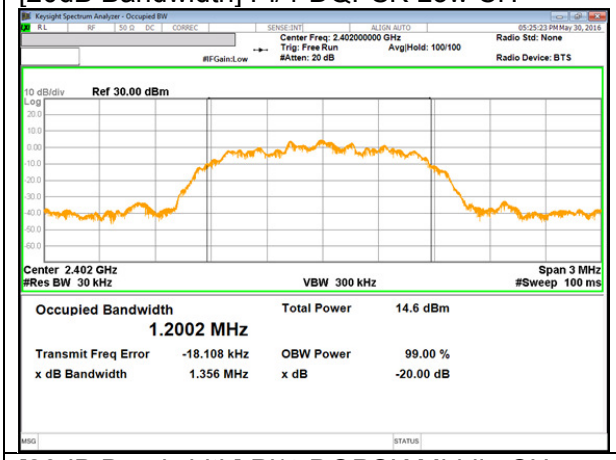
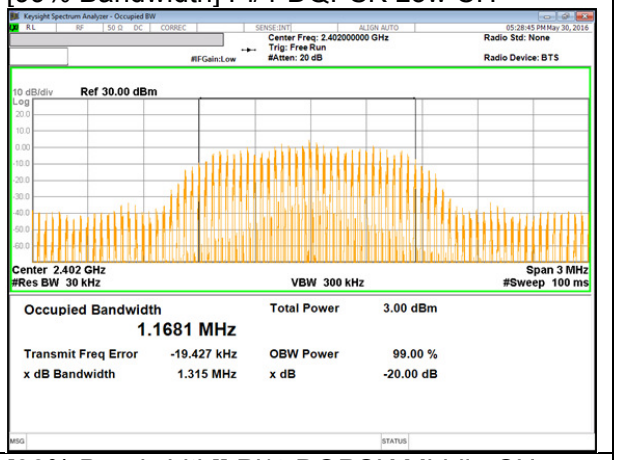
Pi/4-DQPSK BANDWIDTH

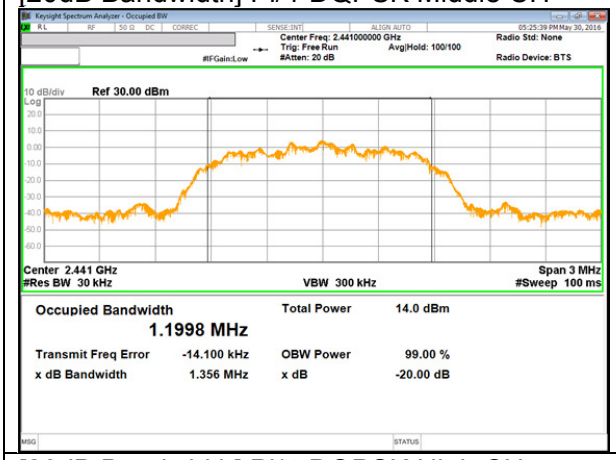
[20dB Bandwidth] Pi/4-DQPSK Low CH



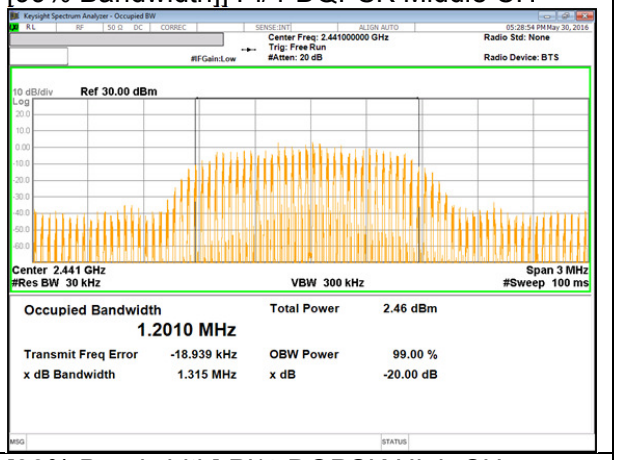
[99% Bandwidth] Pi/4-DQPSK Low CH



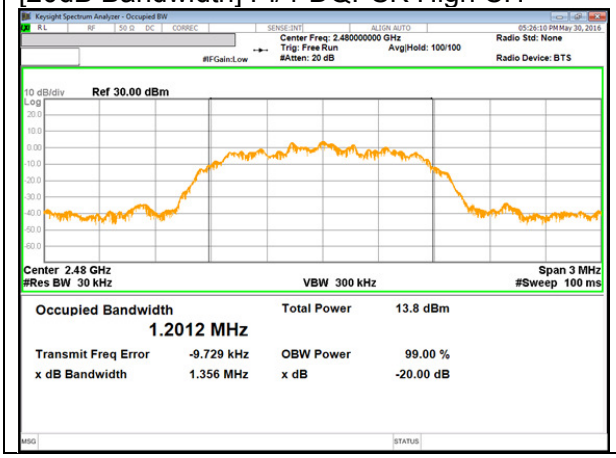
[20dB Bandwidth] Pi/4-DQPSK Middle CH



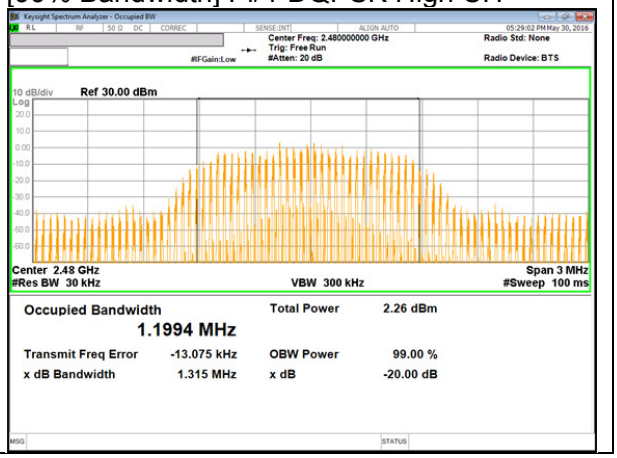
[99% Bandwidth]] Pi/4-DQPSK Middle CH



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



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



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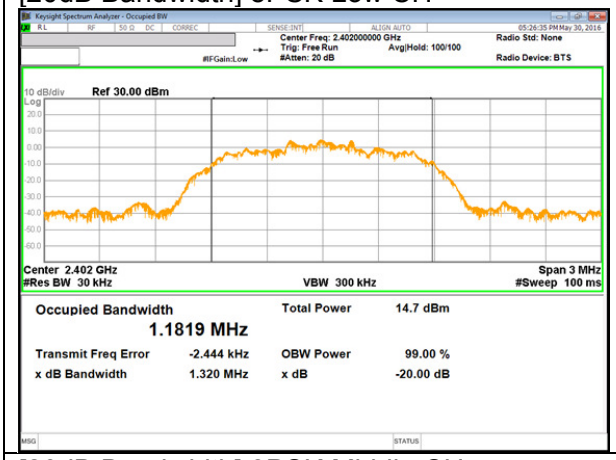
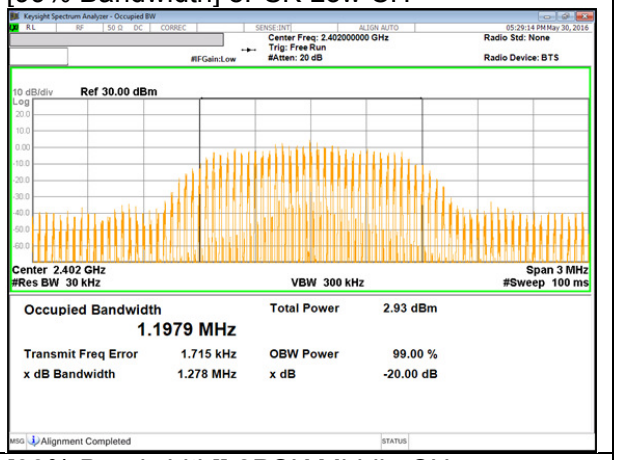
8PSK BANDWIDTH

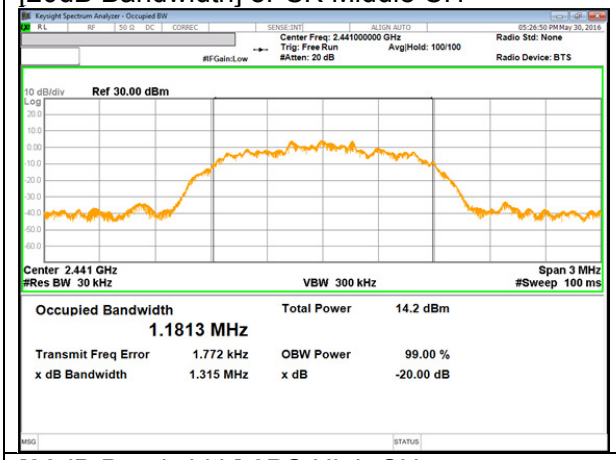
[20dB Bandwidth] 8PSK Low CH



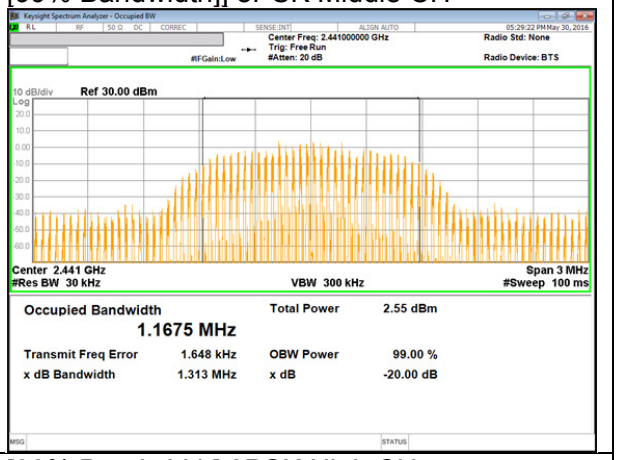
[99% Bandwidth] 8PSK Low CH



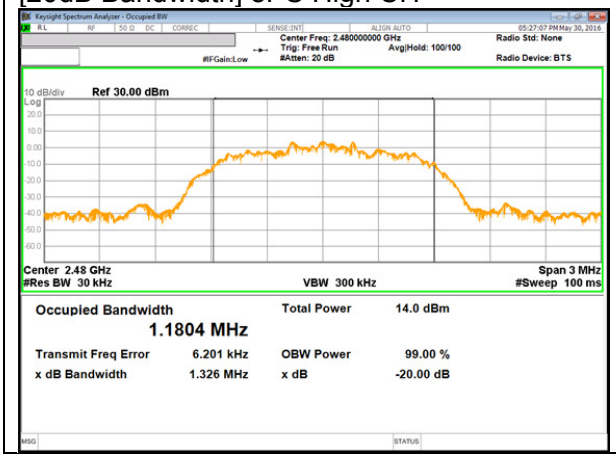
[20dB Bandwidth] 8PSK Middle CH



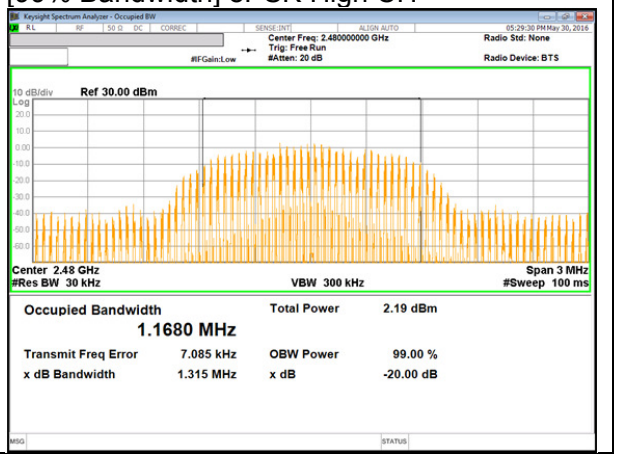
[99% Bandwidth]] 8PSK Middle CH



[20dB Bandwidth] 8PS High CH



[99% Bandwidth] 8PSK High CH



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8.2. 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.

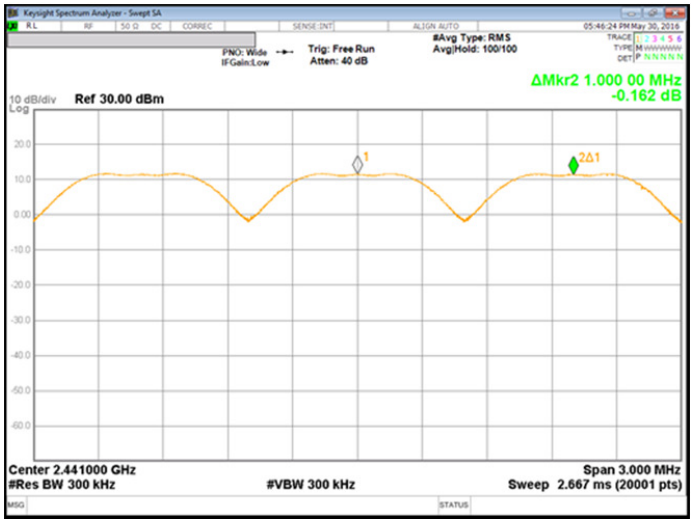
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

DA 00-705: 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

HOPPING FREQUENCY SEPARATION PLOT



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8.3. 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

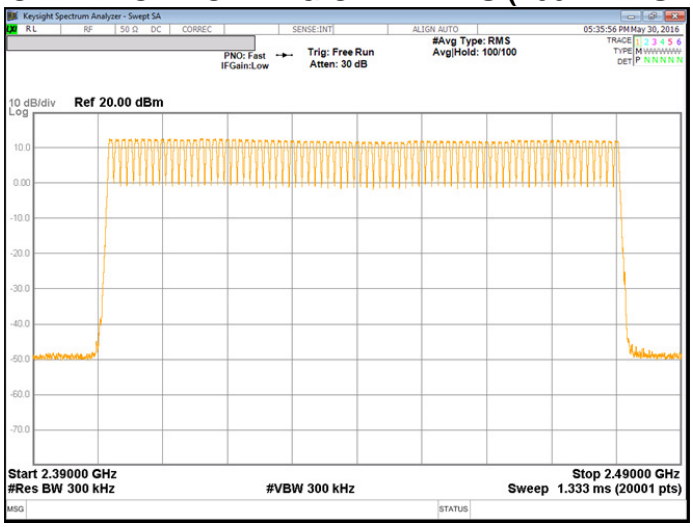
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



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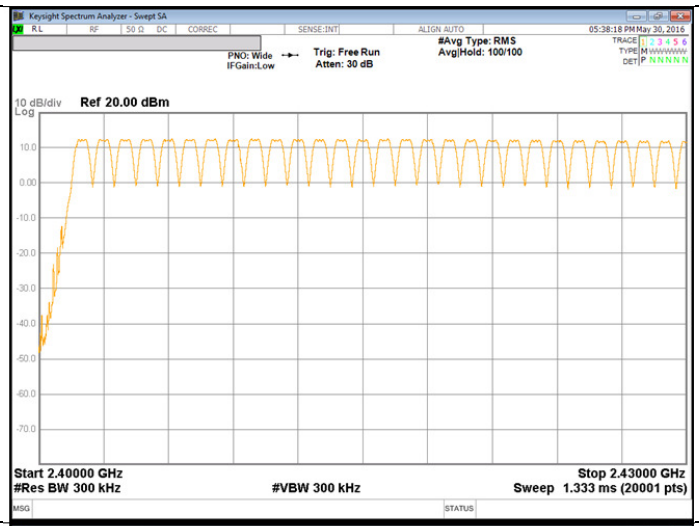
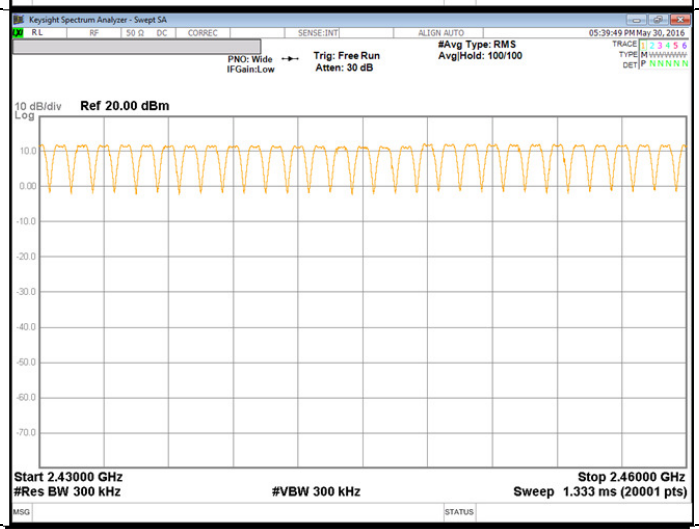
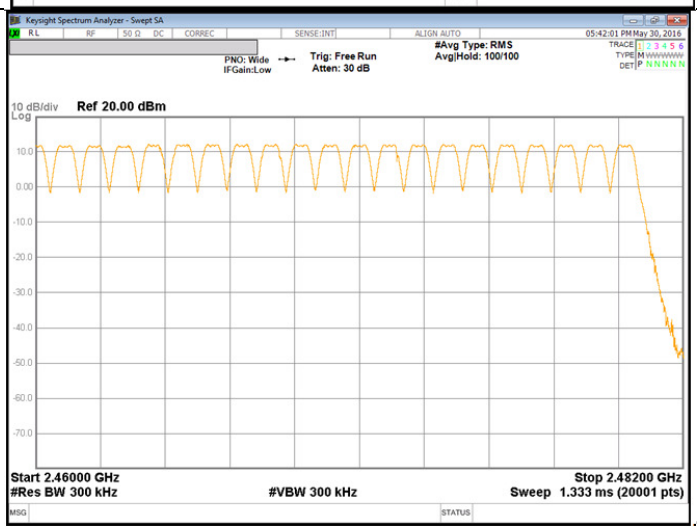
1st SEGMENT 2400 to 2430 MHz			
2nd SEGMENT 2430 to 2460 MHz			
3rd SEGMENT 2460 to 2482 MHz			

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8.4. 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

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.382	32	0.122336	0.4	-0.2777
DH3	1.638	16	0.262080	0.4	-0.1379
DH5	2.886	12	0.346320	0.4	-0.0537
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.382	8	0.030584	0.4	-0.36942
DH3	1.638	4	0.065520	0.4	-0.33448
DH5	2.886	3	0.086580	0.4	-0.31342

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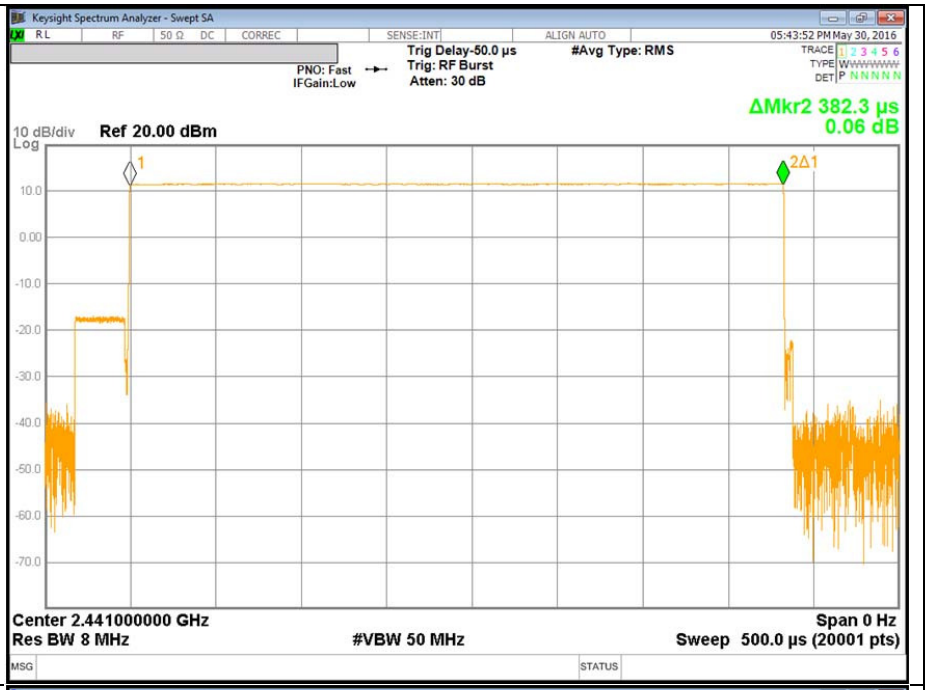
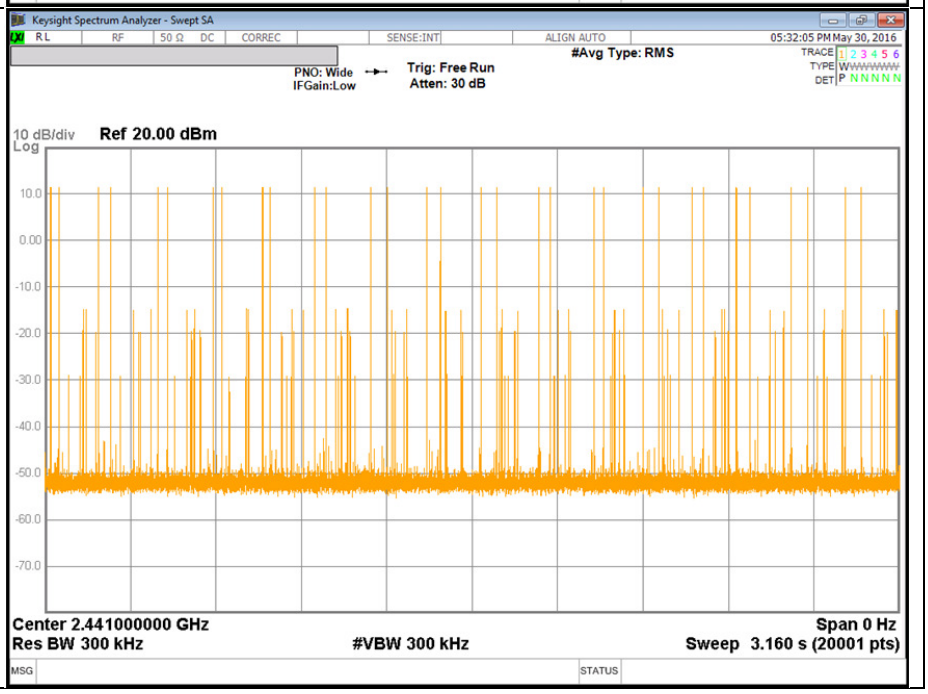
DH1

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

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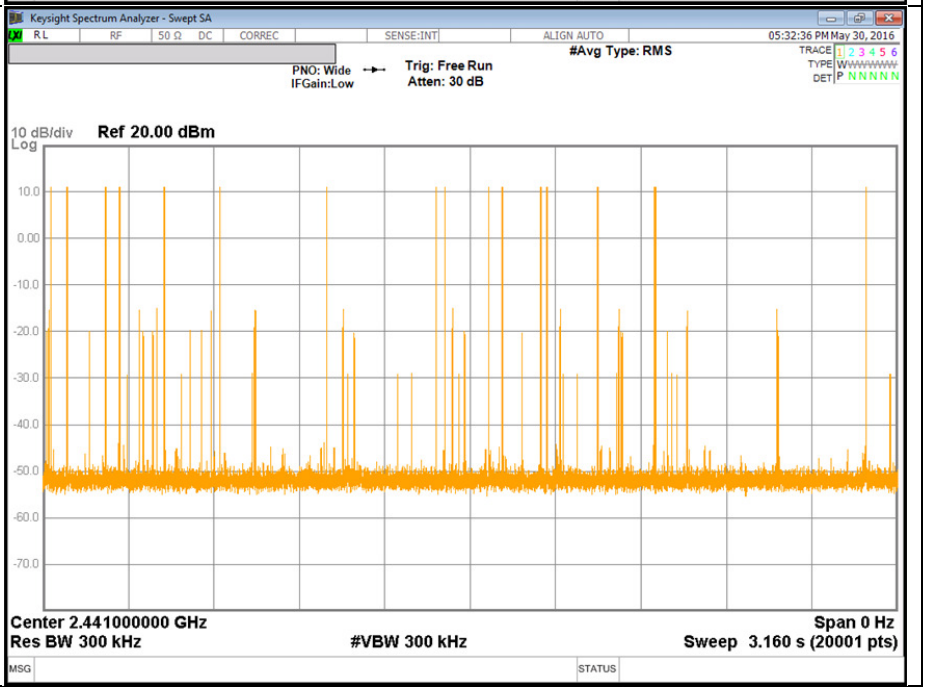
DH3

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

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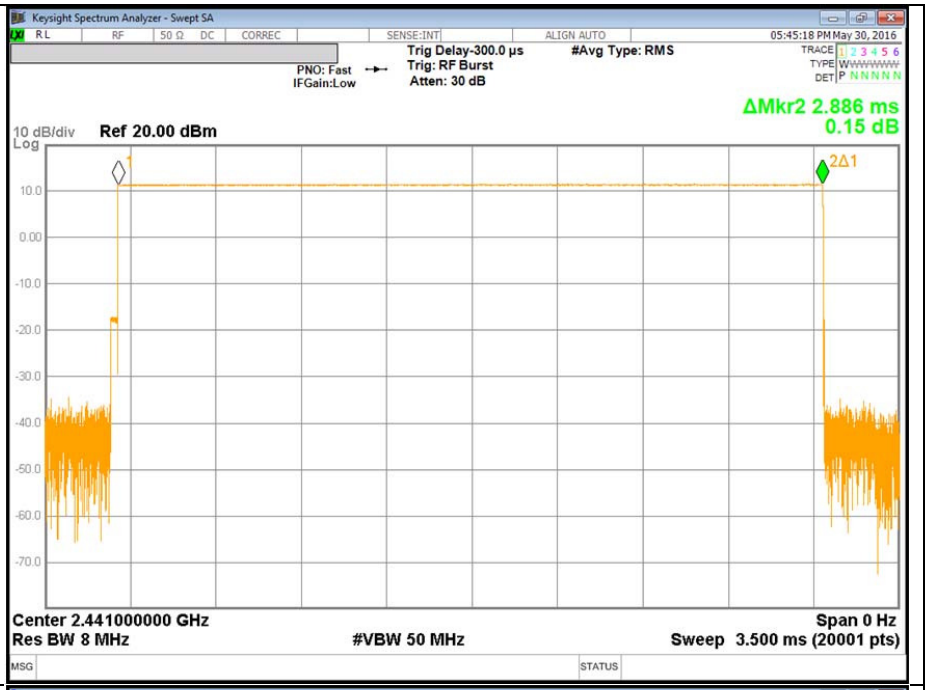
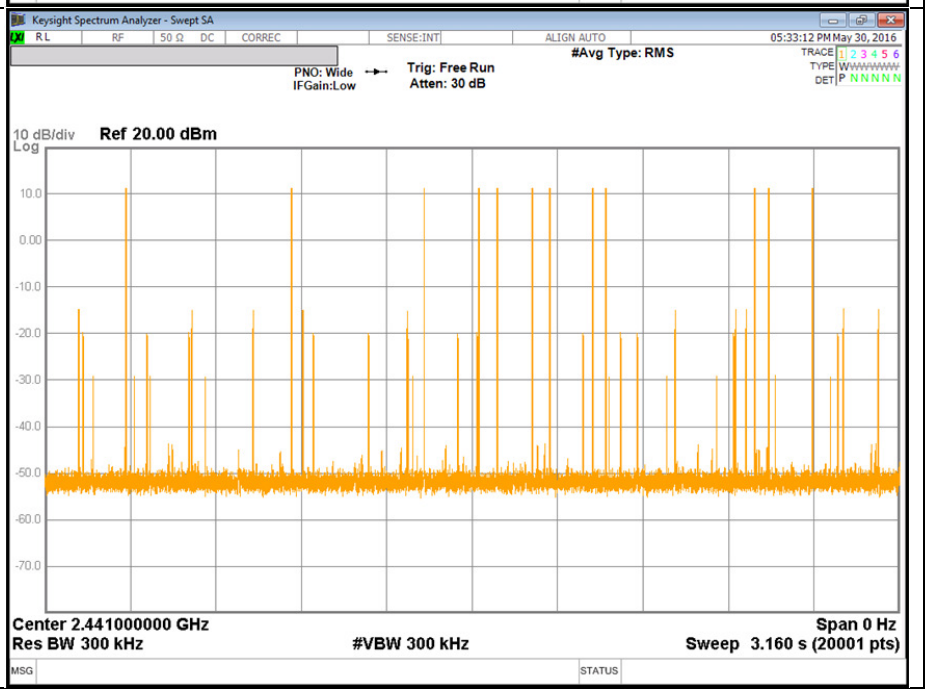
DH5

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

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8.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

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

TEST PROCEDURE

DA 00-705: 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

8.5.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	12.601	21	-8.399
Middle	2441	11.816	21	-9.184
High	2480	11.766	21	-9.234
Worst		12.601	21	-8.399

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	10.687	21	-10.313
Middle	2441	9.982	21	-11.018
High	2480	9.638	21	-11.362
Worst		10.687	21	-10.313

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	11.148	21	-9.852
Middle	2441	10.455	21	-10.545
High	2480	10.108	21	-10.892
Worst		11.148	21	-9.852

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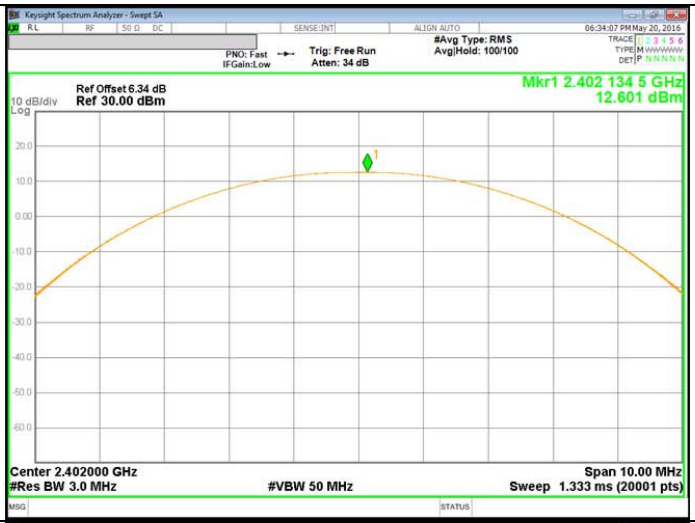
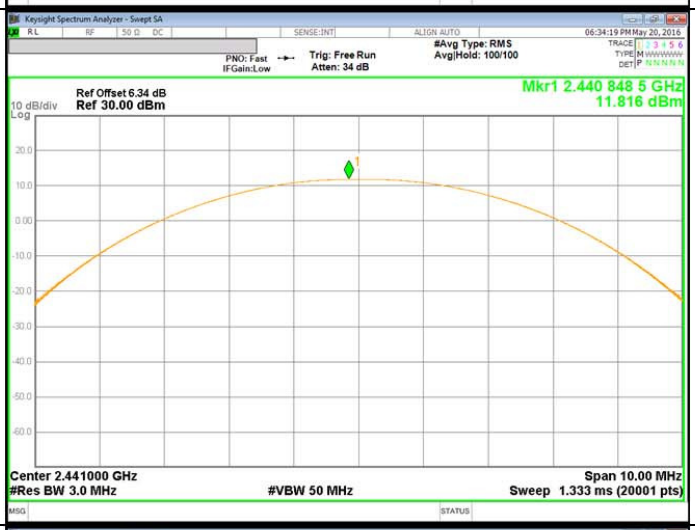
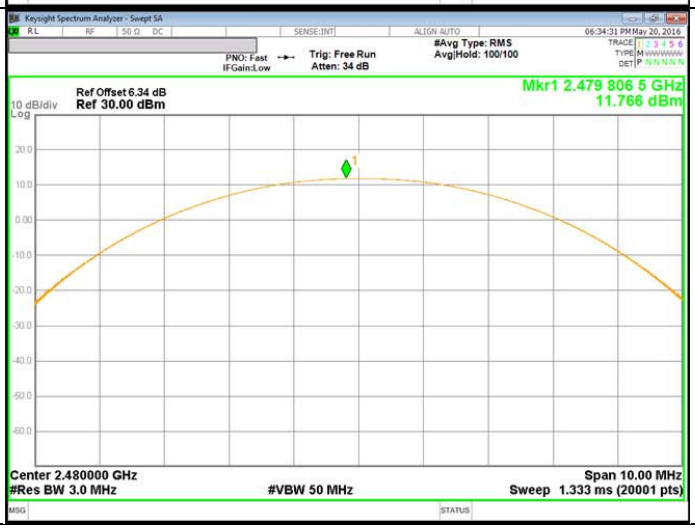
8.5.4. OUTPUT POWER PLOTS

GFSK OUTPUT POWER

GFSK Low CH			
GFSK Middle CH			
GFSK High CH			

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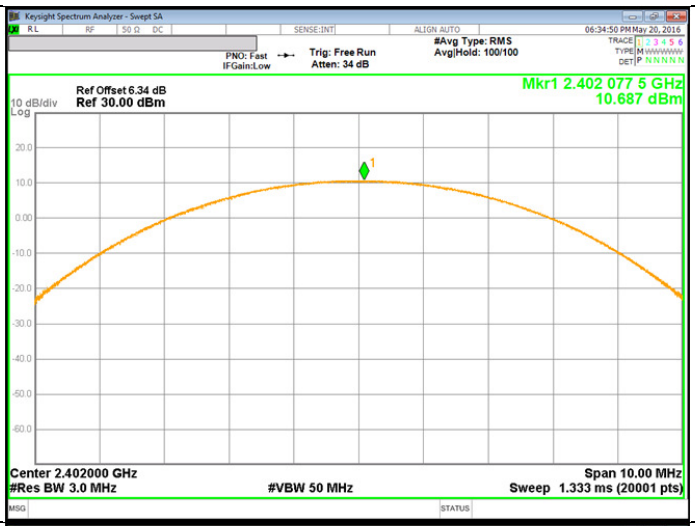
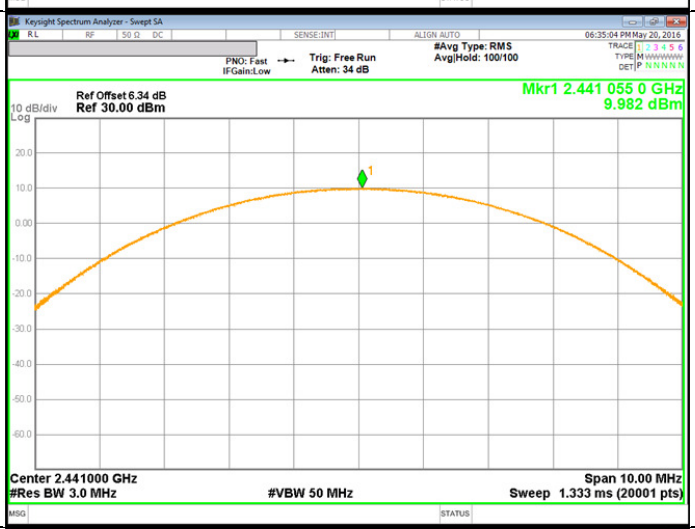
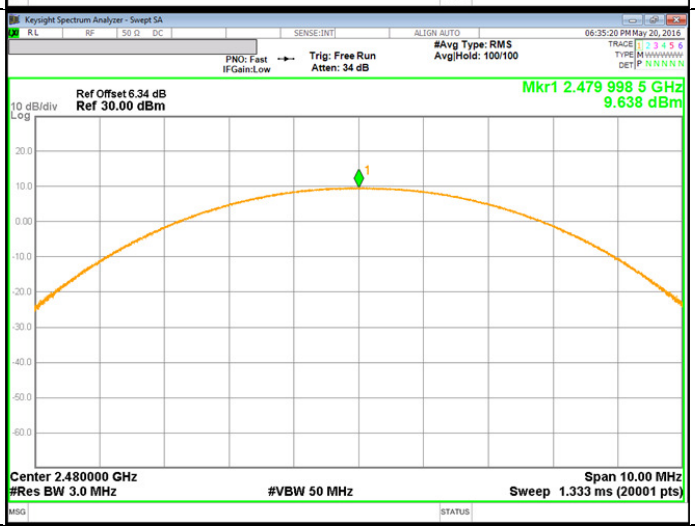
Pi/4-DPSK OUTPUT POWER

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

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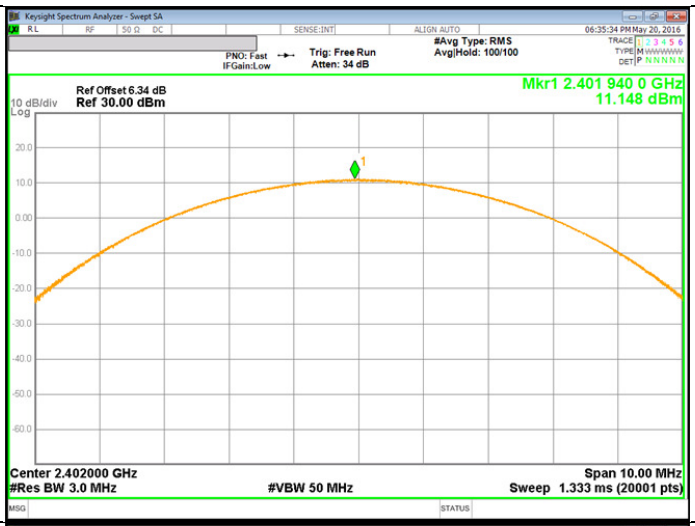
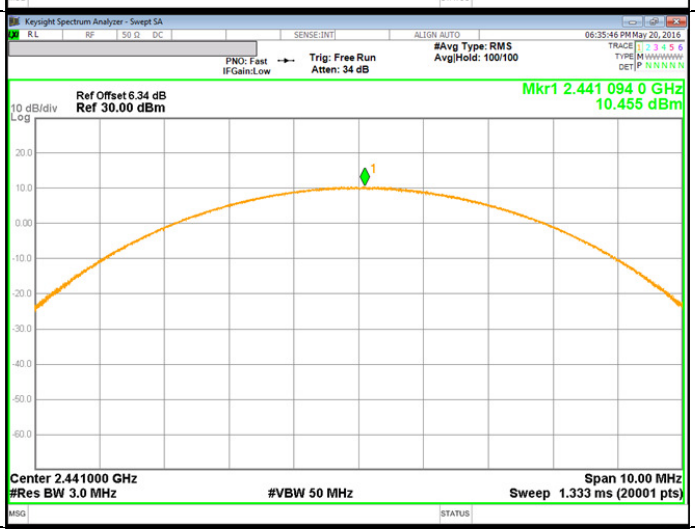
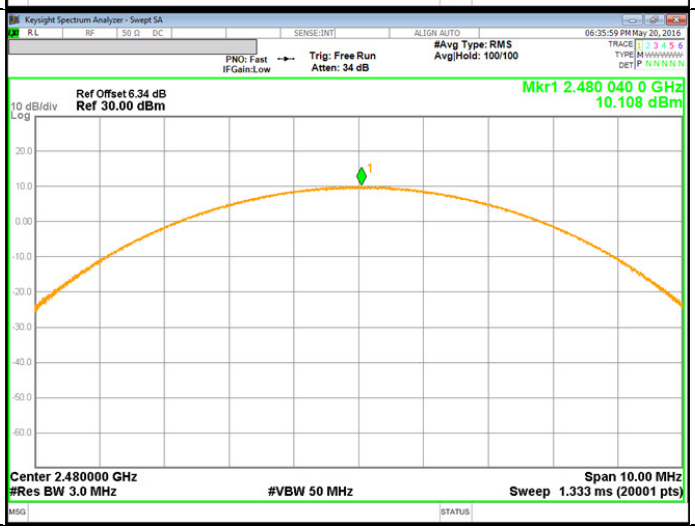
8PSK OUTPUT POWER

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

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8.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

8.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	12.172	16.49
Middle	2441	11.425	13.88
High	2480	11.324	13.56

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.028	6.35
Middle	2441	7.279	5.34
High	2480	6.872	4.87

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.051	6.38
Middle	2441	7.301	5.37
High	2480	6.888	4.88

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8.7. 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

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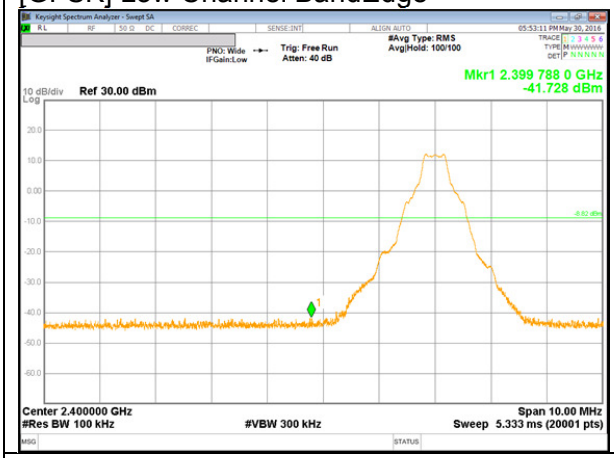
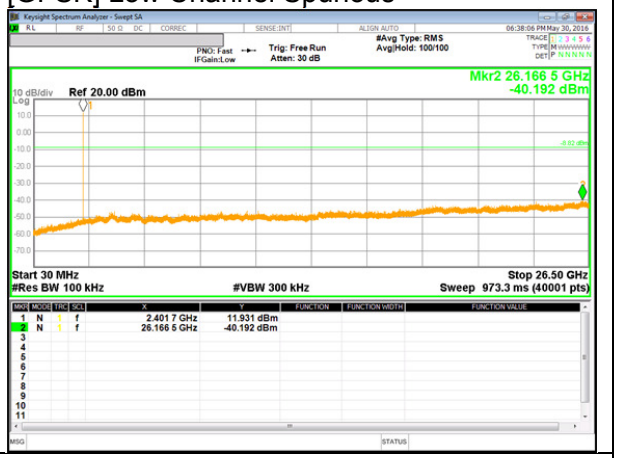
8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

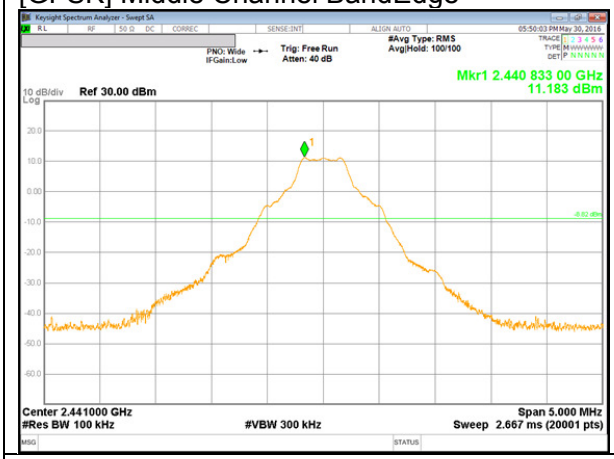
[GFSK] Low Channel BandEdge



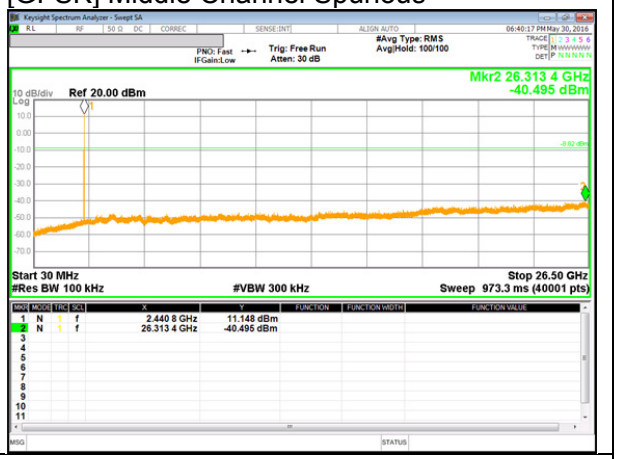
[GFSK] Low Channel Spurious



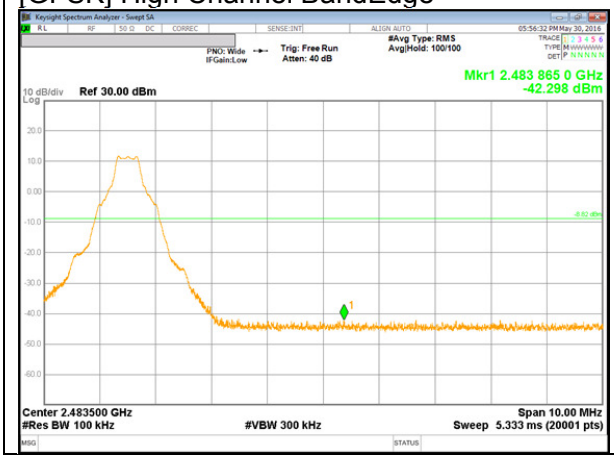
[GFSK] Middle Channel BandEdge



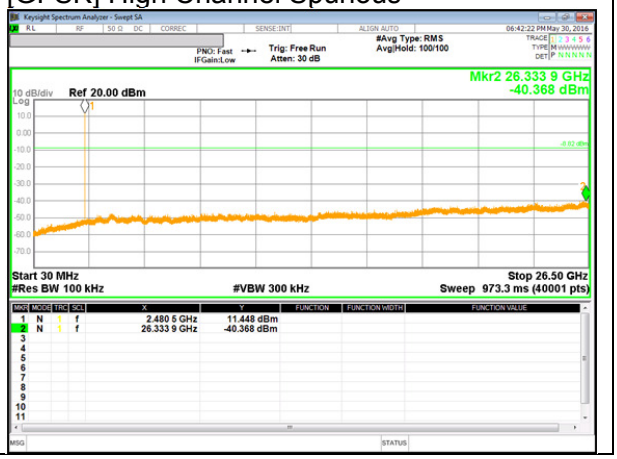
[GFSK] Middle Channel Spurious



[GFSK] High Channel BandEdge



[GFSK] High Channel Spurious



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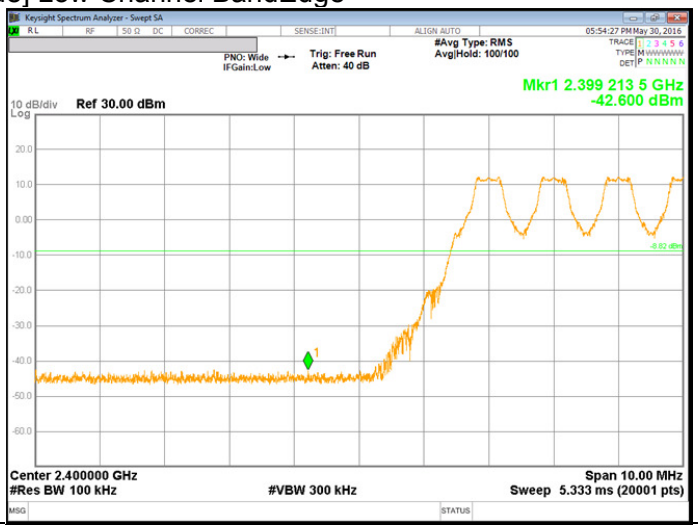
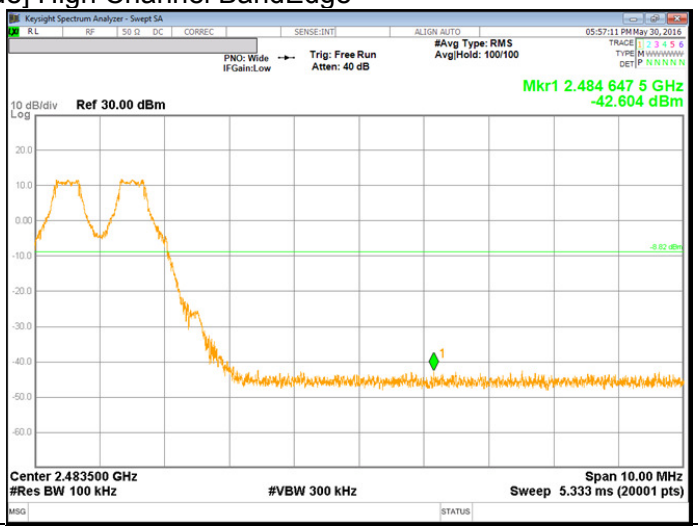
BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge



[GFSK Hopping Mode] High Channel BandEdge



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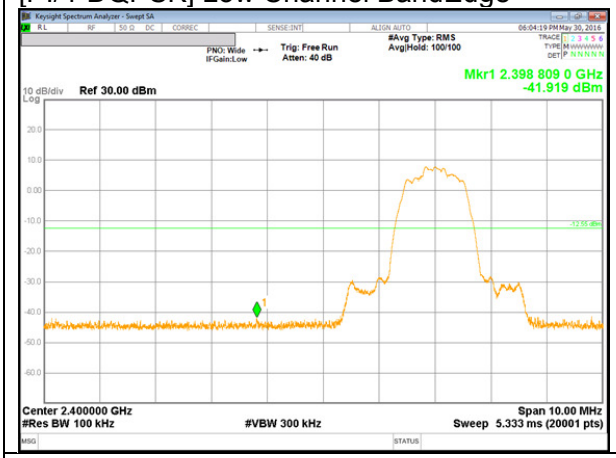
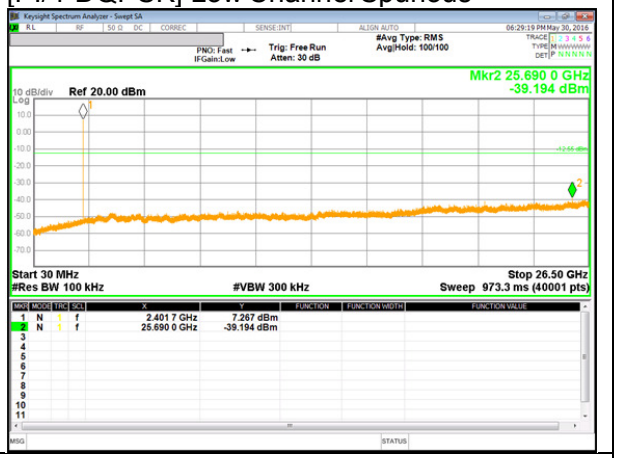
PI/4-DQPSK Mode

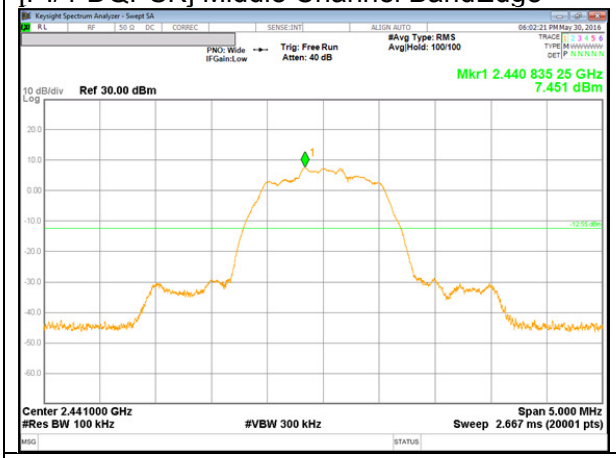
[PI/4-DQPSK] Low Channel BandEdge



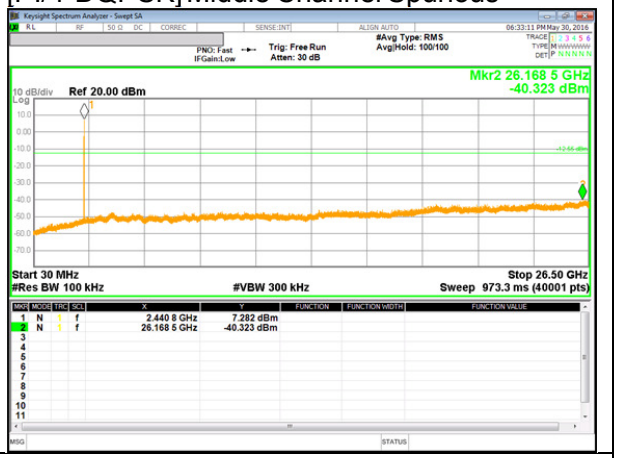
[PI/4-DQPSK] Low Channel Spurious



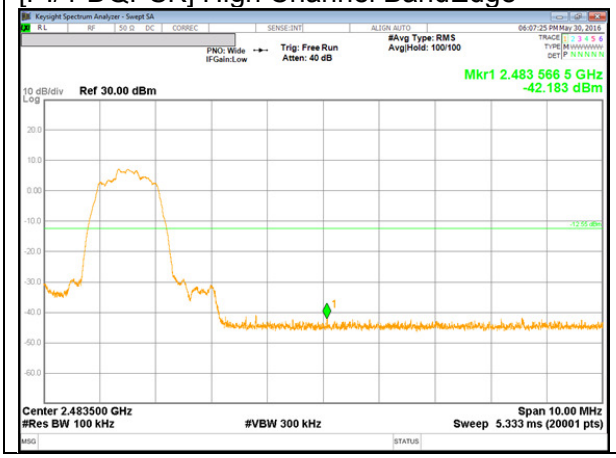
[PI/4-DQPSK] Middle Channel BandEdge



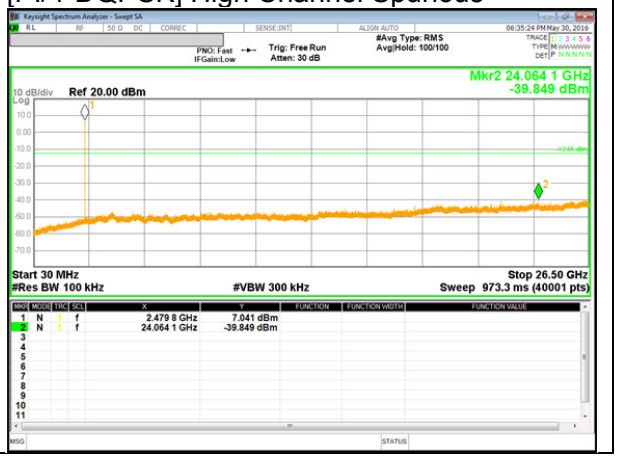
[PI/4-DQPSK] Middle Channel Spurious



[PI/4-DQPSK] High Channel BandEdge



[PI/4-DQPSK] High Channel Spurious



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BandEdge Emission at PI/4-DQPSK Hopping Mode

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

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

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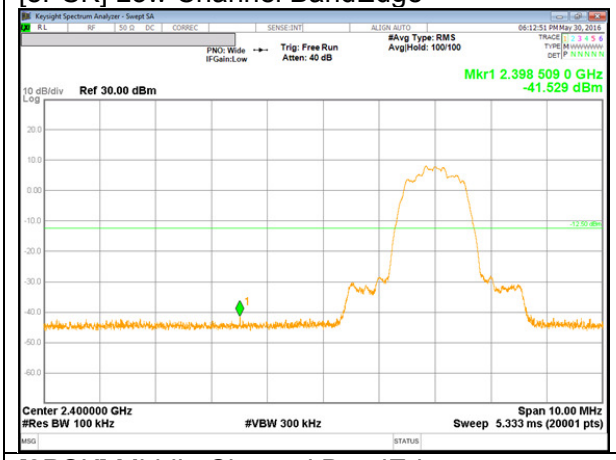
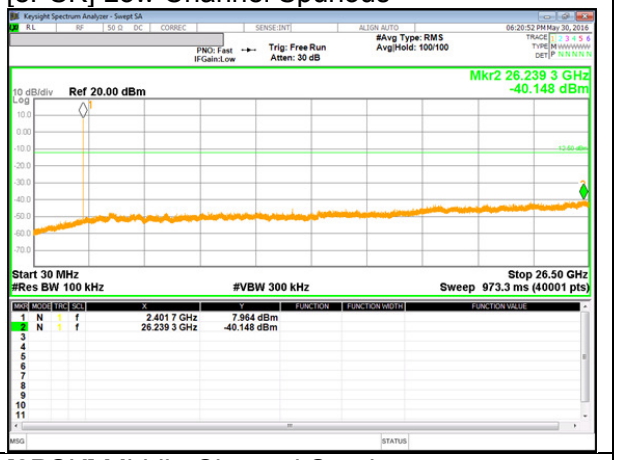
8PSK Mode

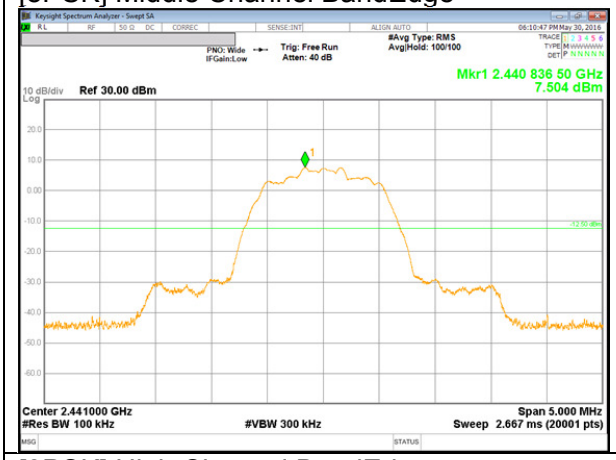
[8PSK] Low Channel BandEdge



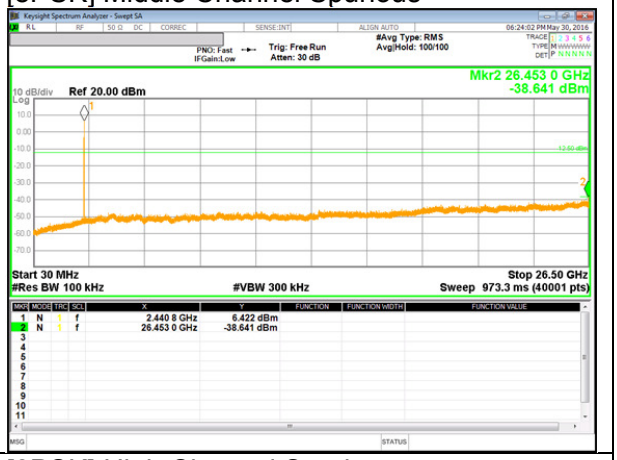
[8PSK] Low Channel Spurious



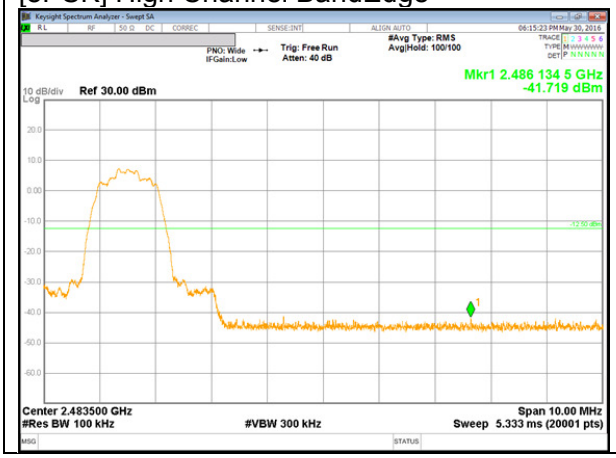
[8PSK] Middle Channel BandEdge



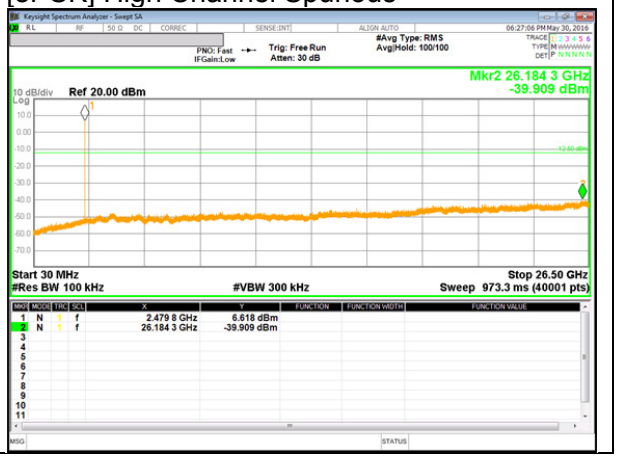
[8PSK] Middle Channel Spurious



[8PSK] High Channel BandEdge



[8PSK] High Channel Spurious



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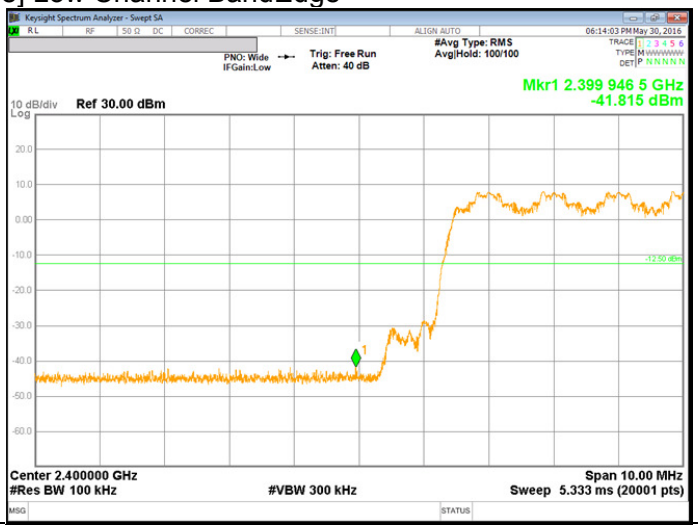
BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge



[8PSK Hopping Mode] High Channel BandEdge

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9. RADIATED TEST RESULTS

9.1. 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.

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TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. 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 band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 1/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.0029S = 350Hz.

The spectrum from 1GHzHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

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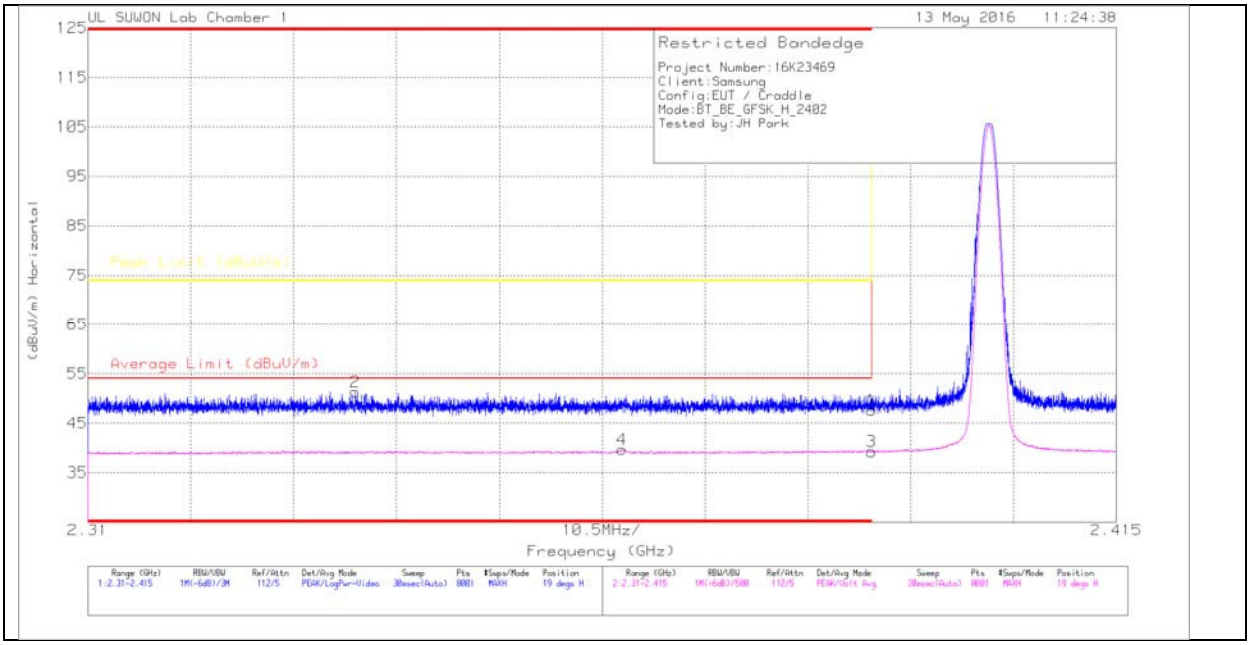
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. 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)_150619	Path_2	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	44.86	Pk	31.8	-29	47.66	-	-	74	-26.34	19	100	H
2	* 2.337	48.61	Pk	31.7	-29	51.31	-	-	74	-22.69	19	100	H
3	* 2.39	36.46	V1TV	31.8	-29	39.26	54	-14.74	-	-	19	100	H
4	* 2.365	36.92	V1TV	31.8	-29	39.72	54	-14.28	-	-	19	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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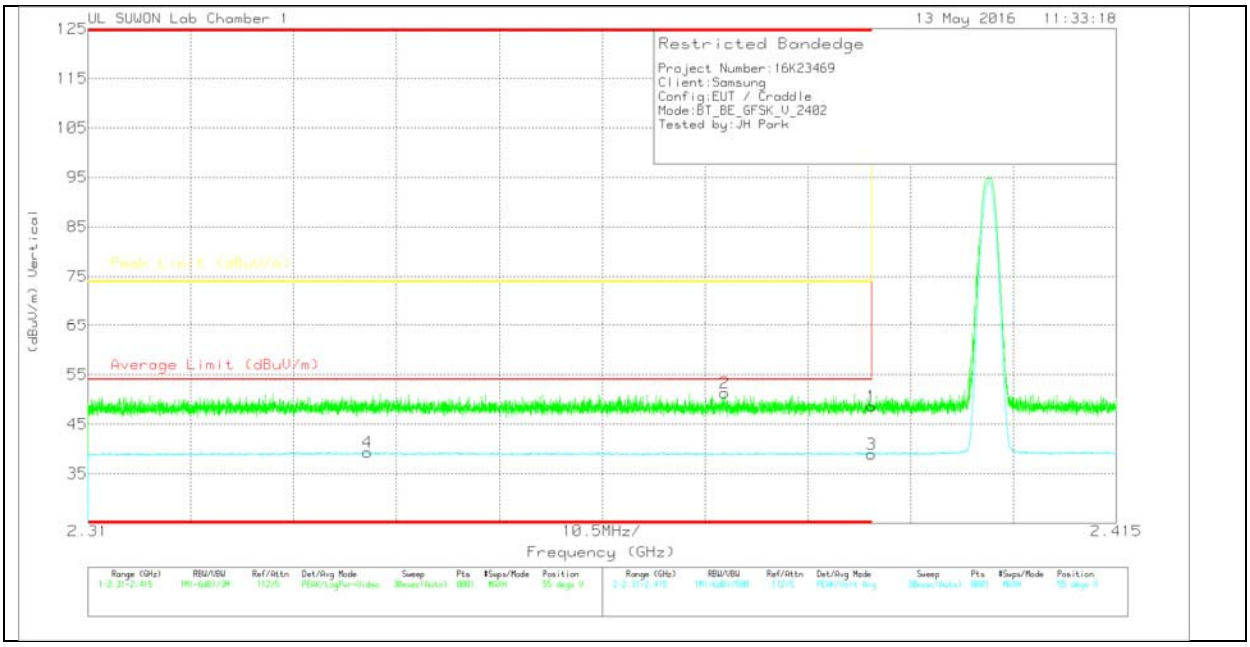
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2	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	45.76	Pk	31.8	-29	48.56	-	-	74	-25.44	55	349	V
2	* 2.375	48.48	Pk	31.8	-29	51.28	-	-	74	-22.72	55	349	V
3	* 2.39	36.2	V1TV	31.8	-29	39	54	-15	-	-	55	349	V
4	* 2.339	36.66	V1TV	31.7	-29	39.36	54	-14.64	-	-	55	349	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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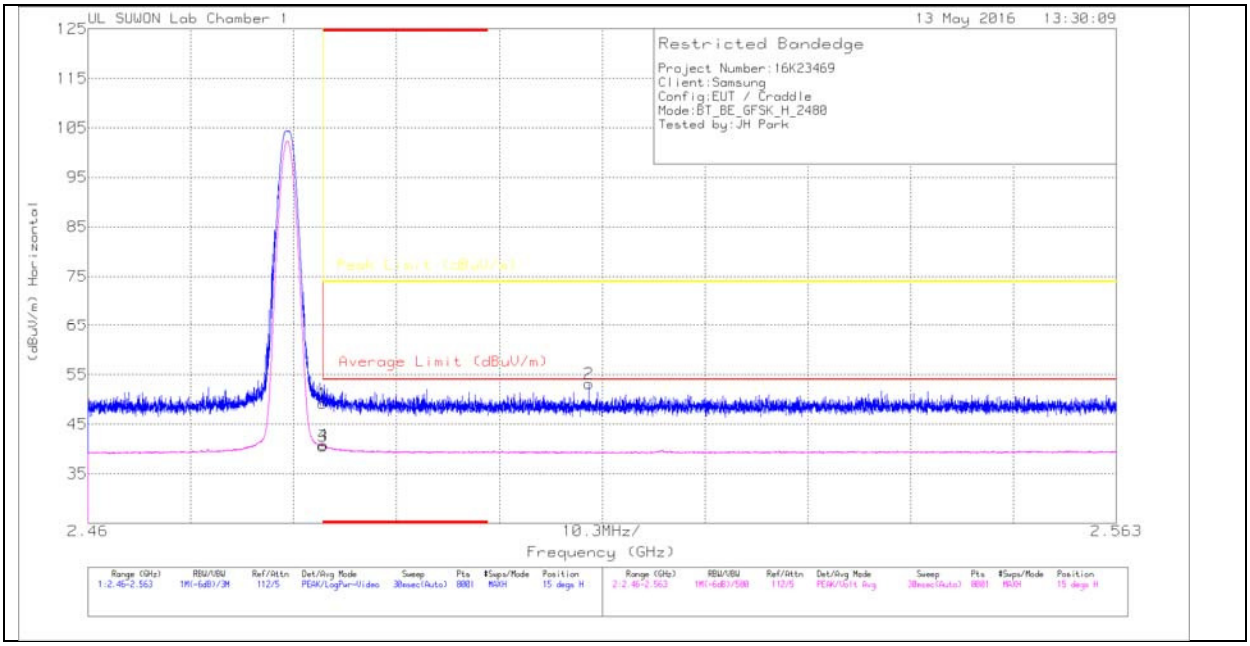
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	46.09	Pk	32	-28.9	49.19	-	-	74	-24.81	15	100	H
2	2.51	50.04	Pk	32	-28.9	53.14	-	-	74	-20.86	15	100	H
3	* 2.484	37.48	V1TV	32	-28.9	40.58	54	-13.42	-	-	15	100	H
4	* 2.484	37.65	V1TV	32	-28.9	40.75	54	-13.25	-	-	15	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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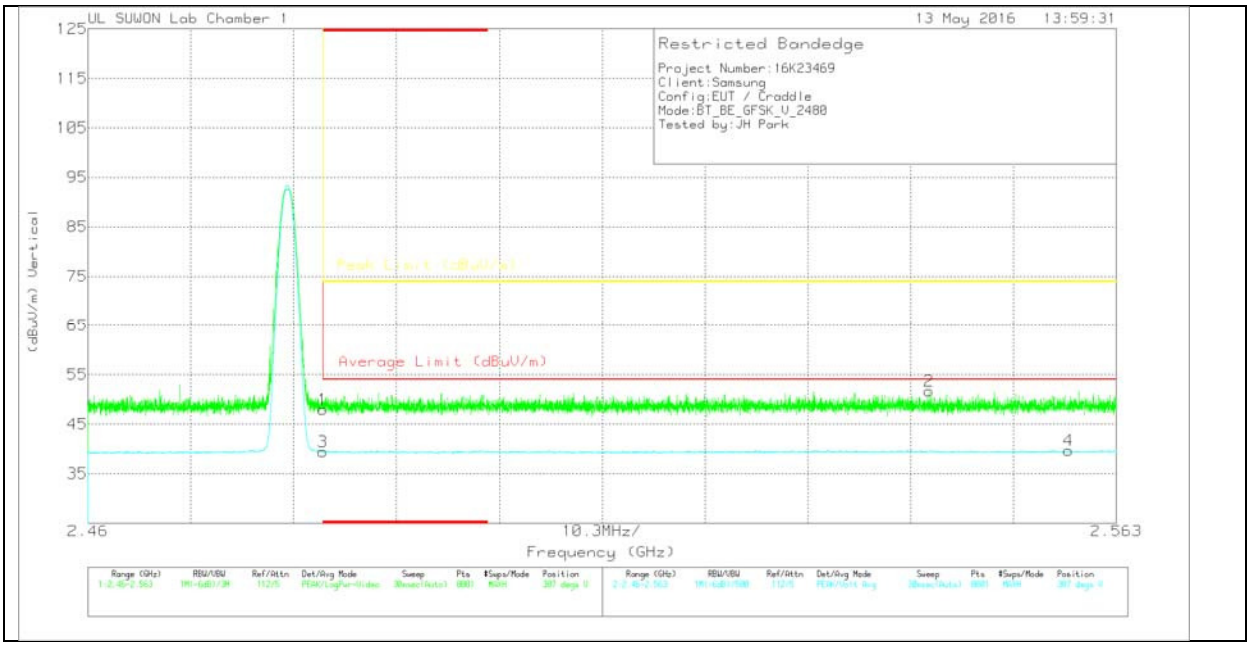
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	44.83	Pk	32	-28.9	47.93	-	-	74	-26.07	307	211	V
2	2.544	48.47	Pk	32	-28.8	51.67	-	-	74	-22.33	307	211	V
3	* 2.484	36.31	V1TV	32	-28.9	39.41	54	-14.59	-	-	307	211	V
4	2.558	36.54	V1TV	32	-28.8	39.74	54	-14.26	-	-	307	211	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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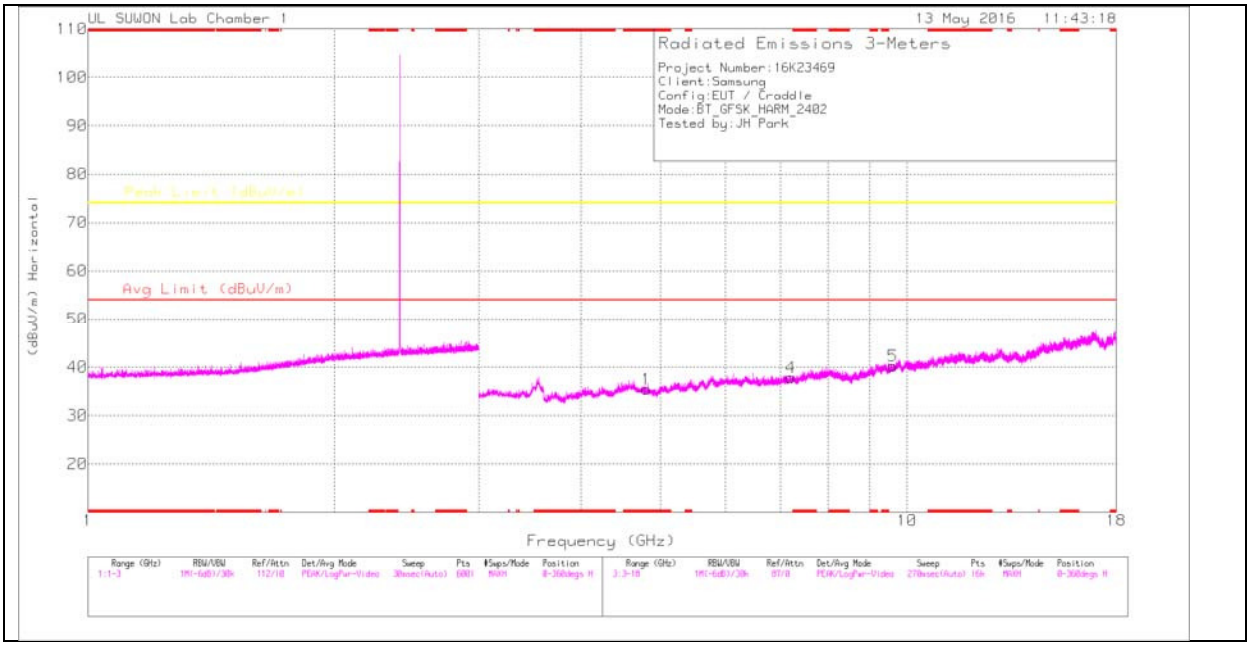
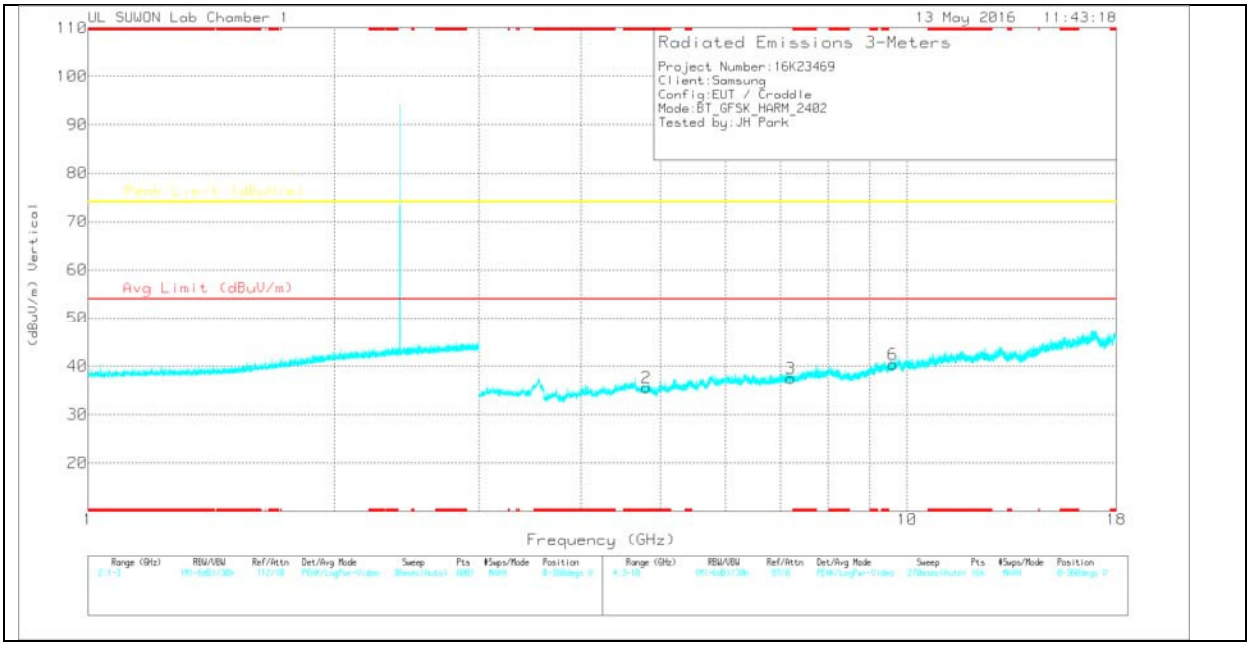
HARMONICS AND SPURIOUS EMISSIONS

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.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.806	35.24	PK	34	-33.8	35.44	-	-	74	-38.56	0-360	200	H
4	7.209	32.88	PK	35.7	-30.8	37.78	-	-	74	-36.22	0-360	100	H
5	9.611	30.57	PK	37	-27.3	40.27	-	-	74	-33.73	0-360	100	H
2	* 4.806	35.36	PK	34	-33.8	35.56	-	-	74	-38.44	0-360	200	V
3	7.21	32.55	PK	35.7	-30.8	37.45	-	-	74	-36.55	0-360	200	V
6	9.614	30.55	PK	37	-27.2	40.35	-	-	74	-33.65	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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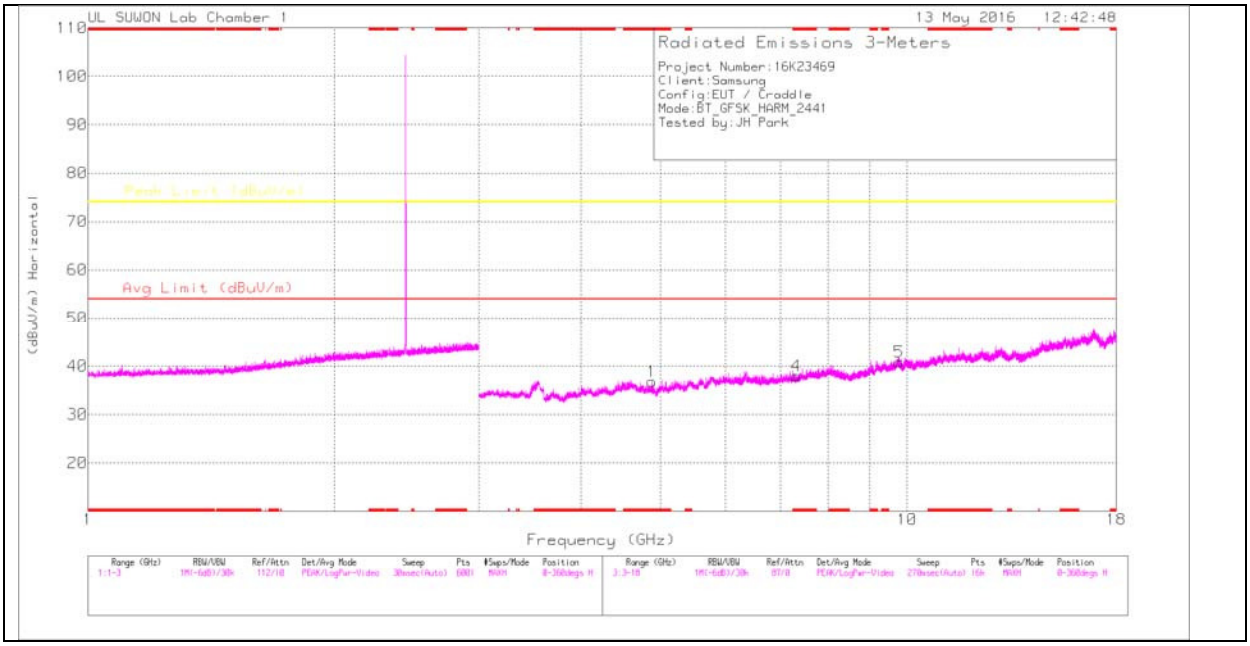
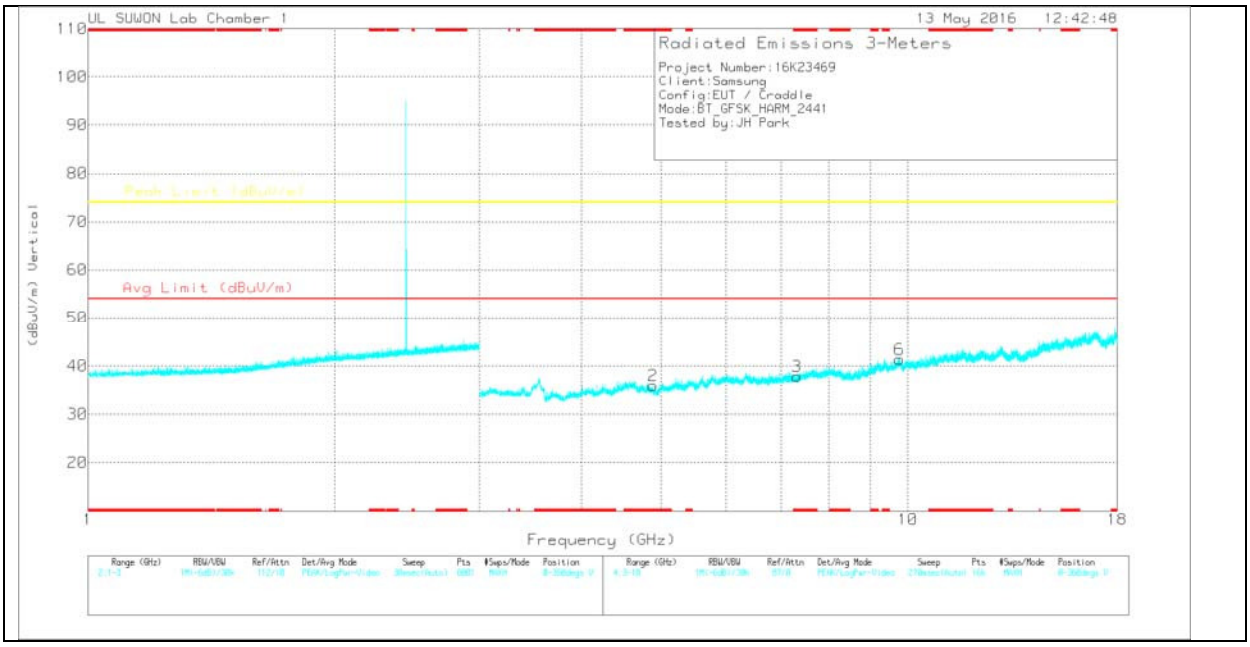
MID CHANNEL HORIZONTAL



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.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.883	36.79	PK	34	-34	36.79	-	-	74	-37.21	0-360	200	H
4	* 7.323	33.04	PK	35.8	-30.9	37.94	-	-	74	-36.06	0-360	100	H
5	9.766	30.2	PK	37.2	-26.5	40.9	-	-	74	-33.1	0-360	200	H
2	* 4.884	35.89	PK	34	-34	35.89	-	-	74	-38.11	0-360	100	V
3	* 7.323	32.93	PK	35.8	-30.9	37.83	-	-	74	-36.17	0-360	100	V
6	9.766	30.83	PK	37.2	-26.6	41.43	-	-	74	-32.57	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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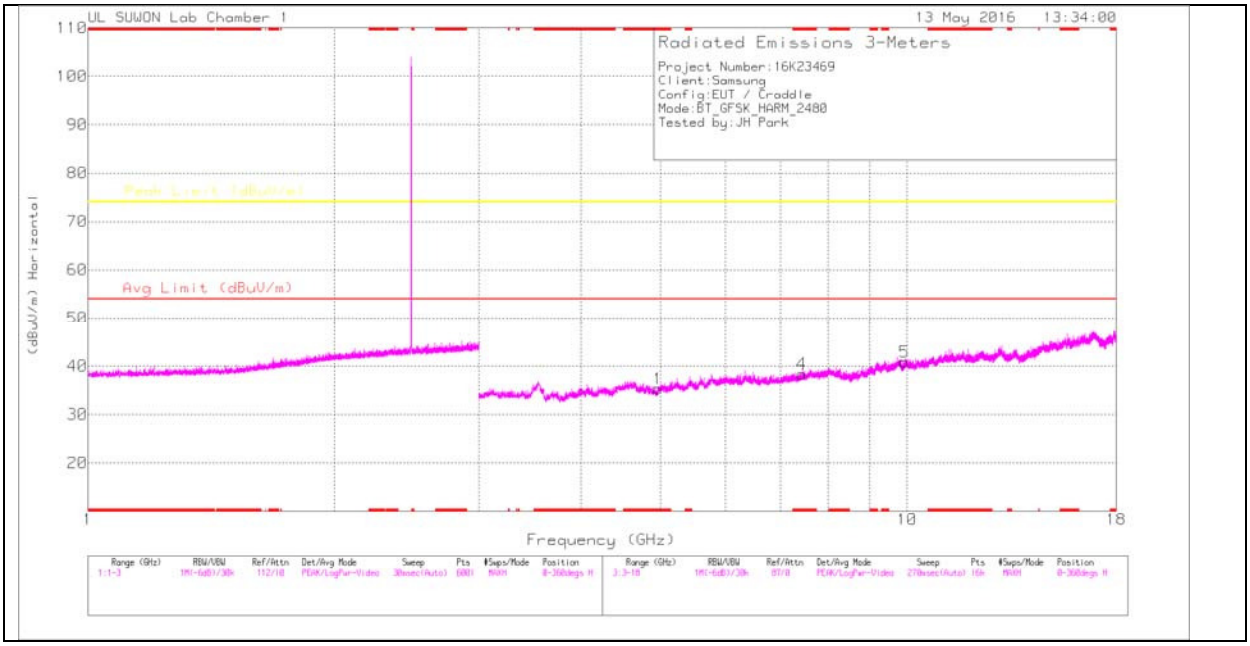
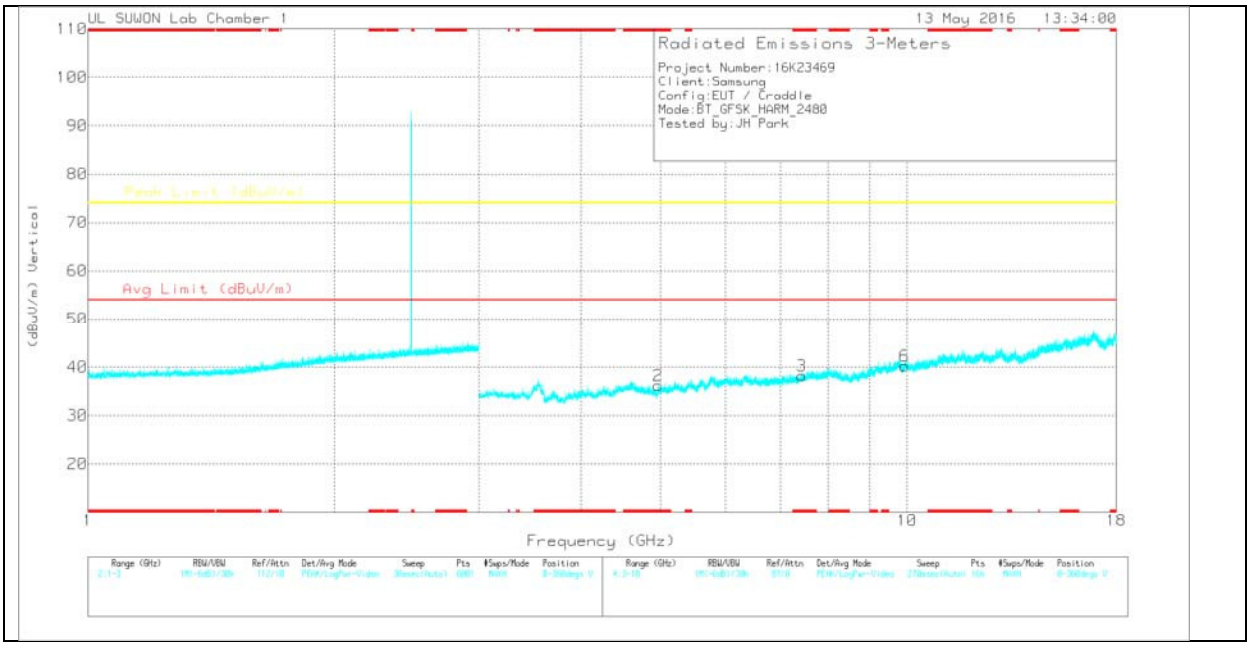
HIGH CHANNEL HORIZONTAL



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.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96	35.25	PK	34	-34	35.25	-	-	74	-38.75	0-360	200	H
4	* 7.44	33.3	PK	35.8	-30.7	38.4	-	-	74	-35.6	0-360	200	H
5	9.92	30.62	PK	37.4	-27.2	40.82	-	-	74	-33.18	0-360	200	H
2	* 4.965	36.08	PK	34.1	-34	36.18	-	-	74	-37.82	0-360	100	V
3	* 7.44	33.06	PK	35.8	-30.7	38.16	-	-	74	-35.84	0-360	100	V
6	9.919	30.09	PK	37.4	-27.2	40.29	-	-	74	-33.71	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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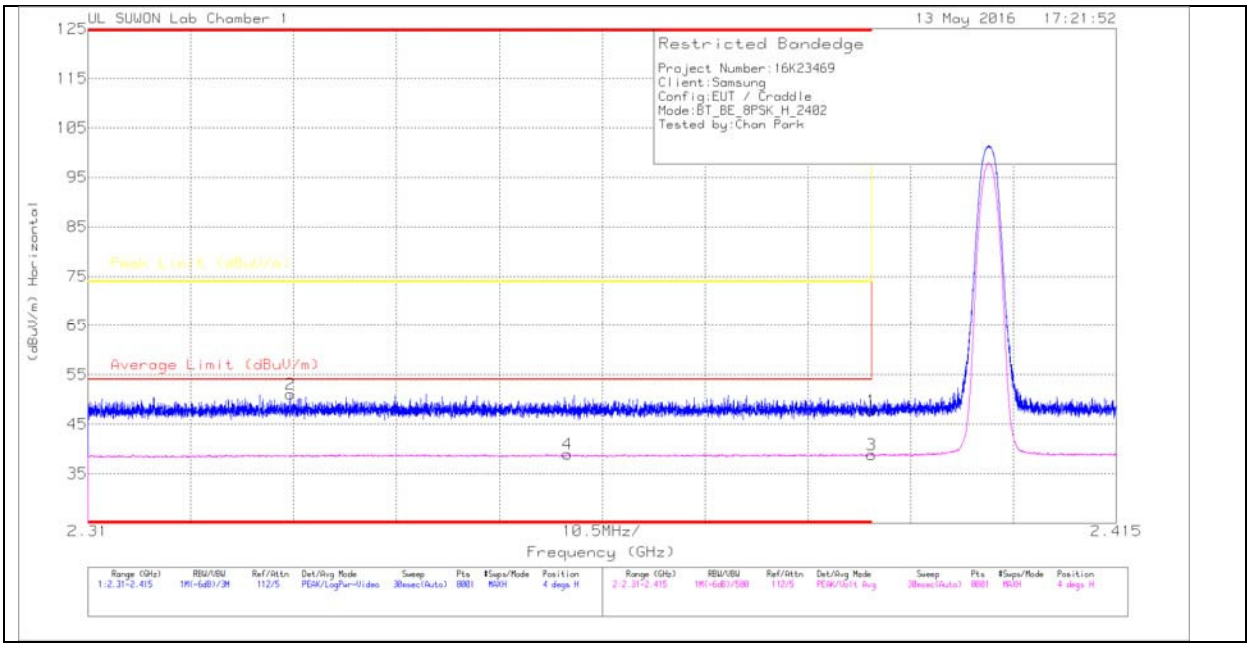
9.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	44.94	Pk	31.8	-29	47.74	-	-	74	-26.26	4	277	H
2	* 2.331	48.4	Pk	31.7	-29	51.1	-	-	74	-22.9	4	277	H
3	* 2.39	35.98	V1TV	31.8	-29	38.78	54	-15.22	-	-	4	277	H
4	* 2.359	36.25	V1TV	31.7	-29	38.95	54	-15.05	-	-	4	277	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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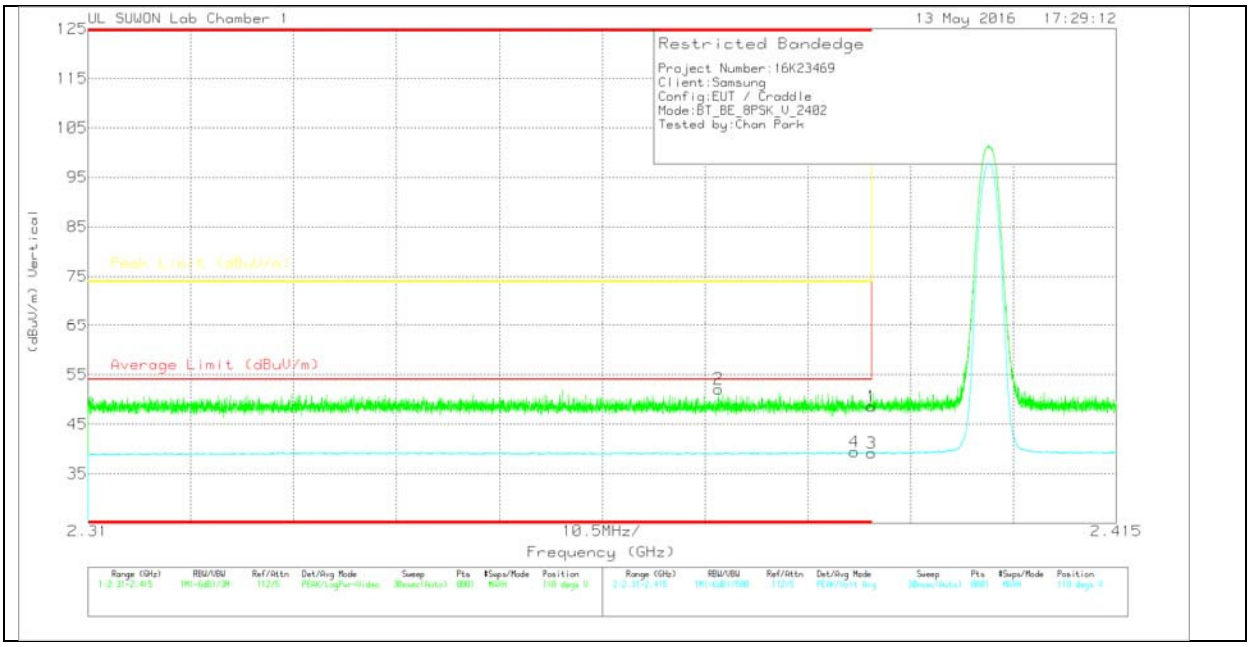
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	45.78	Pk	31.8	-29	48.58	-	-	74	-25.42	118	348	V
2	* 2.374	49.32	Pk	31.8	-29	52.12	-	-	74	-21.88	118	348	V
3	* 2.39	36.35	V1TV	31.8	-29	39.15	54	-14.85	-	-	118	348	V
4	* 2.388	36.63	V1TV	31.8	-29	39.43	54	-14.57	-	-	118	348	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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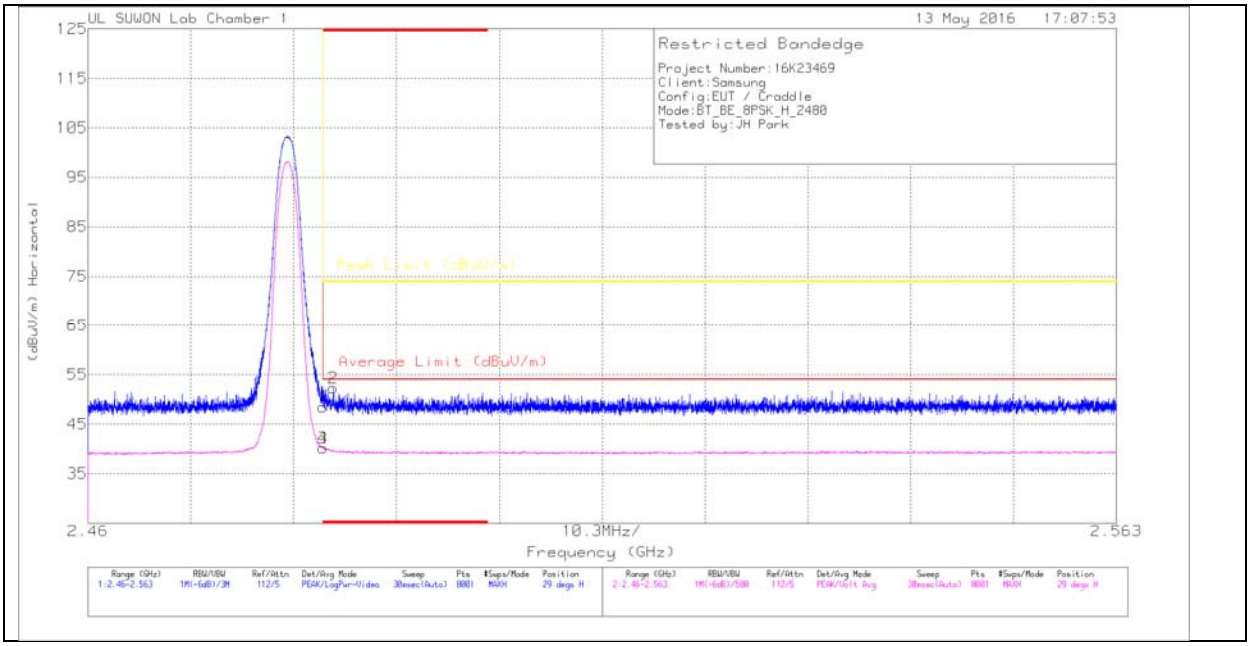
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	45.35	Pk	32	-28.9	48.45	-	-	74	-25.55	29	100	H
2	* 2.485	49.18	Pk	32	-28.9	52.28	-	-	74	-21.72	29	100	H
3	* 2.484	37.14	V1TV	32	-28.9	40.24	54	-13.76	-	-	29	100	H
4	* 2.484	37.14	V1TV	32	-28.9	40.24	54	-13.76	-	-	29	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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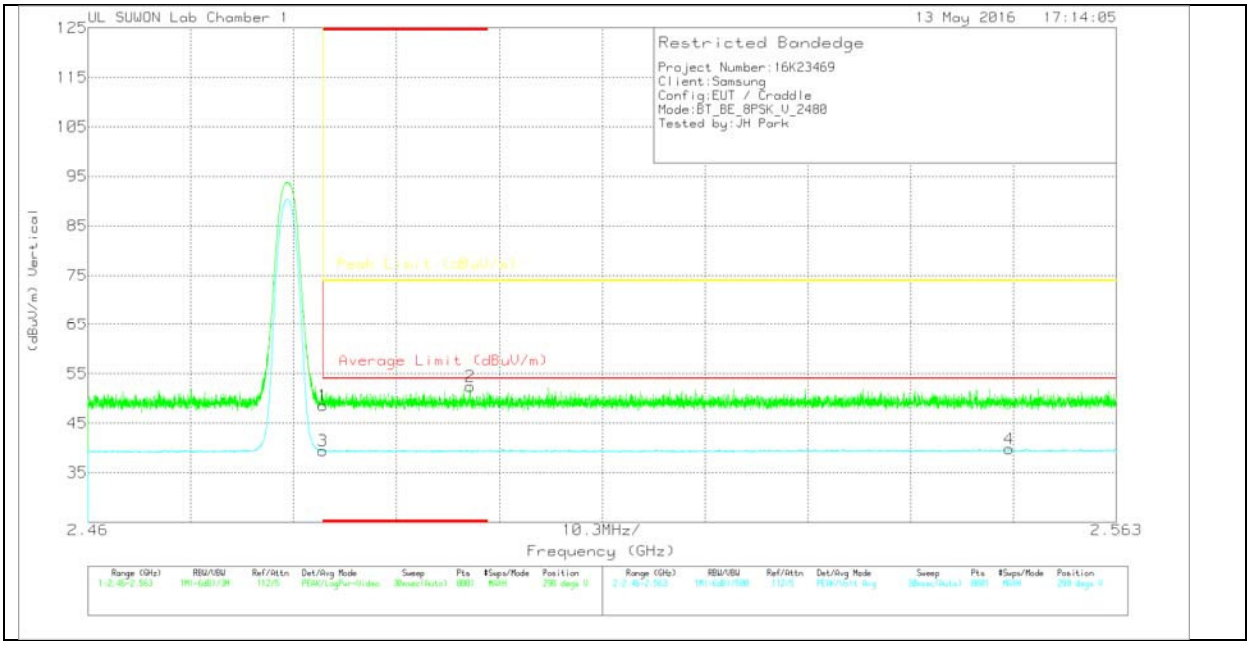
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	45.47	Pk	32	-28.9	48.57	-	-	74	-25.43	298	360	V
2	* 2.498	49.28	Pk	32	-28.9	52.38	-	-	74	-21.62	298	360	V
3	* 2.484	36.35	V1TV	32	-28.9	39.45	54	-14.55	-	-	298	360	V
4	2.552	36.61	V1TV	32	-28.8	39.81	54	-14.19	-	-	298	360	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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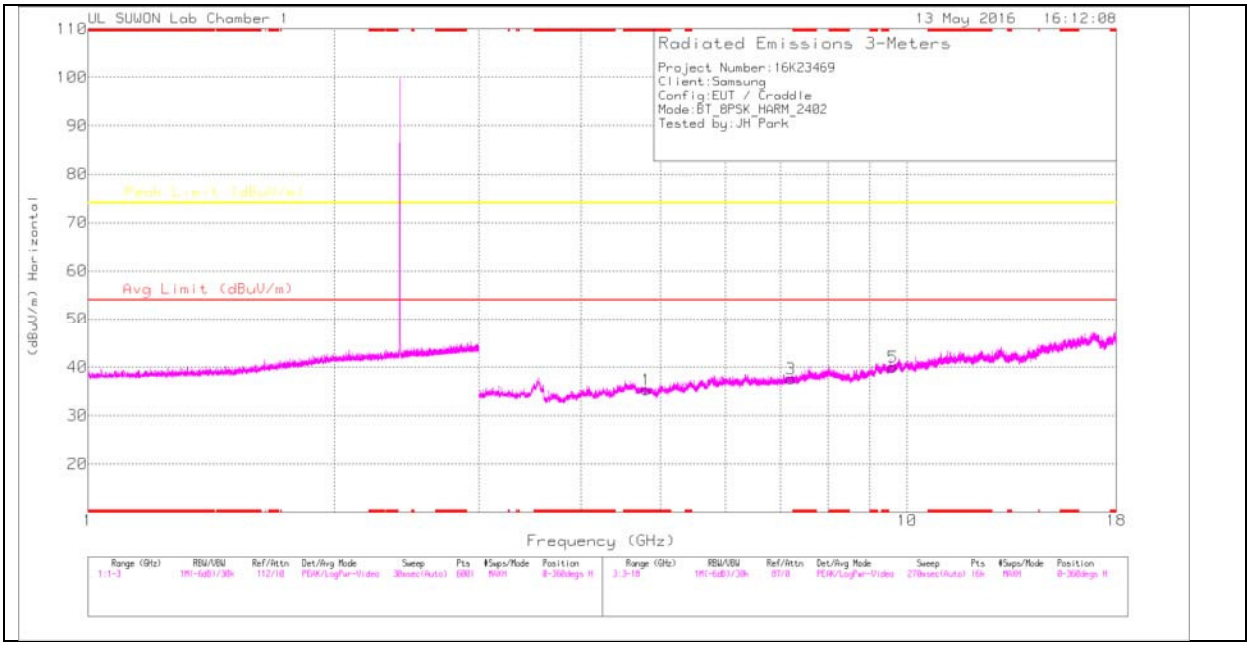
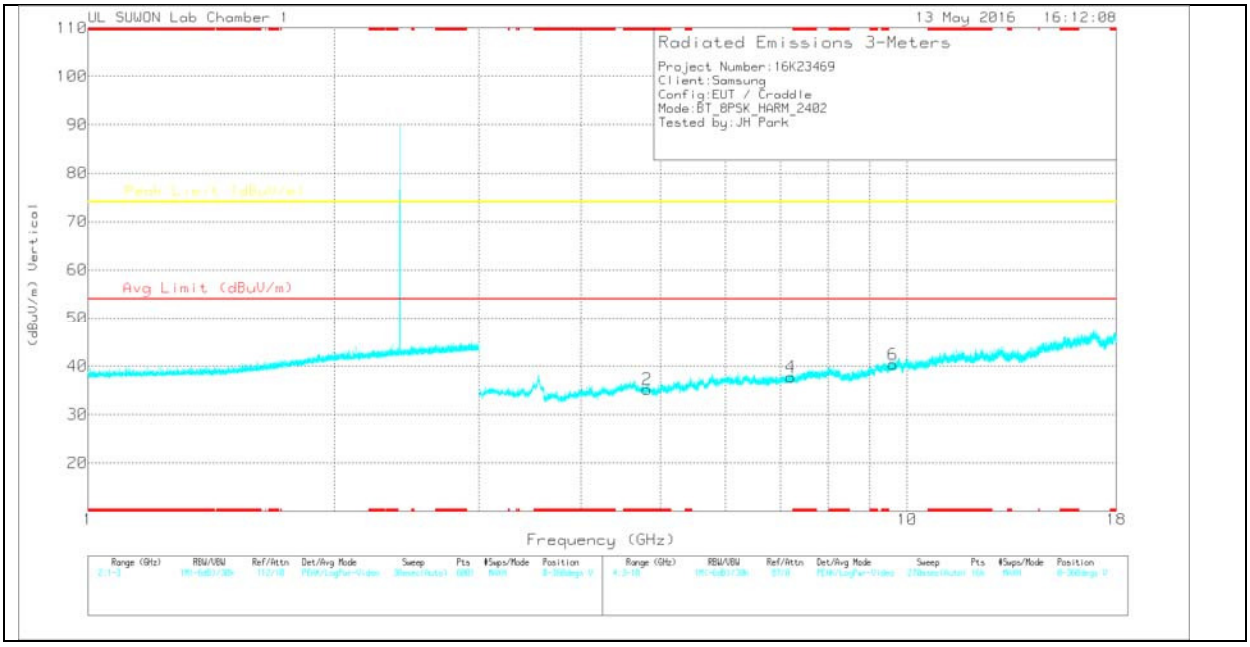
HARMONICS AND SPURIOUS EMISSIONS

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.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	35.13	PK	34	-33.8	35.33	-	-	74	-38.67	0-360	200	H
3	7.207	32.64	PK	35.7	-30.8	37.54	-	-	74	-36.46	0-360	100	H
5	9.607	30.32	PK	37	-27.3	40.02	-	-	74	-33.98	0-360	100	H
2	* 4.809	35.04	PK	34	-33.8	35.24	-	-	74	-38.76	0-360	200	V
4	7.206	32.87	PK	35.7	-30.8	37.77	-	-	74	-36.23	0-360	100	V
6	9.604	30.63	PK	37	-27.3	40.33	-	-	74	-33.67	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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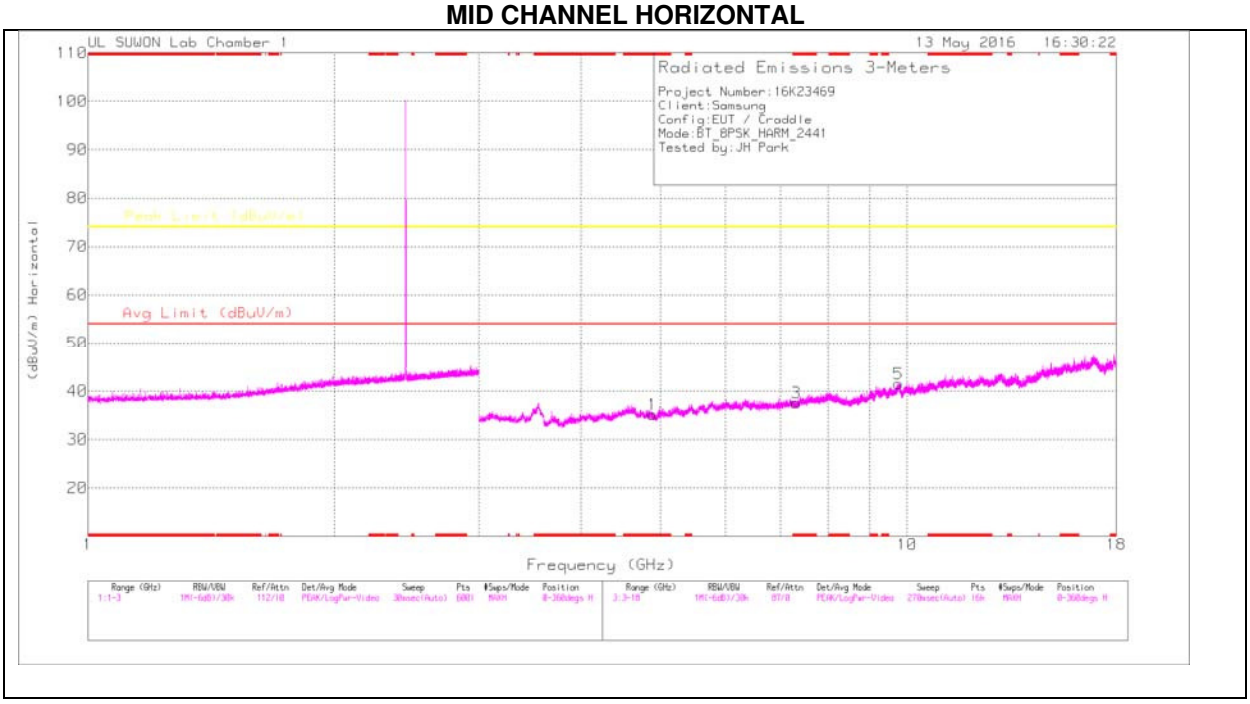
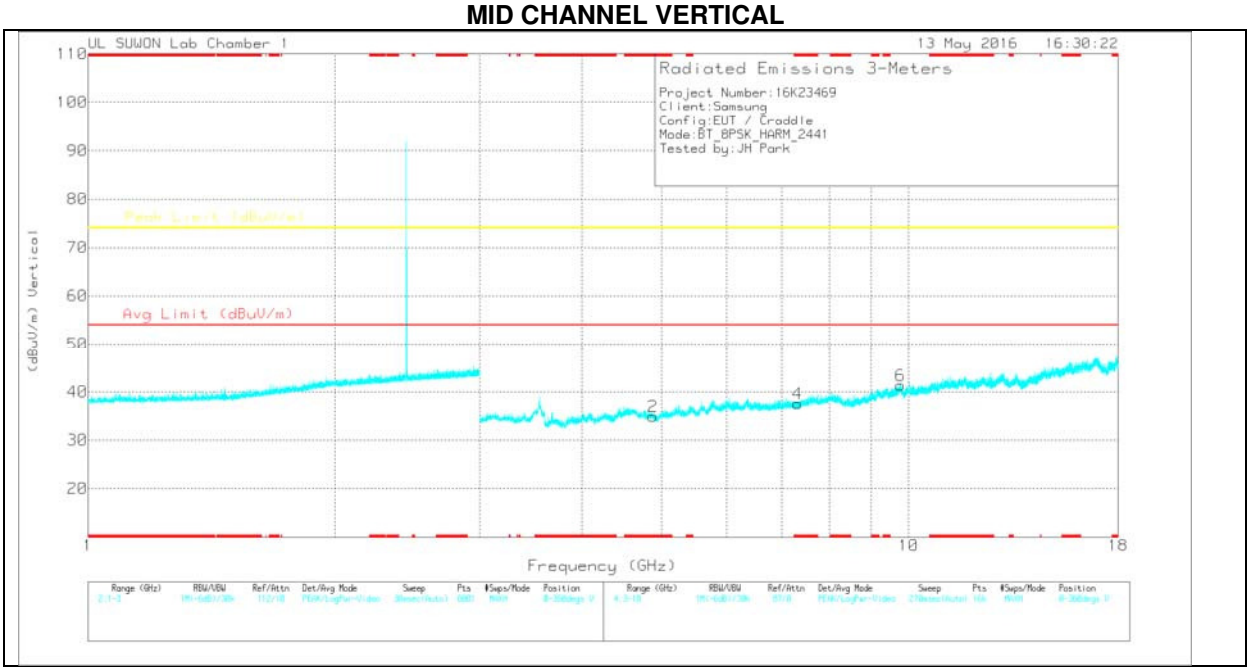
MID CHANNEL HORIZONTAL



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.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.884	35.19	PK	34	-34	35.19	-	-	74	-38.81	0-360	100	H
3	* 7.322	32.65	PK	35.8	-30.9	37.55	-	-	74	-36.45	0-360	200	H
5	9.763	30.85	PK	37.2	-26.6	41.45	-	-	74	-32.55	0-360	200	H
2	* 4.881	34.91	PK	34	-34	34.91	-	-	74	-39.09	0-360	200	V
4	* 7.324	32.72	PK	35.8	-30.9	37.62	-	-	74	-36.38	0-360	200	V
6	9.768	30.62	PK	37.2	-26.5	41.32	-	-	74	-32.68	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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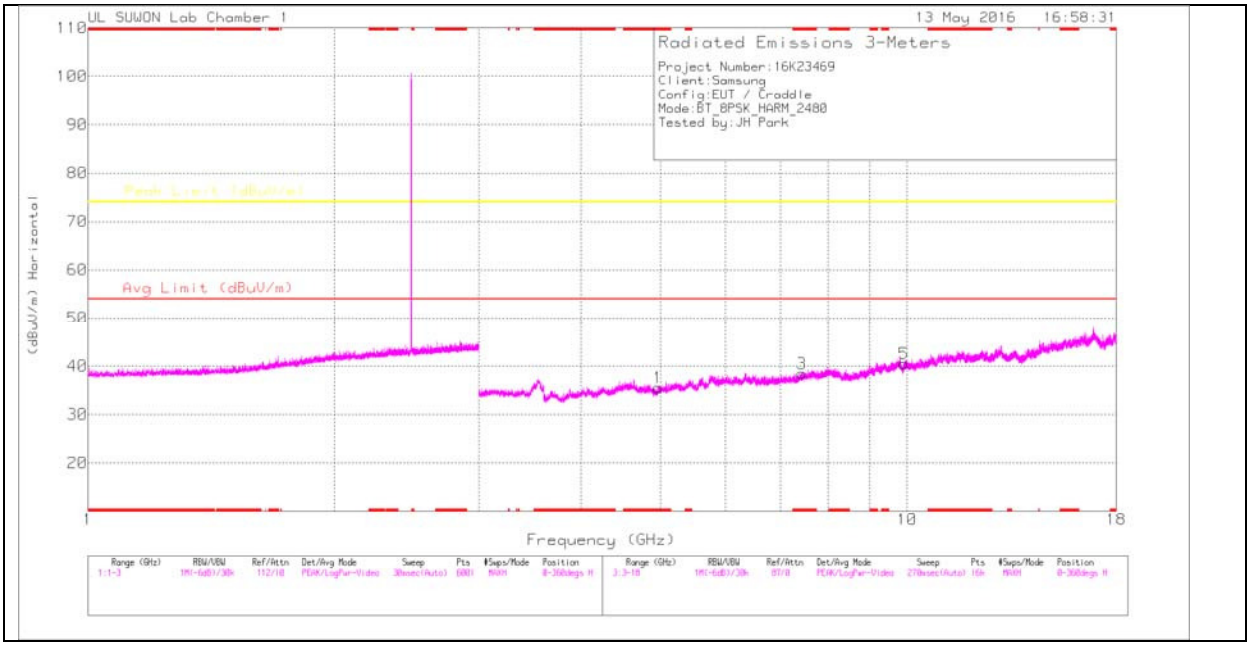
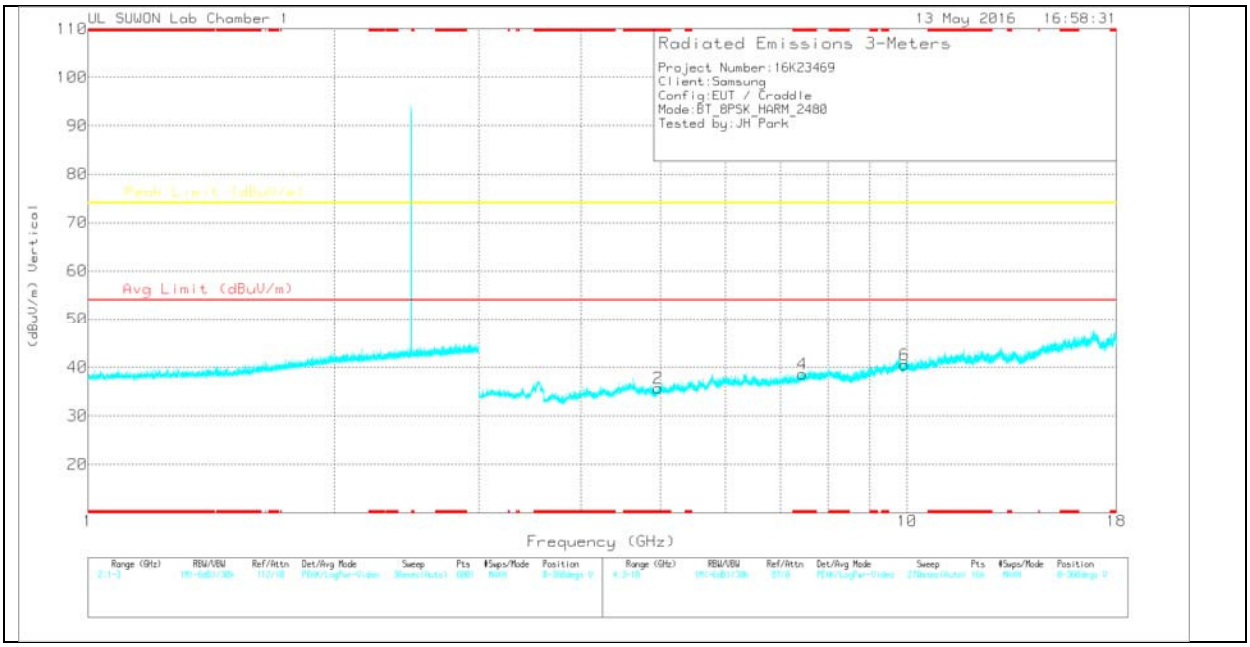
HIGH CHANNEL HORIZONTAL



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.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.963	35.54	PK	34	-34	35.54	-	-	74	-38.46	0-360	200	H
3	* 7.44	33.42	PK	35.8	-30.7	38.52	-	-	74	-35.48	0-360	200	H
5	9.917	30.44	PK	37.4	-27.3	40.54	-	-	74	-33.46	0-360	100	H
2	* 4.961	35.67	PK	34	-34	35.67	-	-	74	-38.33	0-360	100	V
4	* 7.443	33.34	PK	35.8	-30.6	38.54	-	-	74	-35.46	0-360	100	V
6	9.922	30.3	PK	37.4	-27.2	40.5	-	-	74	-33.5	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

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

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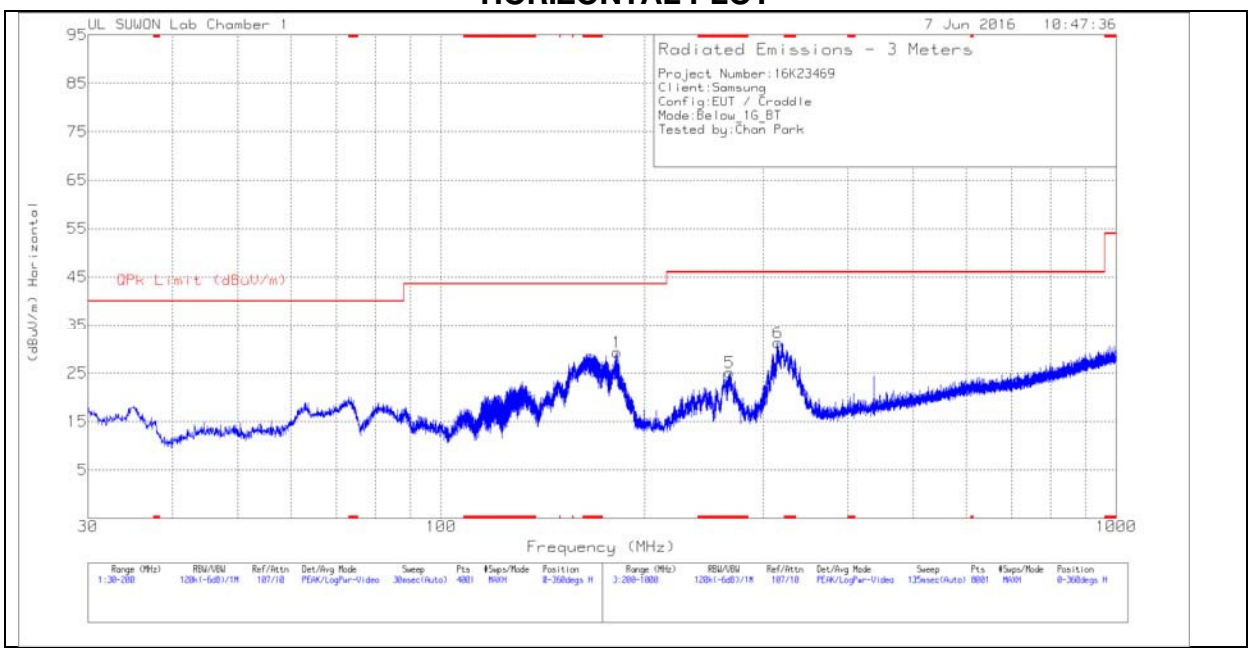
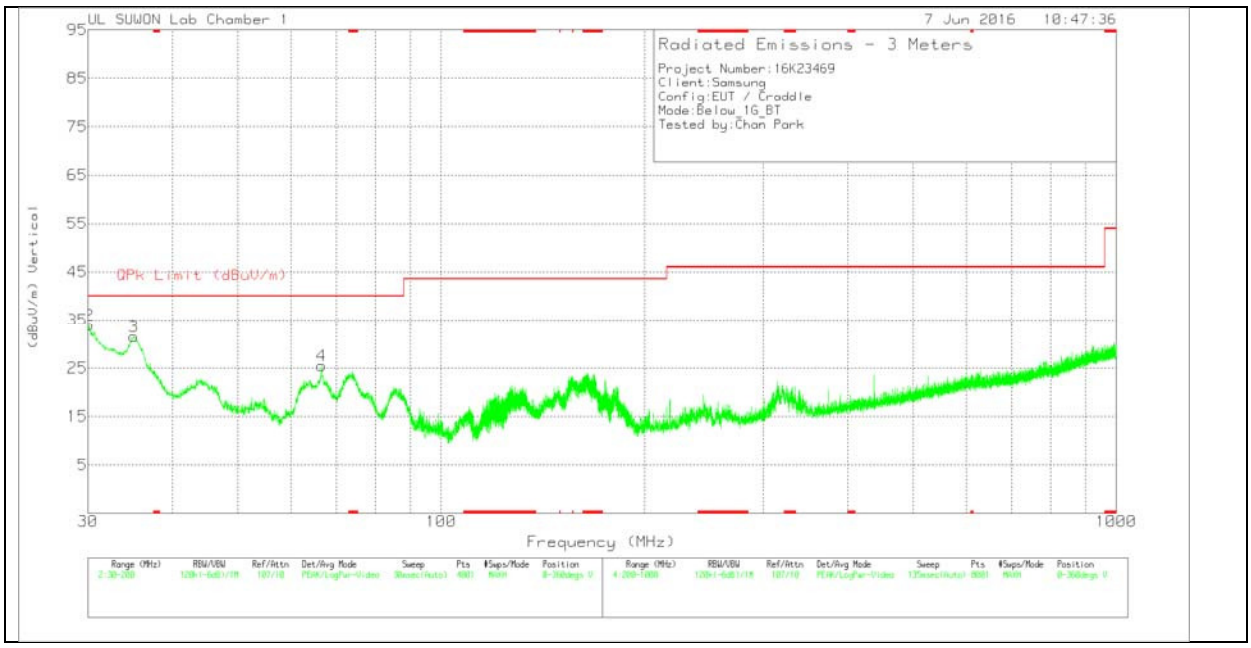
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	182.065	47.98	Pk	9.6	-28.3	29.28	43.52	-14.24	0-360	200	H
2	30.1275	54.11	Pk	10.3	-30.5	33.91	40	-6.09	0-360	100	V
3	35.1	51.47	Pk	10.5	-30.4	31.57	40	-8.43	0-360	100	V
4	66.5925	44.55	Pk	10.7	-29.8	25.45	40	-14.55	0-360	100	V
5	* 267.5	40.11	Pk	12.7	-27.7	25.11	46.02	-20.91	0-360	100	H
6	315.4	44.9	Pk	13.7	-27.3	31.3	46.02	-14.72	0-360	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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10. 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

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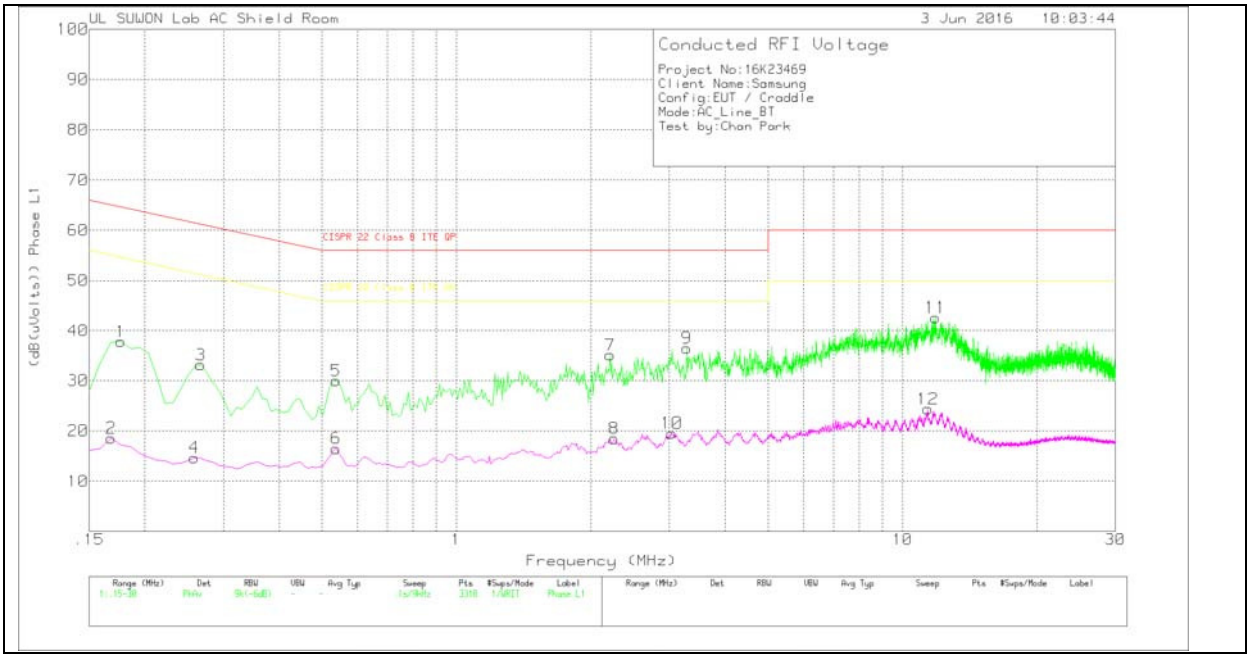
6 WORST EMISSIONS

LINE 1 PLOT



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LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.177	27.6	Pk	10.2	0	37.8	64.63	-26.83	-	-
2	.168	8.37	Av	10.2	0	18.57	-	-	55.06	-36.49
3	.267	23.32	Pk	9.8	0	33.12	61.21	-28.09	-	-
4	.258	4.89	Av	9.8	0	14.69	-	-	51.5	-36.81
5	.537	19.89	Pk	10.1	0	29.99	56	-26.01	-	-
6	.537	6.44	Av	10.1	0	16.54	-	-	46	-29.46
7	2.211	25.19	Pk	9.8	.1	35.09	56	-20.91	-	-
8	2.256	8.59	Av	9.8	.1	18.49	-	-	46	-27.51
9	3.282	26.58	Pk	9.8	.1	36.48	56	-19.52	-	-
10	3.039	9.65	Av	9.8	.1	19.55	-	-	46	-26.45
11	11.859	32.37	Pk	10.1	.2	42.67	60	-17.33	-	-
12	11.4	14.2	Av	10	.2	24.4	-	-	50	-25.6

Pk - Peak detector

Av - Average detection

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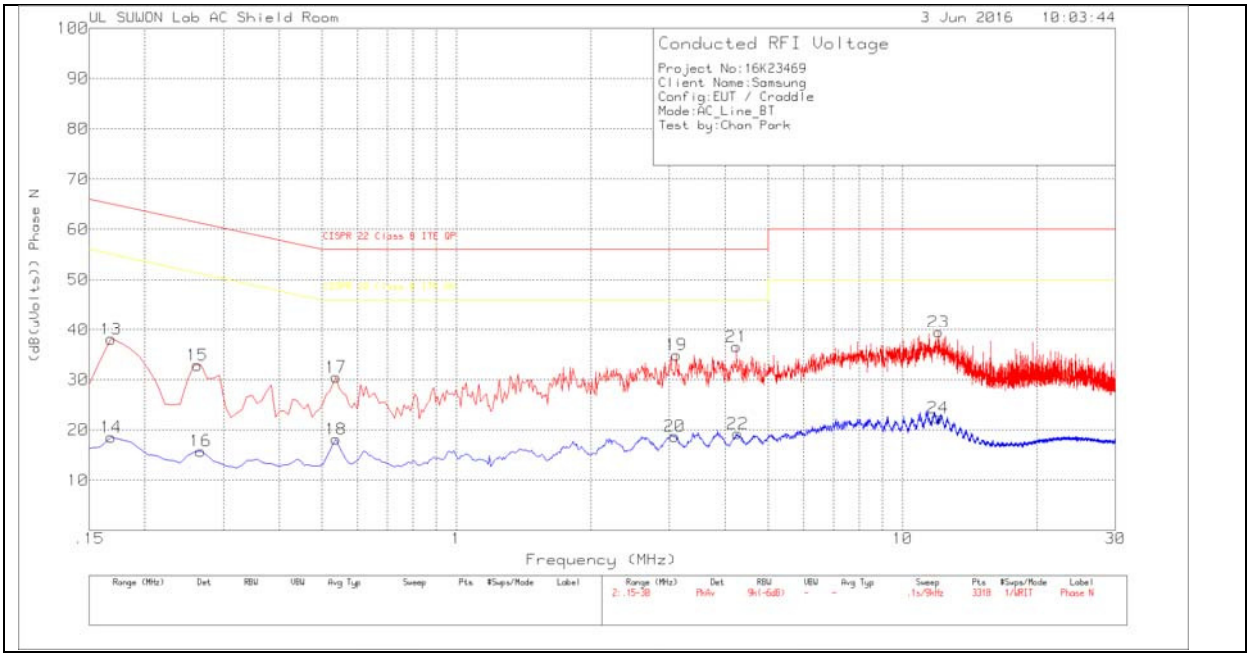
LINE 2 PLOT



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LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.168	27.9	Pk	10.2	0	38.1	65.06	-26.96	-	-
14	.168	8.36	Av	10.2	0	18.56	-	-	55.06	-36.5
15	.2625	23.16	Pk	9.7	0	32.86	61.35	-28.49	-	-
16	.267	6	Av	9.8	0	15.8	-	-	51.21	-35.41
17	.537	20.39	Pk	10.1	0	30.49	56	-25.51	-	-
18	.537	8.08	Av	10.1	0	18.18	-	-	46	-27.82
19	3.111	25.02	Pk	9.8	.1	34.92	56	-21.08	-	-
20	3.084	8.85	Av	9.8	.1	18.75	-	-	46	-27.25
21	4.245	26.66	Pk	9.8	.1	36.56	56	-19.44	-	-
22	4.272	9.37	Av	9.8	.1	19.27	-	-	46	-26.73
23	12.039	29.13	Pk	10.2	.2	39.53	60	-20.47	-	-
24	12.021	11.99	Av	10.2	.2	22.39	-	-	50	-27.61

Pk - Peak detector

Av - Average detection

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