FCC CFR47 PART 15 SUBPART C

Bluetooth

CERTIFICATION TEST REPORT

FOR

WCDMA/LTE Watch + Bluetooth/BLE and DTS b/g/n

MODEL NUMBER : SM-R765T, SM-R765A

FCC ID: A3LSMR765U

REPORT NUMBER: 16K23793-E3V2

ISSUE DATE: SEP 02, 2016

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/29/16	Initial issue	Junwhan Lee
V2	09/02/16	Revised section 5.4, 6, 9.1	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	WCDMA/LTE Watch + Bluetooth/BLE and DTS b/g/n
MODEL NUMBER:	SM-R765T, SM-R765A
SERIAL NUMBER:	R3AH700KEKX, R3AH700KEPA (RADIATED); R3AH700KEQN (CONDUCTED)
DATE TESTED:	AUG 17, 2016 - AUG 26, 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.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, 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

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/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	2.32 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%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

SM-R765T and SM-R765A are same H/W and only difference is supported band.
Band 4 (LTE and WCDMA) of SM-R765A are disabled by S/W.
SM-R765T was used for the 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]
2402 - 2480	Basic GFSK	Average	14.476	28.029
		Peak	15.007	31.674
	Enhanced Pi/4-DPSK	Average	12.076	16.129
		Peak	14.219	26.418
	Enhanced 8PSK	Average	12.078	16.136
		Peak	14.648	29.161

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -4.5 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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z 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 8.6.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	ETA0U60JBE	DK1G826HS17-E	N/A
Data Cable	SAMSUNG	ECB-DU2EBE	N/A	N/A
Wireless Charger	SAMSUNG	EP-YO760	N/A	A3LEPYO760

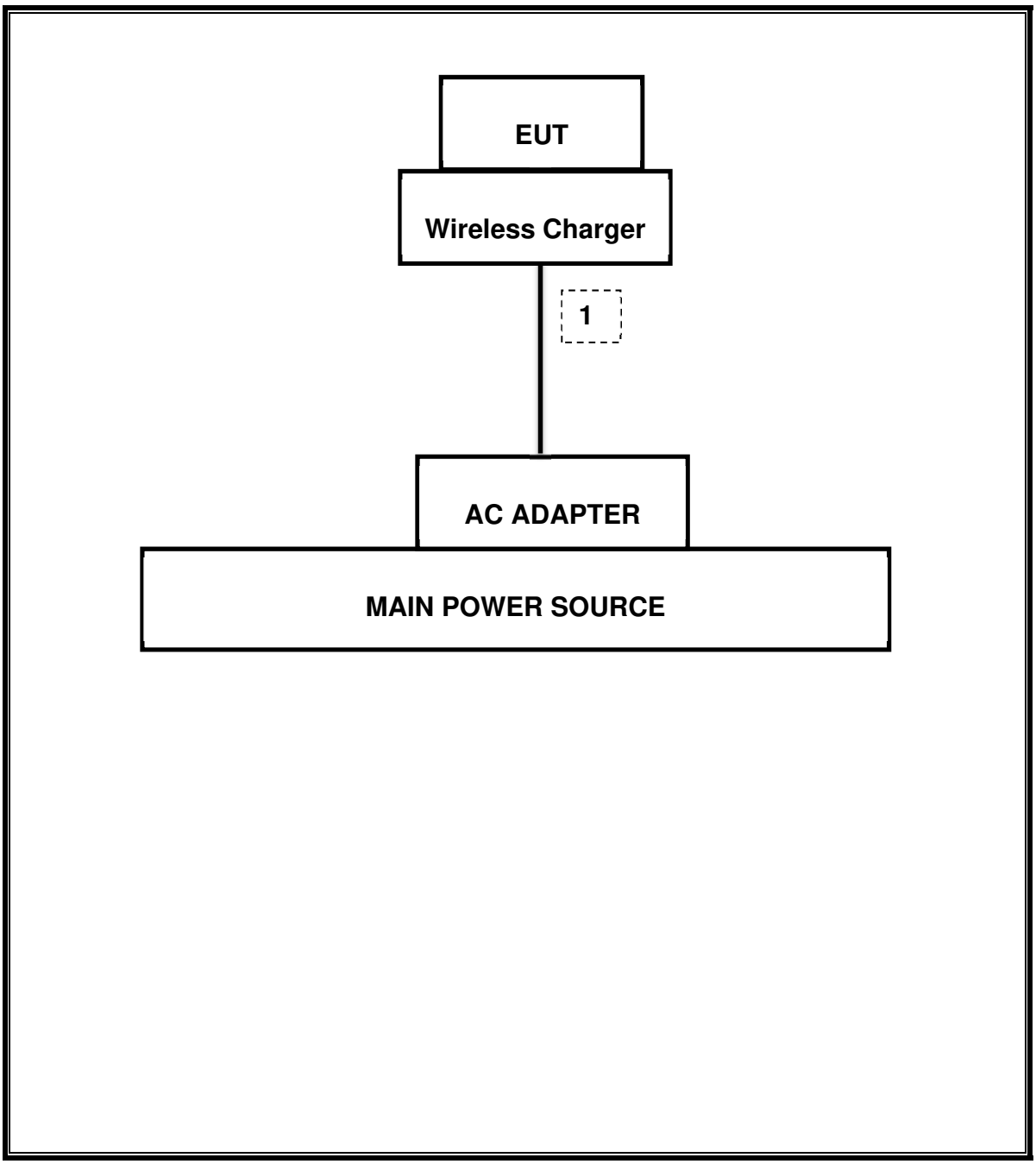
I/O CABLES

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.

SETUP DIAGRAM FOR TESTS



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
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-16-17
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-17
Average Power Sensor	R&S	NRZ-Z91	102681	08-16-17
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-17-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-16-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-17-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-16-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	009	08-17-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	016	08-16-17
LISN	R&S	ENV-216	101836	08-16-17
LISN	R&S	ENV-216	101837	08-16-17
Attenuator	PASTERNACK	PE7087-10	A009	08-16-17

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	1.196 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-38.961 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	15.007 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	0.34548 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	44.95 dBuV (Pk)
15.205, 15.209	Radiated Spurious Emission	< 40dBuV/m	Radiated	Pass	34.7 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	1.047	897.470
Mid	2441	1.046	898.460
High	2480	1.046	901.360
Worst		1.047	901.360

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.290	1.193
Mid	2441	1.347	1.165
High	2480	1.348	1.196
Worst		1.348	1.196

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.297	1.164
Mid	2441	1.300	1.165
High	2480	1.299	1.195
Worst		1.300	1.195

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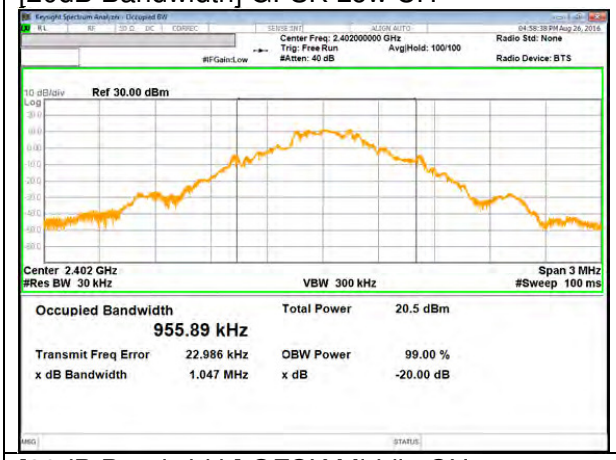
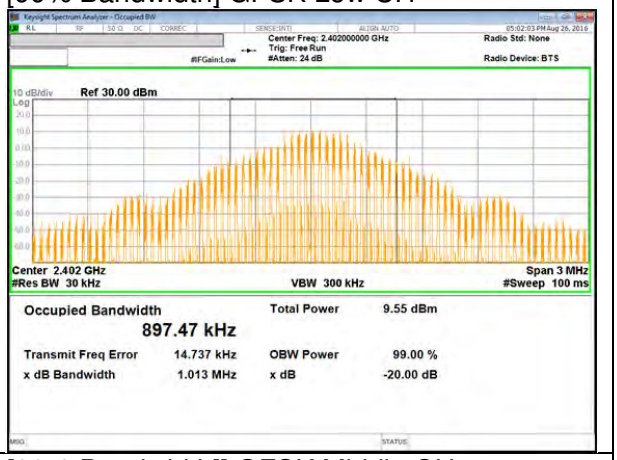
8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

GFSK BANDWIDTH

[20dB Bandwidth] GFSK Low CH

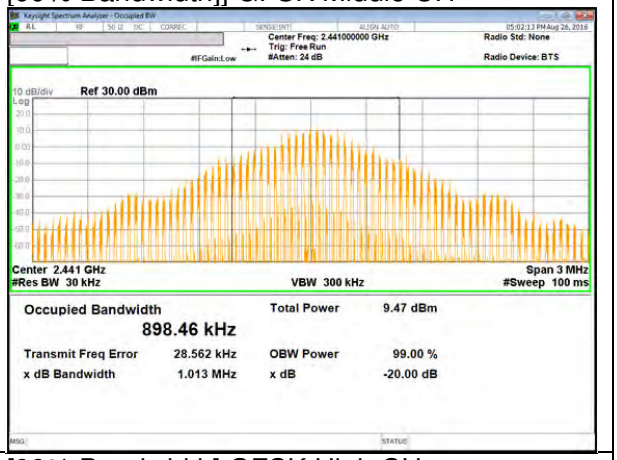


[99% Bandwidth] GFSK Low CH

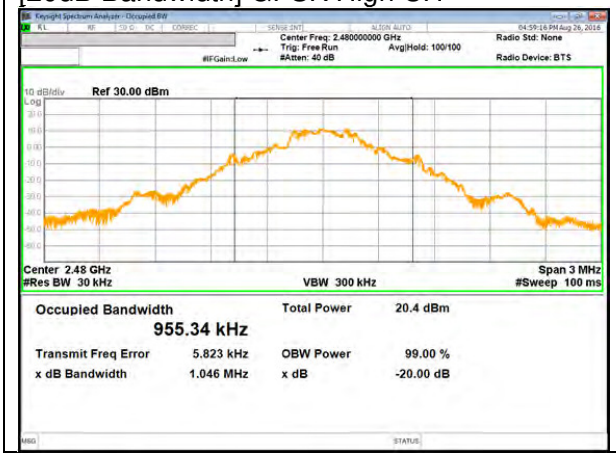


[20dB Bandwidth] GFSK Middle CH

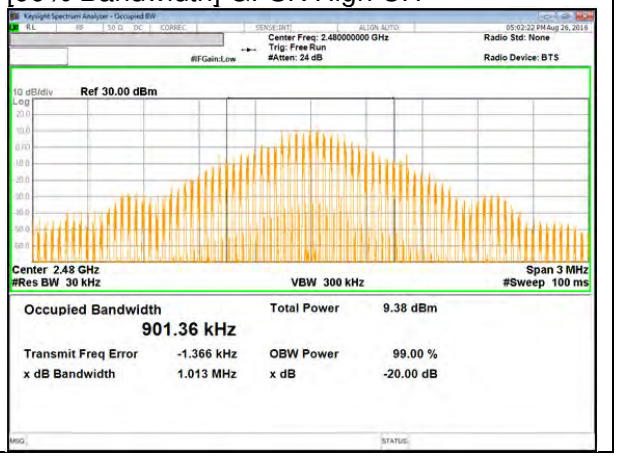
[99% Bandwidth]] GFSK Middle CH



[20dB Bandwidth] GFSK High CH

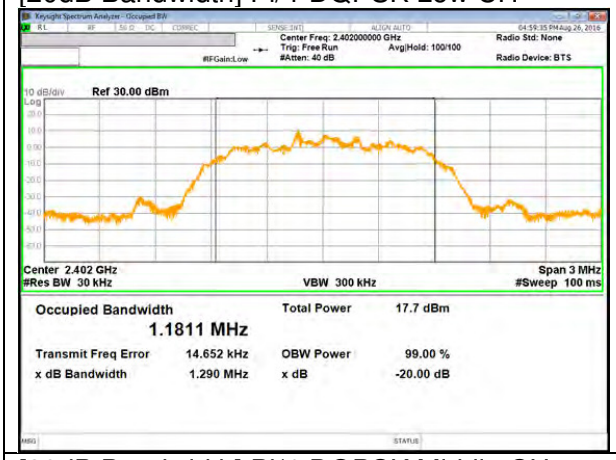


[99% Bandwidth] GFSK High CH

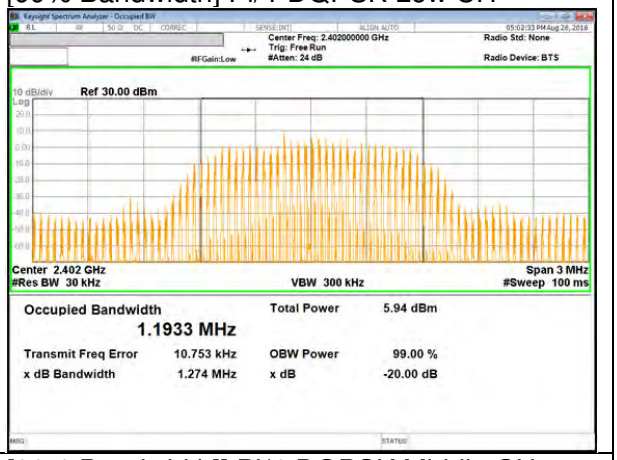


Pi/4-DQPSK BANDWIDTH

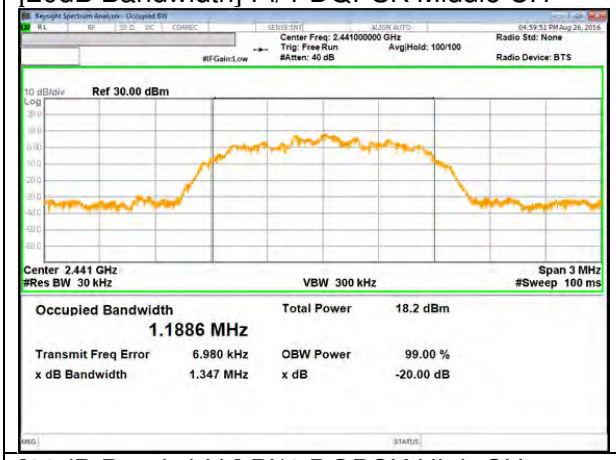
[20dB Bandwidth] Pi/4-DQPSK Low CH



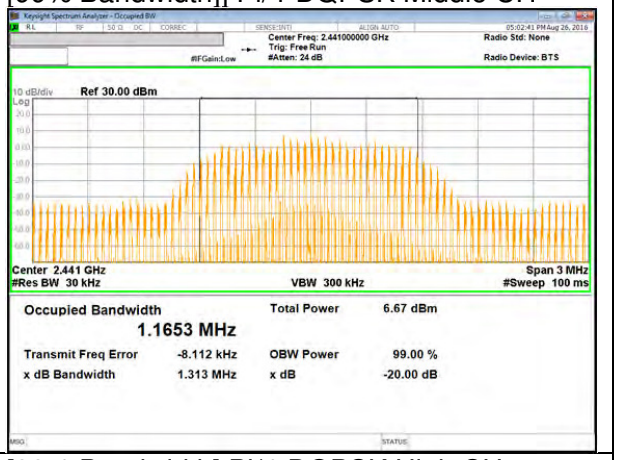
[99% Bandwidth] Pi/4-DQPSK Low CH



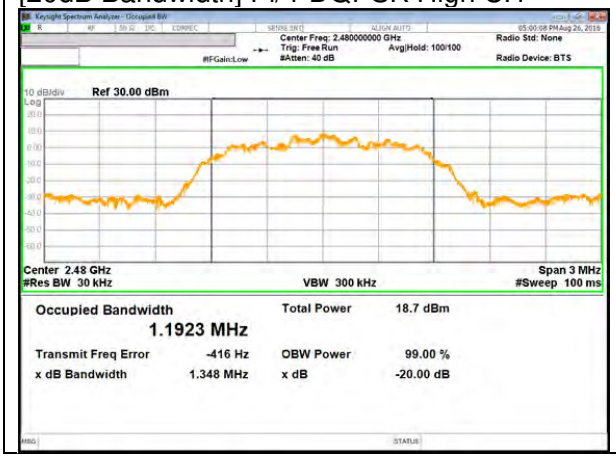
[20dB Bandwidth] Pi/4-DQPSK Middle CH



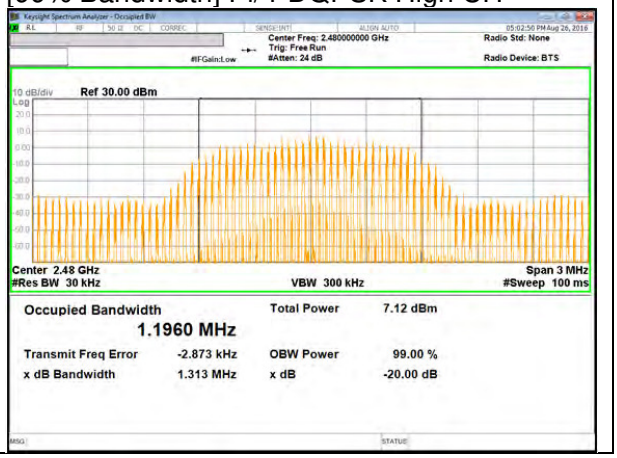
[99% Bandwidth]] Pi/4-DQPSK Middle CH



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

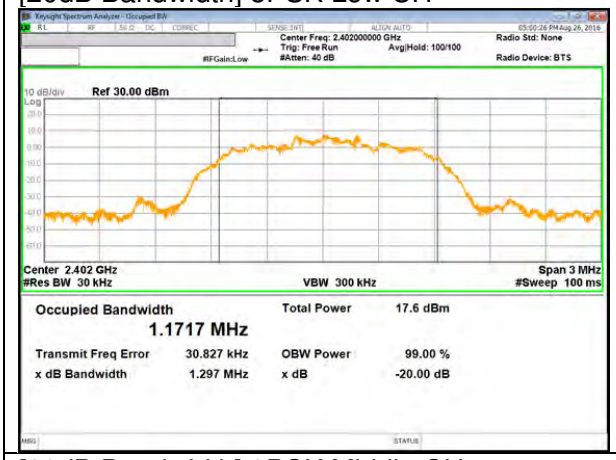


[99% Bandwidth] Pi/4-DQPSK High CH

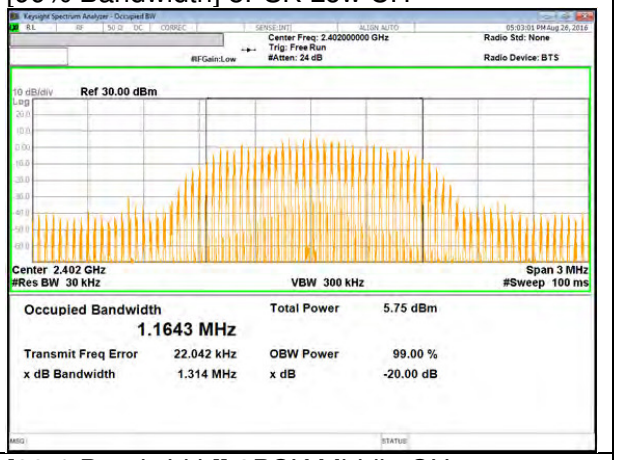


8PSK BANDWIDTH

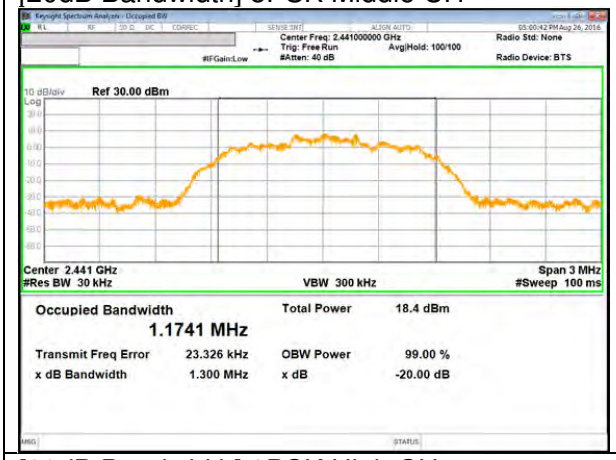
[20dB Bandwidth] 8PSK Low CH



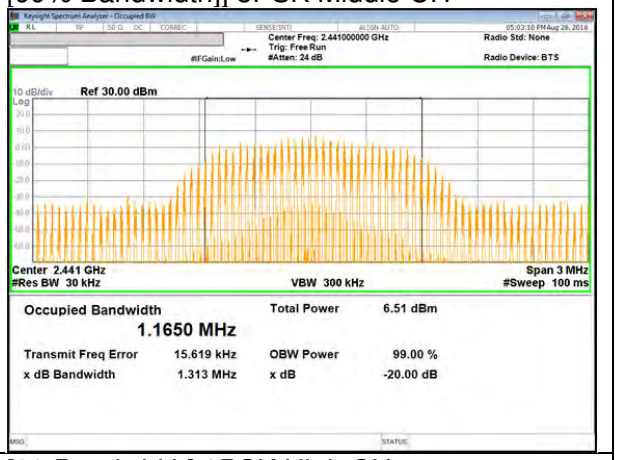
[99% Bandwidth] 8PSK Low CH



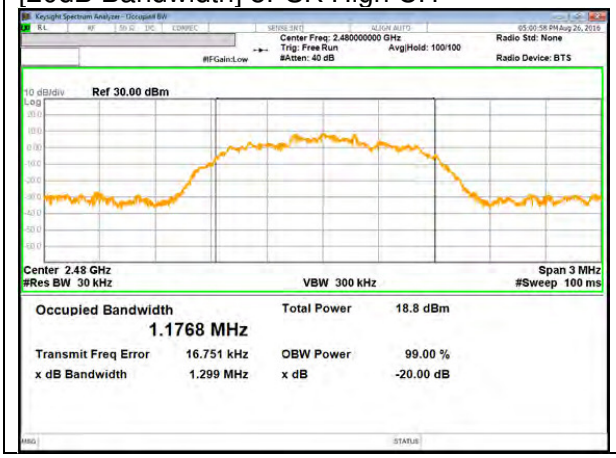
[20dB Bandwidth] 8PSK Middle CH



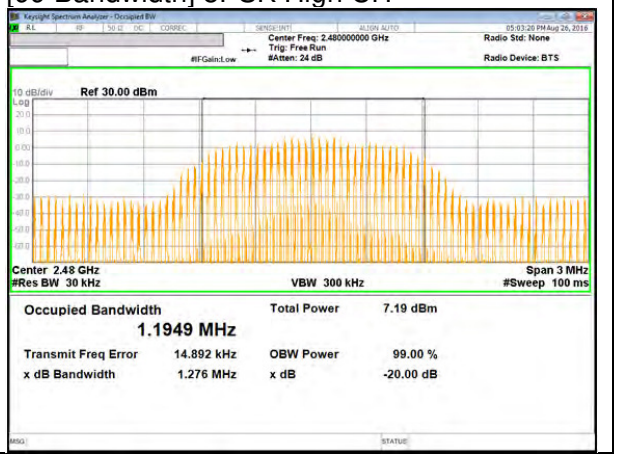
[99% Bandwidth]] 8PSK Middle CH



[20dB Bandwidth] 8PSK High CH



[99 Bandwidth] 8PSK High CH



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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

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

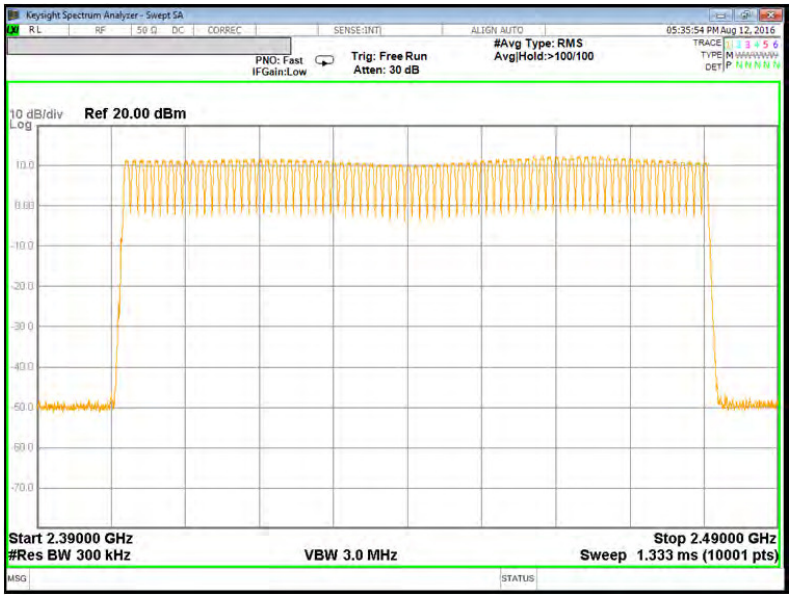
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

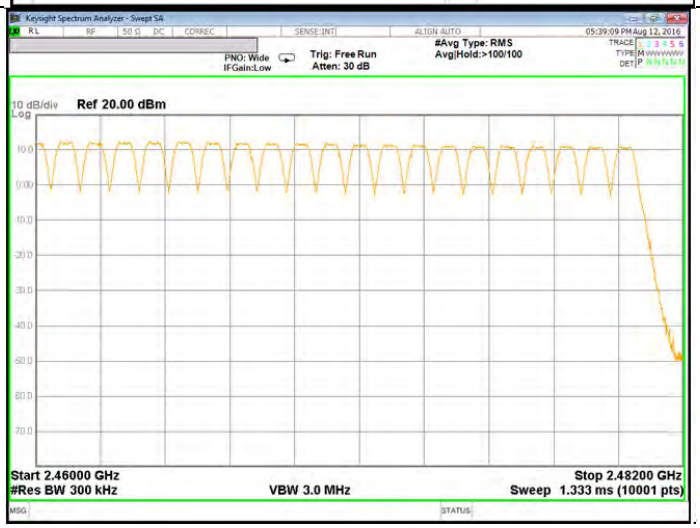
RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



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	0.380	32	0.121632	0.4	-0.2784
DH3	1.634	17	0.277780	0.4	-0.1222
DH5	2.879	12	0.345480	0.4	-0.0545
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.380	8	0.030408	0.4	-0.36959
DH3	1.634	4.25	0.069445	0.4	-0.33056
DH5	2.879	3	0.086370	0.4	-0.31363

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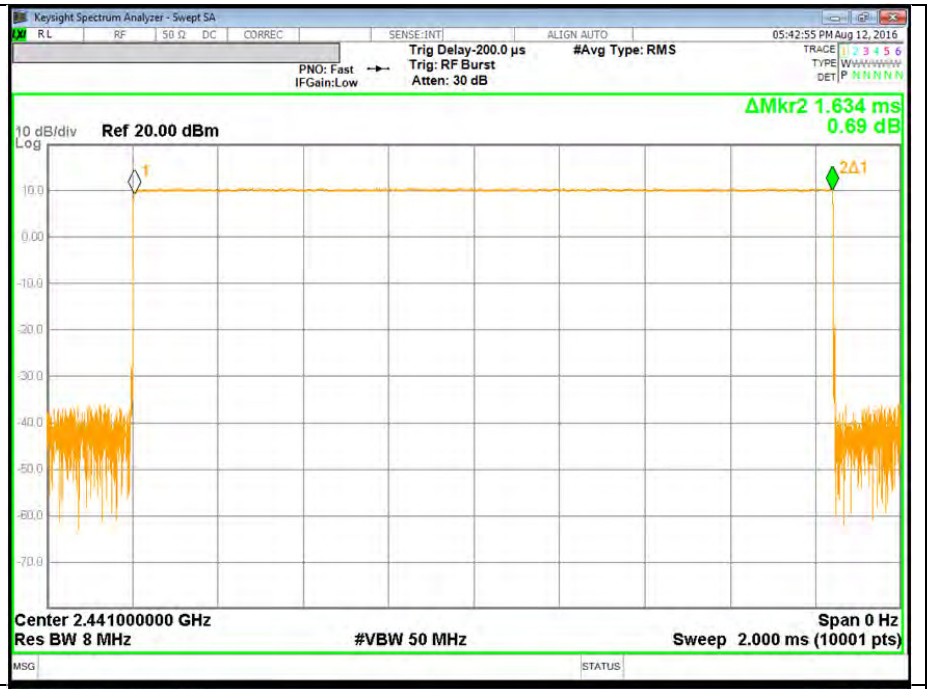
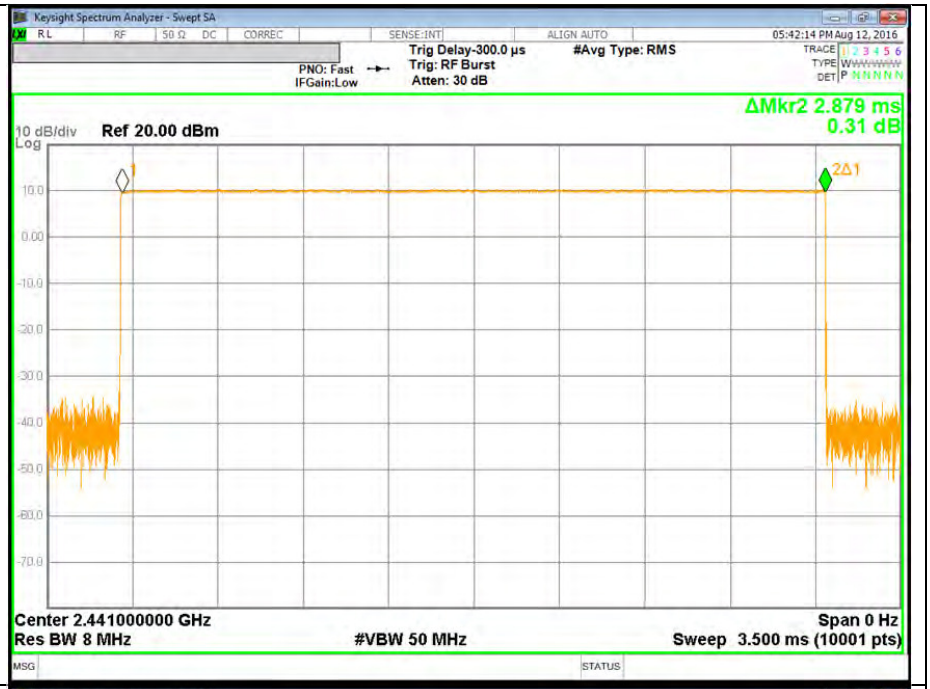
DH1

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	

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	15.007	21	-5.993
Middle	2441	14.912	21	-6.088
High	2480	14.739	21	-6.261
Worst		15.007	21	-5.993

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

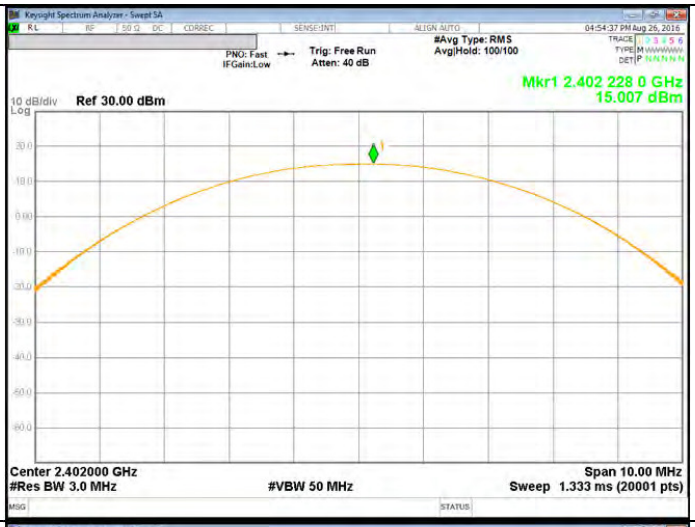
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	13.369	21	-7.631
Middle	2441	13.978	21	-7.022
High	2480	14.219	21	-6.781
Worst		14.219	21	-6.781

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

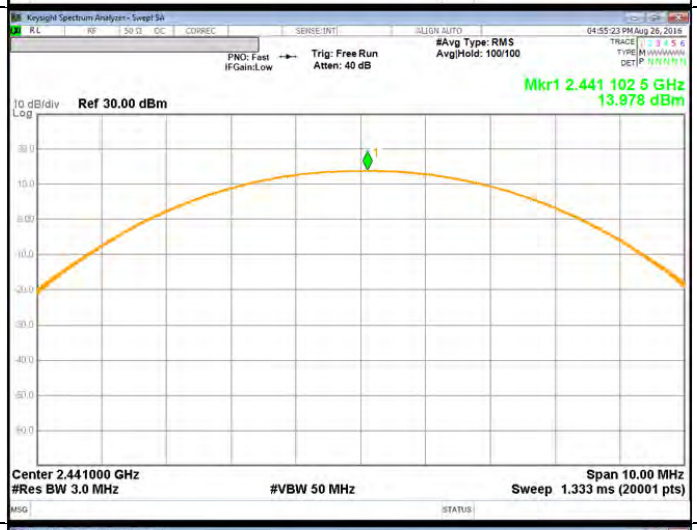
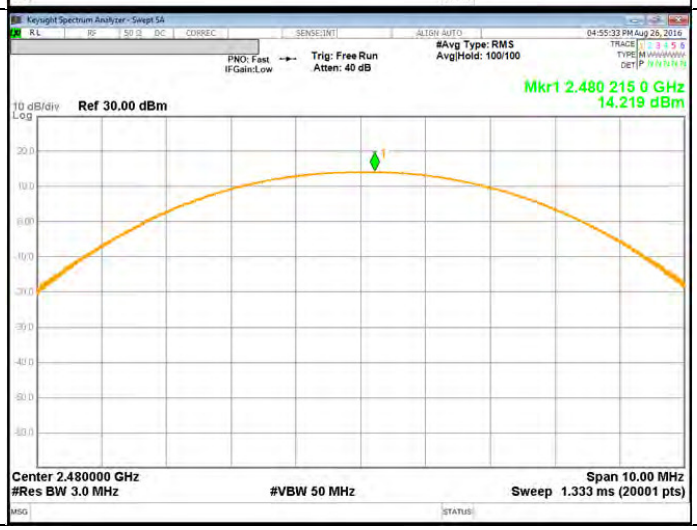
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	13.904	21	-7.096
Middle	2441	14.518	21	-6.482
High	2480	14.648	21	-6.352
Worst		14.648	21	-6.352

8.5.4. OUTPUT POWER PLOTS

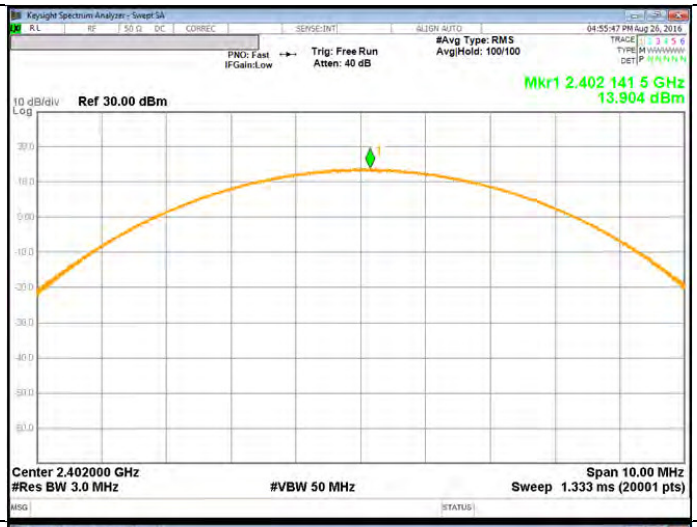
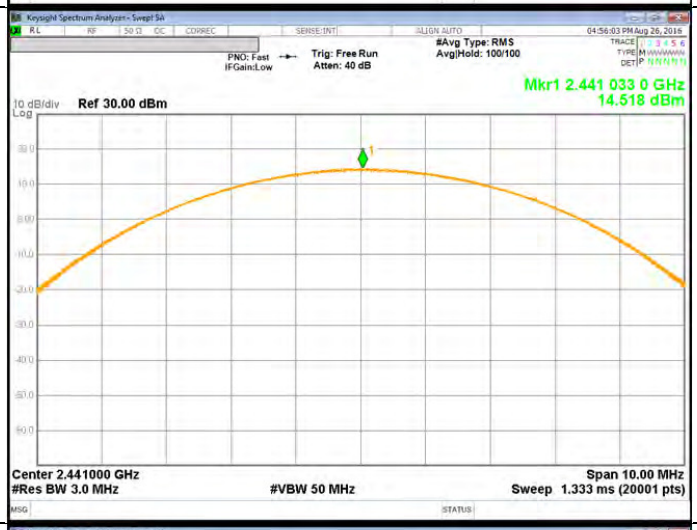
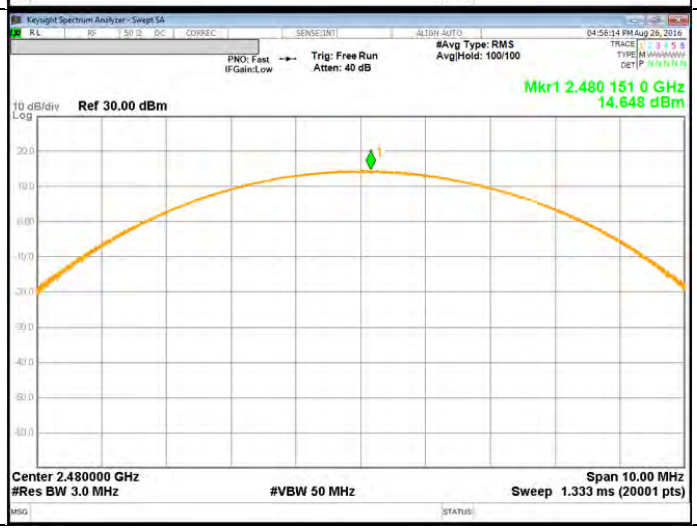
GFSK OUTPUT POWER

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			

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	14.476	28.03
Middle	2441	14.383	27.43
High	2480	14.321	27.05

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	10.779	11.96
Middle	2441	11.604	14.47
High	2480	12.076	16.13

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	10.795	12.01
Middle	2441	11.613	14.50
High	2480	12.078	16.14

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.

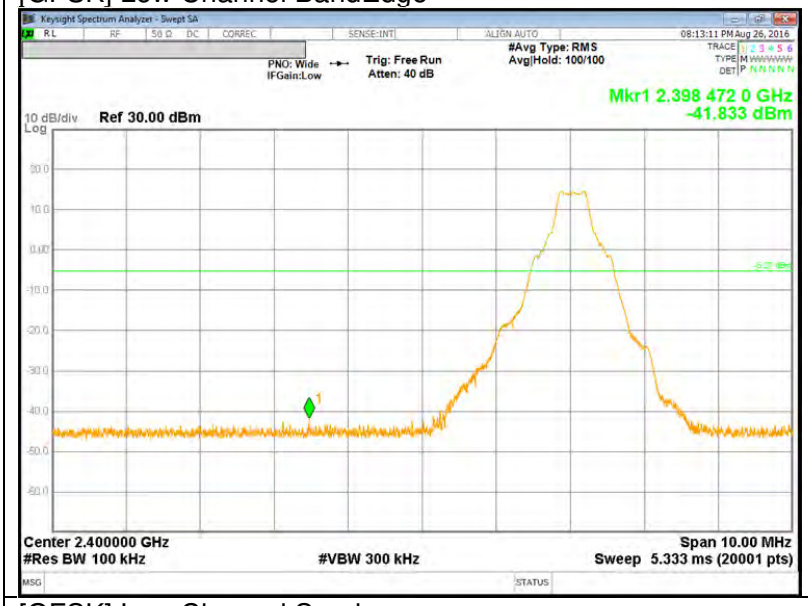
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

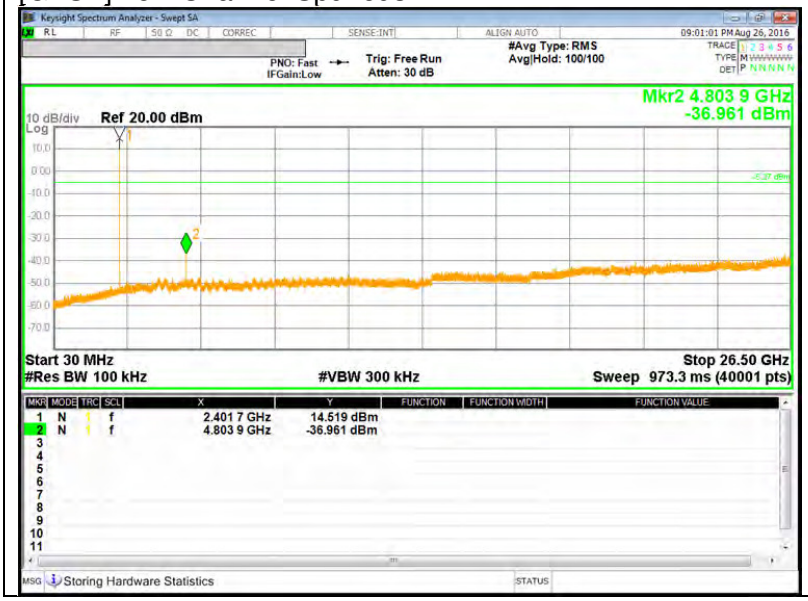
8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

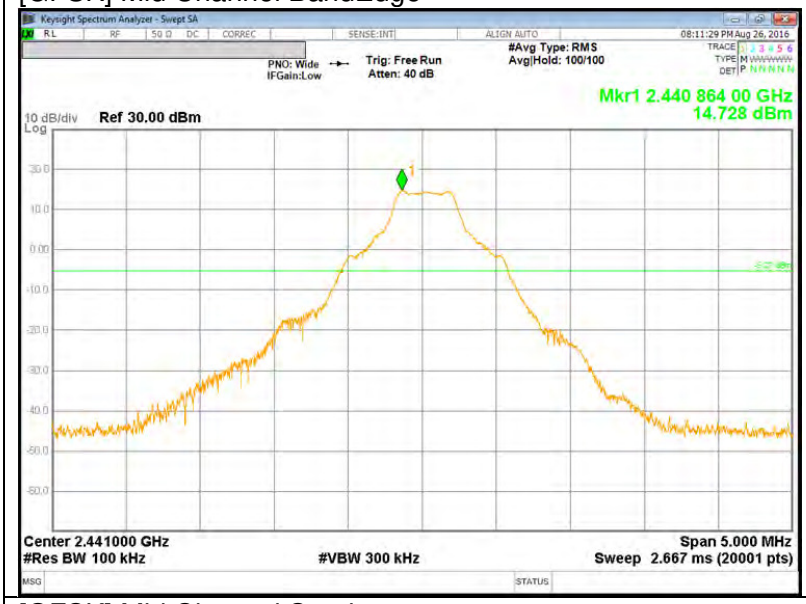
[GFSK] Low Channel BandEdge



[GFSK] Low Channel Spurious

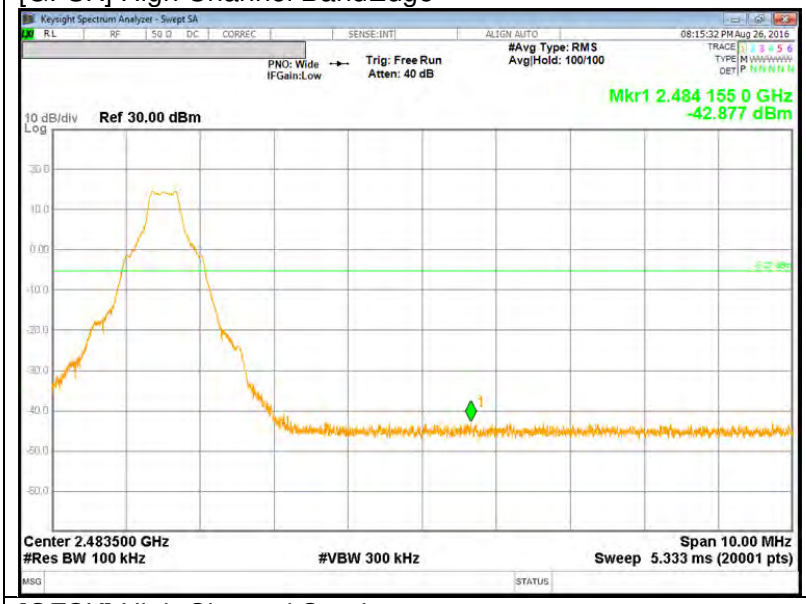


[GFSK] Mid Channel BandEdge



[GFSK] Mid Channel Spurious

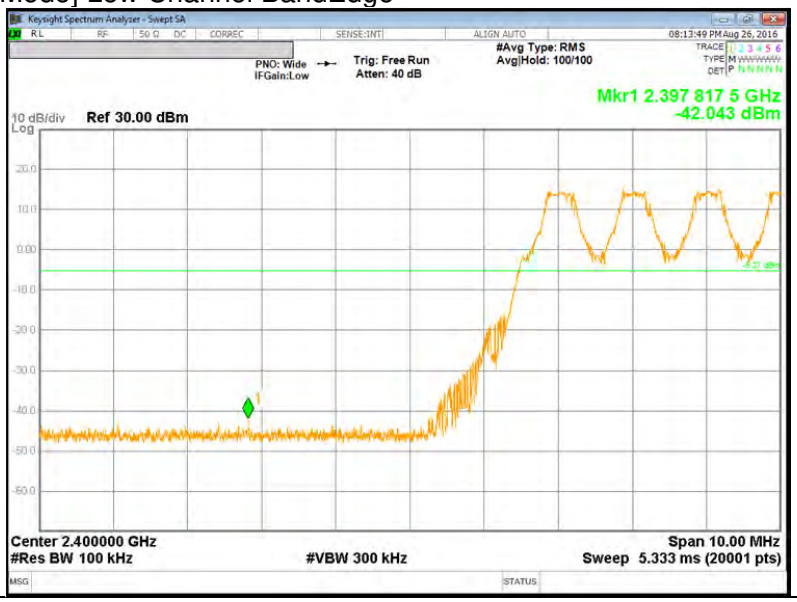
[GFSK] High Channel BandEdge



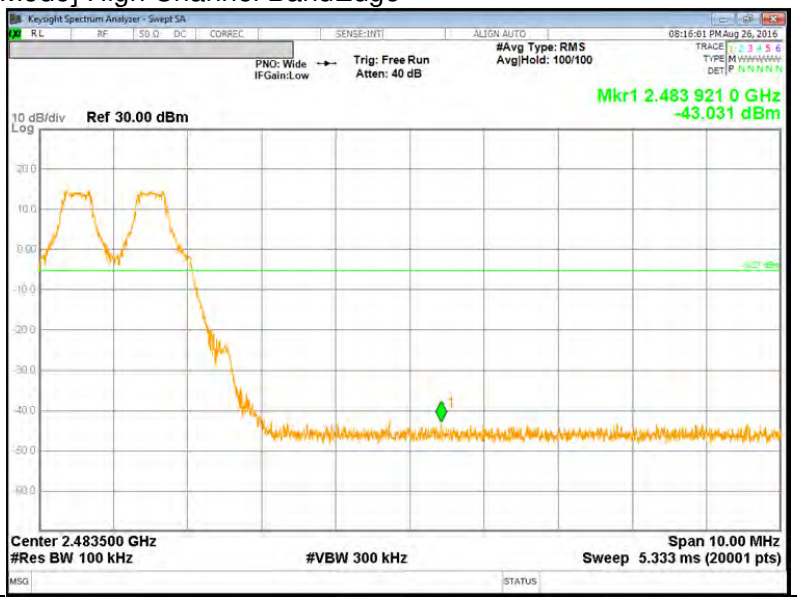
[GFSK] High Channel Spurious

BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge

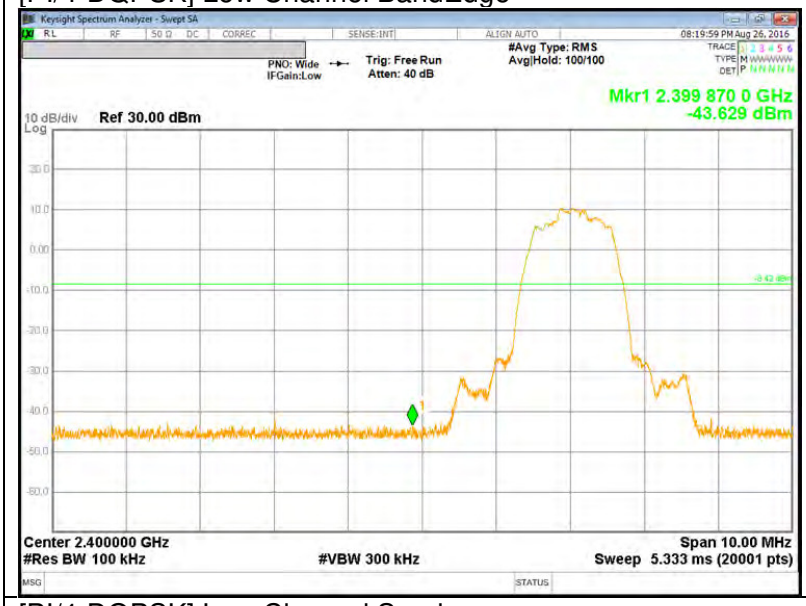


[GFSK Hopping Mode] High Channel BandEdge



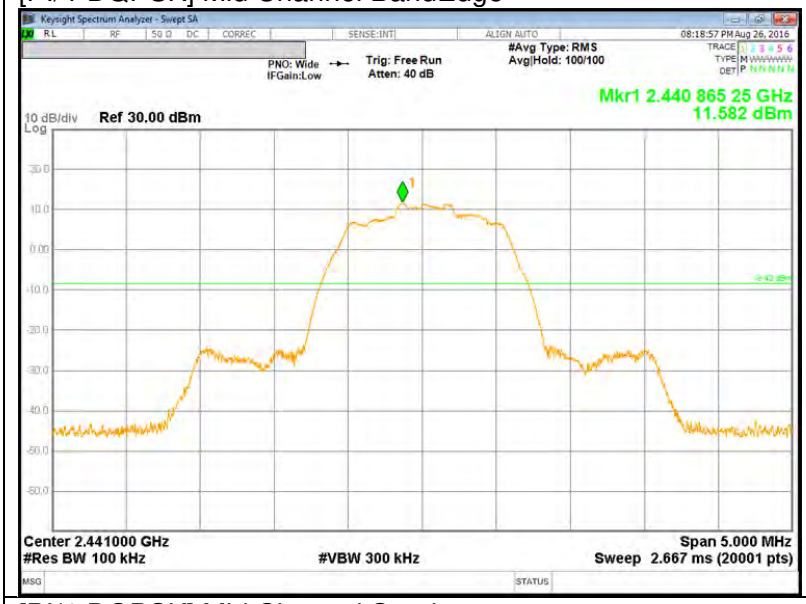
PI/4-DQPSK Mode

[PI/4-DQPSK] Low Channel BandEdge



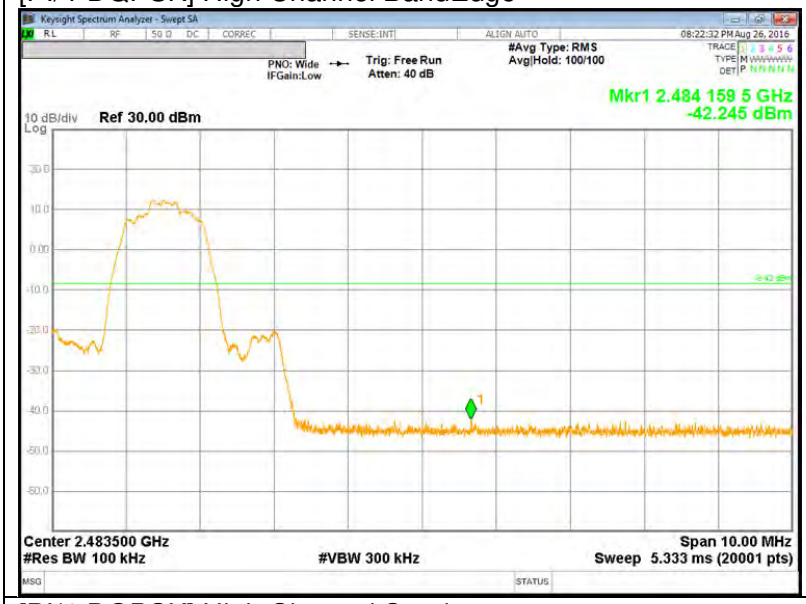
[PI/4-DQPSK] Low Channel Spurious

[PI/4-DQPSK] Mid Channel BandEdge

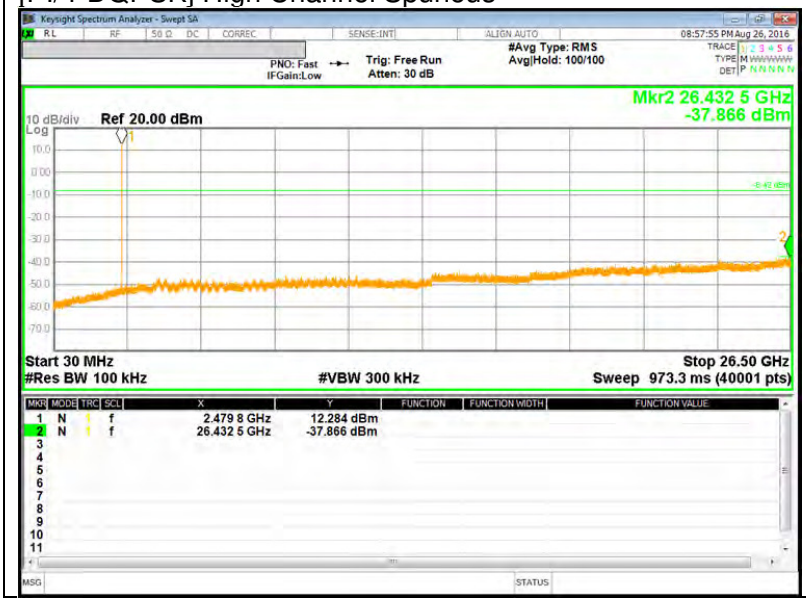


[PI/4-DQPSK] Mid Channel Spurious

[PI/4-DQPSK] High Channel BandEdge



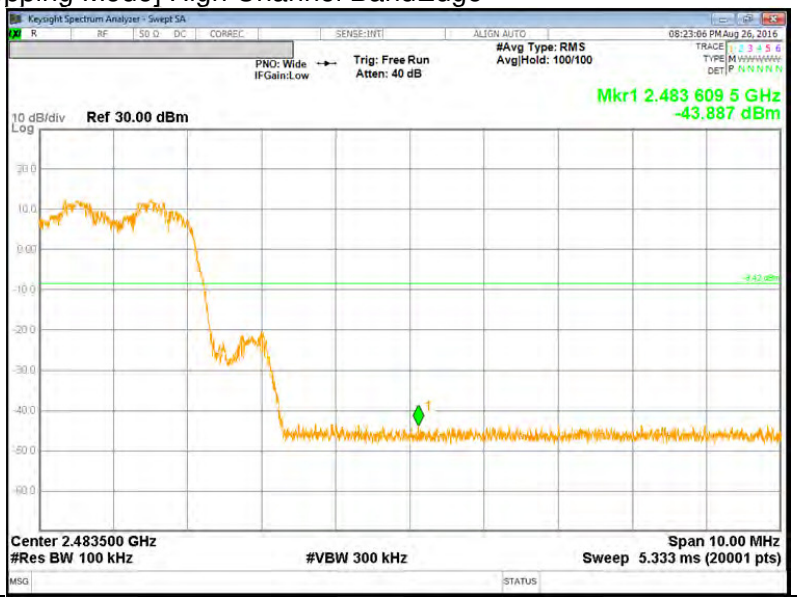
[PI/4-DQPSK] High Channel Spurious



BandEdge Emission at PI/4-DQPSK Hopping Mode

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

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



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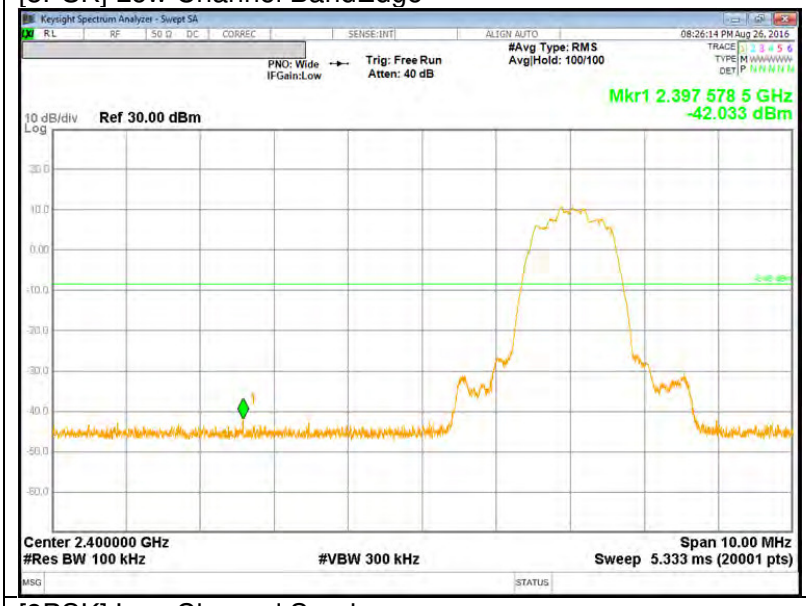
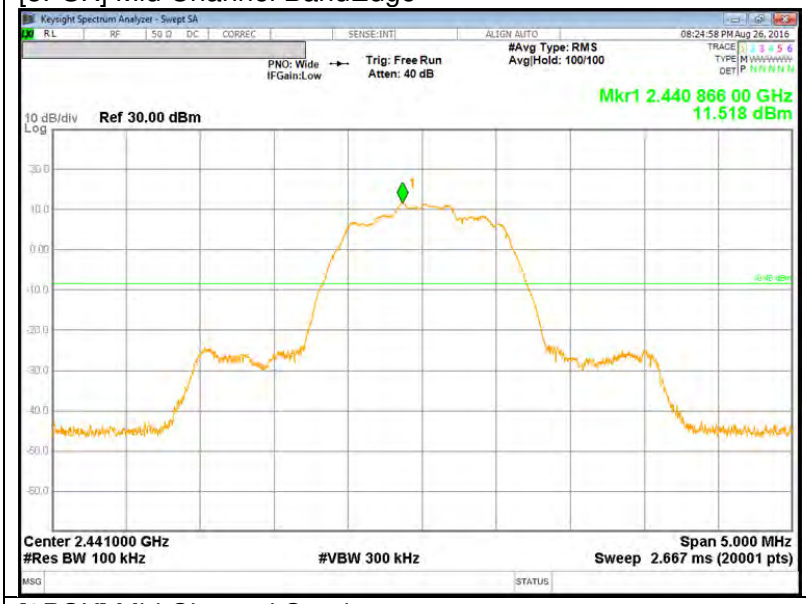
8PSK Mode

[8PSK] Low Channel BandEdge



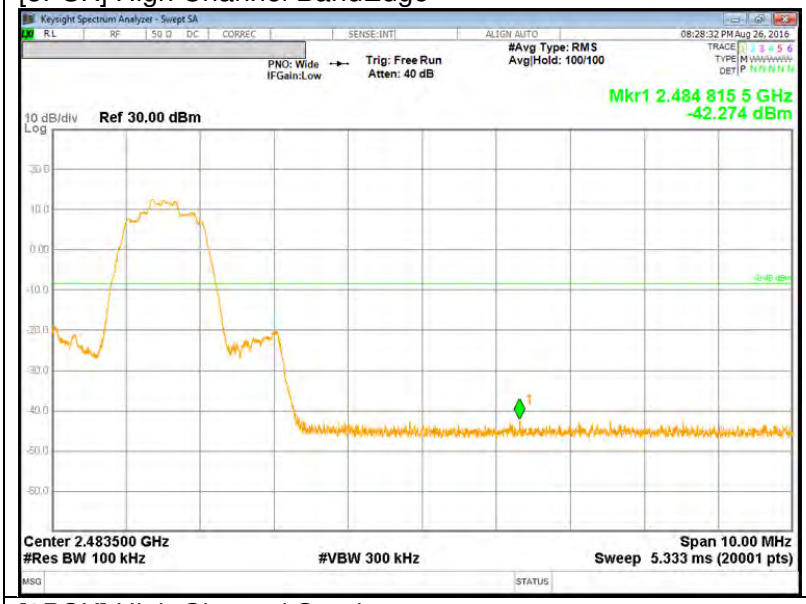
[8PSK] Low Channel Spurious

[8PSK] Mid Channel BandEdge

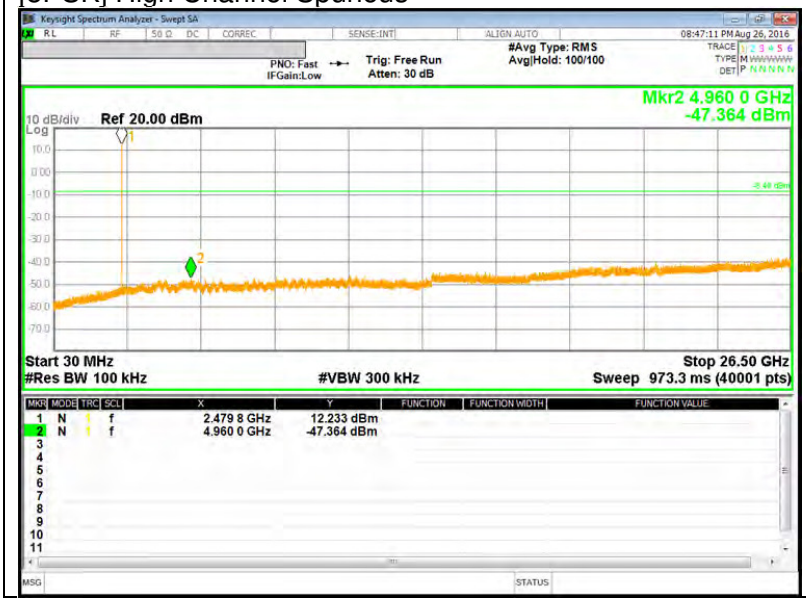


[8PSK] Mid Channel Spurious

[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

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.

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 1 MHz for peak measurements and 1/T (on time) for average measurement.

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

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.

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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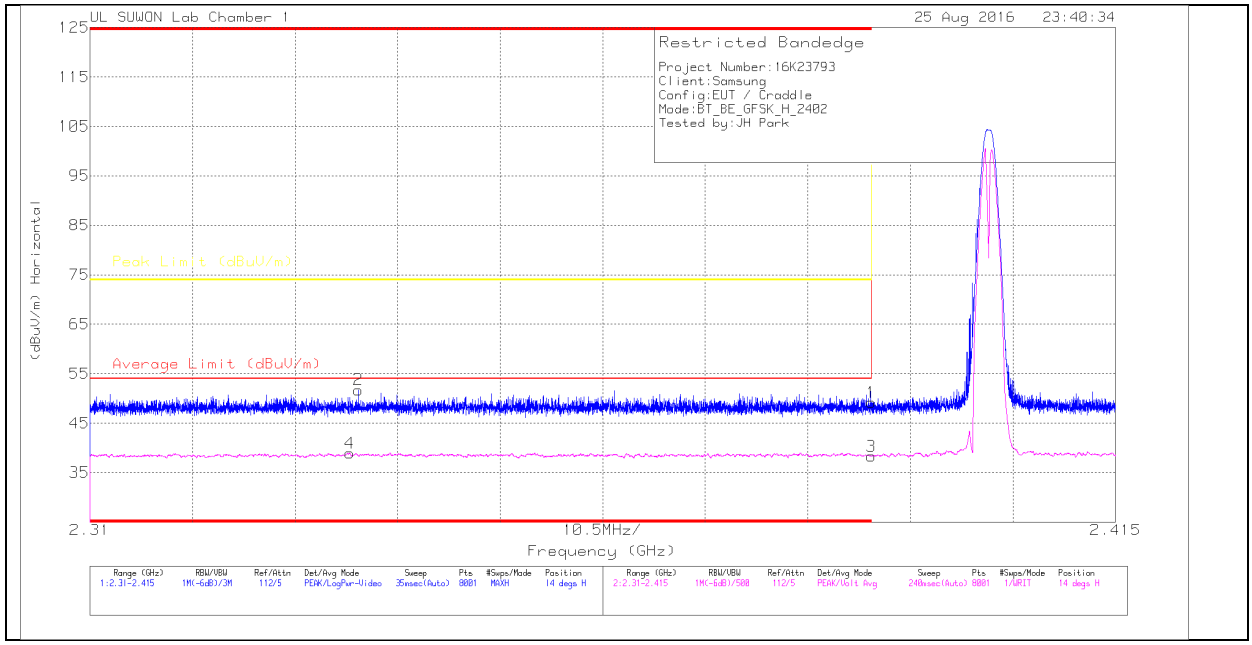
9.2. TRANSMITTER ABOVE 1 GHz

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	46.38	Pk	31.8	-29	49.18	-	-	74	-24.82	14	100	H
2	* 2.337	49.05	Pk	31.7	-29	51.75	-	-	74	-22.25	14	100	H
3	* 2.39	35.5	VA1T	31.8	-29	38.3	54	-15.7	-	-	14	100	H
4	* 2.337	36.28	VA1T	31.7	-29	38.98	54	-15.02	-	-	14	100	H

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

Pk - Peak detector

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

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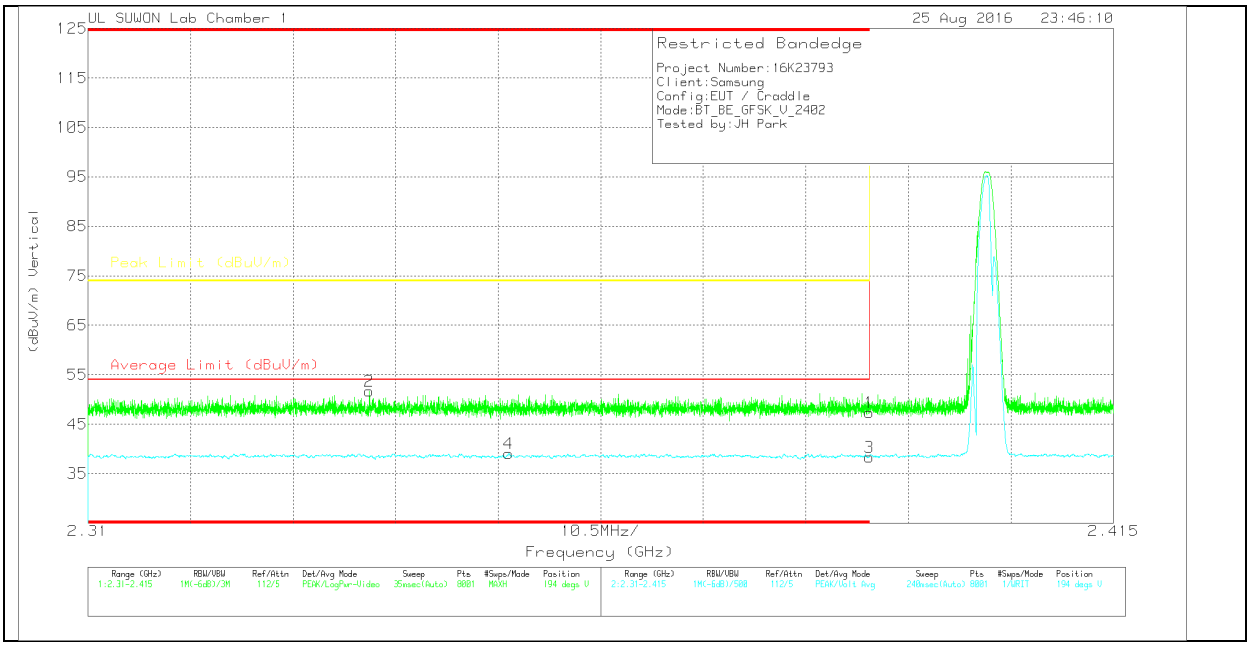
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_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	44.55	Pk	31.8	-29	47.35	-	-	74	-26.65	194	158	V
2	* 2.339	49.04	Pk	31.7	-29	51.74	-	-	74	-22.26	194	158	V
3	* 2.39	35.56	VA1T	31.8	-29	38.36	54	-15.64	-	-	194	158	V
4	* 2.353	36.42	VA1T	31.7	-29	39.12	54	-14.88	-	-	194	158	V

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

Pk - Peak detector

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

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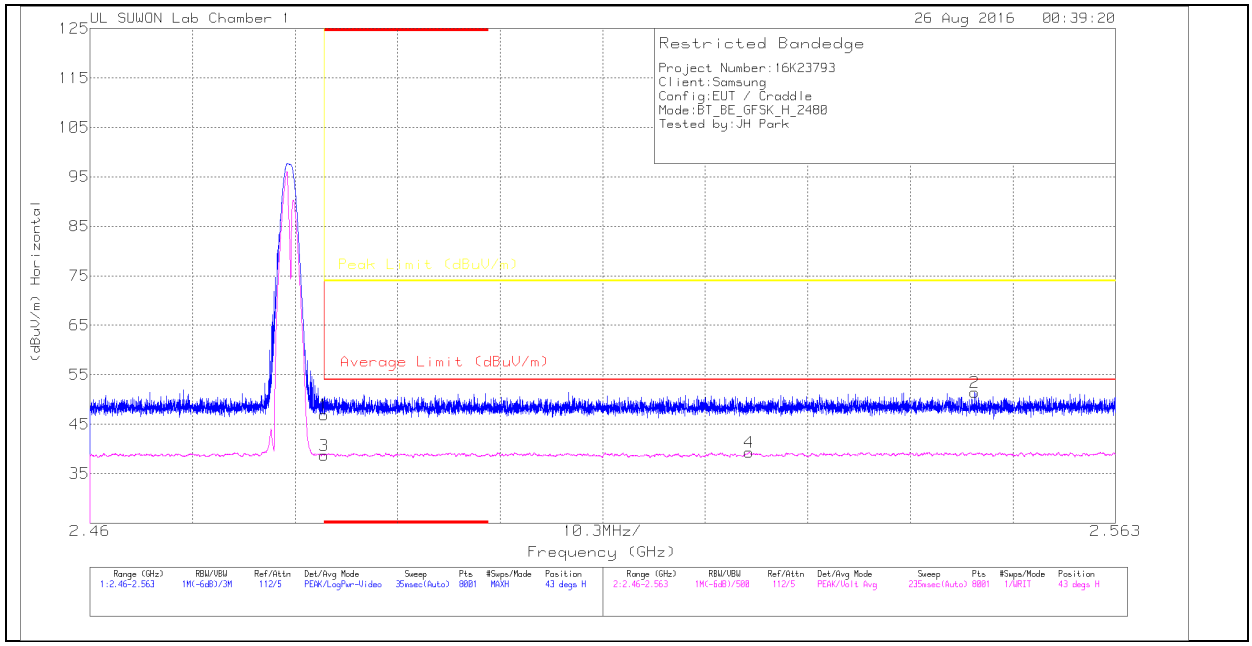
AUTHORIZED BANDEDGE (HIGH CHANNEL)

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	43.71	Pk	32	-28.9	46.81	-	-	74	-27.19	43	304	H
2	2.549	48.23	Pk	32	-28.8	51.43	-	-	74	-22.57	43	304	H
3	* 2.484	35.64	VA1T	32	-28.9	38.74	54	-15.26	-	-	43	304	H
4	2.526	36.14	VA1T	32	-28.8	39.34	54	-14.66	-	-	43	304	H

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

Pk - Peak detector

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

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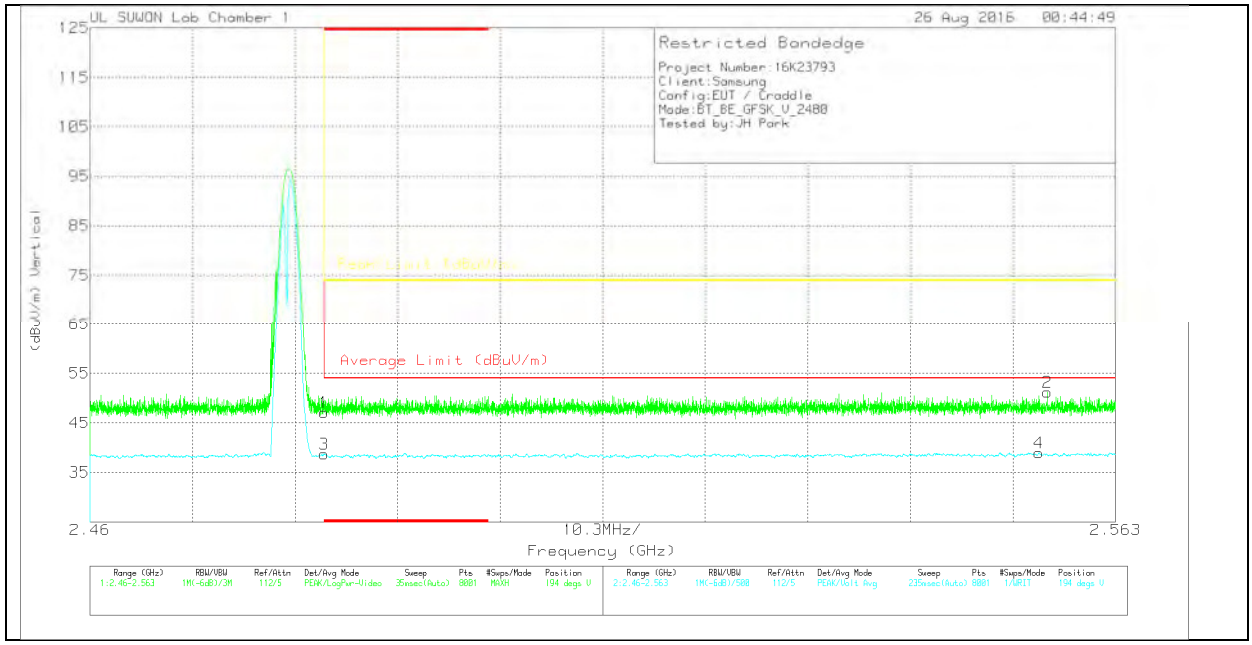
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_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	44.01	Pk	32	-28.9	47.11	-	-	74	-26.89	194	100	V
2	2.556	47.99	Pk	32	-28.8	51.19	-	-	74	-22.81	194	100	V
3	* 2.484	35.55	VA1T	32	-28.9	38.65	54	-15.35	-	-	194	100	V
4	2.555	35.78	VA1T	32	-28.8	38.98	54	-15.02	-	-	194	100	V

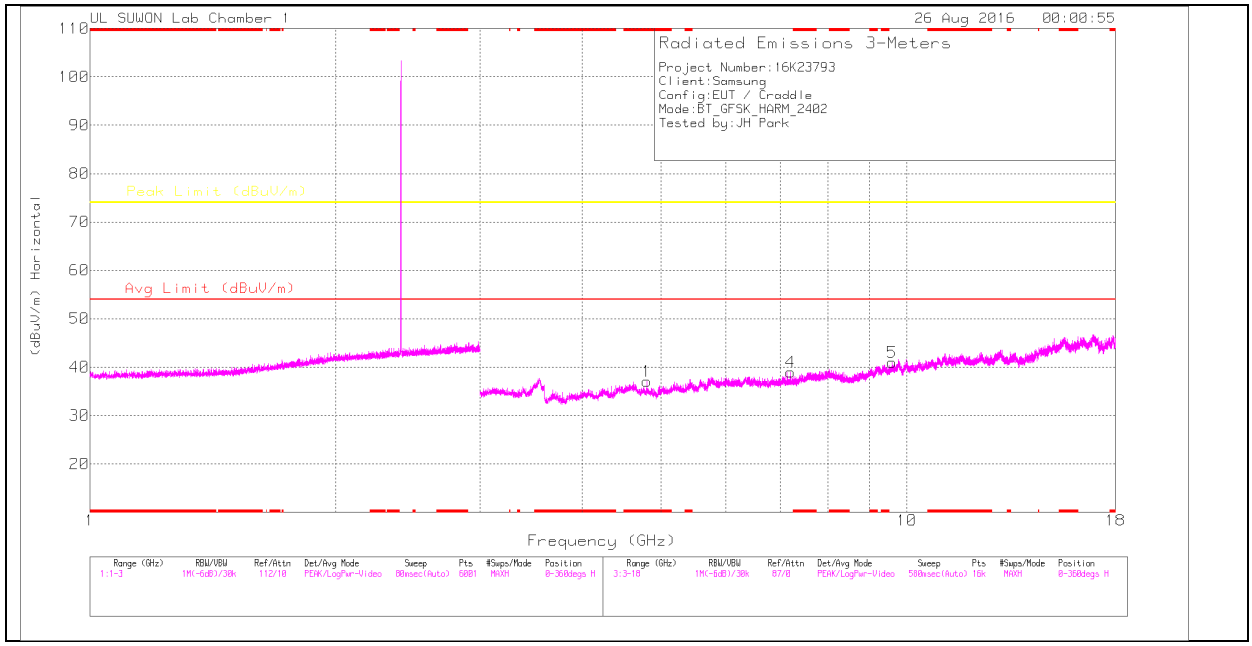
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

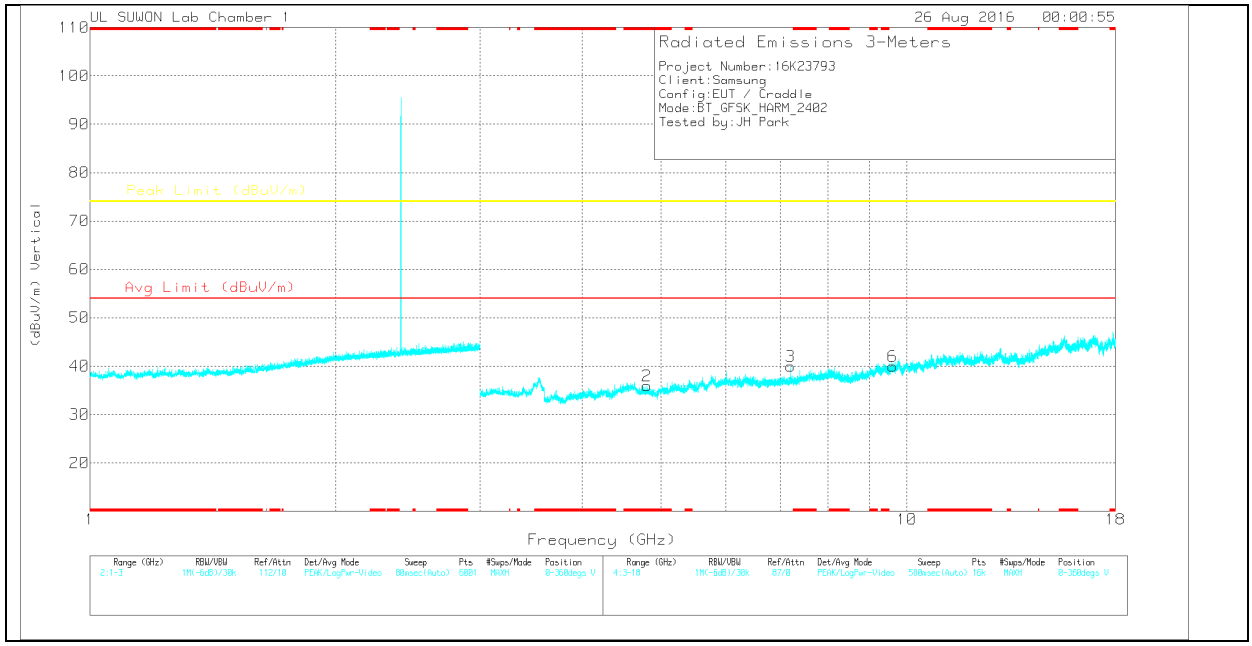
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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

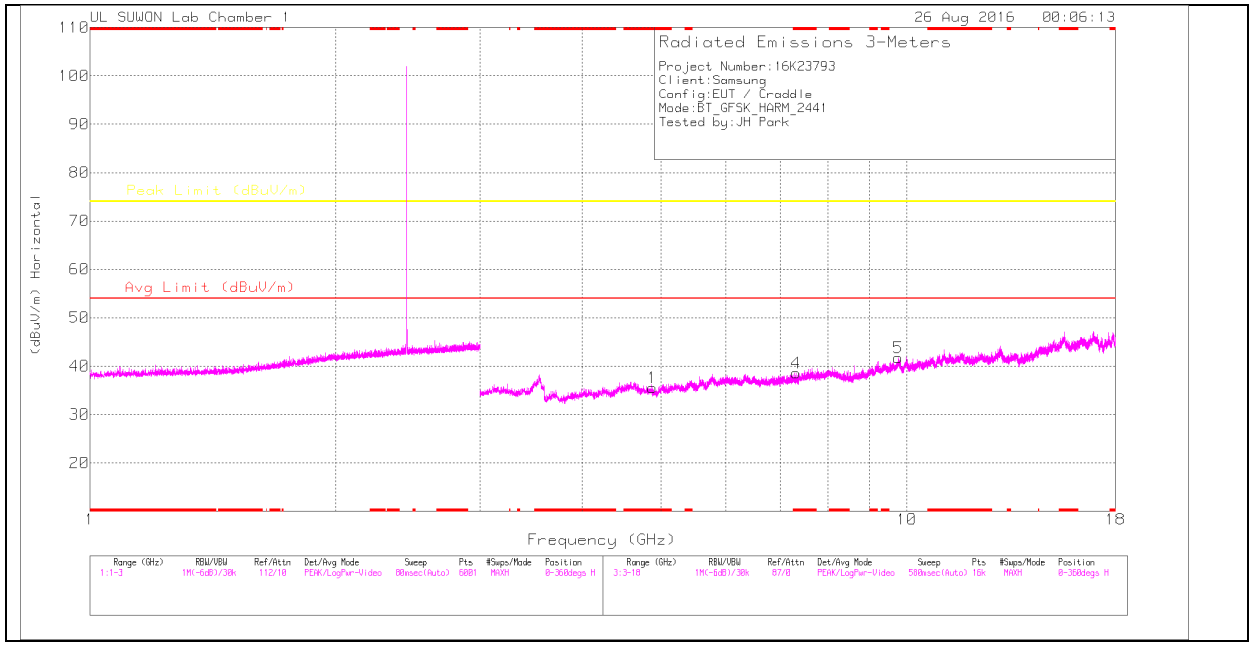
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	36.84	PK	34	-33.8	37.04	-	-	74	-36.96	0-360	150	H
4	7.206	34.07	PK	35.7	-30.8	38.97	-	-	74	-35.03	0-360	250	H
5	9.597	31.3	PK	37	-27.3	41	-	-	74	-33	0-360	150	H
2	* 4.803	35.75	PK	34	-33.8	35.95	-	-	74	-38.05	0-360	150	V
3	7.206	35.04	PK	35.7	-30.8	39.94	-	-	74	-34.06	0-360	150	V
6	9.61	30.31	PK	37	-27.3	40.01	-	-	74	-33.99	0-360	150	V

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

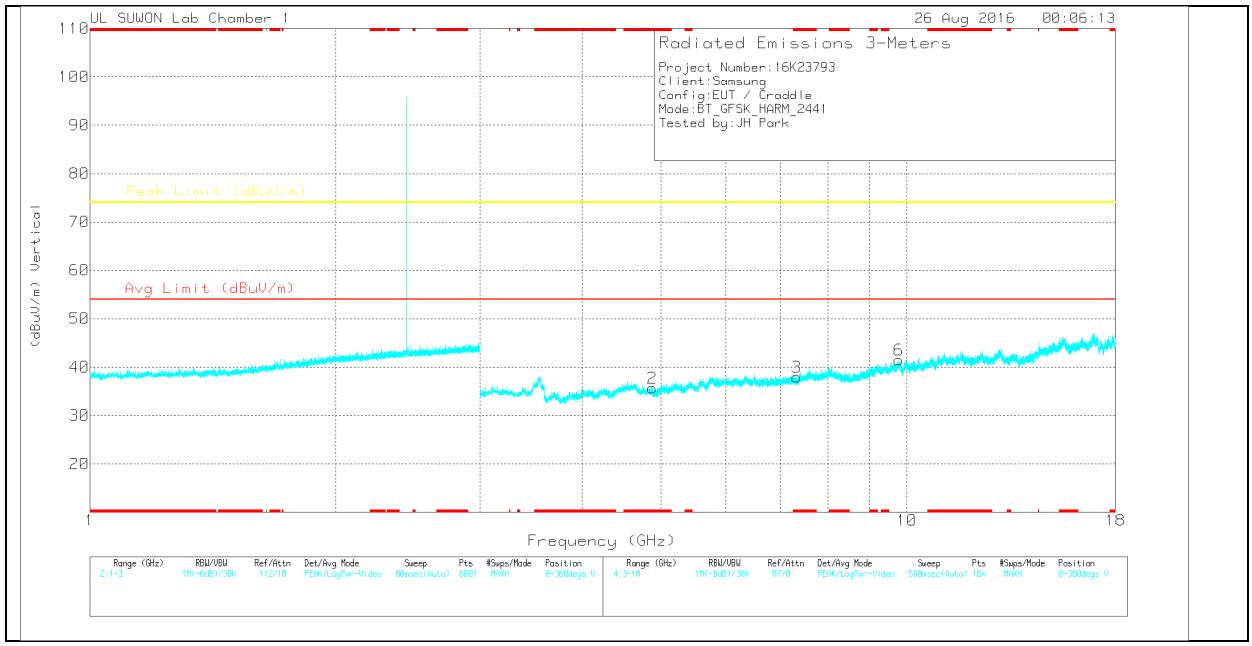
PK – Peak Detector

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

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	* 4.877	35.57	PK	34	-34	35.57	-	-	74	-38.43	0-360	150	H
4	* 7.321	33.64	PK	35.8	-30.9	38.54	-	-	74	-35.46	0-360	150	H
5	9.763	31.21	PK	37.2	-26.6	41.81	-	-	74	-32.19	0-360	150	H
2	* 4.881	35.74	PK	34	-34	35.74	-	-	74	-38.26	0-360	150	V
3	* 7.334	32.93	PK	35.8	-30.8	37.93	-	-	74	-36.07	0-360	250	V
6	9.767	30.77	PK	37.2	-26.5	41.47	-	-	74	-32.53	0-360	150	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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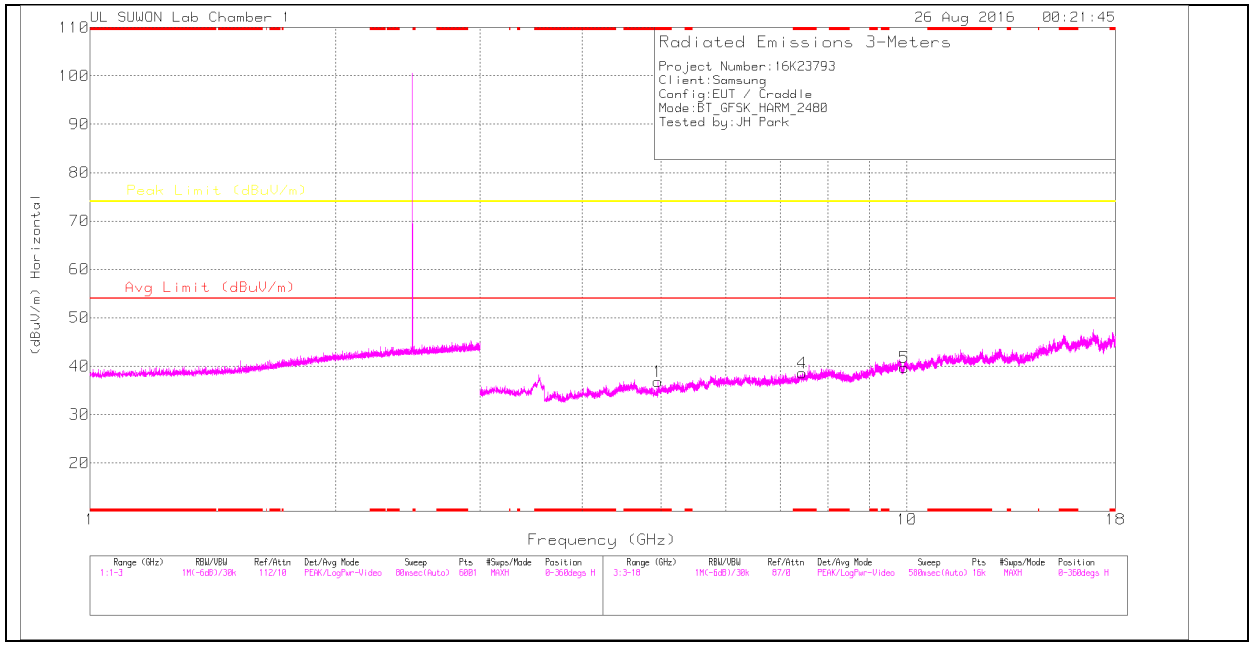
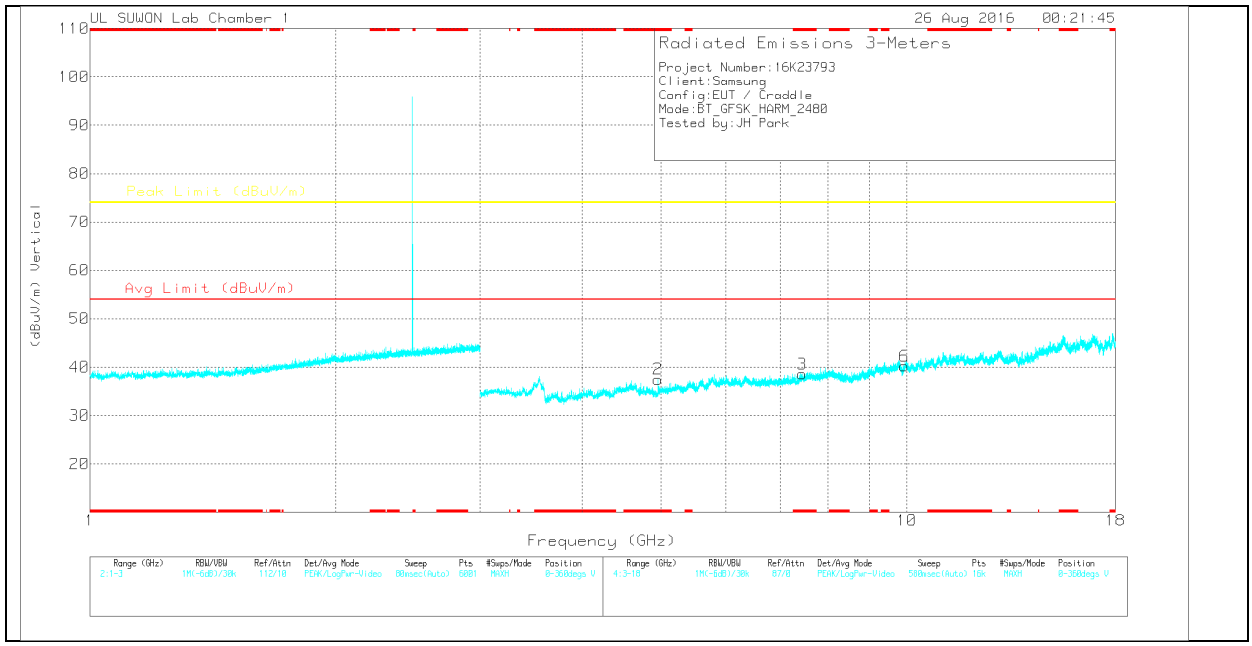
HIGH CHANNEL HORIZONTAL



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.

HIGH 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	* 4.959	36.87	PK	34	-34	36.87	-	-	74	-37.13	0-360	150	H
4	* 7.443	33.46	PK	35.8	-30.7	38.56	-	-	74	-35.44	0-360	150	H
5	9.923	29.43	PK	37.4	-27.1	39.73	-	-	74	-34.27	0-360	150	H
2	* 4.96	37.52	PK	34	-34	37.52	-	-	74	-36.48	0-360	250	V
3	* 7.446	33.42	PK	35.8	-30.6	38.62	-	-	74	-35.38	0-360	250	V
6	9.928	29.82	PK	37.4	-27	40.22	-	-	74	-33.78	0-360	150	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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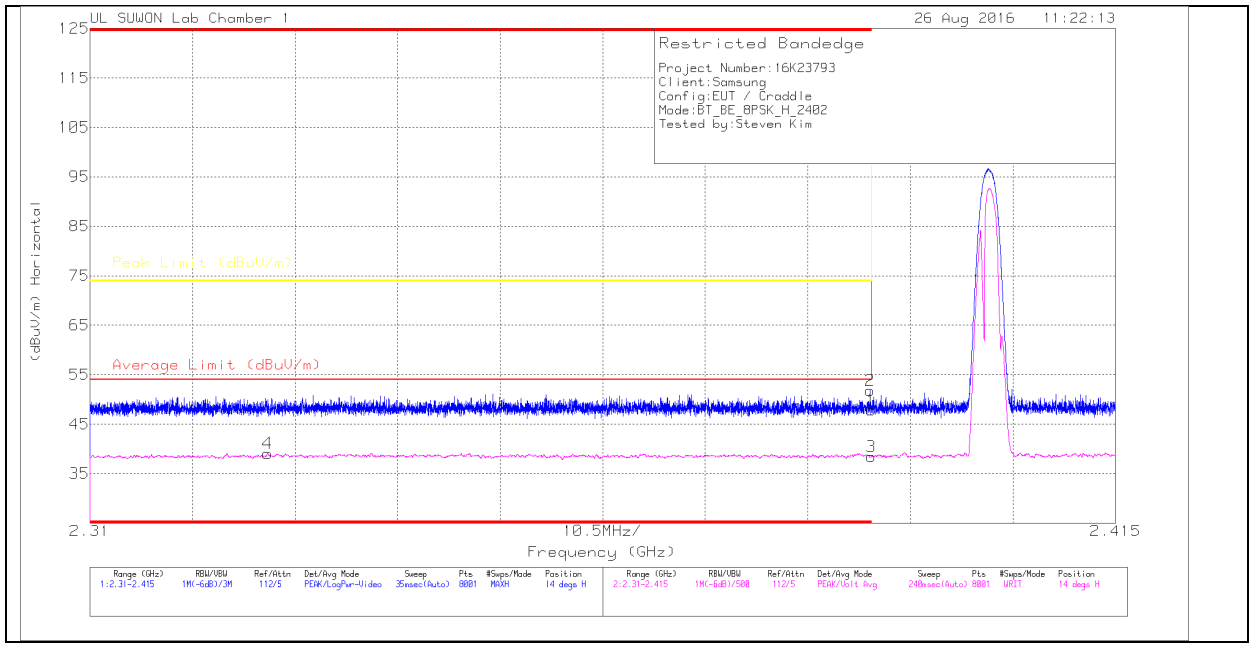
9.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

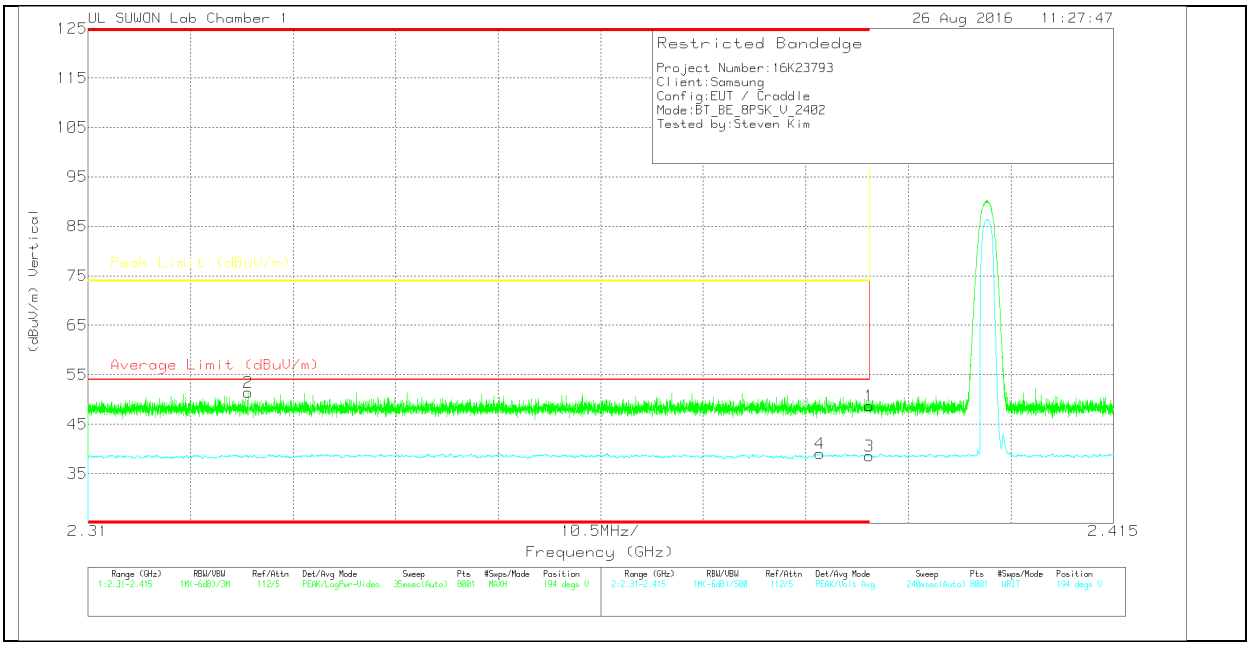
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	45.05	Pk	31.8	-29	47.85	-	-	74	-26.15	14	100	H
2	* 2.39	49.03	Pk	31.8	-29	51.83	-	-	74	-22.17	14	100	H
3	* 2.39	35.67	VA1T	31.8	-29	38.47	54	-15.53	-	-	14	100	H
4	* 2.328	36.43	VA1T	31.7	-29	39.13	54	-14.87	-	-	14	100	H

* - indicates frequency in CFR15.205/IC7.2.2 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)_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	45.92	Pk	31.8	-29	48.72	-	-	74	-25.28	194	158	V
2	* 2.326	48.73	Pk	31.7	-29	51.43	-	-	74	-22.57	194	158	V
3	* 2.39	35.75	VA1T	31.8	-29	38.55	54	-15.45	-	-	194	158	V
4	* 2.385	36.27	VA1T	31.8	-29	39.07	54	-14.93	-	-	194	158	V

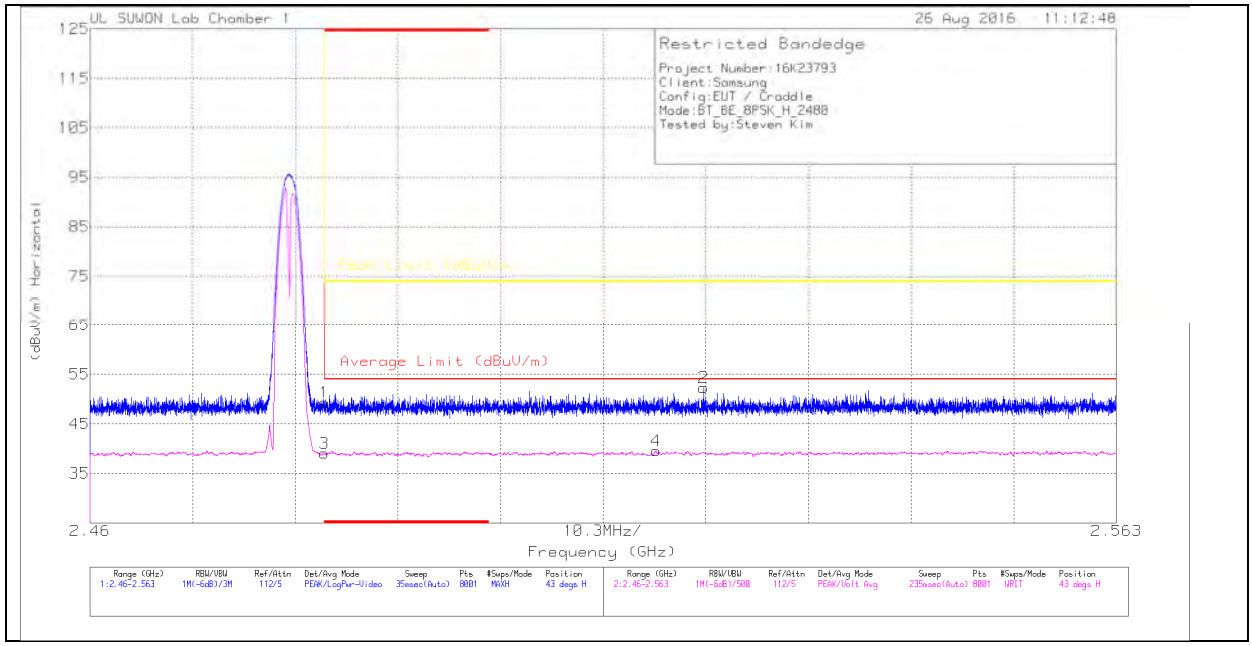
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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)_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	46.2	Pk	32	-28.9	49.3	-	-	74	-24.7	43	304	H
2	2.522	49.2	Pk	32	-28.9	52.3	-	-	74	-21.7	43	304	H
3	* 2.484	35.94	VA1T	32	-28.9	39.04	54	-14.96	-	-	43	304	H
4	2.517	36.44	VA1T	32	-28.9	39.54	54	-14.46	-	-	43	304	H

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

Pk - Peak detector

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

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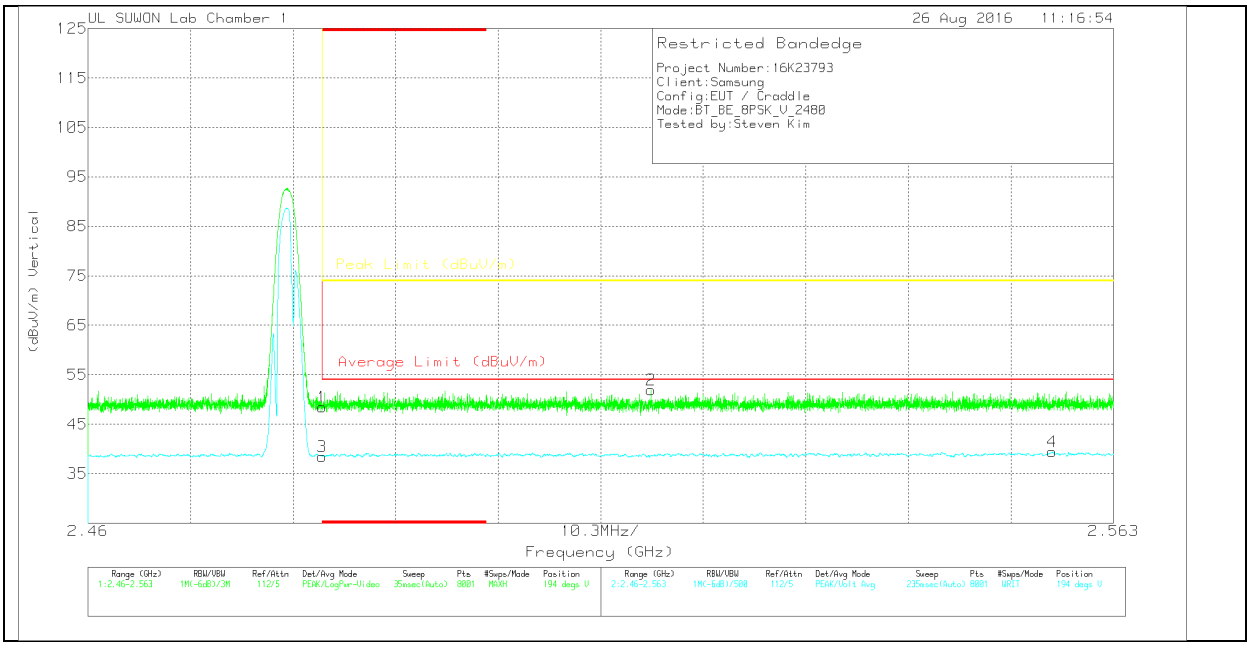
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_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	45.39	Pk	32	-28.9	48.49	-	-	74	-25.51	194	100	V
2	2.517	48.85	Pk	32	-28.9	51.95	-	-	74	-22.05	194	100	V
3	* 2.484	35.38	VA1T	32	-28.9	38.48	54	-15.52	-	-	194	100	V
4	2.557	36.19	VA1T	32	-28.8	39.39	54	-14.61	-	-	194	100	V

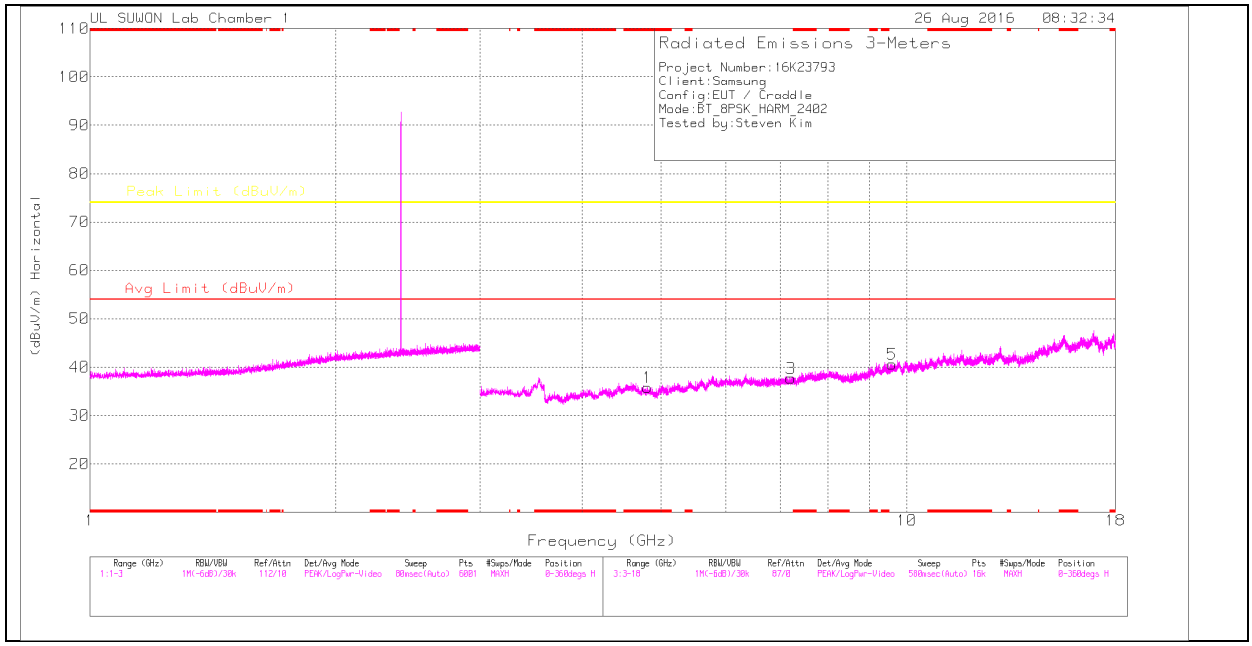
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

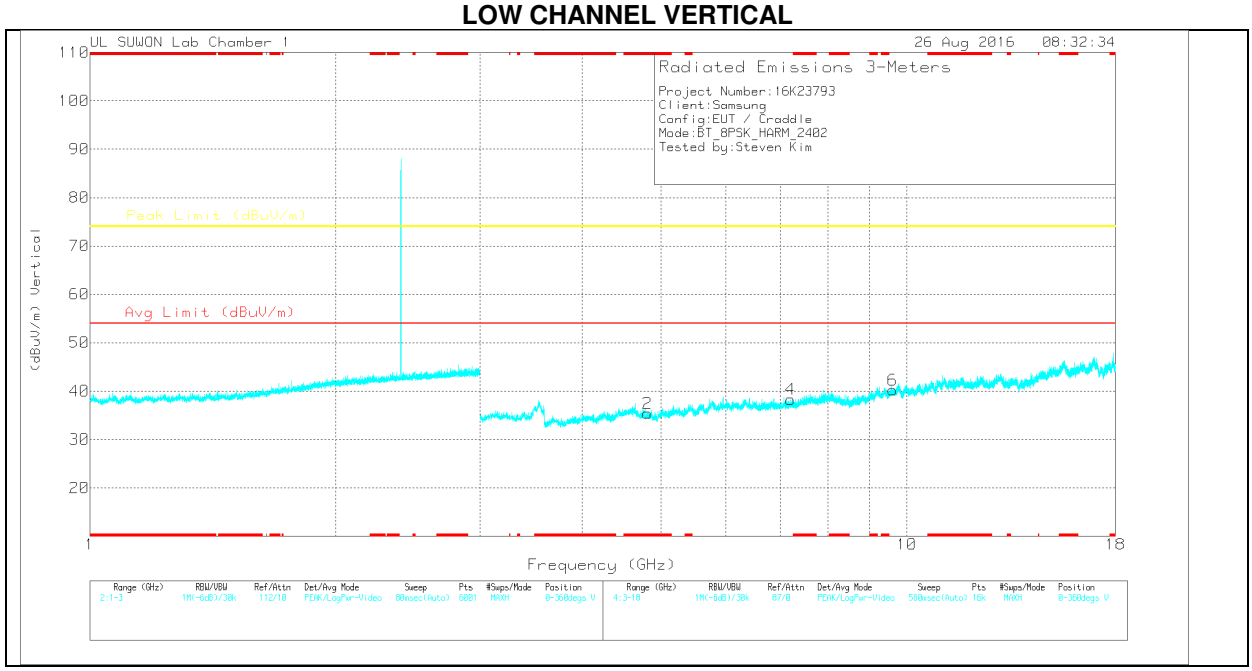
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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(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	* 4.812	35.63	PK	34	-33.8	35.83	-	-	74	-38.17	0-360	250	H
3	7.21	32.83	PK	35.7	-30.8	37.73	-	-	74	-36.27	0-360	250	H
5	9.594	30.96	PK	37	-27.3	40.66	-	-	74	-33.34	0-360	250	H
2	* 4.814	35.29	PK	34	-33.8	35.49	-	-	74	-38.51	0-360	150	V
4	7.207	33.38	PK	35.7	-30.8	38.28	-	-	74	-35.72	0-360	250	V
6	9.599	30.49	PK	37	-27.3	40.19	-	-	74	-33.81	0-360	250	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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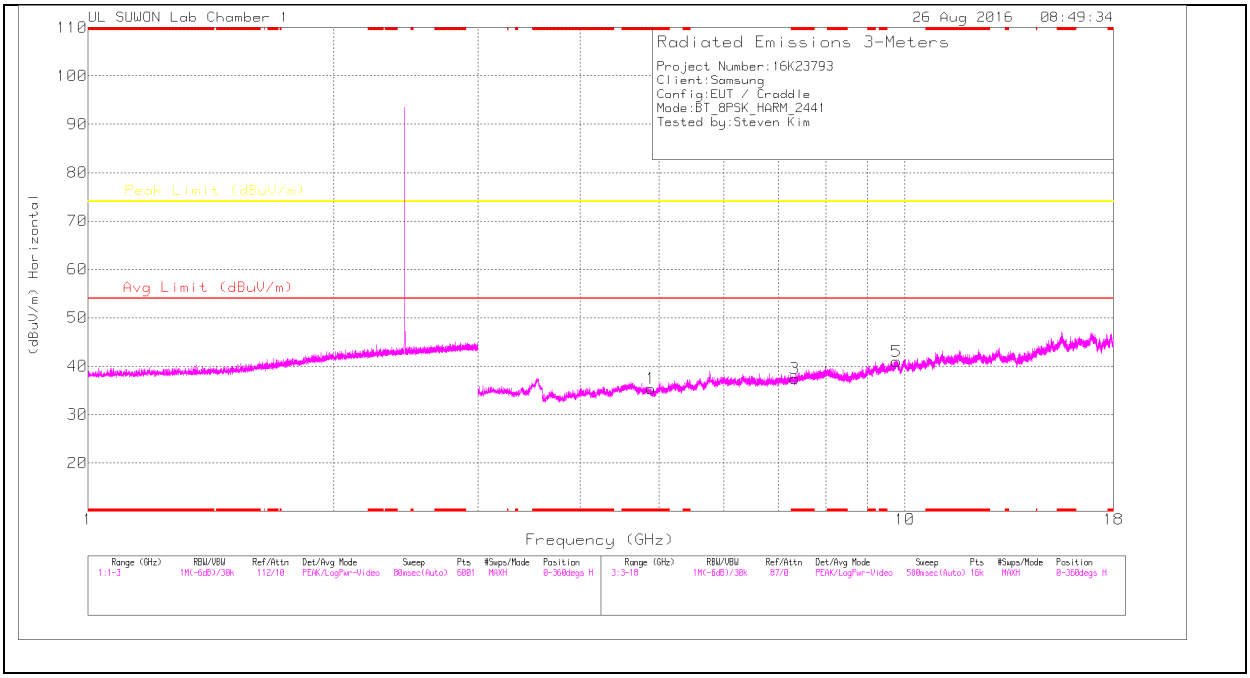
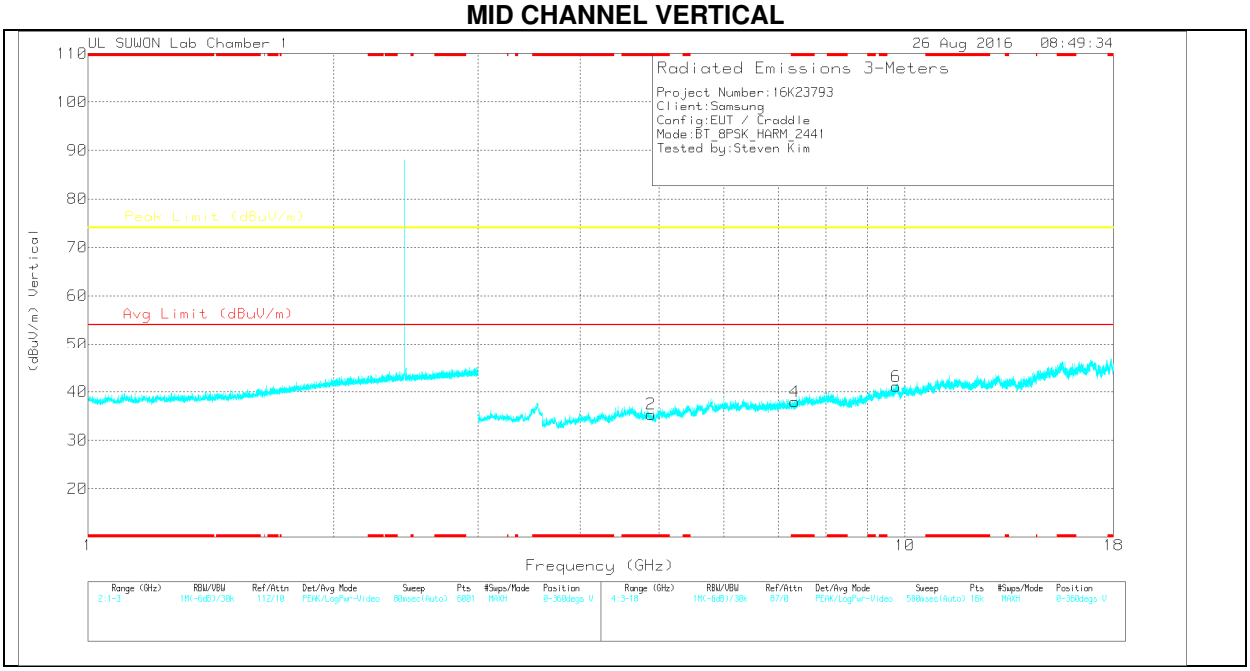
MID CHANNEL HORIZONTAL



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

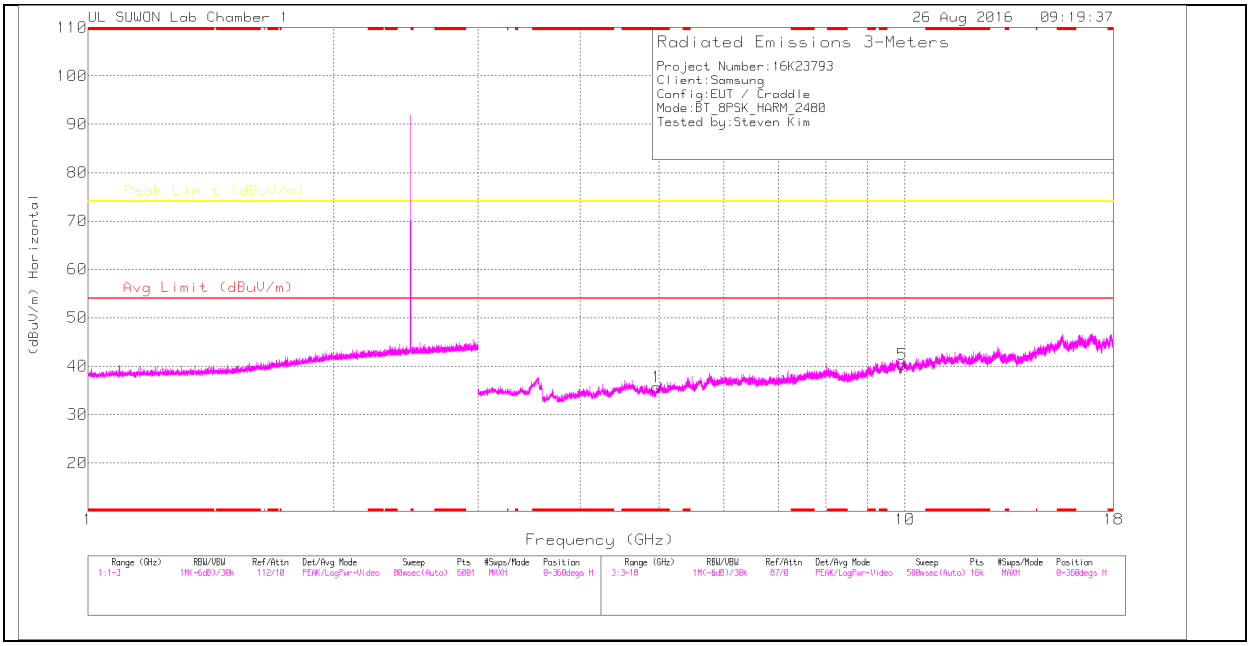
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.886	35.37	PK	34	-34	35.37	-	-	74	-38.63	0-360	250	H
3	* 7.326	32.4	PK	35.8	-30.8	37.4	-	-	74	-36.6	0-360	250	H
5	9.765	30.35	PK	37.2	-26.6	40.95	-	-	74	-33.05	0-360	250	H
2	* 4.89	35.37	PK	34	-34	35.37	-	-	74	-38.63	0-360	150	V
4	* 7.328	32.92	PK	35.8	-30.8	37.92	-	-	74	-36.08	0-360	250	V
6	9.762	30.54	PK	37.2	-26.6	41.14	-	-	74	-32.86	0-360	250	V

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

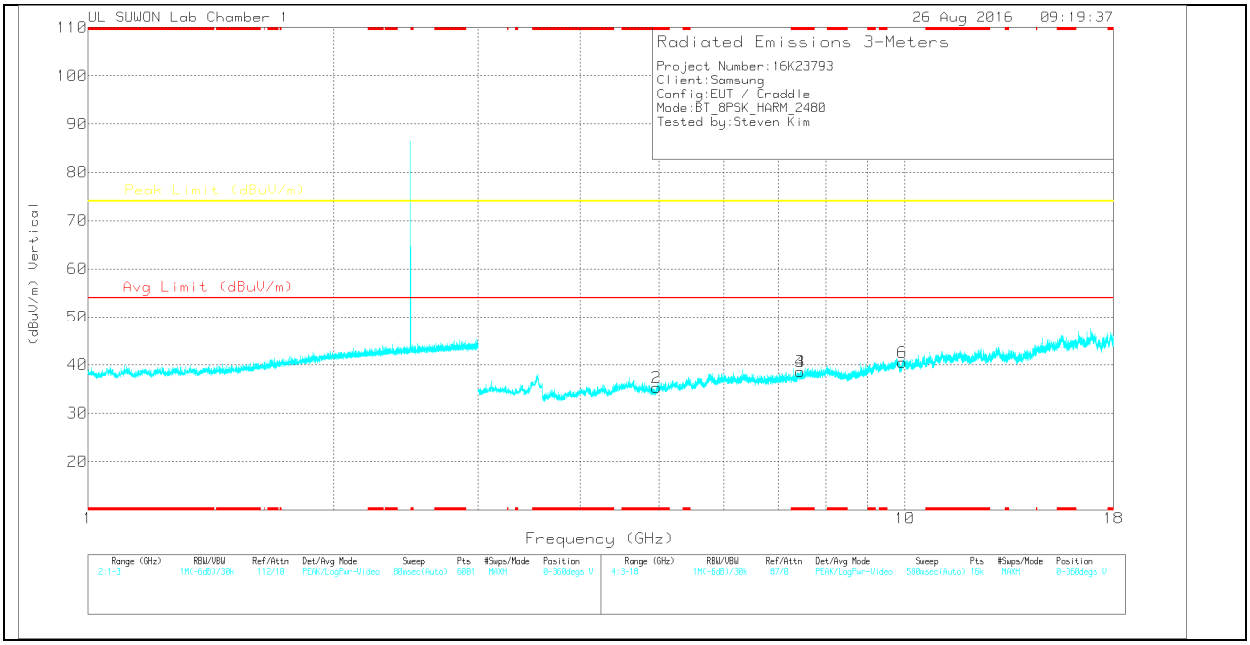
PK – Peak Detector

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

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(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	* 4.965	35.54	PK	34.1	-34	35.64	-	-	74	-38.36	0-360	250	H
5	9.922	30.22	PK	37.4	-27.2	40.42	-	-	74	-33.58	0-360	150	H
2	* 4.969	35.19	PK	34.1	-34	35.29	-	-	74	-38.71	0-360	250	V
3	* 7.445	33.39	PK	35.8	-30.6	38.59	-	-	74	-35.41	0-360	150	V
4	* 7.445	33.39	PK	35.8	-30.6	38.59	-	-	74	-35.41	0-360	150	V
6	9.927	30.21	PK	37.4	-27.1	40.51	-	-	74	-33.49	0-360	250	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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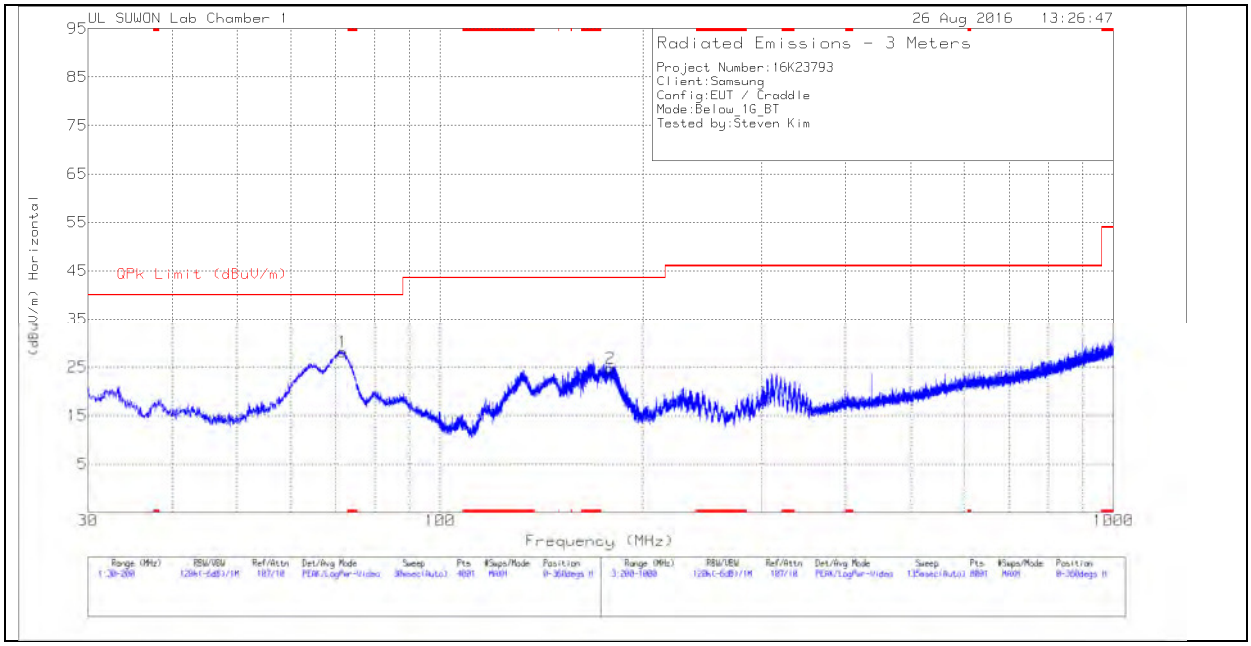
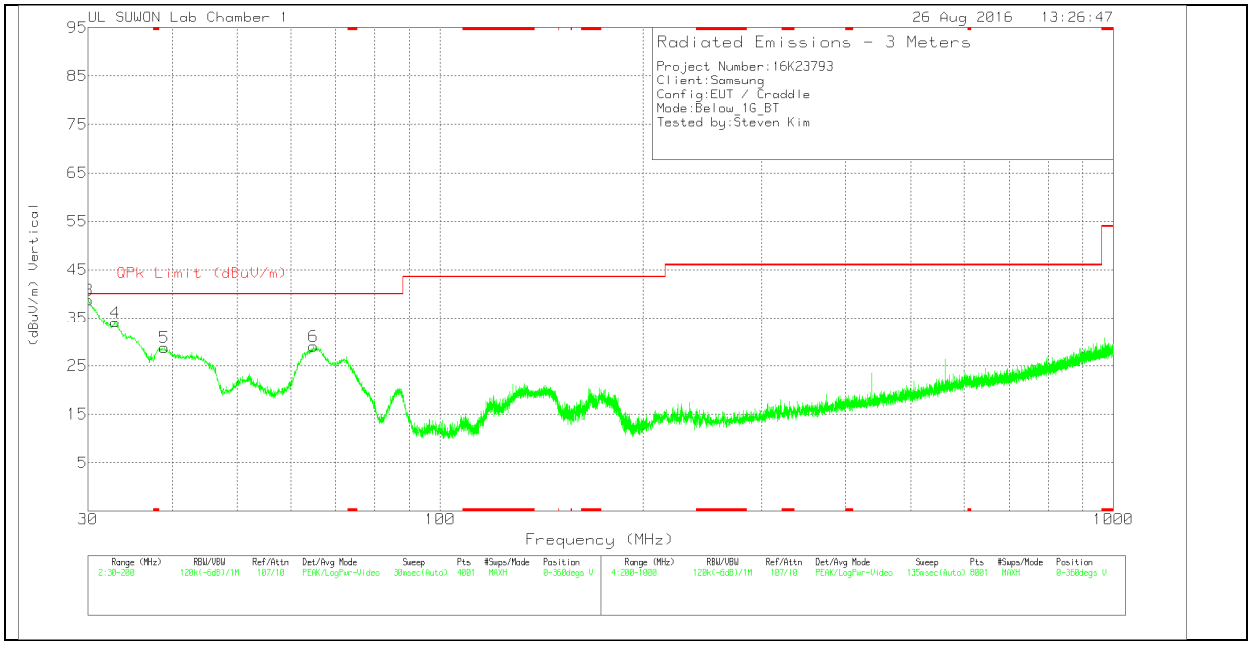
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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	71.6925	48.7	Pk	9.2	-29.7	28.2	40	-11.8	0-360	300	H
2	179.345	43.61	Pk	9.4	-28.3	24.71	43.52	-18.81	0-360	100	H
3	30.0425	58.91	Pk	10.3	-30.5	38.71	40	-1.29	0-360	100	V
4	32.975	54.24	Pk	10.4	-30.5	34.14	40	-5.86	0-360	100	V
5	38.925	47.02	Pk	12	-30.3	28.72	40	-11.28	0-360	100	V
6	64.8925	47.7	Pk	11.2	-29.9	29	40	-11	0-360	300	V

Pk - Peak detector

Radiated Emissions

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
30.0378	54.9	Qp	10.3	-30.5	34.7	40	-5.3	324	111	V

Qp - Quasi-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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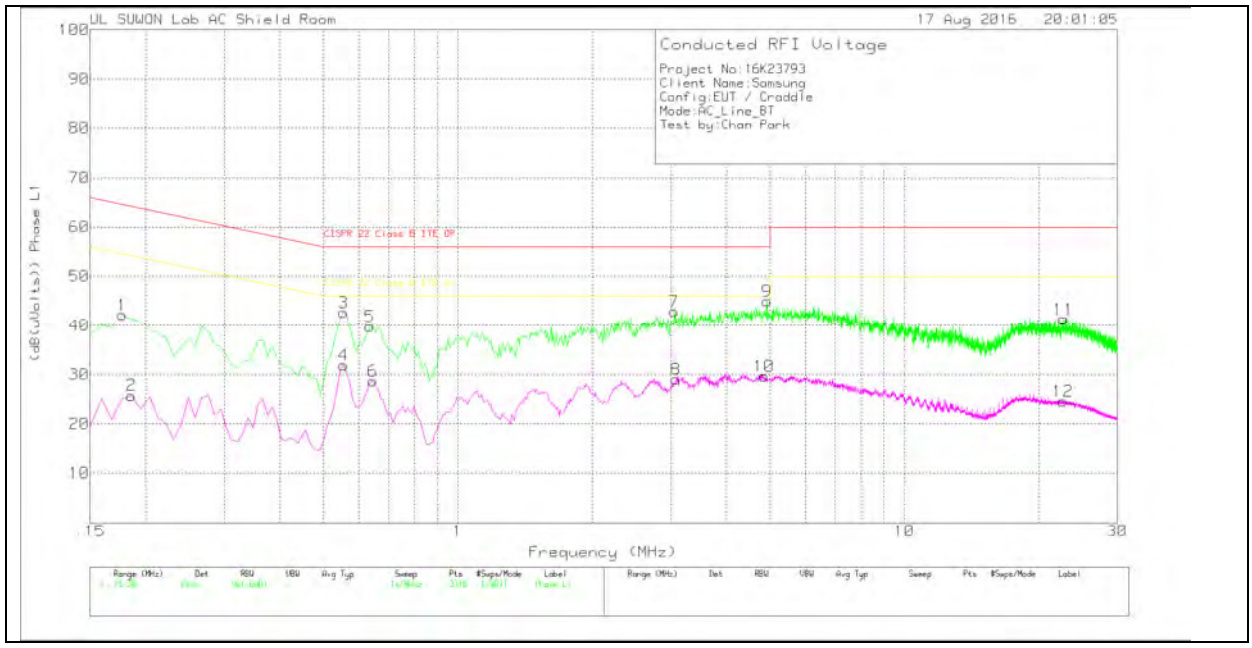
6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

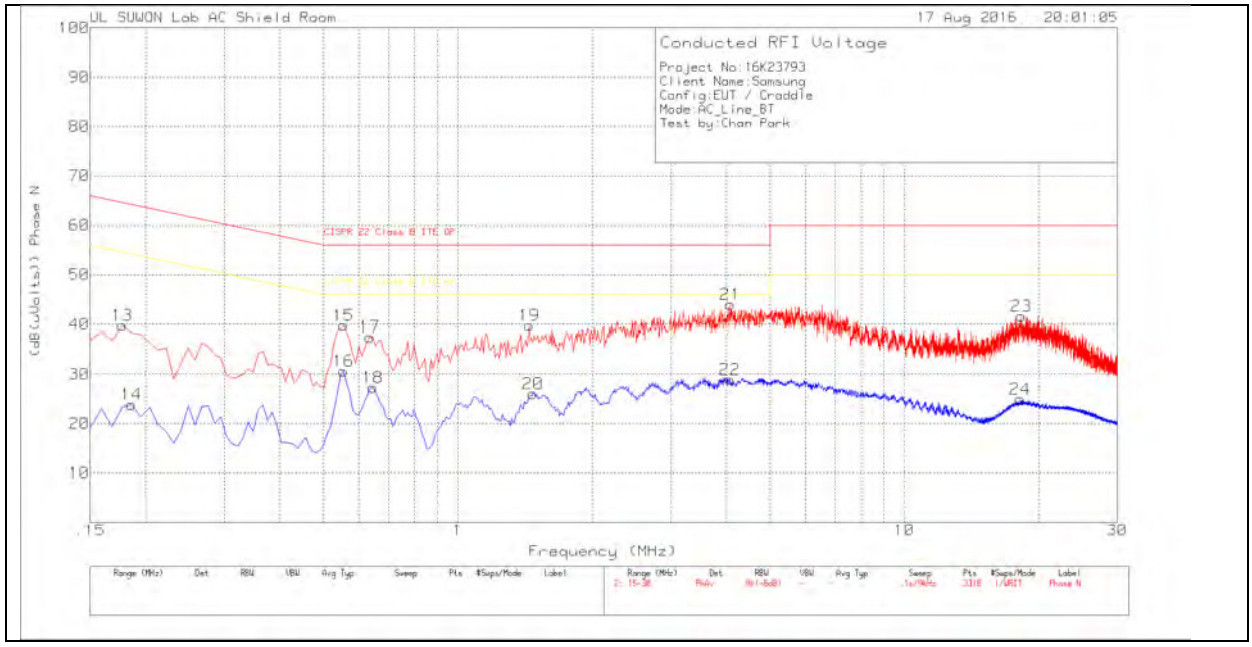
Phase L1 .15 - 30MHz

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	31.99	Pk	10.2	0	42.19	64.63	-22.44	-	-
2	.186	15.66	Av	10.1	0	25.76	-	-	54.21	-28.45
3	.555	32.56	Pk	10.1	0	42.66	56	-13.34	-	-
4	.555	21.74	Av	10.1	0	31.84	-	-	46	-14.16
5	.636	29.74	Pk	10.1	0	39.84	56	-16.16	-	-
6	.645	18.6	Av	10.1	0	28.7	-	-	46	-17.3
7	3.048	33.01	Pk	9.8	.1	42.91	56	-13.09	-	-
8	3.084	19.11	Av	9.8	.1	29.01	-	-	46	-16.99
9	4.92	35.05	Pk	9.8	.1	44.95	56	-11.05	-	-
10	4.848	19.8	Av	9.8	.1	29.7	-	-	46	-16.3
11	22.713	30.63	Pk	10.5	.2	41.33	60	-18.67	-	-
12	22.65	13.83	Av	10.5	.2	24.53	-	-	50	-25.47

Pk - Peak detector

Av - Average detection

LINE 2 PLOT



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	.177	29.66	Pk	10.1	0	39.76	64.63	-24.87	-	-
14	.186	13.9	Av	10	0	23.9	-	-	54.21	-30.31
15	.555	29.65	Pk	10.1	0	39.75	56	-16.25	-	-
16	.555	20.56	Av	10.1	0	30.66	-	-	46	-15.34
17	.636	27.41	Pk	10.1	0	37.51	56	-18.49	-	-
18	.645	17.32	Av	10	0	27.32	-	-	46	-18.68
19	1.446	29.85	Pk	9.8	.1	39.75	56	-16.25	-	-
20	1.473	16.22	Av	9.8	.1	26.12	-	-	46	-19.88
21	4.074	34.1	Pk	9.8	.1	44	56	-12	-	-
22	4.065	19.03	Av	9.8	.1	28.93	-	-	46	-17.07
23	18.258	31	Pk	10.5	.2	41.7	60	-18.3	-	-
24	18.15	14.31	Av	10.5	.2	25.01	-	-	50	-24.99

Pk - Peak detector

Av - Average detection