



FCC CFR47 PART 15 SUBPART C

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n, ANT+ and NFC

MODEL NUMBER : SM-A310M/DS, SM-A310M

FCC ID: A3LSMA310M

REPORT NUMBER: 15K22210-E2

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	11/25/15	Initial issue	Junwhan Lee
2	12/01/15	Revised equipment list	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n, ANT+ and NFC
MODEL NUMBER: SM-A310M/DS, SM-A310M
SERIAL NUMBER: 31004a4aeb191221 (RADIATED); R38GA0PDTTJ (CONDUCTED)
DATE TESTED: NOV 06, 2015 - NOV 20, 2015

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.

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
<input type="checkbox"/> Chamber 1
<input checked="" type="checkbox"/> 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

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 GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n, ANT+ and NFC.
This test report addresses the DTS (BLE) operational mode.

SM-A310M and SM-A310M/DS are same hardware but for different number of SIM card slot.
SM-A310M has one slot. SM-A310M/DS is dual SIM version.
SM-A310M/DS was used for the test.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	BLE	Peak	8.09	6.44
		Average	7.55	5.69

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -3.75dBi

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

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA50EWE	DK2G608VS/A-E	N/A
Data Cable	SAMSUNG	EP-DG920UWE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	N/A	N/A

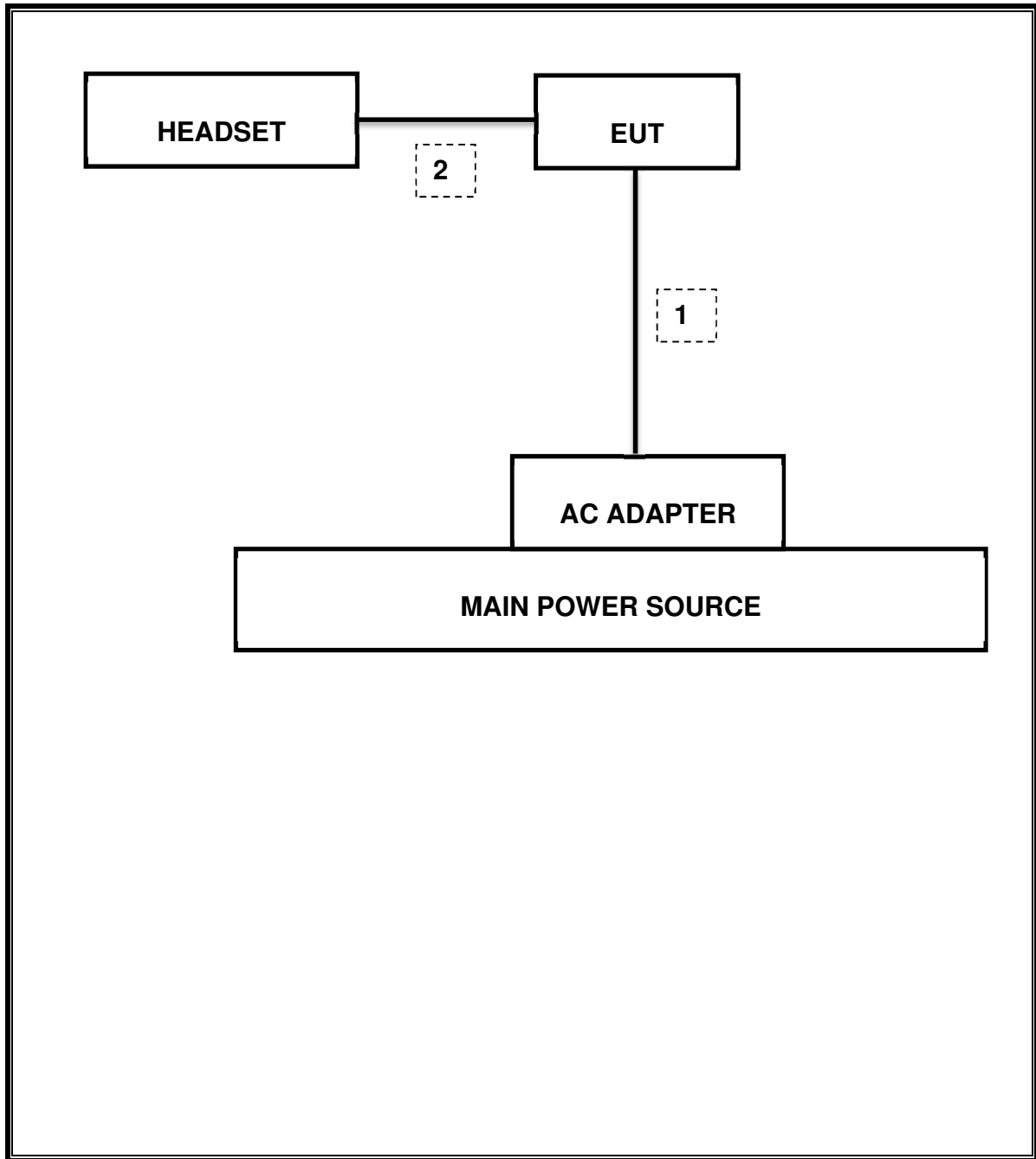
I/O CABLES

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
1	Audio	1	Mini-Jack	Unshielded	1.0m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests. Test software exercised the radio card.

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	749	04-25-16
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-16
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-16
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-16
Antenna, Horn, 40 GHz	ETS	3116C	00166255	09-23-16
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	09-29-16
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

7. MEASUREMENT METHODS

KDB 558074 D01 DTS Meas Guidance v03r03: Measurement Procedure §9.1.1 is used for peak power and §10.2 PKPSD is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

Band edge emissions within Restricted Bands are measured using RMS with duty cycle factor offset method.

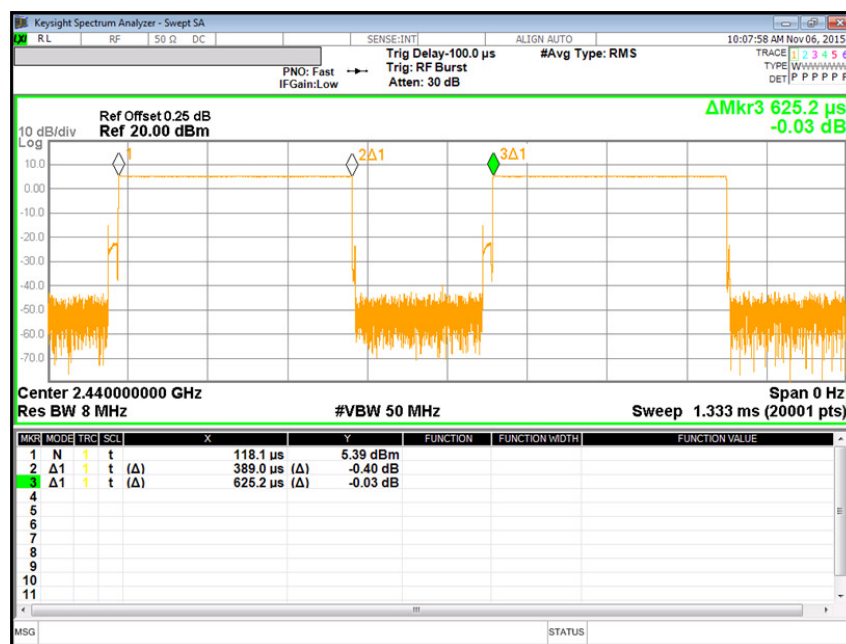
8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None: for reporting purposes only.

8.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
BLE	0.389	0.625	0.622	62.2%	2.06	2.571



9. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	688.3 kHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-50.963 dBm
15.247	TX conducted output power	<30dBm		Pass	8.091 dBm (Peak)
15.247	PSD	<8dBm		Pass	-6.33 dBm (Peak)
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	43.29 dBuV (QP)
15.205, 15.209	Radiated Spurious Emission	< 40dBuV/m	Radiated	Pass	49.16 dBuV/m (QP)

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.




TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Low	2402	710.6	500.0
Mid	2440	692.9	500.0
High	2480	688.3	500.0
Worst		688.3	500.0

6 dB BANDWIDTH PLOTS

<p>Low CH</p>	
<p>Middle CH</p>	
<p>High CH</p>	

10.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

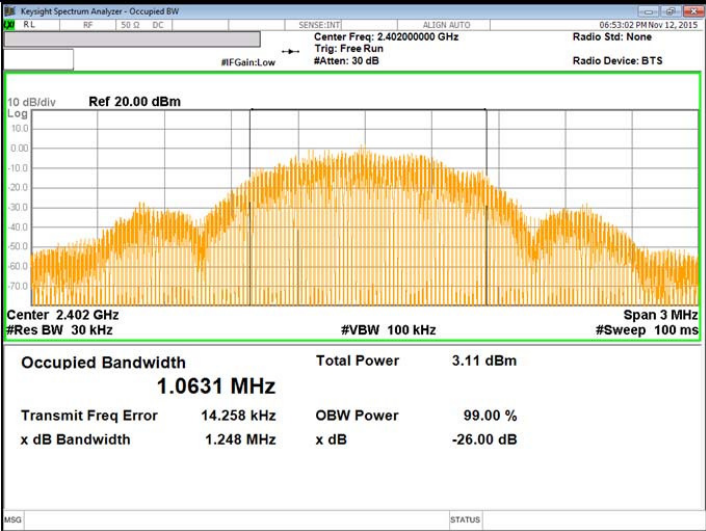
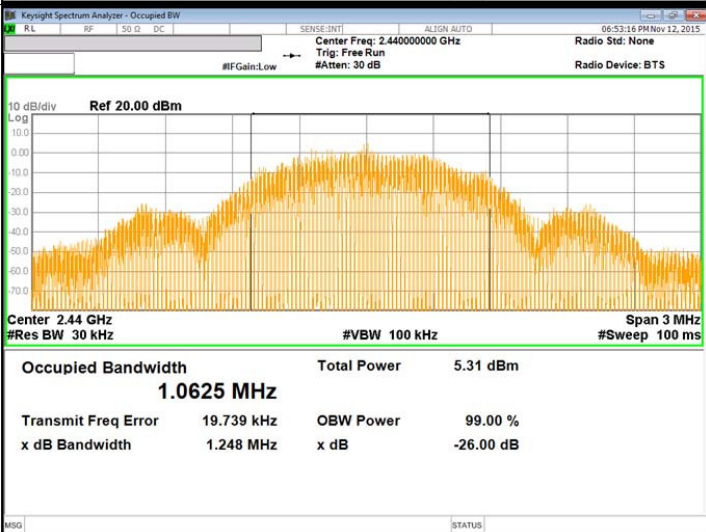

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency [MHz]	99% Bandwidth [MHz]
Low	2402	1.063
Mid	2440	1.063
High	2480	1.067
Worst		1.067

99% BANDWIDTH PLOTS

<p>Low CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.40200000 GHz Trig: Free Run #Gain: Low #Atten: 30 dB Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.402 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>3.11 dBm</td> </tr> <tr> <td>1.0631 MHz</td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>14.258 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.248 MHz</td> <td>x dB</td> </tr> <tr> <td></td> <td></td> <td>99.00 %</td> </tr> <tr> <td></td> <td></td> <td>-26.00 dB</td> </tr> </table>	Occupied Bandwidth	Total Power	3.11 dBm	1.0631 MHz			Transmit Freq Error	14.258 kHz	OBW Power	x dB Bandwidth	1.248 MHz	x dB			99.00 %			-26.00 dB
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x dB Bandwidth	1.248 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	
<p>Middle CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.44000000 GHz Trig: Free Run #Gain: Low #Atten: 30 dB Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.44 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>5.31 dBm</td> </tr> <tr> <td>1.0625 MHz</td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>19.739 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.248 MHz</td> <td>x dB</td> </tr> <tr> <td></td> <td></td> <td>99.00 %</td> </tr> <tr> <td></td> <td></td> <td>-26.00 dB</td> </tr> </table>	Occupied Bandwidth	Total Power	5.31 dBm	1.0625 MHz			Transmit Freq Error	19.739 kHz	OBW Power	x dB Bandwidth	1.248 MHz	x dB			99.00 %			-26.00 dB
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x dB Bandwidth	1.248 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	
<p>High CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW Center Freq: 2.48000000 GHz Trig: Free Run #Gain: Low #Atten: 30 dB Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm</p> <p>Center 2.48 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>2.74 dBm</td> </tr> <tr> <td>1.0672 MHz</td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>23.031 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.229 MHz</td> <td>x dB</td> </tr> <tr> <td></td> <td></td> <td>99.00 %</td> </tr> <tr> <td></td> <td></td> <td>-26.00 dB</td> </tr> </table>	Occupied Bandwidth	Total Power	2.74 dBm	1.0672 MHz			Transmit Freq Error	23.031 kHz	OBW Power	x dB Bandwidth	1.229 MHz	x dB			99.00 %			-26.00 dB
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1.0672 MHz																			
Transmit Freq Error	23.031 kHz	OBW Power																	
x dB Bandwidth	1.229 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	

10.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

Peak power is measured using KDB558074 D01 DTS Meas Guidance v03r03 under section 9.1.1 utilizing spectrum analyzer.

RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	6.188	30.000	-23.812
Mid	2440	8.091	30.000	-21.909
High	2480	5.684	30.000	-24.316
Worst		8.091		-21.909

OUTPUT POWER PLOTS

<p>Low CH</p>	<p>Keysight Spectrum Analyzer - Swept SA 06:29:26 PM Nov 10, 2015 #Avg Type: RMS Avg/Hold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Ref Offset 0.25 dB Ref 20.00 dBm Mkr1 2.402 045 500 GHz 6.188 dBm 10 dB/div Log Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>Middle CH</p>	<p>Keysight Spectrum Analyzer - Swept SA 06:28:56 PM Nov 10, 2015 #Avg Type: RMS Avg/Hold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Ref Offset 0.25 dB Ref 20.00 dBm Mkr1 2.439 944 125 GHz 8.091 dBm 10 dB/div Log Center 2.440000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>
<p>High CH</p>	<p>Keysight Spectrum Analyzer - Swept SA 06:28:34 PM Nov 10, 2015 #Avg Type: RMS Avg/Hold: 100/100 Trig: Free Run Atten: 30 dB PNO: Fast IF Gain: Low Ref Offset 0.25 dB Ref 20.00 dBm Mkr1 2.480 002 250 GHz 5.684 dBm 10 dB/div Log Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 2.667 ms (40001 pts)</p>

10.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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.

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	5.74	3.75
Middle	2440	7.55	5.69
High	2480	4.95	3.12

10.5. PSD

LIMITS

FCC §15.247

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

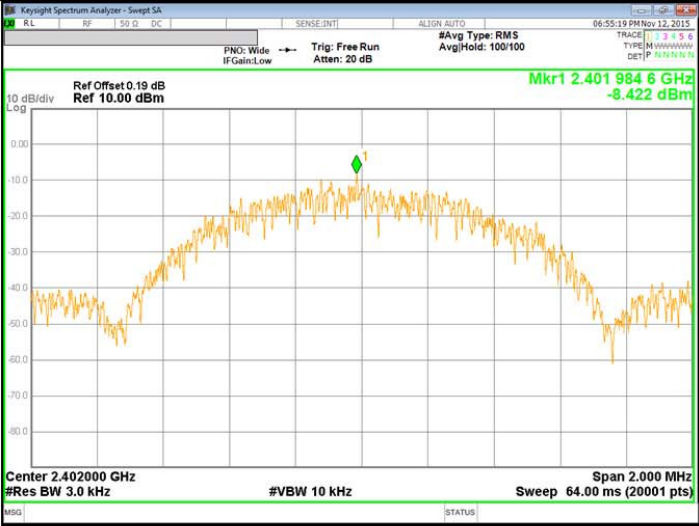
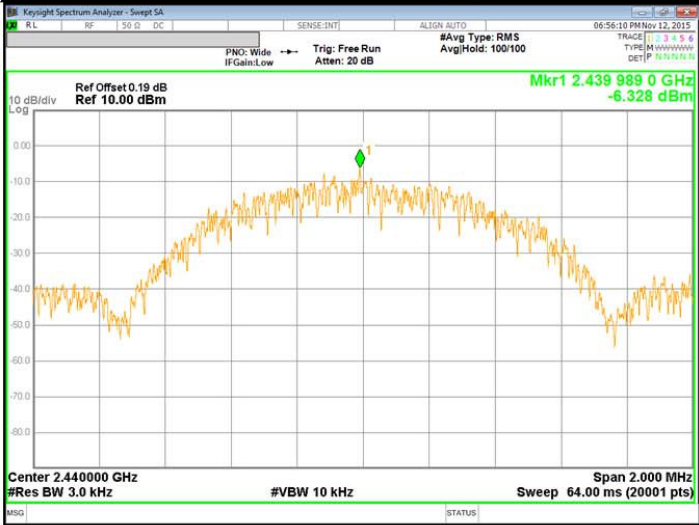
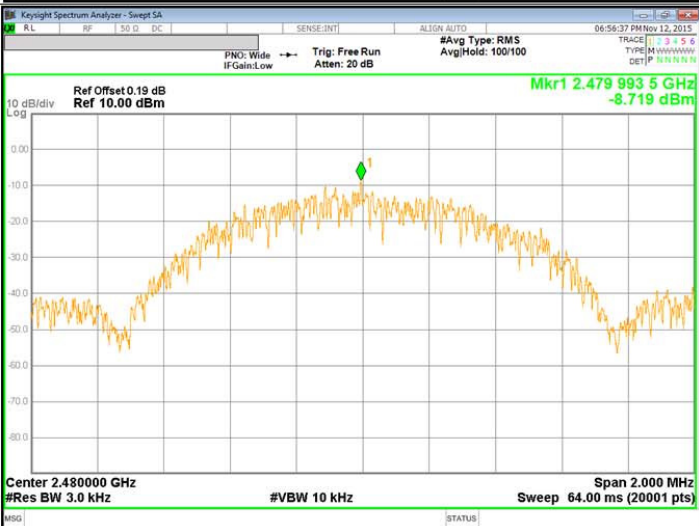
TEST PROCEDURE

Power Spectral Density was performed utilizing the "Method PKPSD (Peak PSD)" under KDB558074 D01 DTS Meas Guidance v03r03

RESULTS

Channel	Frequency [MHz]	PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2402	-8.42	8.00	-16.42
Mid	2440	-6.33	8.00	-14.33
High	2480	-8.72	8.00	-16.72

POWER SPECTRAL DENSITY PLOTS

<p>Low CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA R.L. RF 50 Ω DC SENSE:INTI ALIGN: AUTO 06:55:19 PM Nov 12, 2015 PNO: Wide IF Gain: Low Trig: Free Run #Avg Type: RMS Avg/Hold: 100/100 Ref Offset 0.19 dB Ref 10.00 dBm Mkr1 2.401 984 6 GHz -8.422 dBm 10 dB/div Log Center 2.402000 GHz Span 2.000 MHz #Res BW 3.0 kHz #VBW 10 kHz Sweep 64.00 ms (20001 pts)</p>
<p>Middle CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA R.L. RF 50 Ω DC SENSE:INTI ALIGN: AUTO 06:56:10 PM Nov 12, 2015 PNO: Wide IF Gain: Low Trig: Free Run #Avg Type: RMS Avg/Hold: 100/100 Ref Offset 0.19 dB Ref 10.00 dBm Mkr1 2.439 989 0 GHz -6.328 dBm 10 dB/div Log Center 2.440000 GHz Span 2.000 MHz #Res BW 3.0 kHz #VBW 10 kHz Sweep 64.00 ms (20001 pts)</p>
<p>High CH</p>	 <p>Keysight Spectrum Analyzer - Swept SA R.L. RF 50 Ω DC SENSE:INTI ALIGN: AUTO 06:56:37 PM Nov 12, 2015 PNO: Wide IF Gain: Low Trig: Free Run #Avg Type: RMS Avg/Hold: 100/100 Ref Offset 0.19 dB Ref 10.00 dBm Mkr1 2.479 993 5 GHz -8.719 dBm 10 dB/div Log Center 2.480000 GHz Span 2.000 MHz #Res BW 3.0 kHz #VBW 10 kHz Sweep 64.00 ms (20001 pts)</p>

10.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

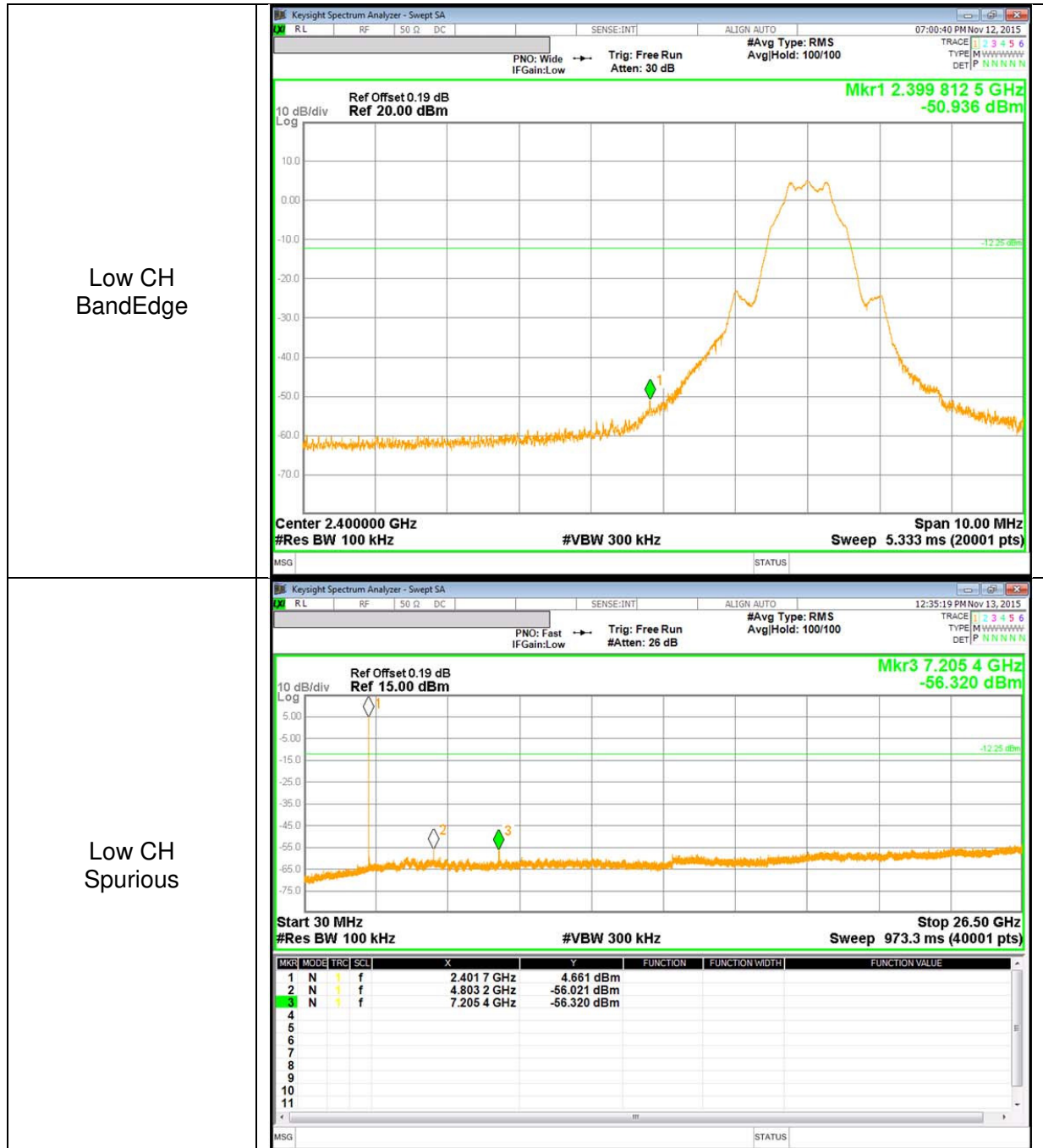
TEST PROCEDURE

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.

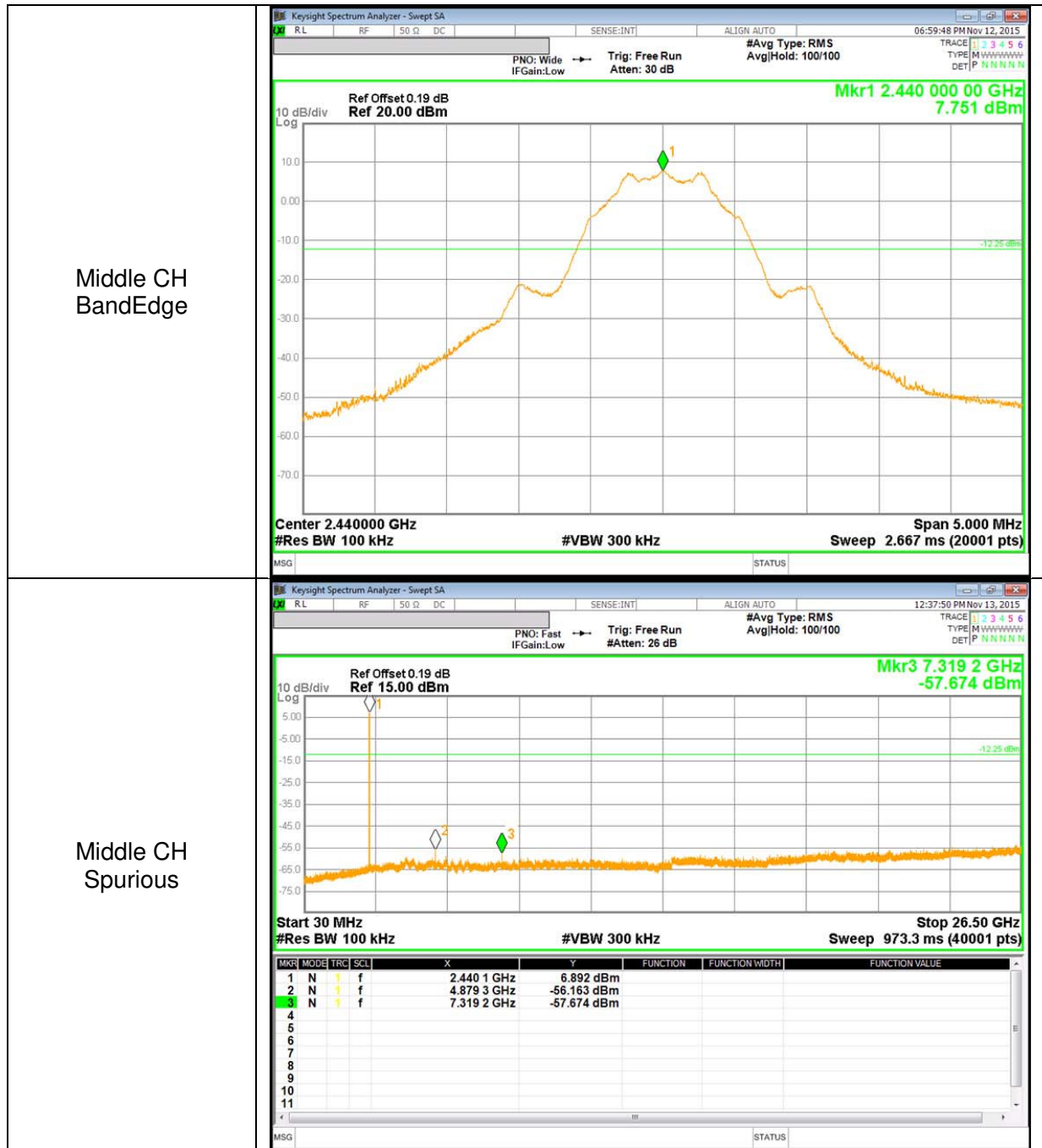
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

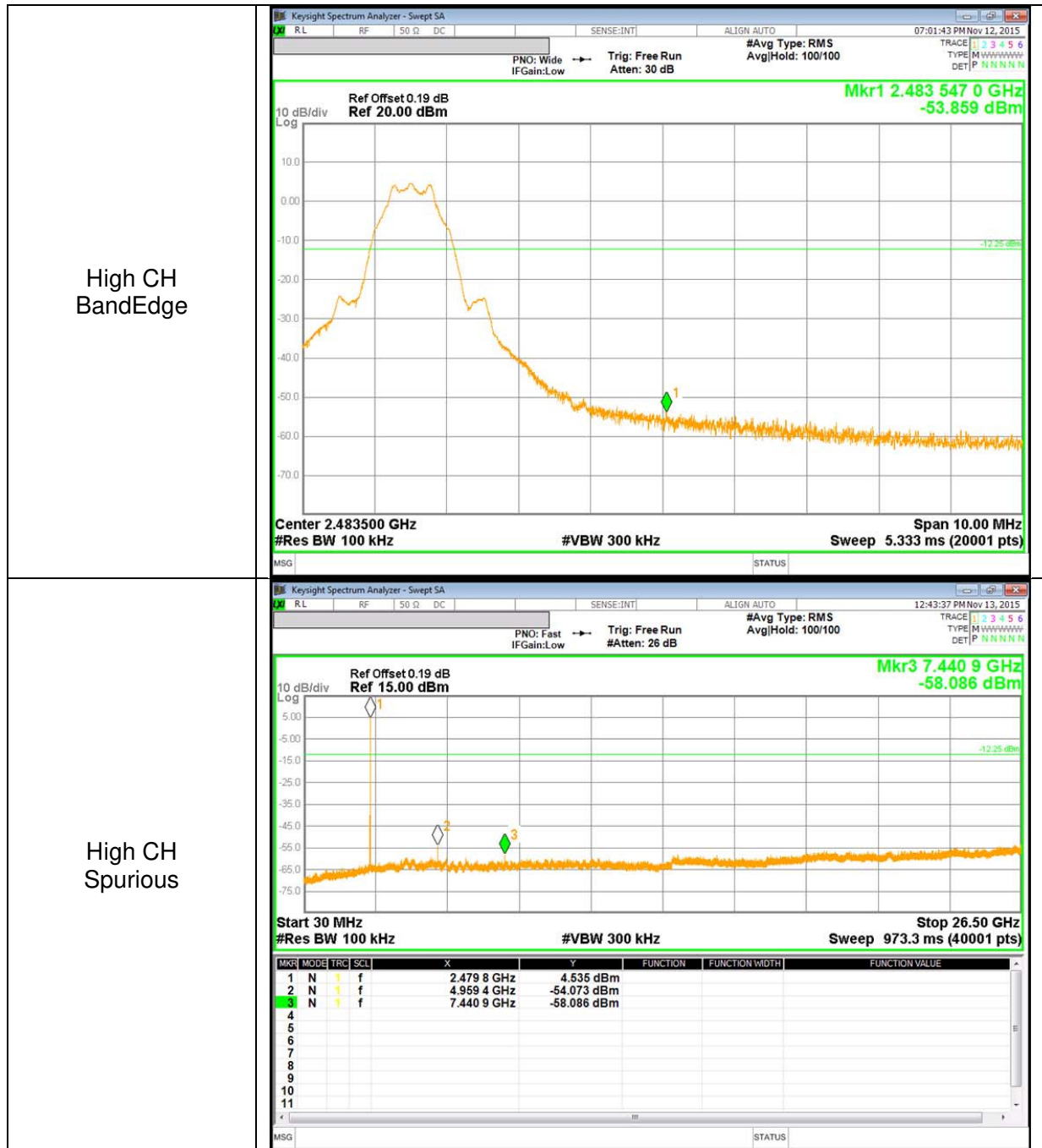
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10 - 2009. 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.

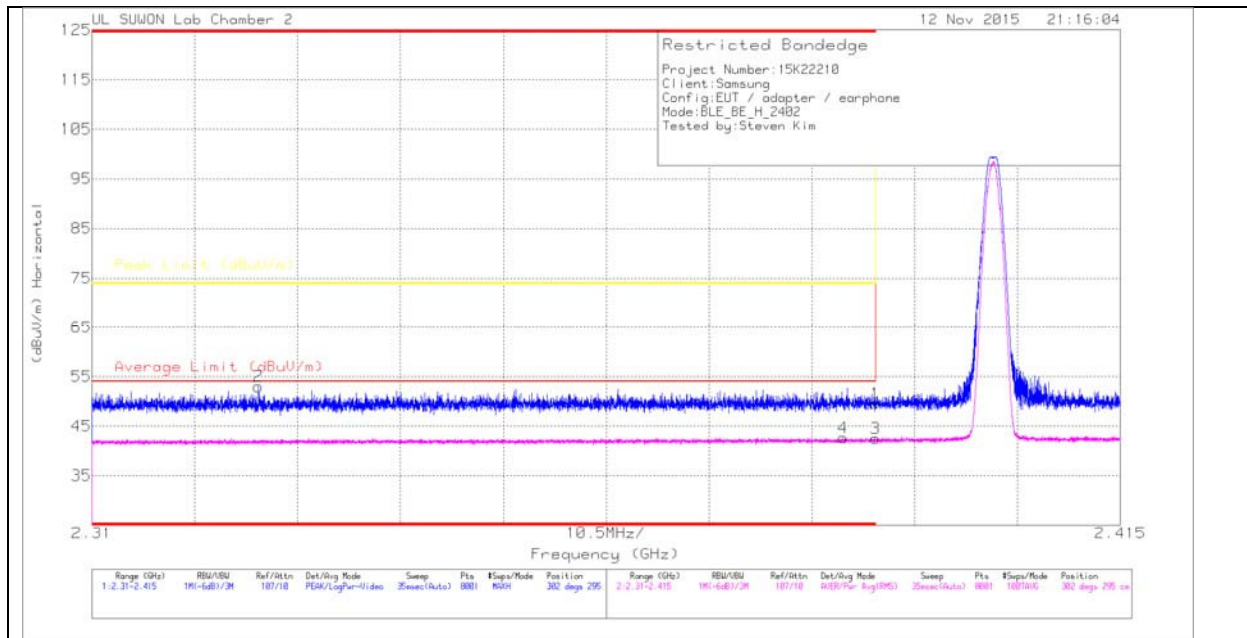
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and add duty cycle factor for average measurements. Duty cycle factor = $10 \log(1/x)$. For this sample: DCF = $10 \log(1/0.622) = 2.06 \text{ dB}$ (Spectrum Analyzer round it up to 2.06dB)

The spectrum from 30 MHz 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.

11.2. TRANSMITTER ABOVE 1 GHz RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

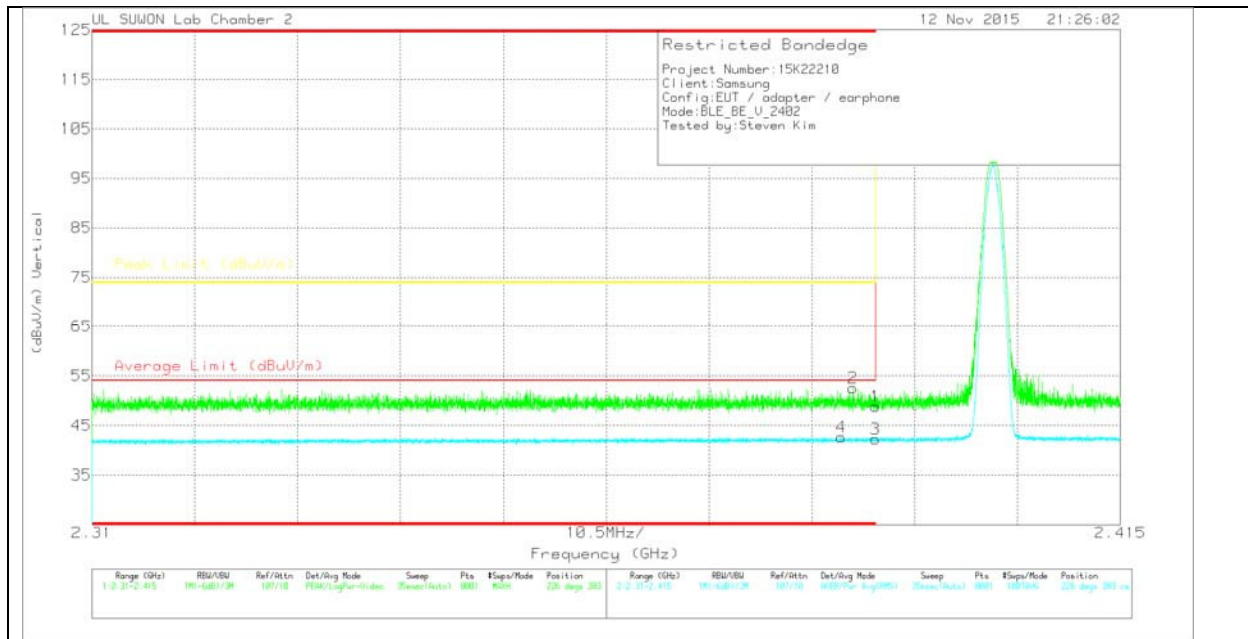
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_2_10dB	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.35	Pk	31.7	-19.5	0	49.55	-	-	74	-24.45	302	295	H
2	* 2.327	41.09	Pk	31.6	-19.7	0	52.99	-	-	74	-21.01	302	295	H
3	* 2.39	28.22	RMS	31.7	-19.5	2.06	42.48	54	-11.52	-	-	302	295	H
4	* 2.387	28.45	RMS	31.7	-19.5	2.06	42.71	54	-11.29	-	-	302	295	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 24)_150619	Path_2_10dB	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	36.64	Pk	31.7	-19.5	0	48.84	-	-	74	-25.16	226	383	V
2	* 2.388	40.4	Pk	31.7	-19.5	0	52.6	-	-	74	-21.4	226	383	V
3	* 2.39	28.03	RMS	31.7	-19.5	2.06	42.29	54	-11.71	-	-	226	383	V
4	* 2.387	28.37	RMS	31.7	-19.5	2.06	42.63	54	-11.37	-	-	226	383	V

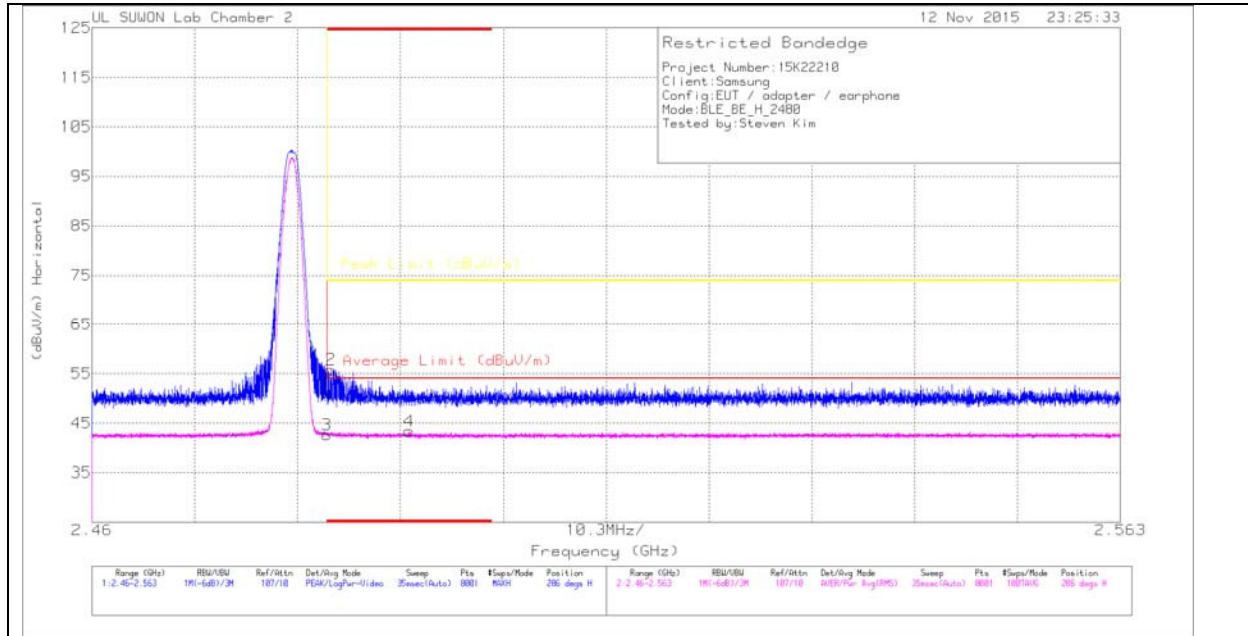
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

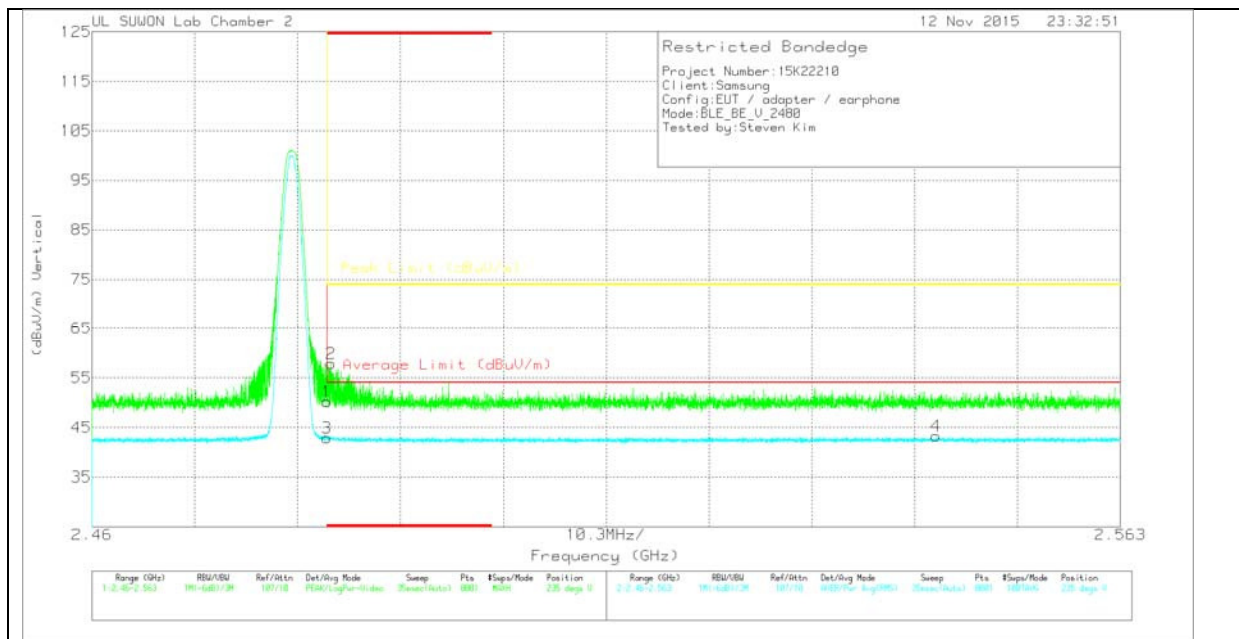
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17)_150619	Path_2_10dB	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.76	Pk	31.8	-19.4	0	51.16	-	-	74	-22.84	286	277	H
2	* 2.484	43.43	Pk	31.8	-19.4	0	55.83	-	-	74	-18.17	286	277	H
3	* 2.484	28.18	RMS	31.8	-19.4	2.06	42.64	54	-11.36	-	-	286	277	H
4	* 2.492	28.89	RMS	31.8	-19.4	2.06	43.35	54	-10.65	-	-	286	277	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17)_150619	Path_2_10dB	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.85	Pk			0	50.25	-	-	74	-23.75	235	353	V
2	* 2.484	45.5	Pk			0	57.9	-	-	74	-16.1	235	353	V
3	* 2.484	28.45	RMS			2.06	42.91	54	-11.09	-	-	235	353	V
4	2.545	28.61	RMS			2.06	43.27	54	-10.73	-	-	235	353	V

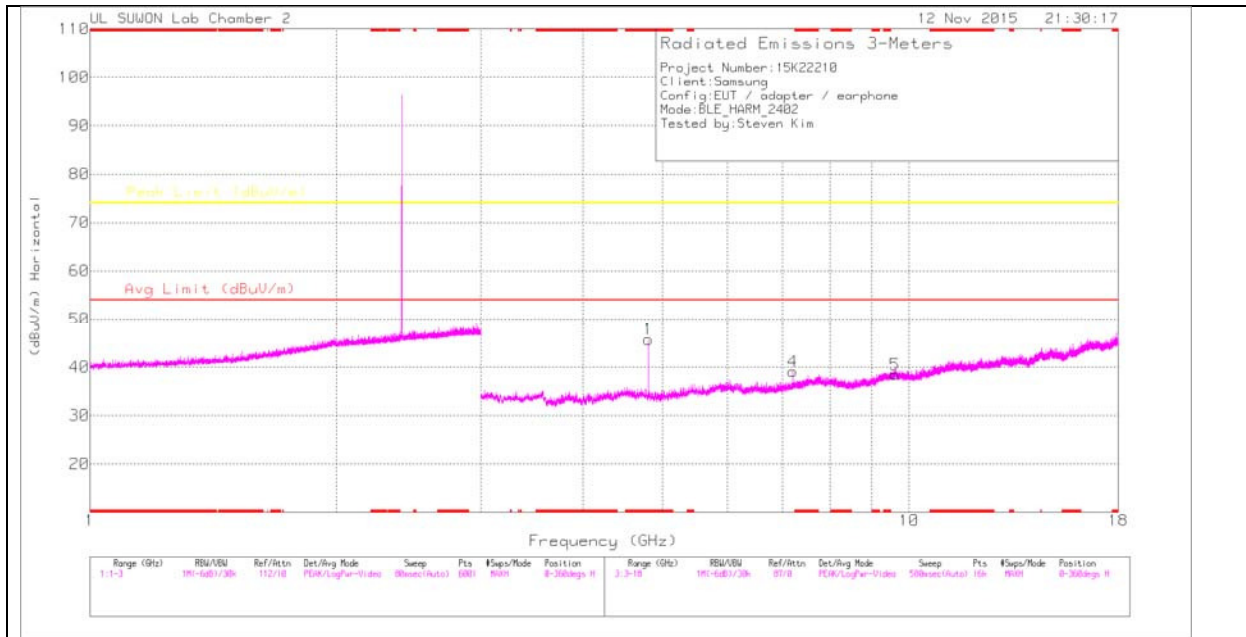
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

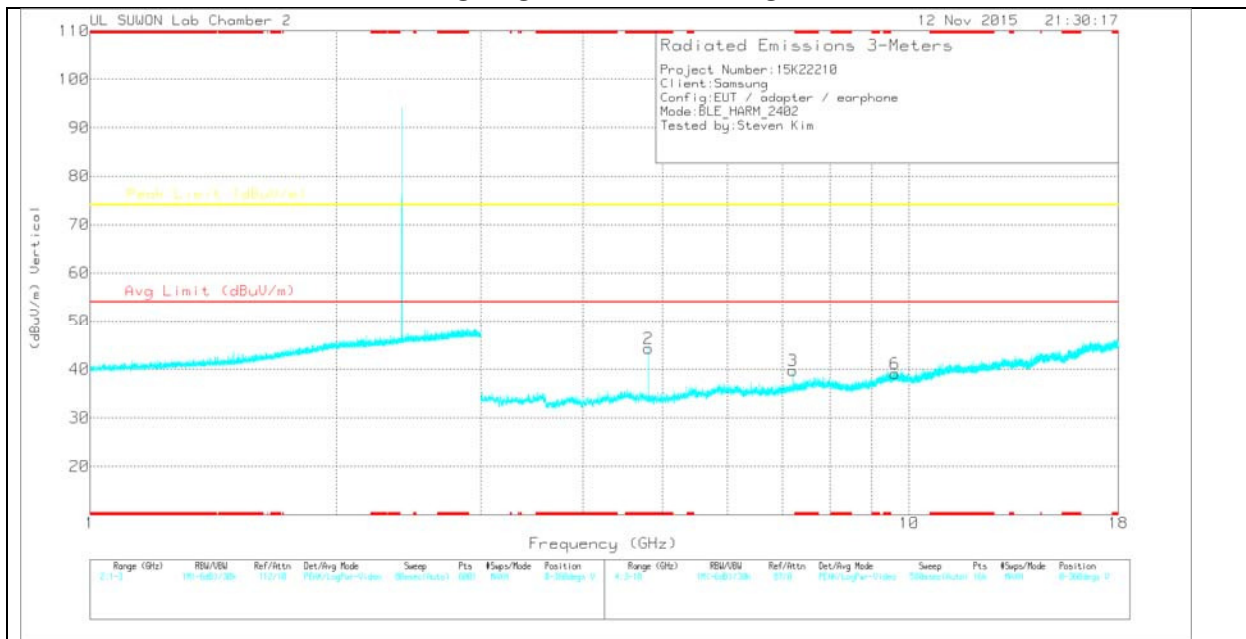
RMS - RMS detection

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(001687 17)_150619	Path_3_3GHP	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	37.14	PK	33.9	-25.3	0	45.74	-	-	74	-28.26	0-360	100	H
4	7.206	26.31	PK	35.8	-23	0	39.11	-	-	74	-34.89	0-360	100	H
5	9.607	20.71	PK	36.9	-19.1	0	38.51	-	-	74	-35.49	0-360	200	H
2	* 4.804	35.64	PK	33.9	-25.3	0	44.24	-	-	74	-29.76	0-360	200	V
3	7.205	26.84	PK	35.8	-22.9	0	39.74	-	-	74	-34.26	0-360	200	V
6	9.604	21.34	PK	36.9	-19.1	0	39.14	-	-	74	-34.86	0-360	200	V

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

PK – Peak Detector

Radiated Emissions

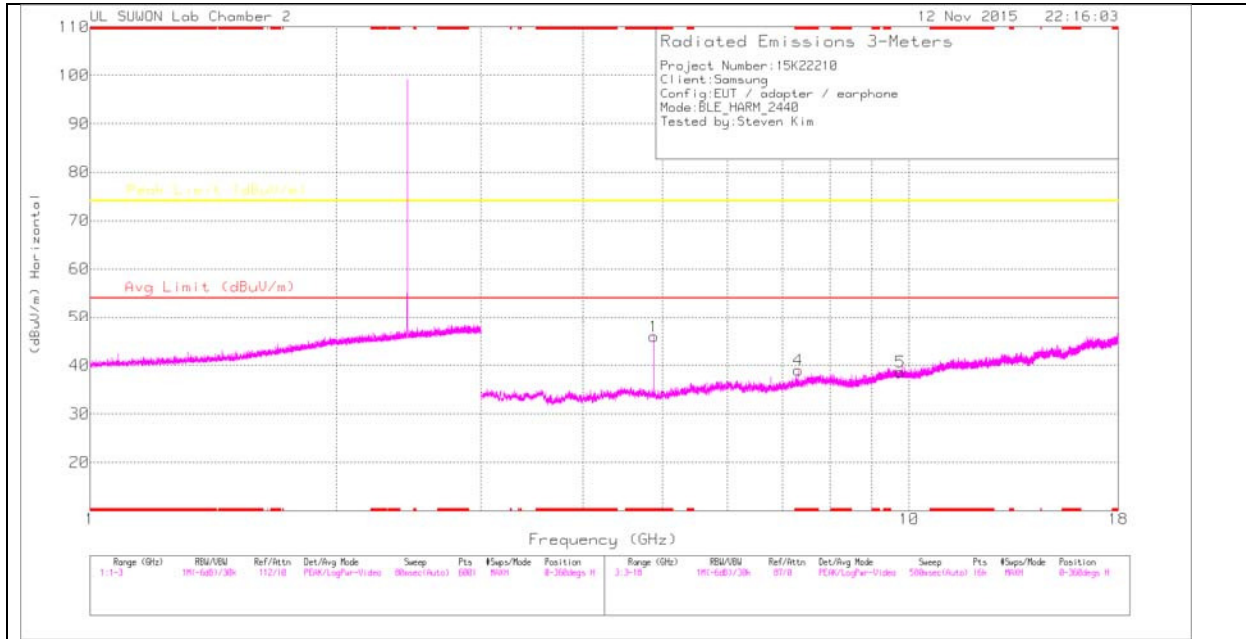
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8724)_150 619	Path_3	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.804	42.92	PK2	33.9	-25.3	0	51.52	-	-	74	-22.48	146	206	H
* 4.804	32.21	MAv1	33.9	-25.3	2.06	42.87	54	-11.13	-	-	146	206	H
* 4.804	44.12	PK2	33.9	-25.3	0	52.72	-	-	74	-21.28	211	260	V
* 4.804	37.92	MAv1	33.9	-25.3	2.06	48.58	54	-5.42	-	-	211	260	V
7.207	36.54	PK2	35.8	-23	0	49.34	-	-	74	-24.66	252	169	V
7.205	24.25	MAv1	35.8	-22.9	2.06	39.21	-	-	-	-	252	169	V
7.205	37.16	PK2	35.8	-22.9	0	50.06	-	-	74	-23.94	347	320	H
7.206	25.41	MAv1	35.8	-22.9	2.06	40.37	-	-	-	-	347	320	H

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

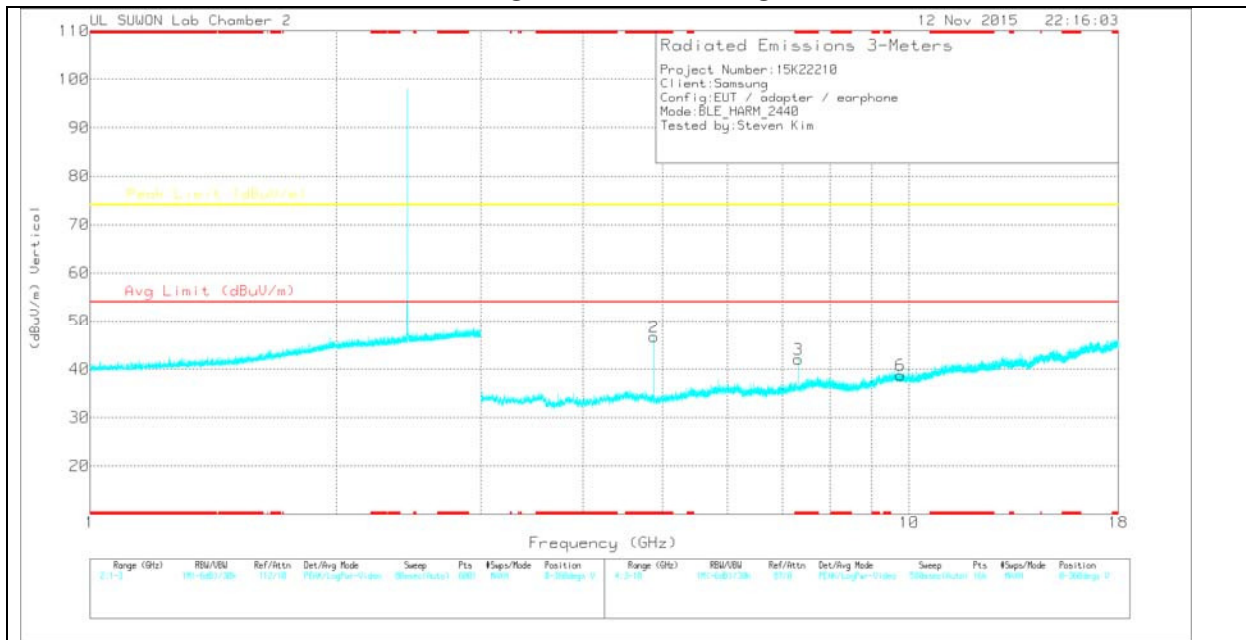
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



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

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17)_150619	Path_3_3GHP	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88	37.27	PK	33.9	-25.2	0	45.97	-	-	74	-28.03	0-360	200	H
4	* 7.319	25.71	PK	35.9	-22.6	0	39.01	-	-	74	-34.99	0-360	200	H
5	9.759	20.85	PK	37	-19.3	0	38.55	-	-	74	-35.45	0-360	200	H
2	* 4.881	38	PK	33.9	-25.2	0	46.7	-	-	74	-27.3	0-360	200	V
3	* 7.321	28.61	PK	35.9	-22.5	0	42.01	-	-	74	-31.99	0-360	200	V
6	9.757	21	PK	37	-19.3	0	38.7	-	-	74	-35.3	0-360	100	V

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

PK – Peak Detector

Radiated Emissions

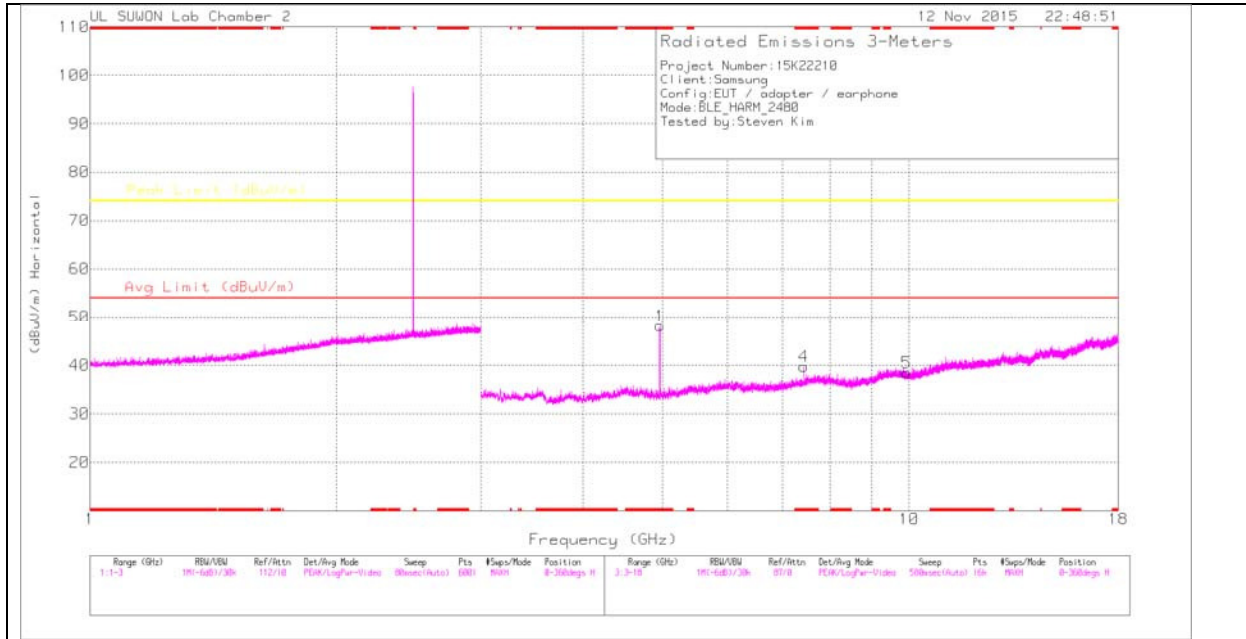
Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8724)_150 619	Path_3	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88	43.31	PK2	33.9	-25.2	0	52.01	-	-	74	-21.99	153	202	H
* 4.88	36.05	MAv1	33.9	-25.2	2.06	46.81	54	-7.19	-	-	153	202	H
* 4.881	45.6	PK2	33.9	-25.2	0	54.3	-	-	74	-19.7	211	287	V
* 4.88	38.4	MAv1	33.9	-25.2	2.06	49.16	54	-4.84	-	-	211	287	V
* 7.319	36.03	PK2	35.9	-22.5	0	49.43	-	-	74	-24.57	260	147	V
* 7.32	22.85	MAv1	35.9	-22.5	2.06	38.31	54	-15.69	-	-	260	147	V
* 7.319	36.07	PK2	35.9	-22.6	0	49.37	-	-	74	-24.63	353	363	H
* 7.32	25.51	MAv1	35.9	-22.5	2.06	40.97	54	-13.03	-	-	353	363	H

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

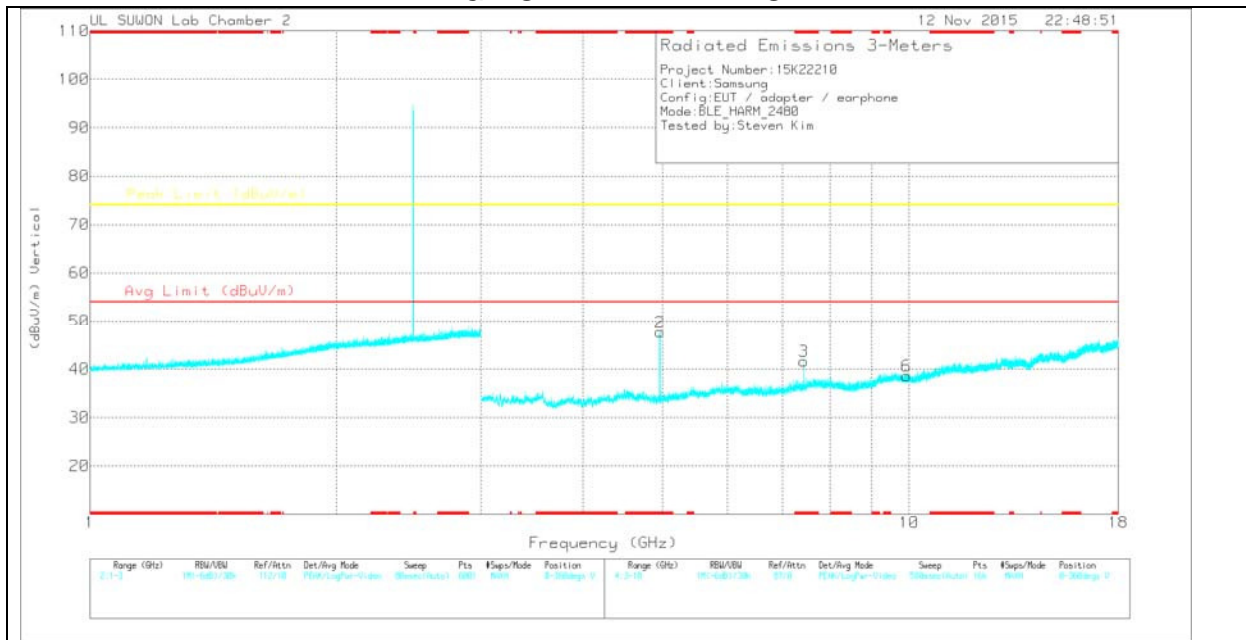
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

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(001687 17)_150619	Path_3_3GHP	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96	39.29	PK	33.9	-25	0	48.19	-	-	74	-25.81	0-360	200	H
4	* 7.439	25.87	PK	36	-22.1	0	39.77	-	-	74	-34.23	0-360	200	H
5	9.922	20.24	PK	37.2	-19	0	38.44	-	-	74	-35.56	0-360	200	H
2	* 4.96	38.81	PK	33.9	-25	0	47.71	-	-	74	-26.29	0-360	200	V
3	* 7.439	27.77	PK	36	-22.1	0	41.67	-	-	74	-32.33	0-360	200	V
6	9.924	20.36	PK	37.2	-19	0	38.56	-	-	74	-35.44	0-360	200	V

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

PK – Peak Detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8724)_150 619	Path_3	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	43.84	PK2	33.9	-25	0	52.74	-	-	74	-21.26	153	275	H
* 4.96	37	MAv1	33.9	-25	2.06	47.96	54	-6.04	-	-	153	275	H
* 4.96	44.87	PK2	33.9	-25	0	53.77	-	-	74	-20.23	215	250	V
* 4.96	38.19	MAv1	33.9	-25	2.06	49.15	54	-4.85	-	-	215	250	V
* 7.441	36.6	PK2	36	-22.1	0	50.5	-	-	74	-23.5	195	171	V
* 7.44	24.61	MAv1	36	-22.1	2.06	40.57	54	-13.43	-	-	195	171	V
* 7.439	36.51	PK2	36	-22.1	0	50.41	-	-	74	-23.59	339	242	H
* 7.439	27.17	MAv1	36	-22.1	2.06	43.13	54	-10.87	-	-	339	242	H

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

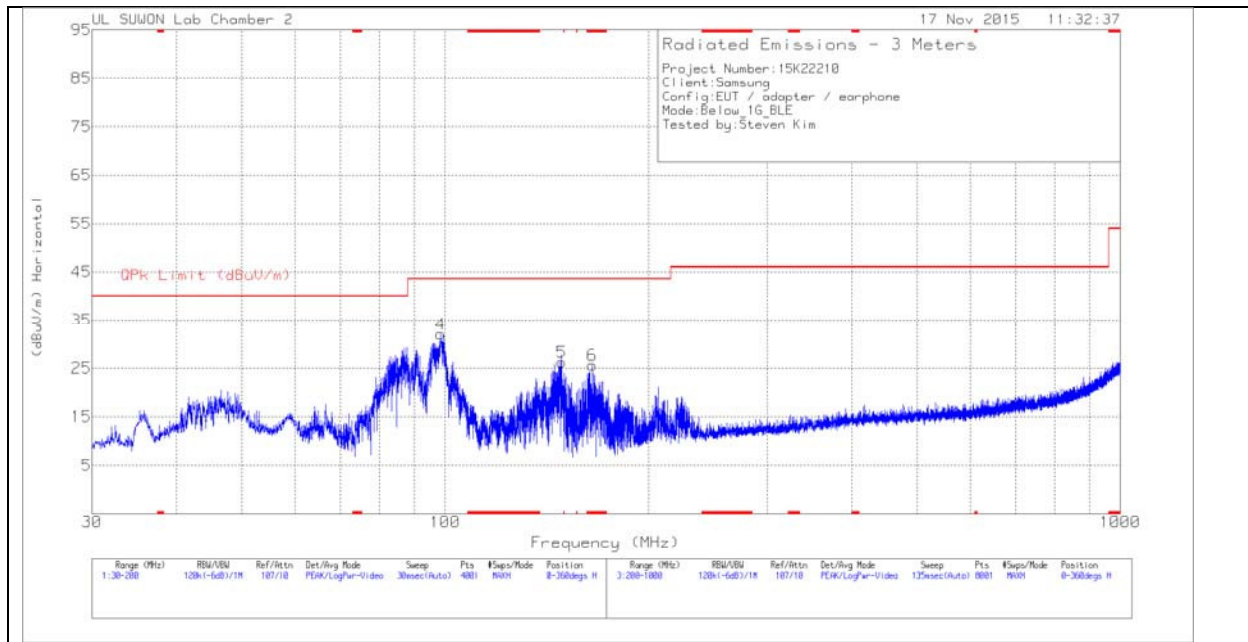
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

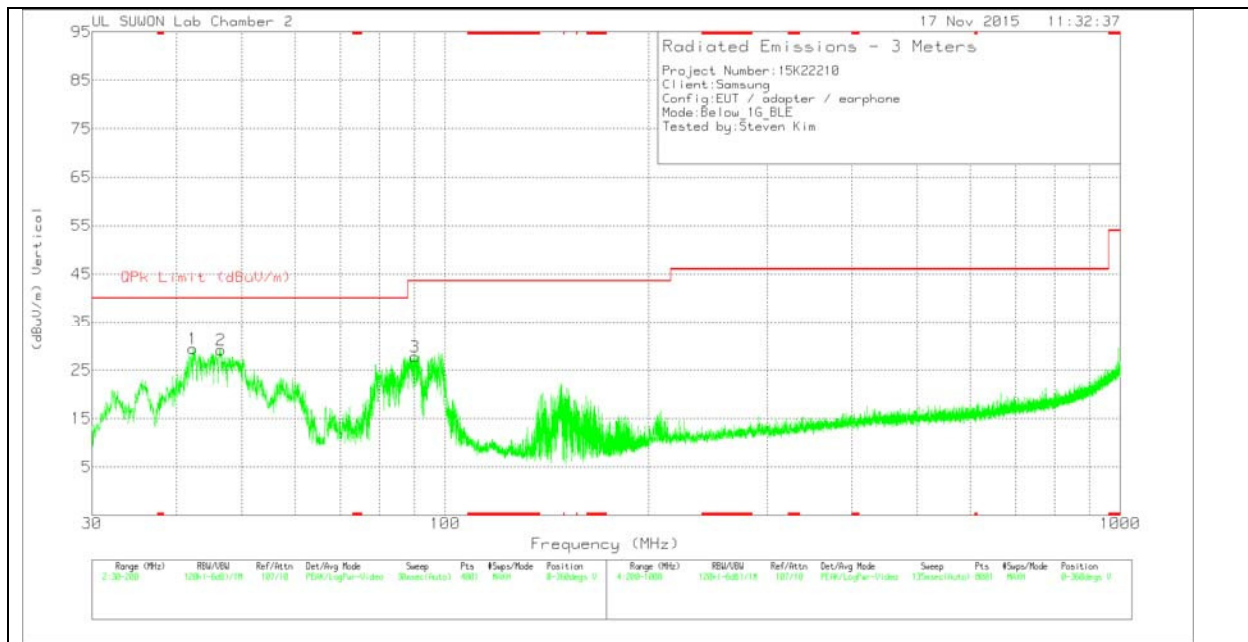
11.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	Below_1G	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	98.5525	51.25	Pk	11.3	-30.5	32.05	43.52	-11.47	0-360	300	H	4
5	149	48.42	Pk	8.2	-30.4	26.22	43.52	-17.3	0-360	300	H	5
6	* 165.235	47.18	Pk	8.8	-30.4	25.58	43.52	-17.94	0-360	200	H	6
1	42.325	46.85	Pk	13.3	-30.7	29.45	40	-10.55	0-360	100	V	1
2	46.6175	45.9	Pk	14	-30.8	29.1	40	-10.9	0-360	100	V	2
3	90.2225	48.72	Pk	9.6	-30.6	27.72	43.52	-15.8	0-360	100	V	3

Pk - Peak detector

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

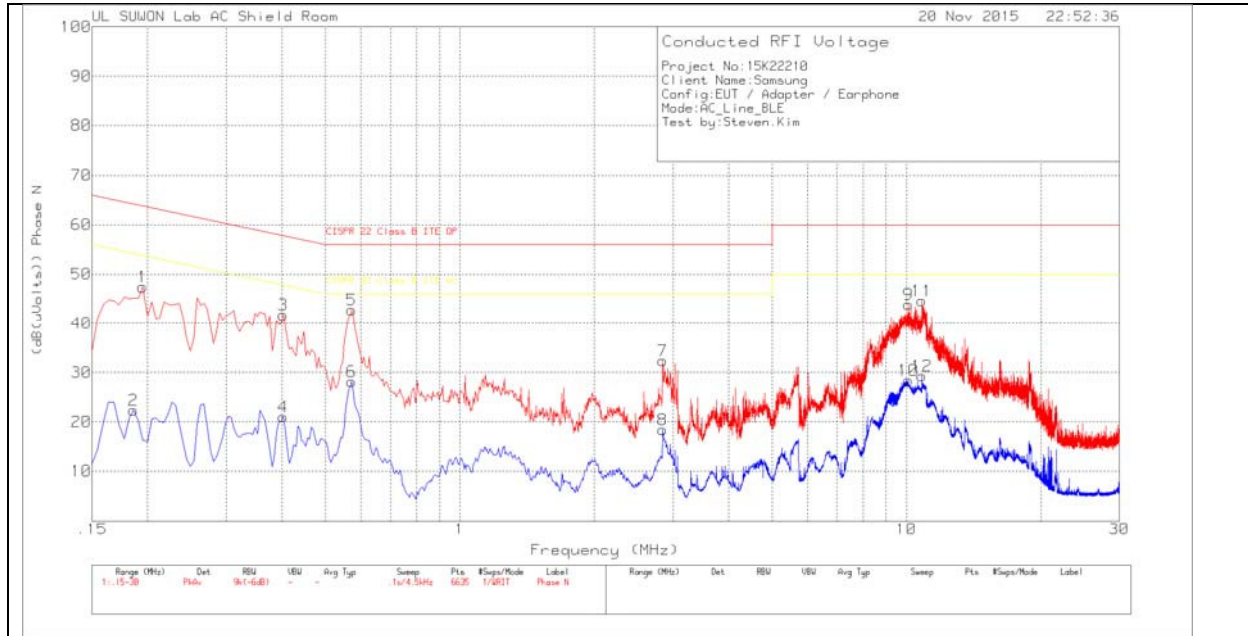
TEST PROCEDURE

ANSI C63.10 - 2009

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

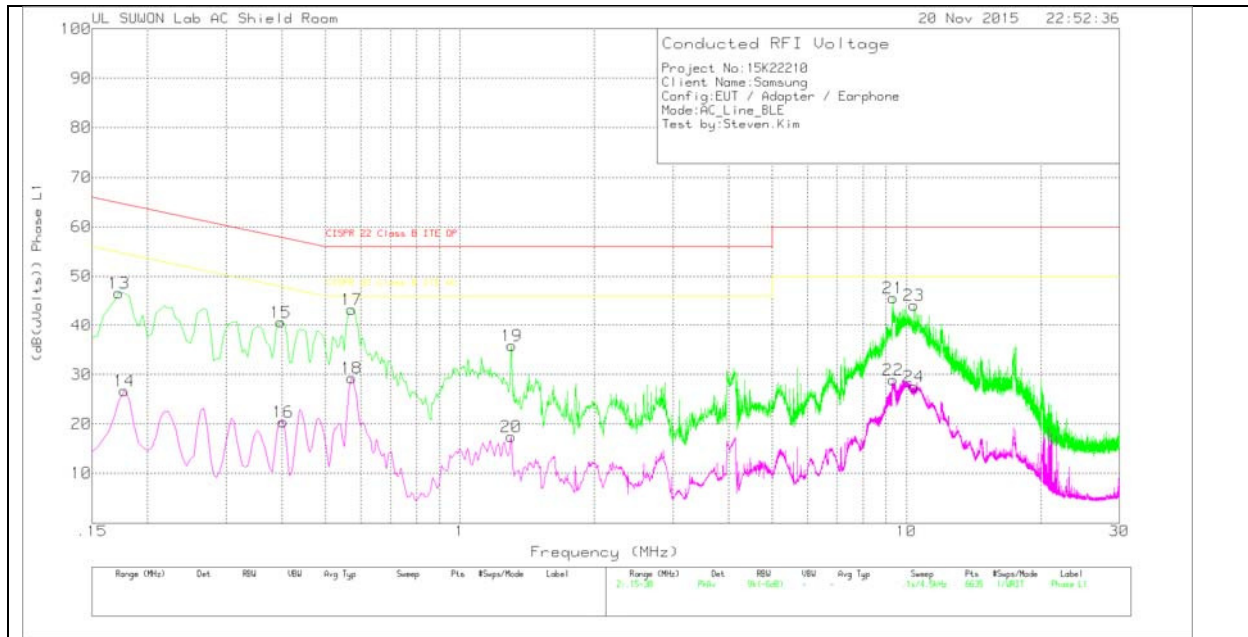
Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.195	37.51	Pk	9.9	0	47.41	63.82	-16.41	-	-
2	.186	12.38	Av	10	0	22.38	-	-	54.21	-31.83
3	.402	31.72	Pk	10	0	41.72	57.81	-16.09	-	-
4	.402	11	Av	10	0	21	-	-	47.81	-26.81
5	.573	32.62	Pk	10.1	0	42.72	56	-13.28	-	-
6	.573	18.11	Av	10.1	0	28.21	-	-	46	-17.79
7	2.85	22.48	Pk	9.8	.1	32.38	56	-23.62	-	-
8	2.85	8.49	Av	9.8	.1	18.39	-	-	46	-27.61
9	10.113	34.01	Pk	9.7	.2	43.91	60	-16.09	-	-
10	10.113	18.51	Av	9.7	.2	28.41	-	-	50	-21.59
11	10.842	34.67	Pk	9.7	.2	44.57	60	-15.43	-	-
12	10.842	19.38	Av	9.7	.2	29.28	-	-	50	-20.72

Pk - Peak detector

Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_L	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.1725	36.85	Pk	9.8	0	46.65	64.84	-18.19	-	-
14	.177	16.94	Av	9.8	0	26.74	-	-	54.63	-27.89
15	.3975	30.81	Pk	9.9	0	40.71	57.91	-17.2	-	-
16	.402	10.53	Av	9.9	0	20.43	-	-	47.81	-27.38
17	.573	33.29	Pk	10	0	43.29	56	-12.71	-	-
18	.573	19.34	Av	10	0	29.34	-	-	46	-16.66
19	1.3065	26.23	Pk	9.5	.1	35.83	56	-20.17	-	-
20	1.302	7.83	Av	9.5	.1	17.43	-	-	46	-28.57
21	9.3525	36.15	Pk	9.3	.2	45.65	60	-14.35	-	-
22	9.33	19.46	Av	9.3	.2	28.96	-	-	50	-21.04
23	10.3965	34.66	Pk	9.3	.2	44.16	60	-15.84	-	-
24	10.401	18	Av	9.3	.2	27.5	-	-	50	-22.5

Pk - Peak detector

Av - Average detection