FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

ARTIK-0530

MODEL NUMBER : SIP005AFS30

FCC ID: A3LSIP005AFS30
IC ID : 649E-SIP005AFS30

REPORT NUMBER: 16K23791-E2V3

ISSUE DATE: OCT 12, 2016

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
1, SAMSUNG-RO, GIHEUNG-GU, YONGIN-SI,
GYEONGGI-DO, 17113, KOREA

Prepared by
UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/29/16	Initial issue	Junwhan Lee
V2	10/06/16	Revised section 11.1	Junwhan Lee
V3	10/12/16	Added AC conducted emission data, Sample serial number changed	Junwhan Lee

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS……5

2. TEST METHODOLOGY 6

3. FACILITIES AND ACCREDITATION 6

4. CALIBRATION AND UNCERTAINTY 6

4.1. MEASURING INSTRUMENT CALIBRATION 6

4.2. SAMPLE CALCULATION 6

4.3. MEASUREMENT UNCERTAINTY 6

5. EQUIPMENT UNDER TEST 7

5.1. DESCRIPTION OF EUT 7

5.2. MAXIMUM OUTPUT POWER 7

5.3. DESCRIPTION OF AVAILABLE ANTENNAS 7

5.4. WORST-CASE CONFIGURATION AND MODE 7

5.5. DESCRIPTION OF TEST SETUP 8

6. TEST AND MEASUREMENT EQUIPMENT 10

7. MEASUREMENT METHODS 11

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS 11

8.1. ON TIME AND DUTY CYCLE RESULTS 11

9. SUMMARY TABLE 12

10. ANTENNA PORT TEST RESULTS 13

10.1. 6 dB BANDWIDTH 13

10.2. 99% BANDWIDTH 15

10.3. OUTPUT POWER 17

10.4. AVERAGE POWER 19

10.5. PSD 20

10.6. CONDUCTED SPURIOUS EMISSIONS 22

11. RADIATED TEST RESULTS 26

11.1. LIMITS AND PROCEDURE 26

11.2. TRANSMITTER ABOVE 1 GHz 28

11.3. WORST-CASE BELOW 1 GHz 38

12. AC POWER LINE CONDUCTED EMISSIONS 40

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

13. SETUP PHOTOS 43

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: ARTIK-0530

MODEL NUMBER: SIP005AFS30

SERIAL NUMBER: 530MWB8R00300018 (RADIATED, CONDUCTED)

DATE TESTED: SEP 06, 2016 - OCT 12, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-GEN Issue 4	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.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 558074 D01 v03r05, ANSI C63.10-2013 for FCC and ANSI C63.10-2013, RSS-GEN Issue 4, RSS-247 Issue 1 for IC.

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%.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a ARTIK-0530.
This test report addresses the DTS (BLE) operational mode.

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	6.025	4.00
		Average	5.825	3.82

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an dipole antenna, with a maximum gain of 1.43 dBi

5.4. WORST-CASE CONFIGURATION AND MODE

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

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

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

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

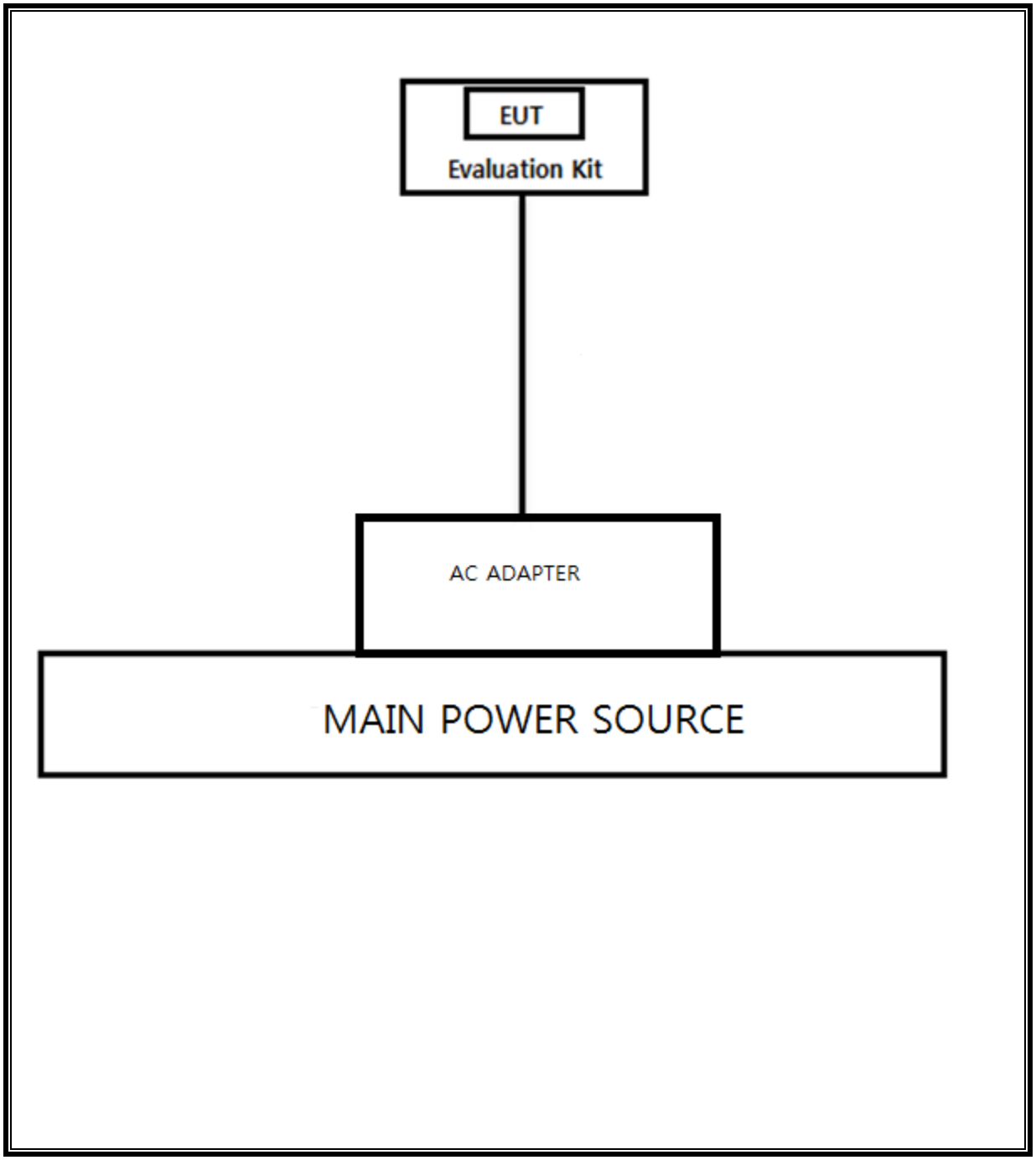
Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Evaluation Kit	SAMSUNG	SIPKITNXD00	N/A	N/A
ADAPTER	Shenzhen Fujia Appliance CO,. LTD	FJ-SW0505000T	N/A	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software exercised the EUT to enable BLE mode.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

SETUP DIAGRAM FOR TESTS



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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	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	08-17-17
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
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
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-16-17

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

7. MEASUREMENT METHODS

KDB 558074 D01 DTS Meas Guidance v03r05: 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.

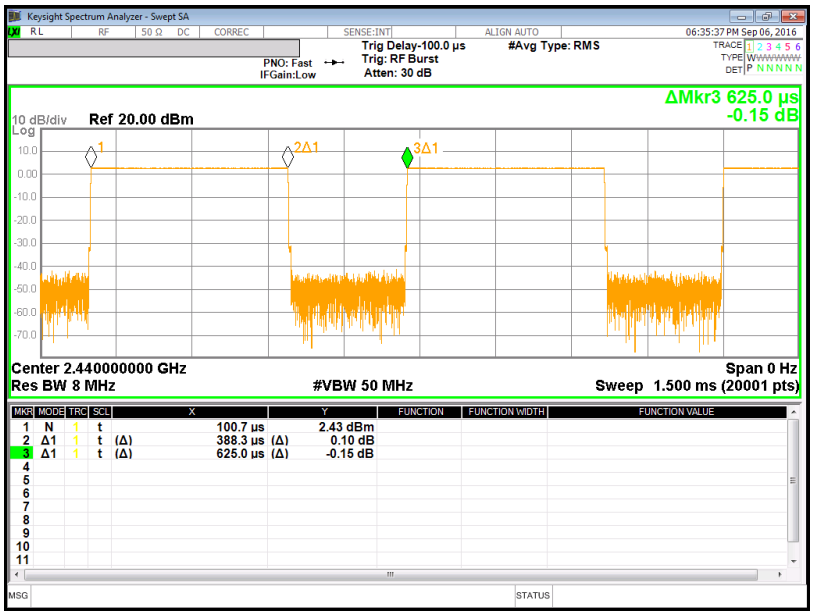
8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

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	0.388	0.625	0.621	62.1%	2.07	2.575



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9. SUMMARY TABLE

FCC Part Section	IC Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	RSS-247 5.2(1)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	633.5 kHz
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-43.382 dBm
15.247	RSS-247 5.4(4)	TX conducted output power	<30dBm		Pass	6.025 dBm (Peak)
15.247	RSS-247 5.2(2)	PSD	<8dBm		Pass	4.98 dBm (Peak)
15.205, 15.209	RSS-GEN Clause 7 & 8.9	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	51.4 dBuV/m (Av)

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)
IC RSS-247 §5.2 (1)

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	641.9	500.0
Mid	2440	643.1	500.0
High	2480	633.5	500.0
Worst		633.5	500.0

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

6 dB BANDWIDTH PLOTS

Low CH			
Middle CH			
High CH			

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

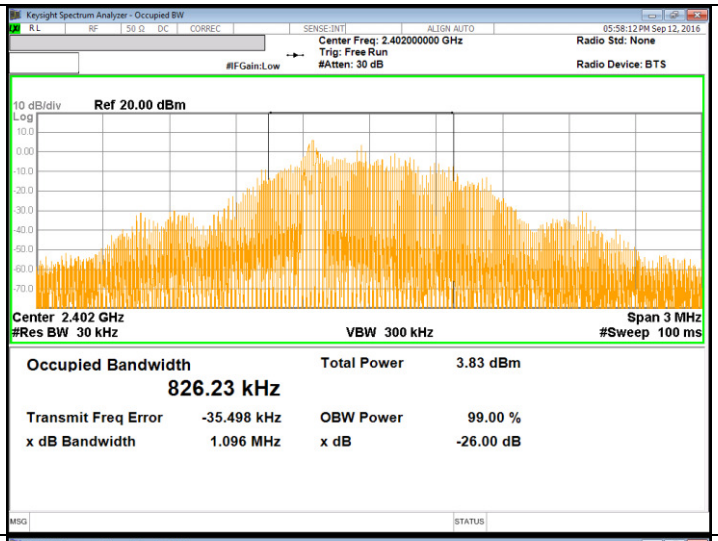
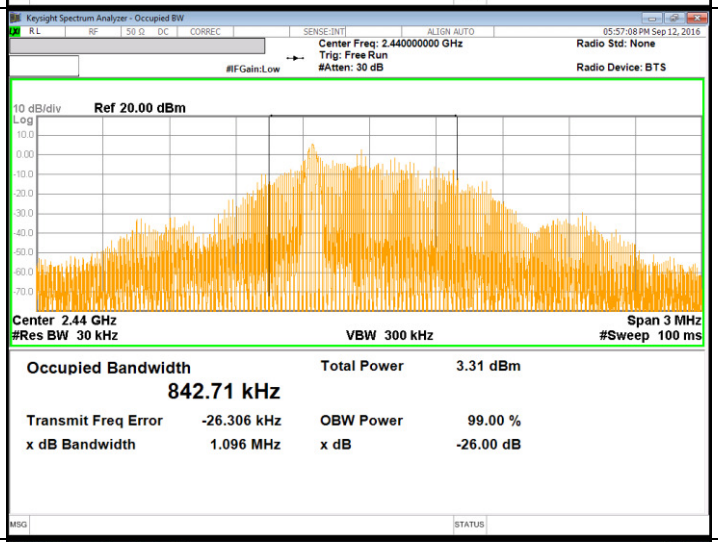
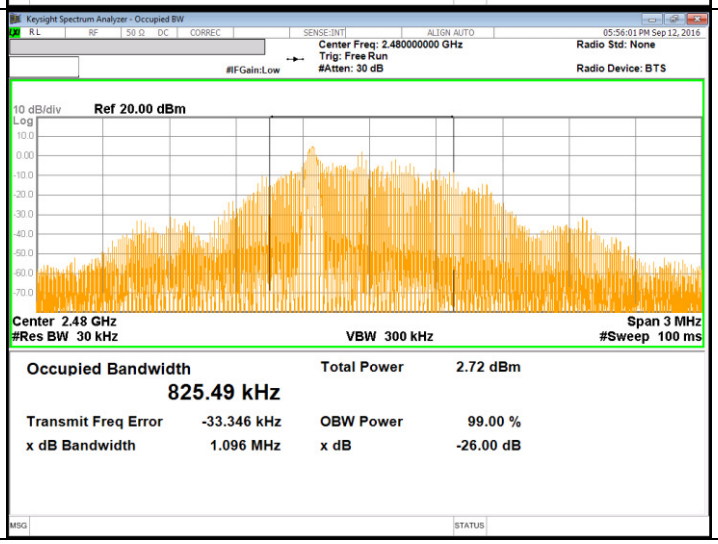
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency [MHz]	99% Bandwidth [KHz]
Low	2402	826.230
Mid	2440	842.710
High	2480	825.490
Worst		842.710

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

99% BANDWIDTH PLOTS

Low CH			
Middle CH			
High CH			

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)
IC RSS-247 §5.4 (4)

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

TEST PROCEDURE

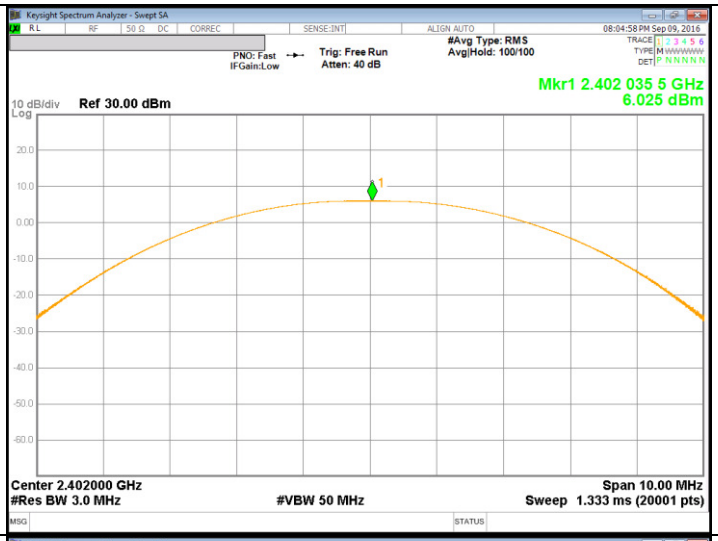
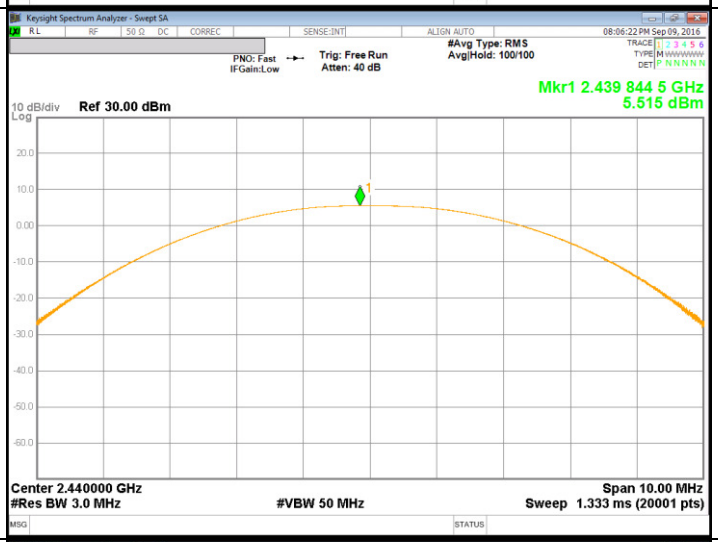
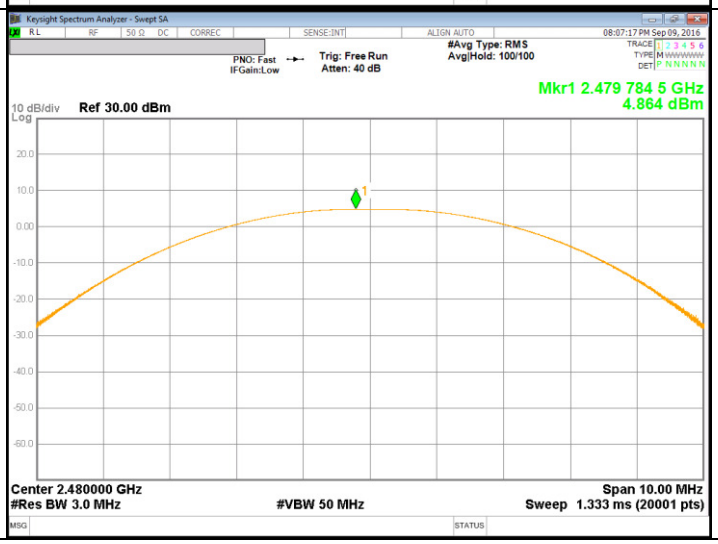
Peak power is measured using KDB558074 D01 DTS Meas Guidance v03r05 under section 9.1.1 utilizing spectrum analyzer.

RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	6.025	30.000	-23.975
Mid	2440	5.515	30.000	-24.485
High	2480	4.864	30.000	-25.136
Worst		6.025		-23.975

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

OUTPUT POWER PLOTS

Low CH			
Middle CH			
High CH			

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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	5.83	3.82
Middle	2440	5.31	3.40
High	2480	4.65	2.92

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.5. PSD

LIMITS

FCC §15.247
IC RSS-247 §5.2 (2)

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

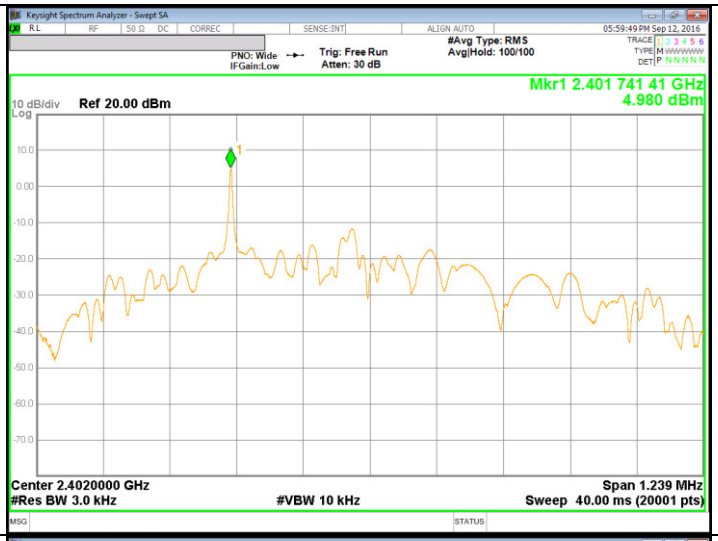
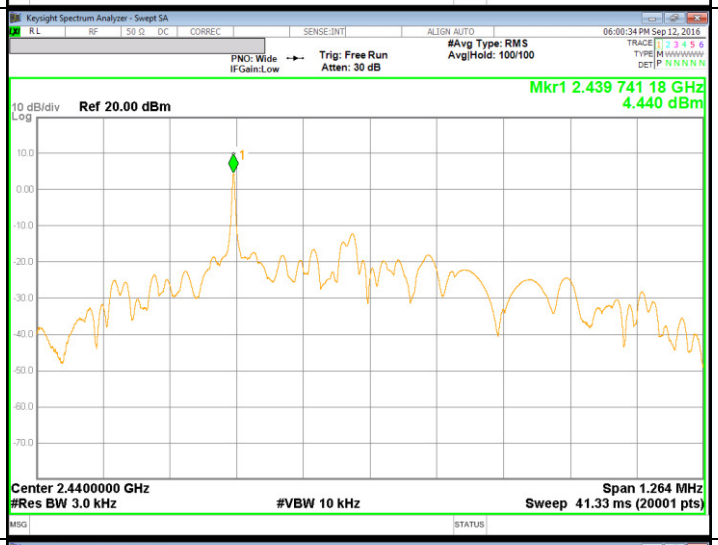
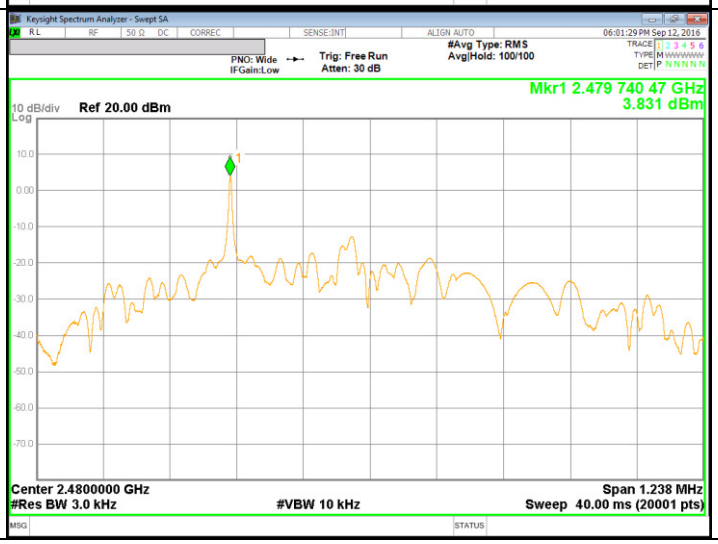
Power Spectral Density was performed utilizing the "Method PKPSD (Peak PSD)" under KDB558074 D01 DTS Meas Guidance v03r05

RESULTS

Channel	Frequency [MHz]	PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2402	4.980	8.00	-3.02
Mid	2440	4.440	8.00	-3.56
High	2480	3.831	8.00	-4.17

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

POWER SPECTRAL DENSITY PLOTS

Low CH			
Middle CH			
High CH			

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)
IC RSS-247 §5.5

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.

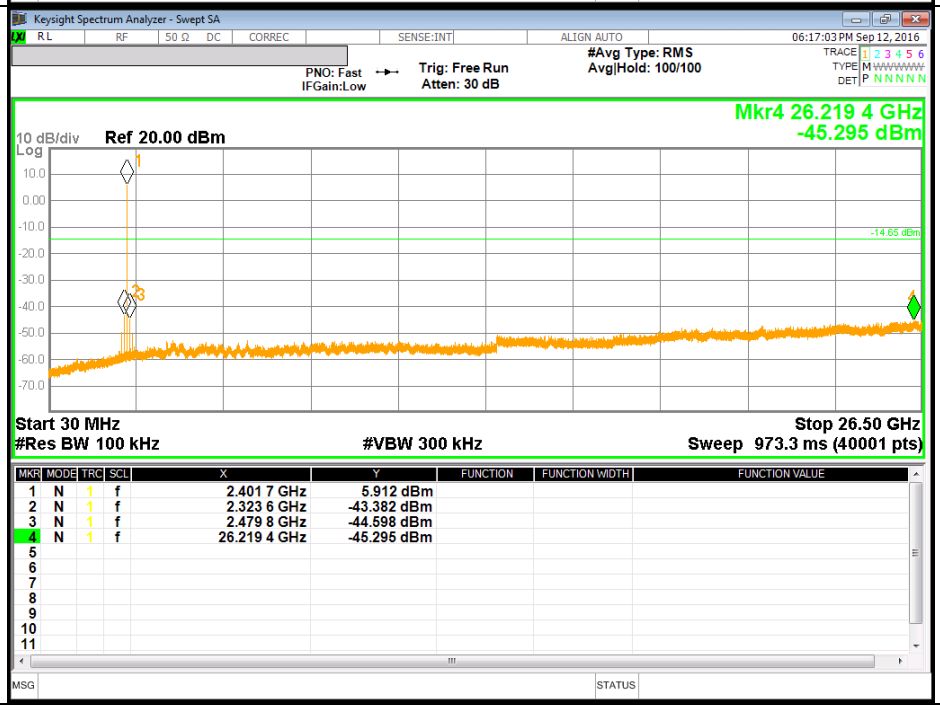
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS

BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL

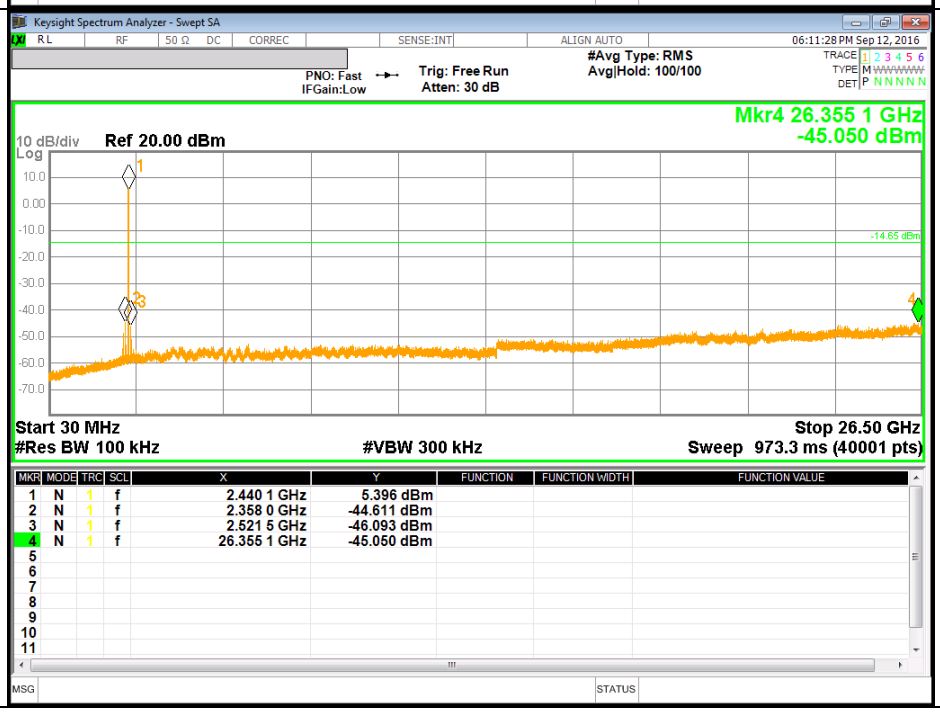
Low CH
BandEdge

Low CH
Spurious



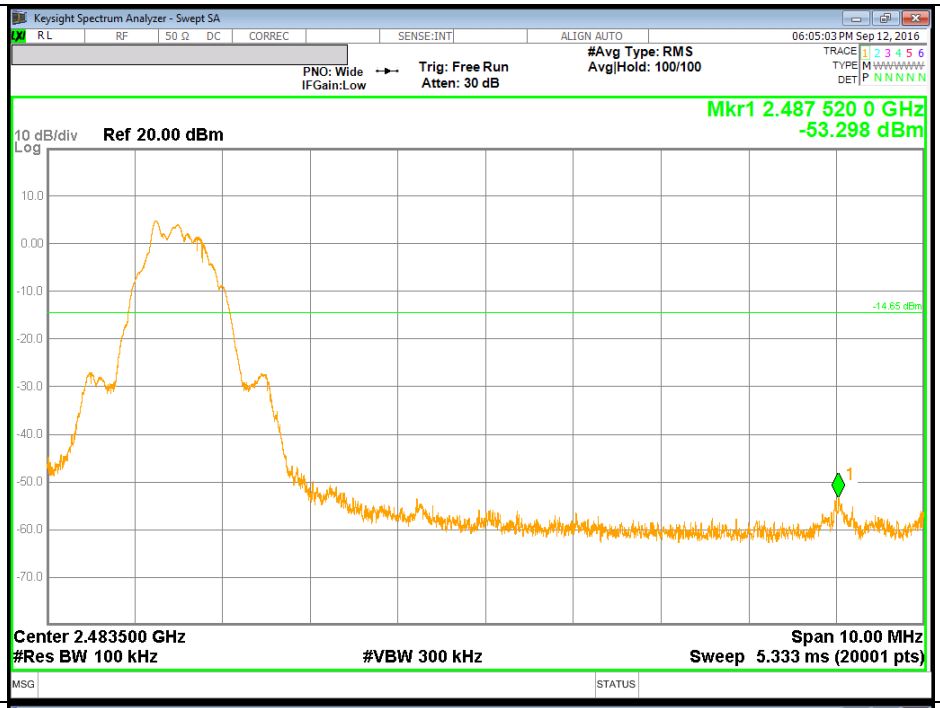
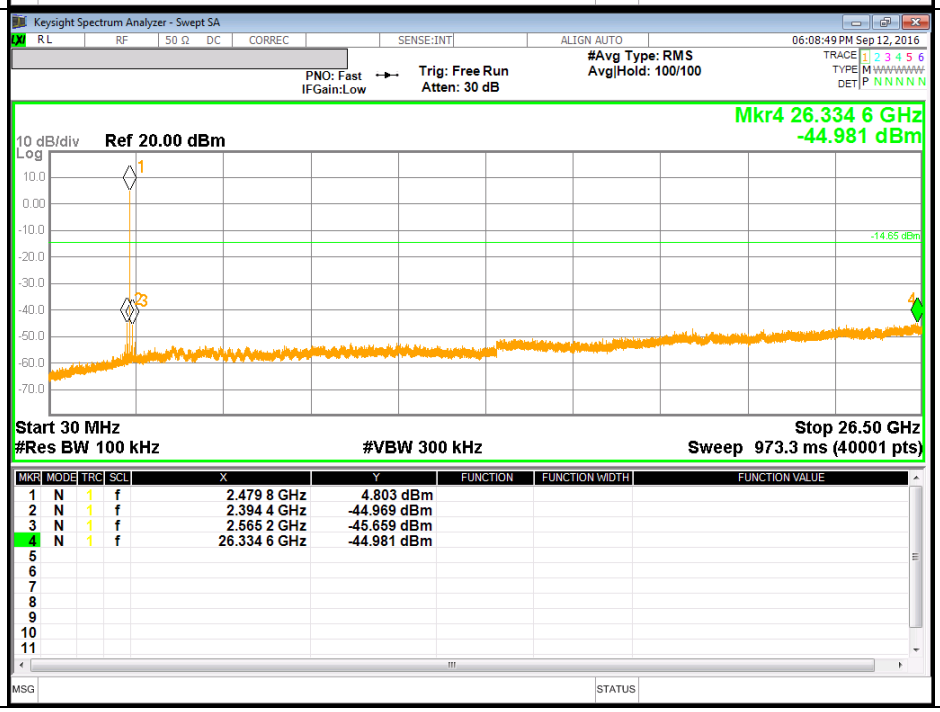
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

SPURIOUS EMISSIONS, MID CHANNEL

Middle CH BandEdge	
Middle CH Spurious	

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

SPURIOUS EMISSIONS, HIGH CHANNEL

High CH BandEdge	
High CH Spurious	

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
IC RSS-GEN Clause 8.9 (Transmitter)
IC RSS-GEN Clause 7 (Receiver)

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.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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 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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. (Restriced bandedge, Final detection of spurious harmonic emissions)Duty cycle factor = 10 log (1/x). For this sample: DCF = 10log(1/0.621)=2.07dB
(Spectrum Analyzer round it up to 2.07dB)

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.

The spectrum from 1 GHz 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.

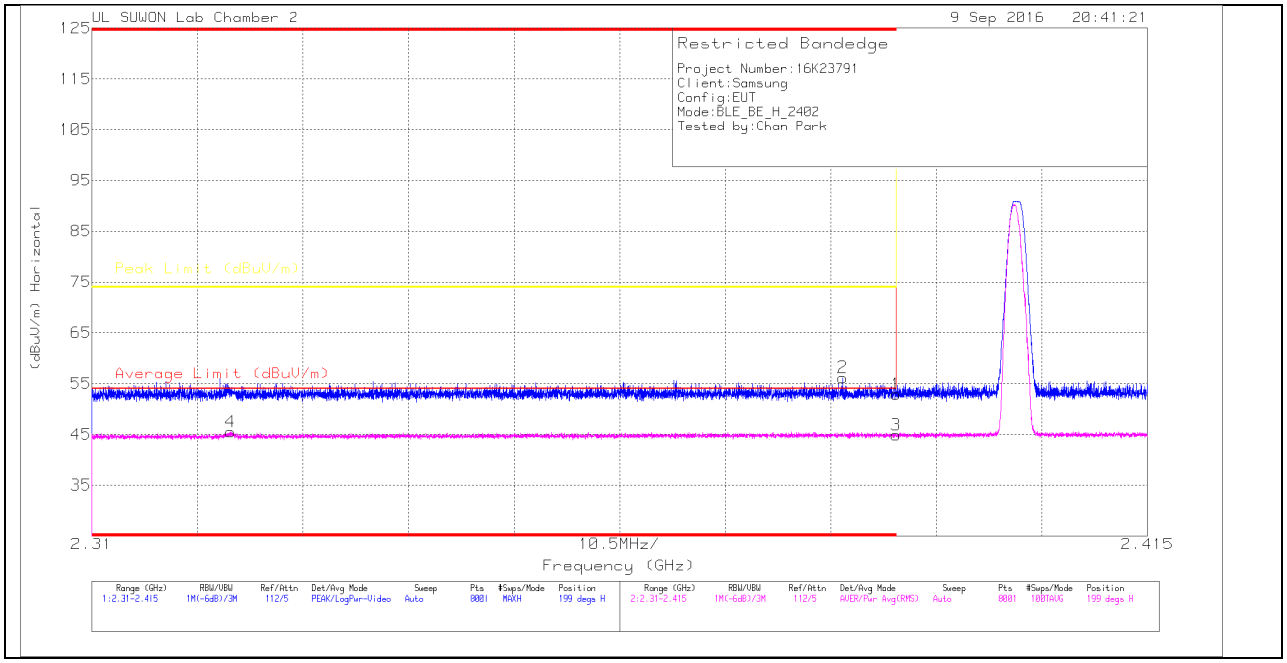
Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

Radiated test of below 30MHz was performed inside anechoic chamber.
For check the correlation with open air site, comparison test was conducted between chamber and open site. The test results indicated that there is a close correlation.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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(00168724)_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	40.75	Pk	31.7	-19.5	0	52.95	-	-	74	-21.05	199	126	H
2	* 2.385	44	Pk	31.7	-19.5	0	56.2	-	-	74	-17.8	199	126	H
3	* 2.39	30.66	RMS	31.7	-19.5	2.07	44.93	54	-9.07	-	-	199	126	H
4	* 2.324	31.56	RMS	31.6	-19.7	2.07	45.53	54	-8.47	-	-	199	126	H

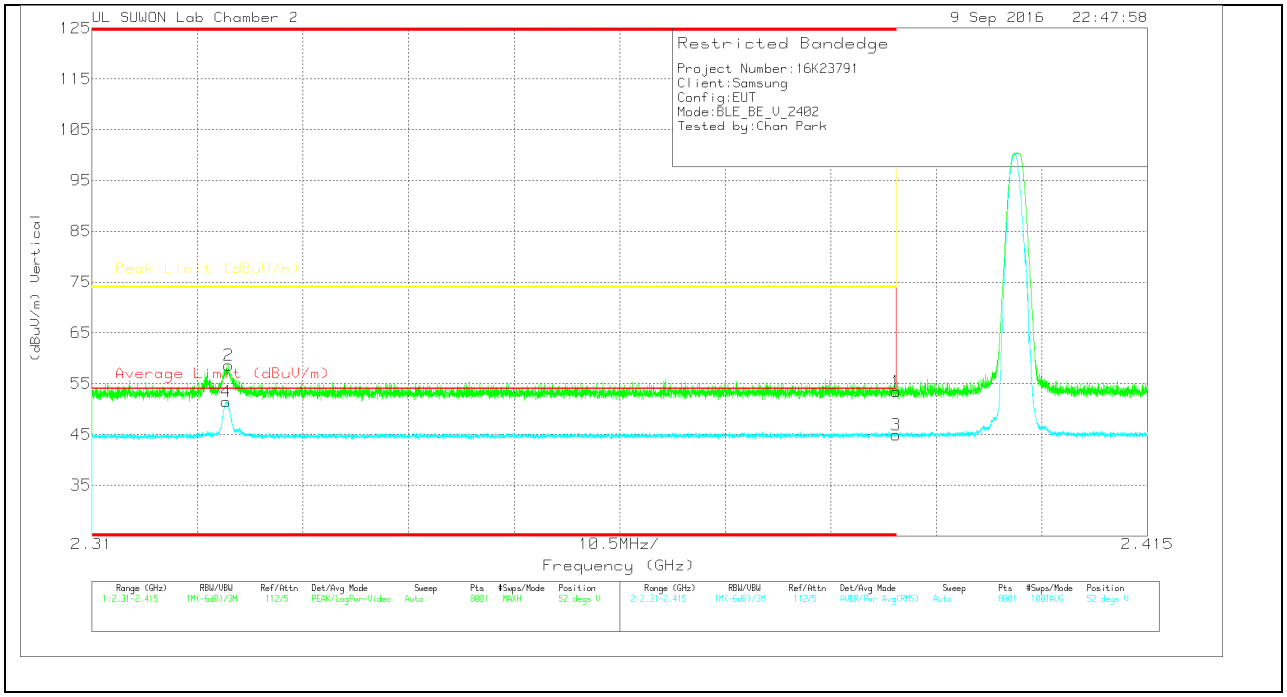
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_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	41.18	Pk	31.7	-19.5	0	53.38	-	-	74	-20.62	52	339	V
2	* 2.324	46.74	Pk	31.6	-19.7	0	58.64	-	-	74	-15.36	52	339	V
3	* 2.39	30.66	RMS	31.7	-19.5	2.07	44.93	54	-9.07	-	-	52	339	V
4	* 2.323	37.43	RMS	31.6	-19.7	2.07	51.4	54	-2.6	-	-	52	339	V

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

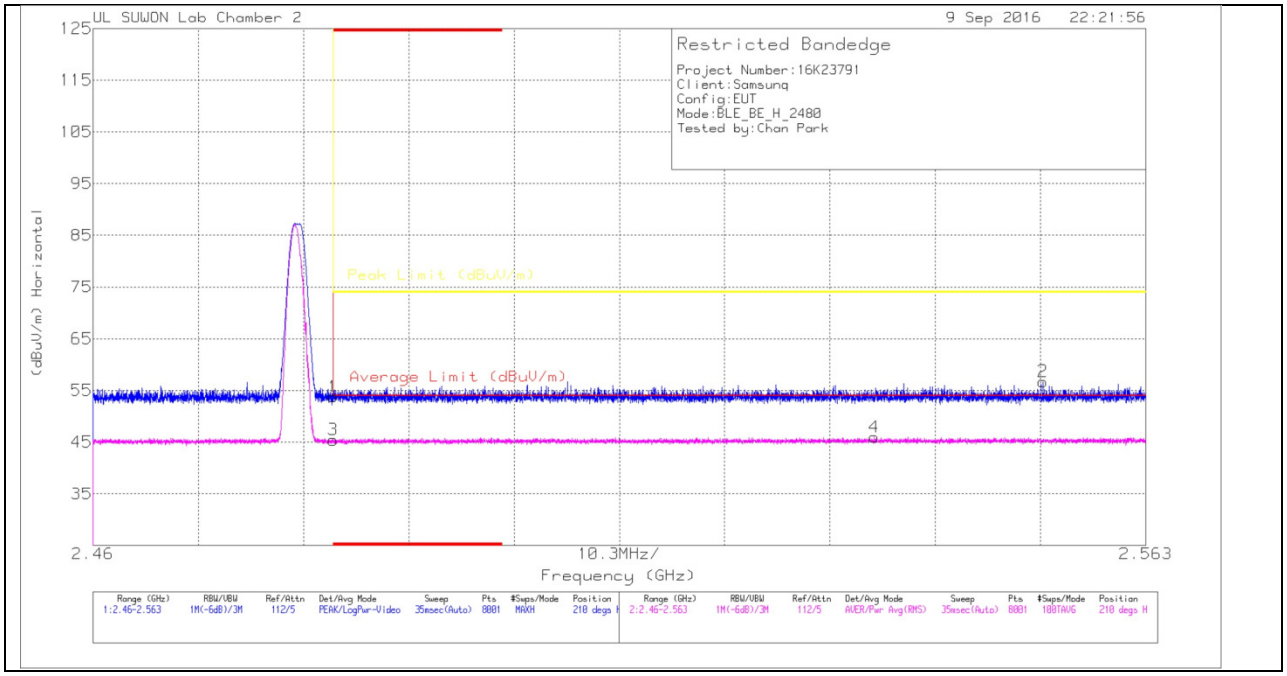
Pk - Peak detector

RMS - RMS detection

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_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	41.36	Pk	31.8	-19.4	0	53.76	-	-	74	-20.24	210	221	H
2	2.553	44.11	Pk	31.9	-19.3	0	56.71	-	-	74	-17.29	210	221	H
3	* 2.484	30.97	RMS	31.8	-19.4	2.07	45.44	54	-8.56	-	-	210	221	H
4	2.536	31.28	RMS	31.9	-19.3	2.07	45.95	54	-8.05	-	-	210	221	H

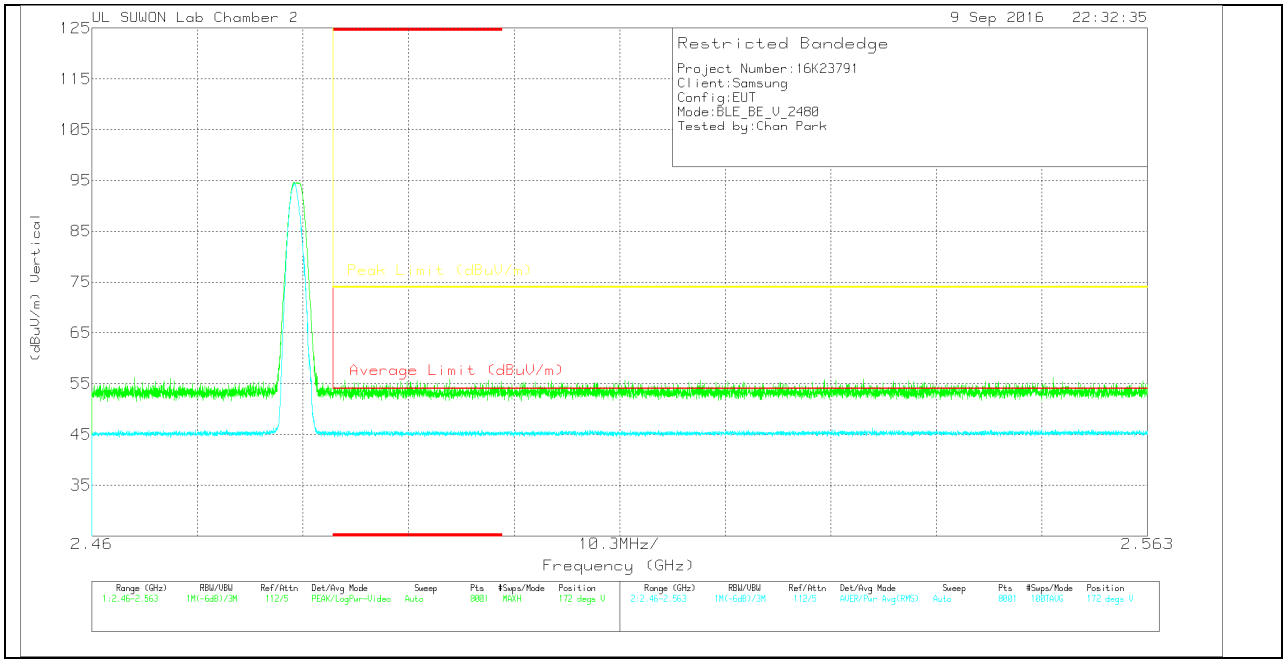
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_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	40.45	Pk	31.8	-19.4	0	52.85	-	-	74	-21.15	172	199	V
2	2.554	43.51	Pk	31.9	-19.3	0	56.11	-	-	74	-17.89	172	199	V
3	* 2.484	31.23	RMS	31.8	-19.4	2.07	45.7	54	-8.3	-	-	172	199	V
4	2.536	31.52	RMS	31.9	-19.3	2.07	46.19	54	-7.81	-	-	172	199	V

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

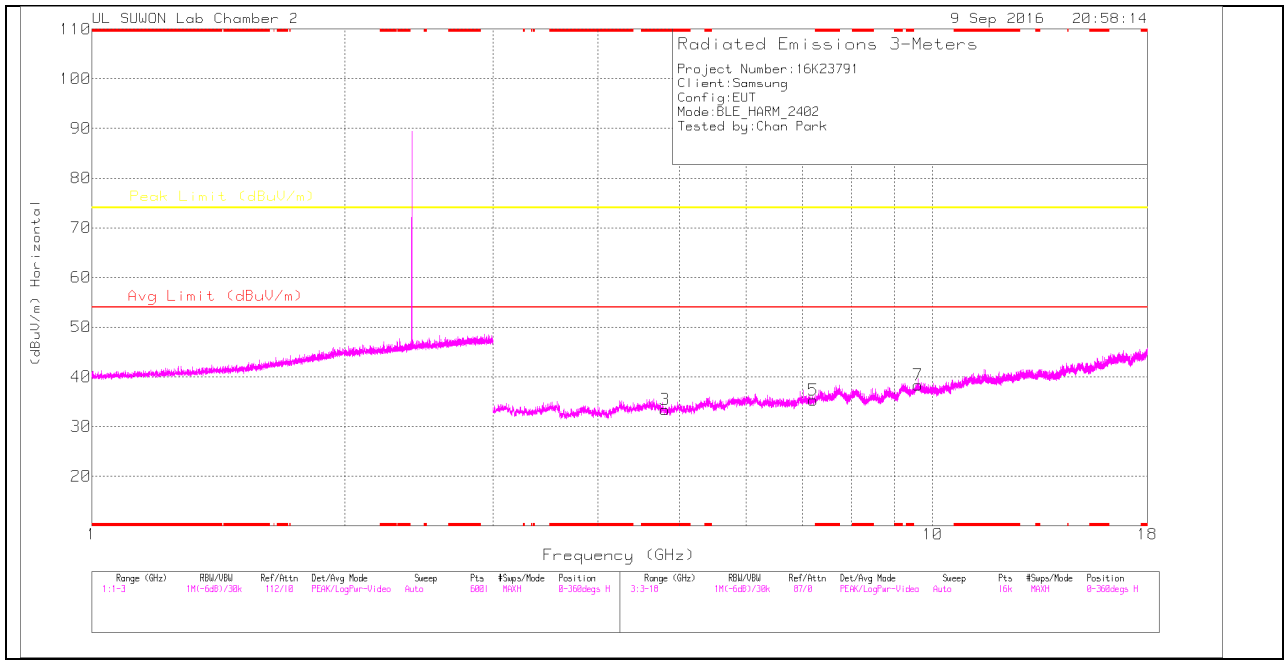
Pk - Peak detector

RMS - RMS detection

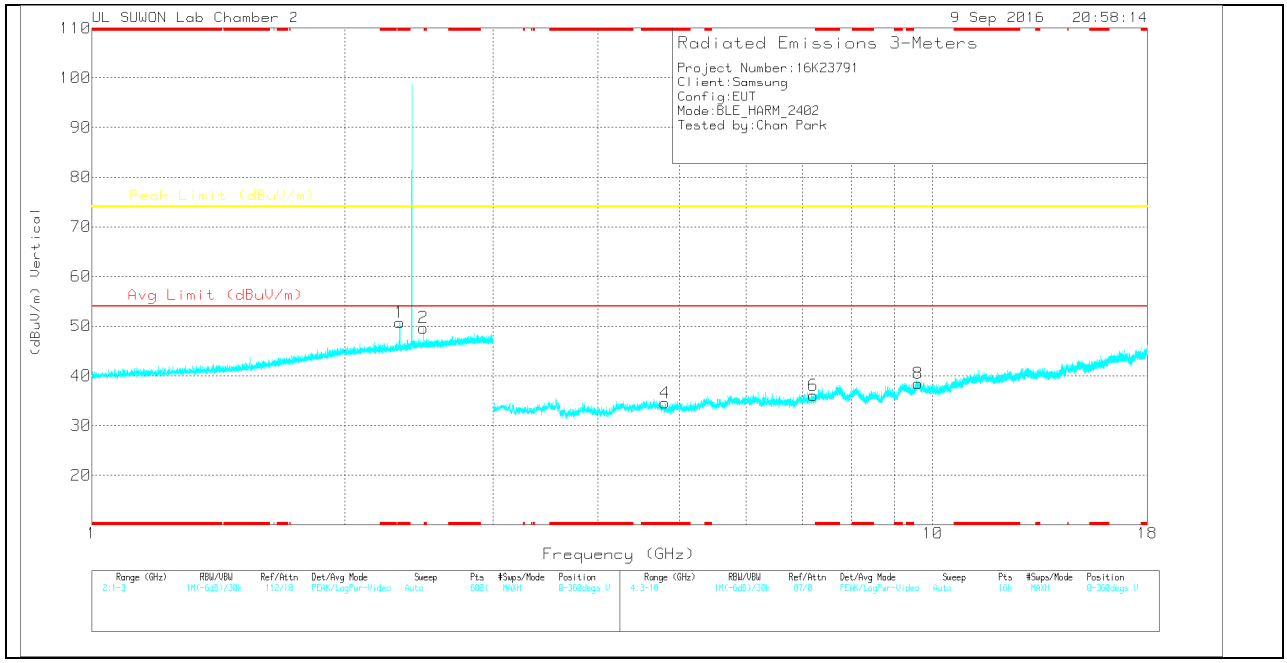
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	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	* 2.324	39.84	PK	31.6	-20.7	0	50.74	-	-	74	-23.26	0-360	250	V
2	2.48	38.26	PK	31.8	-20.4	0	49.66	-	-	74	-24.34	0-360	250	V
3	* 4.802	24.8	PK	33.9	-25.3	0	33.4	-	-	74	-40.6	0-360	250	H
5	7.205	22.37	PK	35.8	-22.9	0	35.27	-	-	74	-38.73	0-360	250	H
7	9.609	20.51	PK	36.9	-19.1	0	38.31	-	-	74	-35.69	0-360	150	H
4	* 4.803	25.99	PK	33.9	-25.3	0	34.59	-	-	74	-39.41	0-360	250	V
6	7.208	23.21	PK	35.8	-23	0	36.01	-	-	74	-37.99	0-360	150	V
8	9.612	20.7	PK	36.9	-19.1	0	38.5	-	-	74	-35.5	0-360	150	V

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

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.324	46.34	PK2	31.6	-20.7	0	57.24	-	-	74	-16.76	38	329	V
* 2.324	39.9	MAv1	31.6	-20.7	0	50.8	54	-3.2	-	-	38	329	V
2.48	43.9	PK2	31.8	-20.4	0	55.3	-	-	74	-18.7	155	259	V

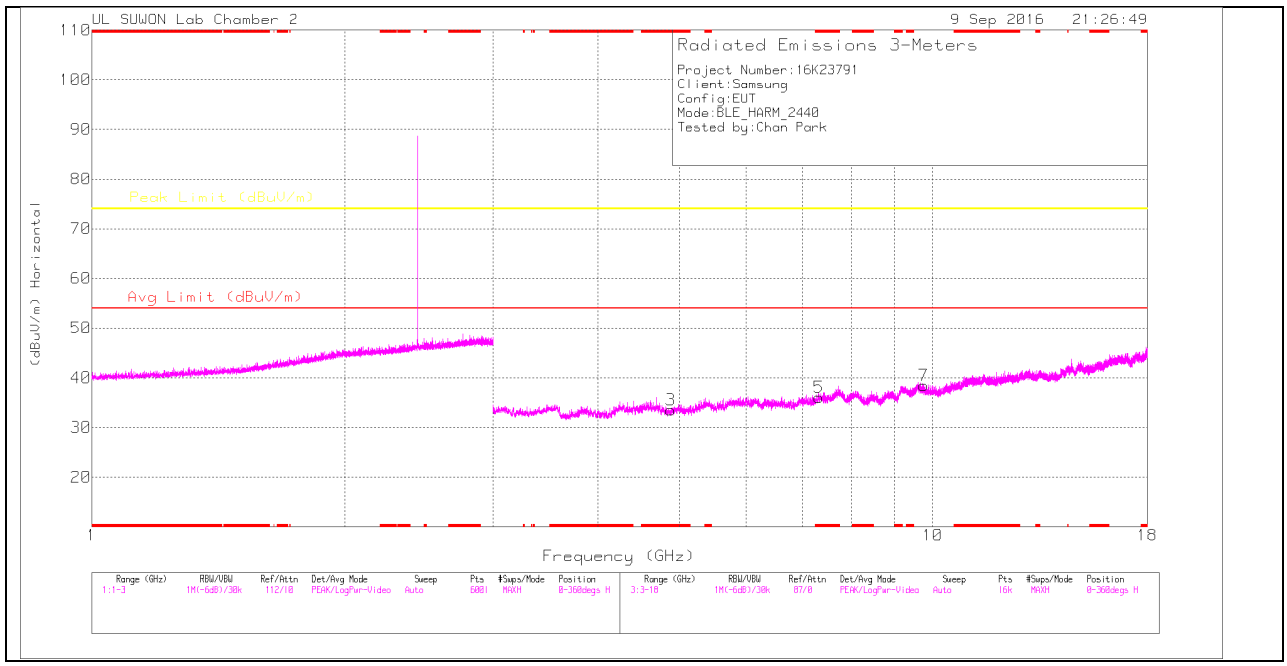
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

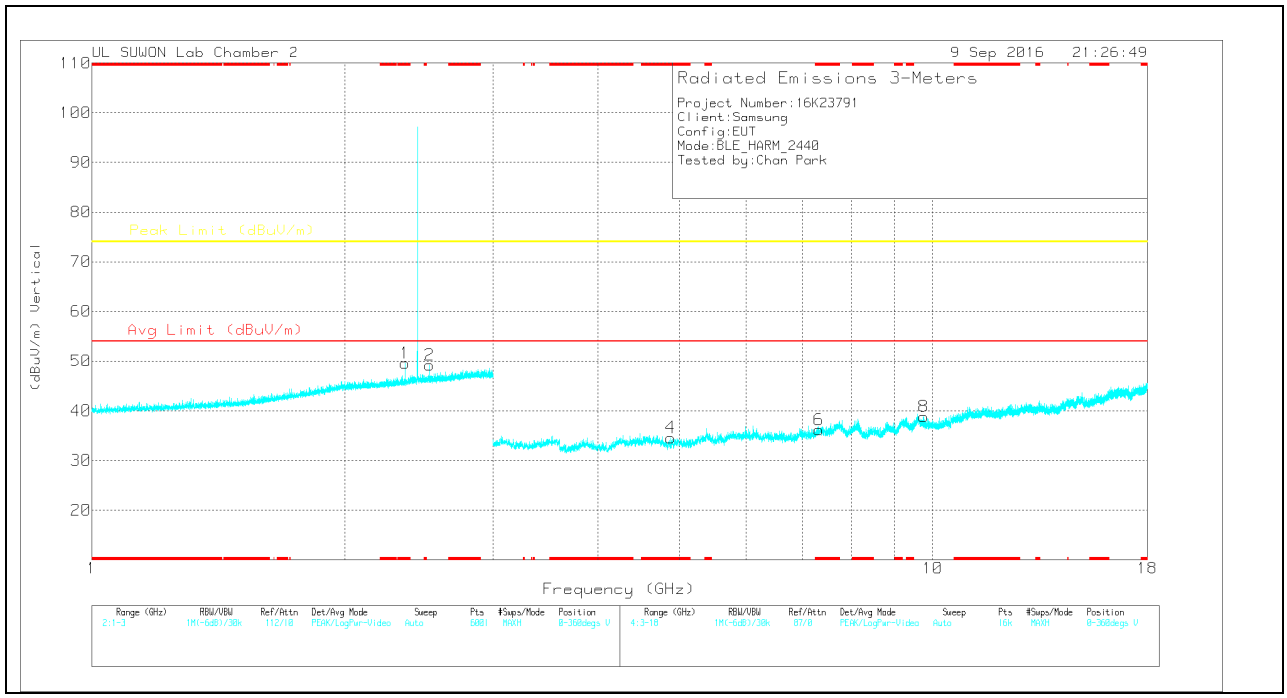
MAv1 - KDB558074 Option 1 Maximum RMS Average

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	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	* 2.358	38.49	PK	31.7	-20.6	0	49.59	-	-	74	-24.41	0-360	250	V
2	2.522	37.6	PK	31.9	-20.3	0	49.2	-	-	74	-24.8	0-360	250	V
3	* 4.878	24.79	PK	33.9	-25.2	0	33.49	-	-	74	-40.51	0-360	150	H
5	* 7.32	22.7	PK	35.9	-22.5	0	36.1	-	-	74	-37.9	0-360	150	H
7	9.762	20.8	PK	37	-19.3	0	38.5	-	-	74	-35.5	0-360	150	H
4	* 4.881	25.91	PK	33.9	-25.2	0	34.61	-	-	74	-39.39	0-360	150	V
6	* 7.316	22.86	PK	35.9	-22.6	0	36.16	-	-	74	-37.84	0-360	250	V
8	9.761	21.17	PK	37	-19.3	0	38.87	-	-	74	-35.13	0-360	250	V

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

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.358	45.28	PK2	31.7	-20.6	0	56.38	-	-	74	-17.62	40	320	V
* 2.358	37.5	MAv1	31.7	-20.6	0	48.6	54	-5.4	-	-	40	320	V

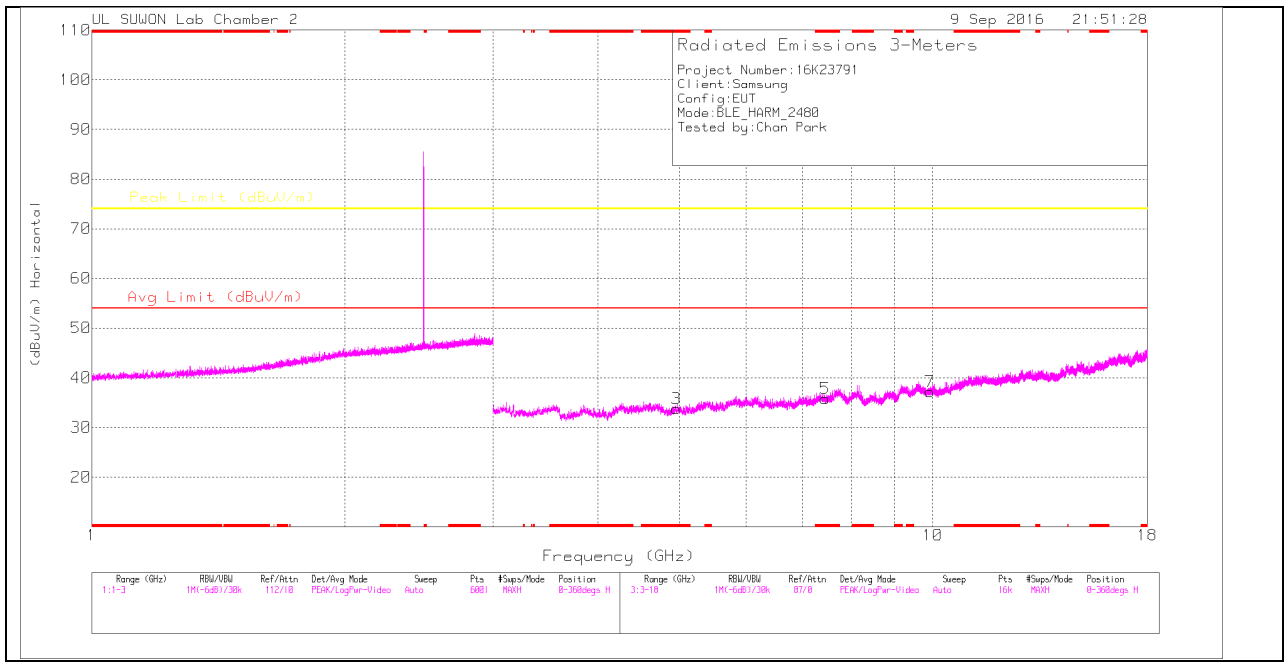
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

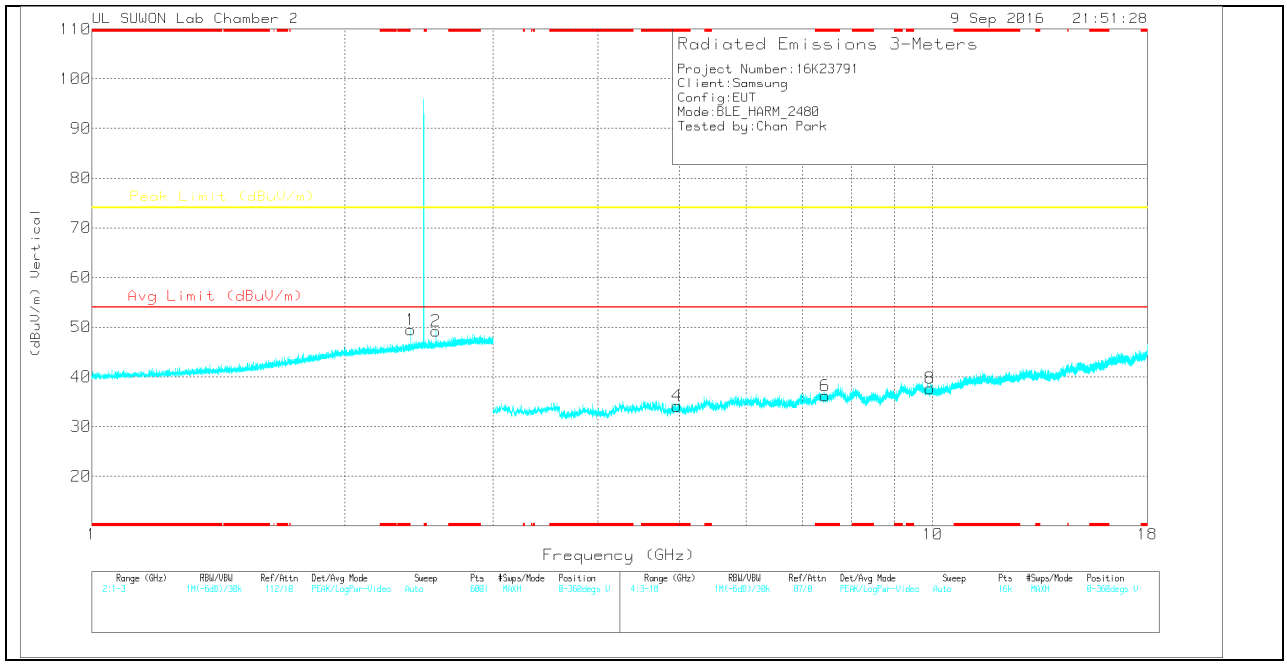
MAv1 - KDB558074 Option 1 Maximum RMS Average

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	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	2.394	38.22	PK	31.7	-20.5	0	49.42	-	-	74	-24.58	0-360	250	V
2	2.565	37.58	PK	31.9	-20.3	0	49.18	-	-	74	-24.82	0-360	250	V
3	* 4.957	24.94	PK	33.9	-25	0	33.84	-	-	74	-40.16	0-360	250	H
5	* 7.443	21.86	PK	36	-22.1	0	35.76	-	-	74	-38.24	0-360	150	H
7	9.918	19.06	PK	37.1	-19	0	37.16	-	-	74	-36.84	0-360	250	H
4	* 4.965	25.21	PK	33.9	-25	0	34.11	-	-	74	-39.89	0-360	250	V
6	* 7.445	22.32	PK	36	-22.1	0	36.22	-	-	74	-37.78	0-360	150	V
8	9.918	19.55	PK	37.1	-19	0	37.65	-	-	74	-36.35	0-360	150	V

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

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168724)_150619	Path_2	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.394	44.96	PK2	31.7	-20.5	0	56.16	-	-	74	-17.84	53	337	V

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

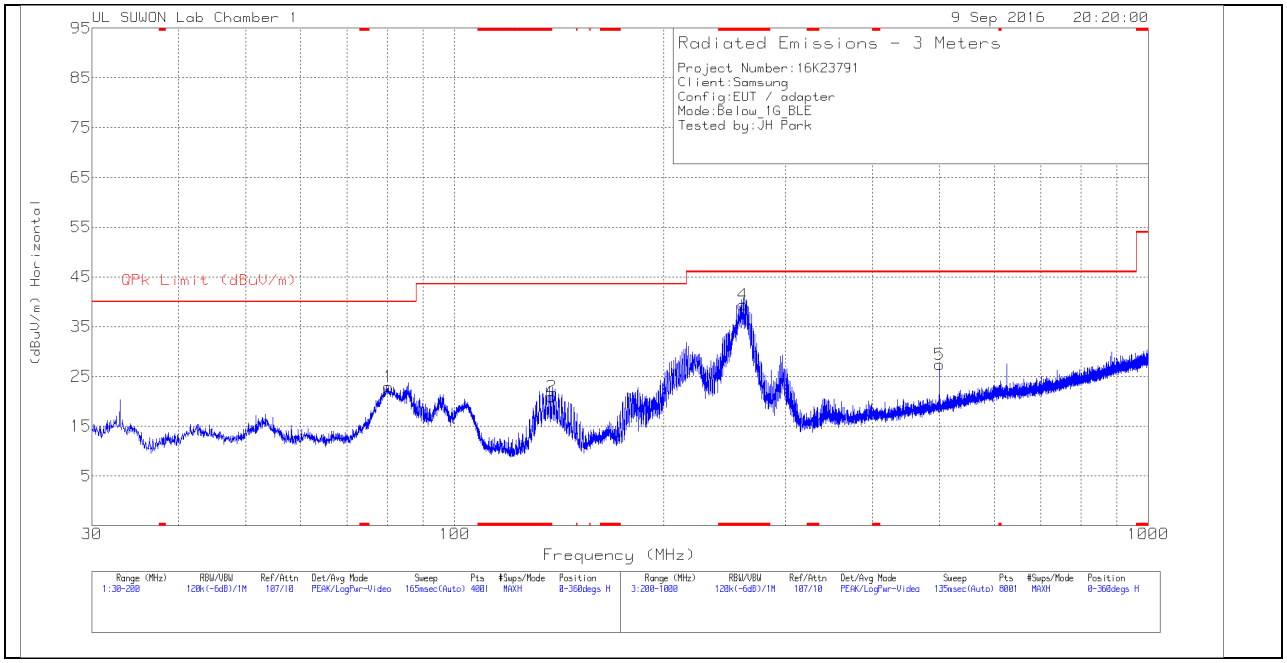
PK2 - KDB558074 Method: Maximum Peak

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

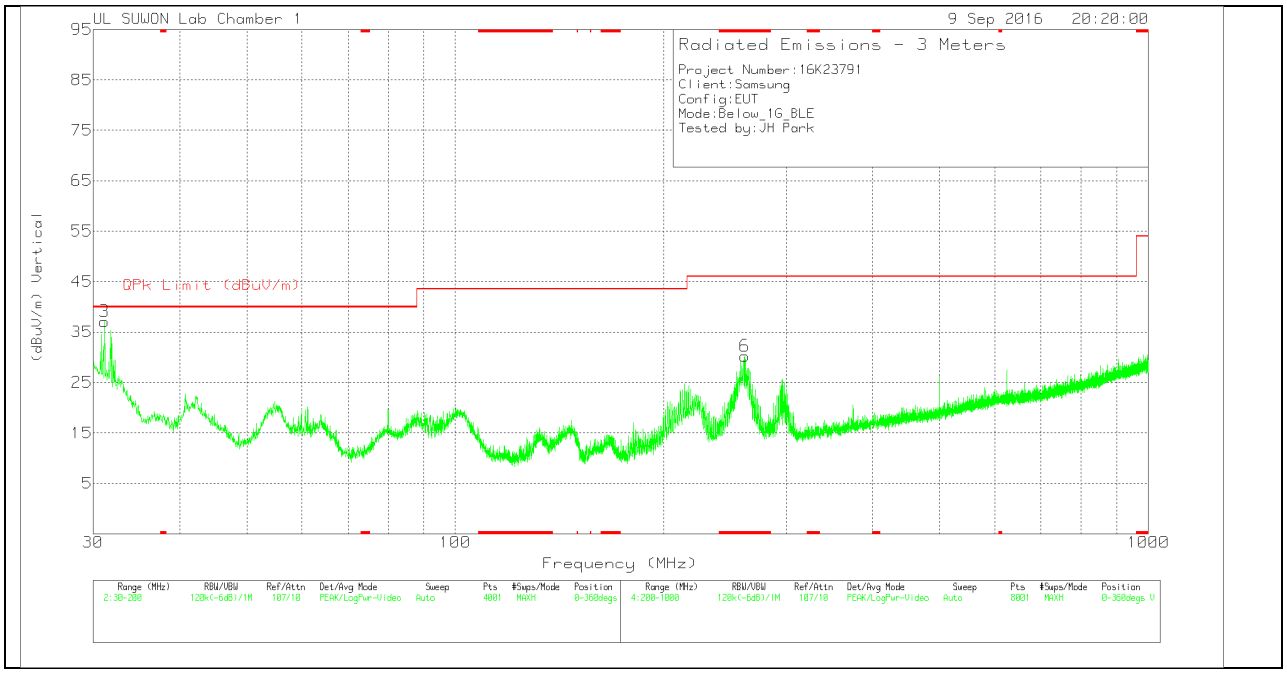
11.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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	80.235	45.67	Pk	6.9	-29.6	22.97	40	-17.03	0-360	200	H
2	138.205	41.77	Pk	8	-28.8	20.97	43.52	-22.55	0-360	200	H
3	31.1475	57.3	Pk	10.3	-30.5	37.1	40	-2.9	0-360	300	V
4	* 260.5	54.57	Pk	12.5	-27.7	39.37	46.02	-6.65	0-360	100	H
5	500	36.62	Pk	17	-26.2	27.42	46.02	-18.6	0-360	200	H
6	* 261.8	45.34	Pk	12.6	-27.7	30.24	46.02	-15.78	0-360	100	V

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

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
31.3455	43.83	Qp	10.3	-30.5	23.63	40	-16.37	199	100	V
* 263.2188	46.84	Qp	12.6	-27.7	31.74	46.02	-14.28	212	106	H

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

Qp - Quasi-Peak detector

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
IC RSS-GEN Clause 8.8

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.

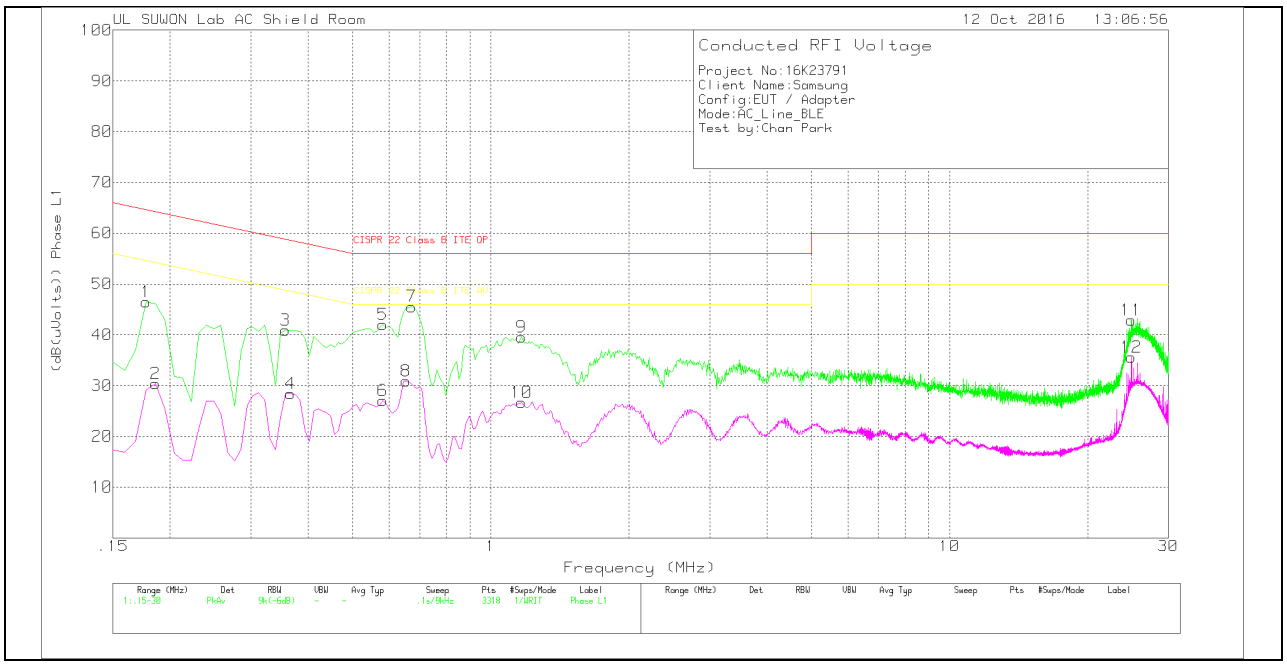
Line conducted data is recorded for both NEUTRAL and HOT lines.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Phase L1 .15 - 30MHz

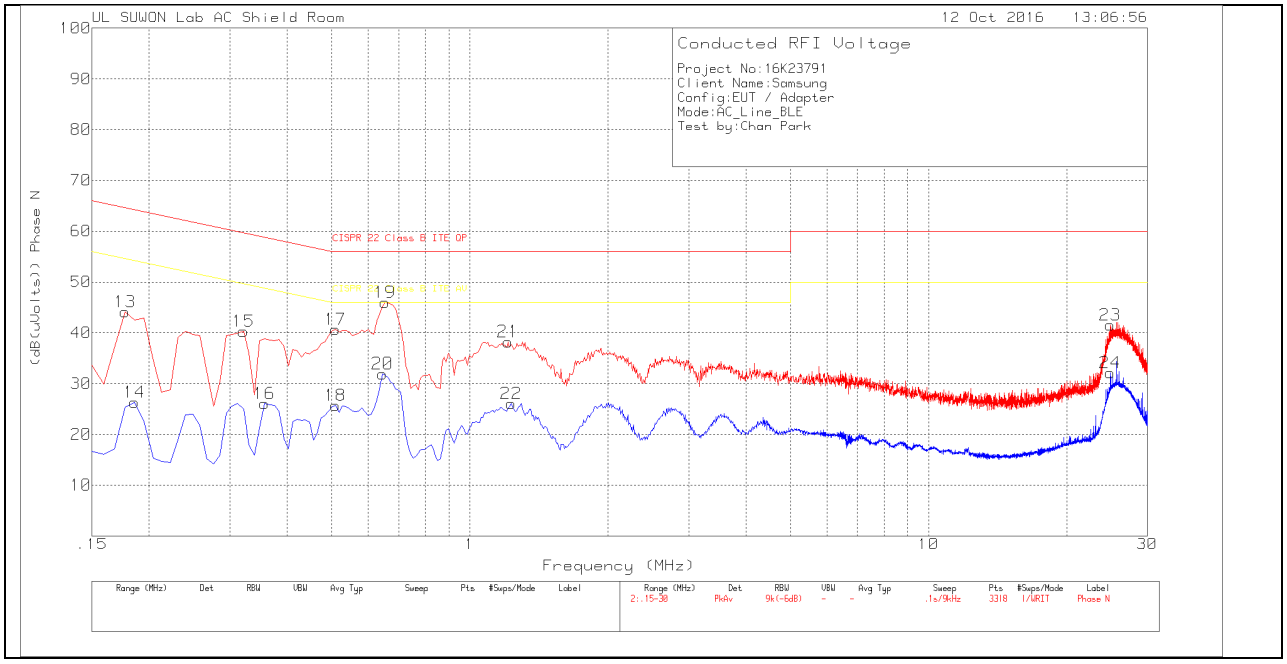
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.177	36.27	Pk	10.2	0	46.47	64.63	-18.16	-	-
2	.186	20.31	Av	10.1	0	30.41	-	-	54.21	-23.8
3	.357	30.85	Pk	10.1	0	40.95	58.8	-17.85	-	-
4	.366	18.35	Av	10.1	0	28.45	-	-	48.59	-20.14
5	.582	31.93	Pk	10.1	0	42.03	56	-13.97	-	-
6	.582	16.91	Av	10.1	0	27.01	-	-	46	-18.99
7	.672	35.45	Pk	10.1	0	45.55	56	-10.45	-	-
8	.654	20.74	Av	10.1	0	30.84	-	-	46	-15.16
9	1.167	29.66	Pk	9.9	0	39.56	56	-16.44	-	-
10	1.167	16.82	Av	9.9	0	26.72	-	-	46	-19.28
11	24.9	32.01	Pk	10.6	.3	42.91	60	-17.09	-	-
12	24.9	24.64	Av	10.6	.3	35.54	-	-	50	-14.46

Pk - Peak detector

Av - Average detection

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LINE 2 PLOT



LINE 2 RESULTS

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	34.07	Pk	10.1	0	44.17	64.63	-20.46	-	-
14	.186	16.28	Av	10	0	26.28	-	-	54.21	-27.93
15	.321	30.35	Pk	9.9	0	40.25	59.68	-19.43	-	-
16	.357	16.07	Av	10	0	26.07	-	-	48.8	-22.73
17	.51	30.51	Pk	10.1	0	40.61	56	-15.39	-	-
18	.51	15.62	Av	10.1	0	25.72	-	-	46	-20.28
19	.654	36.03	Pk	10	0	46.03	56	-9.97	-	-
20	.645	21.94	Av	10	0	31.94	-	-	46	-14.06
21	1.212	28.35	Pk	9.8	.1	38.25	56	-17.75	-	-
22	1.23	16.12	Av	9.8	.1	26.02	-	-	46	-19.98
23	24.9	30.4	Pk	10.8	.3	41.5	60	-18.5	-	-
24	24.9	21.06	Av	10.8	.3	32.16	-	-	50	-17.84

Pk - Peak detector

Av - Average detection

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.