



**FCC CFR47 PART 15 SUBPART C**

**Bluetooth Low Energy**

**CERTIFICATION TEST REPORT**

**FOR**

**WCDMA/LTE Tablet + Bluetooth/BLE and DTS/UNII a/b/g/n/ac**

**MODEL NUMBER : SM-W728, SM-W728N0, SM-W727, SM-W727N0**

**FCC ID: A3LSMW728**

**REPORT NUMBER: 4787827147-E2V1**

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Revision History

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V1	02/17/17	Initial issue	Junwhan Lee

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.  
**EUT DESCRIPTION:** WCDMA/LTE Tablet + Bluetooth/BLE and DTS/UNII a/b/g/n/ac  
**MODEL NUMBER:** SM-W728, SM-W728N0, SM-W727, SM-W727N0  
**SERIAL NUMBER:** R9KCR32HC000QD , 9RKCR32HC000QF (RADIATED);  
9RKCR32HC000RZ (CONDUCTED)  
**DATE TESTED:** JAN 20, 2017 - FEB 15, 2017

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:

Tested By:



SungGil Park  
Suwon Lab Engineer  
UL Korea, Ltd.

Junwhan Lee  
Suwon Lab Engineer  
UL Korea, Ltd.

## 2. TEST METHODOLOGY

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

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 DTS Meas Guidance v03r05.
4. ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<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 a WCDMA/LTE Tablet + Bluetooth/BLE and DTS/UNII a/b/g/n/ac. This test report addresses the DTS (BLE) operational mode.

SM-W728 and multi-models(SM-W727, SM-W727N0, SM-W728N0) are same hardware, but difference is Windows version and HSDPA categories. PED document described detail of difference. All compliance tests were performed using SM-W728 and HSDPA conducted power checks for multi-models were performed.

### 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	2.798	1.90
		Average	2.236	1.67

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -0.54 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.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	EP-TA300	R37HCSB00A3SE3	N/A
Data Cable	SAMSUNG	EP-DW720CWE	N/A	N/A
Earphone	SAMSUNG	EO-EG920BW	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	C Type USB	Shielded	1.2m	N/A
2	Audio	2	Mini-Jack	Unshielded	1.1m	N/A

### ADDITIONAL EQUIPMENT

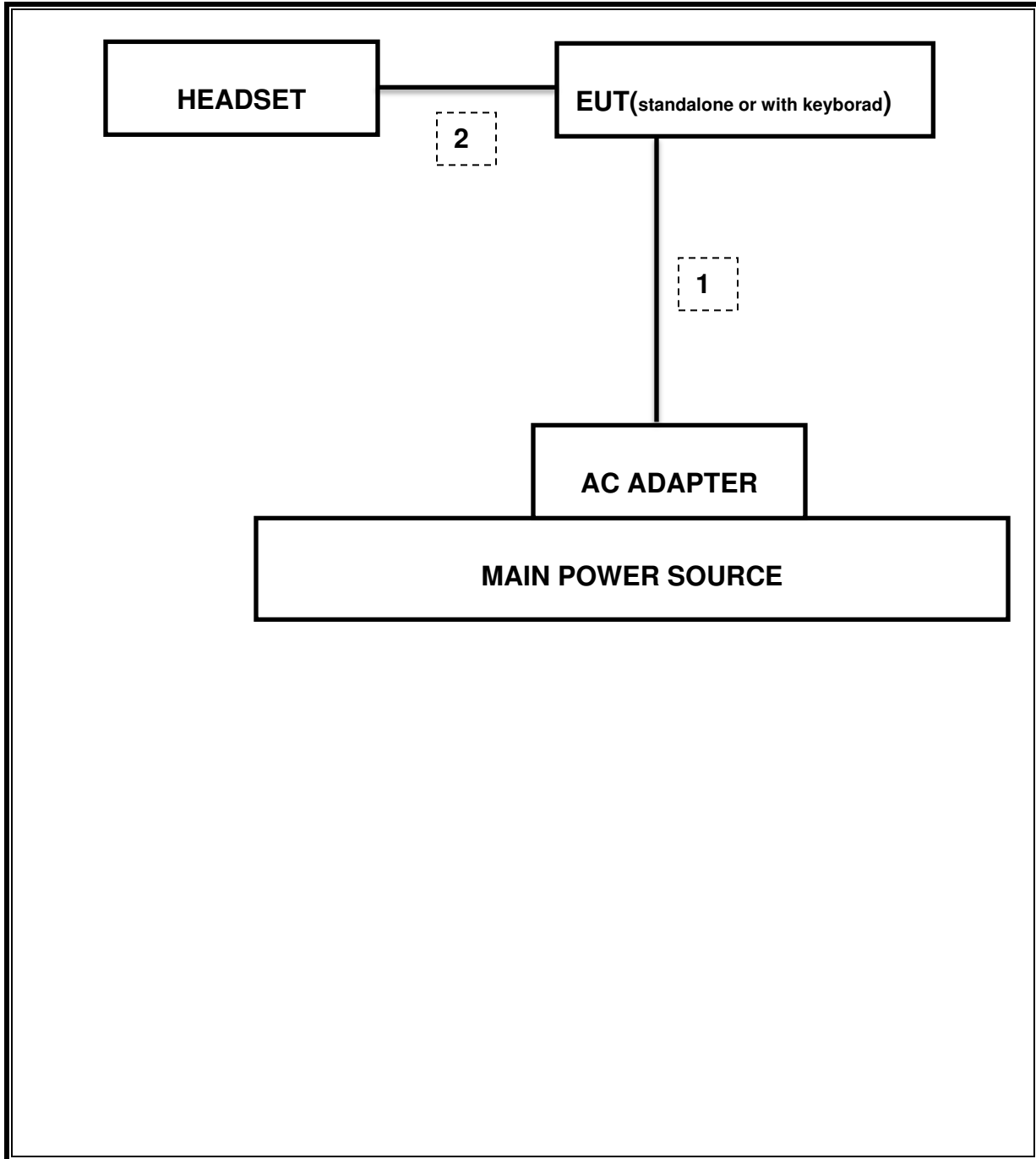
Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Keyboard	SAMSUNG	EJ-CW720	N/A	N/A
S-pen	SAMSUNG	EJ-PT820	N/A	N/A

Additional radiated spurious emission measurements were performed on worst case condition(Max conducted power) equipped with keyboard. Test data shown on section 10 and setup photo shown on section 12. Also radiated spurious emission below 1GHz and AC line conducted test were performed both condition(Stand-alone and equipped with keyboard).

### TEST SETUP

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

**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	10-14-18
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
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	NRP-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
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

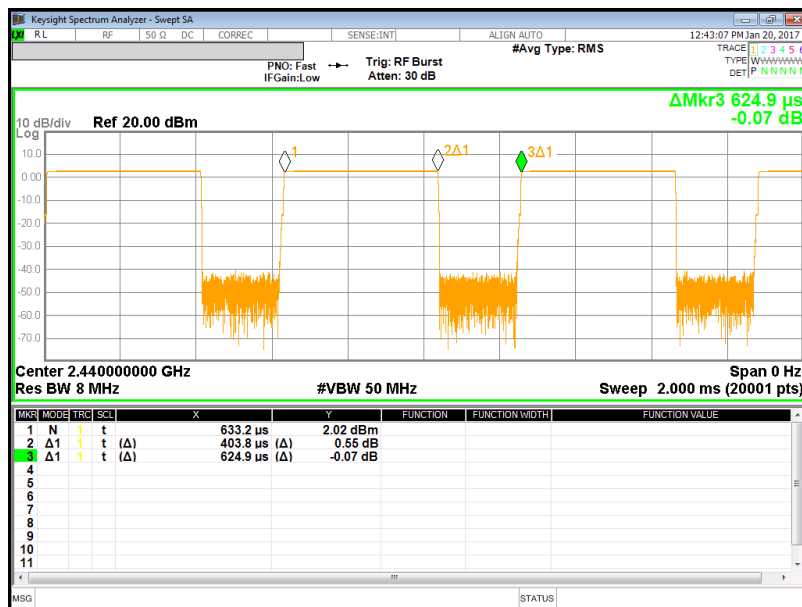
## 7. REFERENCE MEASUREMENT RESULTS

### 7.1. 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]
<b>2400MHz Bands</b>						
BLE	0.404	0.625	0.646	64.6%	1.90	2.476

### LIMITS

None: for reporting purposes only.



## 7.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

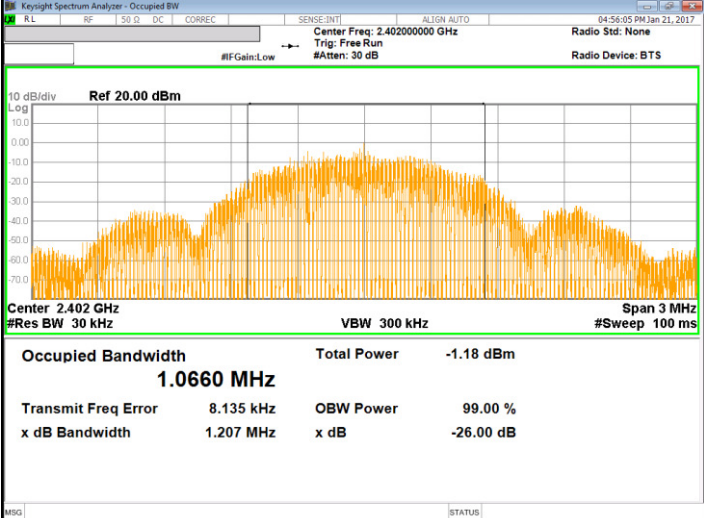
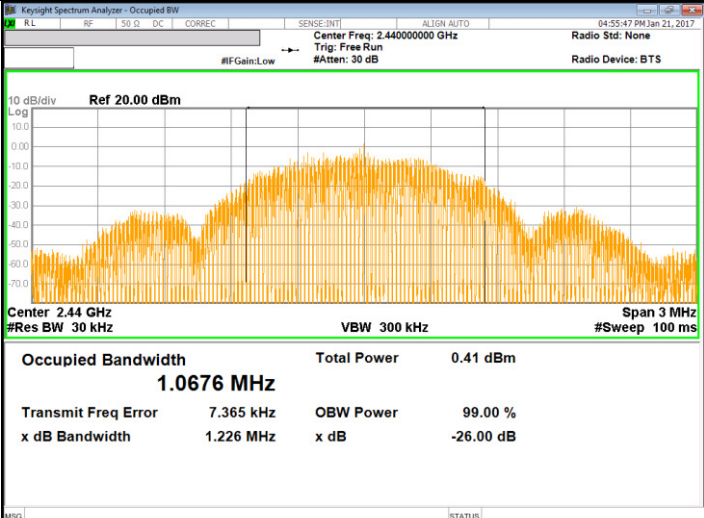
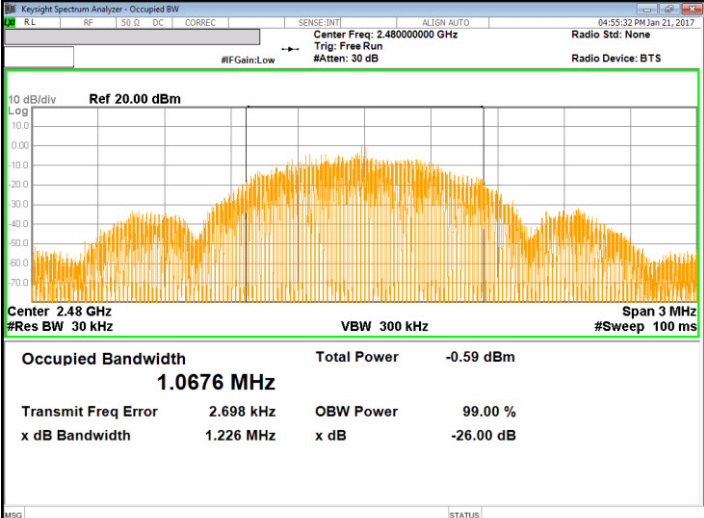
### TEST PROCEDURE

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	1.066
Mid	2440	1.068
High	2480	1.068
Worst		1.068

**99% BANDWIDTH PLOTS**

<p>Low CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW          Center Freq: 2.40200000 GHz          Radio Std: None          Trig: Free Run          #Atten: 30 dB          Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm          Log          10.0          0.00          -10.0          -20.0          -30.0          -40.0          -50.0          -60.0          -70.0</p> <p>Center 2.402 GHz Span 3 MHz          #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>-1.18 dBm</td> </tr> <tr> <td><b>1.0660 MHz</b></td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>8.135 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.207 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	-1.18 dBm	<b>1.0660 MHz</b>			Transmit Freq Error	8.135 kHz	OBW Power	x dB Bandwidth	1.207 MHz	x dB			99.00 %			-26.00 dB
Occupied Bandwidth	Total Power	-1.18 dBm																	
<b>1.0660 MHz</b>																			
Transmit Freq Error	8.135 kHz	OBW Power																	
x dB Bandwidth	1.207 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	
<p>Middle CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW          Center Freq: 2.44000000 GHz          Radio Std: None          Trig: Free Run          #Atten: 30 dB          Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm          Log          10.0          0.00          -10.0          -20.0          -30.0          -40.0          -50.0          -60.0          -70.0</p> <p>Center 2.44 GHz Span 3 MHz          #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>0.41 dBm</td> </tr> <tr> <td><b>1.0676 MHz</b></td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>7.365 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.226 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	0.41 dBm	<b>1.0676 MHz</b>			Transmit Freq Error	7.365 kHz	OBW Power	x dB Bandwidth	1.226 MHz	x dB			99.00 %			-26.00 dB
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Transmit Freq Error	7.365 kHz	OBW Power																	
x dB Bandwidth	1.226 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	
<p>High CH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW          Center Freq: 2.48000000 GHz          Radio Std: None          Trig: Free Run          #Atten: 30 dB          Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm          Log          10.0          0.00          -10.0          -20.0          -30.0          -40.0          -50.0          -60.0          -70.0</p> <p>Center 2.48 GHz Span 3 MHz          #Res BW 30 kHz VBW 300 kHz #Sweep 100 ms</p> <table border="1"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>-0.59 dBm</td> </tr> <tr> <td><b>1.0676 MHz</b></td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>2.698 kHz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>1.226 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	-0.59 dBm	<b>1.0676 MHz</b>			Transmit Freq Error	2.698 kHz	OBW Power	x dB Bandwidth	1.226 MHz	x dB			99.00 %			-26.00 dB
Occupied Bandwidth	Total Power	-0.59 dBm																	
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Transmit Freq Error	2.698 kHz	OBW Power																	
x dB Bandwidth	1.226 MHz	x dB																	
		99.00 %																	
		-26.00 dB																	

## 8. 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	665 kHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-46.802 dBm
15.247	TX conducted output power	<30dBm		Pass	2.798 dBm (Peak)
15.247	PSD	<8dBm		Pass	-12.49 dBm (Peak)
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	48.38 dBuV (Qp)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	47.29 dBuV/m (Av)

## 9. ANTENNA PORT TEST RESULTS

### 9.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

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

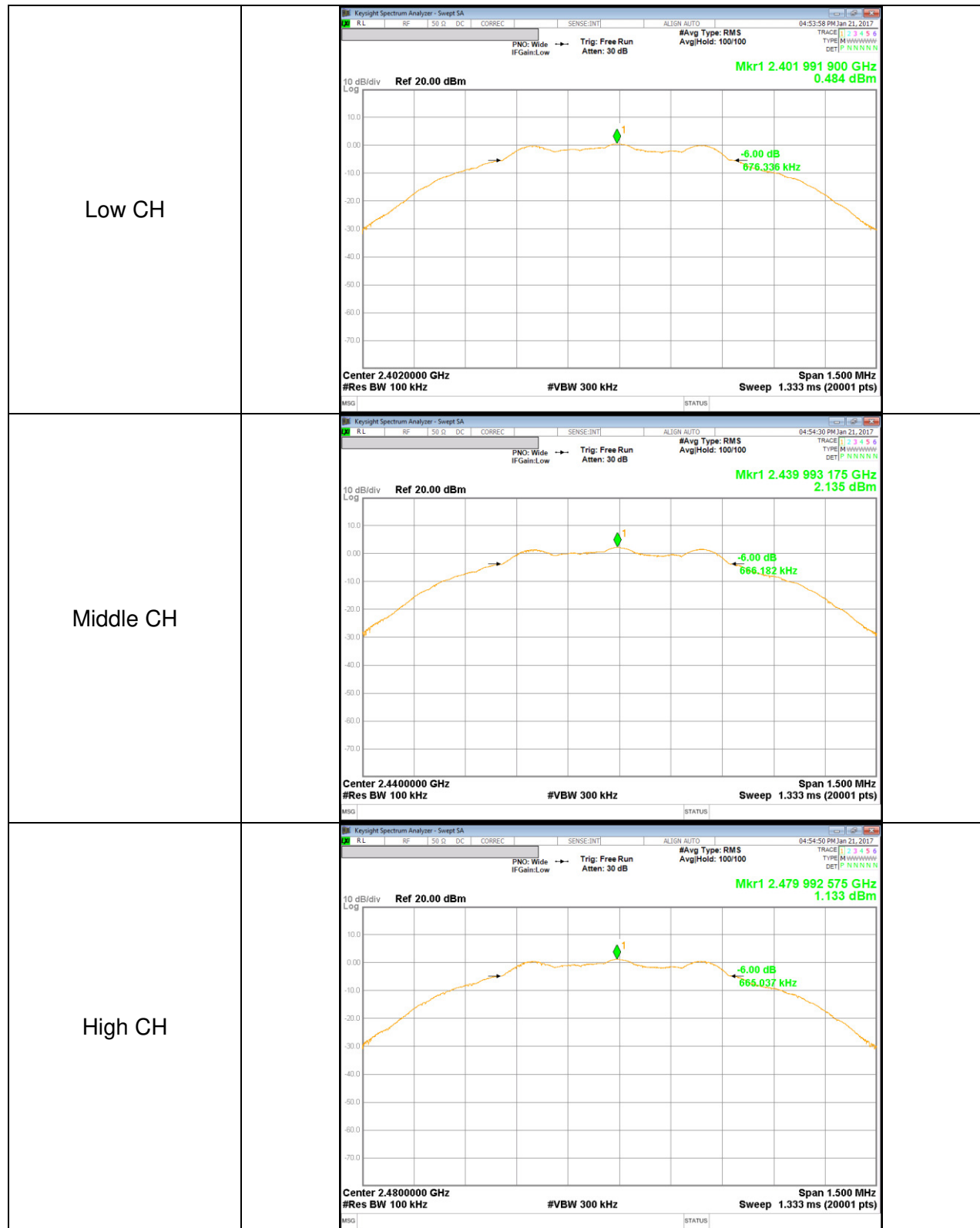
#### TEST PROCEDURE

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	676.3	500.0
Mid	2440	666.2	500.0
High	2480	665.0	500.0
Worst		665.0	500.0

**6 dB BANDWIDTH PLOTS**



## 9.2. 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.

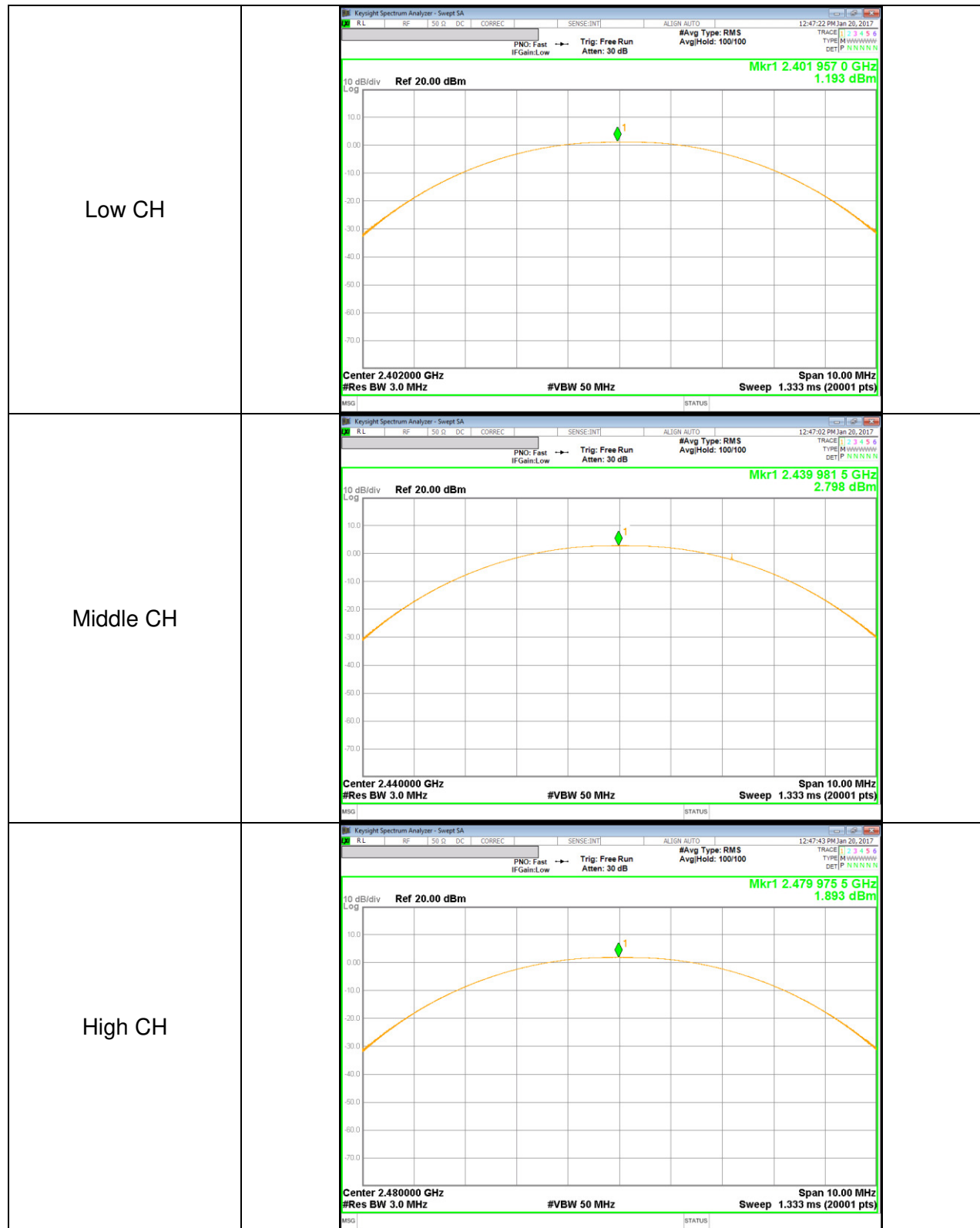
### TEST PROCEDURE

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

### RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Low	2402	1.193	30.000	-28.807
Mid	2440	2.798	30.000	-27.202
High	2480	1.893	30.000	-28.107
Worst		2.798		-27.202

**OUTPUT POWER PLOTS**



### 9.3. 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 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	0.729	1.183
Middle	2440	2.236	1.673
High	2480	1.364	1.369

## 9.4. 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.

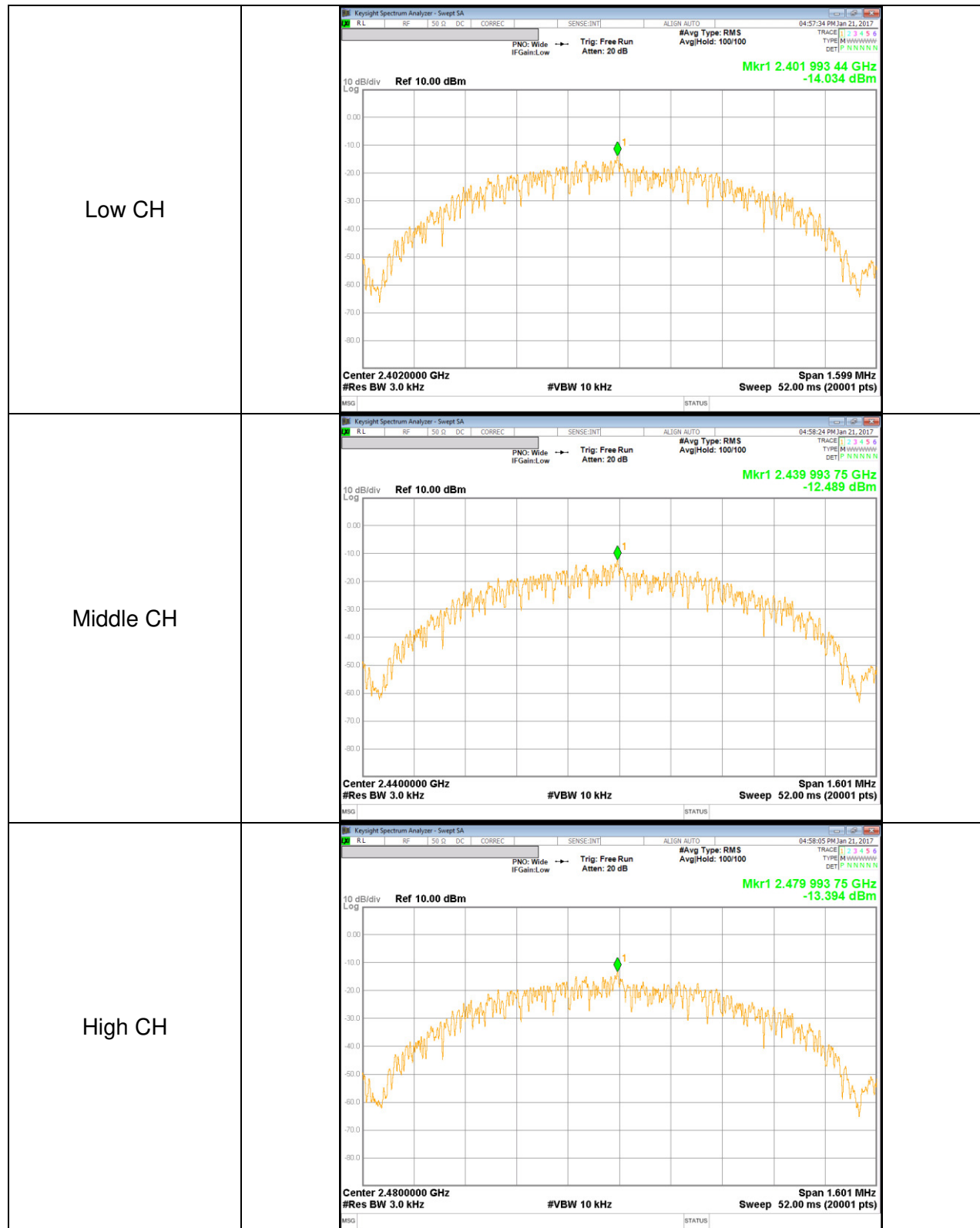
### TEST PROCEDURE

Power Spectral Density was performed utilizing the “§10.2 Method PKPSD (Peak PSD)” under KDB558074 D01 DTS Meas Guidance v03r05

### RESULTS

Channel	Frequency [MHz]	PSD [dBm]	Limit [dBm]	Margin [dB]
Low	2402	-14.03	8.00	-22.03
Mid	2440	-12.49	8.00	-20.49
High	2480	-13.39	8.00	-21.39

**POWER SPECTRAL DENSITY PLOTS**



## 9.5. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

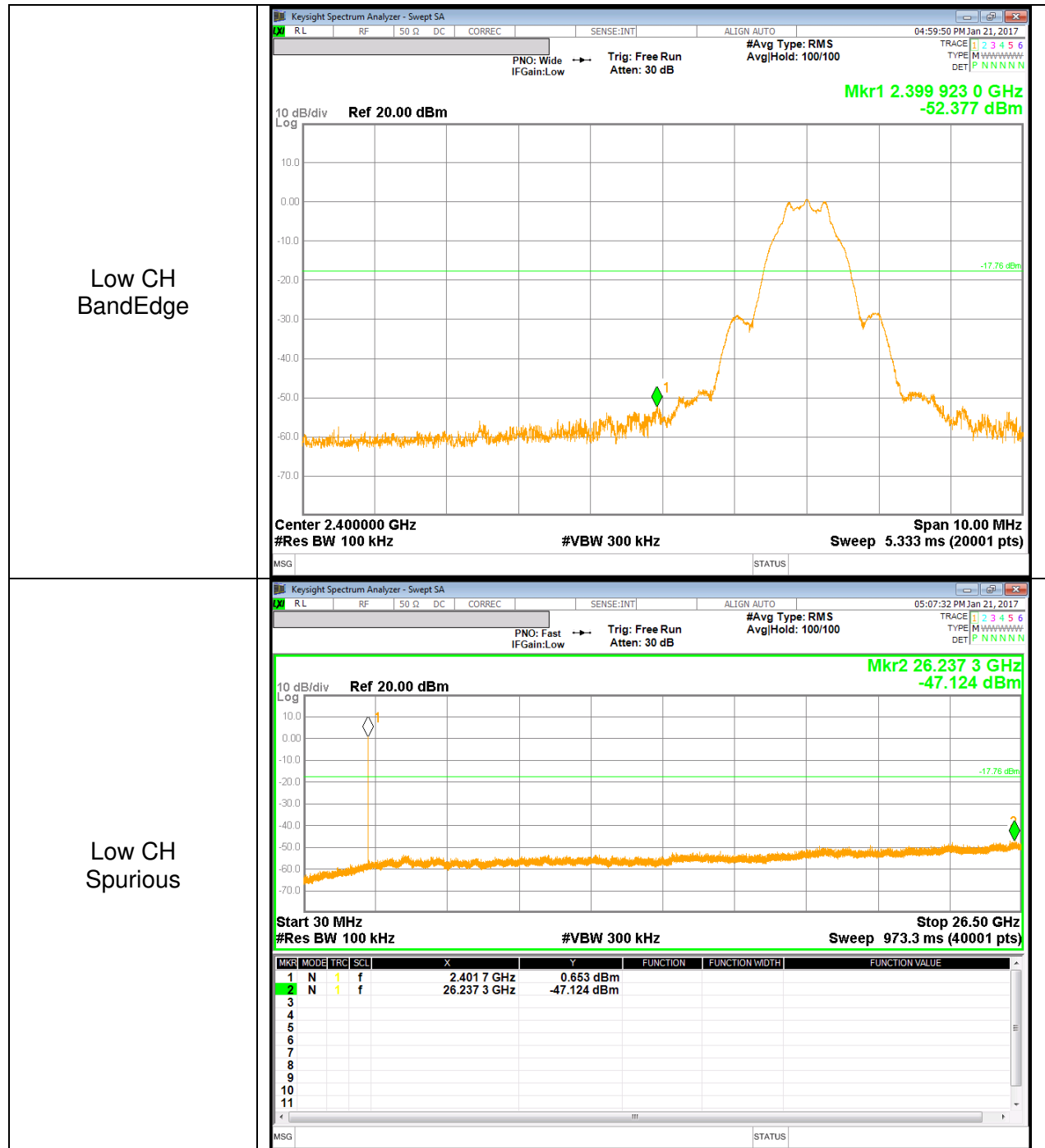
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

### TEST PROCEDURE

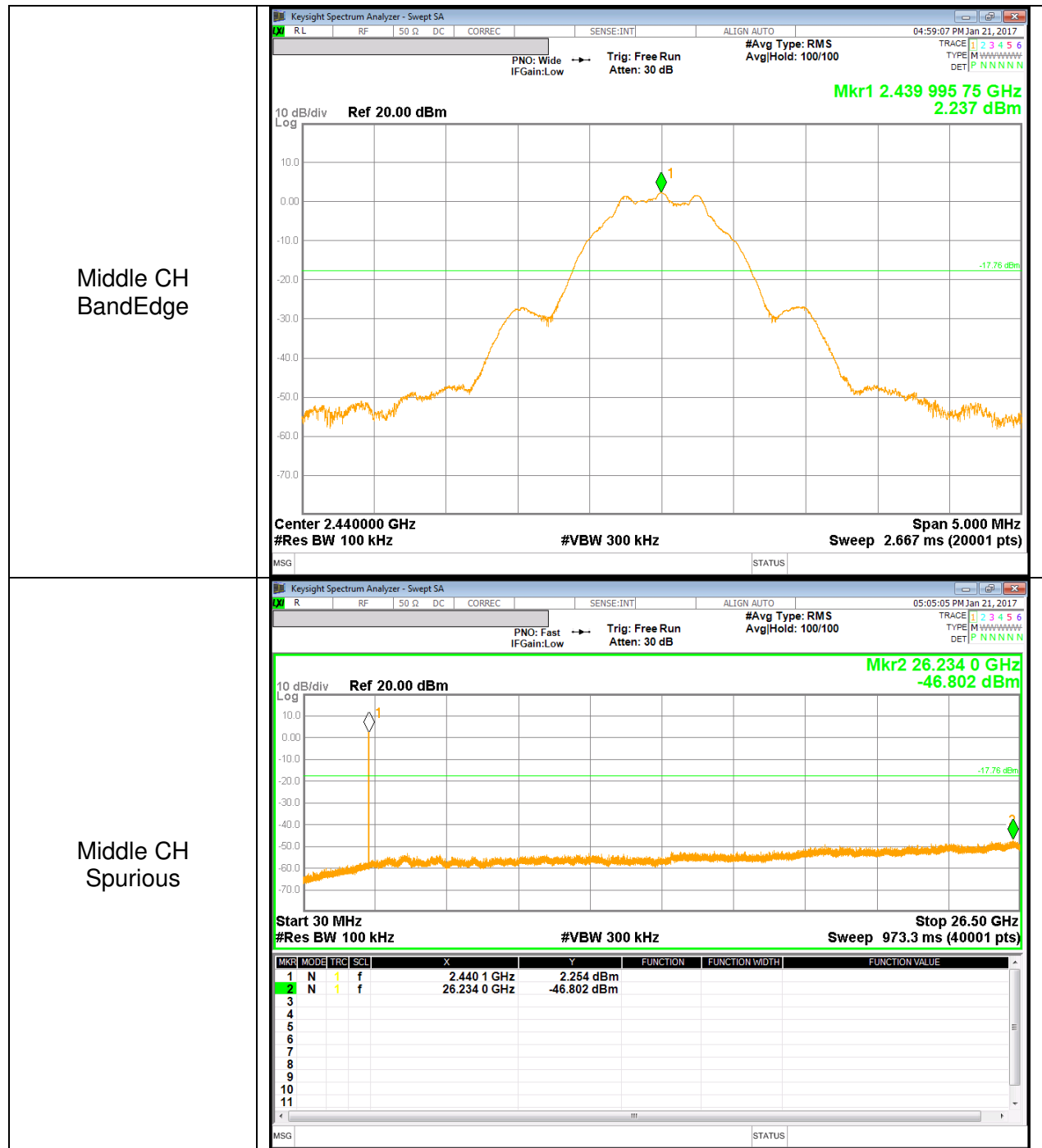
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

**RESULTS**

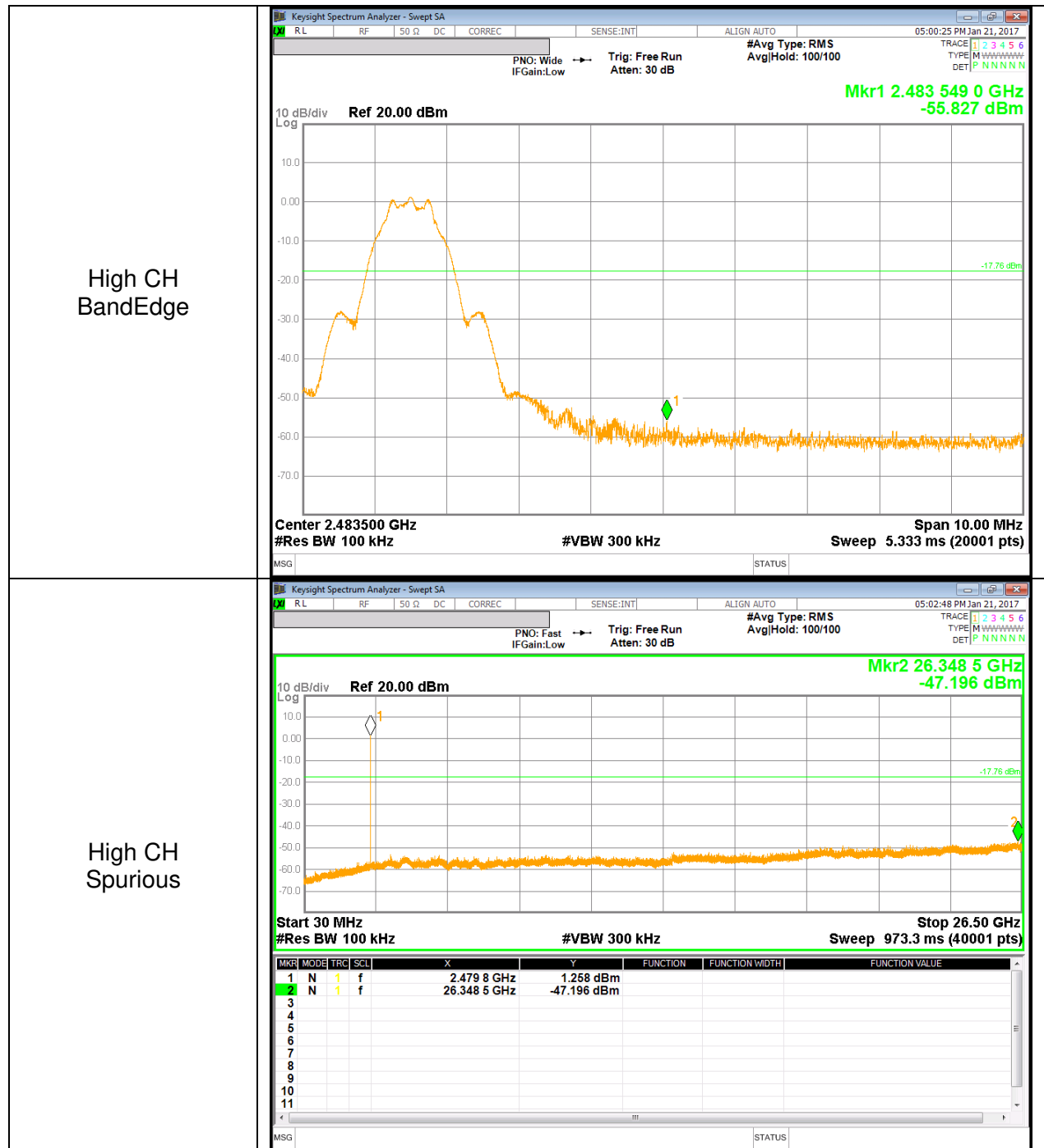
**BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL**



**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**



## 10. RADIATED TEST RESULTS

### 10.1. 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 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. (Restricted bandedge, Final detection of spurious harmonic emissions) Duty cycle factor =  $10 \log(1/x)$ . For this sample: DCF =  $10 \log(1/0.646) = 1.90 \text{ dB}$  (Spectrum Analyzer round it up to 1.90dB)

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.

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.

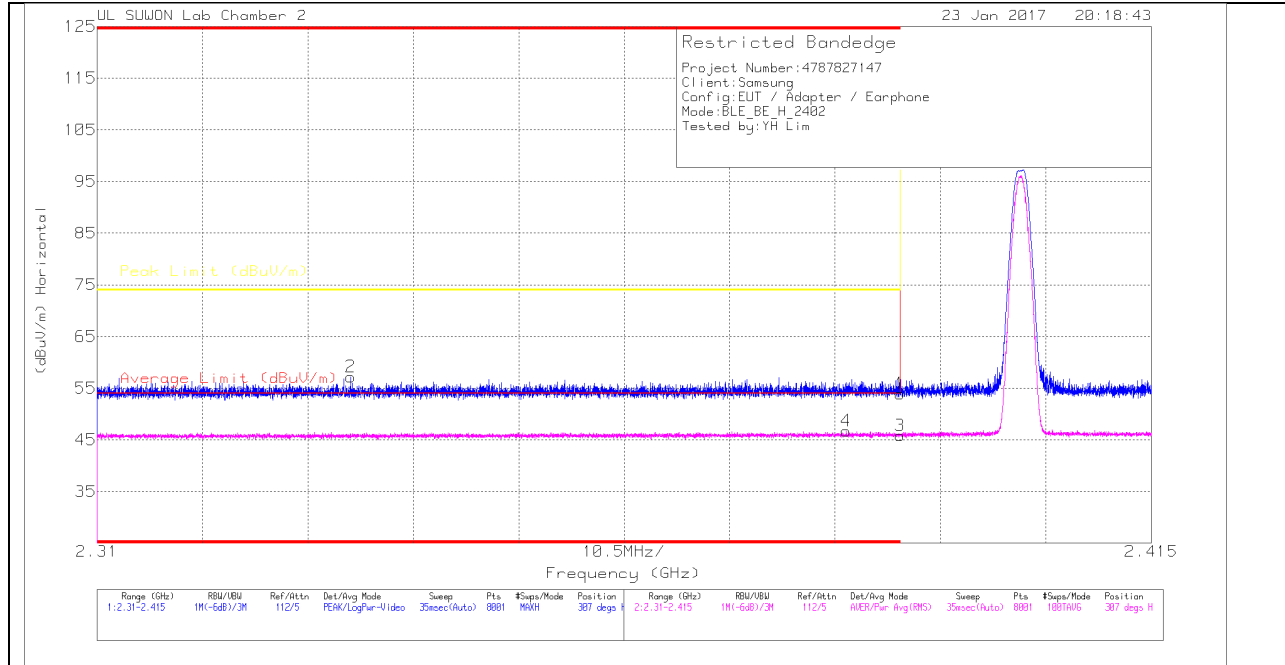
Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).  
Per FCC part 15.31(o), test results were not reported.

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

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site.  
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 937606.

## 10.2. TRANSMITTER ABOVE 1 GHz RESTRICTED BANDEDGE (LOW CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

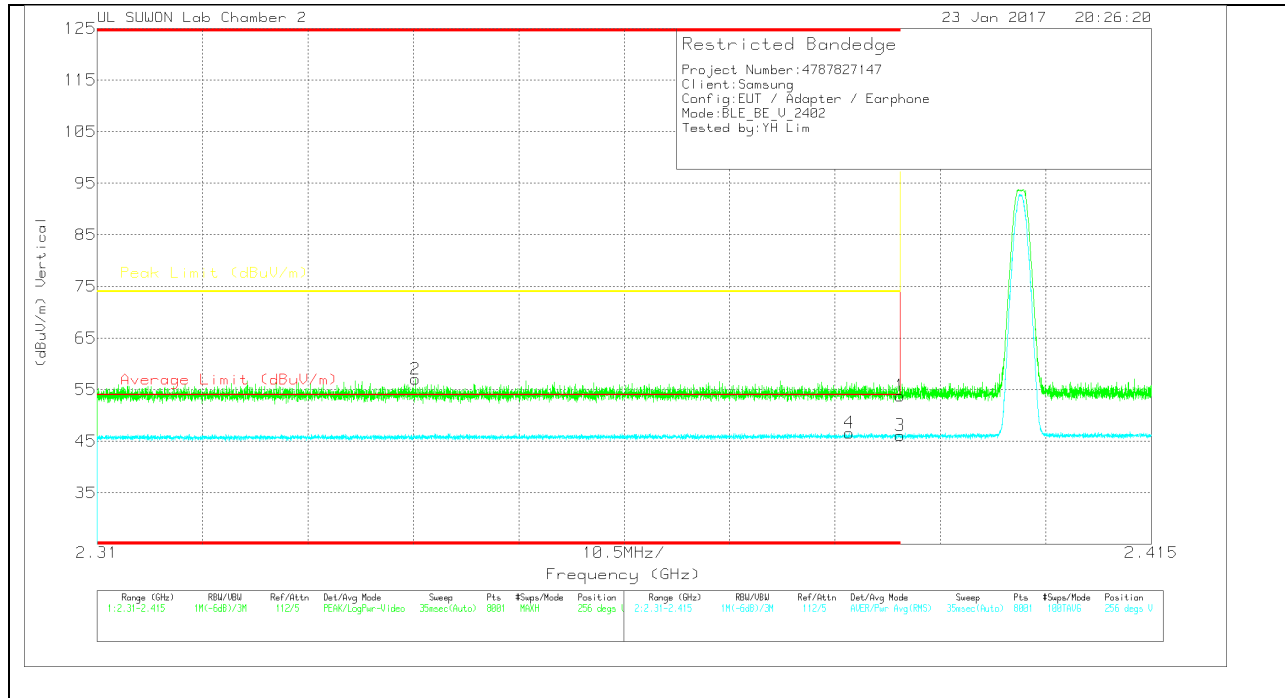
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 24)_150619	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.42	PK	31.7	-18.2	0	53.92	-	-	74	-20.08	307	213	H
2	* 2.335	44.01	PK	31.6	-18.4	0	57.21	-	-	74	-16.79	307	213	H
3	* 2.39	30.45	RMS	31.7	-18.2	1.9	45.85	54	-8.15	-	-	307	213	H
4	* 2.385	31.33	RMS	31.7	-18.2	1.9	46.73	54	-7.27	-	-	307	213	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	10dB(dB)	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	40.3	Pk	31.7	-18.2	0	53.8	-	-	74	-20.2	256	314	V
2	* 2.342	43.74	Pk	31.6	-18.3	0	57.04	-	-	74	-16.96	256	314	V
3	* 2.39	30.73	RMS	31.7	-18.2	1.9	46.13	54	-7.87	-	-	256	314	V
4	* 2.385	31.24	RMS	31.7	-18.2	1.9	46.64	54	-7.36	-	-	256	314	V

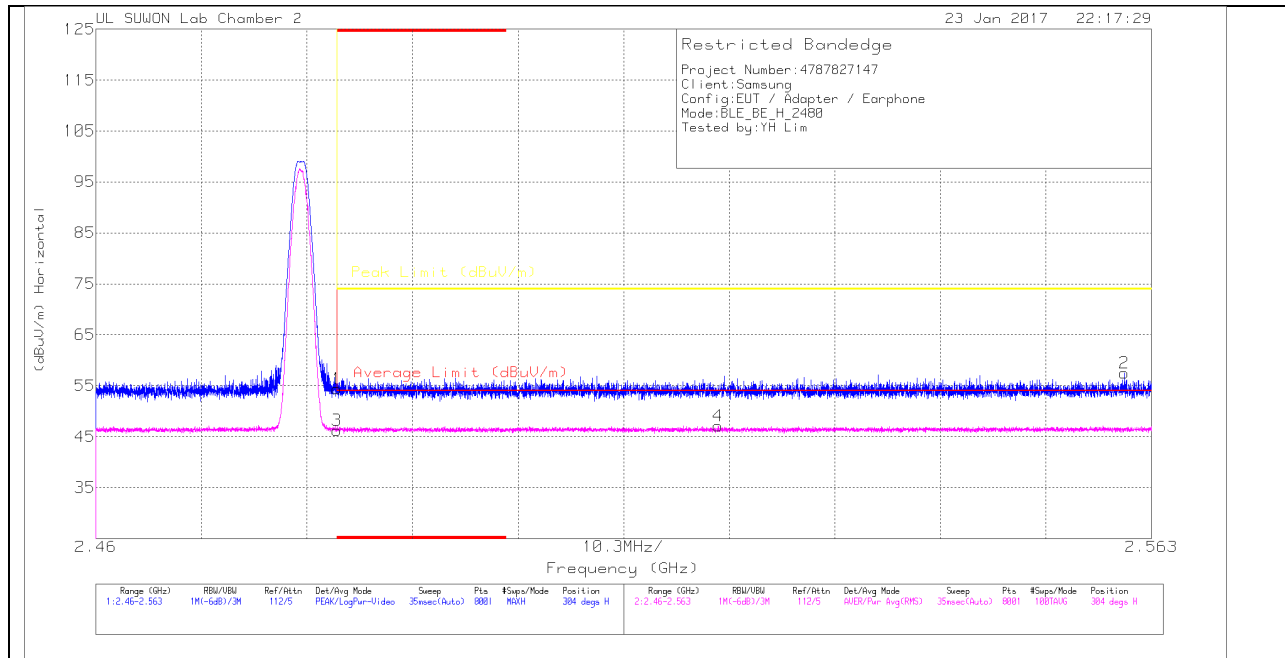
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

## AUTHORIZED BANDEDGE (HIGH CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

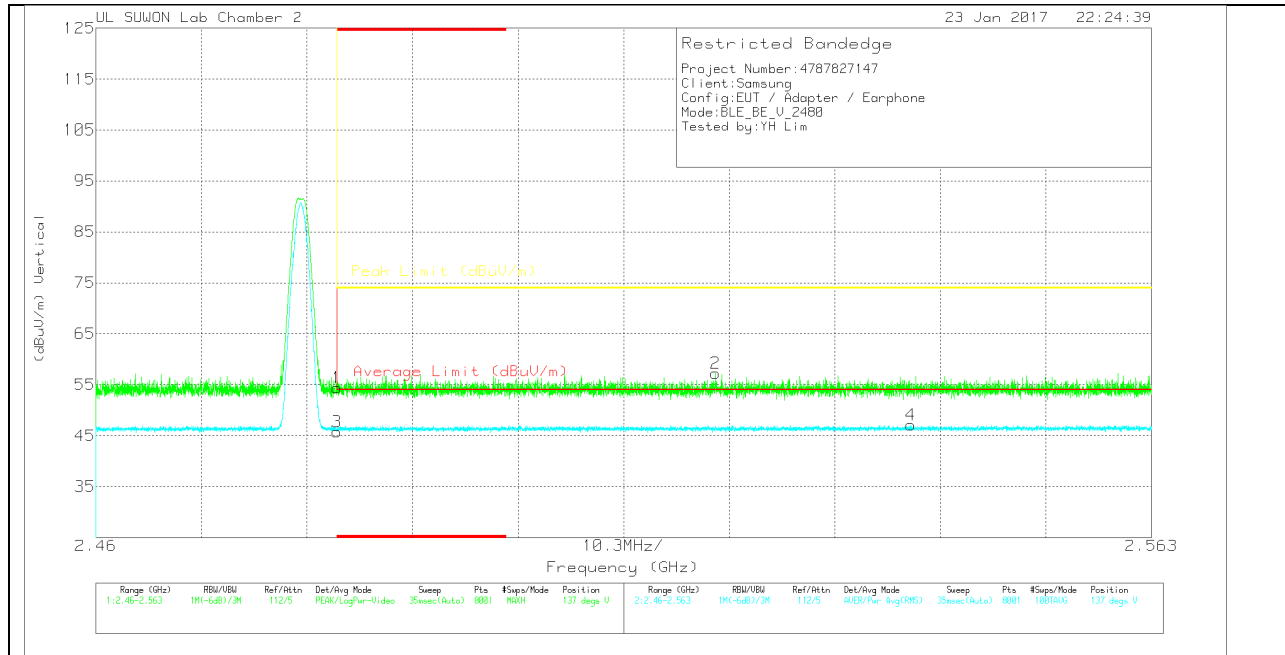
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117/001687 24_150619	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.63	Pk		-18	0	54.43	-	-	74	-19.57	304	198	H
2	2.56	43.58	Pk		-18	0	57.48	-	-	74	-16.52	304	198	H
3	* 2.484	30.53	RMS		-18	1.9	46.23	54	-7.77	-	-	304	198	H
4	2.521	31.36	RMS		-18	1.9	47.16	54	-6.84	-	-	304	198	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	10dB(dB)	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	40.56	Pk	31.8	-18	0	54.36	-	-	74	-19.64	137	397	V
2	2.52	43.37	Pk	31.9	-18	0	57.27	-	-	74	-16.73	137	397	V
3	* 2.484	30.05	RMS	31.8	-18	1.9	45.75	54	-8.25	-	-	137	397	V
4	2.54	31.34	RMS	31.9	-18	1.9	47.14	54	-6.86	-	-	137	397	V

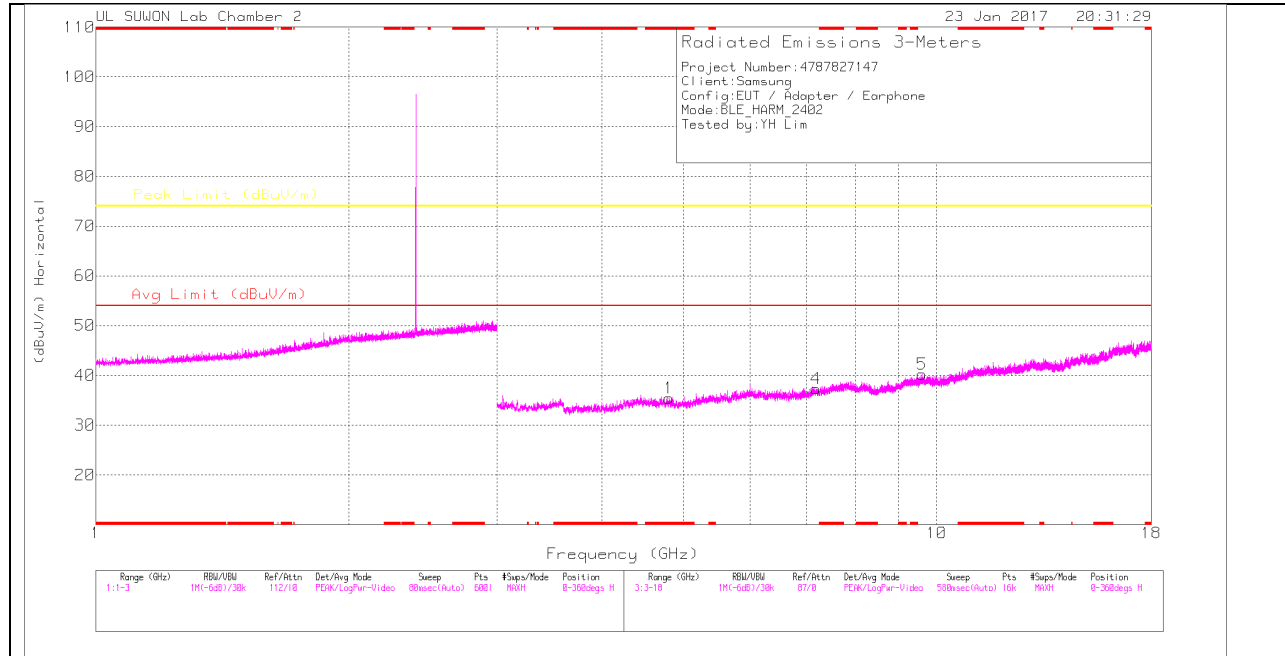
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

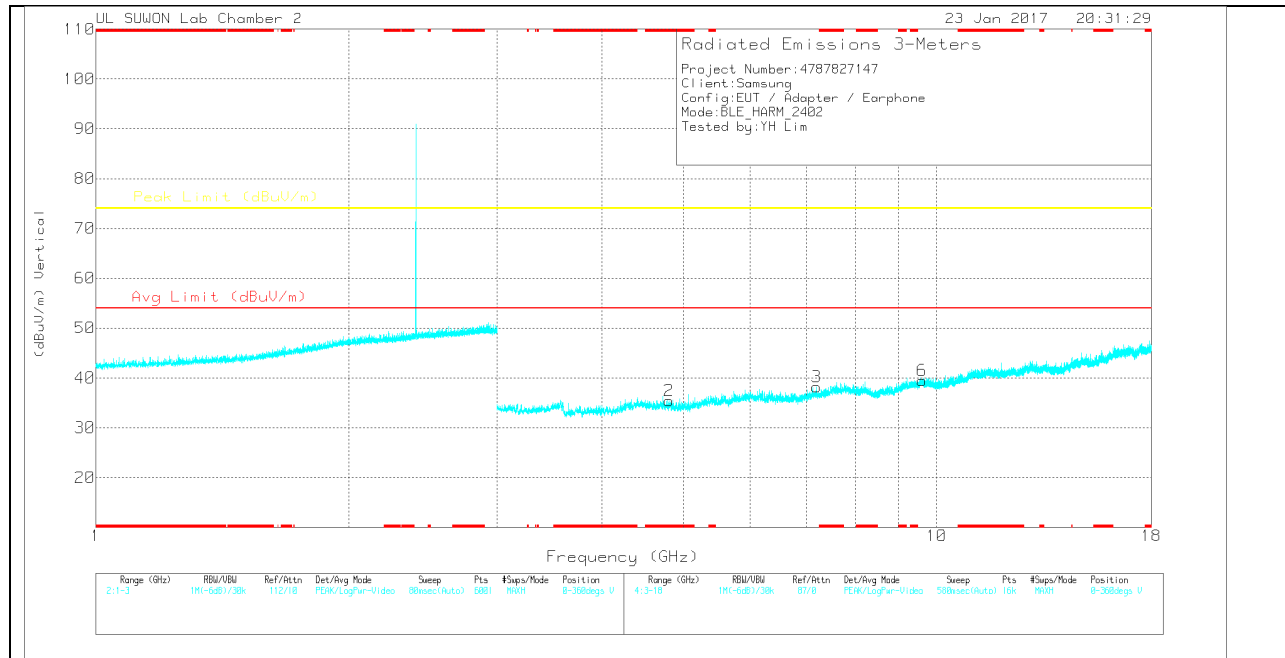
RMS - RMS detection

**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

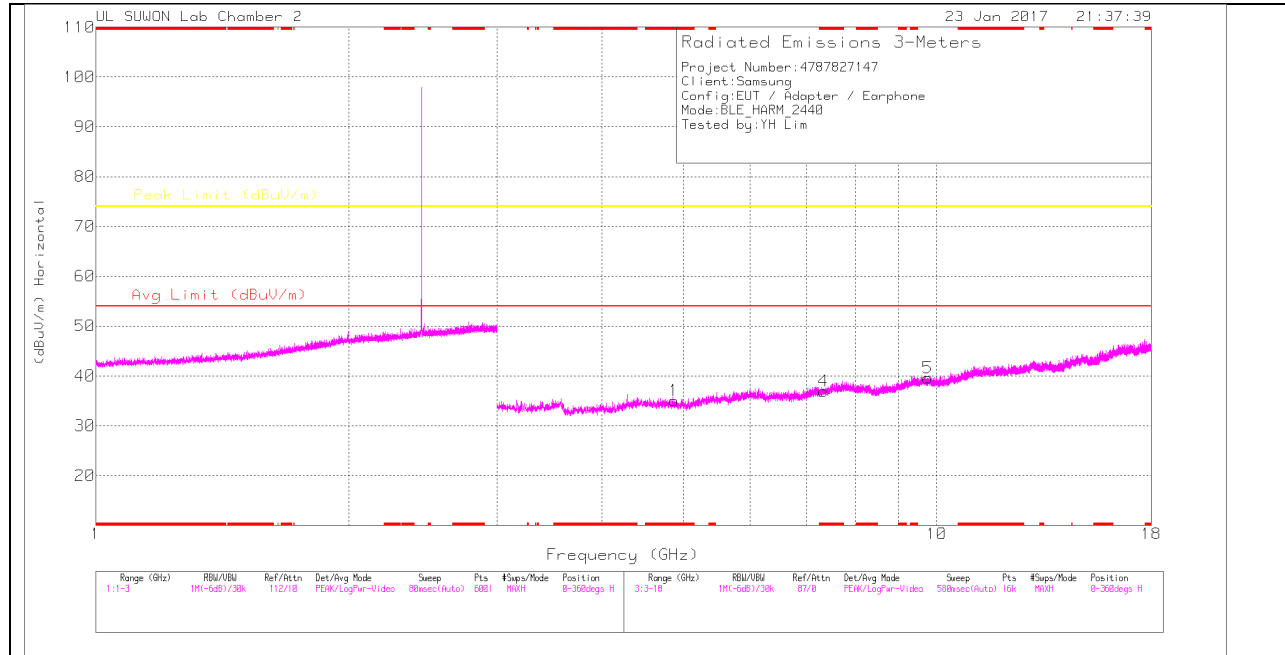
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 24_150619)	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.808	25.87	Pk	33.9	-24.3	0	35.47	-	-	74	-38.53	0-360	250	H
4	7.185	23.12	Pk	35.7	-21.5	0	37.32	-	-	74	-36.68	0-360	150	H
5	9.611	21.73	Pk	36.9	-18.4	0	40.23	-	-	74	-33.77	0-360	150	H
2	* 4.805	25.83	Pk	33.9	-24.3	0	35.43	-	-	74	-38.57	0-360	150	V
3	7.194	23.97	Pk	35.7	-21.5	0	38.17	-	-	74	-35.83	0-360	250	V
6	9.606	21.02	Pk	36.9	-18.4	0	39.52	-	-	74	-34.48	0-360	250	V

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

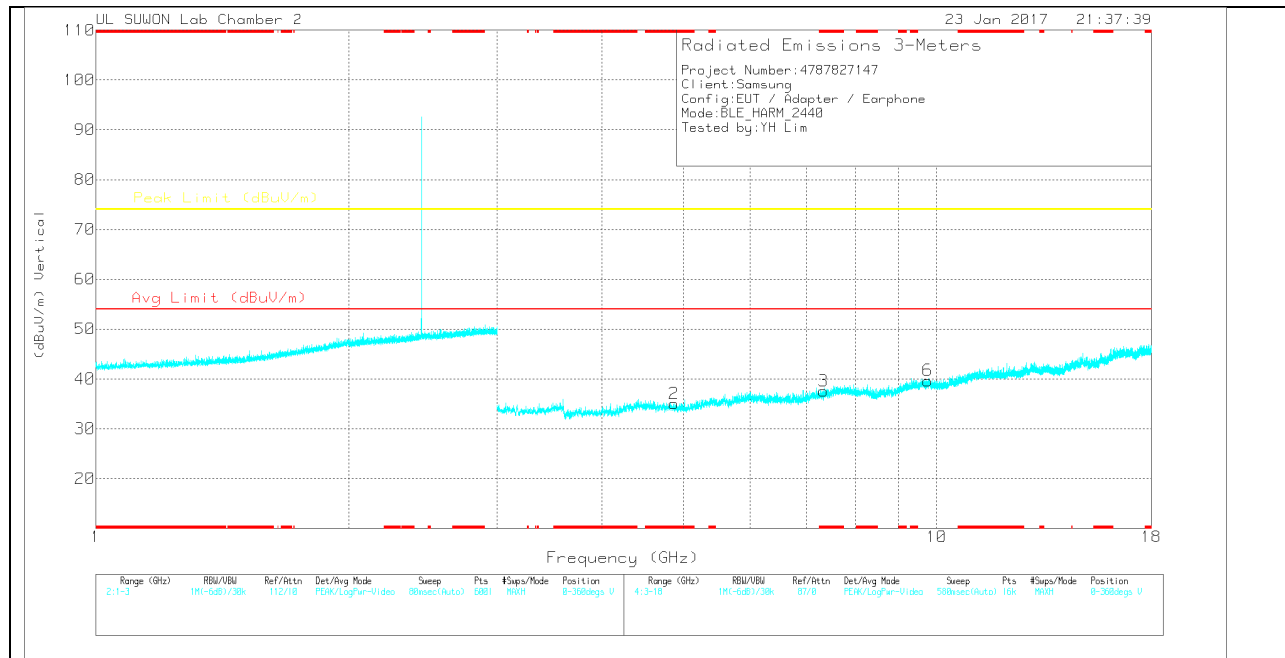
Pk – Peak detector

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

### MID CHANNEL HORIZONTAL



### MID CHANNEL VERTICAL



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

**MID CHANNEL DATA**

Trace Markers

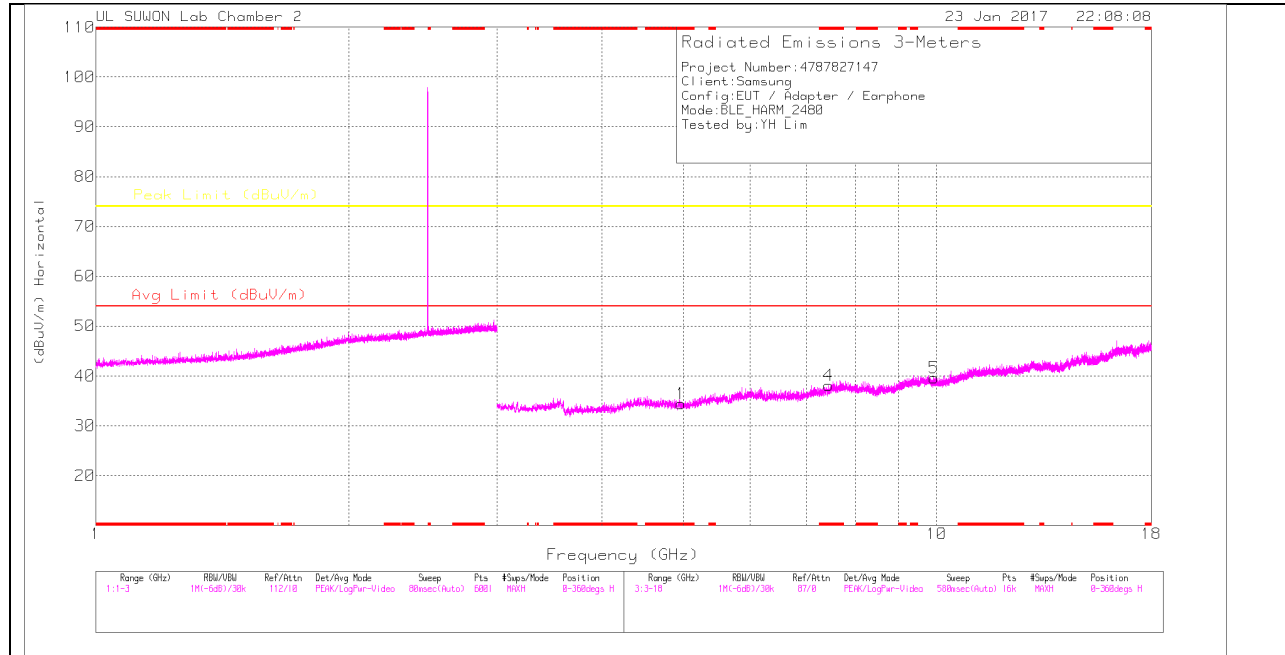
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 24)_150619	3GHz_HP[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.875	25.61	Pk	33.9	-24.5	0	35.01	-	-	74	-38.99	0-360	150	H
4	* 7.338	22.92	Pk	35.9	-21.9	0	36.92	-	-	74	-37.08	0-360	150	H
5	9.758	20.66	Pk	37	-18	0	39.66	-	-	74	-34.34	0-360	150	H
2	* 4.872	25.64	Pk	33.9	-24.5	0	35.04	-	-	74	-38.96	0-360	150	V
3	* 7.338	23.58	Pk	35.9	-21.9	0	37.58	-	-	74	-36.42	0-360	250	V
6	9.751	20.77	Pk	37	-18.1	0	39.67	-	-	74	-34.33	0-360	250	V

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

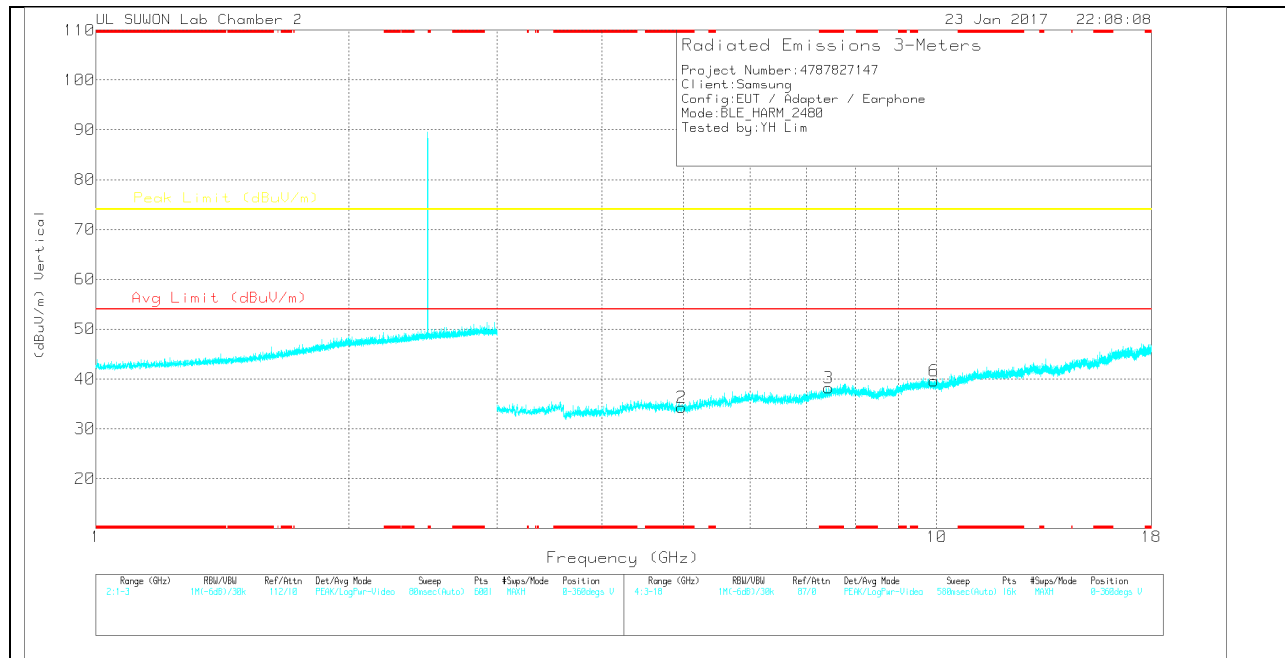
Pk – Peak detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (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(001687 24)_150619	3GHz_HP[dB]	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	* 4.965	25.24	Pk	33.9	-24.7	0	34.44	-	-	74	-39.56	0-360	150	H
4	* 7.438	23.1	Pk	36	-21	0	38.1	-	-	74	-35.9	0-360	250	H
5	9.919	20.56	Pk	37.1	-18	0	39.66	-	-	74	-34.34	0-360	250	H
2	* 4.97	25.06	Pk	33.9	-24.7	0	34.26	-	-	74	-39.74	0-360	250	V
3	* 7.433	23.21	Pk	36	-21	0	38.21	-	-	74	-35.79	0-360	150	V
6	9.922	20.39	Pk	37.2	-18	0	39.59	-	-	74	-34.41	0-360	250	V

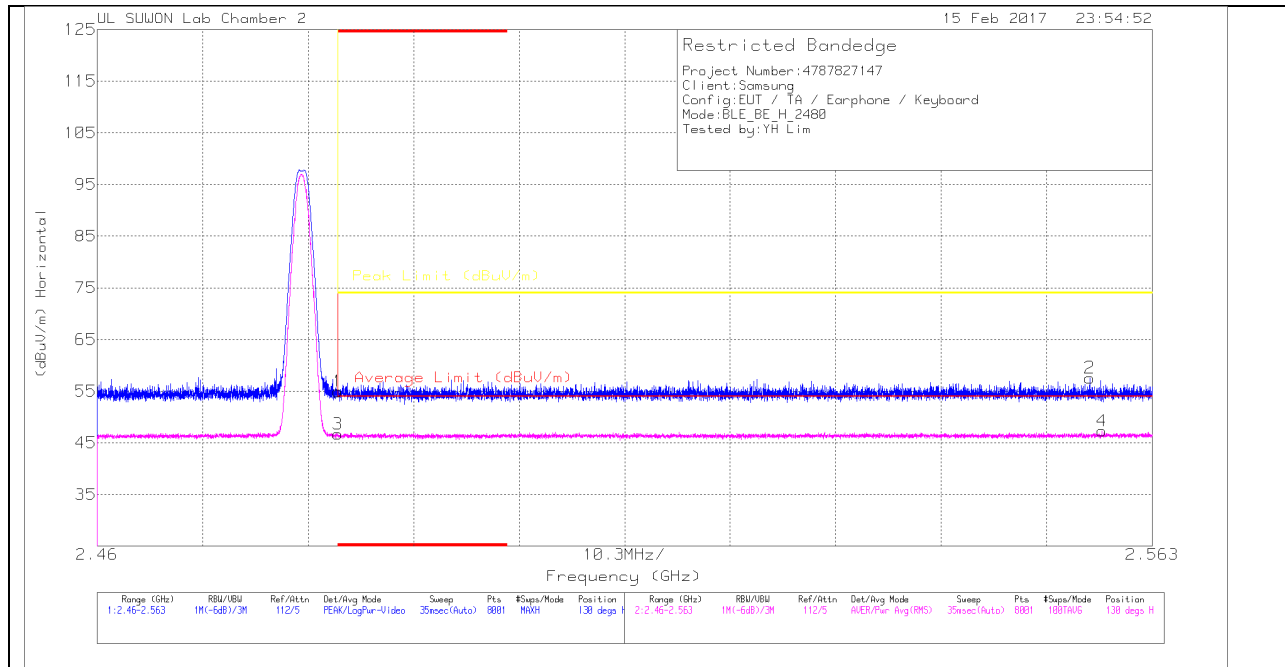
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk – Peak detector

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

## AUTHORIZED BANDEDGE (HIGH CHANNEL) equipped with keyboard

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

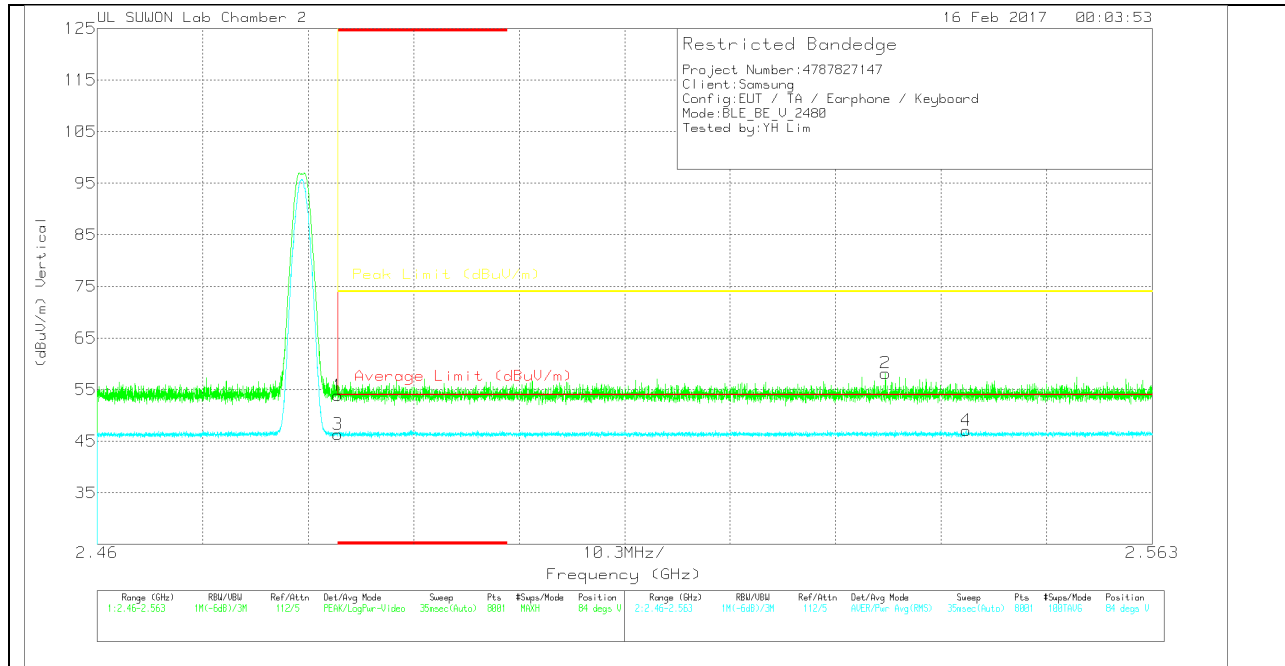
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 24)_150619	10dB(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.15	Pk		-18	0	54.95	-	-	74	-19.05	130	100	H
2	2.557	43.66	Pk		-18	0	57.56	-	-	74	-16.44	130	100	H
3	* 2.484	31.01	RMS		-18	1.9	46.71	54	-7.29	-	-	130	100	H
4	2.558	31.49	RMS		-18	1.9	47.29	54	-6.71	-	-	130	100	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	10dB[dB]	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	40.09	Pk	31.8	-18	0	53.89	-	-	74	-20.11	84	236	V
2	2.537	44.31	Pk	31.9	-18	0	58.21	-	-	74	-15.79	84	236	V
3	* 2.484	30.67	RMS	31.8	-18	1.9	46.37	54	-7.63	-	-	84	236	V
4	2.545	31.31	RMS	31.9	-18	1.9	47.11	54	-6.89	-	-	84	236	V

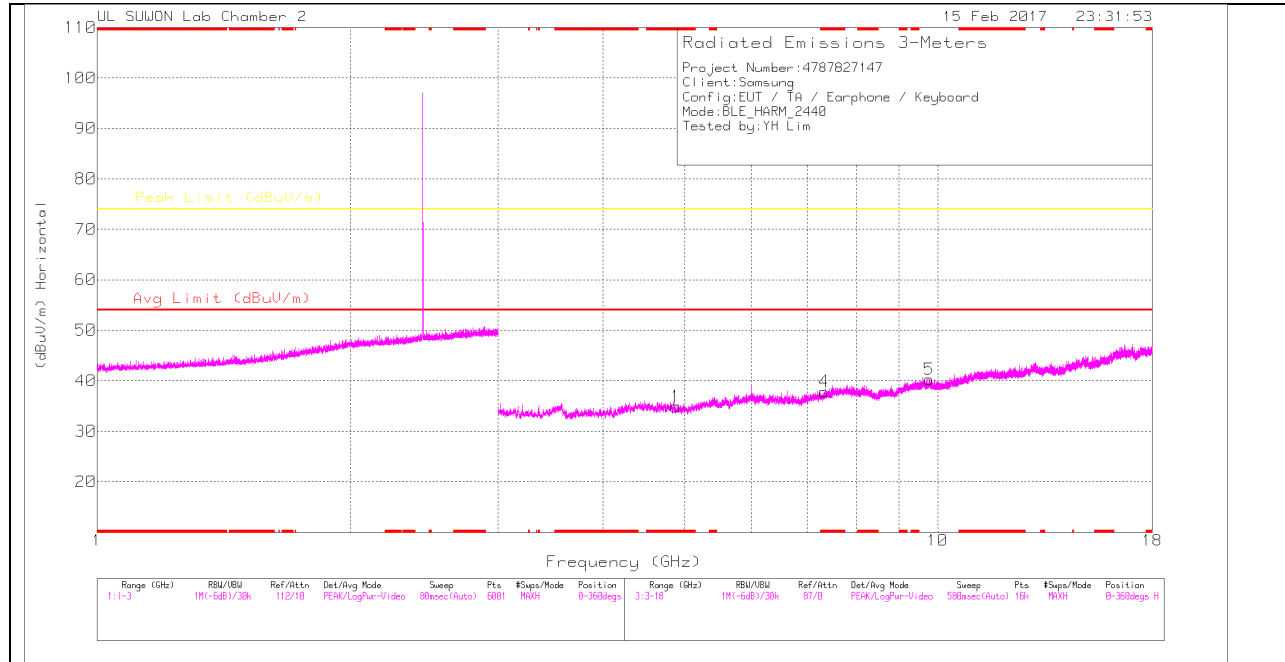
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

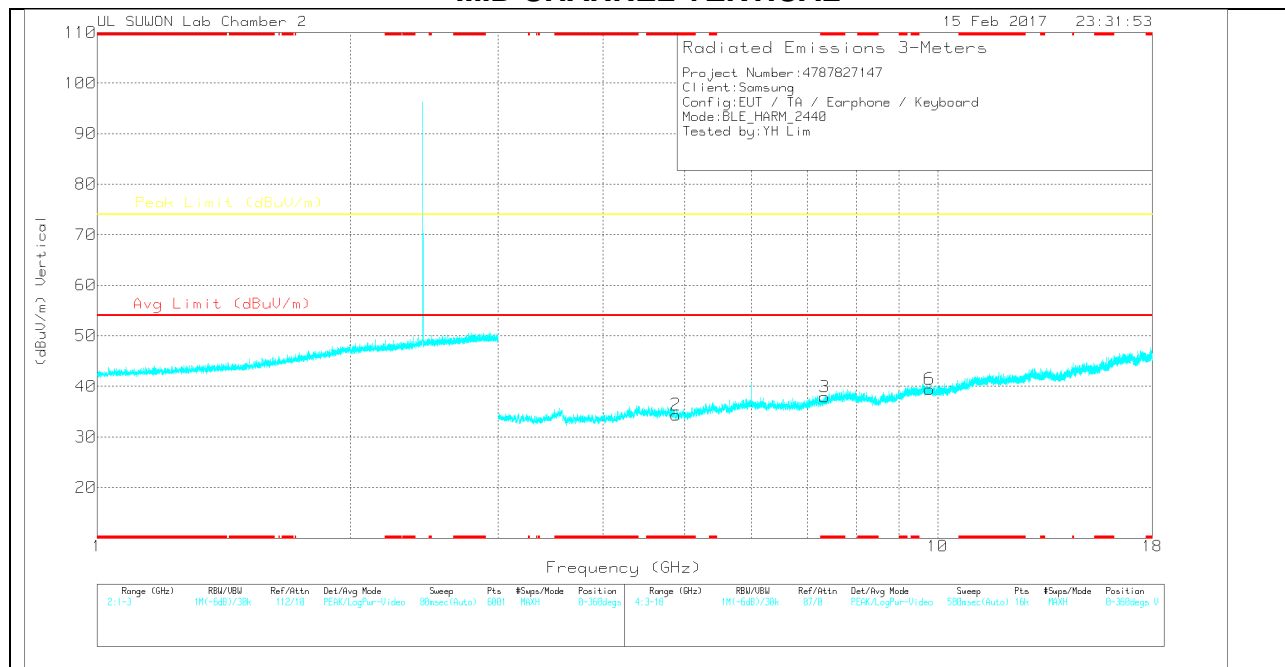
RMS - RMS detection

**HARMONICS AND SPURIOUS EMISSIONS equipped with keyboard**

**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 24)_150619	3GHz_HP[dB]	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	* 4.881	25.59	Pk	33.9	-24.6	0	34.89	-	-	74	-39.11	0-360	250	H
4	* 7.332	23.83	Pk	35.9	-21.9	0	37.83	-	-	74	-36.17	0-360	150	H
5	9.775	21.27	Pk	37	-18	0	40.27	-	-	74	-33.73	0-360	150	H
2	* 4.881	25.06	Pk	33.9	-24.6	0	34.36	-	-	74	-39.64	0-360	150	V
3	* 7.336	23.92	Pk	35.9	-21.9	0	37.92	-	-	74	-36.08	0-360	250	V
6	9.778	20.46	Pk	37	-18	0	39.46	-	-	74	-34.54	0-360	150	V

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

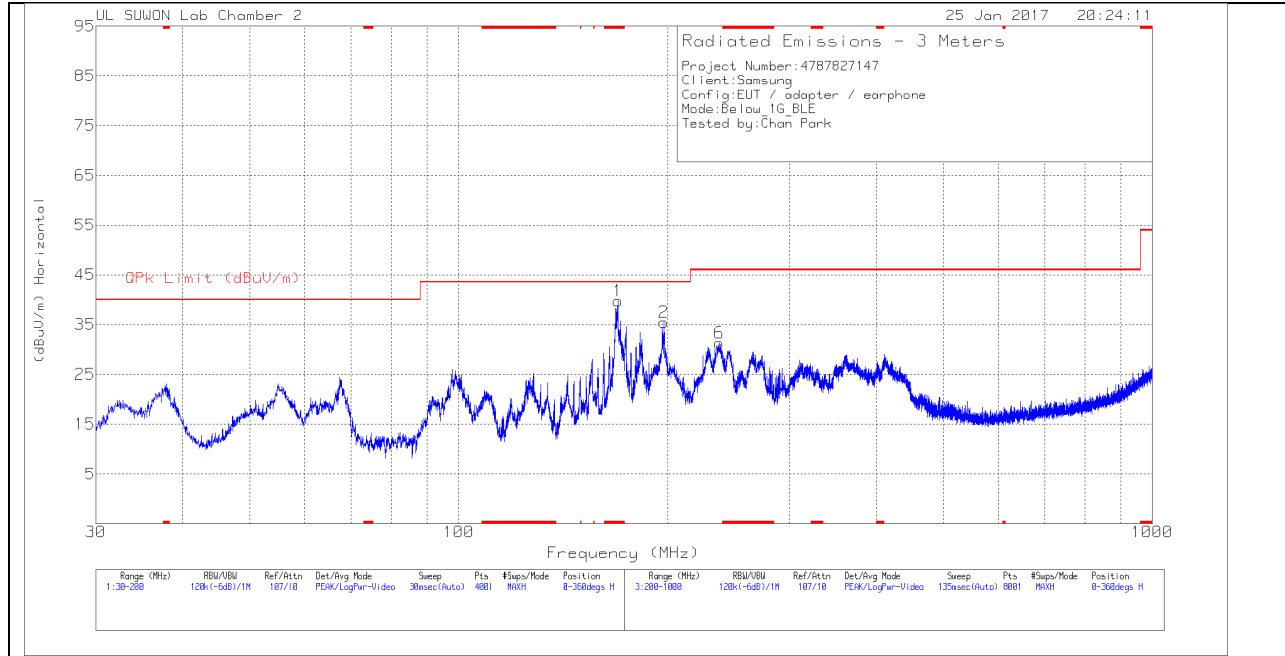
Pk – Peak detector

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

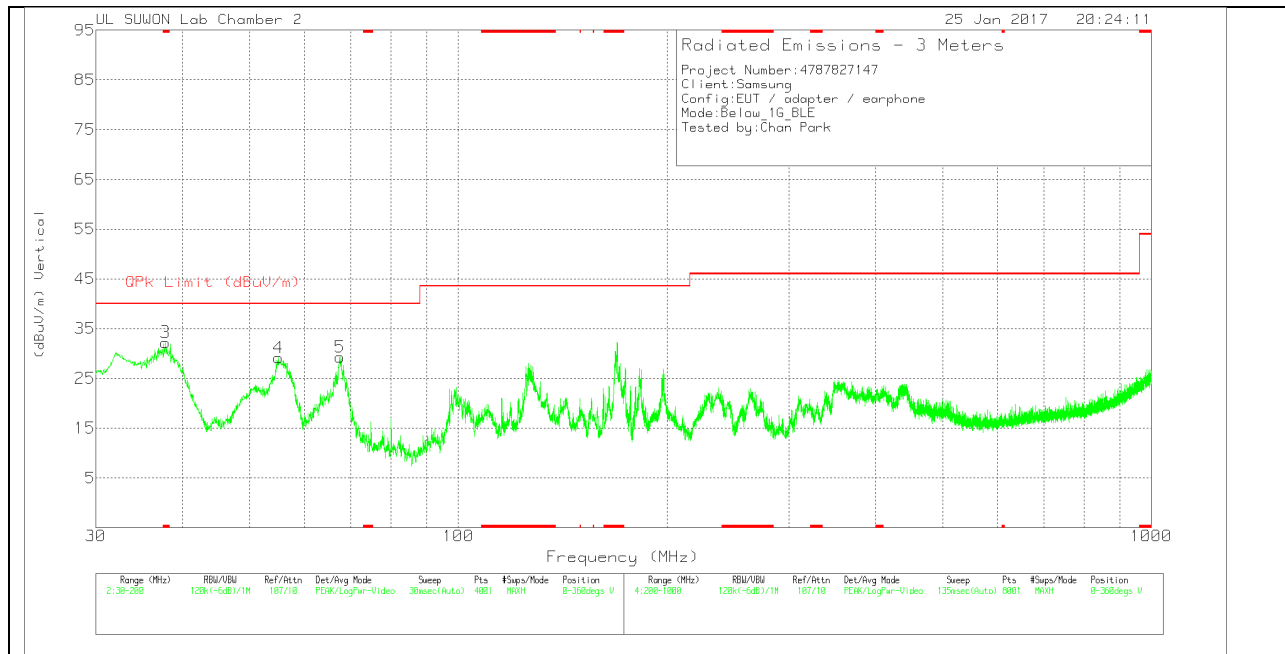
### 10.3. WORST-CASE BELOW 1 GHz

#### 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	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 169.6975	61.34	Pk	9	-30.6	39.74	43.52	-3.78	0-360	200	H
2	197.8325	54.85	Pk	11.2	-30.6	35.45	43.52	-8.07	0-360	102	H
3	* 37.82	51.95	Pk	11.9	-31.6	32.25	40	-7.75	0-360	100	V
4	55.0325	47.2	Pk	13.4	-31.4	29.2	40	-10.8	0-360	100	V
5	67.5275	50.15	Pk	10.4	-31.3	29.25	40	-10.75	0-360	100	V
6	237.3	49.47	Pk	12.2	-30.4	31.27	46.02	-14.75	0-360	100	H

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

Pk - Peak detector

Radiated Emissions

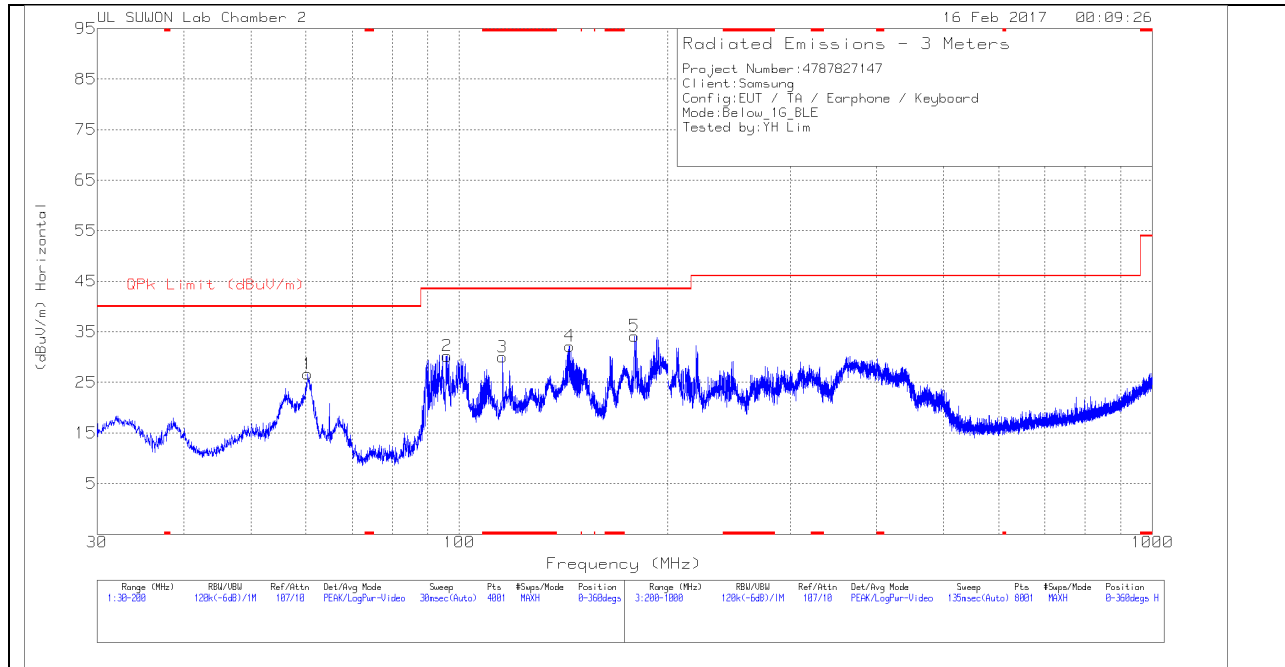
Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 169.6125	61.14	Qp	9	-30.6	39.54	43.52	-3.98	306	203	H
197.8296	53.68	Qp	11.2	-30.6	34.28	43.52	-9.24	344	163	H
* 37.8727	48.55	Qp	11.9	-31.6	28.85	40	-11.15	241	101	V

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

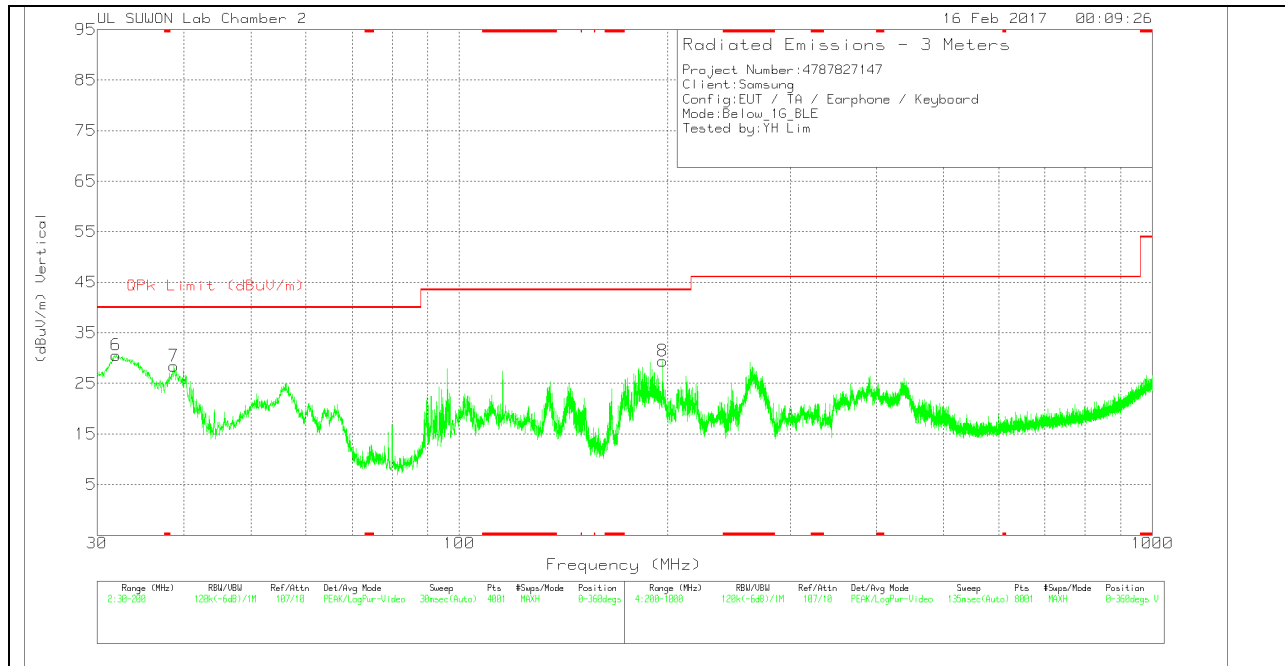
Qp - Quasi-Peak detector

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION) equipped with keyboard**

**HORIZONTAL PLOT**



**VERTICAL PLOT**



**BELOW 1 GHz TABLE**

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	60.3875	45.24	Pk	12.7	-31.3	26.64	40	-13.36	0-360	400	H
2	95.96	50.53	Pk	10.8	-31.1	30.23	43.52	-13.29	0-360	400	H
3	* 115.3825	50.6	Pk	10.3	-30.9	30	43.52	-13.52	0-360	300	H
4	144.1975	54.89	Pk	8.1	-30.8	32.19	43.52	-11.33	0-360	300	H
5	179.005	55.38	Pk	9.4	-30.6	34.18	43.52	-9.34	0-360	200	H
6	31.955	51.78	Pk	10.4	-31.6	30.58	40	-9.42	0-360	100	V
7	38.7125	47.73	Pk	12.2	-31.5	28.43	40	-11.57	0-360	100	V
8	196.3875	48.93	Pk	11	-30.5	29.43	43.52	-14.09	0-360	100	V

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

Pk - Peak detector

## 11. 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.

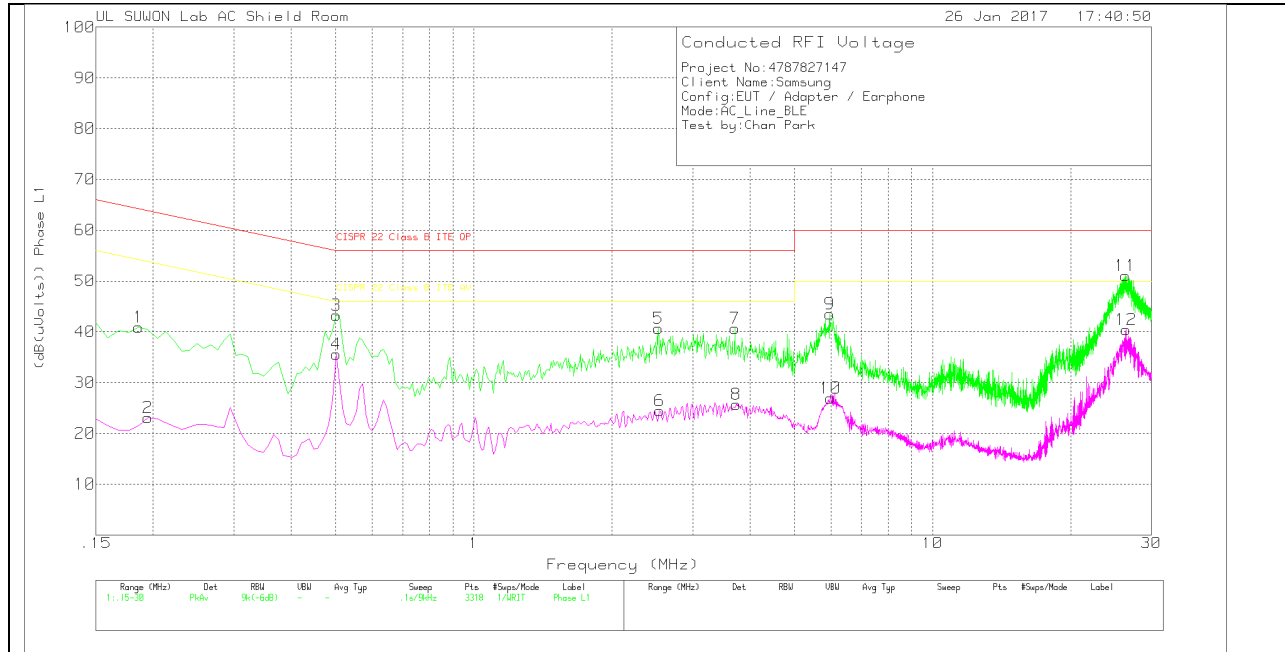
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

**RESULTS**

**6 WORST EMISSIONS**

**LINE 1 PLOT**



**LINE 1 RESULTS**

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith 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	.186	31.01	Pk	9.9	0	40.91	64.21	-23.3	-	-
2	.195	13.22	Av	9.9	0	23.12	-	-	53.82	-30.7
3	.501	33.34	Pk	9.9	0	43.24	56	-12.76	-	-
4	.501	25.69	Av	9.9	0	35.59	-	-	46	-10.41
5	2.526	30.84	Pk	9.7	.1	40.64	56	-15.36	-	-
6	2.544	14.65	Av	9.7	.1	24.45	-	-	46	-21.55
7	3.705	30.75	Pk	9.8	.1	40.65	56	-15.35	-	-
8	3.732	15.76	Av	9.8	.1	25.66	-	-	46	-20.34
9	5.964	33.57	Pk	9.8	.1	43.47	60	-16.53	-	-
10	5.982	17.09	Av	9.8	.1	26.99	-	-	50	-23.01
11	26.385	40.11	Pk	10.6	.3	51.01	60	-8.99	-	-
12	26.394	29.55	Av	10.6	.3	40.45	-	-	50	-9.55

Pk - Peak detector

Av - Average detection

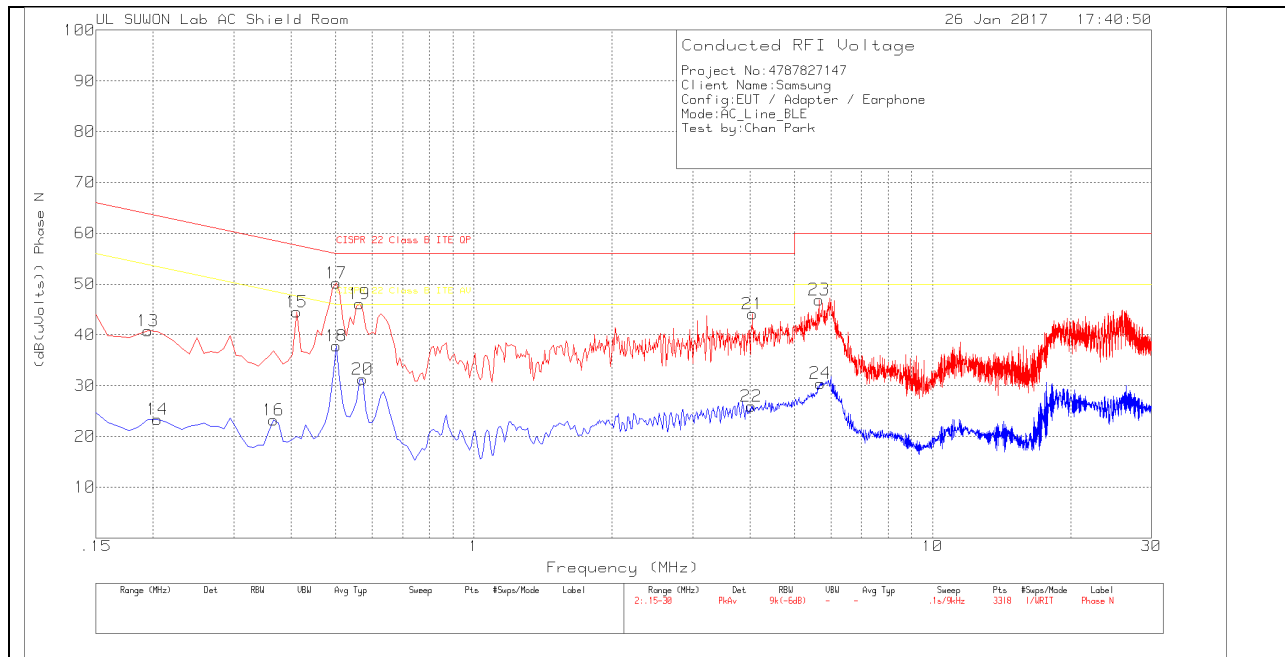
Quasi-Peak Emissions

Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h 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)
.1905	24.99	Qp	9.9	0	34.89	64.01	-29.12	-	-
.5019	30.53	Qp	9.9	0	40.43	56	-15.57	-	-
2.5296	23.27	Qp	9.7	.1	33.07	56	-22.93	-	-
3.7032	22.7	Qp	9.8	.1	32.6	56	-23.4	-	-
5.9685	24.5	Qp	9.8	.1	34.4	60	-25.6	-	-
26.3877	36.99	Qp	10.6	.3	47.89	60	-12.11	-	-

Qp – Quasi-Peak detector

**LINE 2 PLOT**



**LINE 2 RESULTS**

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h 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	.195	30.86	Pk	9.9	0	40.76	63.82	-23.06	-	-
14	.204	13.45	Av	9.9	0	23.35	-	-	53.45	-30.1
15	.411	34.55	Pk	9.9	0	44.45	57.63	-13.18	-	-
16	.366	13.36	Av	9.9	0	23.26	-	-	48.59	-25.33
17	.501	40.34	Pk	9.9	0	50.24	56	-5.76	-	-
18	.501	27.96	Av	9.9	0	37.86	-	-	46	-8.14
19	.564	36.15	Pk	9.9	0	46.05	56	-9.95	-	-
20	.573	21.33	Av	9.9	0	31.23	-	-	46	-14.77
21	4.056	34.25	Pk	9.8	.1	44.15	56	-11.85	-	-
22	4.029	16.09	Av	9.8	.1	25.99	-	-	46	-20.01
23	5.658	36.91	Pk	9.9	.1	46.91	60	-13.09	-	-
24	5.694	20.46	Av	9.9	.1	30.46	-	-	50	-19.54

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

Phase N .15 - 30MHz

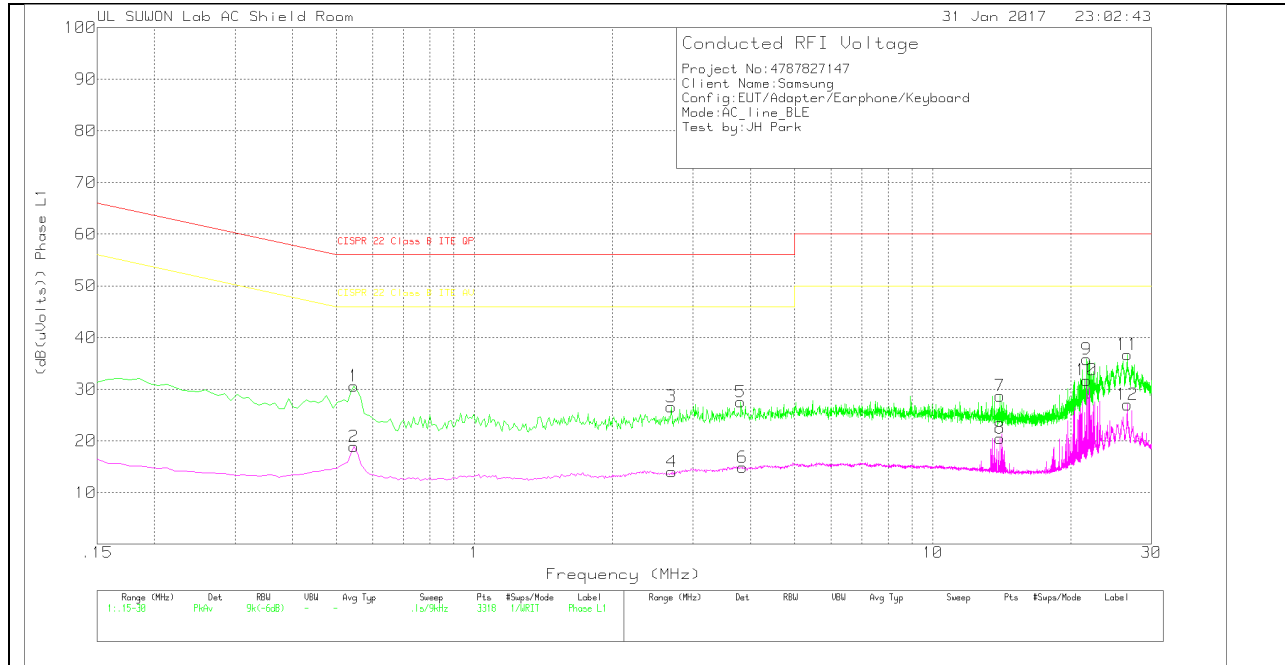
Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.1959	25.48	Qp	9.9	0	35.38	63.78	-28.4	-	-
.4155	22.78	Qp	9.9	0	32.68	57.54	-24.86	-	-
.4992	38.48	Qp	9.9	0	48.38	56.01	-7.63	-	-
.5685	32.5	Qp	9.9	0	42.4	56	-13.6	-	-
4.056	25.54	Qp	9.8	.1	35.44	56	-20.56	-	-
5.6553	29.55	Qp	9.9	.1	39.55	60	-20.45	-	-

Qp – Quasi-Peak detector

**RESULTS equipped with keyboard**

**6 WORST EMISSIONS**

**LINE 1 PLOT**



**LINE 1 RESULTS**

Trace Markers

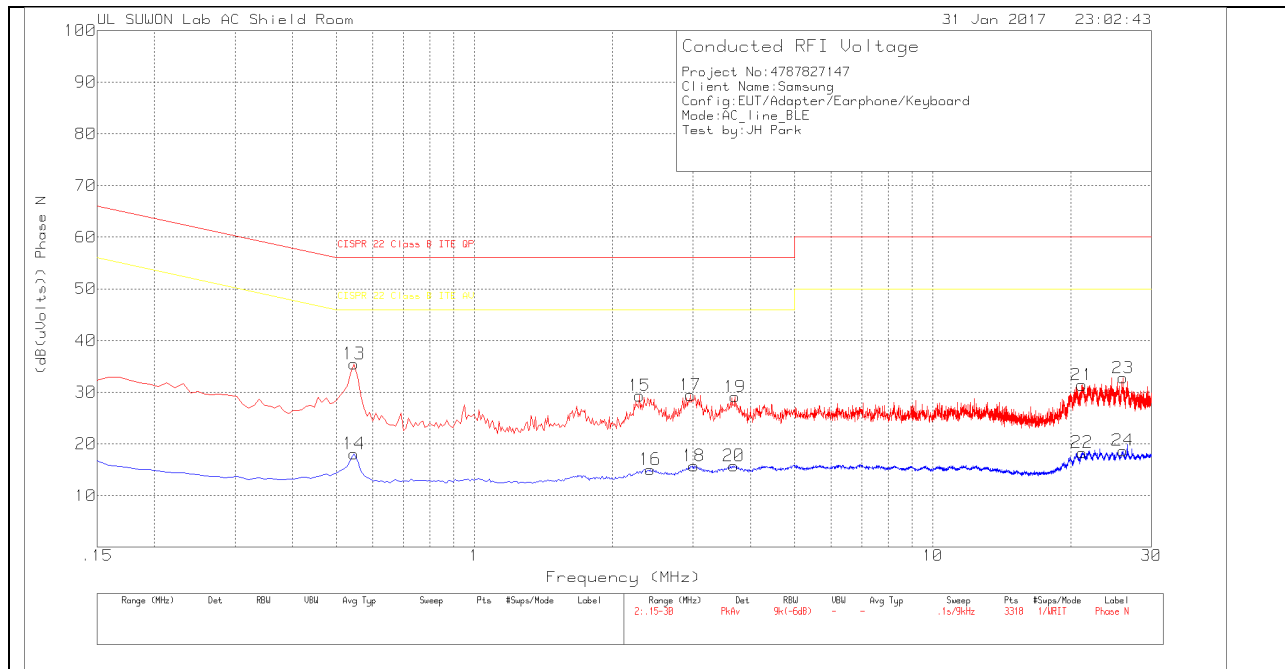
Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith 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	.546	20.71	Pk	9.9	0	30.61	56	-25.39	-	-
2	.546	9.01	Av	9.9	0	18.91	-	-	46	-27.09
3	2.688	16.81	Pk	9.7	.1	26.61	56	-29.39	-	-
4	2.697	4.21	Av	9.7	.1	14.01	-	-	46	-31.99
5	3.813	17.62	Pk	9.8	.1	27.52	56	-28.48	-	-
6	3.849	4.96	Av	9.8	.1	14.86	-	-	46	-31.14
7	14.028	18.42	Pk	10.1	.2	28.72	60	-31.28	-	-
8	14.028	10.23	Av	10.1	.2	20.53	-	-	50	-29.47
9	21.66	25.19	Pk	10.4	.2	35.79	60	-24.21	-	-
10	21.66	21.15	Av	10.4	.2	31.75	-	-	50	-18.25
11	26.61	25.82	Pk	10.6	.3	36.72	60	-23.28	-	-
12	26.61	16.13	Av	10.6	.3	27.03	-	-	50	-22.97

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_w ith 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	.546	25.6	Pk	9.9	0	35.5	56	-20.5	-	-
14	.546	8.18	Av	9.9	0	18.08	-	-	46	-27.92
15	2.292	19.53	Pk	9.7	.1	29.33	56	-26.67	-	-
16	2.418	5.26	Av	9.7	.1	15.06	-	-	46	-30.94
17	2.958	19.65	Pk	9.7	.1	29.45	56	-26.55	-	-
18	3.012	5.86	Av	9.8	.1	15.76	-	-	46	-30.24
19	3.705	19.24	Pk	9.8	.1	29.14	56	-26.86	-	-
20	3.678	5.86	Av	9.8	.1	15.76	-	-	46	-30.24
21	21.165	20.51	Pk	10.7	.2	31.41	60	-28.59	-	-
22	21.174	7.45	Av	10.7	.2	18.35	-	-	50	-31.65
23	26.025	21.59	Pk	10.9	.3	32.79	60	-27.21	-	-
24	25.998	7.52	Av	10.9	.3	18.72	-	-	50	-31.28

Pk - Peak detector

Av - Average detection