



FCC CFR47 PART 15 SUBPART C

Bluetooth Low Energy

CERTIFICATION TEST REPORT

FOR

Bluetooth/BLE and DTS/UNII a/b/g/n/ac Tablet

MODEL NUMBER : SM-W620

FCC ID: A3LSMW620

REPORT NUMBER: 478783948-E2V2

ISSUE DATE: MAR 15 , 2017

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	03/10/17	Initial issue	Junwhan Lee
V2	03/15/17	Revised section 1.3	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: Bluetooth/BLE and DTS/UNII a/b/g/n/ac Tablet

MODEL NUMBER: SM-W620

SERIAL NUMBER: 9XB1R32HC00284, 9XB1R32HC00285 (RADIATED, Original model);
9XB1R32HC0004LK (CONDUCTED, Original model);
9X8LR32J2000G1H (RADIATED, Spot check model)

DATE TESTED: JAN 25, 2017 - FEB 03, 2017 (Original Test)
MAR 07, 2017 (Spot check Test)

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
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SungGil Park
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Junwhan Lee
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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMW627, DTS BLE(FCC CFR 47 Part 15C). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMW620 shares the same enclosure and circuit board as FCC ID: A3LSMTW627. The BLE circuitry and layout are identical between these two units. The WLAN antennas and surrounding circuitry are the same between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMW627 remains representative of FCC ID: A3LSMW620. The test data of FCC ID: A3LSMW627 being submitted for this application to cover BLE features.

1.3. SPOT CHECK VERIFICATION DATA

Band	Test Item	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
				SM-W627 Results	SM-W620 Results		
				FCC ID : A3LSMW627	FCC ID : A3LSMW620		
DTS BLE (2.4GHz)	Band Edge	2480	54 dBuV/m	42.53 dBuV/m	42.11 dBuV/m	-0.42 dBc	
	RSE	2440	74 dBuV/m	41.4 dBuV/m	40.28 dBuV/m	-1.12 dBc	Noise floor level (Both data)

Comparison of two models, all test results of spotcheck model are lower than original model. Also all test results comply with FCC Technical Limits.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Type Grant/Permissive Change	Reference Application	Folder Test/RF Exposure	Report Title / Section
DTS	A3LSMW627	Grant	4787821360-E1V1	Test	FCC Report DTS WLAN / All sections
			4787821360-E2V1	Test	FCC Report DTS BLE / All sections
			4787821360-S1V1	RF Exposure	FCC Report SAR / Section 9.3, 10.5
DSS	A3LSMW627	Grant	4787821360-E3V1	Test	FCC Report BT / All sections
			4787821360-S1V1	RF Exposure	FCC Report SAR / Section 9.5, 10.7

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
☒ 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:

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

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 Bluetooth/BLE and DTS/UNII a/b/g/n/ac Tablet.
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	4.259	2.67
		Average	4.016	2.52

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -2.1 dBi

5.4. WORST-CASE CONFIGURATION AND MODE

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

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

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

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Adapter	SAMSUNG	EP-TA600	R37HCEP01N1SE3	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

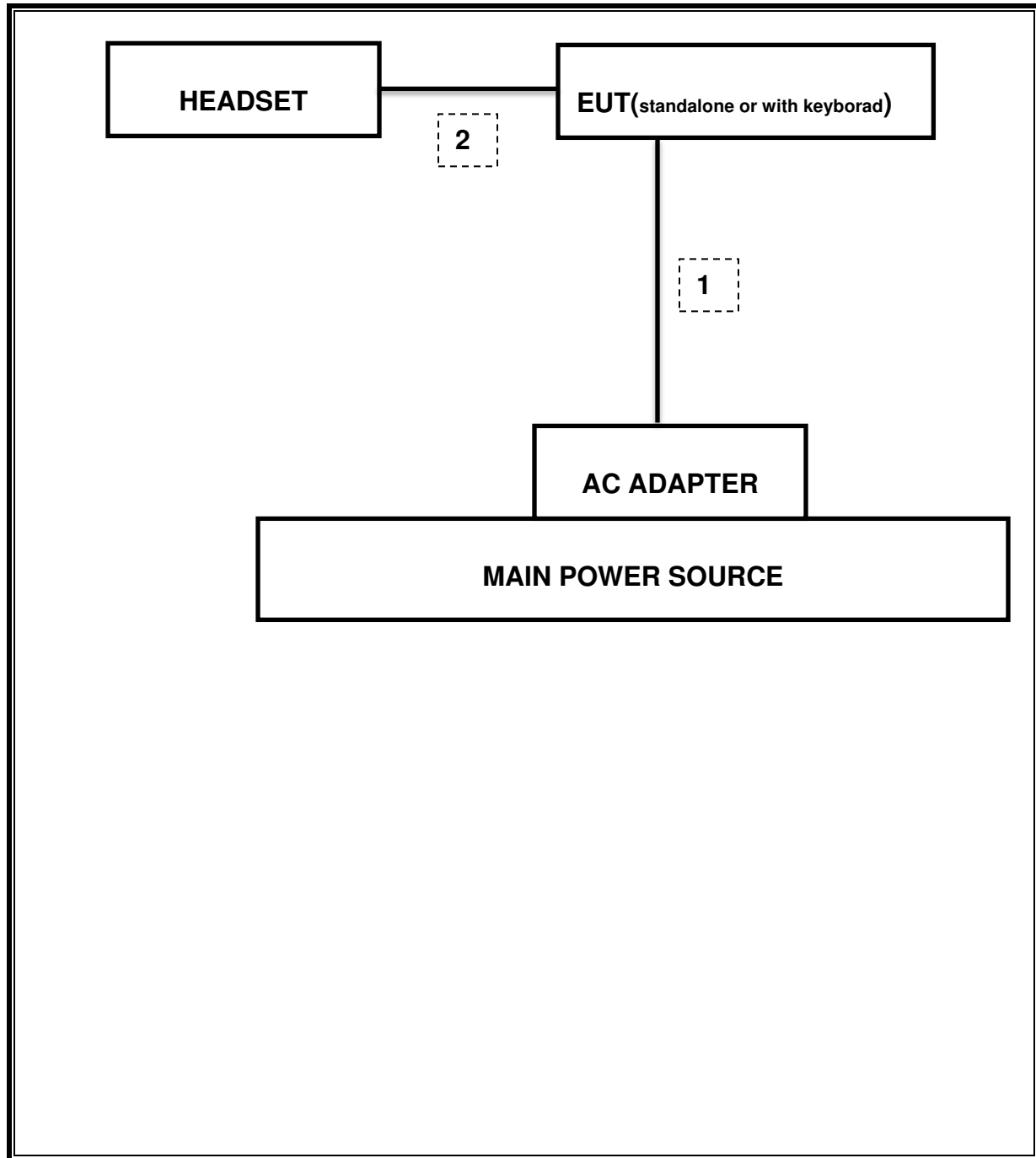
Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Keyboard	SAMSUNG	EJ-CW620	N/A	N/A

Additional radiated spurious emission measurements were performed on worst case condition(Max conducted power) equipped with keyboard. Test data shown on section 11 and setup photo shown on section 13. 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 in hidden menu 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	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	

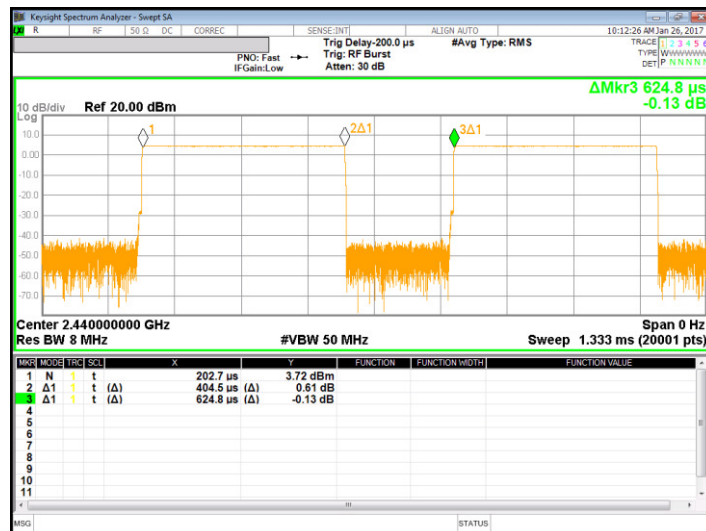
7. REFERENCE MEASUREMENT RESULTS

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]
2400MHz Bands						
BLE	0.405	0.625	0.647	64.7%	1.89	2.472

LIMITS

None: for reporting purposes only.



7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

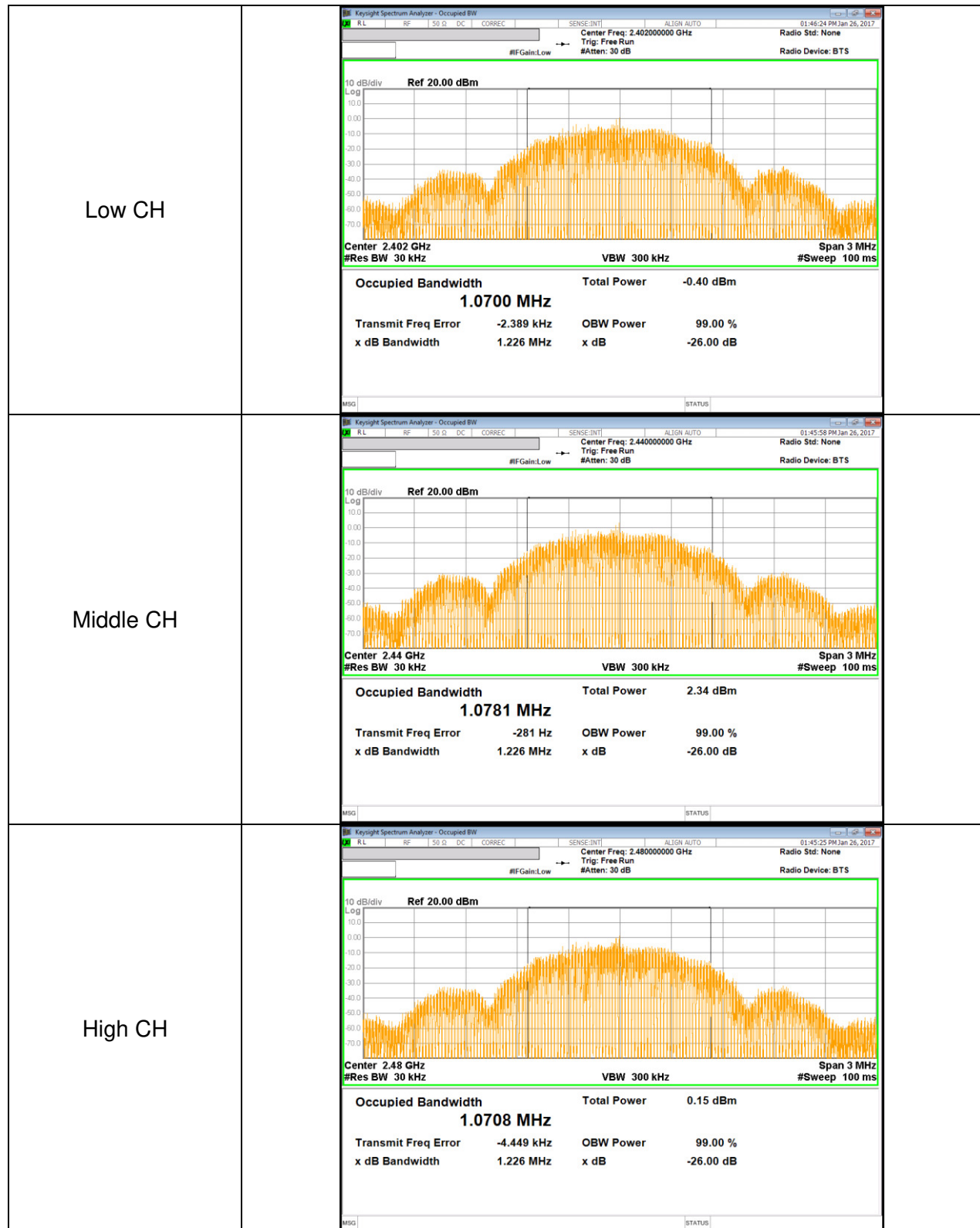
TEST PROCEDURE

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	1.070
Mid	2440	1.078
High	2480	1.071
Worst		1.078

99% BANDWIDTH PLOTS



8. 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	669.3 kHz
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-55.122 dBm
15.247	RSS-247 5.4(4)	TX conducted output power	<30dBm		Pass	4.259 dBm (Peak)
15.247	RSS-247 5.2(2)	PSD	<8dBm		Pass	-10.85 dBm (Peak)
15.207 (a)	RSS-GEN Clause 7 & 8.9	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	42.63 dBuV (Qp)
15.205, 15.209	RSS-GEN Clause 8.8	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	42.53 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	678.6	500.0
Mid	2440	672.0	500.0
High	2480	669.3	500.0
Worst		669.3	500.0

Low CH

Middle CH

High CH

The figure displays three screenshots of a Keysight Spectrum Analyzer, showing the signal spectrum for different channels (Low CH, Middle CH, and High CH). Each screenshot includes the following information:

- Top Panel:** Keysight Spectrum Analyzer - Sweep SA. Settings include: PNO: Wide, IF Gain: Low, Trig: Free Run, Atten: 30 dB, #Avg Type: RMS, Avg/Hold: 100/100. The date and time are 01:42:56 PM Jan 26, 2017.
- Plot Area:** The plot shows the signal spectrum with a reference level of 20.00 dBm. The y-axis is labeled "10 dB/div Log" and ranges from -70.0 to 10.0. The x-axis is labeled "MHz" and ranges from 2.400000 to 2.400000. The plot shows a signal peak at approximately 2.402000 GHz (Low CH), 2.439991600 GHz (Middle CH), and 2.479990625 GHz (High CH). The peak level is marked as -6.00 dB.
- Bottom Panel:** The bottom panel shows the center frequency, resolution bandwidth, and span. For Low CH: Center 2.4020000 GHz, #Res BW 100 kHz, #VBW 300 kHz, Sweep 1.333 ms (20001 pts). For Middle CH: Center 2.4400000 GHz, #Res BW 100 kHz, #VBW 300 kHz, Sweep 1.333 ms (20001 pts). For High CH: Center 2.4800000 GHz, #Res BW 100 kHz, #VBW 300 kHz, Sweep 1.333 ms (20001 pts).

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.

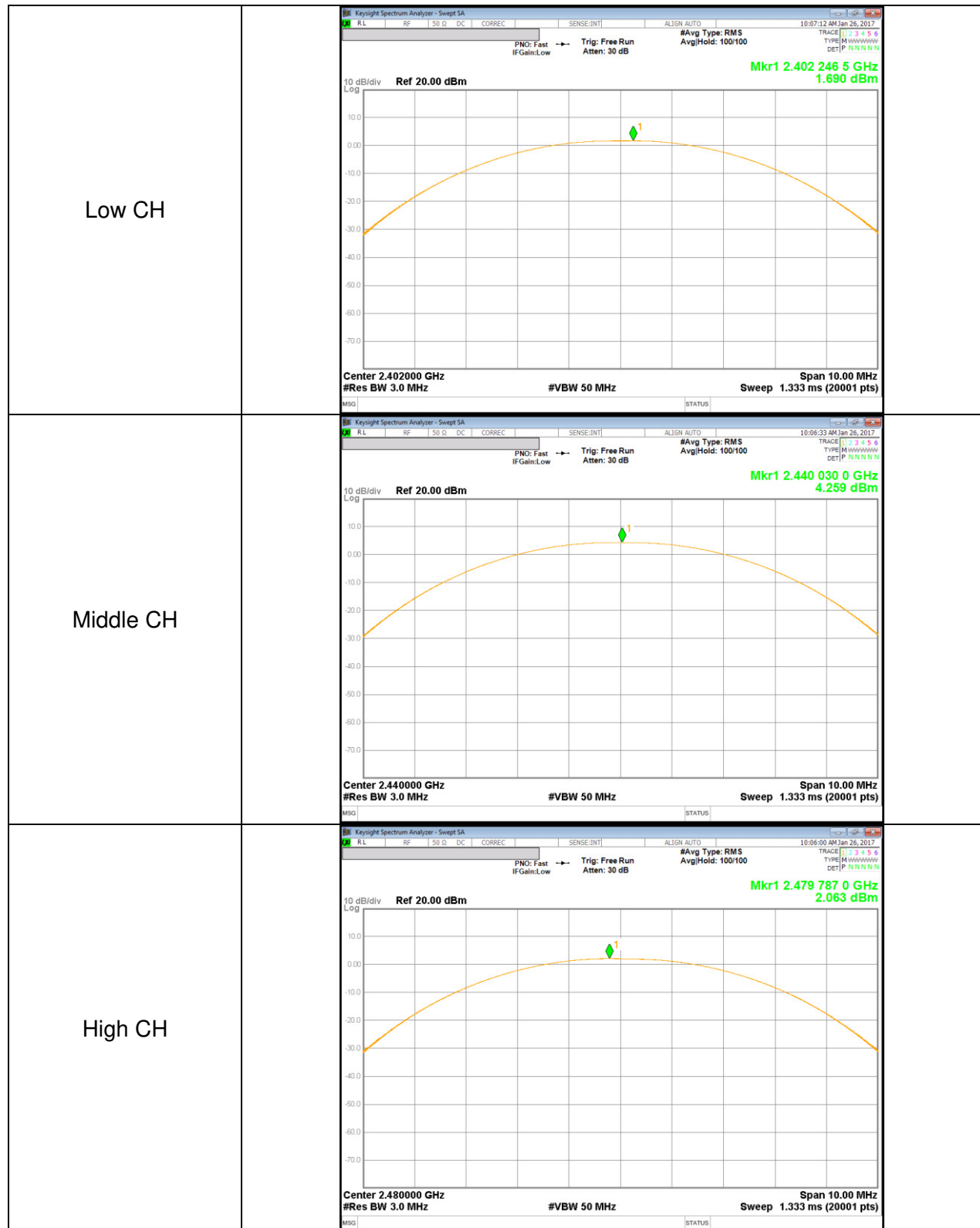
TEST PROCEDURE

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	1.690	30.000	-28.310
Mid	2440	4.259	30.000	-25.741
High	2480	2.063	30.000	-27.937
Worst		4.259		-25.741

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 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	1.427	1.389
Middle	2440	4.016	2.521
High	2480	1.747	1.495

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.

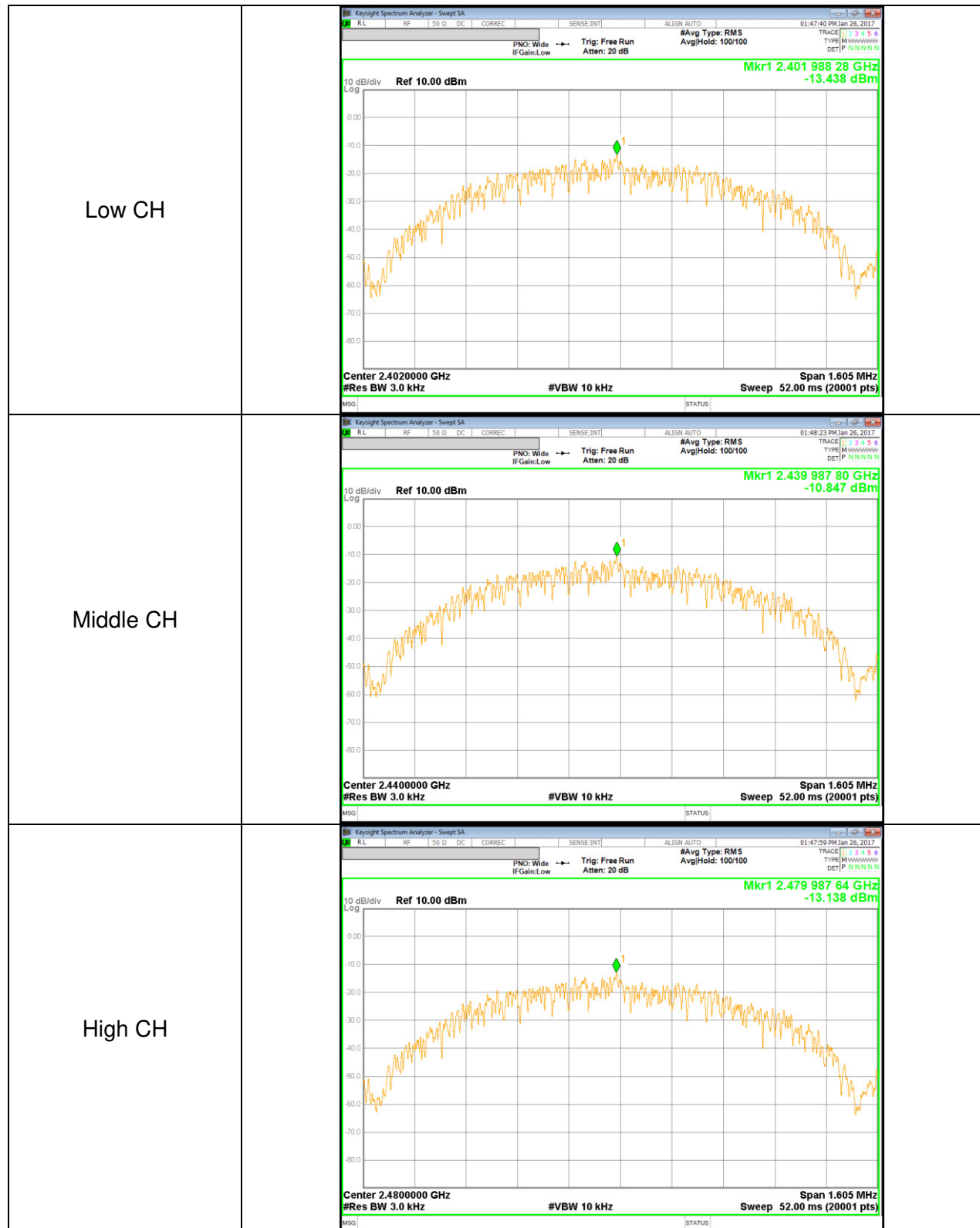
TEST PROCEDURE

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	-13.44	8.00	-21.44
Mid	2440	-10.85	8.00	-18.85
High	2480	-13.14	8.00	-21.14

POWER SPECTRAL DENSITY PLOTS



9.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

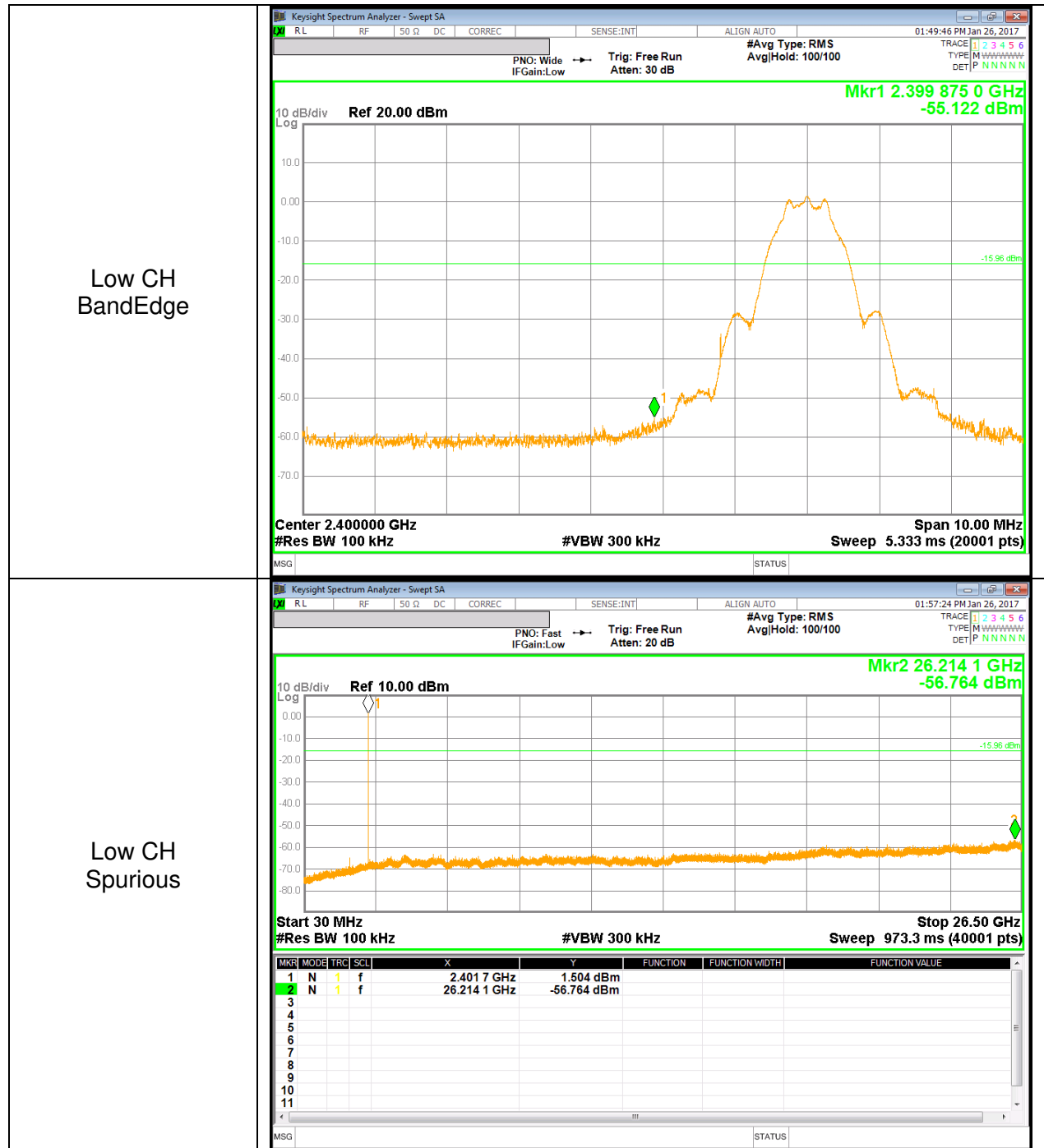
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

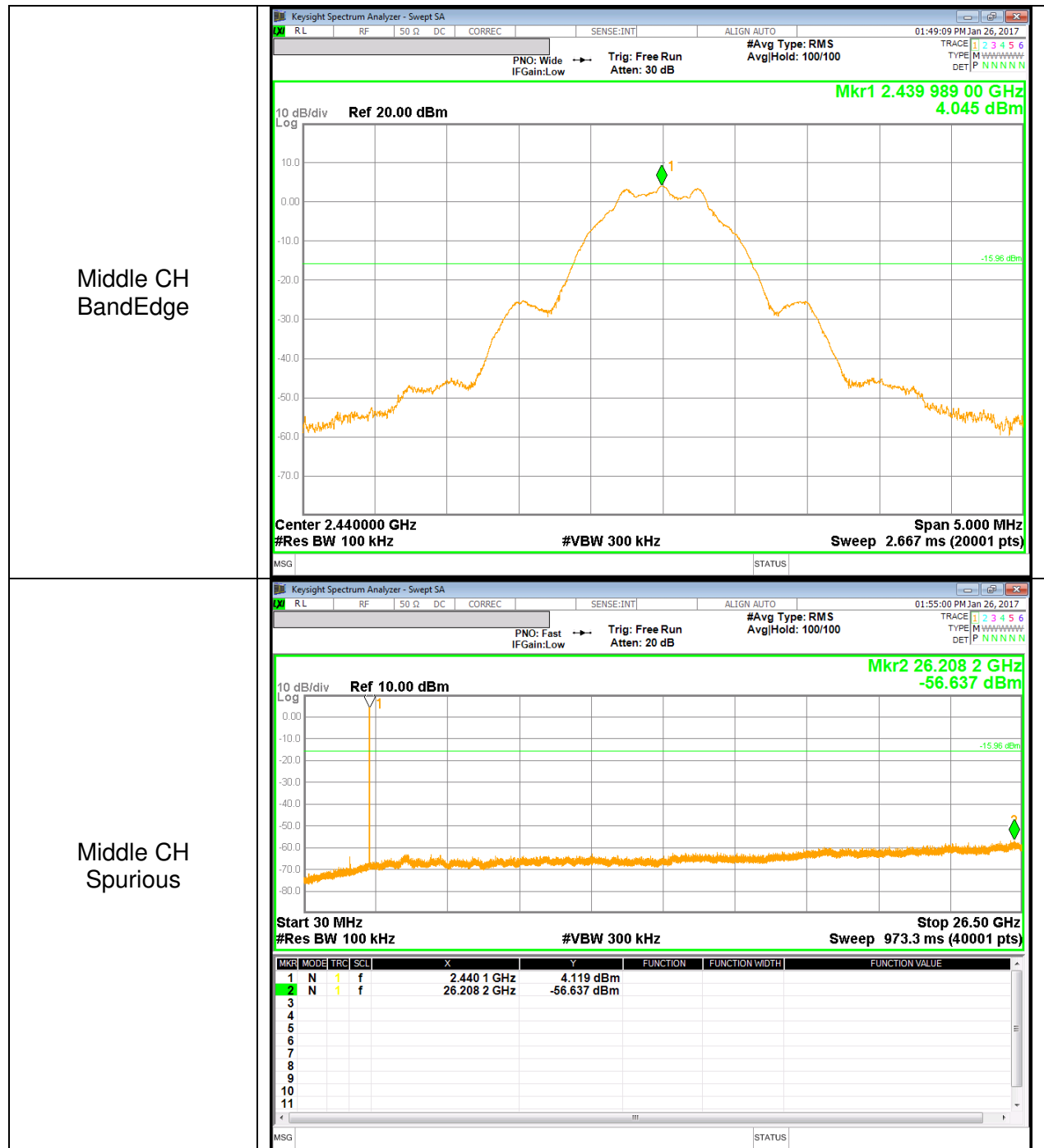
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

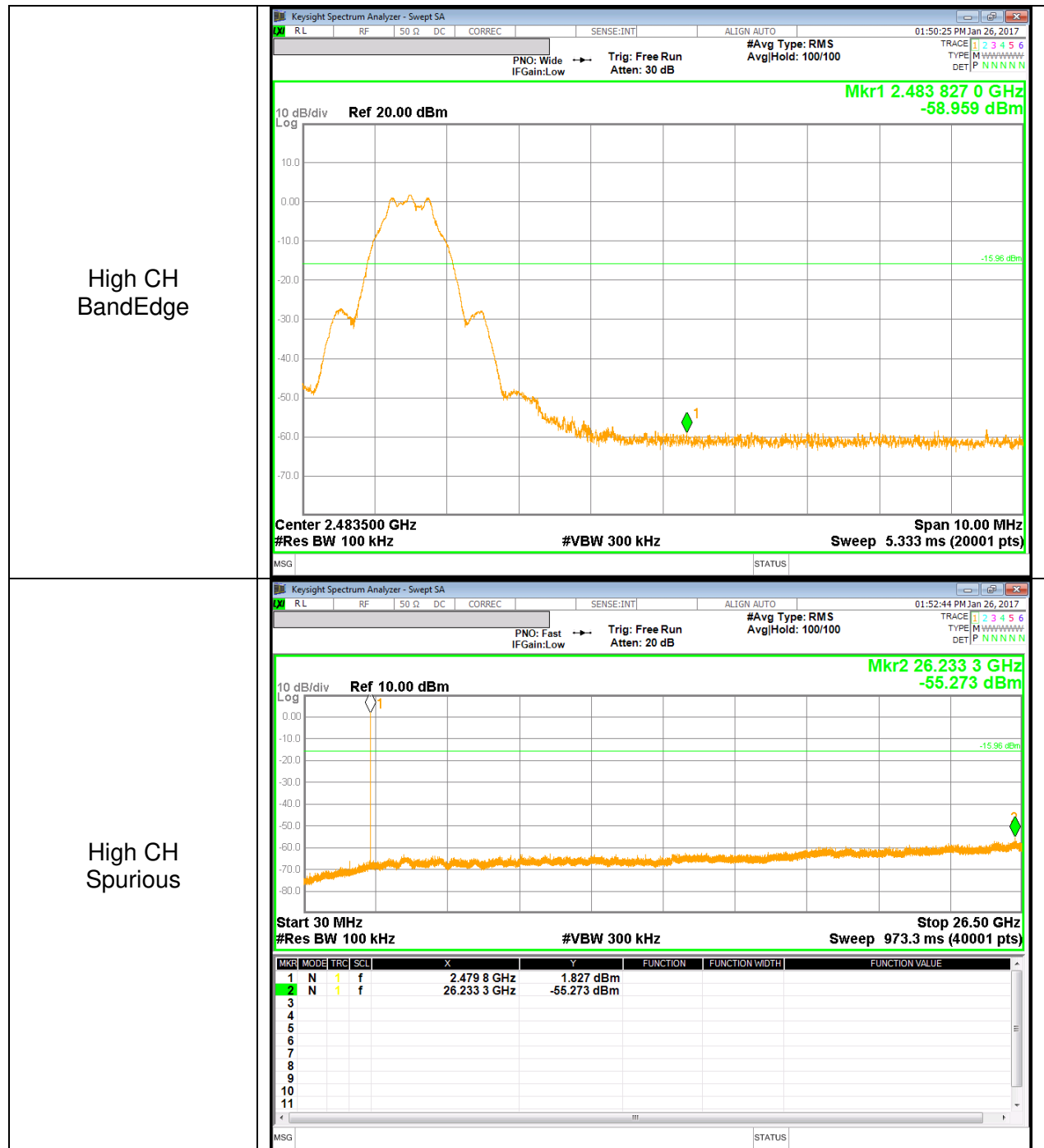
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL



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 = $10 \log(1/0.647) = 1.89\text{dB}$ (Spectrum Analyzer round it up to 1.89dB)

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.

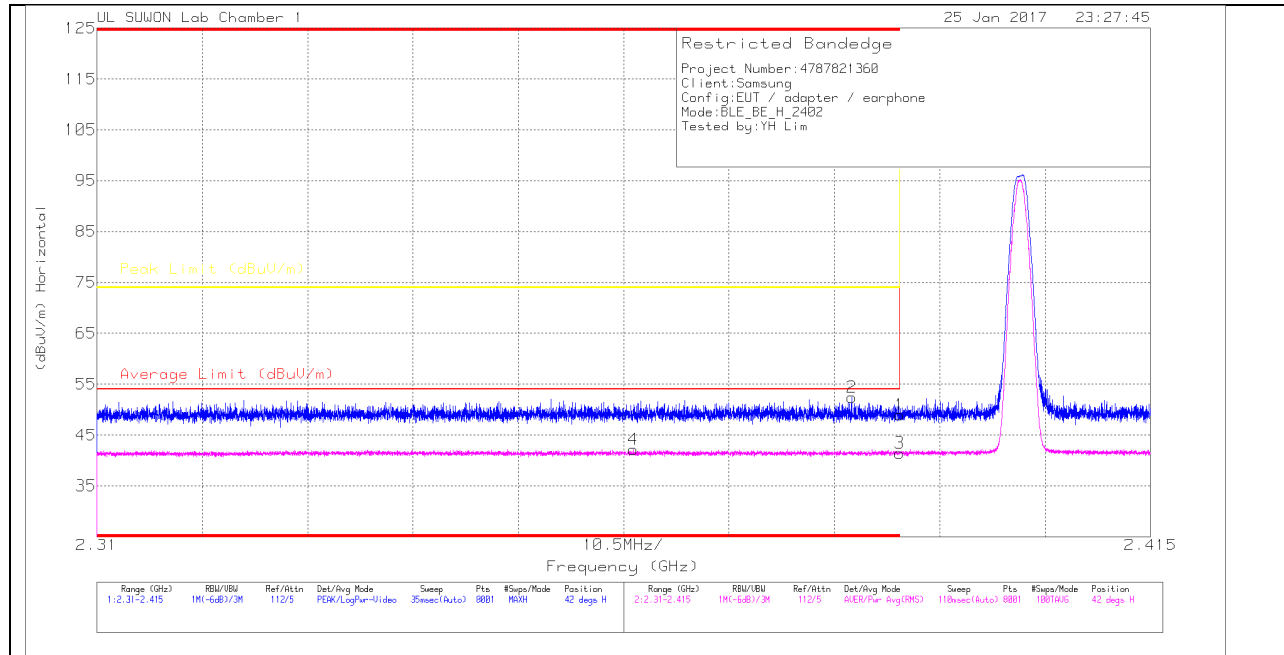
Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

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

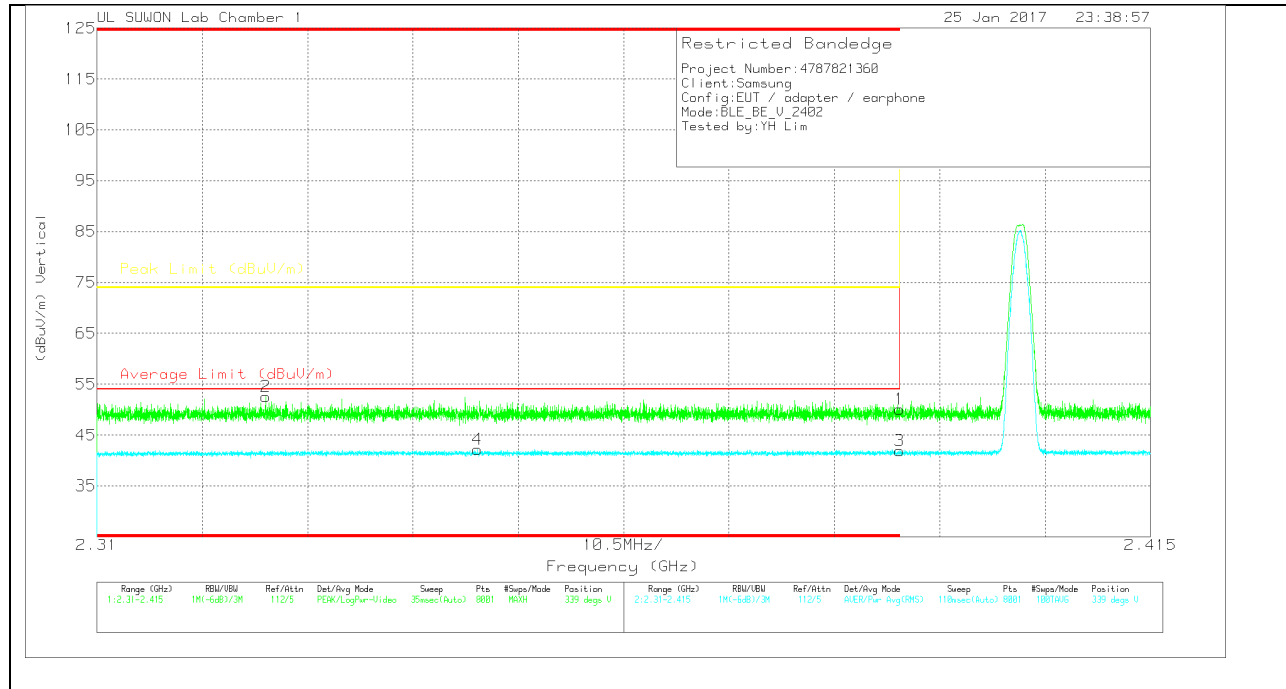
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168 717)_15061 9	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	45.54	Pk		-28.4	0	48.94	-	-	74	-25.06	42	294	H
2	* 2.385	49.14	Pk		-28.5	0	52.44	-	-	74	-21.56	42	294	H
3	* 2.39	36.18	RMS		-28.4	1.89	41.47	54	-12.53	-	-	42	294	H
4	* 2.363	36.89	RMS		-28.4	1.89	42.18	54	-11.82	-	-	42	294	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(00168 717)_15061 9	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	46.72	Pk	31.8	-28.4	0	50.12	-	-	74	-23.88	339	138	V
2	* 2.327	49.35	Pk	31.7	-28.5	0	52.55	-	-	74	-21.45	339	138	V
3	* 2.39	36.63	RMS	31.8	-28.4	1.89	41.92	54	-12.08	-	-	339	138	V
4	* 2.348	37.1	RMS	31.7	-28.5	1.89	42.19	54	-11.81	-	-	339	138	V

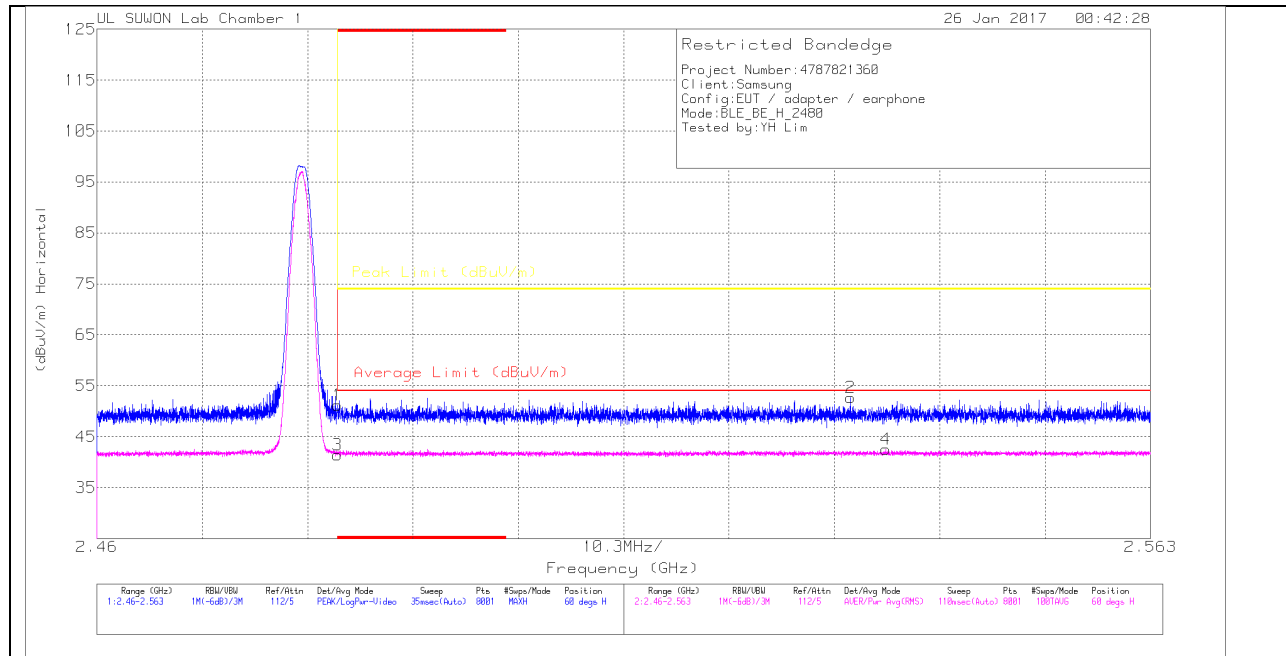
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

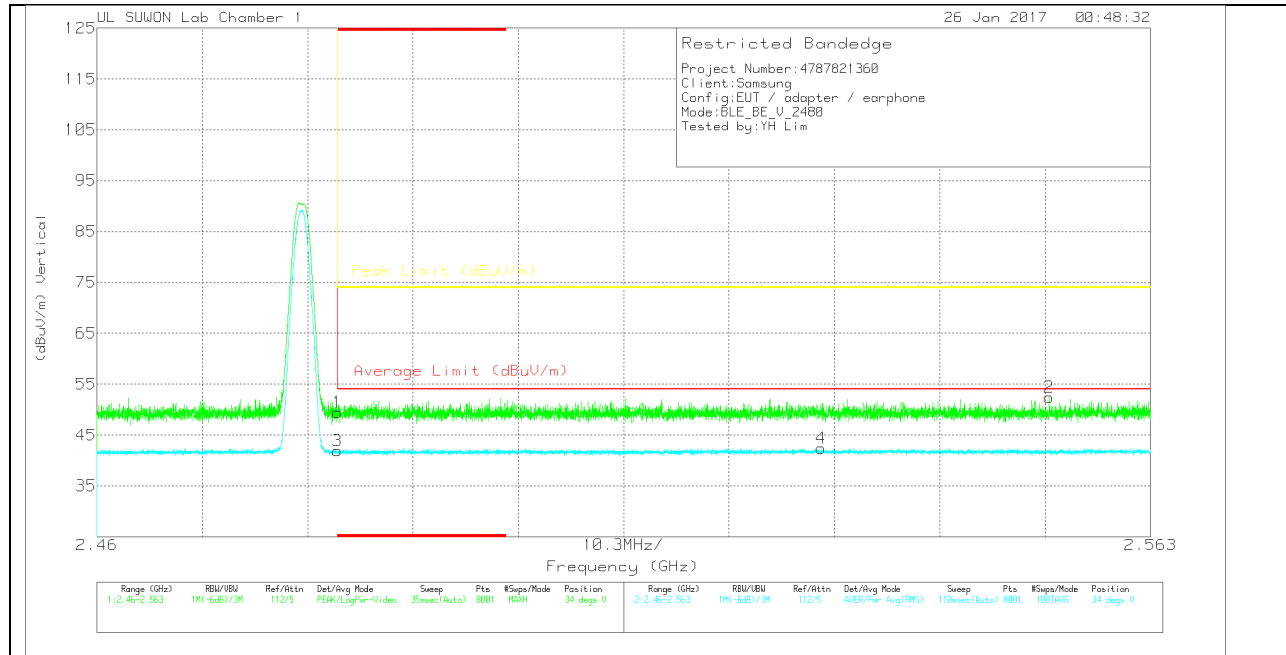
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117/00168 717/_15061 9	10dB[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	47.53	Pk	32	-28.3	0	51.23	-	-	74	-22.77	60	246	H
2	2.534	49.02	Pk	32	-28.3	0	52.72	-	-	74	-21.28	60	246	H
3	* 2.484	35.82	RMS	32	-28.3	1.89	41.41	54	-12.59	-	-	60	246	H
4	2.537	36.94	RMS	32	-28.3	1.89	42.53	54	-11.47	-	-	60	246	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(00168 717)_15061 9	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	45.78	Pk	32	-28.3	0	49.48	-	-	74	-24.52	34	361	V
2	2.553	48.73	Pk	32	-28.3	0	52.43	-	-	74	-21.57	34	361	V
3	* 2.484	36.32	RMS	32	-28.3	1.89	41.91	54	-12.09	-	-	34	361	V
4	2.531	36.81	RMS	32	-28.3	1.89	42.4	54	-11.6	-	-	34	361	V

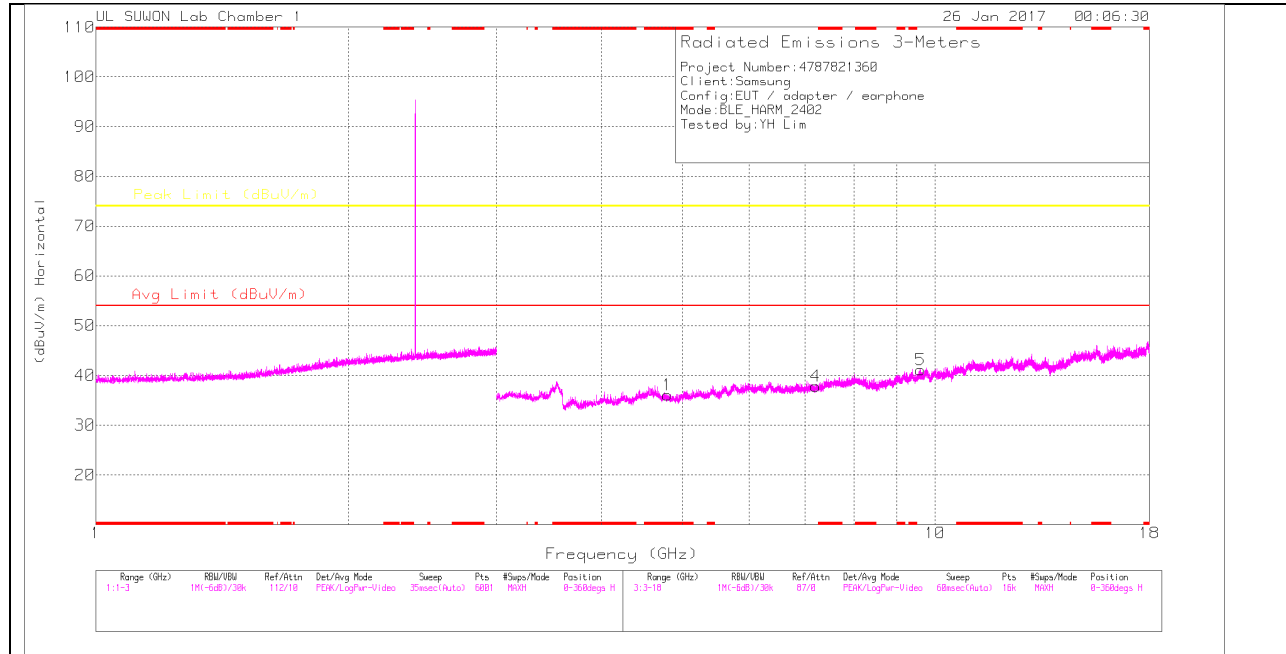
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

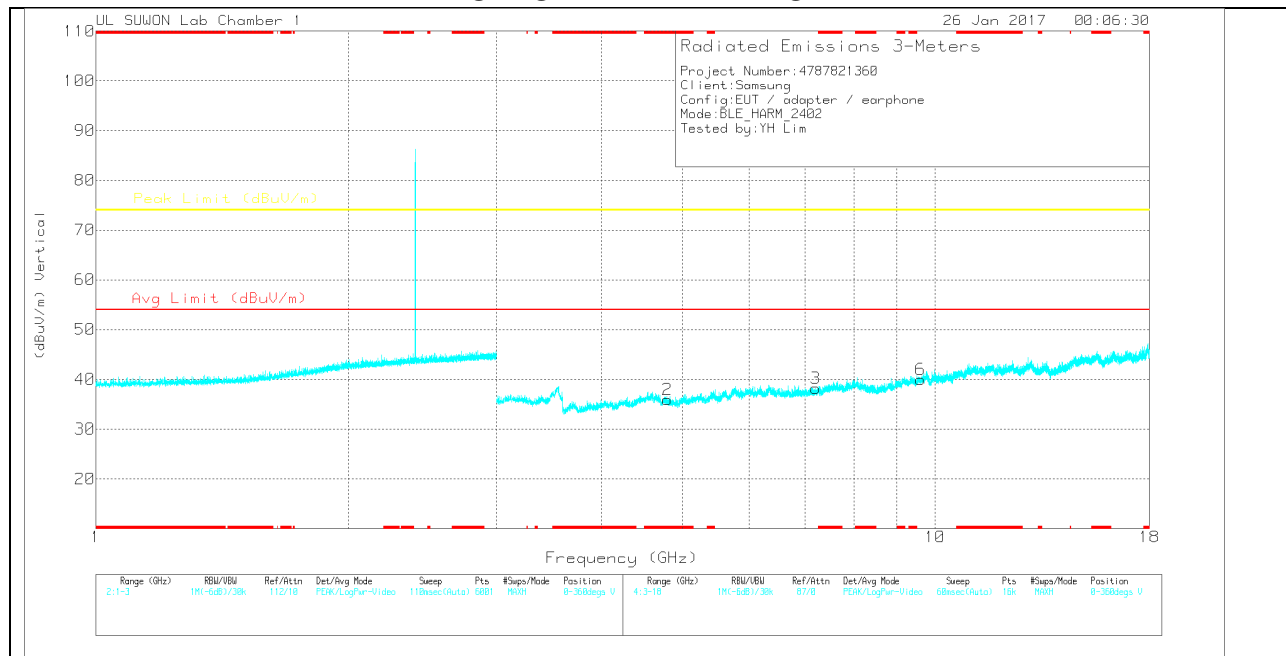
RMS - RMS detection

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

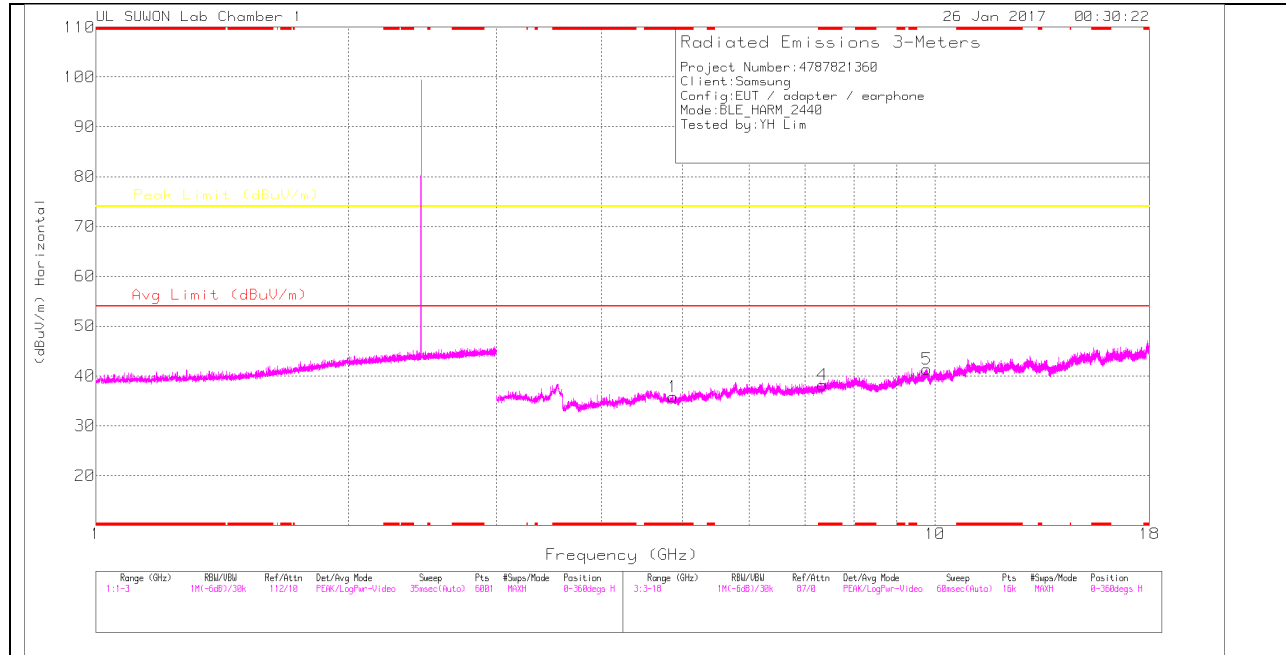
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17)_150619	3GHz_HP(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.797	35.52	PK	34	-33.4	0	36.12	-	-	74	-37.88	0-360	150	H
4	7.208	32.78	PK	35.7	-30.7	0	37.78	-	-	74	-36.22	0-360	250	H
5	9.599	31.45	PK	37	-27.3	0	41.15	-	-	74	-32.85	0-360	250	H
2	* 4.796	35.35	PK	34	-33.4	0	35.95	-	-	74	-38.05	0-360	250	V
3	7.206	33.08	PK	35.7	-30.6	0	38.18	-	-	74	-35.82	0-360	250	V
6	9.605	30.36	PK	37	-27.4	0	39.96	-	-	74	-34.04	0-360	250	V

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

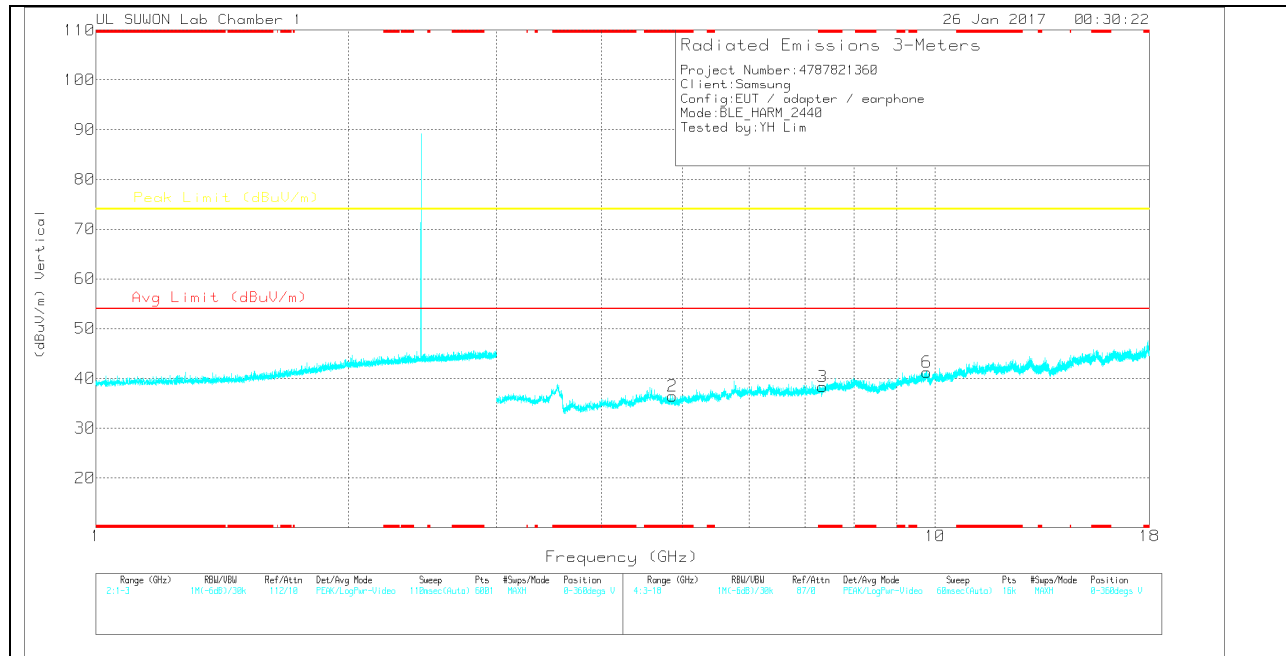
PK – Peak Detector

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

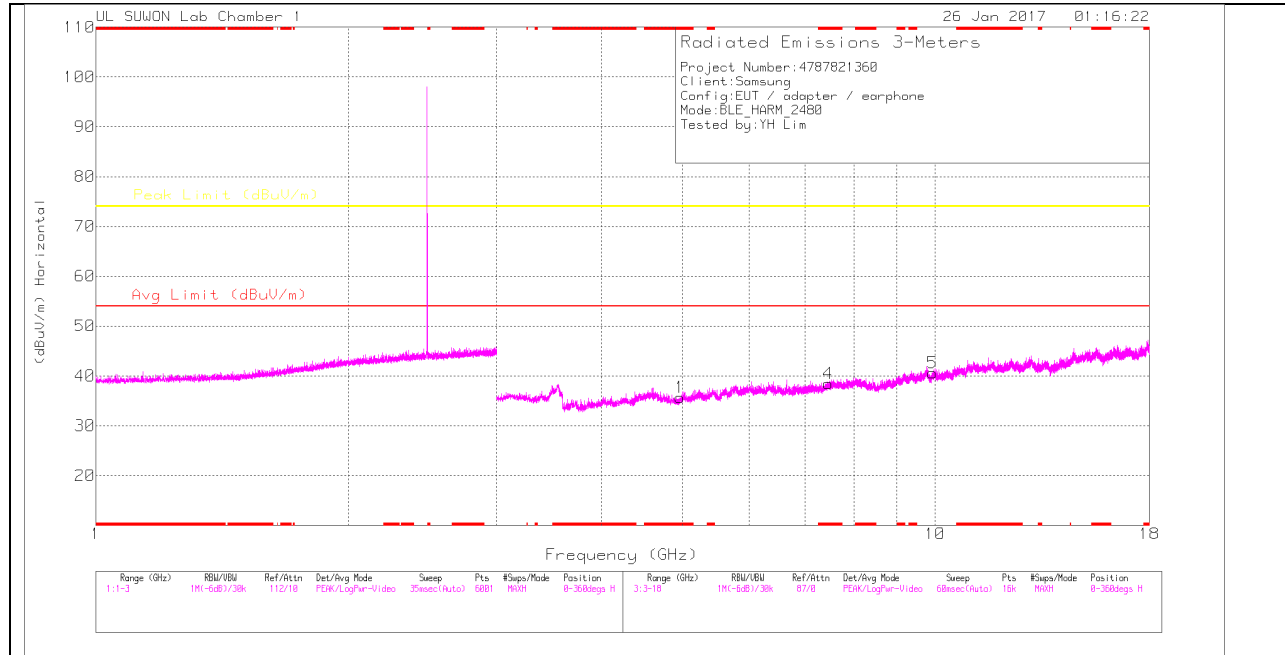
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17)_150619	3GHz_HP[dB]	DC Corr [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.868	35.38	PK	34	-33.6	0	35.78	-	-	74	-38.22	0-360	150	H
4	* 7.348	32.87	PK	35.8	-30.5	0	38.17	-	-	74	-35.83	0-360	150	H
5	9.766	30.8	PK	37.2	-26.6	0	41.4	-	-	74	-32.6	0-360	150	H
2	* 4.863	36	PK	34	-33.6	0	36.4	-	-	74	-37.6	0-360	150	V
3	* 7.34	33.03	PK	35.8	-30.5	0	38.33	-	-	74	-35.67	0-360	250	V
6	9.766	30.61	PK	37.2	-26.6	0	41.21	-	-	74	-32.79	0-360	150	V

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

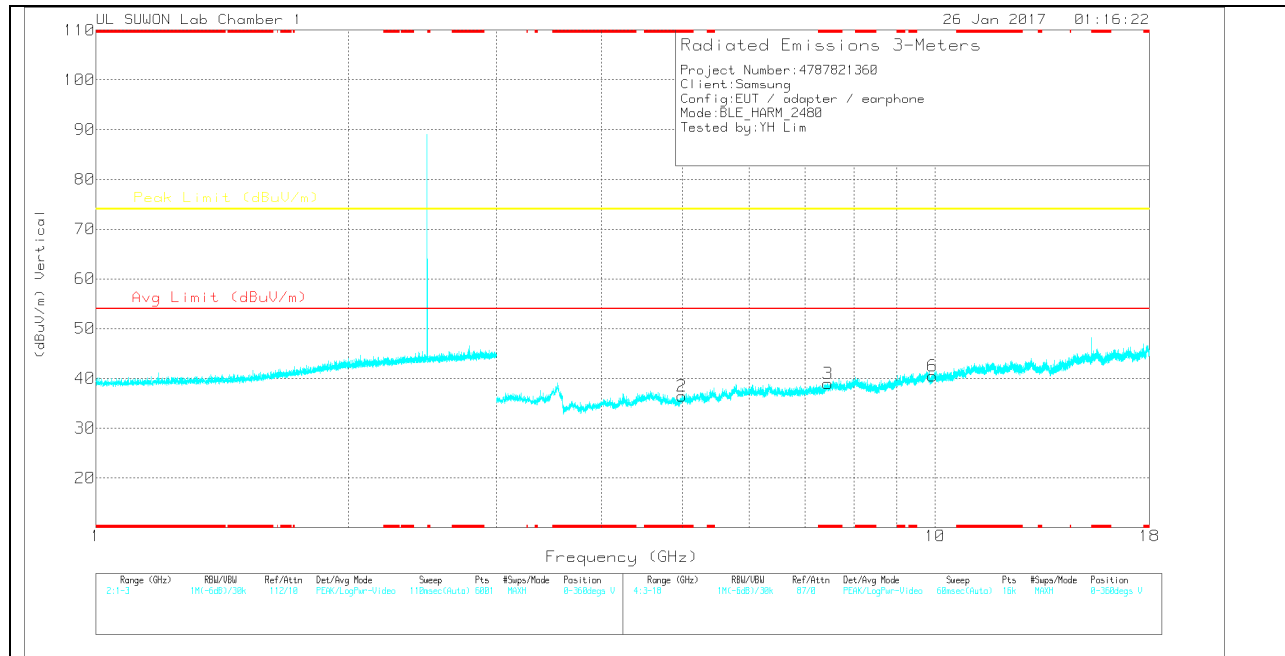
PK – Peak Detector

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

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	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	* 4.961	35.27	PK	34	-33.6	0	35.67	-	-	74	-38.33	0-360	150	H
4	* 7.456	32.98	PK	35.8	-30.3	0	38.48	-	-	74	-35.52	0-360	150	H
5	9.931	30.03	PK	37.4	-26.8	0	40.63	-	-	74	-33.37	0-360	150	H
2	* 4.993	35.83	PK	34.1	-33.5	0	36.43	-	-	74	-37.57	0-360	250	V
3	* 7.45	33.59	PK	35.8	-30.4	0	38.99	-	-	74	-35.01	0-360	250	V
6	9.933	29.93	PK	37.4	-26.8	0	40.53	-	-	74	-33.47	0-360	150	V

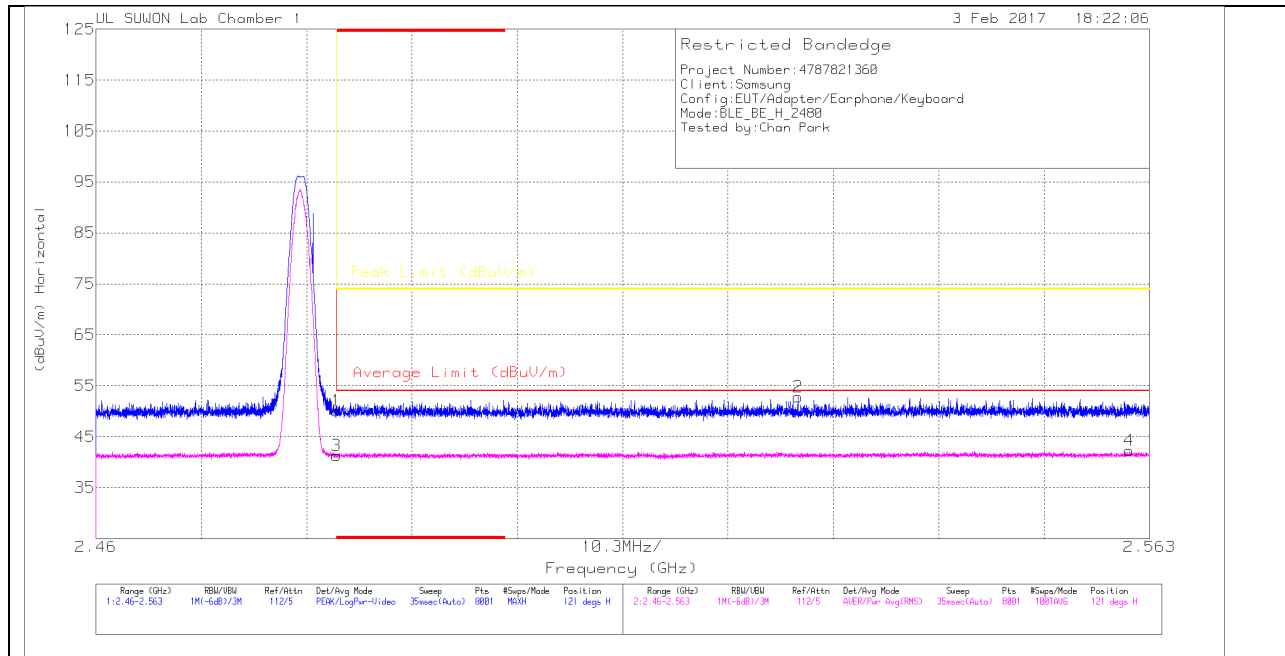
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

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

AUTHORIZED BANDEGE (HIGH CHANNEL) equipped with keyboard

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

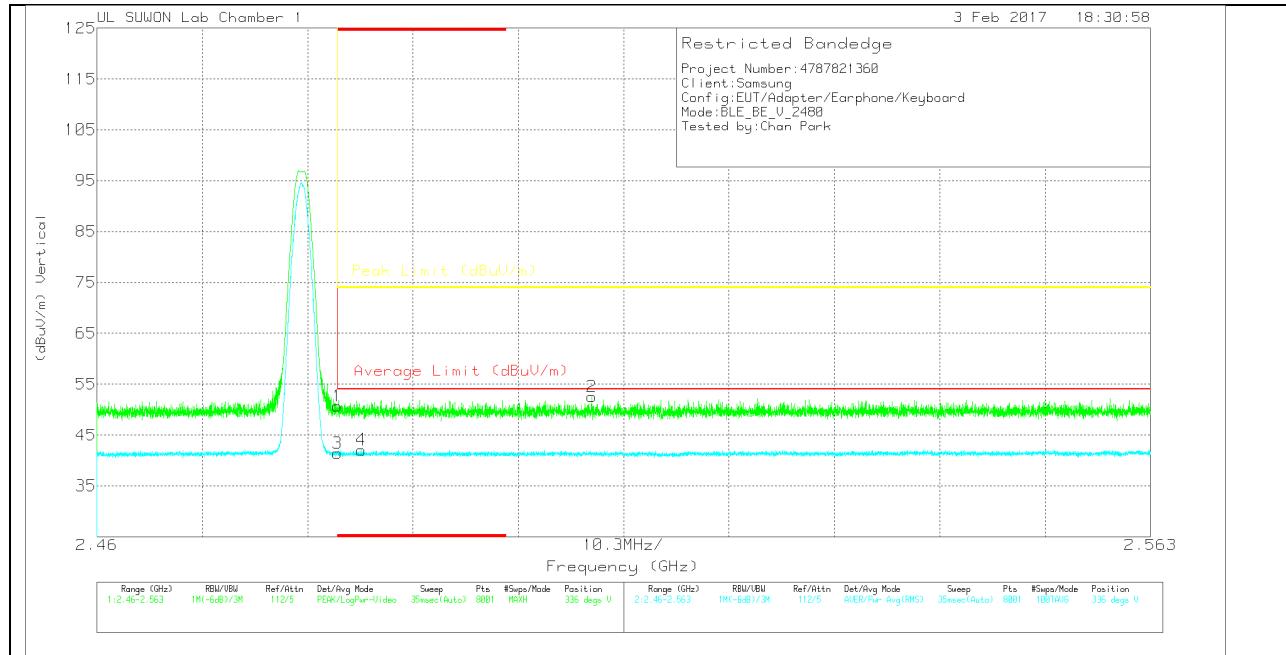
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117/00168 7171_15061 9	10dB_Att(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	46.78	Pk	32	-28.7	0	50.08	-	-	74	-23.92	121	200	H
2	2.529	49.5	Pk	32	-28.7	0	52.8	-	-	74	-21.2	121	200	H
3	* 2.484	36.13	RMS	32	-28.7	1.89	41.32	54	-12.68	-	-	121	200	H
4	2.561	36.94	RMS	32	-28.5	1.89	42.33	54	-11.67	-	-	121	200	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(00168 717)_15061 9	10dB_Att(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	47.37	Pk	32	-28.7	0	50.67	-	-	74	-23.33	336	343	V
2	2.508	49	Pk	32	-28.5	0	52.5	-	-	74	-21.5	336	343	V
3	* 2.484	36.23	RMS	32	-28.7	1.89	41.42	54	-12.58	-	-	336	343	V
4	* 2.486	36.81	RMS	32	-28.6	1.89	42.1	54	-11.9	-	-	336	343	V

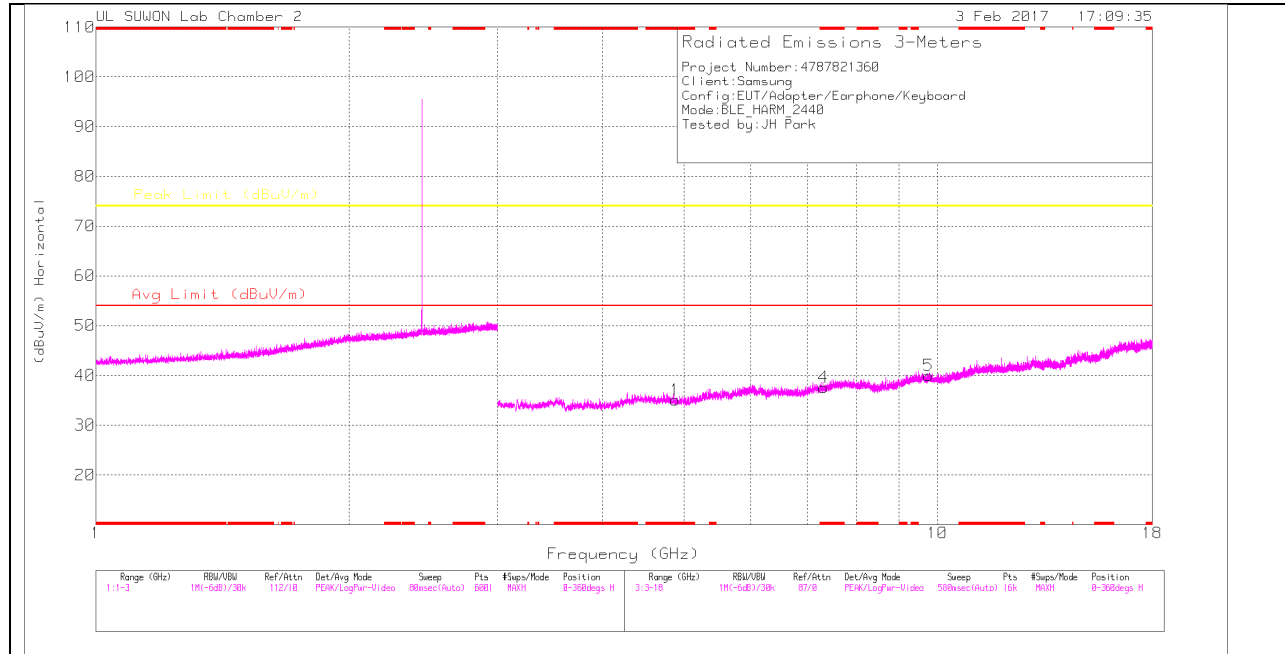
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

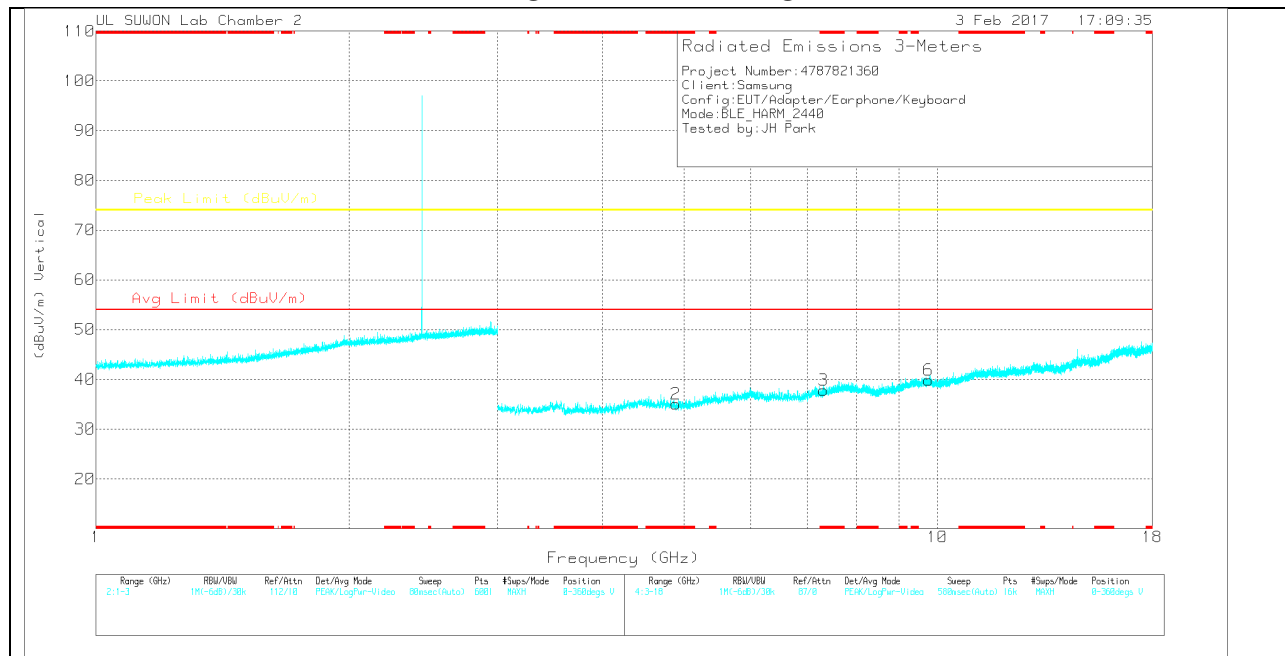
RMS - RMS detection

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	* 4.883	25.8	PK	33.9	-24.6	0	35.1	-	-	74	-38.9	0-360	150	H
4	* 7.319	23.71	PK	35.9	-22	0	37.61	-	-	74	-36.39	0-360	150	H
5	9.761	21.04	PK	37	-18	0	40.04	-	-	74	-33.96	0-360	250	H
2	* 4.886	25.75	PK	33.9	-24.6	0	35.05	-	-	74	-38.95	0-360	150	V
3	* 7.319	23.96	PK	35.9	-22	0	37.86	-	-	74	-36.14	0-360	150	V
6	9.76	20.83	PK	37	-18	0	39.83	-	-	74	-34.17	0-360	250	V

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

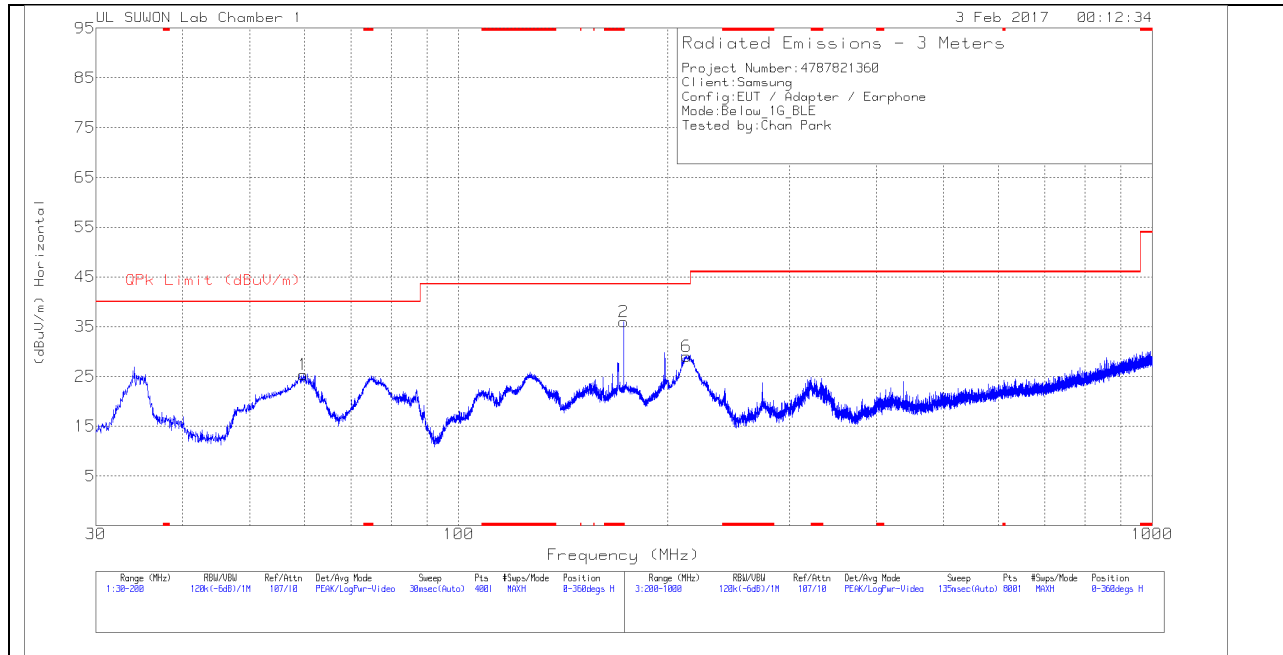
PK – Peak Detector

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

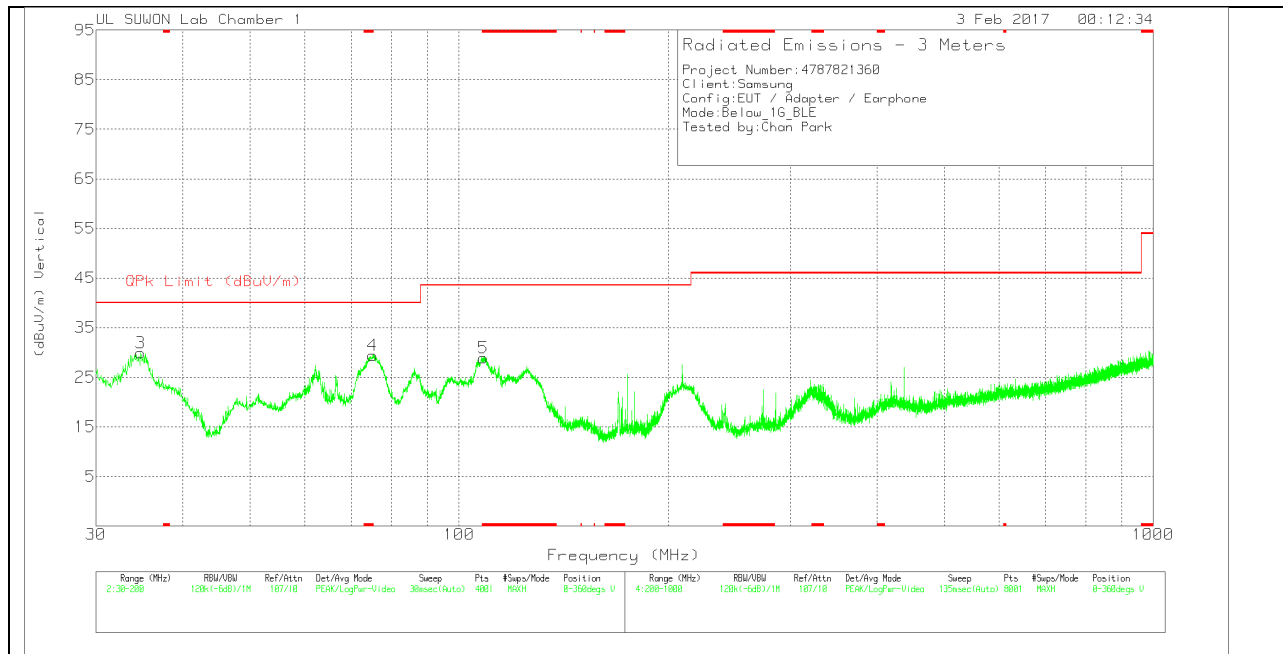
10.3. WORST-CASE BELOW 1 GHz

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	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	59.75	42.53	Pk	12.7	-29.9	25.33	40	-14.67	0-360	400	H
2	* 173.0975	55.25	Pk	9.1	-28.4	35.95	43.52	-7.57	0-360	200	H
3	34.76	49.77	Pk	10.5	-30.4	29.87	40	-10.13	0-360	100	V
4	* 75.0925	50.95	Pk	8.2	-29.7	29.45	40	-10.55	0-360	100	V
5	* 108.3913	47.25	Pk	10.9	-29.2	28.95	43.52	-14.57	0-360	100	V
6	213.1	45.44	Pk	11.6	-28	29.04	43.52	-14.48	0-360	100	H

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

Pk - Peak detector

Radiated Emissions

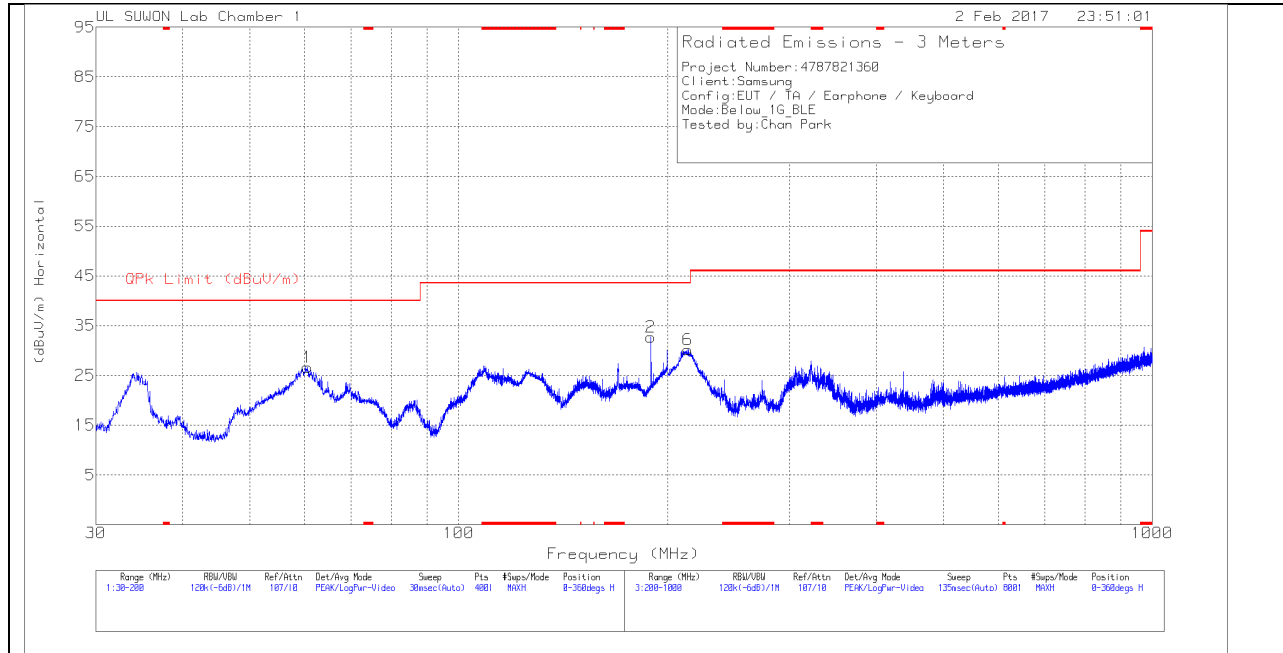
Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 173.0752	39.13	Qp	9.1	-28.4	19.83	43.52	-23.69	186	182	H

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

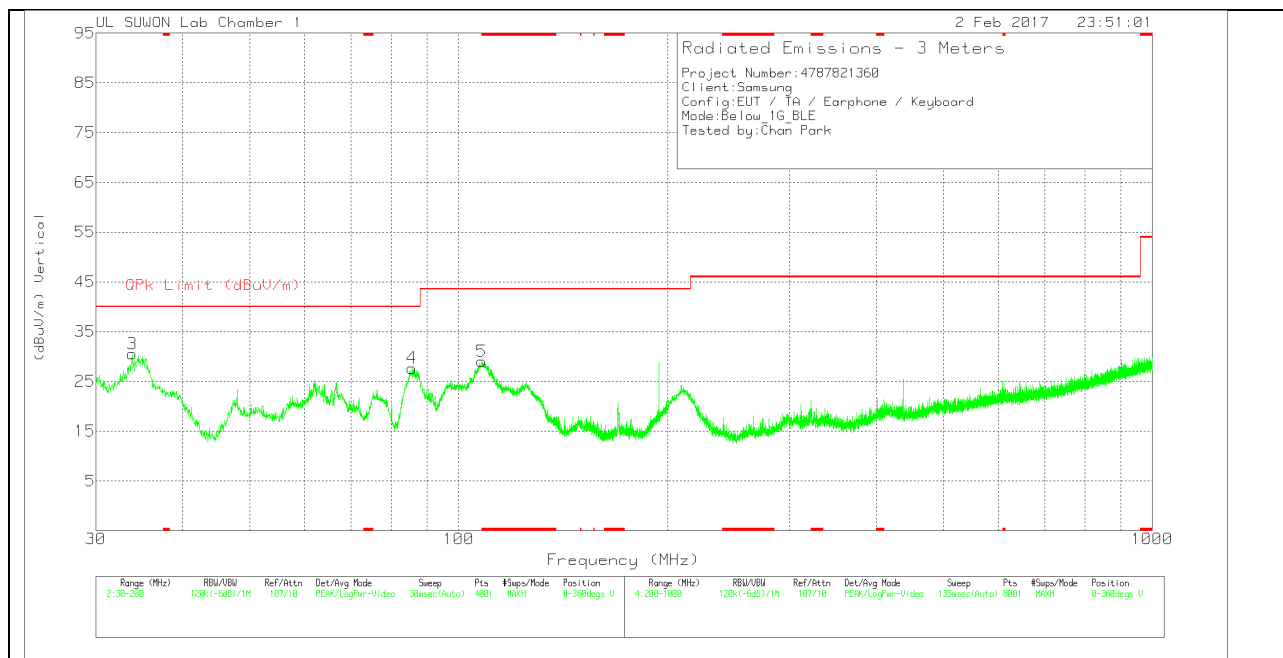
Qp - Quasi-Peak detector

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	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	60.515	44.08	Pk	12.5	-29.9	26.68	40	-13.32	0-360	400	H
2	189.375	50.66	Pk	10.3	-28.3	32.66	43.52	-10.86	0-360	200	H
3	33.825	50.61	Pk	10.4	-30.5	30.51	40	-9.49	0-360	100	V
4	85.7175	48.8	Pk	8.4	-29.5	27.7	40	-12.3	0-360	100	V
5	107.945	47.34	Pk	10.9	-29.2	29.04	43.52	-14.48	0-360	100	V
6	214.2	46.6	Pk	11.6	-28	30.2	43.52	-13.32	0-360	100	H

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.

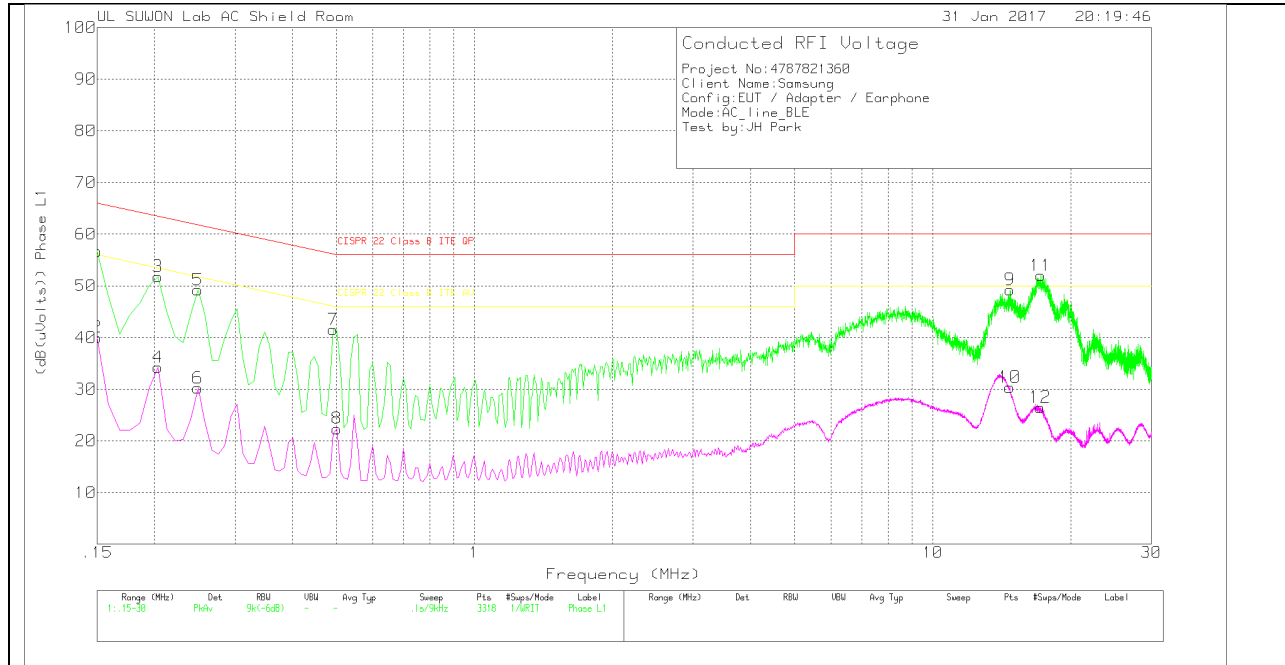
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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	.15	47.02	Pk	9.7	0	56.72	66	-9.28	-	-
2	.15	30.33	Av	9.7	0	40.03	-	-	56	-15.97
3	.204	41.89	Pk	9.9	0	51.79	63.45	-11.66	-	-
4	.204	24.33	Av	9.9	0	34.23	-	-	53.45	-19.22
5	.249	39.51	Pk	9.7	0	49.21	61.79	-12.58	-	-
6	.249	20.52	Av	9.7	0	30.22	-	-	51.79	-21.57
7	.492	31.66	Pk	9.9	0	41.56	56.13	-14.57	-	-
8	.501	12.48	Av	9.9	0	22.38	-	-	46	-23.62
9	14.757	38.95	Pk	10.1	.2	49.25	60	-10.75	-	-
10	14.721	20.07	Av	10.1	.2	30.37	-	-	50	-19.63
11	17.196	41.61	Pk	10.2	.2	52.01	60	-7.99	-	-
12	17.16	16.08	Av	10.2	.2	26.48	-	-	50	-23.52

Pk - Peak detector

Av - Average detection

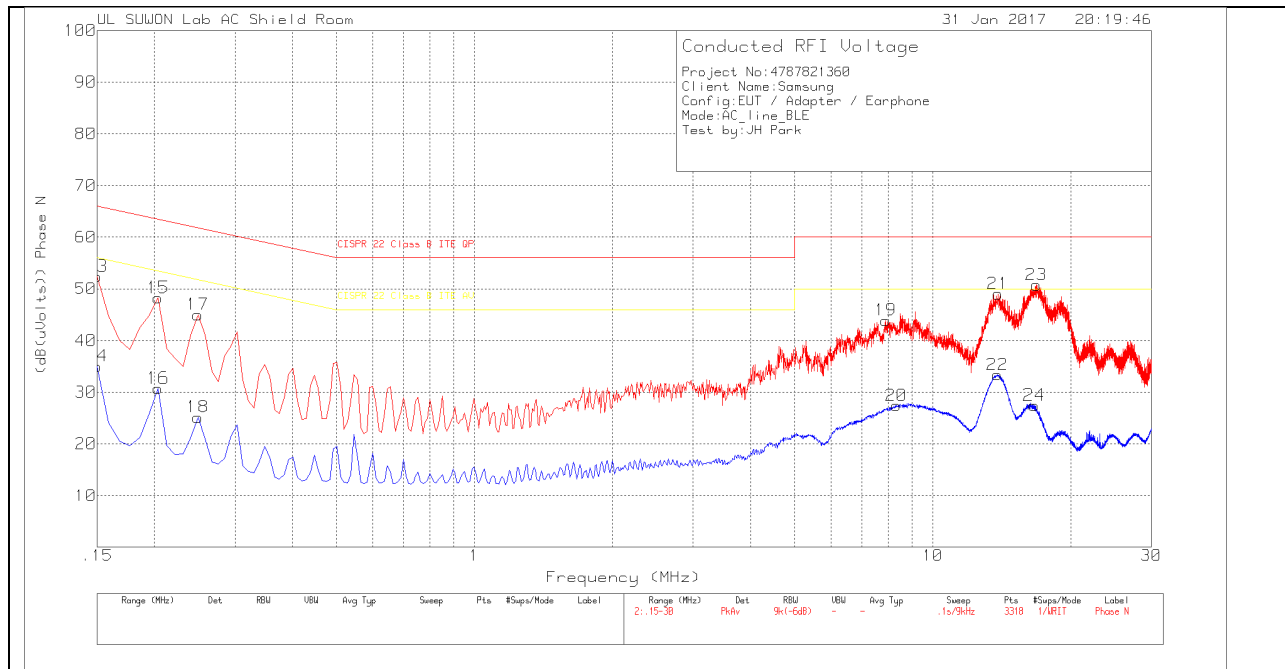
Quasi-Peak Emissions

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)
.1518	38.39	Qp	9.8	0	48.19	65.9	-17.71	-	-
.1518	38.34	Qp	9.8	0	48.14	65.9	-17.76	-	-
.2022	34.84	Qp	9.9	0	44.74	63.52	-18.78	-	-
.2517	29.76	Qp	9.7	0	39.46	61.7	-22.24	-	-
14.7534	26.53	Qp	10.1	.2	36.83	60	-23.17	-	-
14.7201	26.64	Qp	10.1	.2	36.94	60	-23.06	-	-
17.1915	30.93	Qp	10.2	.2	41.33	60	-18.67	-	-
17.1609	31.3	Qp	10.2	.2	41.7	60	-18.3	-	-

Qp – Quasi-Peak detector

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	.15	42.7	Pk	9.7	0	52.4	66	-13.6	-	-
14	.15	25.33	Av	9.7	0	35.03	-	-	56	-20.97
15	.204	38.36	Pk	9.9	0	48.26	63.45	-15.19	-	-
16	.204	20.86	Av	9.9	0	30.76	-	-	53.45	-22.69
17	.249	35.32	Pk	9.7	0	45.02	61.79	-16.77	-	-
18	.249	15.47	Av	9.7	0	25.17	-	-	51.79	-26.62
19	7.89	33.82	Pk	10	.1	43.92	60	-16.08	-	-
20	8.331	17.3	Av	10	.1	27.4	-	-	50	-22.6
21	13.902	38.54	Pk	10.3	.2	49.04	60	-10.96	-	-
22	13.839	22.87	Av	10.3	.2	33.37	-	-	50	-16.63
23	16.836	40.06	Pk	10.5	.2	50.76	60	-9.24	-	-
24	16.656	16.75	Av	10.5	.2	27.45	-	-	50	-22.55

Pk - Peak detector

Av - Average detection

Quasi-Peak Emissions

Phase N .15 - 30MHz

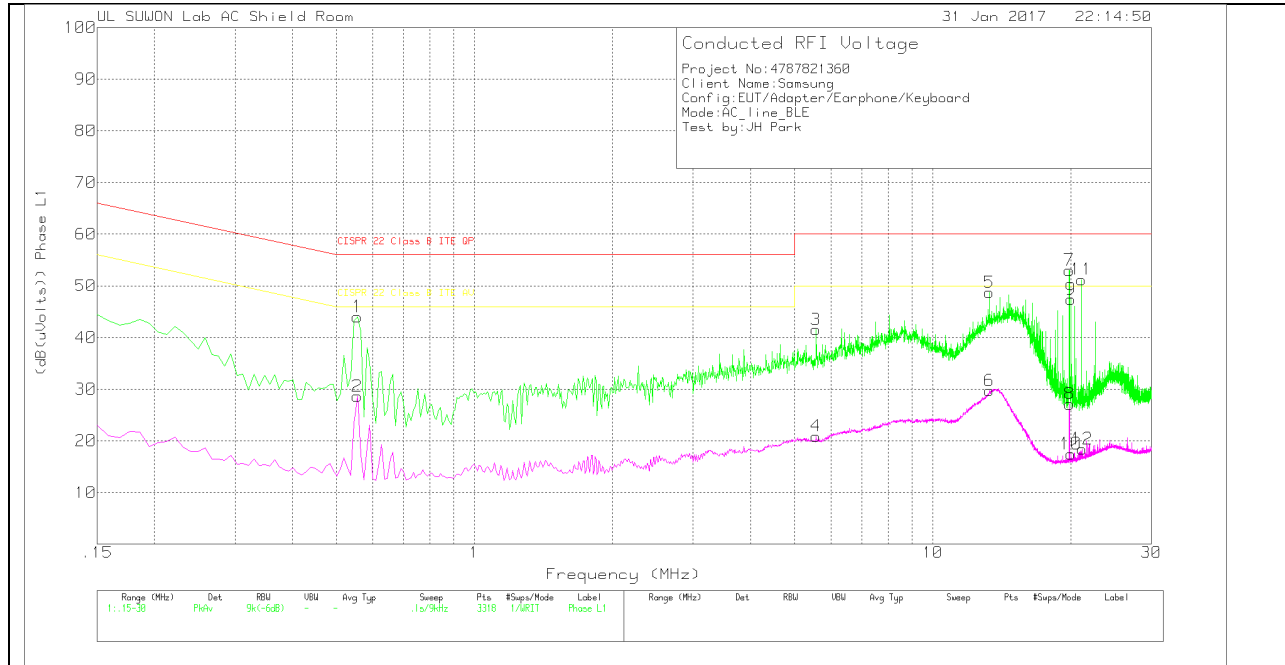
Frequency (MHz)	Meter Reading (dBuV)	Det	101837_wit h ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.1518	37.74	Qp	9.8	0	47.54	65.9	-18.36	-	-
.1518	37.7	Qp	9.8	0	47.5	65.9	-18.4	-	-
.2022	34.09	Qp	9.9	0	43.99	63.52	-19.53	-	-
.2517	29.11	Qp	9.7	0	38.81	61.7	-22.89	-	-
13.8993	30.3	Qp	10.3	.2	40.8	60	-19.2	-	-
13.8399	30.46	Qp	10.3	.2	40.96	60	-19.04	-	-
16.8324	31.5	Qp	10.5	.2	42.2	60	-17.8	-	-
16.6533	31.93	Qp	10.5	.2	42.63	60	-17.37	-	-

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	.555	34.11	Pk	9.9	0	44.01	56	-11.99	-	-
2	.555	18.75	Av	9.9	0	28.65	-	-	46	-17.35
3	5.568	31.64	Pk	9.8	.1	41.54	60	-18.46	-	-
4	5.568	11.02	Av	9.8	.1	20.92	-	-	50	-29.08
5	13.29	38.42	Pk	10.1	.2	48.72	60	-11.28	-	-
6	13.29	19.43	Av	10.1	.2	29.73	-	-	50	-20.27
7	19.869	42.53	Pk	10.3	.2	53.03	60	-6.97	-	-
8	19.878	16.64	Av	10.3	.2	27.14	-	-	50	-22.86
9	20.031	36.81	Pk	10.4	.2	47.41	60	-12.59	-	-
10	20.031	6.9	Av	10.4	.2	17.5	-	-	50	-32.5
11	21.147	40.62	Pk	10.4	.2	51.22	60	-8.78	-	-
12	21.174	7.84	Av	10.4	.2	18.44	-	-	50	-31.56

Pk - Peak detector

Av - Average detection

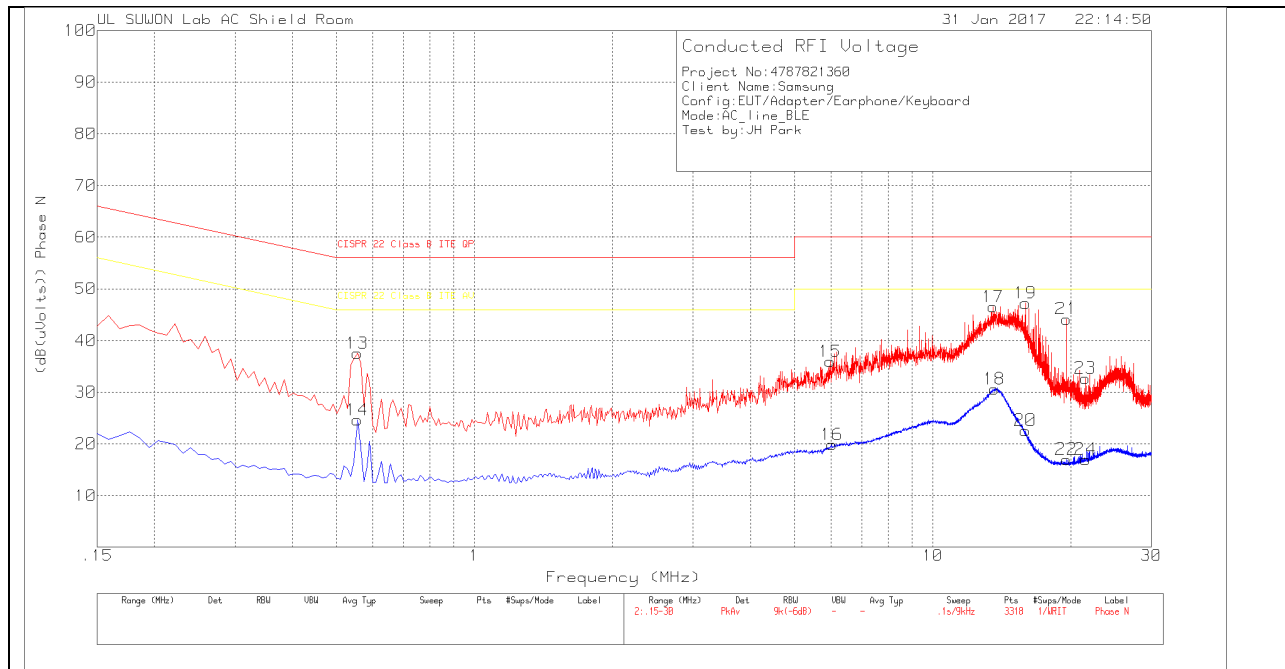
Quasi-Peak Emissions

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)
13.29	26.97	Qp	10.1	.2	37.27	60	-22.73	-	-
19.8663	8.25	Qp	10.3	.2	18.75	60	-41.25	-	-
19.878	8	Qp	10.3	.2	18.5	60	-41.5	-	-
20.0265	7.82	Qp	10.4	.2	18.42	60	-41.58	-	-
21.1479	8.58	Qp	10.4	.2	19.18	60	-40.82	-	-
21.1749	13.62	Qp	10.4	.2	24.22	60	-35.78	-	-

Qp – Quasi-Peak detector

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	.555	27.64	Pk	9.9	0	37.54	56	-18.46	-	-
14	.555	14.72	Av	9.9	0	24.62	-	-	46	-21.38
15	5.973	25.92	Pk	9.9	.1	35.92	60	-24.08	-	-
16	6.027	9.89	Av	9.9	.1	19.89	-	-	50	-30.11
17	13.551	36.05	Pk	10.3	.2	46.55	60	-13.45	-	-
18	13.6365	20.11	Av	10.3	.2	30.61	-	-	50	-19.39
19	15.936	36.62	Pk	10.4	.2	47.22	60	-12.78	-	-
20	15.927	11.98	Av	10.4	.2	22.58	-	-	50	-27.42
21	19.572	33.36	Pk	10.6	.2	44.16	60	-15.84	-	-
22	19.572	6.2	Av	10.6	.2	17	-	-	50	-33
23	21.534	21.8	Pk	10.7	.2	32.7	60	-27.3	-	-
24	21.57	6.1	Av	10.7	.2	17	-	-	50	-33

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)
13.5528	28.08	Qp	10.3	.2	38.58	60	-21.42	-	-
13.6365	28.26	Qp	10.3	.2	38.76	60	-21.24	-	-
15.9315	23.02	Qp	10.4	.2	33.62	60	-26.38	-	-
15.9315	22.7	Qp	10.4	.2	33.3	60	-26.7	-	-
19.5756	10.43	Qp	10.6	.2	21.23	60	-38.77	-	-
21.5385	9.11	Qp	10.7	.2	20.01	60	-39.99	-	-
21.5736	9.41	Qp	10.7	.2	20.31	60	-39.69	-	-

Qp – Quasi-Peak detector