# FCC CFR47 PART 15 SUBPART C

# Bluetooth Low Energy

# CERTIFICATION TEST REPORT

# FOR

# GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n and NFC

# MODEL NUMBER : SM-G390F

# FCC ID: A3LSMG390F

# REPORT NUMBER: 4787833362-E2V1

# ISSUE DATE: FEB 22, 2017

*Prepared for*
**SAMSUNG ELECTRONICS CO., LTD.**
**129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,**
**GYEONGGI-DO, 16677, KOREA**

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ACCREDITED
TL-637

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 02/22/17 | Initial issue | Junwhan Lee |


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# 1. ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **COMPANY NAME:** | SAMSUNG ELECTRONICS CO., LTD. |
| **EUT DESCRIPTION:** | GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n and NFC |
| **MODEL NUMBER:** | SM-G390F |
| **SERIAL NUMBER:** | R38HC0238JF (RADIATED);<br>420044acec93b391, 4200c84ccaf0a3bd (CONDUCTED) |
| **DATE TESTED:** | JAN 18, 2017 - FEB 03, 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.

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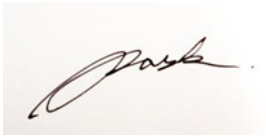
UL Korea, Ltd. By:



SungGil Park
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# 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 |

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# 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%.


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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n and NFC.
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 | 6.927 | 4.93 |
| | | Average | 6.159 | 4.13 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of 2.27 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.


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## 5.5. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Charger | SAMSUNG | EP-TA50EWE | DK1H822VS/A-E | N/A |
| Data Cable | SAMSUNG | ECB-DU68WE | N/A | N/A |
| Earphone | SAMSUNG | EHS64AVFWE | N/A | N/A |

**I/O CABLES**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | DC Power | 1 | Mini-USB | Shielded | 0.8m | N/A |
| 2 | Audio | 2 | Mini-Jack | Unshielded | 1.0m | N/A |

**TEST SETUP**

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


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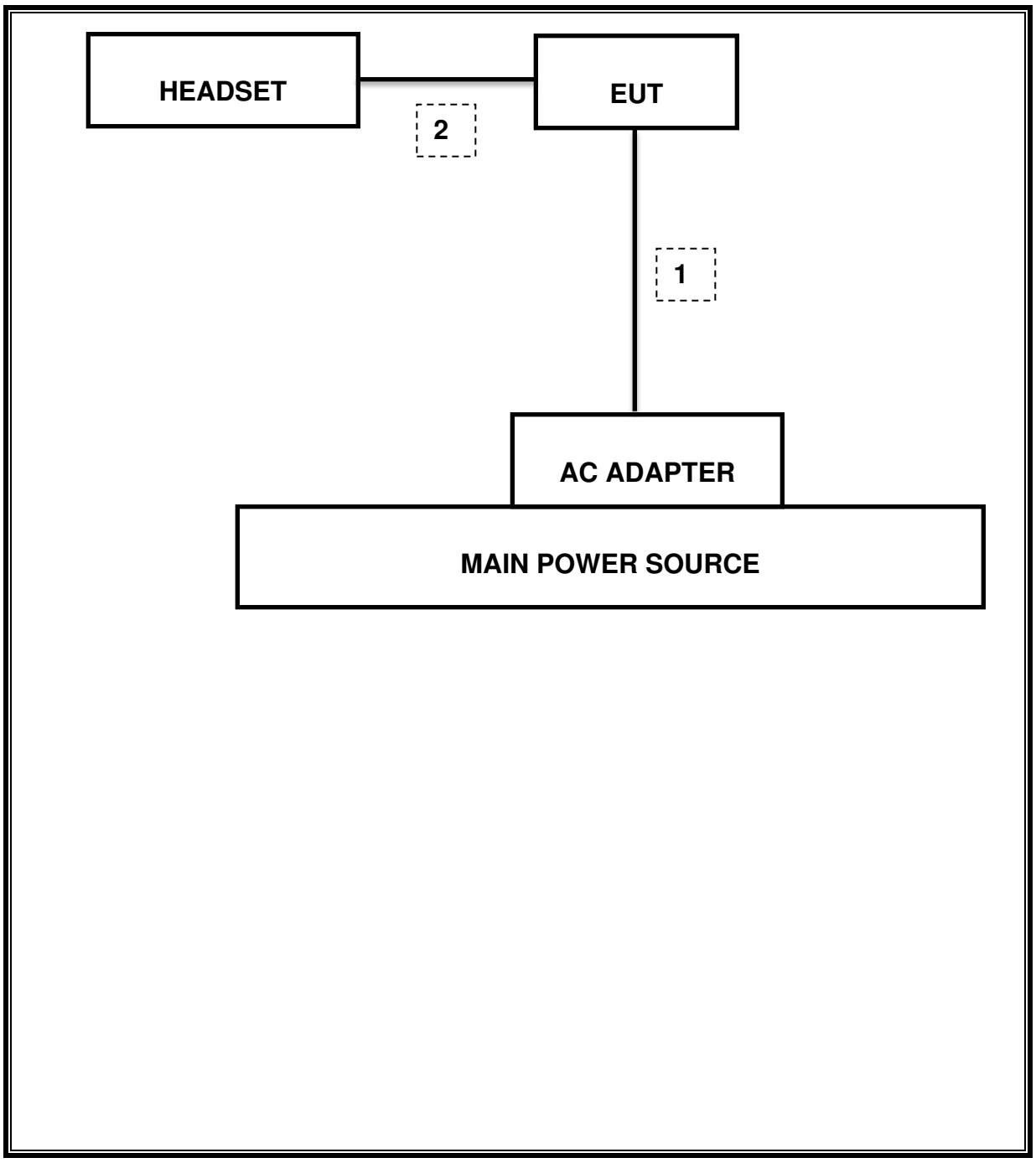
**SETUP DIAGRAM FOR TESTS**





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# 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 | 03-17-17 |
| 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 |
| 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 | |


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# 7. REFERENCE MEASUREMENT RESULTS

## 7.1. ON TIME AND DUTY CYCLE RESULTS

**LIMITS**

None: for reporting purposes only.

| Mode | ON Time B [msec] | Period [msec] | Duty Cycle x [linear] | Duty Cycle [%] | Duty Cycle Correction Factor [dB] | 1/T Minimum VBW [kHz] |
|---|---|---|---|---|---|---|
| 2400MHz Bands | | | | | | |
| BLE | 0.389 | 0.624 | 0.624 | 62.4% | 2.05 | 2.569 |

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## 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 more than 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 | 1.085 |
| Mid | 2440 | 1.071 |
| High | 2480 | 1.083 |
| Worst | | 1.085 |


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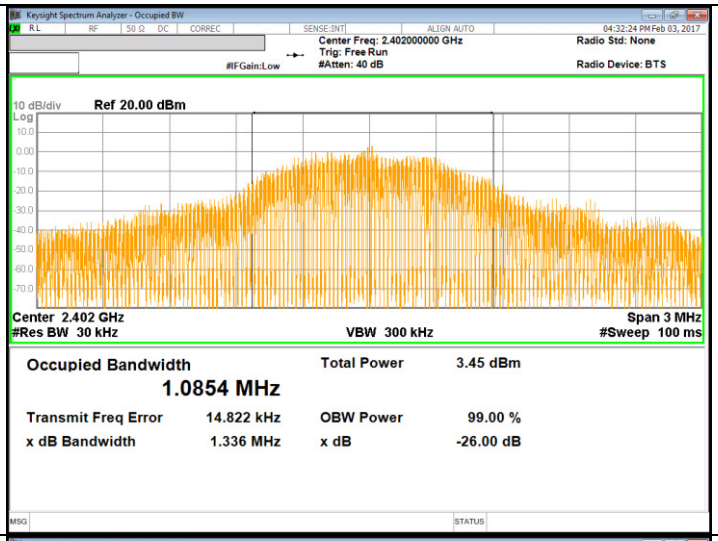
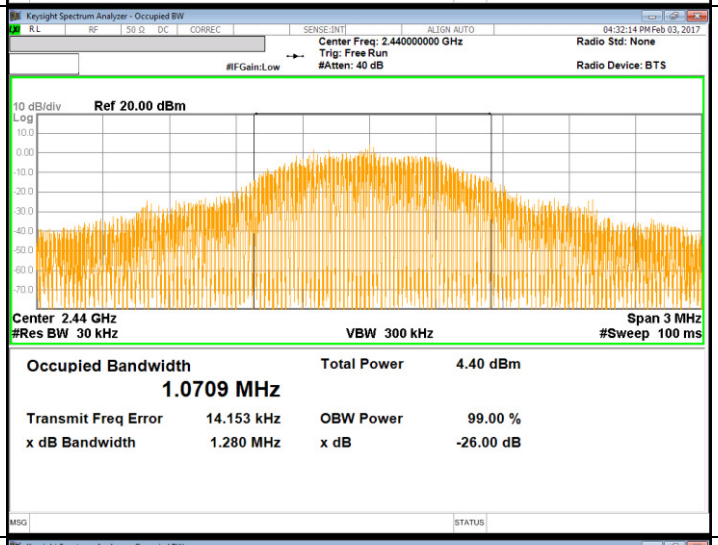
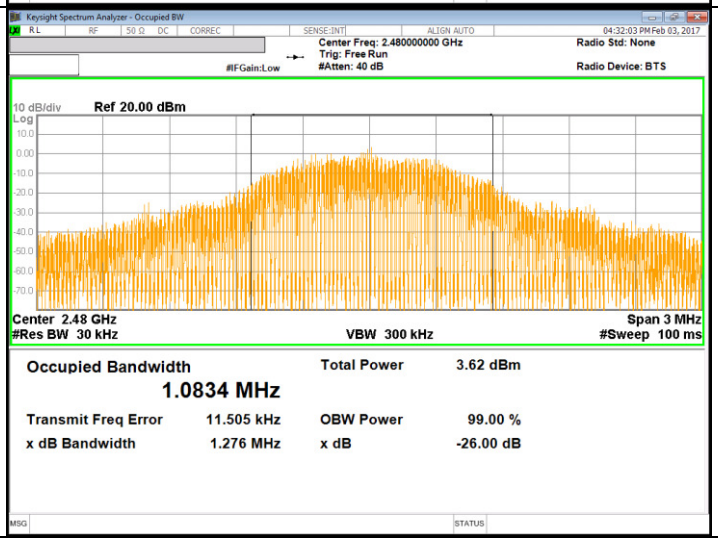
## 99% BANDWIDTH PLOTS

| | | |
|---|---|---|
| Low CH | |  |
| Middle CH | |  |
| High CH | |  |



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# 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 | 727.3 kHz |
| 2.1051, 15.247 (d) | Band Edge / Conducted Spurious Emission | -20dBc | | Pass | -44.743 dBm |
| 15.247 | TX conducted output power | <30dBm | | Pass | 6.927 dBm (Peak) |
| 15.247 | PSD | <8dBm | | Pass | -9.23 dBm (Peak) |
| 15.207 (a) | AC Power Line conducted emissions | Section 10 | Power Line conducted | Pass | 55.1 dBuV (Pk) |
| 15.205, 15.209 | Radiated Spurious Emission | < 54dBuV/m | Radiated | Pass | 47.4 dBuV/m (Av) |


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# 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**

Reference to KDB 558074 D01 DTS Meas Guidance v03r05: The transmitter output is connected to a spectrum analyzer with the RBW set to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

**RESULTS**

| Channel | Frequency [MHz] | 6 dB Bandwidth [kHz] | Minimum Limit [kHz] |
|---|---|---|---|
| Low | 2402 | 727.3 | 500.0 |
| Mid | 2440 | 731.3 | 500.0 |
| High | 2480 | 730.8 | 500.0 |
| Worst | | 727.3 | 500.0 |


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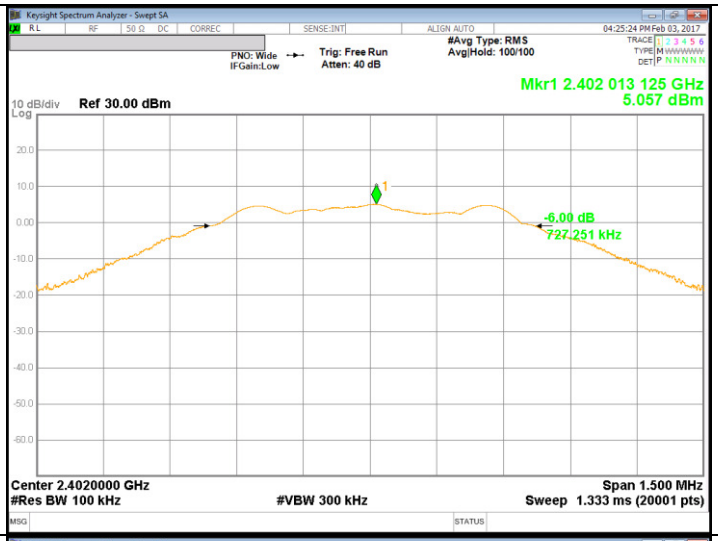
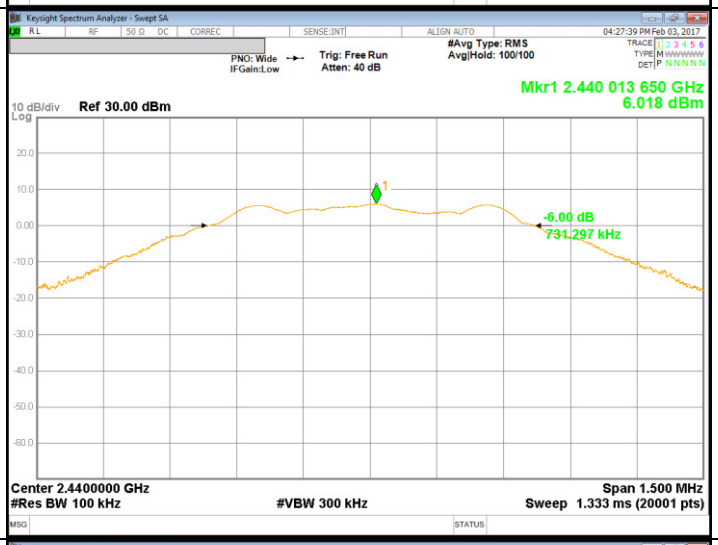
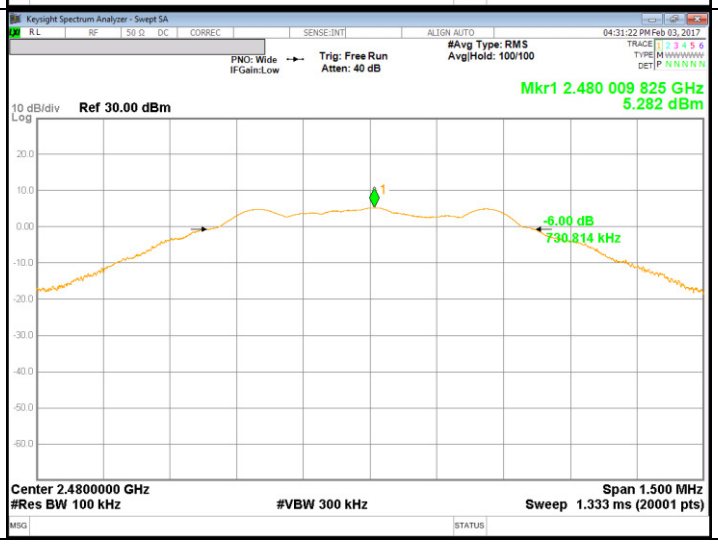
## 6 dB BANDWIDTH PLOTS

| | | |
|---|---|---|
| Low CH |  | |
| Middle CH |  | |
| High CH |  | |



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## 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 | 6.010 | 30.000 | -23.990 |
| Mid | 2440 | 6.927 | 30.000 | -23.073 |
| High | 2480 | 6.027 | 30.000 | -23.973 |
| Worst | | 6.927 | | -23.073 |


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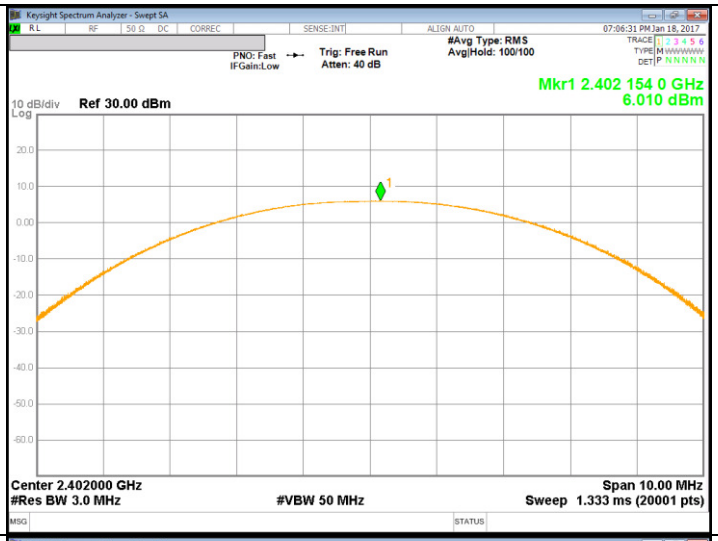
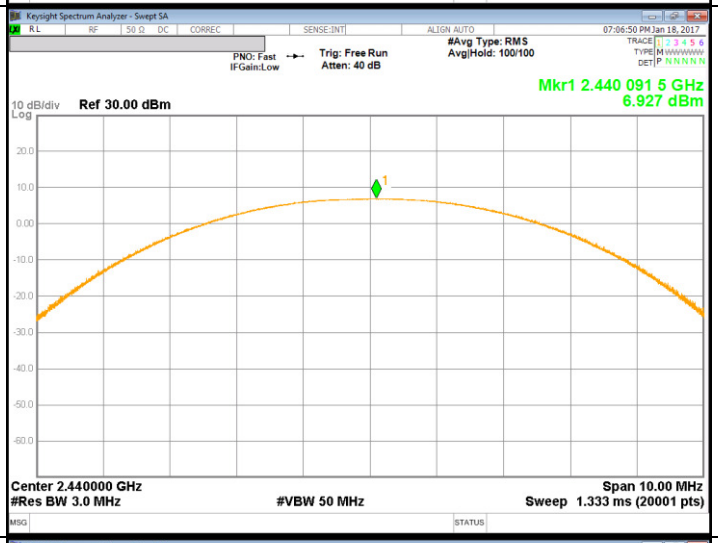
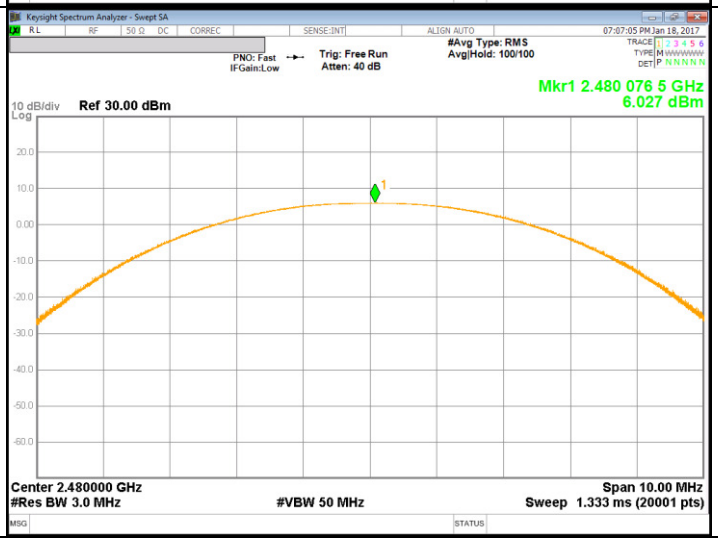
## OUTPUT POWER PLOTS

| | | |
|---|---|---|
| Low CH |  | |
| Middle CH |  | |
| High CH |  | |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## 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 | 5.172 | 3.290 |
| Middle | 2440 | 6.159 | 4.129 |
| High | 2480 | 5.328 | 3.410 |


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## 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 | -10.13 | 8.00 | -18.13 |
| Mid | 2440 | -9.23 | 8.00 | -17.23 |
| High | 2480 | -10.07 | 8.00 | -18.07 |


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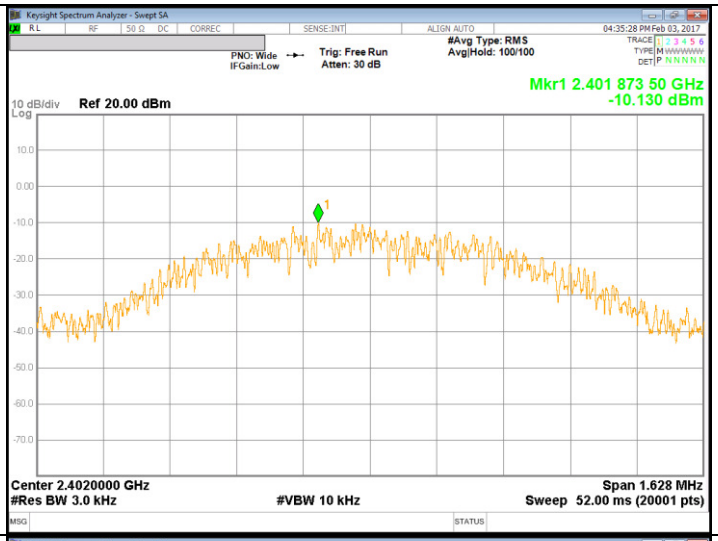
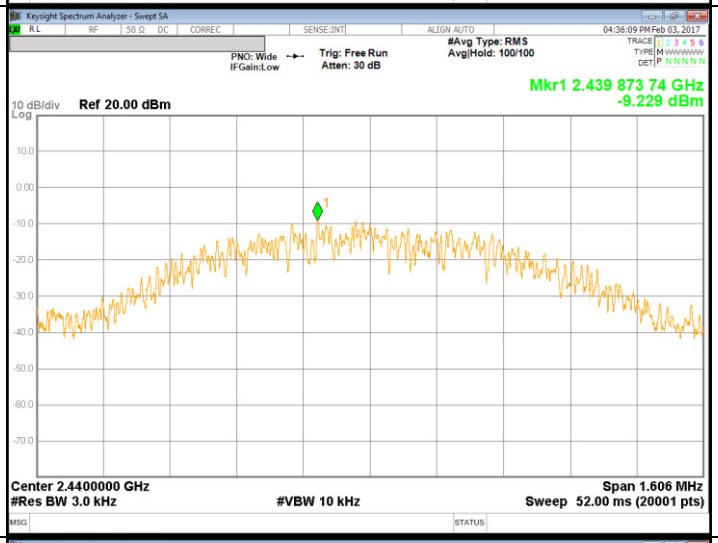
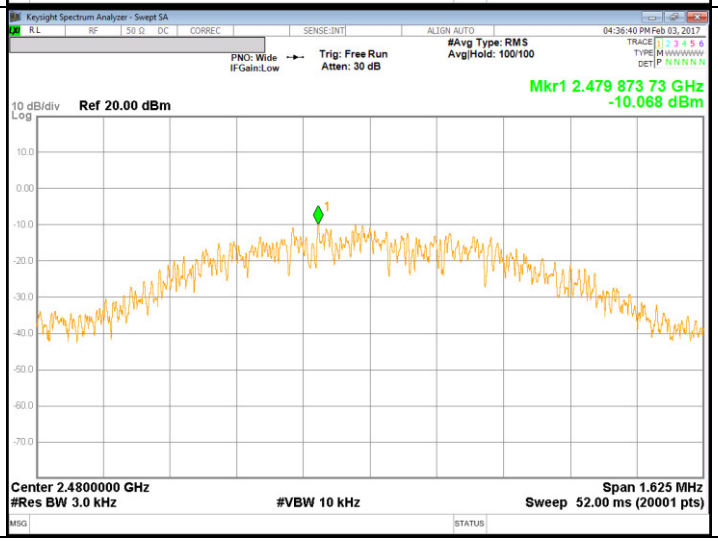
## POWER SPECTRAL DENSITY PLOTS

| | | |
|---|---|---|
| Low CH |  | |
| Middle CH |  | |
| High CH |  | |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## 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.


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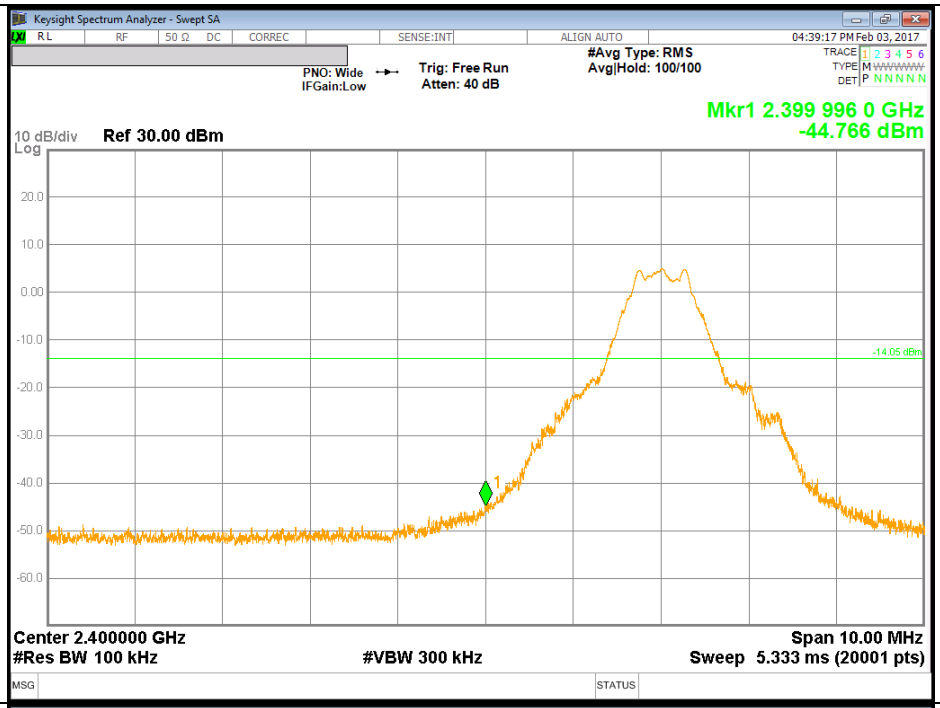
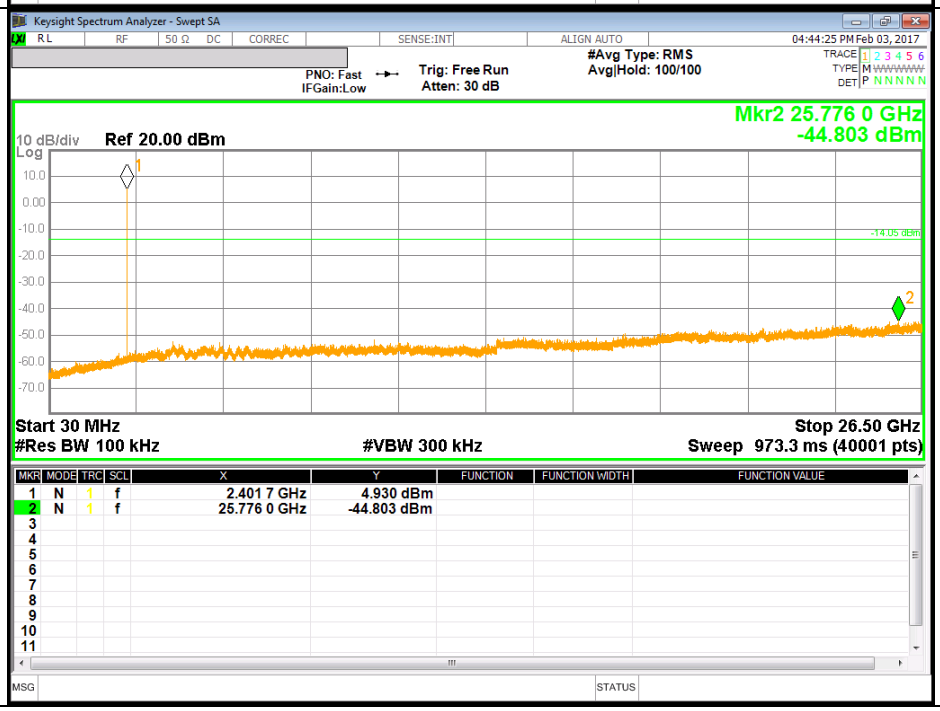
## RESULTS

## BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL

| | |
|---|---|
| Low CH BandEdge |  |
| Low CH Spurious |  |



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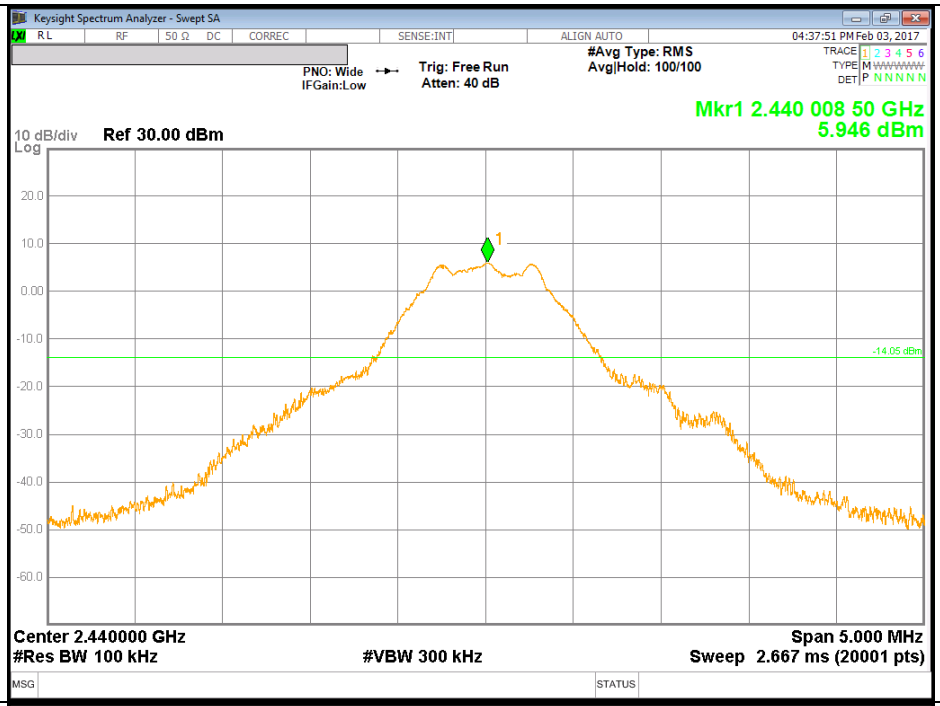
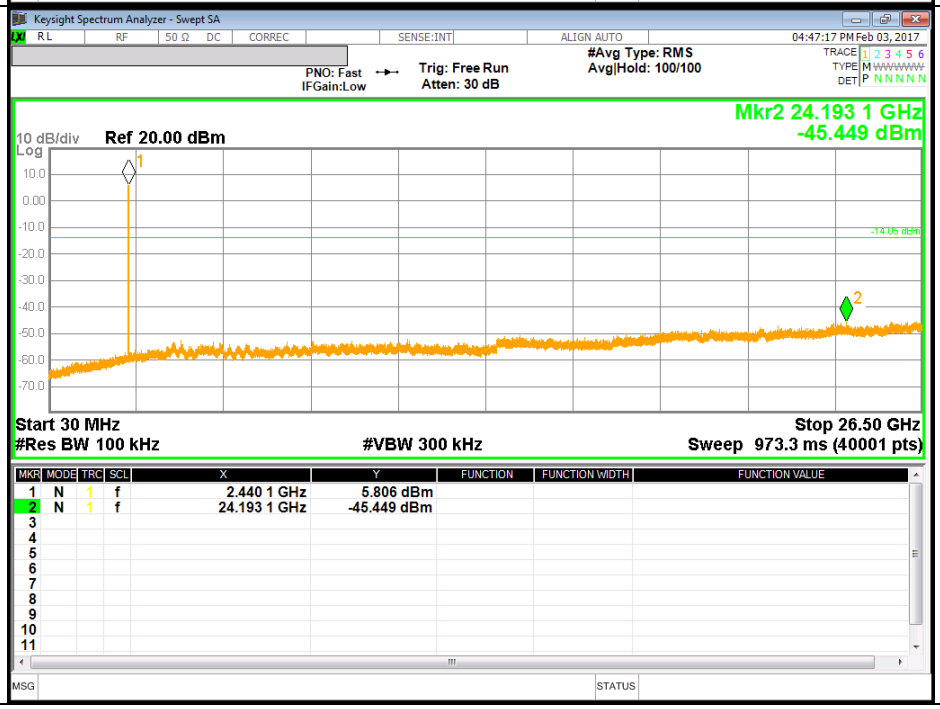
## SPURIOUS EMISSIONS, MID CHANNEL

| | |
|---|---|
| Middle CH BandEdge |  |
| Middle CH Spurious |  |



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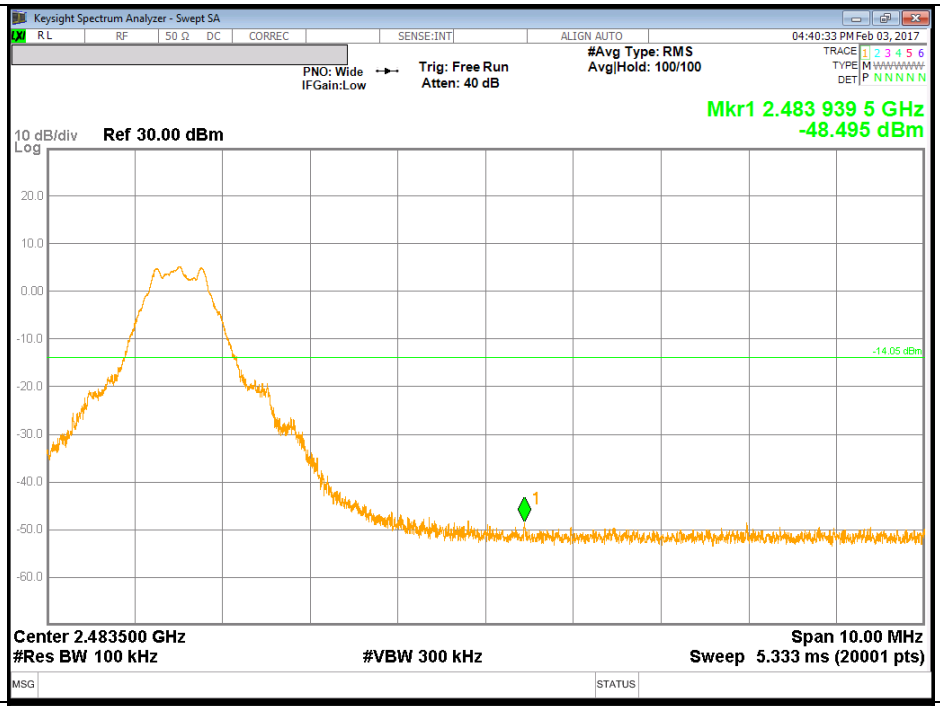
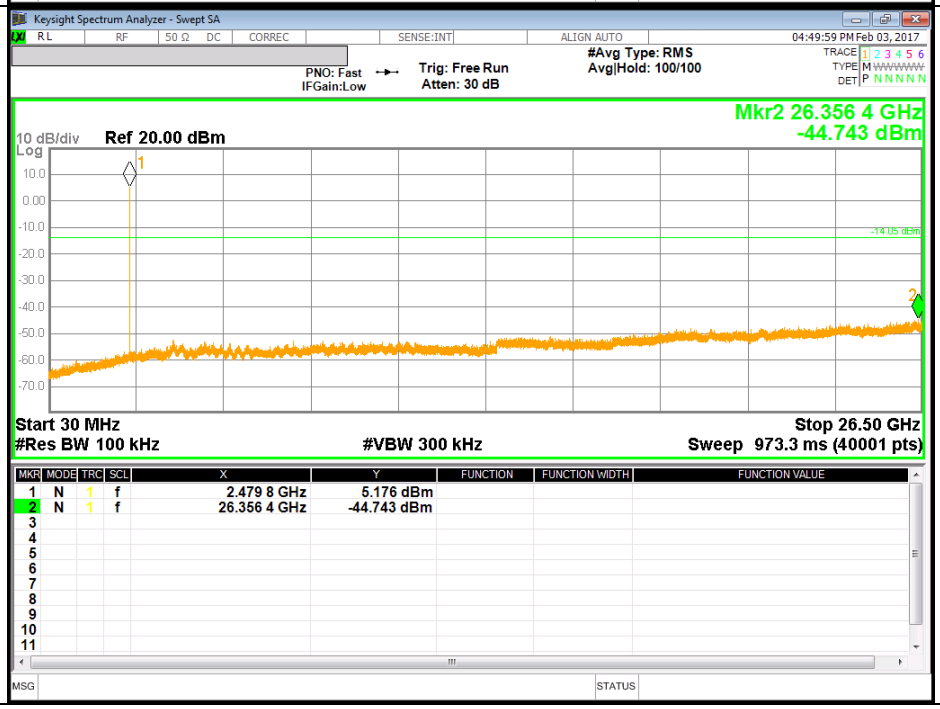
## SPURIOUS EMISSIONS, HIGH CHANNEL

| | |
|---|---|
| High CH BandEdge |  |
| High CH Spurious |  |



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# 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.


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**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(1/0.624)=2.05dB
(Spectrum Analyzer round it up to 2.05dB)

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 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.


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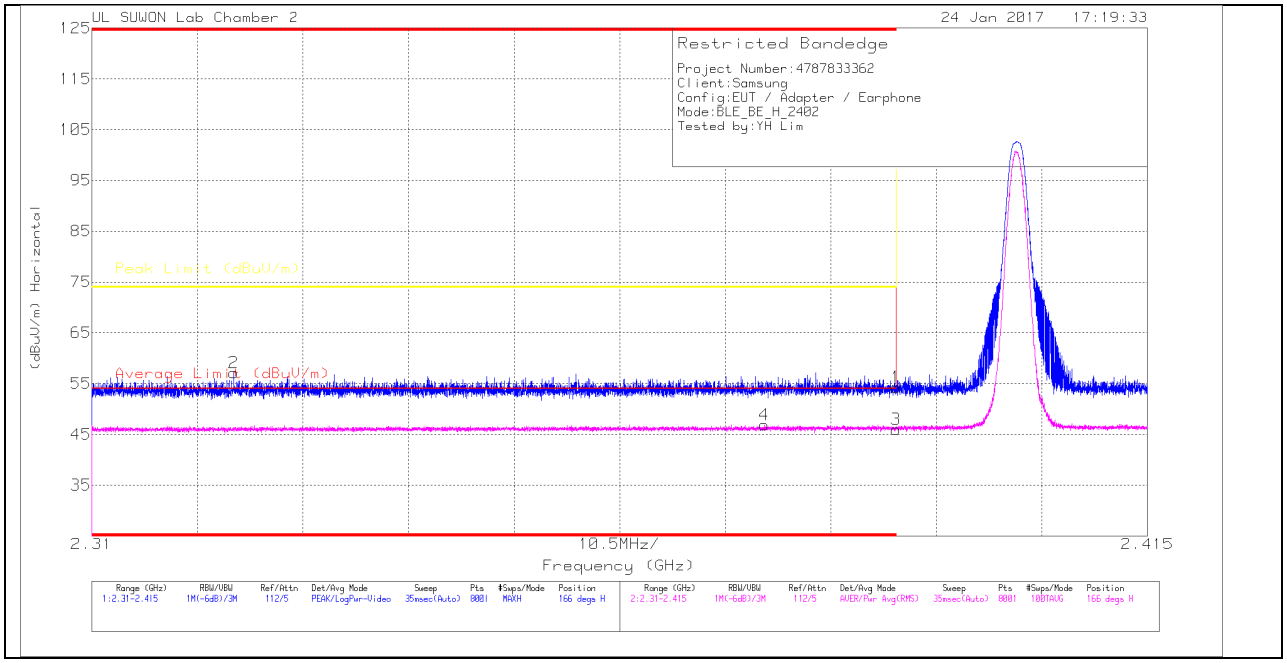
## 10.2. TRANSMITTER ABOVE 1 GHz
## RESTRICTED BANDEDGE (LOW CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT




### HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | 40.77 | Pk | 31.7 | -18.2 | 0 | 54.27 | - | - | 74 | -19.73 | 166 | 263 | H |
| 2 | * 2.324 | 43.92 | Pk | 31.6 | -18.4 | 0 | 57.12 | - | - | 74 | -16.88 | 166 | 263 | H |
| 3 | * 2.39 | 30.5 | RMS | 31.7 | -18.2 | 2.05 | 46.05 | 54 | -7.95 | - | - | 166 | 263 | H |
| 4 | * 2.377 | 31.41 | RMS | 31.7 | -18.3 | 2.05 | 46.86 | 54 | -7.14 | - | - | 166 | 263 | H |

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

Pk - Peak detector

RMS - RMS detection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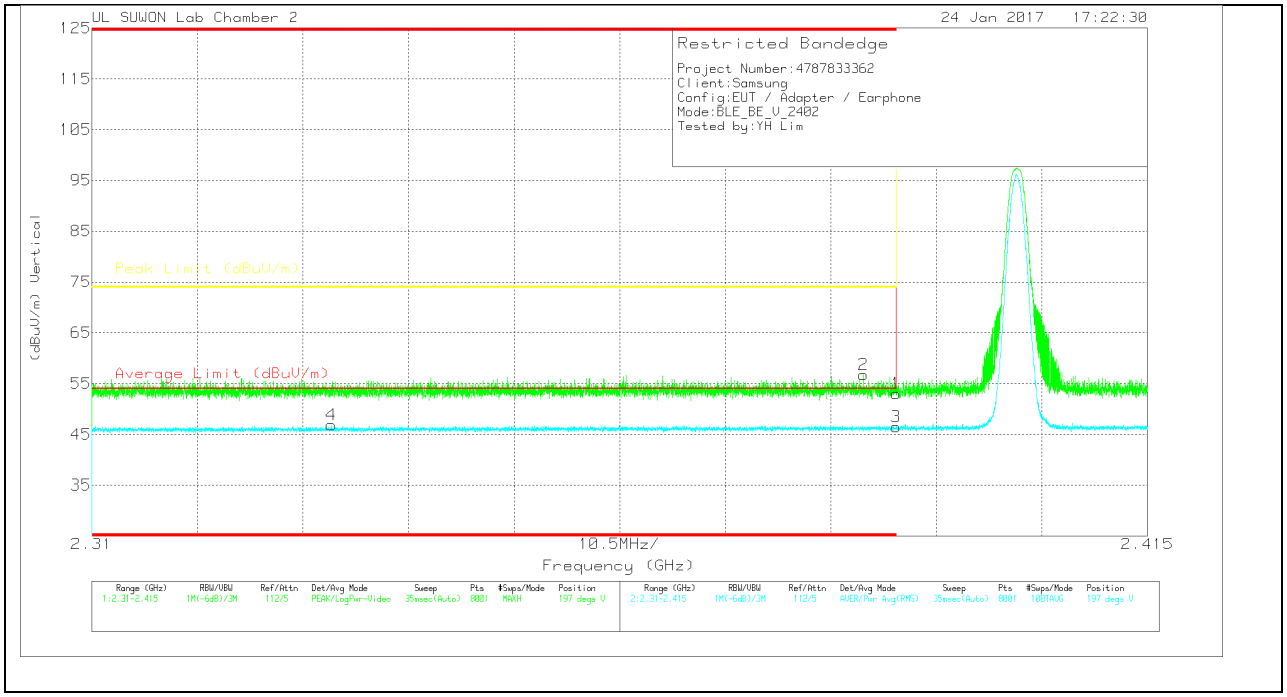
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | 39.58 | Pk | 31.7 | -18.2 | 0 | 53.08 | - | - | 74 | -20.92 | 197 | 400 | V |
| 2 | * 2.387 | 43.25 | Pk | 31.7 | -18.2 | 0 | 56.75 | - | - | 74 | -17.25 | 197 | 400 | V |
| 3 | * 2.39 | 30.94 | RMS | 31.7 | -18.2 | 2.05 | 46.49 | 54 | -7.51 | - | - | 197 | 400 | V |
| 4 | * 2.334 | 31.6 | RMS | 31.6 | -18.4 | 2.05 | 46.85 | 54 | -7.15 | - | - | 197 | 400 | V |

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

Pk - Peak detector

RMS - RMS detection



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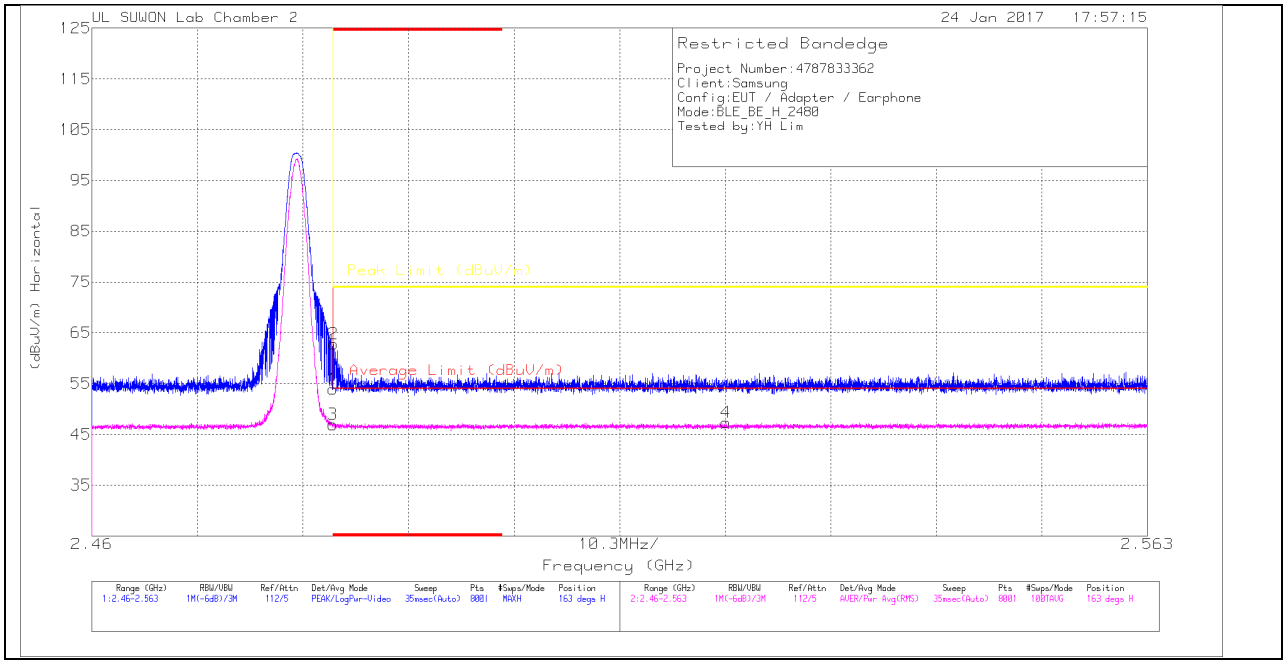
# AUTHORIZED BANDEDGE (HIGH CHANNEL)

## HORIZONTAL PEAK AND AVERAGE PLOT




## HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | 40.06 | Pk | 31.8 | -18 | 0 | 53.86 | - | - | 74 | -20.14 | 163 | 149 | H |
| 2 | * 2.484 | 49.01 | Pk | 31.8 | -18 | 0 | 62.81 | - | - | 74 | -11.19 | 163 | 149 | H |
| 3 | * 2.484 | 31.08 | RMS | 31.8 | -18 | 2.05 | 46.93 | 54 | -7.07 | - | - | 163 | 149 | H |
| 4 | 2.522 | 31.45 | RMS | 31.9 | -18 | 2.05 | 47.4 | 54 | -6.6 | - | - | 163 | 149 | H |

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

Pk - Peak detector

RMS - RMS detection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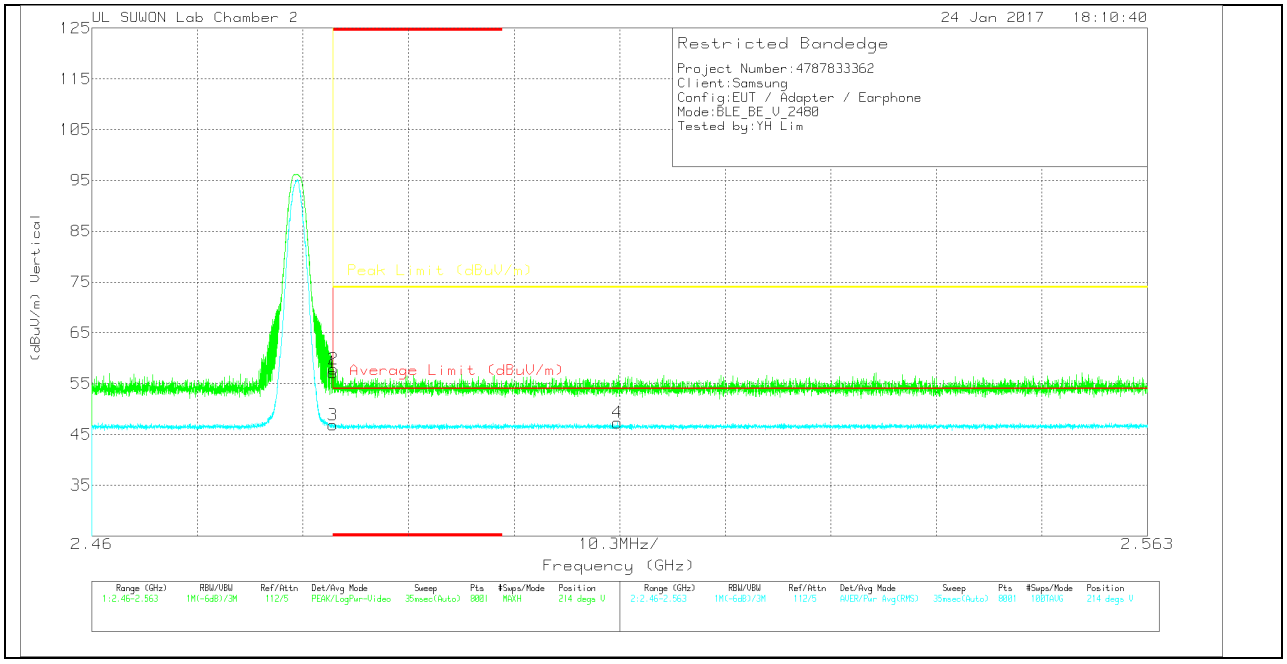
## VERTICAL PEAK AND AVERAGE PLOT




## VERTICAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | 43.39 | Pk | 31.8 | -18 | 0 | 57.19 | - | - | 74 | -16.81 | 214 | 307 | V |
| 2 | * 2.484 | 44.12 | Pk | 31.8 | -18 | 0 | 57.92 | - | - | 74 | -16.08 | 214 | 307 | V |
| 3 | * 2.484 | 31.03 | RMS | 31.8 | -18 | 2.05 | 46.88 | 54 | -7.12 | - | - | 214 | 307 | V |
| 4 | 2.511 | 31.35 | RMS | 31.9 | -18 | 2.05 | 47.3 | 54 | -6.7 | - | - | 214 | 307 | V |

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

Pk - Peak detector

RMS - RMS detection



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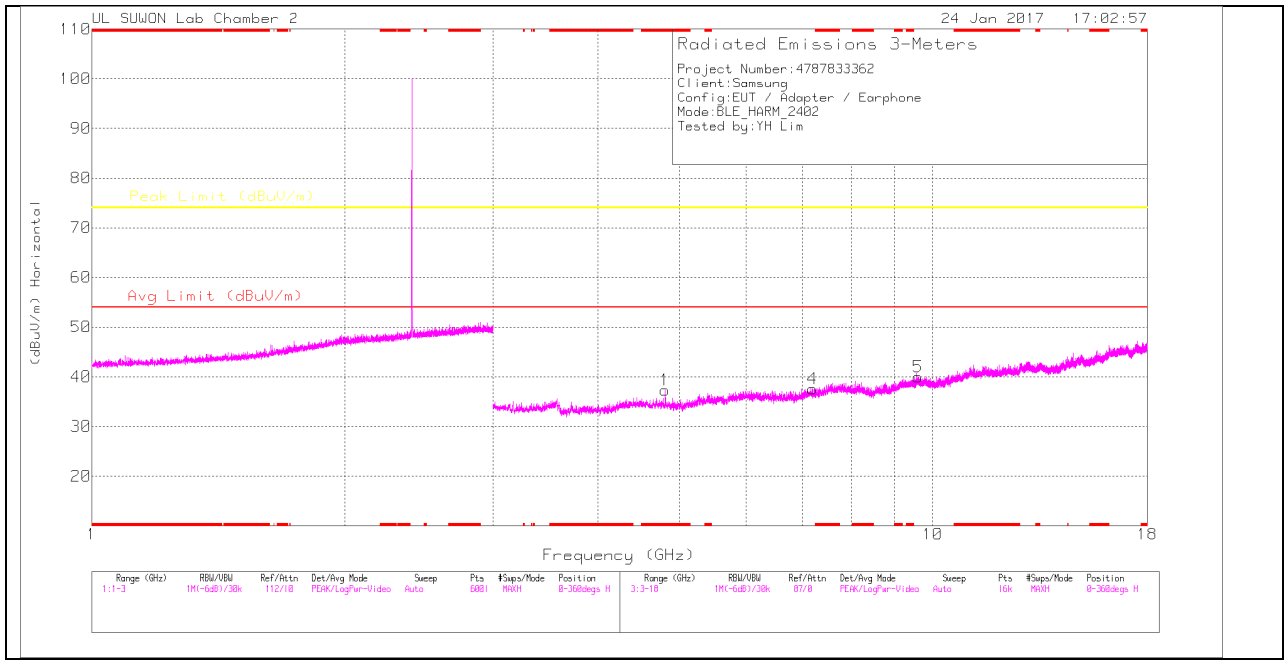
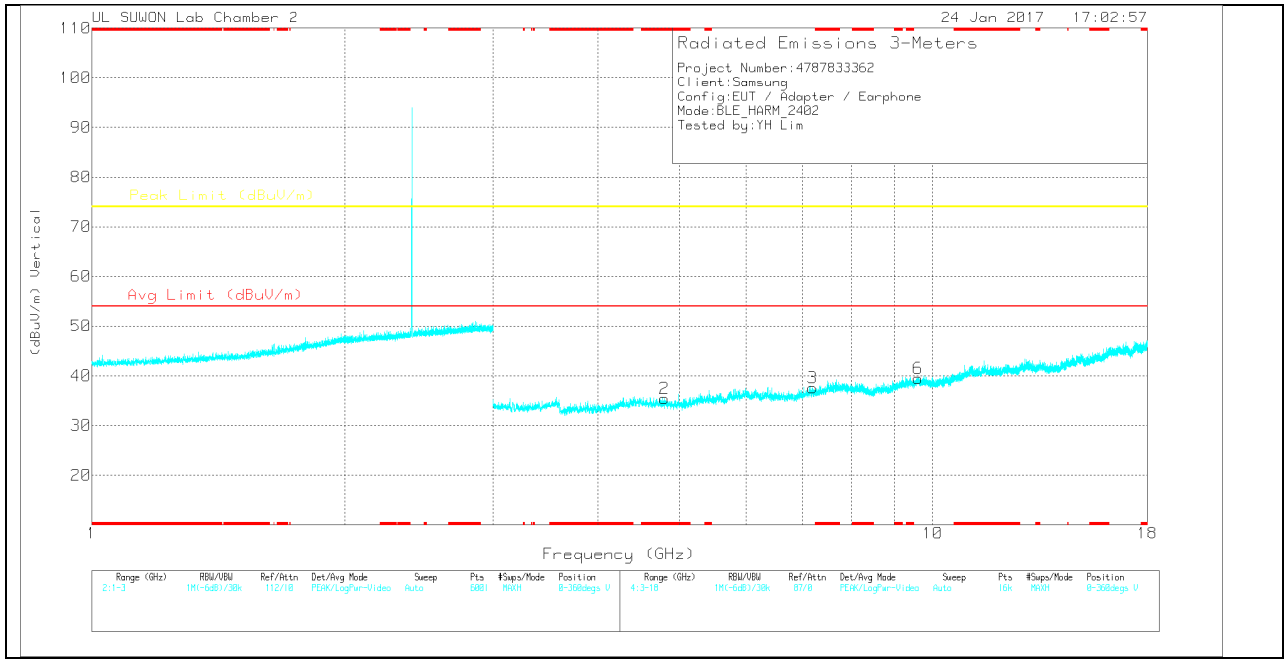
**HARMONICS AND SPURIOUS EMISSIONS**

## 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.



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# LOW CHANNEL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | * 4.804 | 27.73 | Pk | 33.9 | -24.3 | 0 | 37.33 | - | - | 74 | -36.67 | 0-360 | 250 | H |
| 4 | 7.197 | 23.46 | Pk | 35.7 | -21.6 | 0 | 37.56 | - | - | 74 | -36.44 | 0-360 | 150 | H |
| 5 | 9.608 | 21.46 | Pk | 36.9 | -18.4 | 0 | 39.96 | - | - | 74 | -34.04 | 0-360 | 150 | H |
| 2 | * 4.796 | 25.78 | Pk | 33.9 | -24.3 | 0 | 35.38 | - | - | 74 | -38.62 | 0-360 | 250 | V |
| 3 | 7.2 | 23.46 | Pk | 35.7 | -21.6 | 0 | 37.56 | - | - | 74 | -36.44 | 0-360 | 250 | V |
| 6 | 9.613 | 20.95 | Pk | 36.9 | -18.4 | 0 | 39.45 | - | - | 74 | -34.55 | 0-360 | 250 | V |

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

Pk – Peak detector

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


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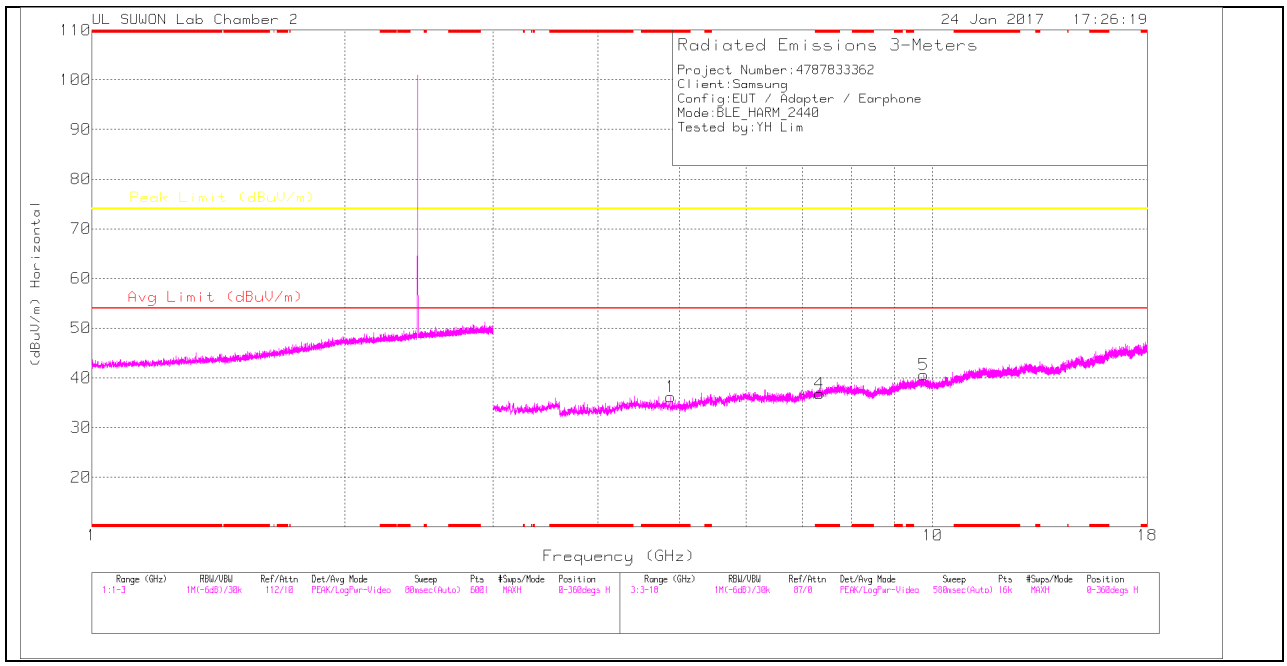
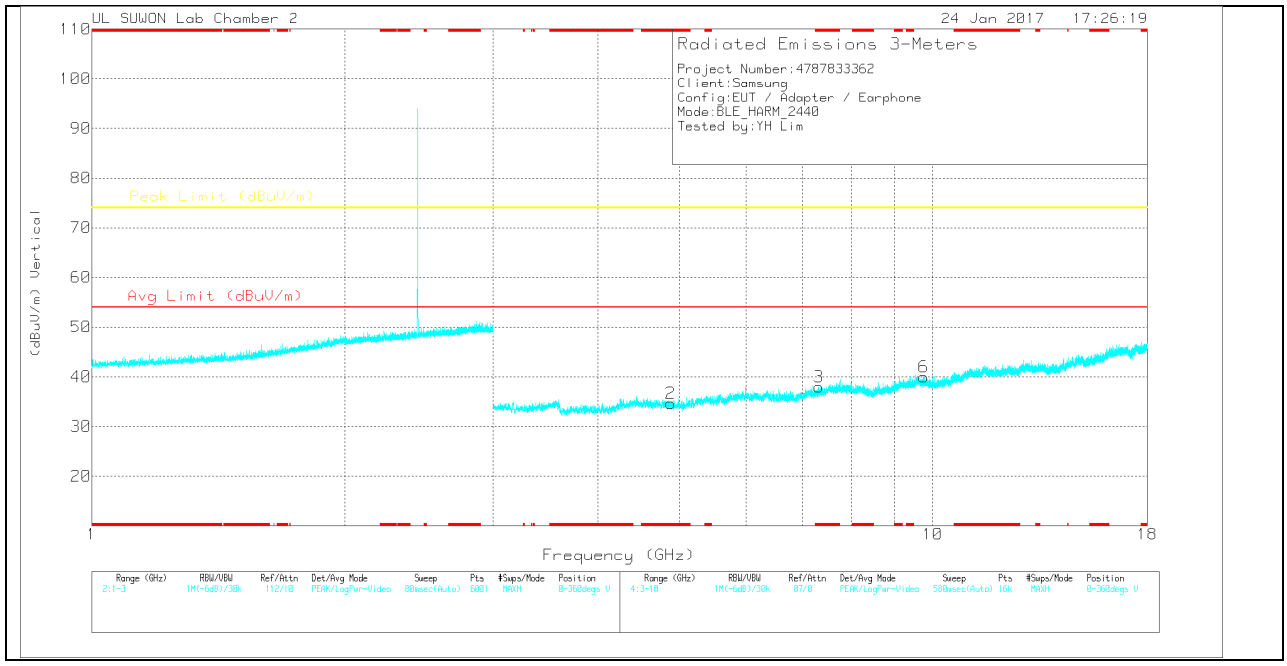
## MID CHANNEL HORIZONTAL




## MID CHANNEL VERTICAL




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

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | * 4.88 | 26.91 | Pk | 33.9 | -24.6 | 0 | 36.21 | - | - | 74 | -37.79 | 0-360 | 150 | H |
| 4 | * 7.331 | 22.88 | Pk | 35.9 | -21.9 | 0 | 36.88 | - | - | 74 | -37.12 | 0-360 | 150 | H |
| 5 | 9.76 | 21.61 | Pk | 37 | -18 | 0 | 40.61 | - | - | 74 | -33.39 | 0-360 | 150 | H |
| 2 | * 4.881 | 25.39 | Pk | 33.9 | -24.6 | 0 | 34.69 | - | - | 74 | -39.31 | 0-360 | 250 | V |
| 3 | * 7.327 | 23.99 | Pk | 35.9 | -21.9 | 0 | 37.99 | - | - | 74 | -36.01 | 0-360 | 250 | V |
| 6 | 9.76 | 20.98 | Pk | 37 | -18 | 0 | 39.98 | - | - | 74 | -34.02 | 0-360 | 150 | V |

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

Pk – Peak detector

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


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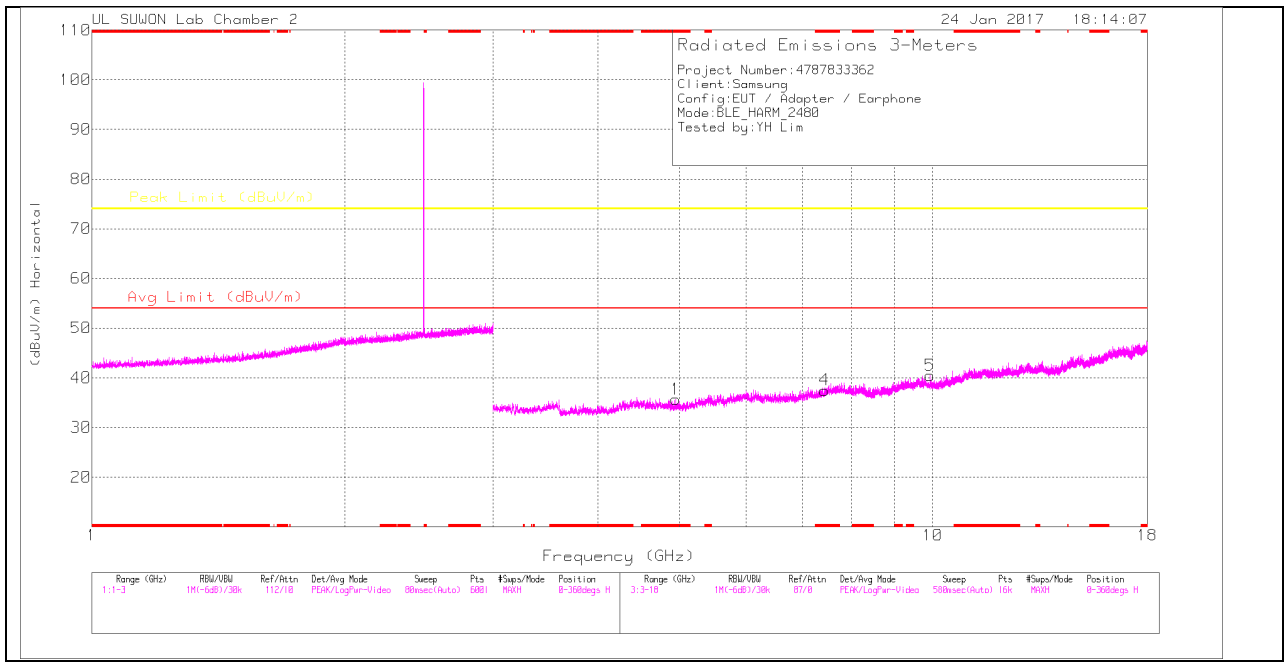
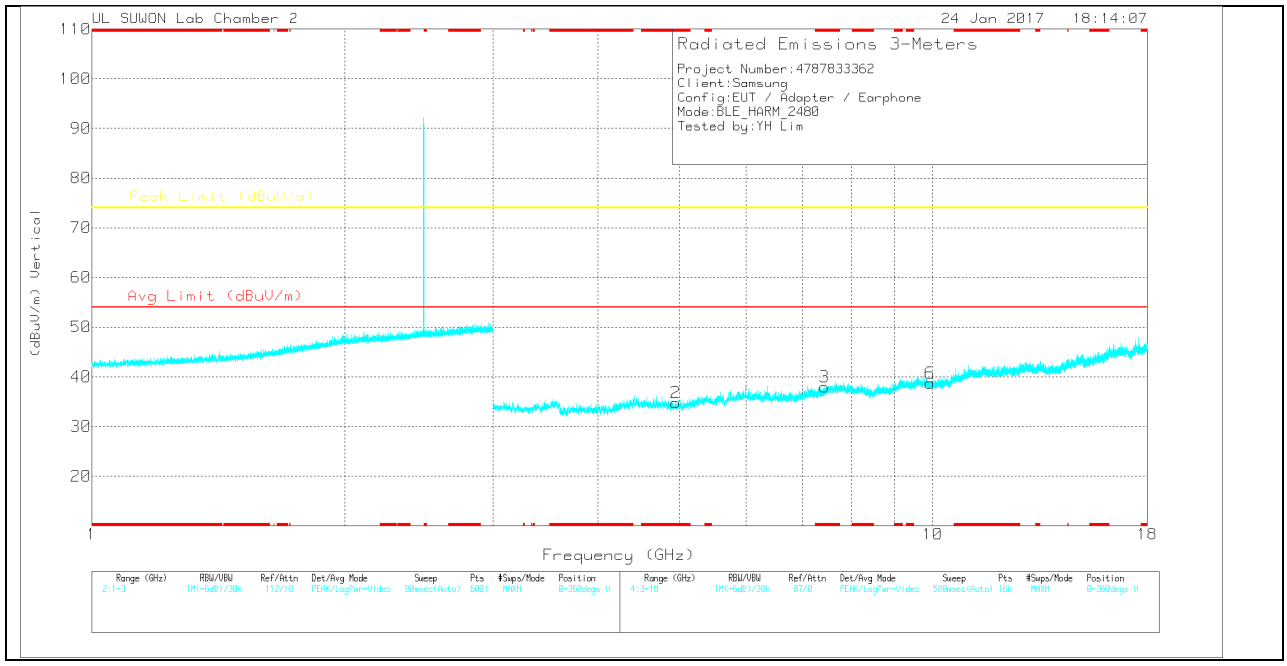
## HIGH CHANNEL HORIZONTAL




## HIGH CHANNEL VERTICAL




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



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## HIGH CHANNEL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117(00168724)_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 | * 4.951 | 26.49 | Pk | 33.9 | -24.7 | 0 | 35.69 | - | - | 74 | -38.31 | 0-360 | 150 | H |
| 4 | * 7.439 | 22.52 | Pk | 36 | -21 | 0 | 37.52 | - | - | 74 | -36.48 | 0-360 | 150 | H |
| 5 | 9.92 | 21.35 | Pk | 37.1 | -18 | 0 | 40.45 | - | - | 74 | -33.55 | 0-360 | 250 | H |
| 2 | * 4.946 | 25.64 | Pk | 33.9 | -24.7 | 0 | 34.84 | - | - | 74 | -39.16 | 0-360 | 250 | V |
| 3 | * 7.438 | 22.96 | Pk | 36 | -21 | 0 | 37.96 | - | - | 74 | -36.04 | 0-360 | 150 | V |
| 6 | 9.918 | 19.67 | Pk | 37.1 | -18 | 0 | 38.77 | - | - | 74 | -35.23 | 0-360 | 250 | V |

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

Pk – Peak detector

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


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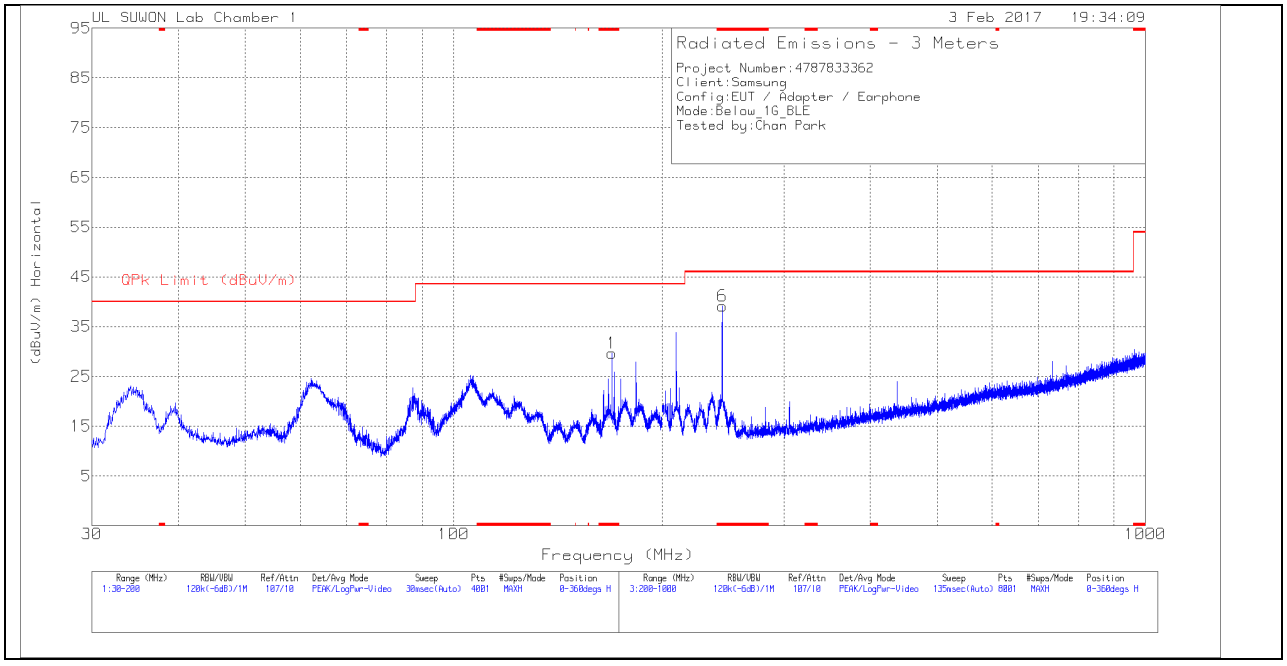
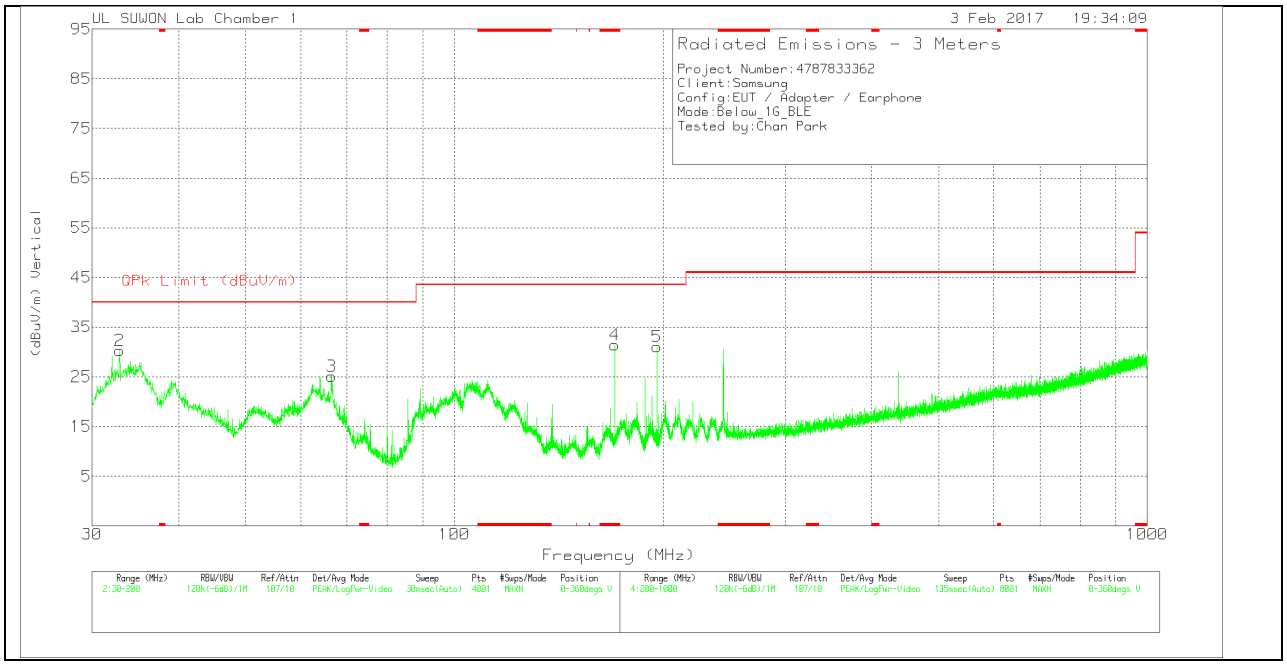
## 10.3. WORST-CASE BELOW 1 GHz

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

### HORIZONTAL PLOT




### VERTICAL PLOT





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## 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 | * 169.4 | 49.15 | Pk | 8.9 | -28.4 | 29.65 | 43.52 | -13.87 | 0-360 | 200 | H |
| 2 | 32.89 | 50.43 | Pk | 10.4 | -30.5 | 30.33 | 40 | -9.67 | 0-360 | 100 | V |
| 3 | 66.5075 | 44.24 | Pk | 10.7 | -29.8 | 25.14 | 40 | -14.86 | 0-360 | 100 | V |
| 4 | * 170.4625 | 50.82 | Pk | 9 | -28.4 | 31.42 | 43.52 | -12.1 | 0-360 | 100 | V |
| 5 | 196.0475 | 48.3 | Pk | 11 | -28.2 | 31.1 | 43.52 | -12.42 | 0-360 | 100 | V |
| 6 | * 244.5 | 54.88 | Pk | 12.2 | -27.9 | 39.18 | 46.02 | -6.84 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| * 244.5676 | 54.76 | Qp | 12.2 | -27.8 | 39.16 | 46.02 | -6.86 | 197 | 114 | H |

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

Qp - Quasi-Peak detector


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# 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.


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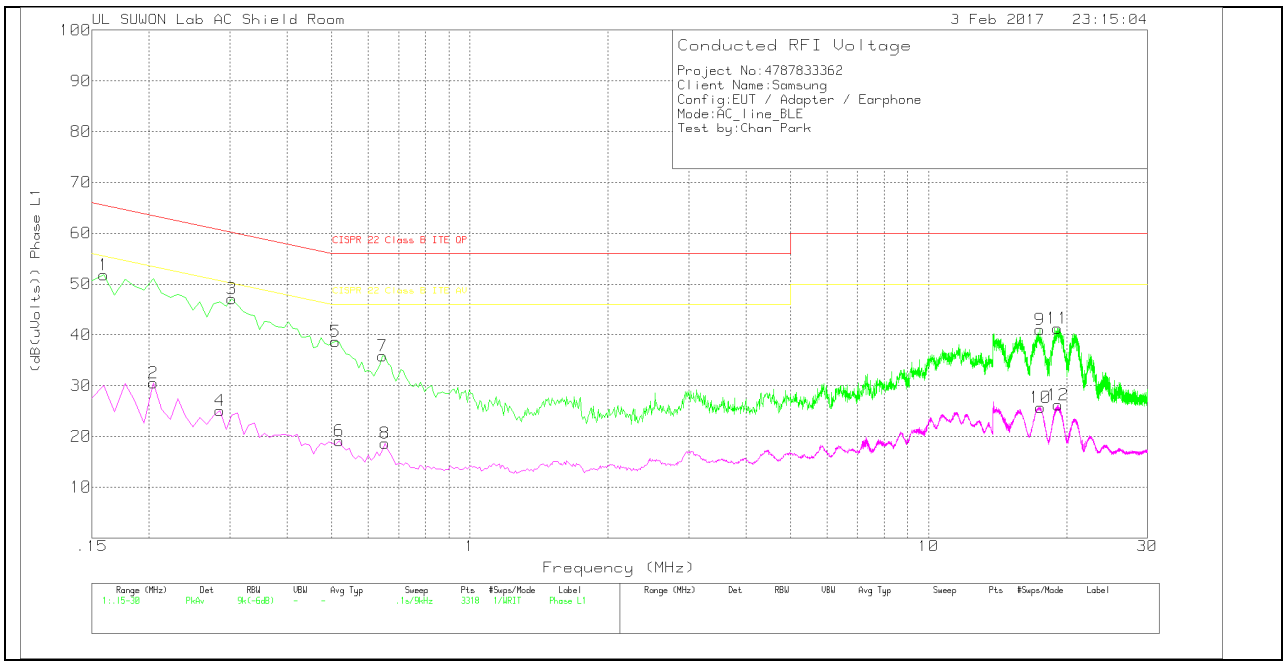
## RESULTS

## 6 WORST EMISSIONS

# LINE 1 PLOT



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## LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_with ex-cord_L1 | CE Shield Room | Corrected Reading (dB(uVolts)) | CISPR 22 Class B ITE QP | Margin (dB) | CISPR 22 Class B ITE AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .159 | 41.88 | Pk | 9.9 | 0 | 51.78 | 65.52 | -13.74 | - | - |
| 2 | .204 | 20.65 | Av | 9.9 | 0 | 30.55 | - | - | 53.45 | -22.9 |
| 3 | .303 | 37.43 | Pk | 9.7 | 0 | 47.13 | 60.16 | -13.03 | - | - |
| 4 | .285 | 15.33 | Av | 9.7 | 0 | 25.03 | - | - | 50.67 | -25.64 |
| 5 | .51 | 28.82 | Pk | 9.9 | 0 | 38.72 | 56 | -17.28 | - | - |
| 6 | .519 | 9.19 | Av | 9.9 | 0 | 19.09 | - | - | 46 | -26.91 |
| 7 | .645 | 25.97 | Pk | 9.9 | 0 | 35.87 | 56 | -20.13 | - | - |
| 8 | .654 | 8.77 | Av | 9.9 | 0 | 18.67 | - | - | 46 | -27.33 |
| 9 | 17.466 | 30.64 | Pk | 10.2 | .2 | 41.04 | 60 | -18.96 | - | - |
| 10 | 17.556 | 15.15 | Av | 10.3 | .2 | 25.65 | - | - | 50 | -24.35 |
| 11 | 19.095 | 30.83 | Pk | 10.3 | .2 | 41.33 | 60 | -18.67 | - | - |
| 12 | 19.158 | 15.65 | Av | 10.3 | .2 | 26.15 | - | - | 50 | -23.85 |

Pk - Peak detector

Av - Average detection


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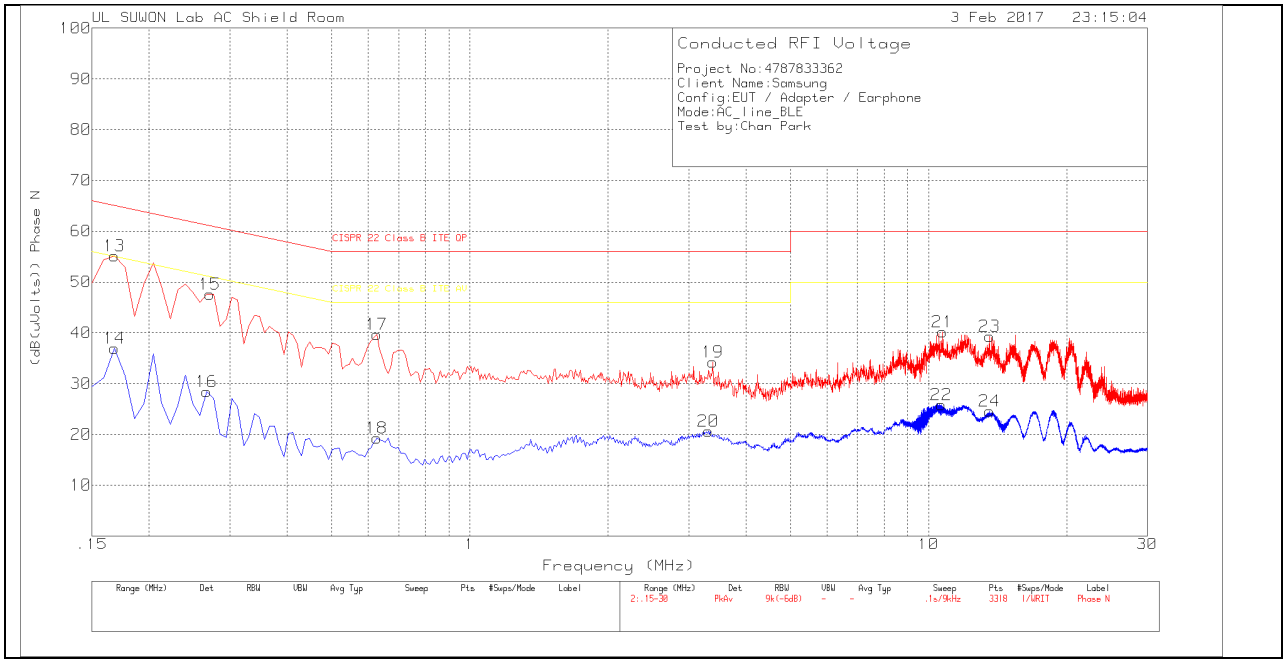
# LINE 2 PLOT



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## LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_with ex-cord_N | CE Shield Room | Corrected Reading (dB(uVolts)) | CISPR 22 Class B ITE QP | Margin (dB) | CISPR 22 Class B ITE AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | .168 | 45.1 | Pk | 10 | 0 | 55.1 | 65.06 | -9.96 | - | - |
| 14 | .168 | 26.96 | Av | 10 | 0 | 36.96 | - | - | 55.06 | -18.1 |
| 15 | .2715 | 37.87 | Pk | 9.7 | 0 | 47.57 | 61.07 | -13.5 | - | - |
| 16 | .267 | 18.69 | Av | 9.7 | 0 | 28.39 | - | - | 51.21 | -22.82 |
| 17 | .627 | 29.77 | Pk | 9.9 | 0 | 39.67 | 56 | -16.33 | - | - |
| 18 | .627 | 9.35 | Av | 9.9 | 0 | 19.25 | - | - | 46 | -26.75 |
| 19 | 3.39 | 24.35 | Pk | 9.8 | .1 | 34.25 | 56 | -21.75 | - | - |
| 20 | 3.309 | 10.67 | Av | 9.8 | .1 | 20.57 | - | - | 46 | -25.43 |
| 21 | 10.725 | 29.89 | Pk | 10.1 | .2 | 40.19 | 60 | -19.81 | - | - |
| 22 | 10.671 | 15.54 | Av | 10.1 | .2 | 25.84 | - | - | 50 | -24.16 |
| 23 | 13.605 | 28.81 | Pk | 10.3 | .2 | 39.31 | 60 | -20.69 | - | - |
| 24 | 13.605 | 14.05 | Av | 10.3 | .2 | 24.55 | - | - | 50 | -25.45 |

Pk - Peak detector

Av - Average detection


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