



FCC CFR47 PART 15 SUBPART C

ANT+

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-A600G/DS, SM-A600G

FCC ID: A3LSMA600G

REPORT NUMBER: 4788371671-E5V2

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Testing
Laboratory

TL-637

Revision History

| <u>Rev.</u> | <u>Issue Date</u> | <u>Revisions</u> | <u>Revised By</u> |
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| V1 | 03/31/18 | Initial issue | Junwhan Lee |
| V2 | 04/07/18 | Updated to address TCB's question | Junwhan Lee |

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. ATTESTATION OF TEST RESULTS | 4 |
| 1.1. INTRODUCTION OF TEST DATA REUSE..... | 5 |
| 1.2. DIFFERENCE..... | 5 |
| 1.3. SPOT CHECK VERIFICATION DATA | 5 |
| 1.4. REFERENCE DETAIL | 6 |
| 2. TEST METHODOLOGY | 7 |
| 3. FACILITIES AND ACCREDITATION | 7 |
| 4. CALIBRATION AND UNCERTAINTY | 7 |
| 4.1. MEASURING INSTRUMENT CALIBRATION | 7 |
| 4.2. SAMPLE CALCULATION | 7 |
| 4.3. MEASUREMENT UNCERTAINTY..... | 7 |
| 5. EQUIPMENT UNDER TEST | 8 |
| 5.1. DESCRIPTION OF EUT | 8 |
| 5.2. MAXIMUM E-FIELD STRENGTH | 8 |
| 5.3. DESCRIPTION OF AVAILABLE ANTENNAS | 8 |
| 5.4. WORST-CASE CONFIGURATION AND MODE..... | 8 |
| 5.5. DESCRIPTION OF TEST SETUP..... | 9 |
| 6. TEST AND MEASUREMENT EQUIPMENT | 11 |
| 7. LIMITS AND RESULTS..... | 12 |
| 7.1. 99% BANDWIDTH..... | 12 |
| 7.2. TRANSMITTER RADIATED EMISSIONS..... | 14 |
| 7.2.1. DUTY CYCLE | 17 |
| 7.2.2. FUNDAMENTAL FIELD STRENGTH LEVEL..... | 18 |
| 7.2.3. TRANSMITTER BAND EDGES | 24 |
| 7.2.4. HARMONICS AND SPURIOUS EMISSIONS | 28 |
| 7.2.5. SPURIOUS BELOW 1 GHz | 34 |
| 8. AC POWER LINE CONDUCTED EMISSIONS..... | 36 |
| 9. SETUP PHOTOS..... | 41 |

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 ANT+
MODEL NUMBER: SM-A600G/DS, SM-A600G
SERIAL NUMBER: R38K108GLMR, R38K108GVGN (RADIATED, Original);
R38K10BCS5W (CONDUCTED, Original)
R38K108KQ3P (RADIATED, Spot check & Additional test);
DATE TESTED: FEB 21, 2018 - MAR 06, 2018 (Original)
MAR 13, 2018 - MAR 29, 2018 (Spot check & Additional 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
UL Korea, Ltd. By:

Tested By:



SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMA600GN ANT+(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: A3LSMA600G shares the same enclosure and circuit board as FCC ID: A3LSMA600GN. The ANT+ antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMA600GN remains representative of FCC ID: A3LSMA600G. The test data of FCC ID: A3LSMA600GN being submitted for this application to cover ANT+ features.

Due to difference of charger, radiated emission under 1GHz and AC line conducted test were performed newly.

1.3. SPOT CHECK VERIFICATION DATA

| Mode | Test Item | Frequency | Test Limit | Original model | Spot check model | Deviation | Remark |
|------|-------------|-----------|------------|----------------------|---------------------|-----------|-------------------|
| | | | | SM-A600GN/DS Results | SM-A600G/DS Results | | |
| | | | | FCC ID : A3LSMA600GN | FCC ID : A3LSMA600G | | |
| ANT+ | Fundamental | 2402 MHz | 114 dBuV/m | 96.88 dBuV/m | 94.99 dBuV/m | -1.89 dB | |
| | Band Edge | 2480 MHz | 74 dBuV/m | 57.79 dBuV/m | 57.64 dBuV/m | -0.15 dB | |
| | RSE | 2402 MHz | 74 dBuV/m | 39.47 dBuV/m | 39.51 dBuV/m | 0.04 dB | Noise floor level |

Comparison of two models, upper deviation is within 3dB range and all test results are under 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 | A3LSMA600GN | Grant | 4788371667-E1V2 | Test | FCC Report DTS WLAN / All sections (Except section 11.3 and 12) |
| | | | 4788371667-E2V2 | Test | FCC Report BLE All sections (Except section 11.3 and 12) |
| DSS | A3LSMA600GN | Grant | 4788371667-E3V2 | Test | FCC Report BT / All sections (Except section 11.3 and 12) |
| NII | A3LSMA600GN | Grant | 4788371667-E4V2 | Test | FCC Report UNII WALN / All sections (Except section 12 and 13) |
| DXX | A3LSMA600GN | Grant | 4788371667-E5V2 | Test | FCC Report ANT+ / All sections (Except section 7.2.5 and 8) |
| PCE | A3LSMA600GN | Grant | 4788371667-E7V2 | Test | FCC Report WWAN / All sections (Except Conducted Output Power & Test result of LTE Band 66) |

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. ANSI C63.10-2013.
4. KDB 484596 D01 Referencing Test Data DR01-42712

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 checked="" type="checkbox"/> Chamber 1 |
| <input checked="" type="checkbox"/> Chamber 2 |
| <input type="checkbox"/> Chamber 3 |

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 | 3.86 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 GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n and ANT+. This test report addresses the ANT+ operational mode.

5.2. MAXIMUM E-FIELD STRENGTH

The ANT+ mode has maximum output fundamental field strength as follows:

| Frequency Range [MHz] | Mode | Peak E-field Strength [dBuV/m] | Avg E-field Strength [dBuV/m] | Distance [m] |
|--------------------------|-------|-----------------------------------|----------------------------------|-----------------|
| 2402 - 2480 | ANT + | 96.88 | 48.48 | 3.00 |

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -3.01 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.

Note : All radiated and power line conducted tests were performed connected with earphone and charger for evaluation of worst case mode.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| Support Equipment List | | | | |
|------------------------|--------------|------------|---------------|--------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Charger | SAMSUNG | EP-TA50EWE | DW3K115DS/A-E | N/A |
| Data Cable | SAMSUNG | ECB-DU68WE | N/A | N/A |
| Earphone | SAMSUNG | EHS61ASFWE | N/A | N/A |

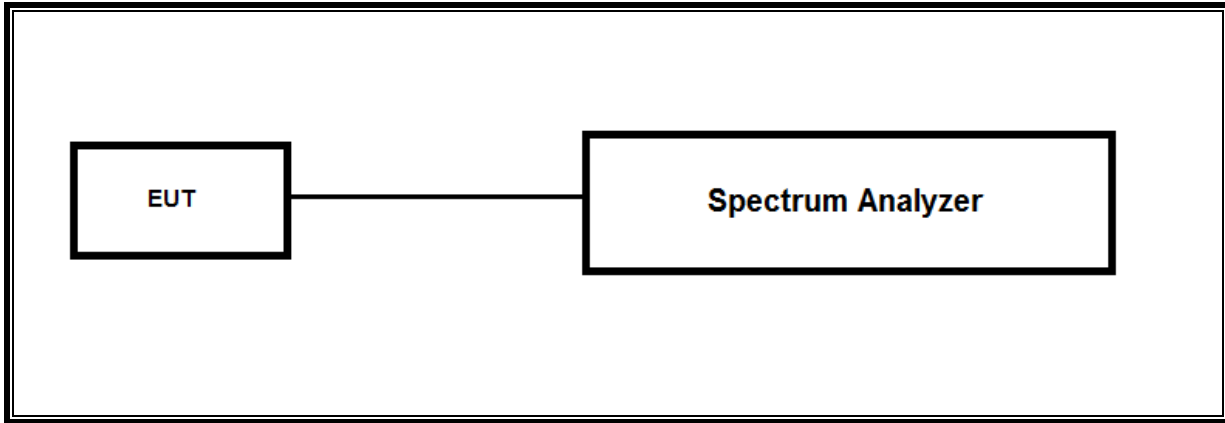
I/O CABLES

| 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 | 1.2m | N/A |
| 2 | Audio | 2 | Mini-Jack | Unshielded | 1.2m | N/A |

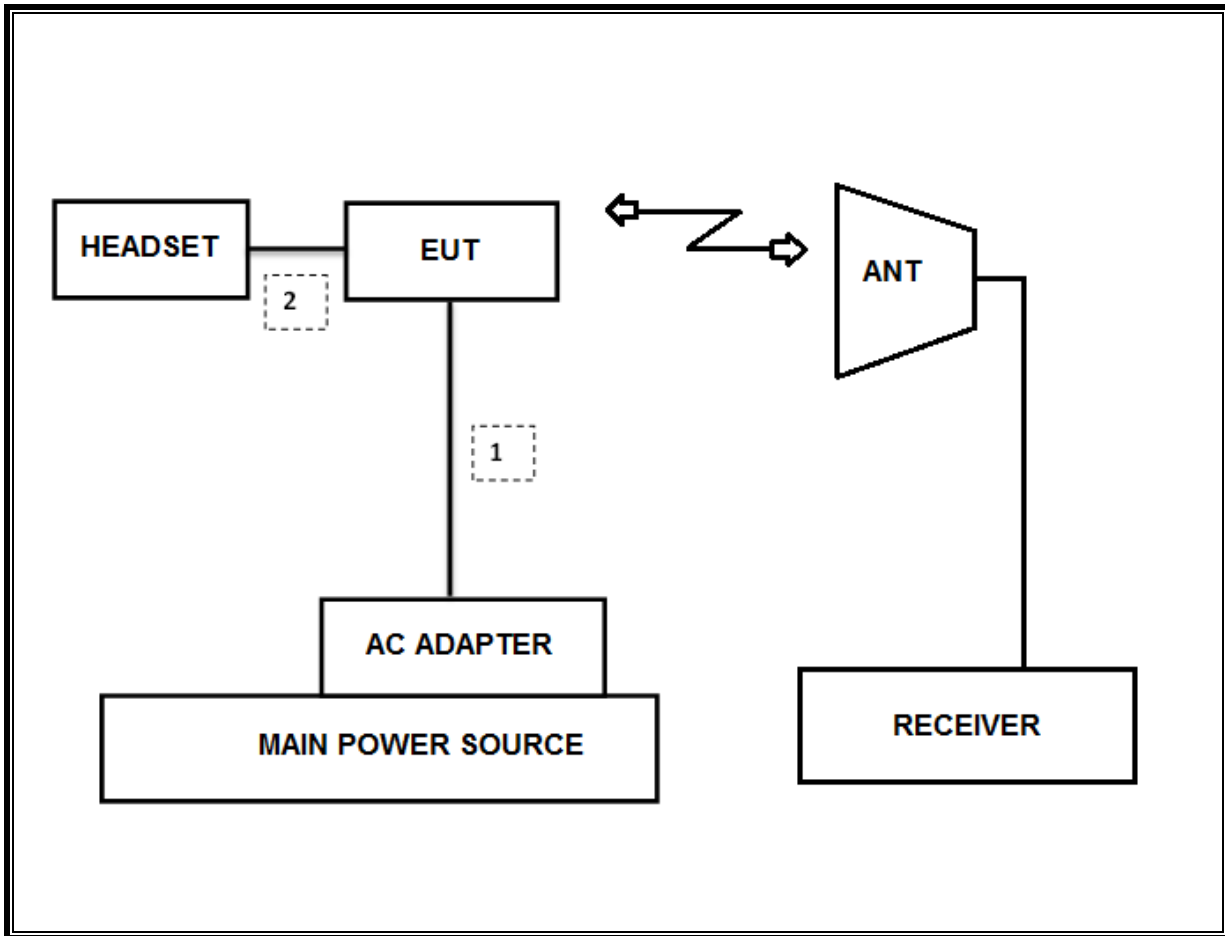
TEST SETUP

The EUT is set to continuously transmit in ANT + test mode.
 Test software in hidden menu exercised the EUT to enable ANT+ mode.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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 | 08-31-19 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 749 | 09-14-19 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 845 | 08-31-19 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00167211 | 10-14-18 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00161451 | 03-10-19 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168724 | 05-31-19 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168717 | 05-31-19 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00205959 | 11-29-18 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00166155 | 12-04-19 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00168645 | 12-04-19 |
| Antenna, Horn, 40 GHz | ETS | 3116C-PA | 00168841 | 11-13-19 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 341282 | 08-09-18 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 351741 | 08-07-18 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 370599 | 08-10-18 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1876511 | 08-08-18 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1896138 | 08-08-18 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 2029169 | 08-11-18 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54170614 | 08-08-18 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54490312 | 08-08-18 |
| Average Power Sensor | Agilent / HP | U2000 | MY54270007 | 08-08-18 |
| Attenuator | PASTERNAK | PE7087-10 | A001 | 08-08-18 |
| Attenuator | PASTERNAK | PE7087-10 | A008 | 08-08-18 |
| Attenuator | PASTERNAK | PE7087-10 | 2 | 08-10-18 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100439 | 08-08-18 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100457 | 08-08-18 |
| EMI Test Receive, 44 GHz | R&S | ESW44 | 101590 | 08-09-18 |
| EMI Test Receive, 3 GHz | R&S | ESR3 | 101832 | 08-07-18 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 009 | 08-08-18 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 015 | 08-08-18 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 020 | 08-11-18 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 010 | 08-08-18 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 015 | 08-08-18 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 020 | 08-11-18 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 009 | 08-08-18 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 016 | 08-08-18 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 021 | 08-11-18 |
| LISN | R&S | ENV-216 | 101837 | 08-09-18 |
| 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. LIMITS AND RESULTS

7.1. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

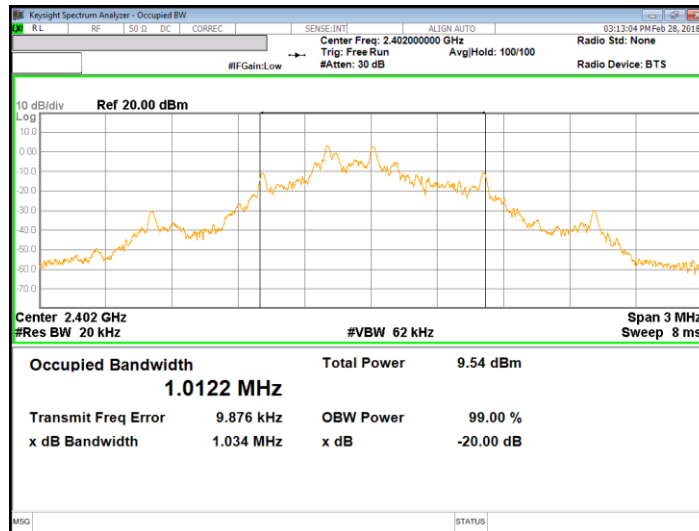
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

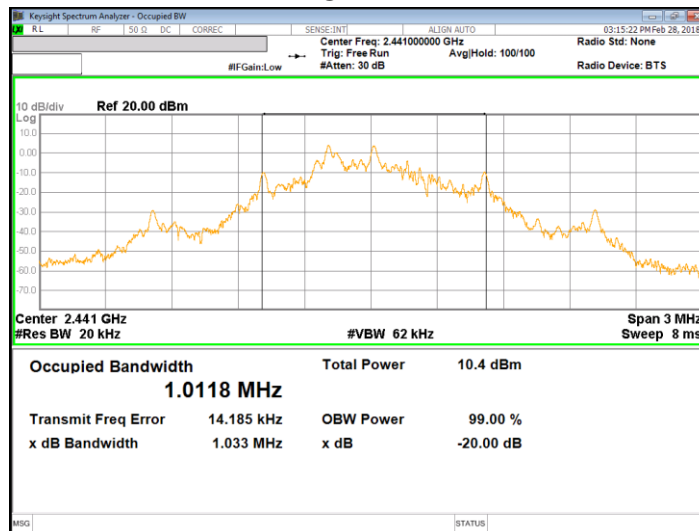
| Channel | Frequency [MHz] | 99% Bandwidth [MHz] | 20 dB Bandwidth [MHz] |
|---------|--------------------|------------------------|--------------------------|
| Low | 2402 | 1.012 | 1.034 |
| Mid | 2441 | 1.012 | 1.033 |
| High | 2480 | 1.012 | 1.033 |
| Worst | | 1.012 | 1.034 |

99% BANDWIDTH PLOTS

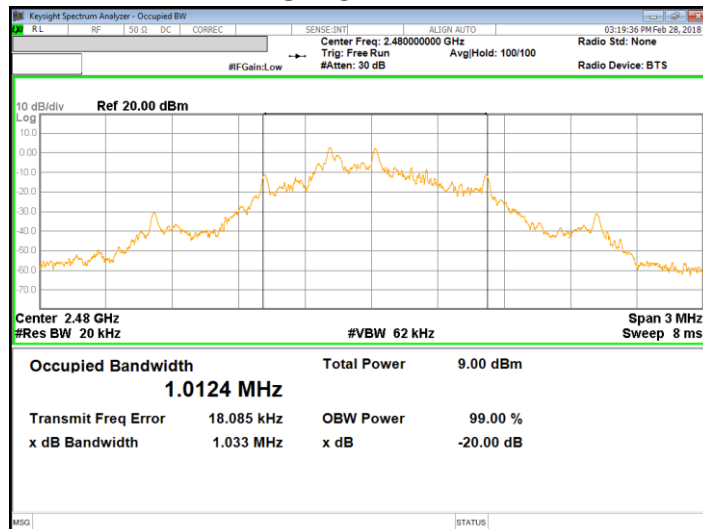
LOW CHANNEL



MID CHANNEL



HIGH CHANNEL



7.2. TRANSMITTER RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.10: 2013

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.

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.

LIMIT

FCC §15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|------------------------------|---|---|
| 902-928 MHz | 50 | 500 |
| 2400-2483.5 MHz | 50 | 500 |
| 5725-5875 MHz | 50 | 500 |
| 24.0-24.25 GHz | 250 | 2500 |

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in Sec. 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

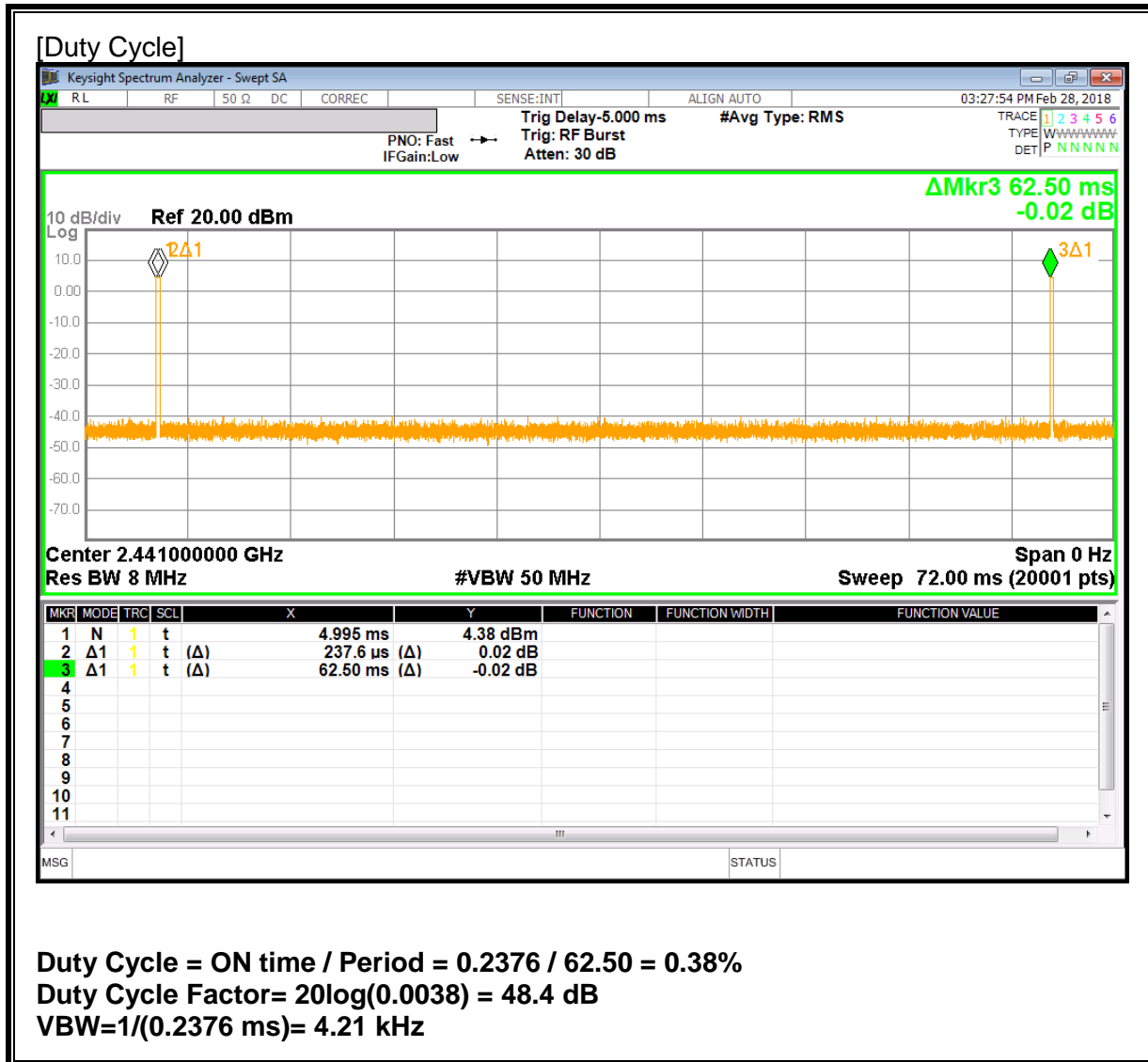
FCC §15.205 and §15.209

| 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.

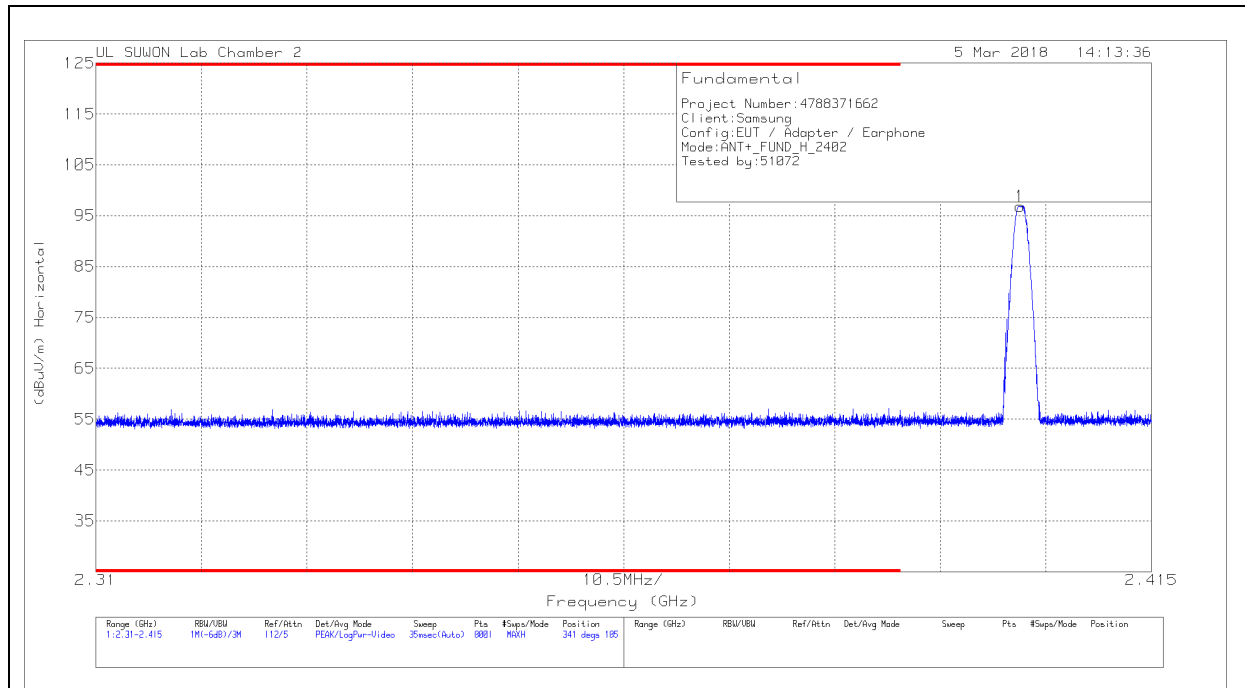
RESULTS

7.2.1. DUTY CYCLE



7.2.2. FUNDAMENTAL FIELD STRENGTH LEVEL

LOW CHANNEL, HORIZONTAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|----------------------------|----------------|-------------|----------|
| 1 | 2.402 | 83.78 | Pk | 31.3 | -18.2 | 96.88 | 341 | 185 | H |

Pk - Peak detector

* Pk Limit : 114dBuV/m
 Pk Margin : 17.12dB

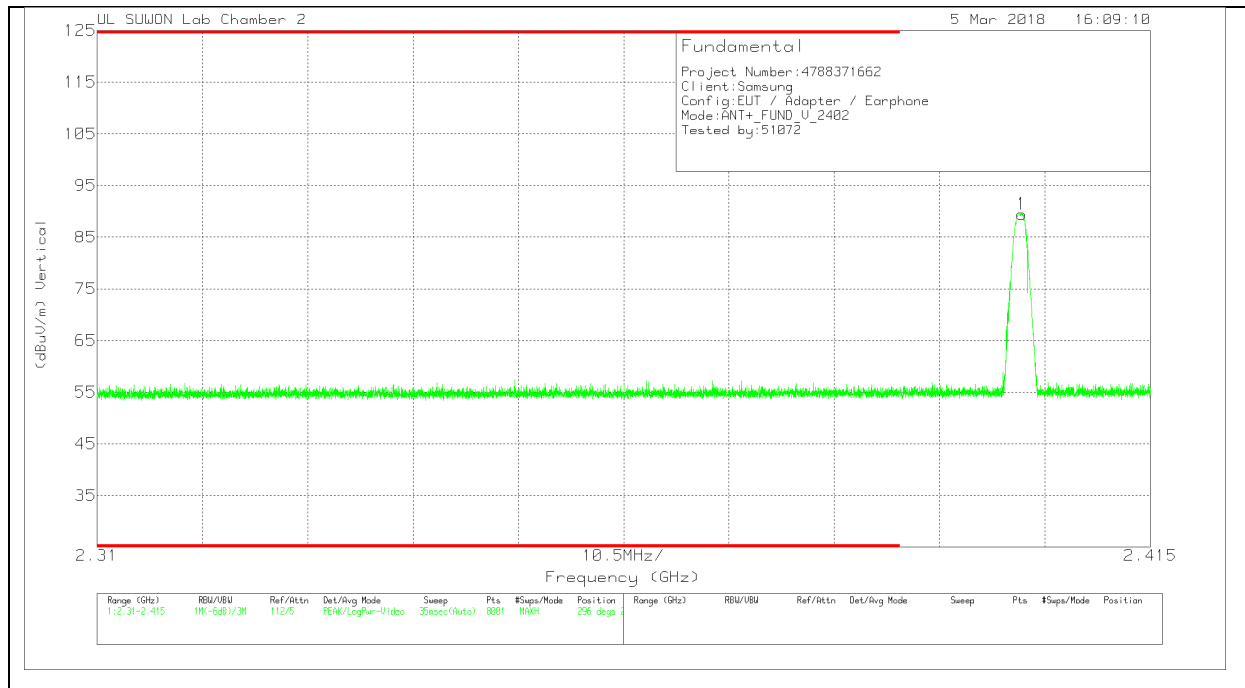
** For marker 1, used the following method to do averaging:

DCCF=48.4

Corrected AV reading = Peak Reading – DCCF
 = 96.88 – 48.4= 48.48 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 45.52 dB

LOW CHANNEL, VERTICAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|----------------------------|----------------|-------------|----------|
| 1 | 2.402 | 76.37 | Pk | 31.3 | -18.2 | 89.47 | 296 | 274 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

** Pk Limit : 114dBuV/m
 Pk Margin : 24.53 dB

*** For marker 1, used the following method to do averaging:

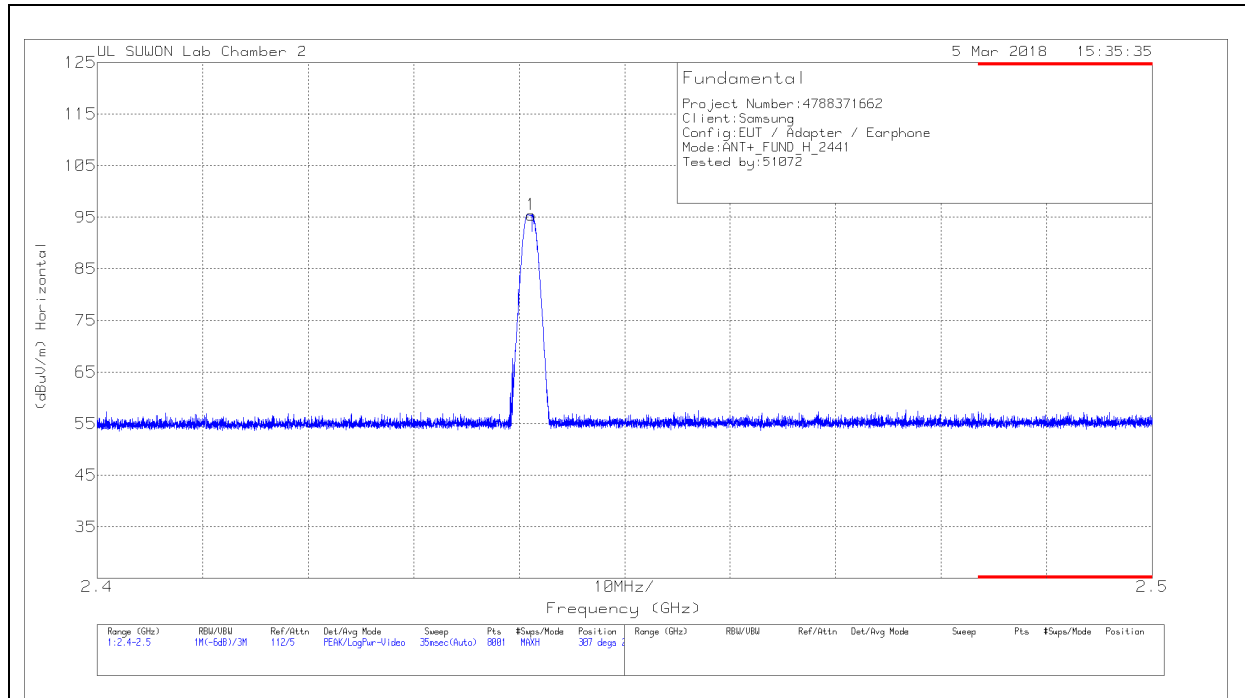
DCCF=48.4

Corrected AV reading = Peak Reading – DCCF

= 89.47 – 48.4= 41.07 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 52.93 dB

MID CHANNEL, HORIZONTAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|--------------|----------------------------|----------------|-------------|----------|
| 1 | 2.441 | 82.05 | Pk | 31.5 | -18.1 | 0 | 95.45 | 307 | 209 | H |

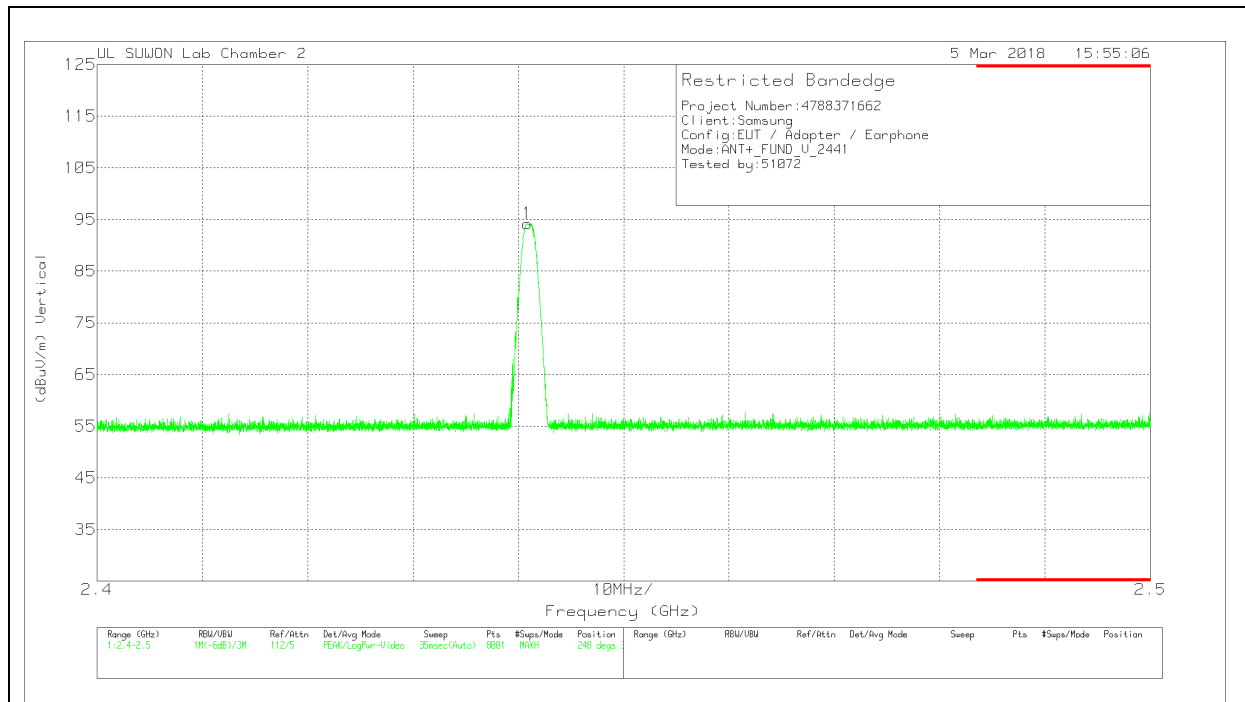
Pk - Peak detector

** Pk Limit : 114dBuV/m
 Pk Margin : 18.55 dB

*** For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 95.45 – 48.4= 47.05 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 46.95 dB

MID CHANNEL, VERTICAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|----------------------------|----------------|-------------|----------|
| 1 | 2.441 | 80.82 | Pk | 31.5 | -18.1 | 94.22 | 248 | 394 | V |

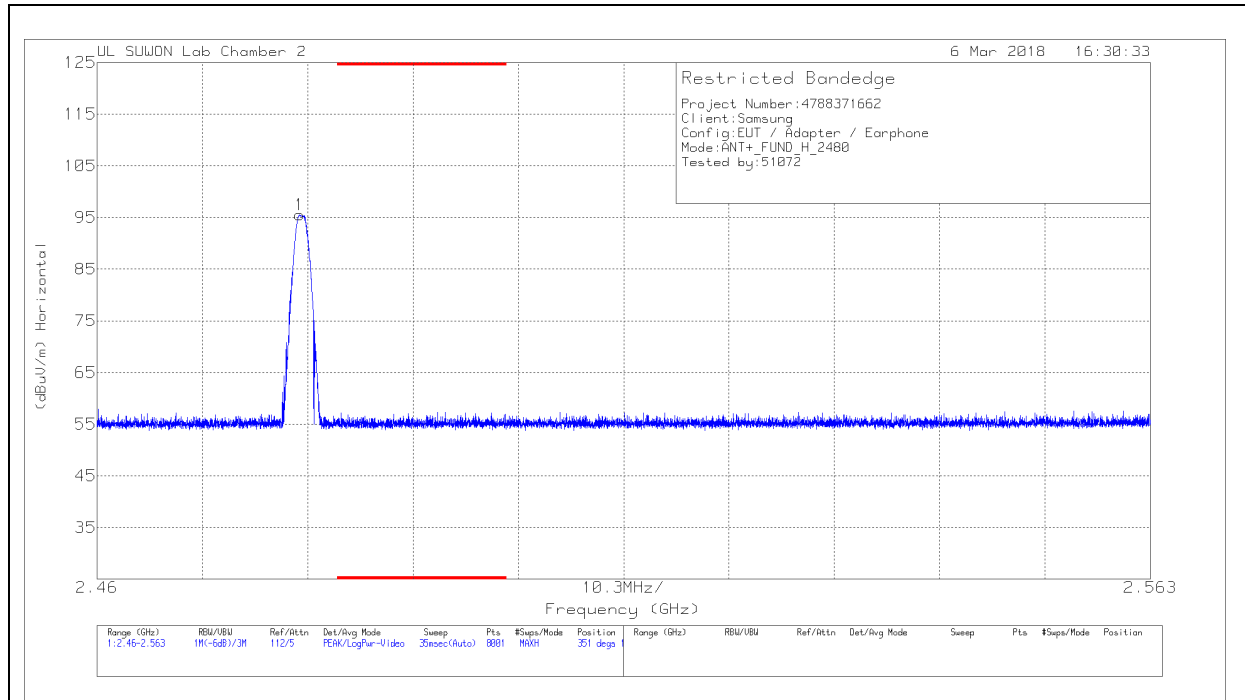
Pk - Peak detector

** Pk Limit : 114dBuV/m
 Pk Margin : 19.78 dB

*** For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 94.22 – 48.4= 45.82 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 48.18 dB

HIGH CHANNEL, HORIZONTAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|--------------|----------------------------|----------------|-------------|----------|
| 1 | 2.48 | 81.91 | Pk | 31.6 | -18 | 0 | 95.51 | 351 | 154 | H |

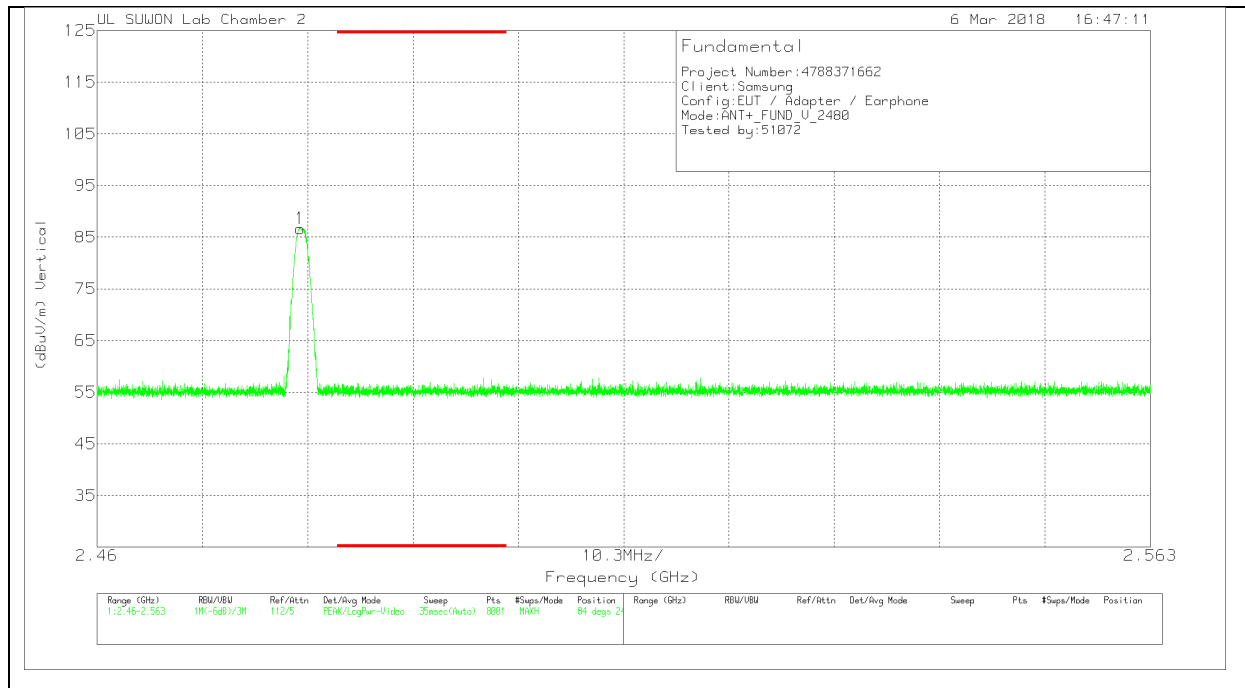
Pk - Peak detector

** Pk Limit : 114dBuV/m
 Pk Margin : 18.49 dB

*** For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 95.51 – 48.4= 47.11 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 46.89 dB

HIGH CHANNEL, VERTICAL



Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|--------------|----------------------------|----------------|-------------|----------|
| 1 | 2.48 | 73.07 | Pk | 31.6 | -18 | 0 | 86.67 | 84 | 246 | V |

Pk - Peak detector

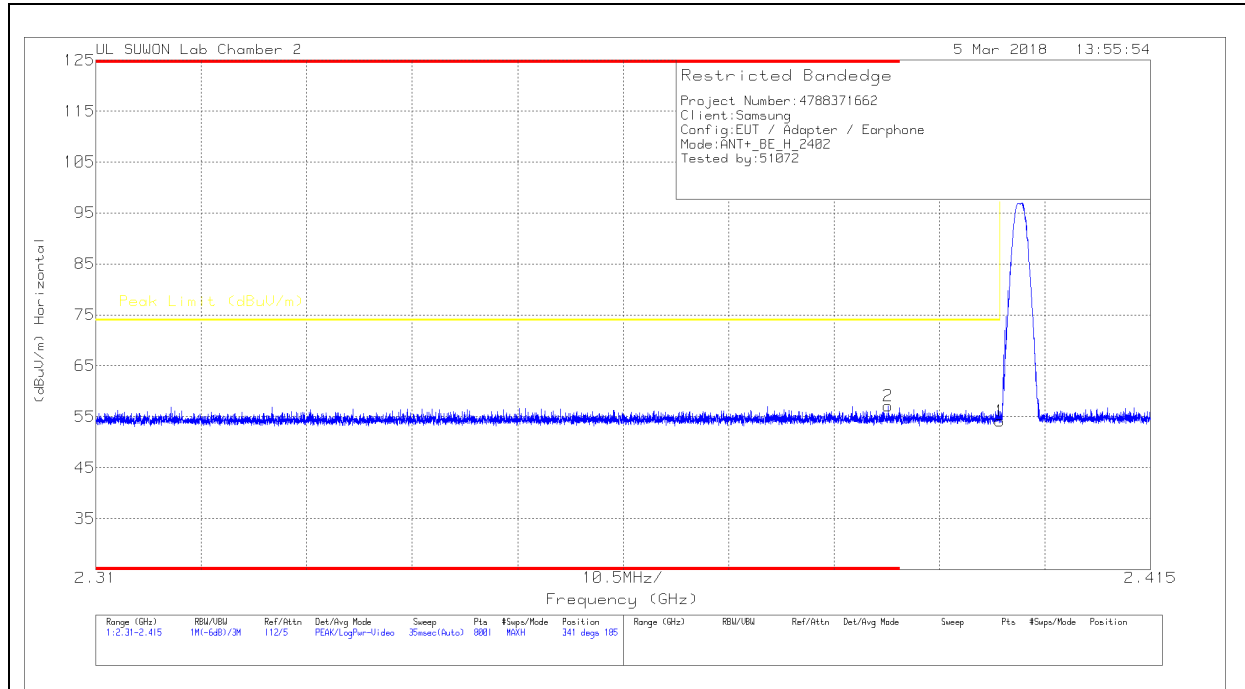
** Pk Limit : 114dBuV/m
 Pk Margin : 27.33dB

*** For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 96.88 – 48.4= 38.27 dBuV/m

***AVG Limit : 94dBuV/m
 AVG Margin : 55.73 dB

7.2.3. TRANSMITTER BAND EDGES

BANDEDGE (LOW CHANNEL, HORIZONTAL)



HORIZONTAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1 | 2.4 | 41.05 | Pk | 31.3 | -18.2 | 54.15 | 74 | -19.85 | 341 | 185 | H |
| 2 | * 2.389 | 44.04 | Pk | 31.3 | -18.2 | 57.14 | 74 | -16.86 | 341 | 185 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

* For marker 1, used the following method to do averaging:

DCCF=48.4

Corrected AV reading = Peak Reading – DCCF

= 54.2 – 48.4 = 5.75 dBuV/m [AVG Limit : 54dBuV/m, Margin : 48.25 dB]

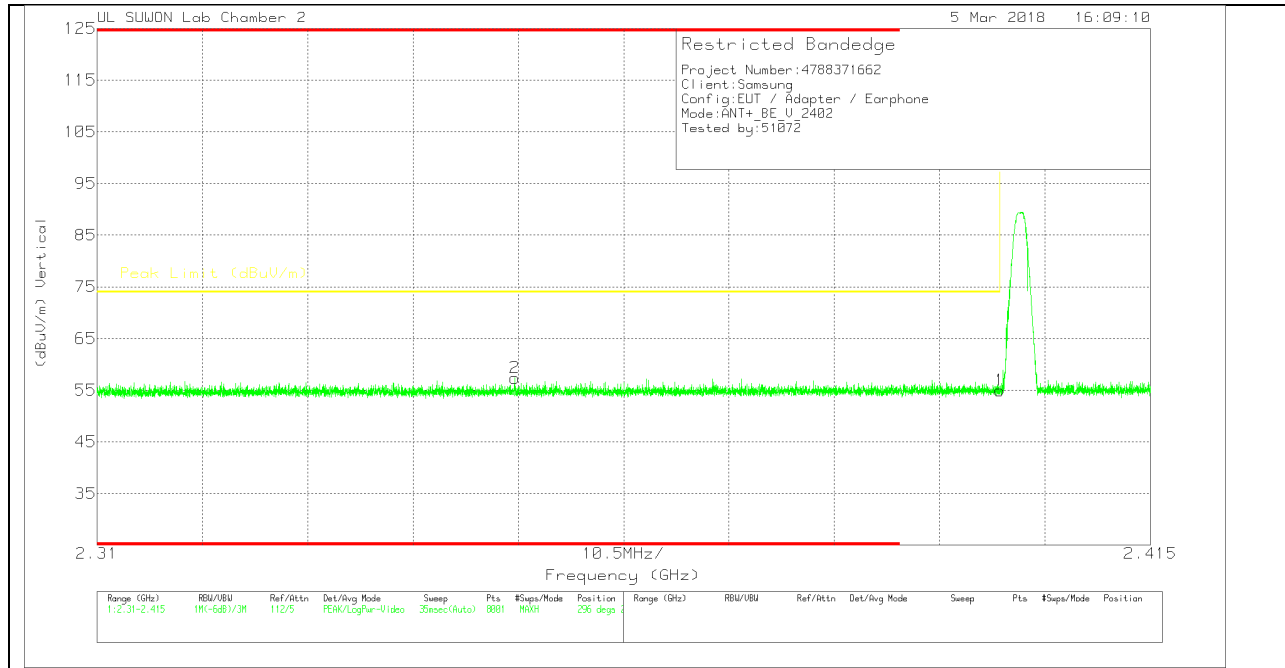
* For marker 2, used the following method to do averaging:

DCCF=48.4

Corrected AV reading = Peak Reading – DCCF

= 57.36 – 48.4 = 8.74 dBuV/m [AVG Limit : 54dBuV/m, Margin : 45.26 dB]

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1 | 2.4 | 41.85 | Pk | 31.3 | -18.2 | 54.95 | 74 | -19.05 | 296 | 274 | V |
| 2 | * 2.352 | 44.48 | Pk | 31.2 | -18.3 | 57.38 | 74 | -16.62 | 296 | 274 | V |

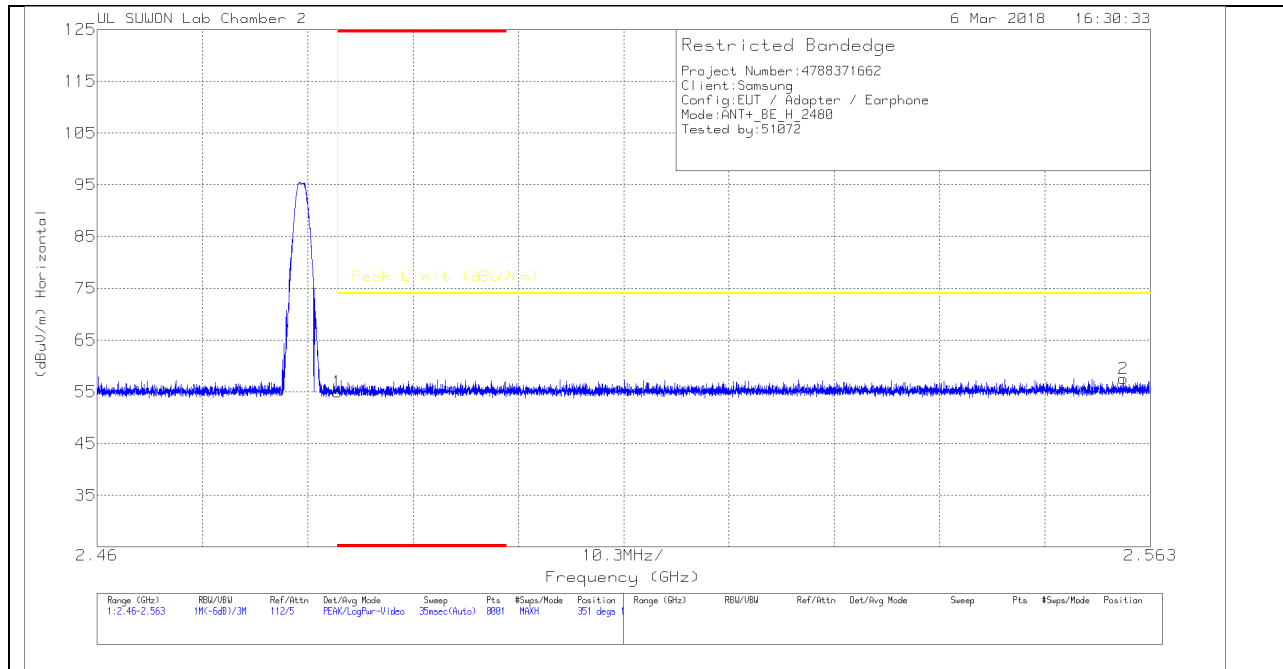
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector

* For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 54.95 – 48.4 = 6.55 dBuV/m [AVG Limit : 54dBuV/m, Margin : 47.45 dB]

* For marker 2, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 57.38 – 48.4 = 8.98 dBuV/m [AVG Limit : 54dBuV/m, Margin : 45.02 dB]

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

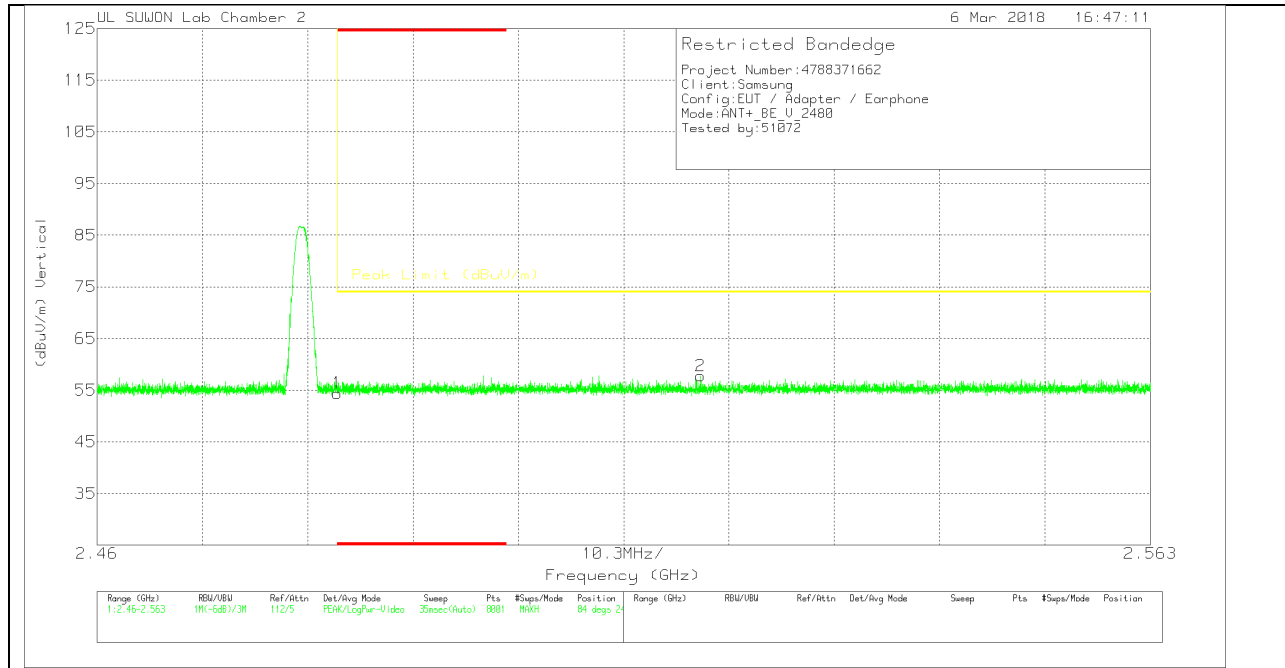
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[001687_24] | 10dB[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|----------|--------------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 41.37 | Pk | | -18 | 0 | 54.97 | 74 | -19.03 | 351 | 154 | H |
| 2 | 2.56 | 43.84 | Pk | | -18 | 0 | 57.54 | 74 | -16.46 | 351 | 154 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector

* For marker 1, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 54.97 – 48.4 = 6.57 dBuV/m [AVG Limit : 54dBuV/m, Margin : 47.43 dB]

* For marker 2, used the following method to do averaging:
 DCCF=48.4
 Corrected AV reading = Peak Reading – DCCF
 = 57.54 – 48.4 = 9.14 dBuV/m [AVG Limit : 54dBuV/m, Margin : 44.86 dB]

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[001687_24] | 10dB[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|------------------------|----------|--------------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 40.84 | Pk | | 31.6 | -18 | 54.44 | 74 | -19.56 | 84 | 246 | V |
| 2 | 2.519 | 44.19 | Pk | | 31.6 | -18 | 57.79 | 74 | -16.21 | 84 | 246 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

* For marker 1, used the following method to do averaging:

DCCF=48.4

Corrected AV reading = Peak Reading – DCCF

= 54.44 – 48.4 = 6.04 dBuV/m [AVG Limit : 54dBuV/m, Margin : 47.96 dB]

* For marker 2, used the following method to do averaging:

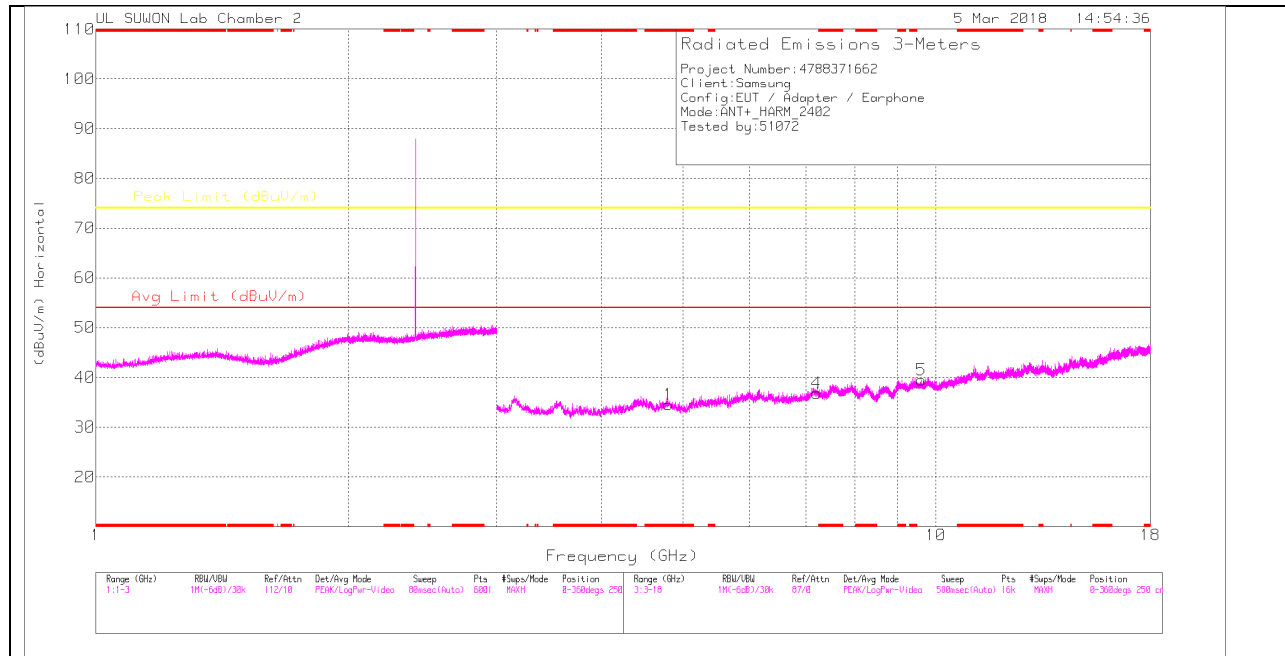
DCCF=48.4

Corrected AV reading = Peak Reading – DCCF

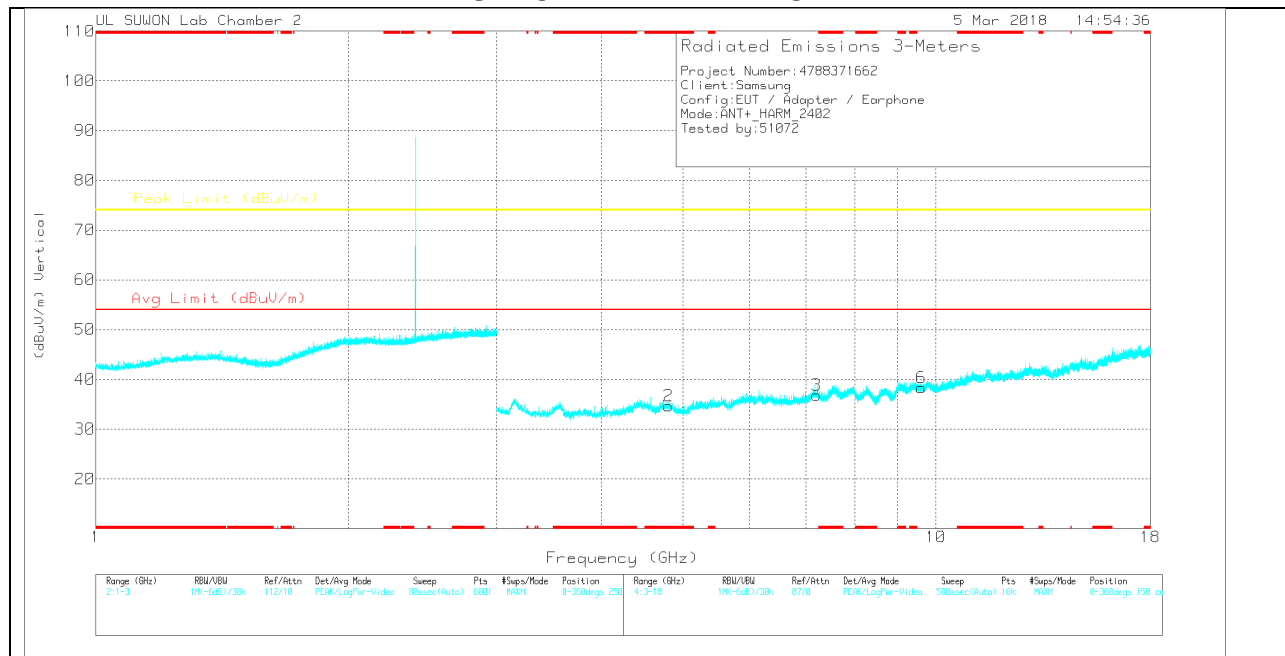
= 57.79 – 48.4 = 9.39 dBuV/m [AVG Limit : 54dBuV/m, Margin : 44.61 dB]

7.2.4. 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

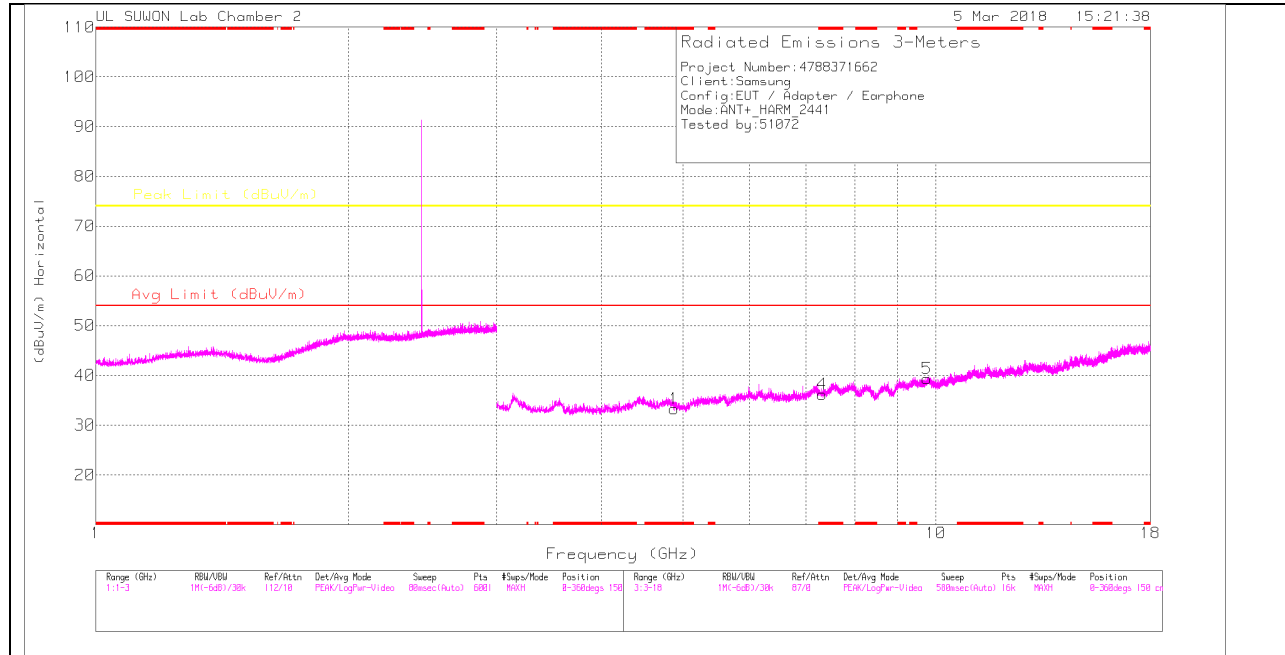
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117[00168724] | 3GHz_HP[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity | |
|--------|-----------------|----------------------|-----|-----------------------|-------------|--------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|---|
| 1 | * 4.805 | 25 | PK | | 33.8 | -24.3 | 0 | 34.5 | - | - | 74 | -39.5 | 0-360 | 250 | H |
| 4 | 7.206 | 22.64 | PK | | 35.9 | -21.7 | 0 | 36.84 | - | - | 74 | -37.16 | 0-360 | 250 | H |
| 5 | 9.609 | 21.17 | PK | | 36.7 | -18.4 | 0 | 39.47 | - | - | 74 | -34.53 | 0-360 | 250 | H |
| 2 | * 4.805 | 25.2 | PK | | 33.8 | -24.3 | 0 | 34.7 | - | - | 74 | -39.3 | 0-360 | 250 | V |
| 3 | 7.206 | 22.64 | PK | | 35.9 | -21.7 | 0 | 36.84 | - | - | 74 | -37.16 | 0-360 | 250 | V |
| 6 | 9.609 | 20.02 | PK | | 36.7 | -18.4 | 0 | 38.32 | - | - | 74 | -35.68 | 0-360 | 250 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

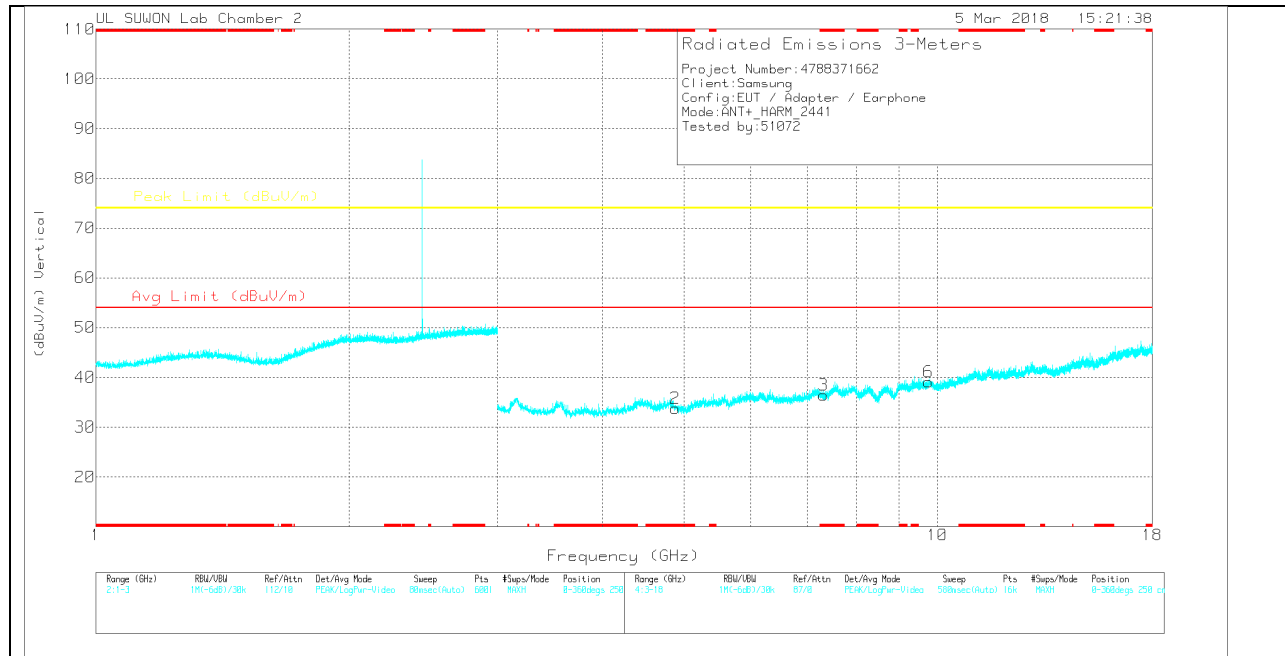
PK – Peak Detector

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

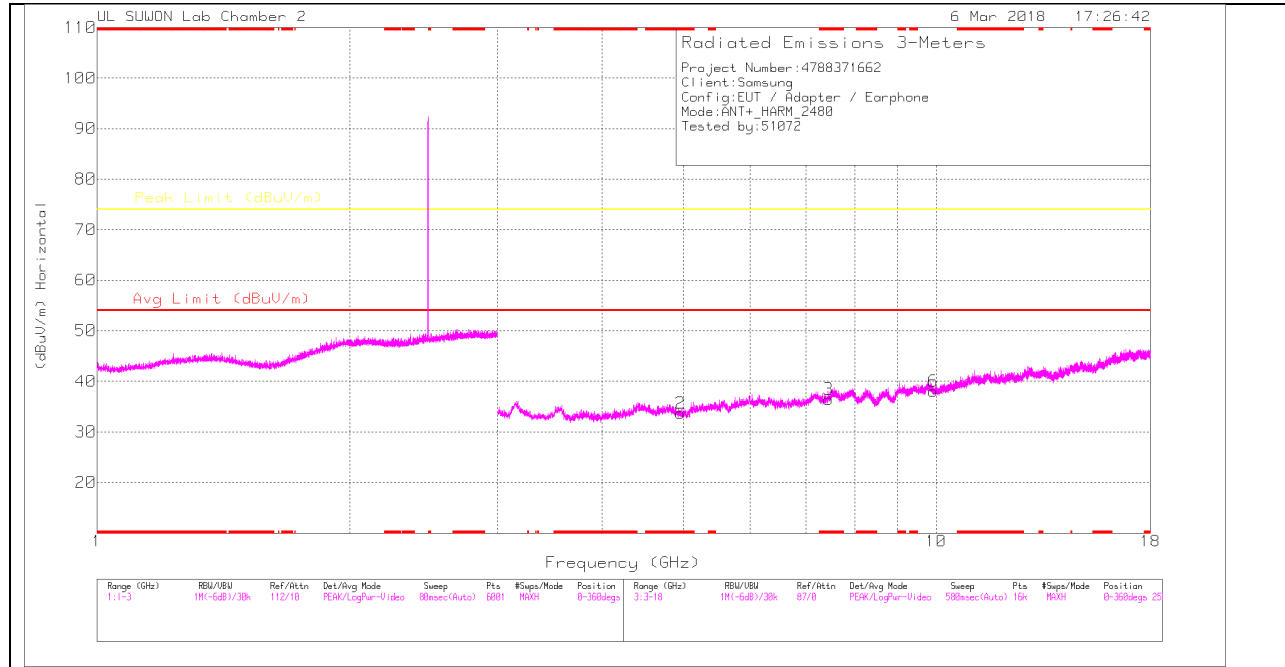
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117(00168724) | 3GHz_HP(dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|-------------|--------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 1 | * 4.882 | 24.04 | PK | | -24.6 | 0 | 33.24 | - | - | 74 | -40.76 | 0-360 | 150 | H |
| 4 | * 7.323 | 22.2 | PK | | -21.9 | 0 | 36.2 | - | - | 74 | -37.8 | 0-360 | 250 | H |
| 5 | 9.765 | 20.41 | PK | | -18 | 0 | 39.31 | - | - | 74 | -34.69 | 0-360 | 250 | H |
| 2 | * 4.882 | 24.64 | PK | | -24.6 | 0 | 33.84 | - | - | 74 | -40.16 | 0-360 | 250 | V |
| 3 | * 7.323 | 22.5 | PK | | -21.9 | 0 | 36.5 | - | - | 74 | -37.5 | 0-360 | 250 | V |
| 6 | 9.765 | 20.2 | PK | | -18 | 0 | 39.1 | - | - | 74 | -34.9 | 0-360 | 150 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

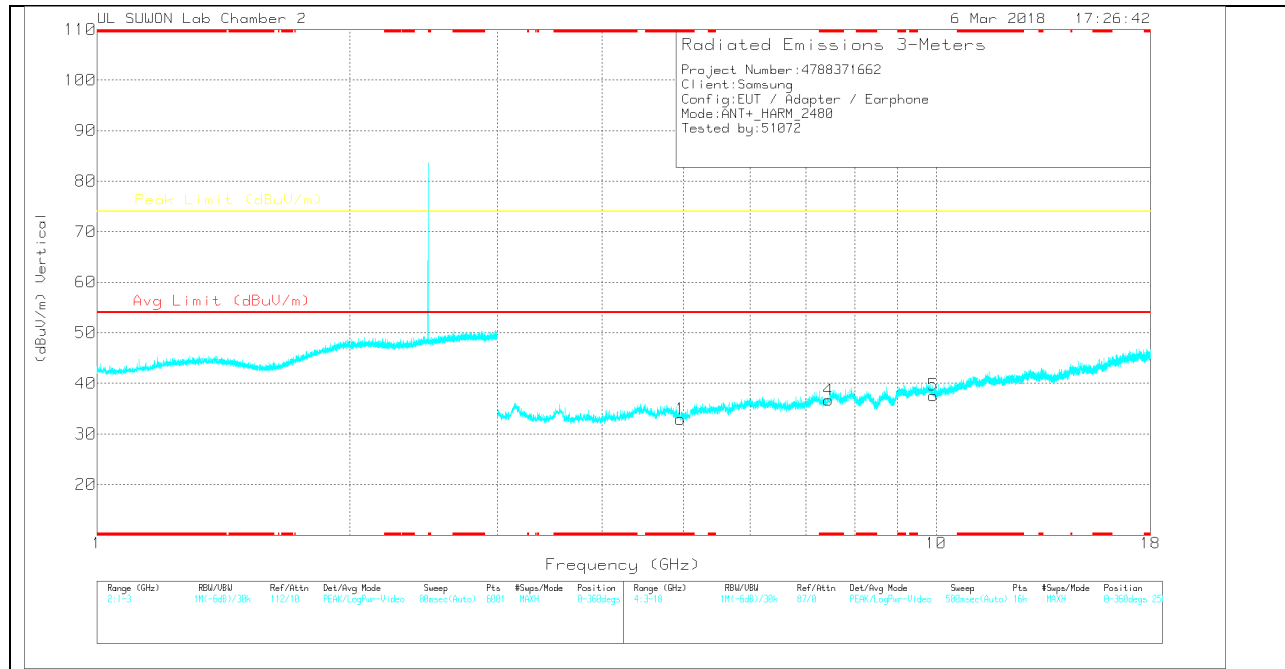
PK – Peak Detector

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

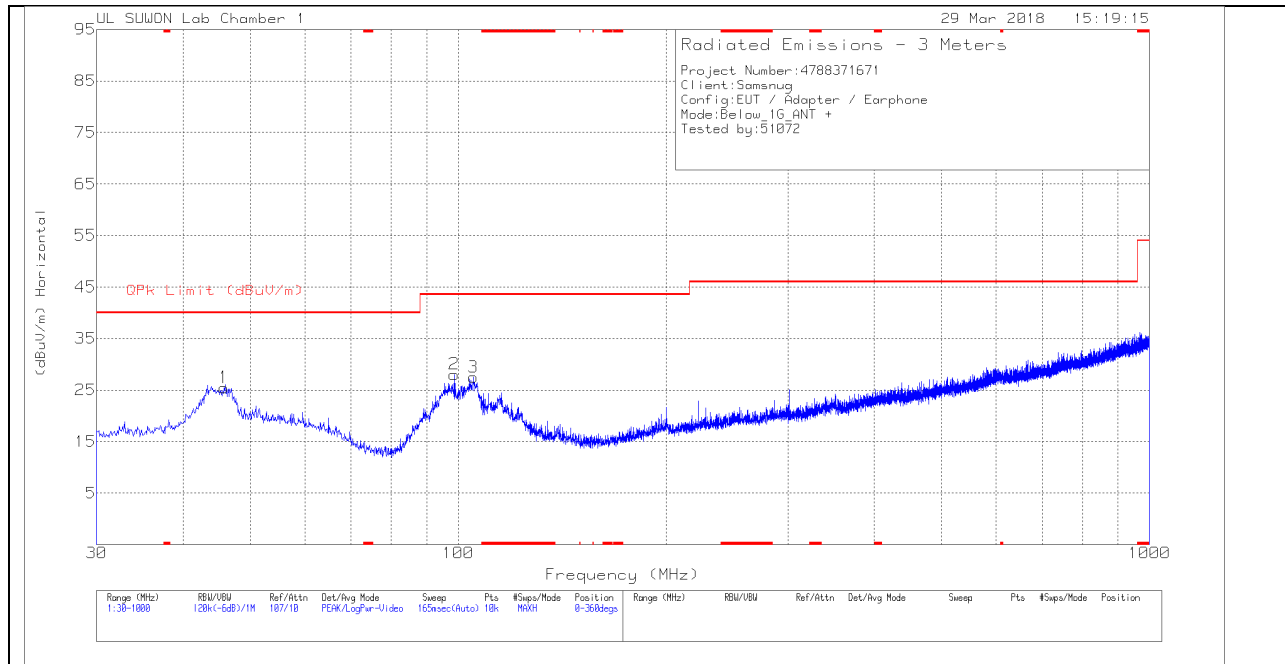
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 170531_3117(00168724) | 3GHz_HP(dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|-------------|--------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 2 | * 4.96 | 24.6 | PK | | -24.7 | 0 | 33.7 | - | - | 74 | -40.3 | 0-360 | 250 | H |
| 3 | * 7.441 | 21.55 | PK | | -21 | 0 | 36.45 | - | - | 74 | -37.55 | 0-360 | 250 | H |
| 6 | 9.92 | 18.93 | PK | | -18 | 0 | 38.03 | - | - | 74 | -35.97 | 0-360 | 150 | H |
| 1 | * 4.96 | 23.8 | PK | | -24.7 | 0 | 32.9 | - | - | 74 | -41.1 | 0-360 | 250 | V |
| 4 | * 7.441 | 21.78 | PK | | -21 | 0 | 36.68 | - | - | 74 | -37.32 | 0-360 | 150 | V |
| 5 | 9.92 | 18.51 | PK | | -18 | 0 | 37.61 | - | - | 74 | -36.39 | 0-360 | 250 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK – Peak Detector

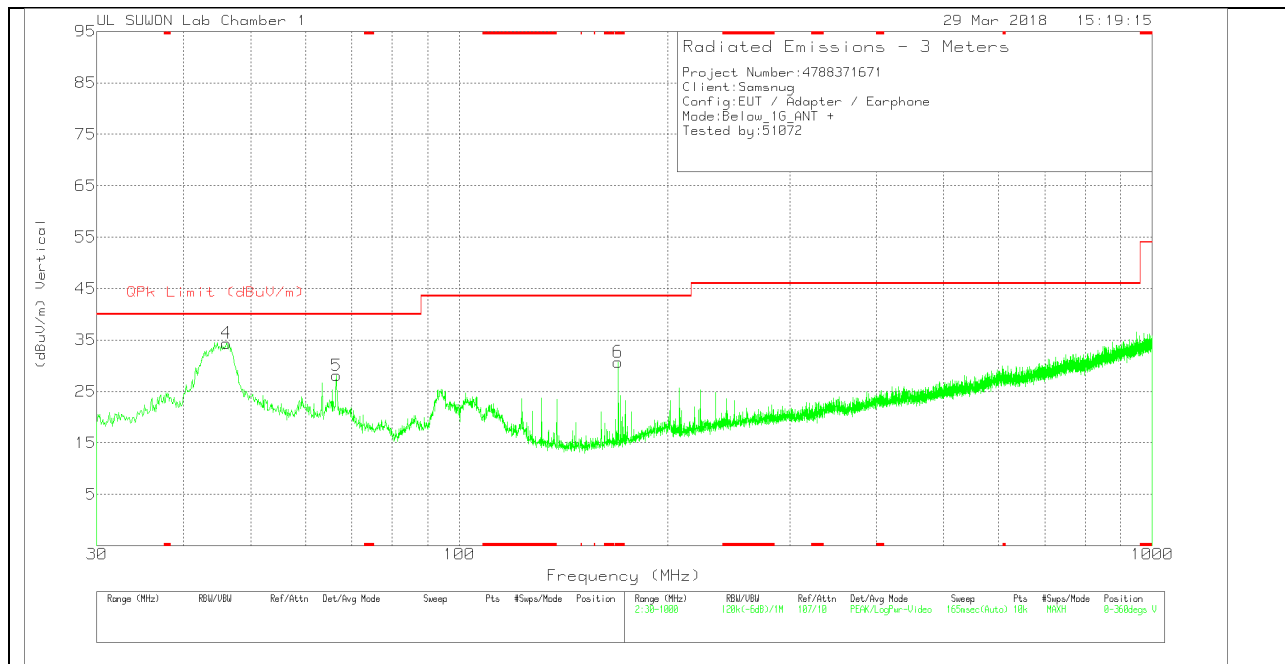
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

7.2.5. SPURIOUS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (HORIZONTAL)



SPURIOUS EMISSIONS 30 TO 1000 MHz (VERTICAL)



BELOW 1 GHz TABLE

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 750_20170831 | 30-1000MHz[dB] | DC Corr (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|--------------|----------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 1 | 45.811 | 35.06 | Pk | 19.7 | -29.3 | 0 | 25.46 | 40 | -14.54 | 0-360 | 400 | H |
| 2 | 98.676 | 39.35 | Pk | 17.2 | -28.5 | 0 | 28.05 | 43.52 | -15.47 | 0-360 | 300 | H |
| 3 | 105.175 | 38.27 | Pk | 17.6 | -28.4 | 0 | 27.47 | 43.52 | -16.05 | 0-360 | 300 | H |
| 4 | 46.102 | 43.99 | Pk | 19.7 | -29.3 | 0 | 34.39 | 40 | -5.61 | 0-360 | 100 | V |
| 5 | 66.472 | 40.48 | Pk | 16.5 | -28.9 | 0 | 28.08 | 40 | -11.92 | 0-360 | 100 | V |
| 6 | * 169.583 | 43.83 | Pk | 14.7 | -27.8 | 0 | 30.73 | 43.52 | -12.79 | 0-360 | 200 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | 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.

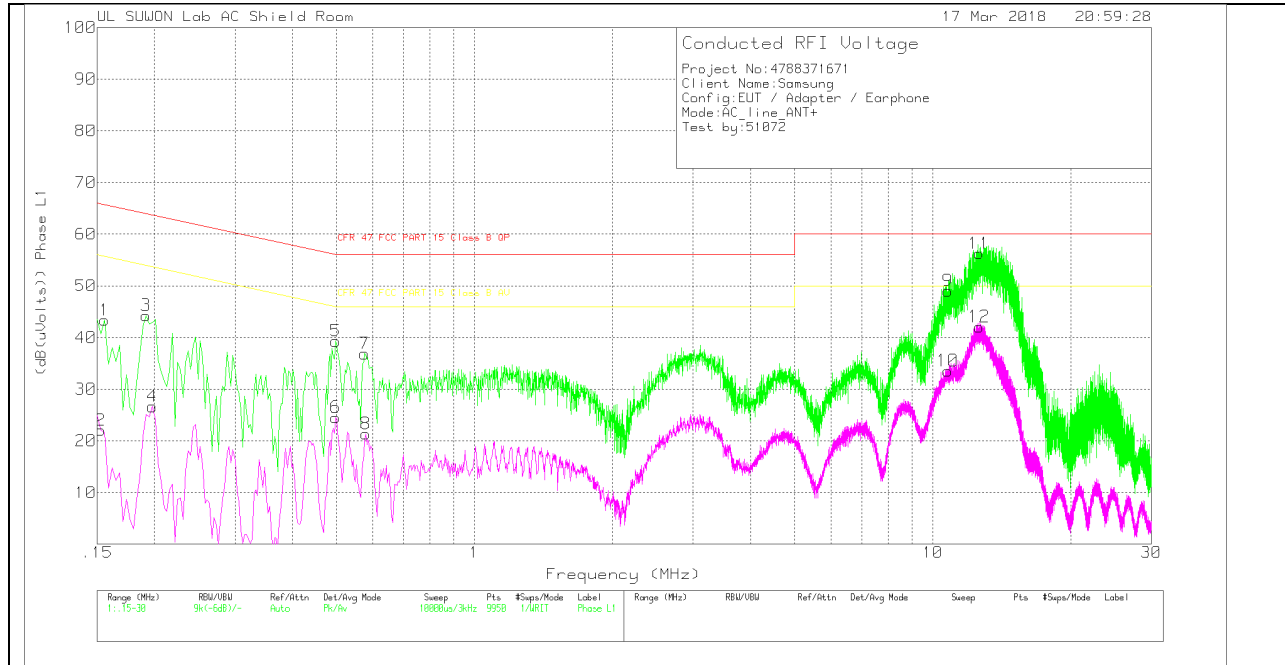
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

Trace Markers

Range 1: Phase L1 .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_L1_with extension | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|--------|-----------------|----------------------|-----|--------------------------|---------------|--------------------------------|-------------------------------|-------------|-------------------------------|-------------|
| 1 | .156 | 33.28 | Pk | 10 | .1 | 43.38 | 65.67 | -22.29 | - | - |
| 2 | .153 | 11.95 | Av | 10 | .1 | 22.05 | - | - | 55.84 | -33.79 |
| 3 | .192 | 34.27 | Pk | 9.8 | .2 | 44.27 | 63.95 | -19.68 | - | - |
| 4 | .198 | 16.66 | Av | 9.8 | .2 | 26.66 | - | - | 53.69 | -27.03 |
| 5 | .498 | 29.41 | Pk | 9.7 | .2 | 39.31 | 56.03 | -16.72 | - | - |
| 6 | .498 | 14.66 | Av | 9.7 | .2 | 24.56 | - | - | 46.03 | -21.47 |
| 7 | .576 | 26.88 | Pk | 9.8 | .2 | 36.88 | 56 | -19.12 | - | - |
| 8 | .579 | 11.37 | Av | 9.8 | .2 | 21.37 | - | - | 46 | -24.63 |
| 9 | 10.803 | 38.94 | Pk | 9.8 | .3 | 49.04 | 60 | -10.96 | - | - |
| 10 | 10.779 | 23.46 | Av | 9.8 | .3 | 33.56 | - | - | 50 | -16.44 |
| 11 | 12.621 | 46.18 | Pk | 9.8 | .3 | 56.28 | 60 | -3.72 | - | - |
| 12 | 12.621 | 31.98 | Av | 9.8 | .3 | 42.08 | - | - | 50 | -7.92 |

Pk - Peak detector
 Av - Average detection

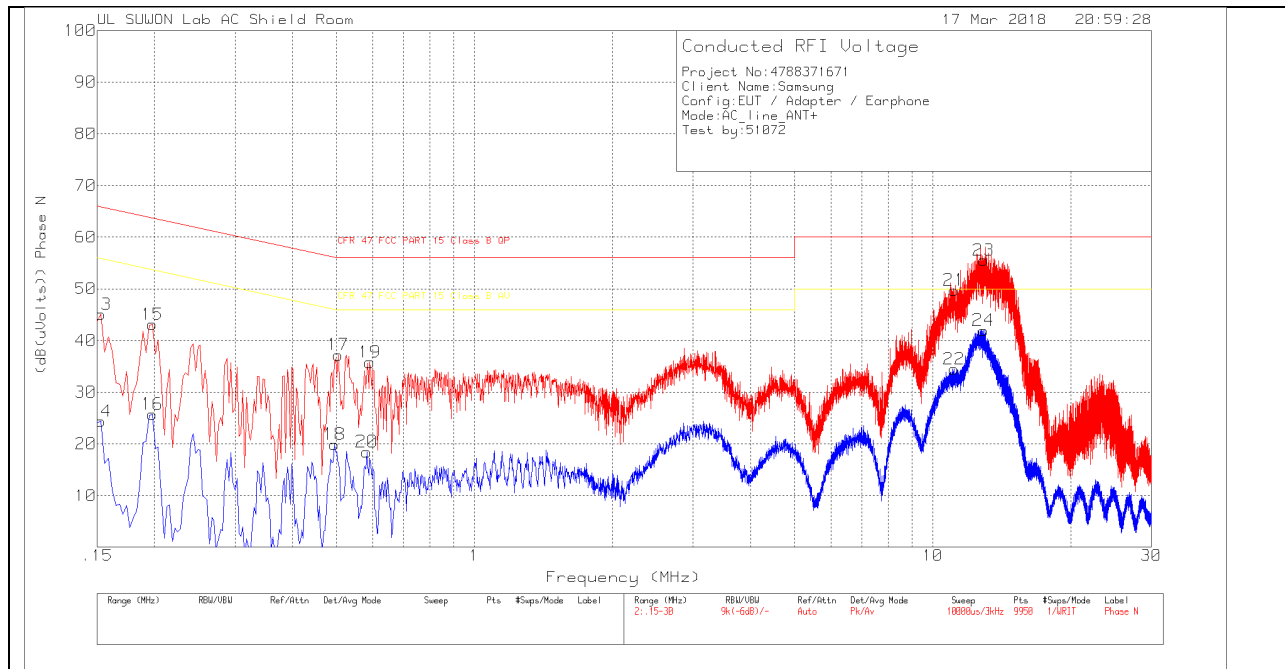
Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

| Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_L1_with extension | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|-----------------|----------------------|-----|--------------------------|---------------|--------------------------------|-------------------------------|-------------|-------------------------------|-------------|
| .15525 | 29.07 | Qp | 10 | .1 | 39.17 | 65.71 | -26.54 | - | - |
| .15225 | 32.22 | Qp | 10 | .1 | 42.32 | 65.88 | -23.56 | - | - |
| .19275 | 31.56 | Qp | 9.8 | .2 | 41.56 | 63.92 | -22.36 | - | - |
| .19815 | 31.29 | Qp | 9.8 | .2 | 41.29 | 63.69 | -22.4 | - | - |
| .49875 | 25.33 | Qp | 9.7 | .2 | 35.23 | 56.02 | -20.79 | - | - |
| .57615 | 23.77 | Qp | 9.8 | .2 | 33.77 | 56 | -22.23 | - | - |
| .57975 | 23.52 | Qp | 9.8 | .2 | 33.52 | 56 | -22.48 | - | - |
| 10.8032 | 34.43 | Qp | 9.8 | .3 | 44.53 | 60 | -15.47 | - | - |
| 10.7783 | 33.85 | Qp | 9.8 | .3 | 43.95 | 60 | -16.05 | - | - |
| 12.6203 | 40.63 | Qp | 9.8 | .3 | 50.73 | 60 | -9.27 | - | - |

Qp - Quasi-Peak detector

LINE 2 PLOT



LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_N_with extension | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|--------|-----------------|----------------------|-----|-------------------------|---------------|--------------------------------|-------------------------------|-------------|-------------------------------|-------------|
| 13 | .153 | 34.99 | Pk | 10 | .1 | 45.09 | 65.84 | -20.75 | - | - |
| 14 | .153 | 14.27 | Av | 10 | .1 | 24.37 | - | - | 55.84 | -31.47 |
| 15 | .198 | 33.01 | Pk | 9.9 | .2 | 43.11 | 63.69 | -20.58 | - | - |
| 16 | .198 | 15.65 | Av | 9.9 | .2 | 25.75 | - | - | 53.69 | -27.94 |
| 17 | .504 | 27.22 | Pk | 9.8 | .2 | 37.22 | 56 | -18.78 | - | - |
| 18 | .495 | 9.91 | Av | 9.8 | .2 | 19.91 | - | - | 46.08 | -26.17 |
| 19 | .591 | 25.88 | Pk | 9.7 | .2 | 35.78 | 56 | -20.22 | - | - |
| 20 | .582 | 8.57 | Av | 9.7 | .2 | 18.47 | - | - | 46 | -27.53 |
| 21 | 11.133 | 39.63 | Pk | 9.8 | .3 | 49.73 | 60 | -10.27 | - | - |
| 22 | 11.133 | 24.37 | Av | 9.8 | .3 | 34.47 | - | - | 50 | -15.53 |
| 23 | 12.915 | 45.32 | Pk | 9.8 | .4 | 55.52 | 60 | -4.48 | - | - |
| 24 | 12.9 | 31.76 | Av | 9.8 | .4 | 41.96 | - | - | 50 | -8.04 |

Pk - Peak detector
 Av - Average detection

Quasi-Peak Emissions

Range 2: Phase N .15 - 30MHz

| Frequency (MHz) | Meter Reading (dBuV) | Det | 101837_N_with extension | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|-----------------|----------------------|-----|-------------------------|---------------|--------------------------------|-------------------------------|-------------|-------------------------------|-------------|
| .15225 | 31.69 | Qp | 10 | .1 | 41.79 | 65.88 | -24.09 | - | - |
| .19725 | 30.68 | Qp | 9.9 | .2 | 40.78 | 63.73 | -22.95 | - | - |
| .50325 | 23.34 | Qp | 9.8 | .2 | 33.34 | 56 | -22.66 | - | - |
| .49575 | 23.28 | Qp | 9.8 | .2 | 33.28 | 56.07 | -22.79 | - | - |
| .59175 | 21.42 | Qp | 9.7 | .2 | 31.32 | 56 | -24.68 | - | - |
| .58275 | 21.66 | Qp | 9.7 | .2 | 31.56 | 56 | -24.44 | - | - |
| 11.1323 | 34.23 | Qp | 9.8 | .3 | 44.33 | 60 | -15.67 | - | - |
| 12.9143 | 39.42 | Qp | 9.8 | .4 | 49.62 | 60 | -10.38 | - | - |
| 12.9002 | 40.42 | Qp | 9.8 | .4 | 50.62 | 60 | -9.38 | - | - |

Qp - Quasi-Peak detector