



**FCC CFR47 PART 15 SUBPART C**

**ANT+**

**CERTIFICATION TEST REPORT**

**FOR**

**GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT**

**MODEL NUMBER : SM-N975F/DS, SM-N975F, SM-N975X**

**FCC ID: A3LSMN975F**

**REPORT NUMBER: 4789067225-E10V2**

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**TL-637**

Revision History

| Rev. | Issue Date | Revisions                         | Revised By  |
|------|------------|-----------------------------------|-------------|
| V1   | 06/27/19   | Initial issue                     | Junwhan Lee |
| V2   | 06/28/19   | Updated to address TCB's question | 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/ac/ax, ANT+, NFC and WPT

**MODEL NUMBER:** SM-N975F/DS, SM-N975F, SM-N975X

**SERIAL NUMBER:** R3CM506PPMB (CONDUCTED, Original)  
cea741c773197e35, R3CM506Q9KN (RADIATED, Original);  
R38M50ASH5W(Spot check)

**DATE TESTED:** MAY 30, 2019 – JUN 17, 2019 (Original);  
JUN 21, 2019 – JUN 28, 2019 (Spot check);

| 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.



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UL Korea, Ltd.

## 1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN976B DXX 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: A3LSMN975F shares the same enclosure and circuit board as FCC ID: A3LSMN976B. 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: A3LSMN976B remains representative of FCC ID: A3LSMN975F. The test data of FCC ID: A3LSMN976B being submitted for this application to cover ANT+ features.

## 1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated spurious and band edge emissions)

| Mode | Test Item   | Fundamental Frequency | Test Limit | Original model      | Spot check model    | Deviation | Remark            |
|------|-------------|-----------------------|------------|---------------------|---------------------|-----------|-------------------|
|      |             |                       |            | SM-N976B            | SM-N975F/DS         |           |                   |
|      |             |                       |            | FCC ID : A3LSMN976B | FCC ID : A3LSMN975F |           |                   |
| ANT+ | Fundamental | 2480 MHz              | 114 dBuV/m | 96.97 dBuV/m        | 98.71 dBuV/m        | 1.74 dB   |                   |
|      | Band Edge   | 2402 MHz              | 74 dBuV/m  | 57.14 dBuV/m        | 56.65 dBuV/m        | -0.49 dB  |                   |
|      | RSE         | 2480 MHz              | 74 dBuV/m  | 40.57 dBuV/m        | 39.07 dBuV/m        | -1.50 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 in the individual test reports:

| Equipment Class | Reference FCC ID (Parent) | Application Type | Reference Test report number | Exhibit Type | Variant Test Report Number   | Data Re-used |
|-----------------|---------------------------|------------------|------------------------------|--------------|------------------------------|--------------|
| PCE             | A3LSMN976B                | Original Grant   | 4789009800-E2                | Test Report  | 4789067225-E2                | All          |
|                 |                           |                  | 4789009800-E3                | Test Report  | 4789067225-E3                | All          |
| DTS             | A3LSMN976B                | Original Grant   | 4789009800-E5 (802.11b/g/n)  | Test Report  | 4789067225-E5 (802.11b/g/n)  | All          |
|                 |                           |                  | 4789009800-E6 (802.11ax)     | Test Report  | 4789067225-E6 (802.11ax)     | All          |
|                 |                           |                  | 4789009800-E4 Bluetooth LE   | Test Report  | 4789067225-E4 Bluetooth LE   | All          |
| DSS             | A3LSMN976B                | Original Grant   | 4789009800-E7 (Bluetooth)    | Test Report  | 4789067225-E7 (Bluetooth)    | All          |
| NII             | A3LSMN976B                | Original Grant   | 4789009800-E8 (802.11a/n/ac) | Test Report  | 4789067225-E8 (802.11a/n/ac) | All          |
|                 |                           |                  | 4789009800-E9 (802.11ax)     | Test Report  | 4789067225-E9 (802.11ax)     | All          |
| DXX             | A3LSMN976B                | Original Grant   | 4789009800-E10 (ANT+)        | Test Report  | 4789067225-E10 (ANT+)        | All          |
|                 |                           |                  | 4789009800-E11 (NFC)         | Test Report  | 4789067225-E11 (NFC)         | All          |
| DCD             | A3LSMN976B                | Original Grant   | 4789009800-E12 (WPT)         | Test Report  | 4789067225-E12 (WPT)         | All          |

For this application the data reuse is summarized below for each equipment class:

| Equipment Class | Reference FCC ID (Parent) | Application Type | Data Re-used                                |
|-----------------|---------------------------|------------------|---------------------------------------------|
| PCE             | A3LSMN976B                | Original Grant   | All except SAR (full test), HAC (full test) |
|                 |                           |                  | All except SAR (full test), HAC (full test) |
| DTS             | A3LSMN976B                | Original Grant   | All except SAR (full test), HAC (full test) |
|                 |                           |                  | All except SAR (full test), HAC (full test) |
|                 |                           |                  | All                                         |
| DSS             | A3LSMN976B                | Original Grant   | All except SAR (full test)                  |
| NII             | A3LSMN976B                | Original Grant   | All except SAR (full test), HAC (full test) |
|                 |                           |                  | All except SAR (full test), HAC (full test) |
| DXX             | A3LSMN976B                | Original Grant   | All                                         |
|                 |                           |                  | All                                         |
| DCD             | A3LSMN976B                | Original Grant   | All except RF exposure                      |

## 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 v01

## 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, 30 MHz to 1 GHz  | 3.86 dB     |
| Radiated Disturbance, 1 GHz to 18 GHz  | 5.97 dB     |
| Radiated Disturbance, 18 GHz to 40 GHz | 5.57 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/ac/ax, ANT+, NFC and WPT. 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<br>[MHz] | Mode  | Peak E-field Strength<br>[dBuV/m] | Avg E-field Strength<br>[dBuV/m] | Distance<br>[m] |
|--------------------------|-------|-----------------------------------|----------------------------------|-----------------|
| 2402 - 2480              | ANT + | 96.97                             | 66.76                            | 3.00            |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -6.11 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 Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

Note : All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |          |                |        |
|------------------------|--------------|----------|----------------|--------|
| Description            | Manufacturer | Model    | Serial Number  | FCC ID |
| Charger                | SAMSUNG      | EP-TA800 | R37M4PW4FW1SE3 | N/A    |
| Data Cable             | SAMSUNG      | EP-DG977 | N/A            | N/A    |

### I/O CABLE

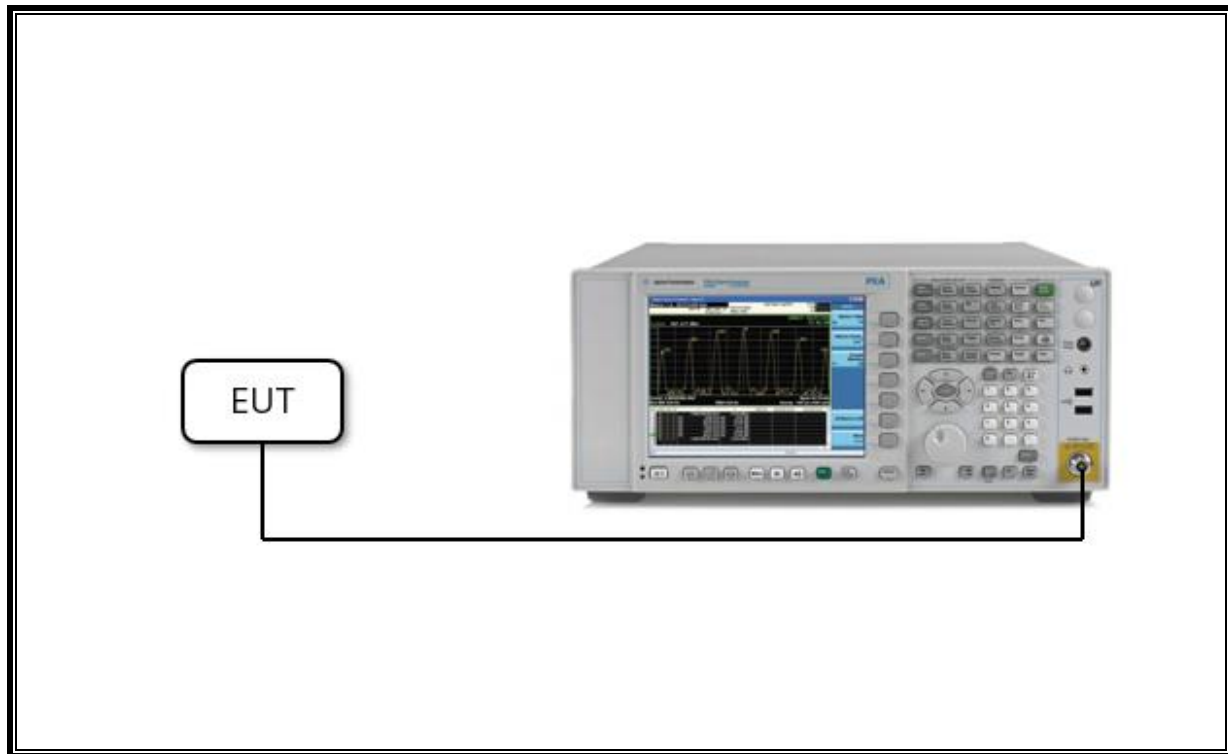
| I/O Cable List |          |                      |                |            |                  |         |
|----------------|----------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port     | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | DC Power | 1                    | C Type         | Shielded   | 1.0m             | N/A     |

### TEST SETUP

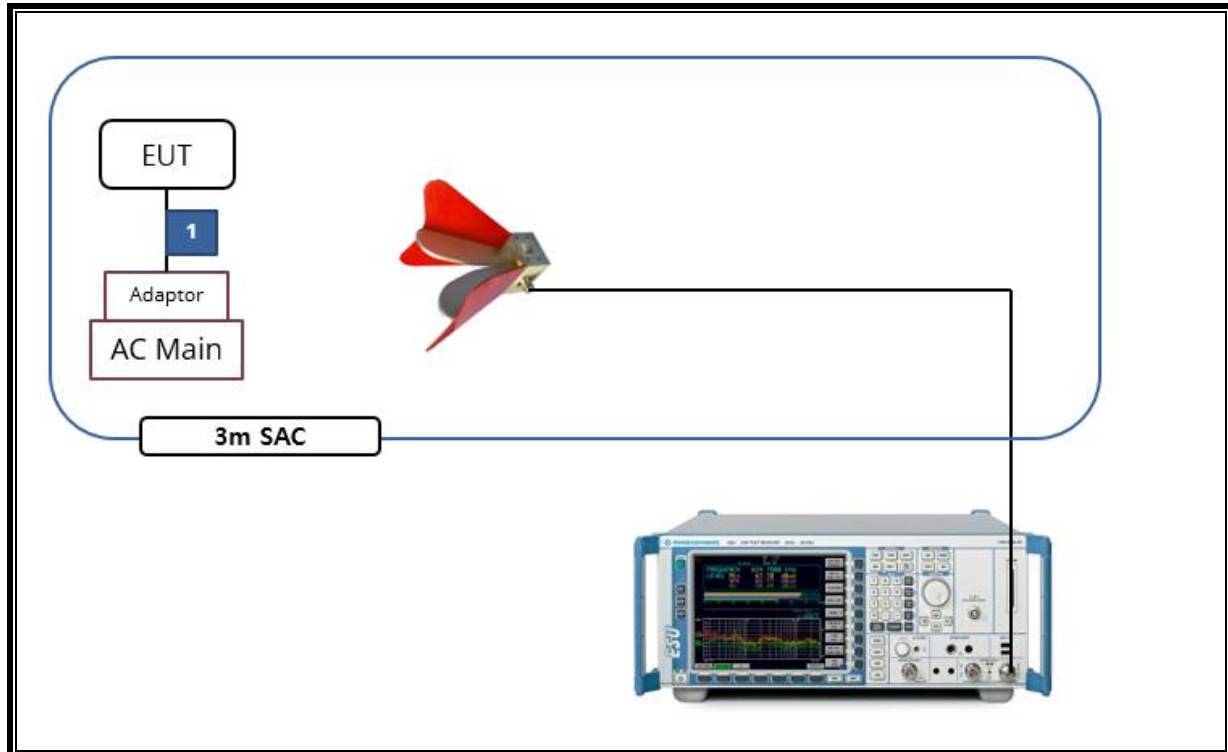
The EUT is set to continuously transmit in ANT + test mode.  
Test software in hidden menu exercised the EUT to enable ANT+ mode.

This EUT is able to equipped with S-pen on the inside. Spot check were performed both inserted and removed condition. Because there is no deviation between the two data, all tests were performed under equipped with the S-pen.

**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        | New Cal Due |
| Antenna, Bilog, 30MHz-1GHz  | SCHWARZBECK   | VULB9163               | 750        | 08-04-20    |
| Antenna, Bilog, 30MHz-1GHz  | SCHWARZBECK   | VULB9163               | 749        | 08-04-20    |
| Antenna, Bilog, 30MHz-1GHz  | SCHWARZBECK   | VULB9163               | 845        | 08-04-20    |
| Antenna, Loop, 9kHz-30MHz   | R&S           | HFH2-Z2                | 100418     | 10-26-19    |
| Antenna, Horn, 18 GHz       | ETS           | 3115                   | 00167211   | 08-04-20    |
| Antenna, Horn, 18 GHz       | ETS           | 3115                   | 00161451   | 08-04-20    |
| Antenna, Horn, 18 GHz       | ETS           | 3117                   | 00168724   | 08-04-20    |
| Antenna, Horn, 18 GHz       | ETS           | 3117                   | 00168717   | 08-04-20    |
| Antenna, Horn, 18 GHz       | ETS           | 3117                   | 00205959   | 08-04-20    |
| Antenna, Horn, 40 GHz       | ETS           | 3116C                  | 00166155   | 08-14-20    |
| Antenna, Horn, 40 GHz       | ETS           | 3116C                  | 00168645   | 12-04-19    |
| Antenna, Horn, 40 GHz       | ETS           | 3116C-PA               | 00168841   | 08-09-19    |
| Preamplifier, 1000 MHz      | Sonoma        | 310N                   | 341282     | 08-07-19    |
| Preamplifier, 1000 MHz      | Sonoma        | 310N                   | 351741     | 08-07-19    |
| Preamplifier, 1000 MHz      | Sonoma        | 310N                   | 370599     | 08-06-19    |
| Preamplifier, 18 GHz        | Miteq         | AFS42-00101800-25-S-42 | 1876511    | 08-07-19    |
| Preamplifier, 18 GHz        | Miteq         | AFS42-00101800-25-S-42 | 1896138    | 08-07-19    |
| Preamplifier, 18 GHz        | Miteq         | AFS42-00101800-25-S-42 | 2029169    | 08-07-19    |
| Spectrum Analyzer, 44 GHz   | Agilent / HP  | N9030A                 | MY54170614 | 08-07-19    |
| Spectrum Analyzer, 44 GHz   | Agilent / HP  | N9030A                 | MY54490312 | 08-06-19    |
| Spectrum Analyzer, 43.5 GHz | R&S           | FSW43                  | 104089     | 08-06-19    |
| Average Power Sensor        | Agilent / HP  | U2000                  | MY54270007 | 08-07-19    |
| Attenuator                  | PASTERNAK     | PE7087-10              | A001       | 08-08-19    |
| Attenuator                  | PASTERNAK     | PE7087-10              | A008       | 08-08-19    |
| Attenuator                  | PASTERNAK     | PE7004-10              | 2          | 08-07-19    |
| Attenuator                  | PASTERNAK     | PE7087-10              | A009       | 08-08-19    |
| EMI Test Receive, 40 GHz    | R&S           | ESU40                  | 100439     | 08-06-19    |
| EMI Test Receive, 40 GHz    | R&S           | ESU40                  | 100457     | 08-06-19    |
| EMI Test Receive, 44 GHz    | R&S           | ESW44                  | 101590     | 08-06-19    |
| EMI Test Receive, 3 GHz     | R&S           | ESR3                   | 101832     | 08-06-19    |
| Low Pass Filter 5GHz        | Micro-Tronics | LPS17541               | 009        | 08-07-19    |
| Low Pass Filter 5GHz        | Micro-Tronics | LPS17541               | 015        | 08-07-19    |
| Low Pass Filter 5GHz        | Micro-Tronics | LPS17541               | 020        | 08-06-19    |
| High Pass Filter 3GHz       | Micro-Tronics | HPM17543               | 010        | 08-07-19    |
| High Pass Filter 3GHz       | Micro-Tronics | HPM17543               | 015        | 08-07-19    |
| High Pass Filter 3GHz       | Micro-Tronics | HPM17543               | 020        | 08-06-19    |
| High Pass Filter 6GHz       | Micro-Tronics | HPS17542               | 009        | 08-07-19    |
| High Pass Filter 6GHz       | Micro-Tronics | HPS17542               | 016        | 08-07-19    |
| High Pass Filter 6GHz       | Micro-Tronics | HPS17542               | 021        | 08-06-19    |
| LISN                        | R&S           | ENV-216                | 101837     | 08-09-19    |
| 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

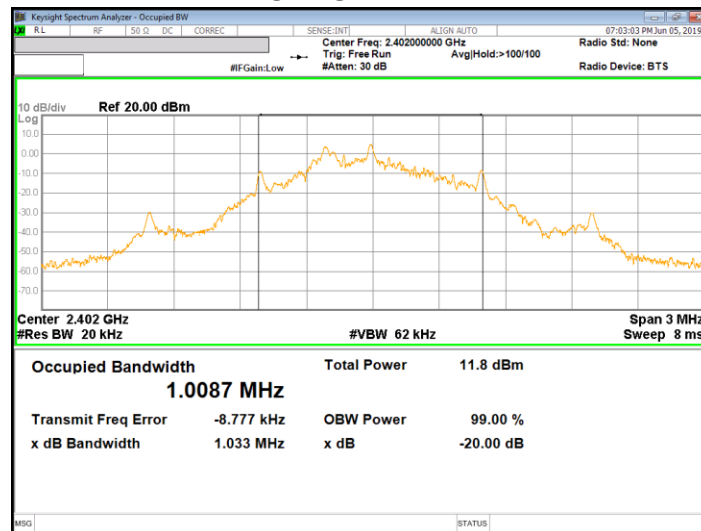
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

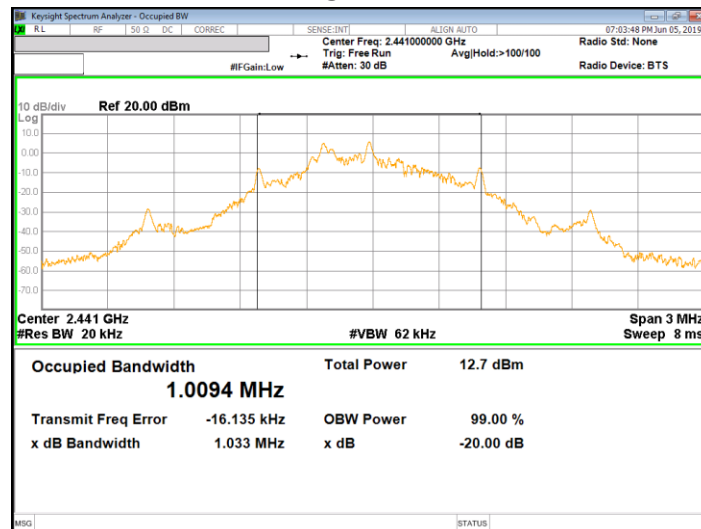
| Channel | Frequency<br>[MHz] | 99% Bandwidth<br>[kHz] | 20 dB Bandwidth<br>[kHz] |
|---------|--------------------|------------------------|--------------------------|
| Low     | 2402               | 1008.7                 | 1033.0                   |
| Mid     | 2441               | 1009.4                 | 1033.0                   |
| High    | 2480               | 1009.6                 | 1032.0                   |
| Worst   |                    | 1009.6                 | 1033.0                   |

## 99% BANDWIDTH PLOTS

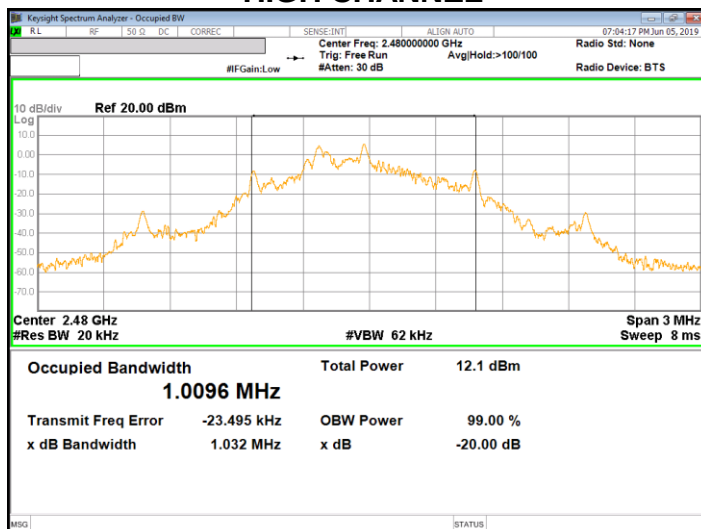
### LOW CHANNEL



### 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                        |

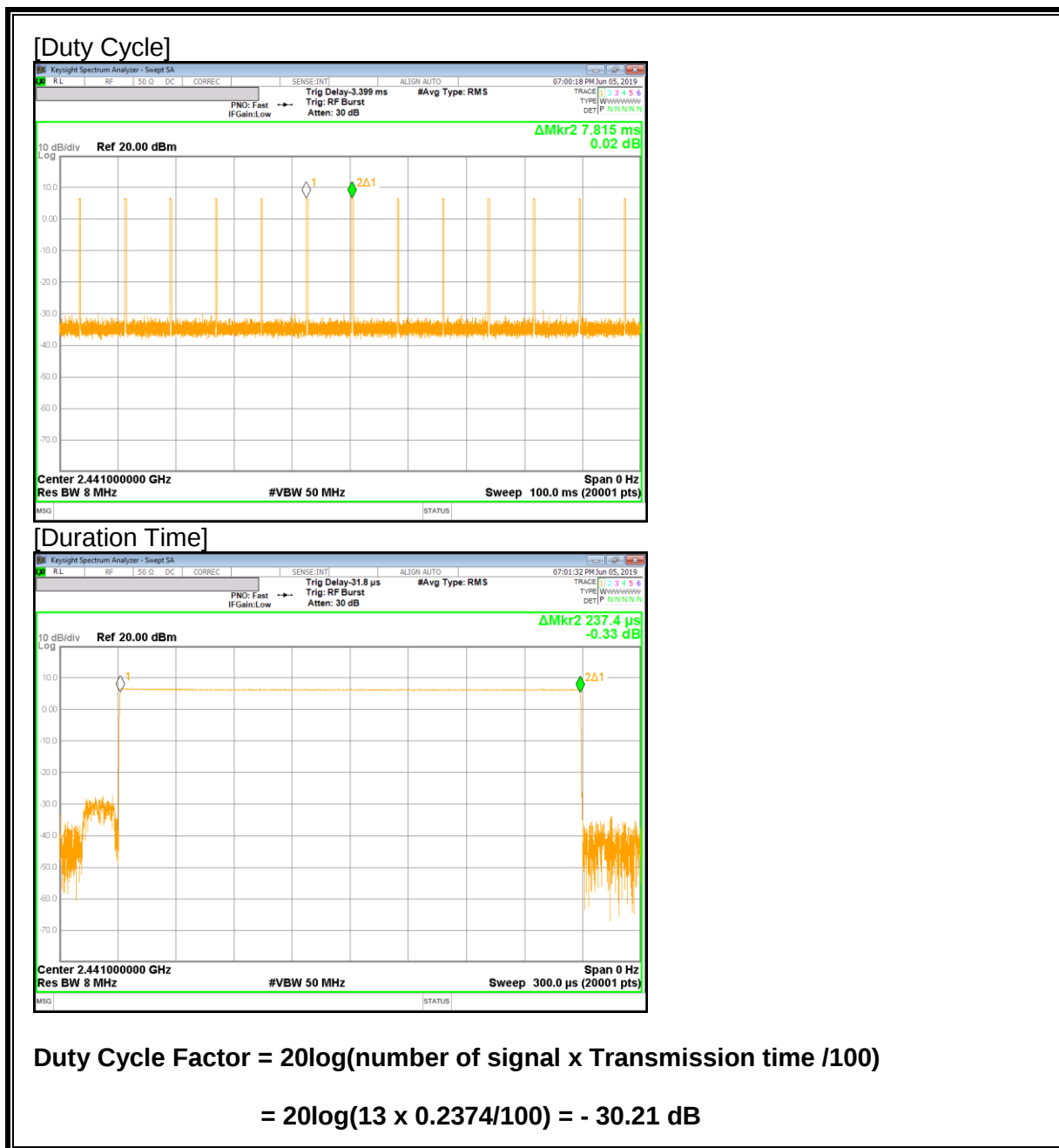
\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

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.

Although these tests were performed other than open field 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 414788.

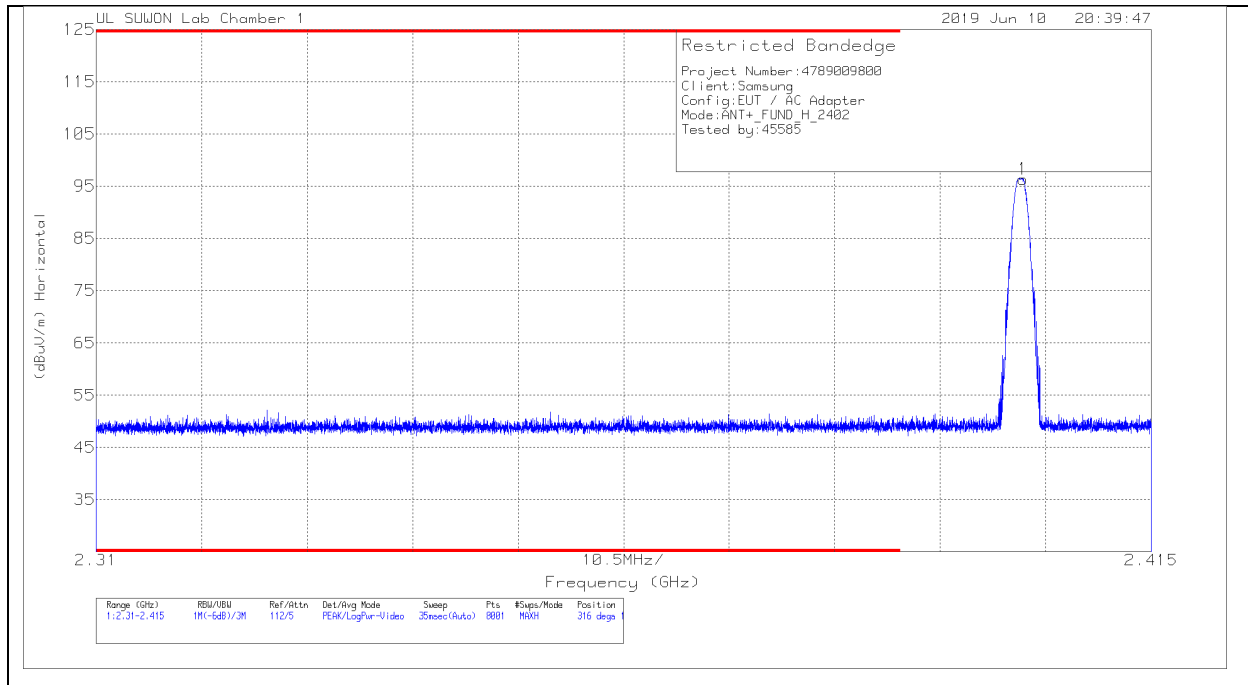
## RESULTS

### 7.2.1. DUTY CYCLE



## 7.2.1. FUNDAMENTAL FIELD STRENGTH LEVEL

### LOW CHANNEL, HORIZONTAL



### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.40226         | 90.04                | Pk  | 31.7          | -25.4    | 96.34                      | 316            | 154         | H        |

### Pk - Peak detector

| Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------------|----------------|-------------|
| 96.34                 | 114            | 17.66       |

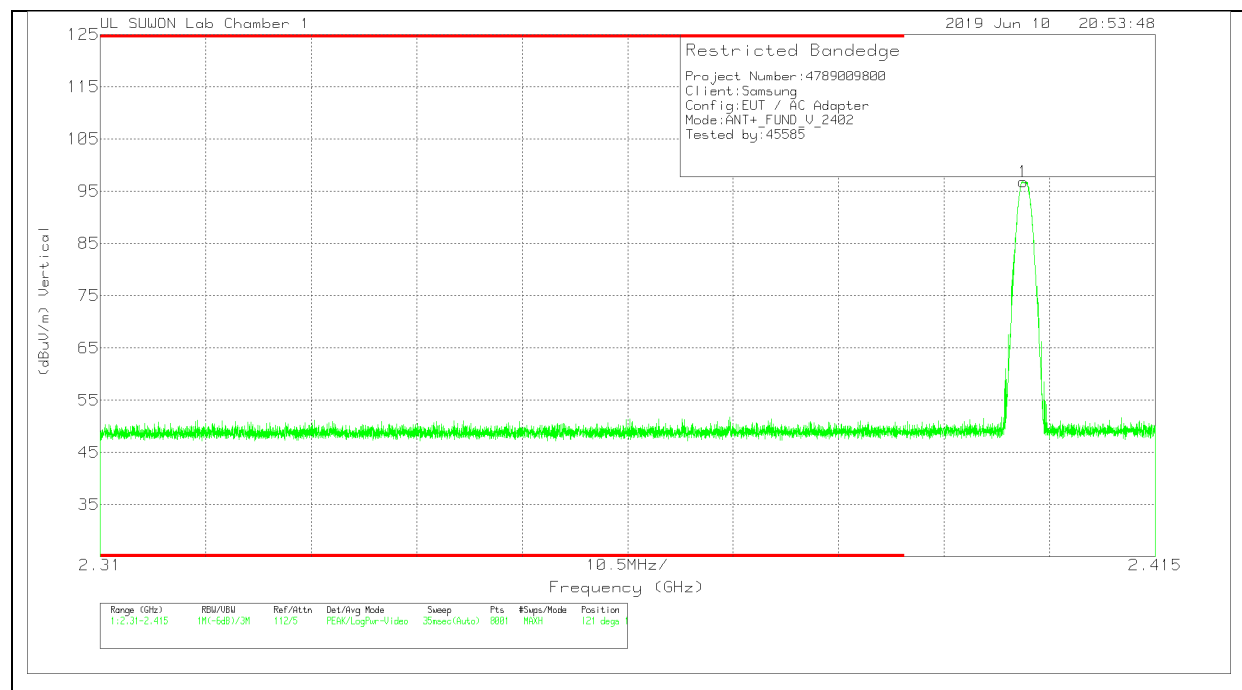
\*\* For marker 1 used the following method to do averaging:

DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 96.34 + -30.21 = 66.13 dBuV/m, AVG Limit : 94 dBuV/m, Margin 27.87 dB]

# LOW CHANNEL, VERTICAL



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.40185         | 90.51                | Pk  | 31.7          | -25.4    | 96.81                      | 121            | 170         | V        |

Pk - Peak detector

| * Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-------------------------|----------------|-------------|
| 96.81                   | 114            | 17.19       |

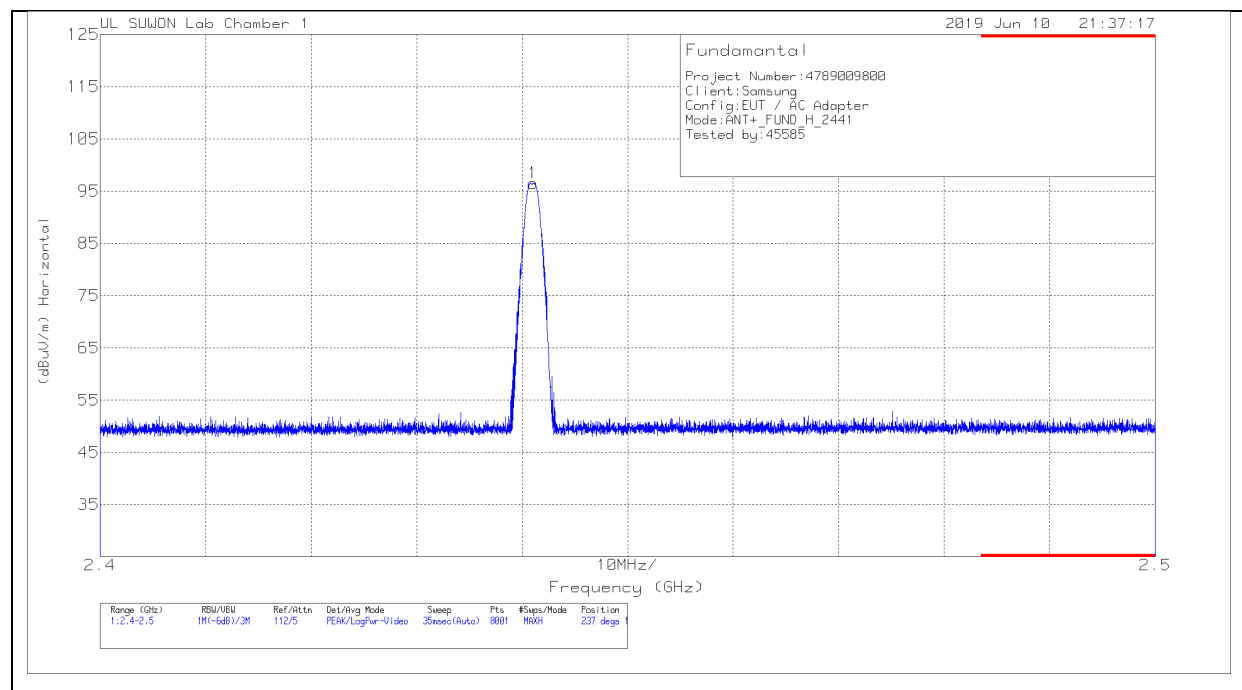
\*\* For marker 1 used the following method to do averaging:

DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 96.81 + -30.21 = 66.6 dBuVm, AVG Limit : 94 dBuVm, Margin 27.4 dB]

# MID CHANNEL, HORIZONTAL



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.44105         | 90.02                | Pk  | 31.8          | -25.3    | 96.52                      | 237            | 174         | H        |

## Pk - Peak detector

| * Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-------------------------|----------------|-------------|
| 96.52                   | 114            | 17.48       |

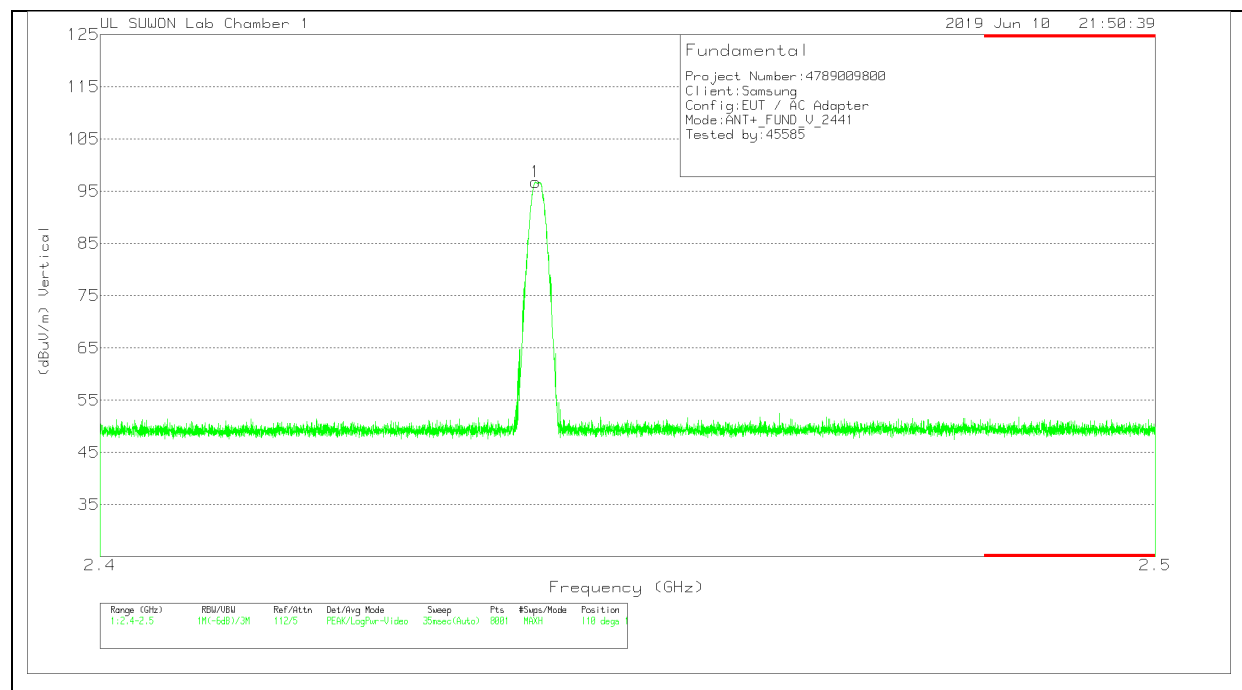
\*\* For marker 1 used the following method to do averaging:

DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 96.52 + -30.21 = 66.31 dBuVm, AVG Limit : 94 dBuVm, Margin 27.69 dB]

# MID CHANNEL, VERTICAL



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.44079         | 90.35                | Pk  | 31.8          | -25.4    | 96.75                      | 110            | 181         | V        |

## Pk - Peak detector

| * Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-------------------------|----------------|-------------|
| 96.75                   | 114            | 17.25       |

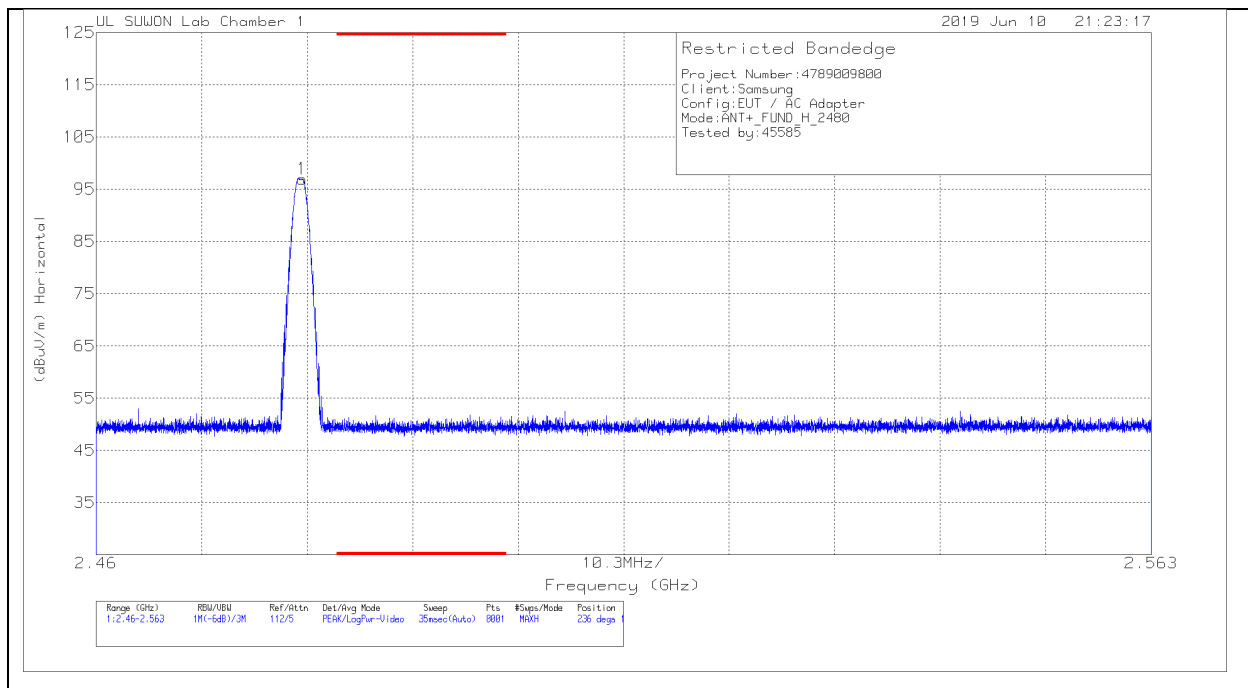
\*\* For marker 1 used the following method to do averaging:

DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 96.75 + -30.21 = 66.54 dBuV/m AVG Limit : 94 dBuV/m, Margin 27.46 dB]

# **HIGH CHANNEL, HORIZONTAL**



## **Trace Markers**

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.48014         | 90.37                | Pk  | 31.9          | -25.3    | 96.97                      | 236            | 162         | H        |

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

Pk - Peak detector

| * Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-------------------------|----------------|-------------|
| 96.97                   | 114            | 17.03       |

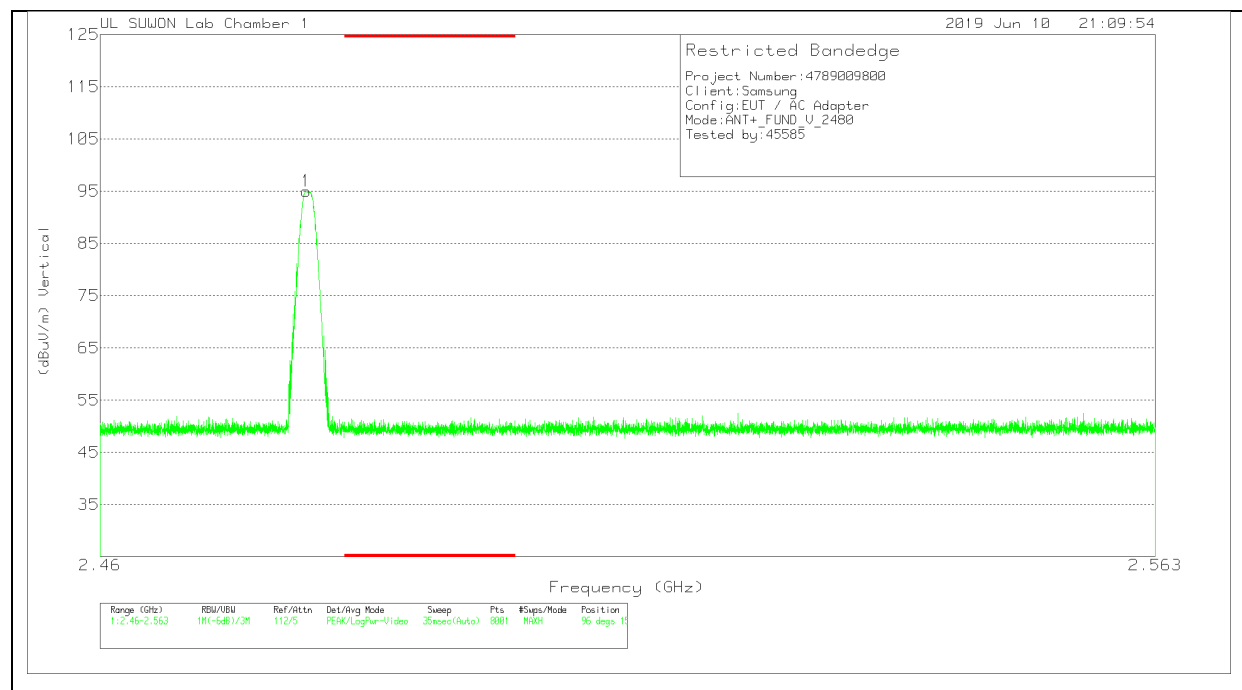
\*\* For marker 1 used the following method to do averaging:

DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 96.97 + -30.21 = 66.76 dBuV/m AVG Limit : 94 dBuV/m, Margin 27.24 dB]

# HIGH CHANNEL, VERTICAL



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|----------------|-------------|----------|
| 1      | 2.47982         | 88.41                | Pk  | 31.9          | -25.3    | 95.01                      | 96             | 156         | V        |

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

| * | Peak reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|-----------------------|----------------|-------------|
|   | 95.01                 | 114            | 18.99       |

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

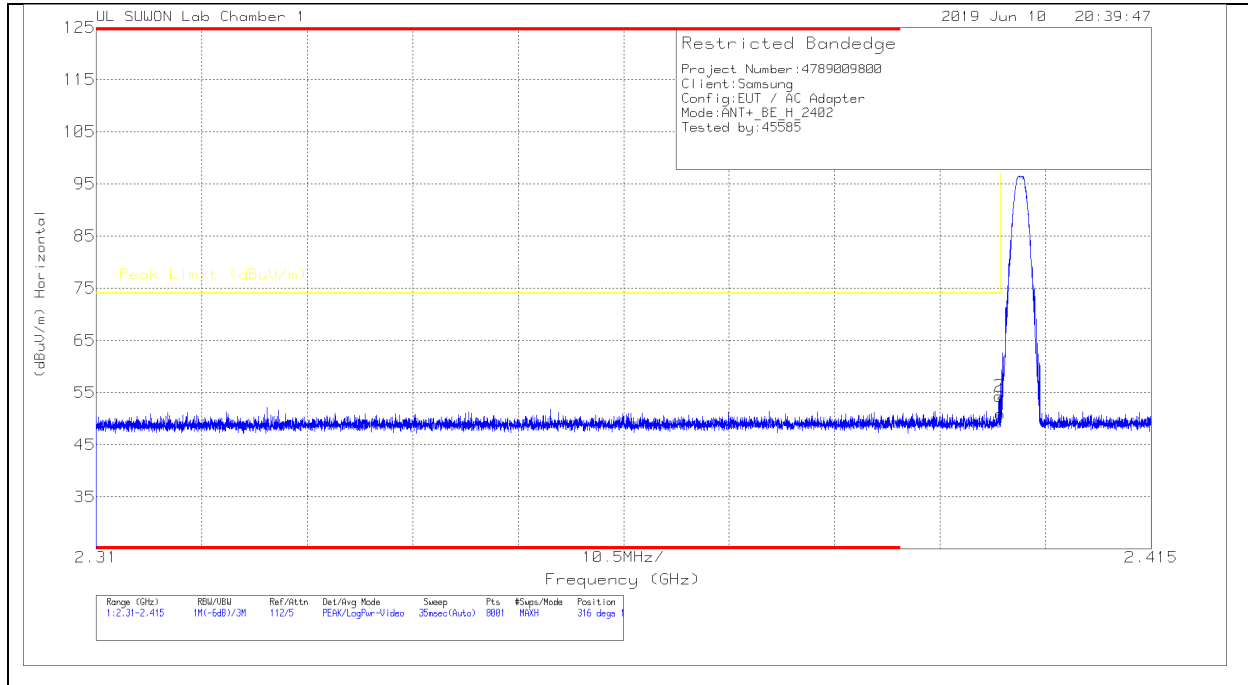
DCCF = -30.21

Corrected AV reading = Peak Reading + DCCF

= 95.01 + -30.21 = 64.8 dBuV/m AVG Limit : 94 dBuV/m, Margin 29.2 dB]

## 7.2.2. TRANSMITTER BAND EDGES

### BANDEDGE (LOW CHANNEL, HORIZONTAL)



### HORIZONTAL DATA

#### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1      | 2.4             | 44.77                | Pk  | 31.7          | -25.5    | 50.97                      | 74                  | -23.03         | 316            | 154         | H        |
| 2      | 2.39988         | 48.12                | Pk  | 31.7          | -25.5    | 54.32                      | 74                  | -19.68         | 316            | 154         | H        |

Pk - Peak detector

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

DCCF = -30.21 / Peak Reading = 50.97 dBuV/m

Corrected AV reading = Peak Reading + DCCF

= 50.97 + -30.21 = 20.76 dBuV/m AVG Limit : 54 dBuV/m, Margin 33.24 dB]

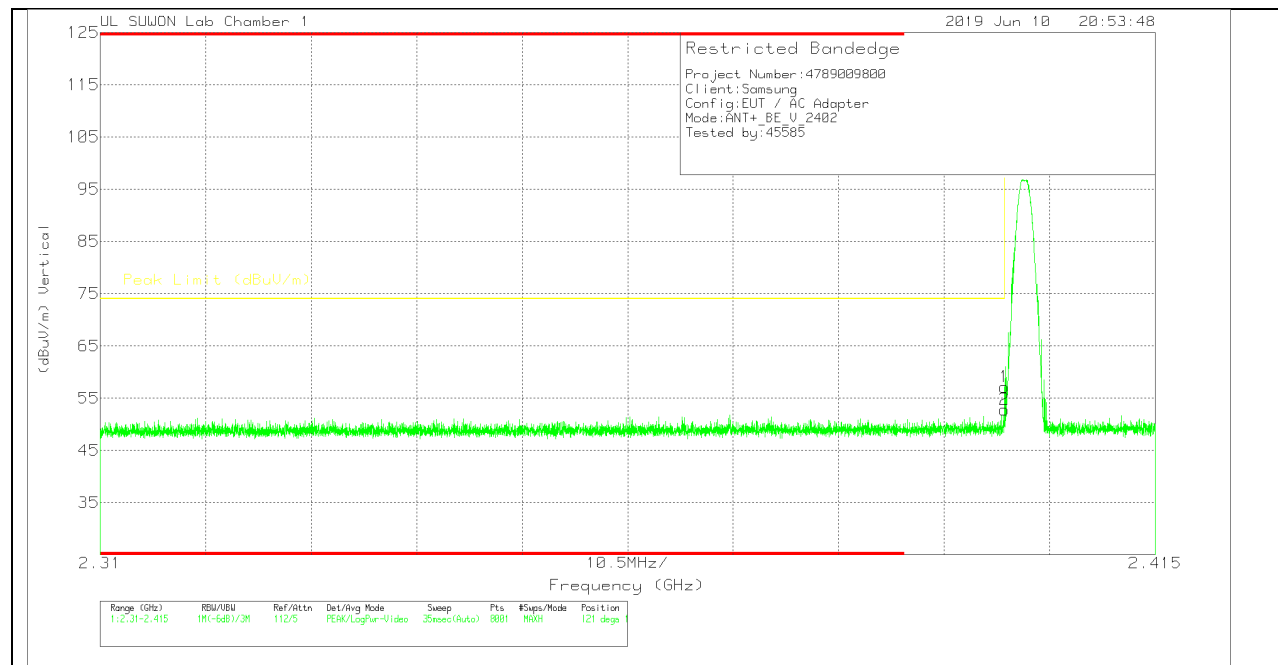
\* For marker 2 used the following method to do averaging:

DCCF = -30.21 / Peak Reading = 54.32 dBuV/m

Corrected AV reading = Peak Reading + DCCF

= 54.32 + -30.21 = 24.11 dBuV/m AVG Limit : 54 dBuV/m, Margin 29.89 dB]

## VERTICAL PEAK AND AVERAGE PLOT



## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1      | 2.4             | 50.94                | Pk  | 31.7          | -25.5    | 57.14                      | 74                  | -16.86         | 121            | 170         | V        |
| 2      | 2.39999         | 46.6                 | Pk  | 31.7          | -25.5    | 52.8                       | 74                  | -21.2          | 121            | 170         | V        |

### Pk - Peak detector

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

$$DCCF = -30.21 \quad / \quad \text{Peak Reading} = 57.14 \text{ dBuV/m}$$

$$\text{Corrected AV reading} = \text{Peak Reading} + DCCF$$

$$= 57.14 + -30.21 = 26.93 \text{ dBuV/m} \quad \text{AVG Limit : 54 dBuV/m, Margin 27.07 dB}$$

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

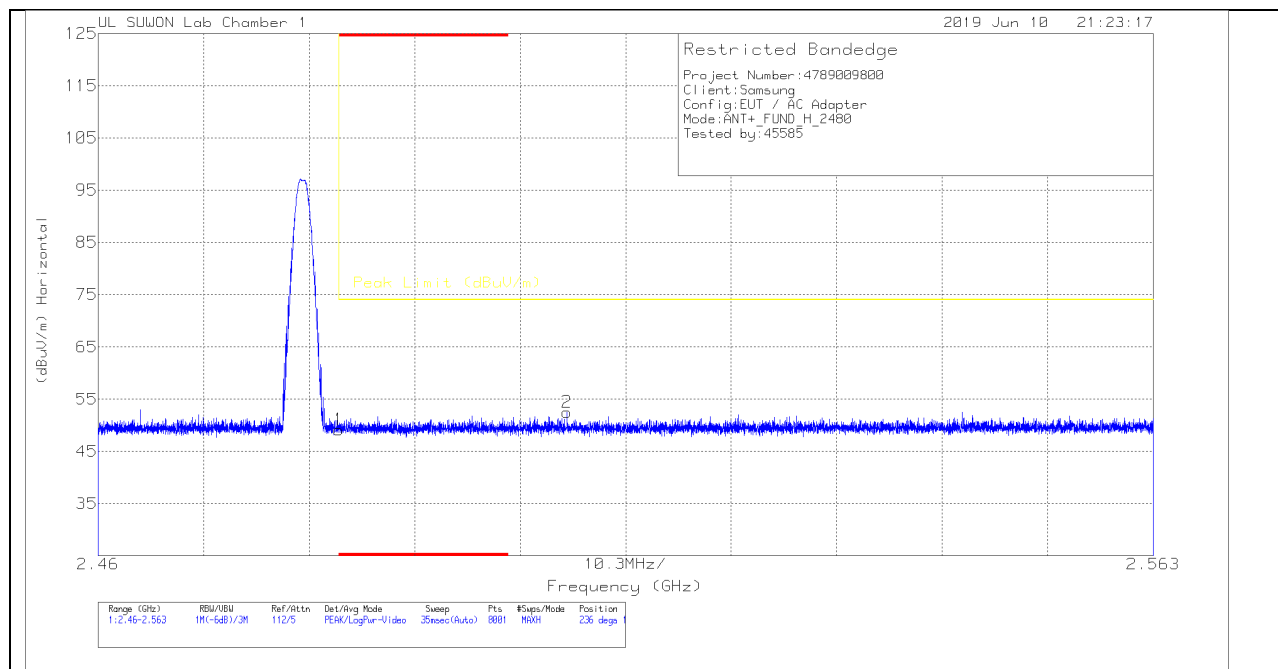
$$DCCF = -30.21 \quad / \quad \text{Peak Reading} = 52.8 \text{ dBuV/m}$$

$$\text{Corrected AV reading} = \text{Peak Reading} + DCCF$$

$$= 52.8 + -30.21 = 22.59 \text{ dBuV/m} \quad \text{AVG Limit : 54 dBuV/m, Margin 31.41 dB}$$

## AUTHORIZED BANDEDGE (HIGH CHANNEL)

### HORIZONTAL PEAK AND AVERAGE PLOT



### HORIZONTAL DATA

#### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.48351       | 42.55                | Pk  | 31.9          | -25.3    | 49.15                      | 74                  | -24.85         | 236            | 162         | H        |
| 2      | 2.50576         | 45.71                | Pk  | 32            | -25.2    | 52.51                      | 74                  | -21.49         | 236            | 162         | 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 = -30.21 / Peak Reading = 49.15 dBuV/m

Corrected AV reading = Peak Reading + DCCF

= 49.15 + -30.21 = 18.94 dBuV/m AVG Limit : 54 dBuV/m, Margin 35.06 dB]

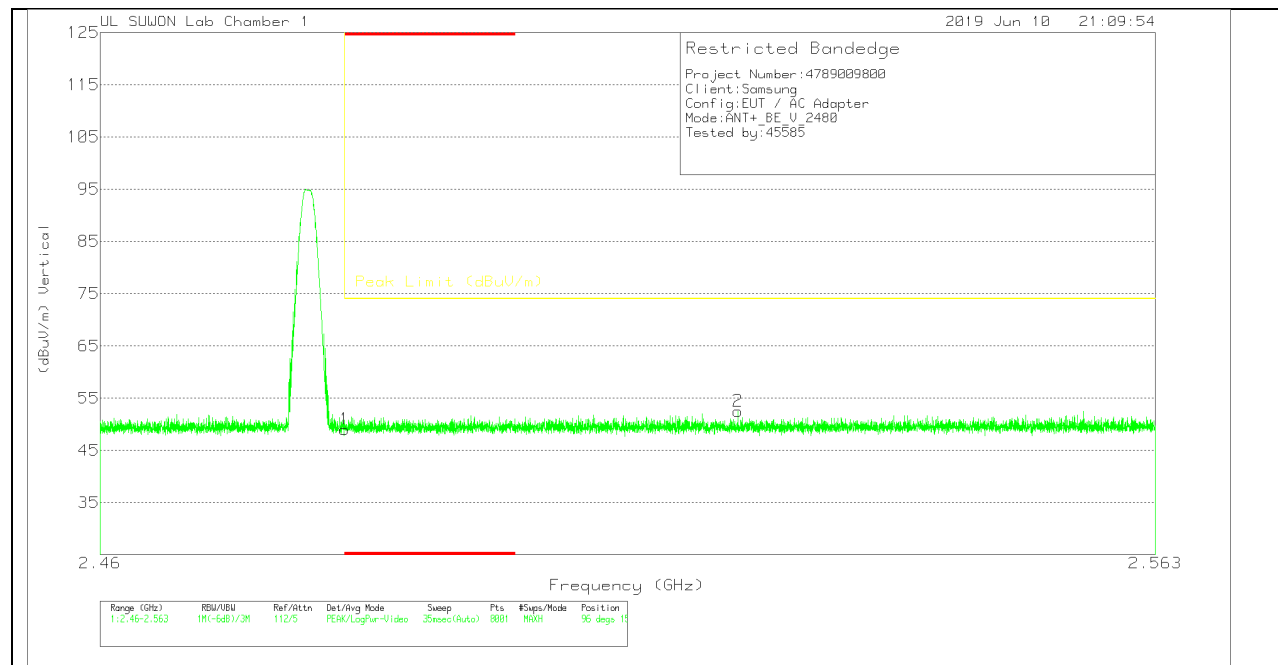
\* For marker 2 used the following method to do averaging:

DCCF = -30.21 / Peak Reading = 52.51 dBuV/m

Corrected AV reading = Peak Reading + DCCF

= 52.51 + -30.21 = 22.3 dBuV/m AVG Limit : 54 dBuV/m, Margin 31.7 dB]

## VERTICAL PEAK AND AVERAGE PLOT



## VERTICAL DATA

### Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB[dB] | Corrected Reading (dBuV/m) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|---------------|----------|----------------------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.48351       | 42.45                | Pk  | 31.9          | -25.3    | 49.05                      | 74                  | -24.95         | 96             | 156         | V        |
| 2      | 2.52176         | 45.73                | Pk  | 32            | -25.2    | 52.53                      | 74                  | -21.47         | 96             | 156         | V        |

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

Pk - Peak detector

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

$$DCCF = -30.21 \quad / \quad \text{Peak Reading} = 49.05 \text{ dBuV/m}$$

$$\text{Corrected AV reading} = \text{Peak Reading} + DCCF$$

$$= 49.05 + -30.21 = 18.84 \text{ dBuV/m} \quad \text{AVG Limit : 54 dBuV/m, Margin 35.16 dB}$$

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

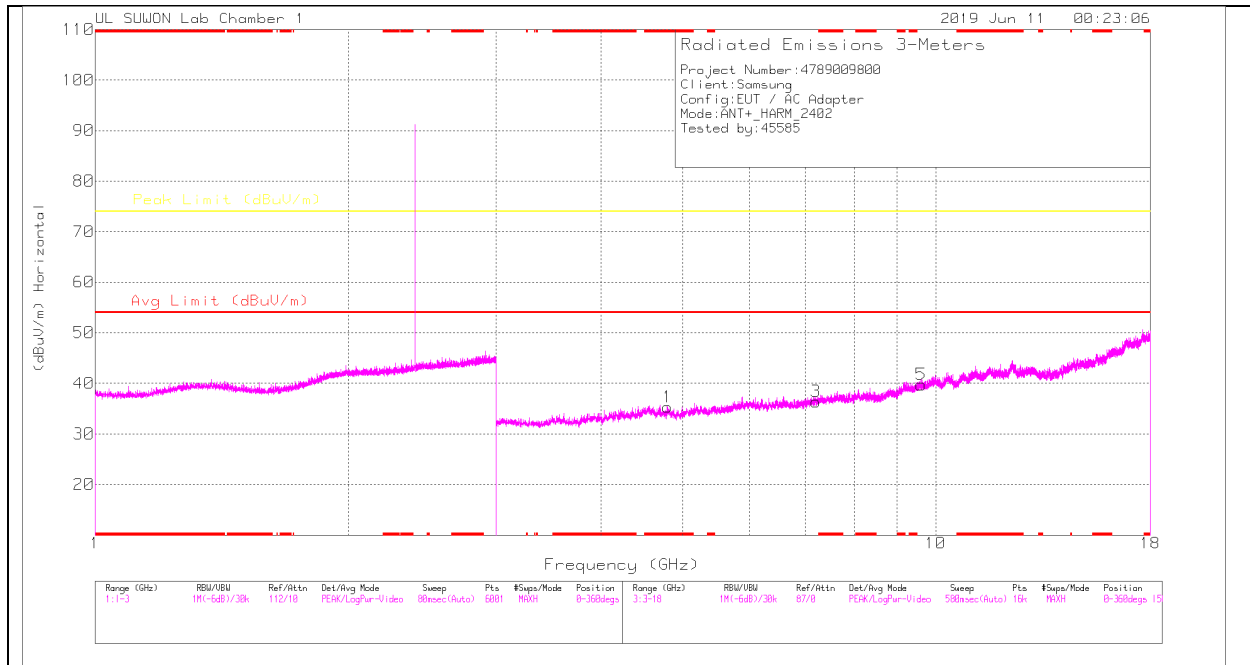
$$DCCF = -30.21 \quad / \quad \text{Peak Reading} = 52.53 \text{ dBuV/m}$$

$$\text{Corrected AV reading} = \text{Peak Reading} + DCCF$$

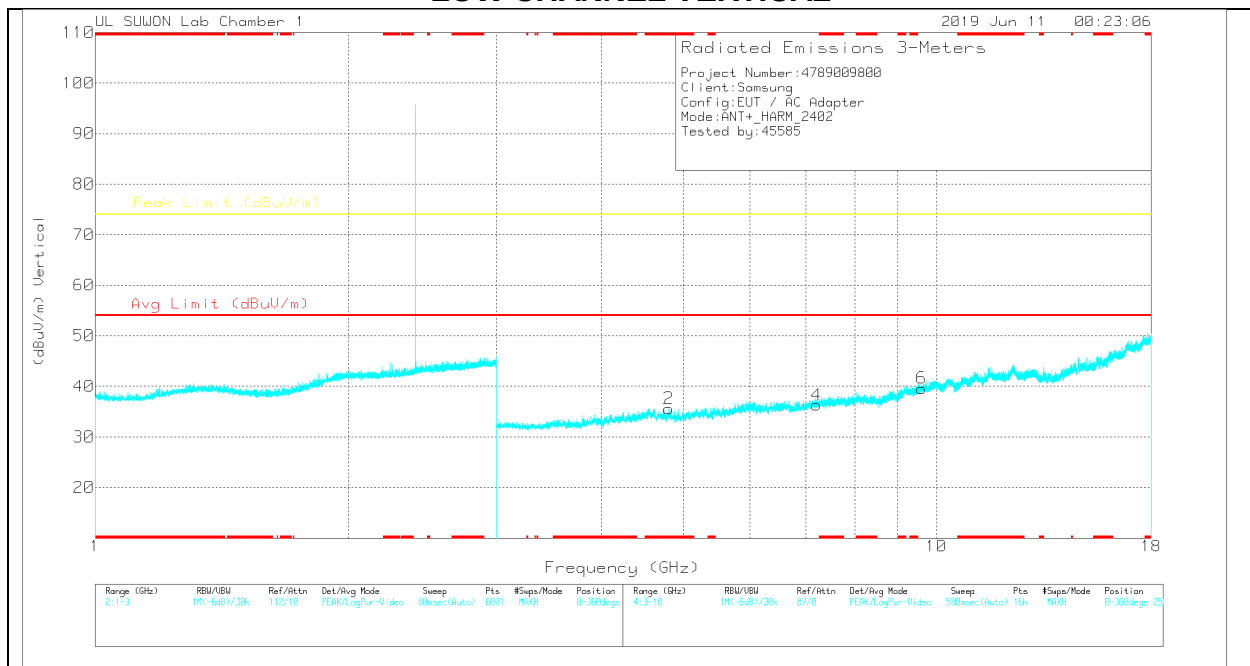
$$= 52.53 + -30.21 = 22.32 \text{ dBuV/m} \quad \text{AVG Limit : 54 dBuV/m, Margin 31.68 dB}$$

## 7.2.3. 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

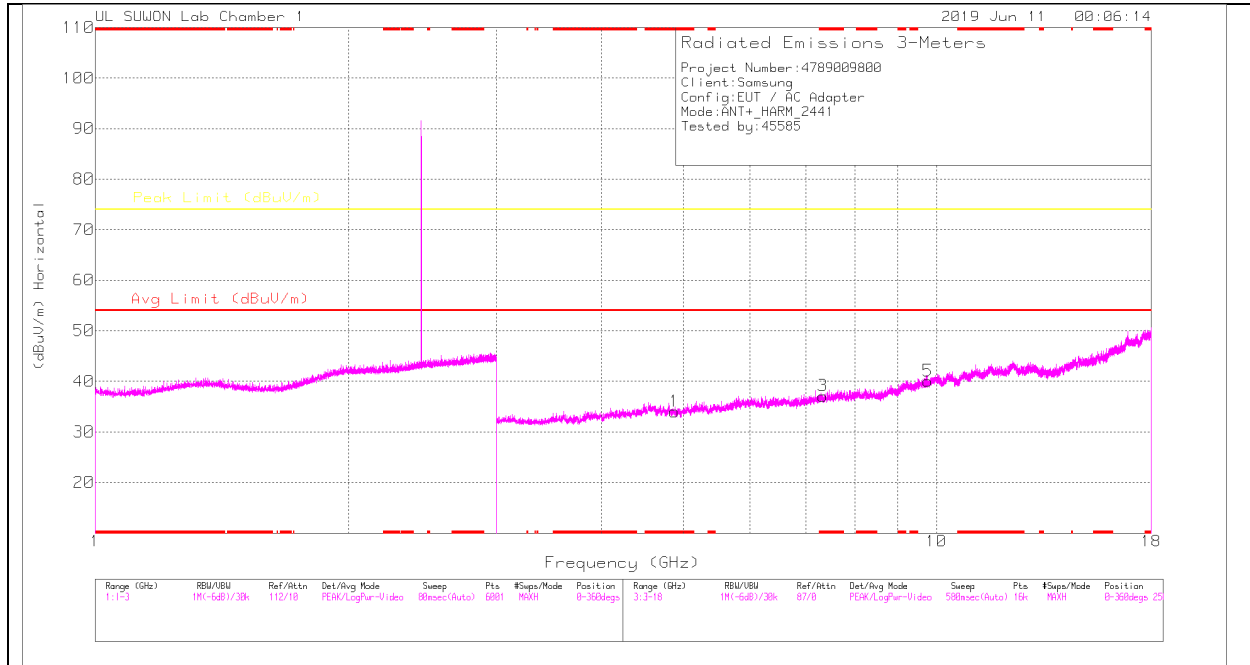
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_0016871 7 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 1      | * 4.80082       | 32.49                | PK  | 34.2           | -31.4       | 35.29                      | -                  | -           | 74                  | -38.71      | 0-360          | 250         | H        |
| 3      | 7.20724         | 28.48                | PK  | 35.8           | -27.9       | 36.38                      | -                  | -           | 74                  | -37.62      | 0-360          | 250         | H        |
| 5      | 9.60896         | 25.85                | PK  | 37             | -23.1       | 39.75                      | -                  | -           | 74                  | -34.25      | 0-360          | 250         | H        |
| 2      | * 4.80457       | 32.79                | PK  | 34.2           | -31.4       | 35.59                      | -                  | -           | 74                  | -38.41      | 0-360          | 250         | V        |
| 4      | 7.20724         | 28.38                | PK  | 35.8           | -27.9       | 36.28                      | -                  | -           | 74                  | -37.72      | 0-360          | 150         | V        |
| 6      | 9.60802         | 25.71                | PK  | 37             | -23.1       | 39.61                      | -                  | -           | 74                  | -34.39      | 0-360          | 150         | V        |

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

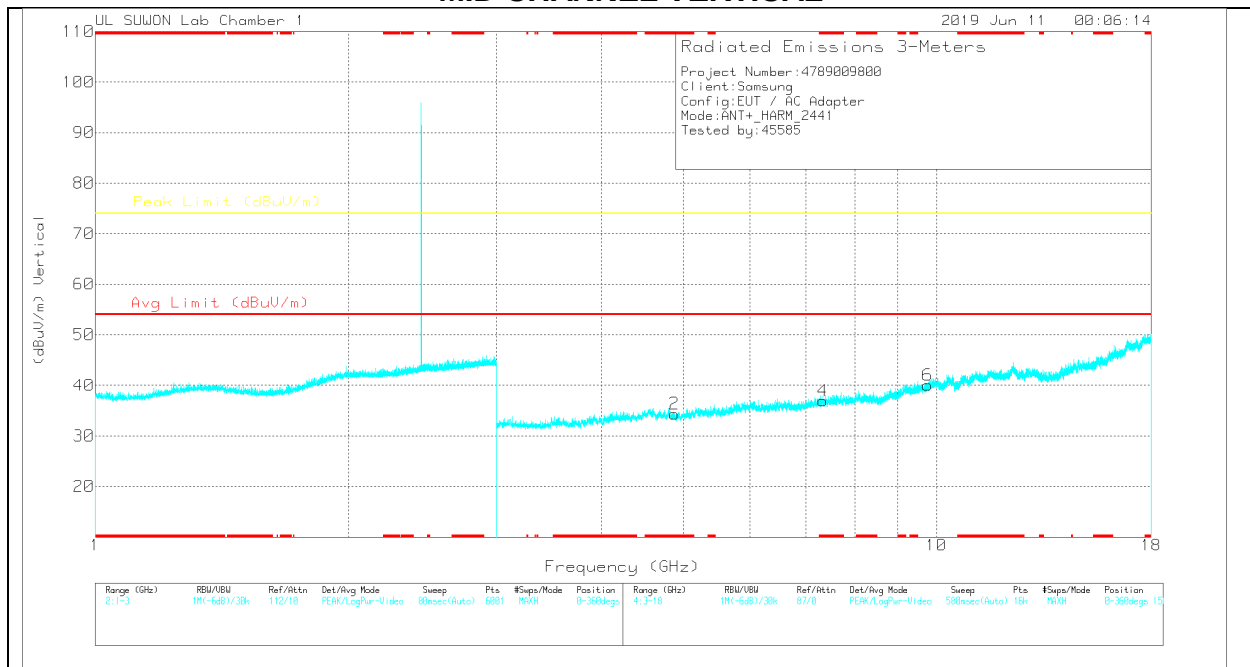
PK – Peak Detector

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

## 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

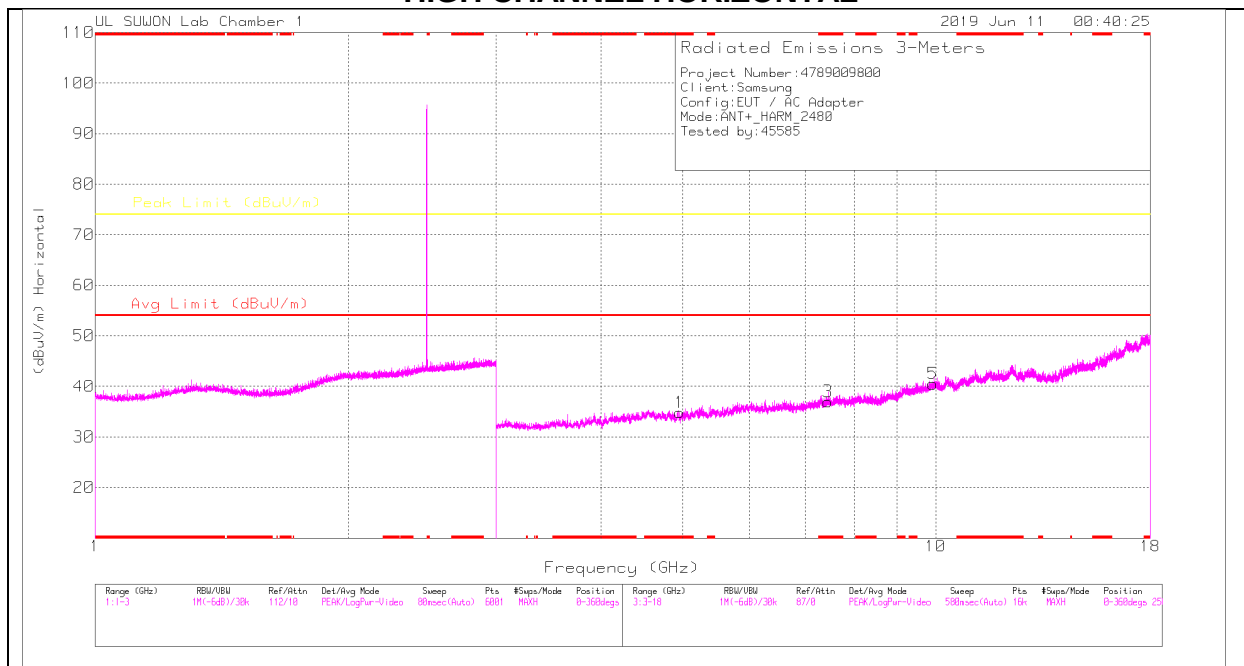
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_0016871 7 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 1      | * 4.88144       | 31.33                | PK  | 34.2           | -31.5       | 34.03                      | -                  | -           | 74                  | -39.97      | 0-360          | 250         | H        |
| 3      | * 7.32348       | 28.62                | PK  | 35.8           | -27.3       | 37.12                      | -                  | -           | 74                  | -36.88      | 0-360          | 150         | H        |
| 5      | 9.76457         | 26.77                | PK  | 37.2           | -23.9       | 40.07                      | -                  | -           | 74                  | -33.93      | 0-360          | 250         | H        |
| 2      | * 4.88332       | 31.67                | PK  | 34.2           | -31.5       | 34.37                      | -                  | -           | 74                  | -39.63      | 0-360          | 150         | V        |
| 4      | * 7.32348       | 28.42                | PK  | 35.8           | -27.3       | 36.92                      | -                  | -           | 74                  | -37.08      | 0-360          | 250         | V        |
| 6      | 9.76176         | 26.74                | PK  | 37.2           | -23.9       | 40.04                      | -                  | -           | 74                  | -33.96      | 0-360          | 150         | V        |

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

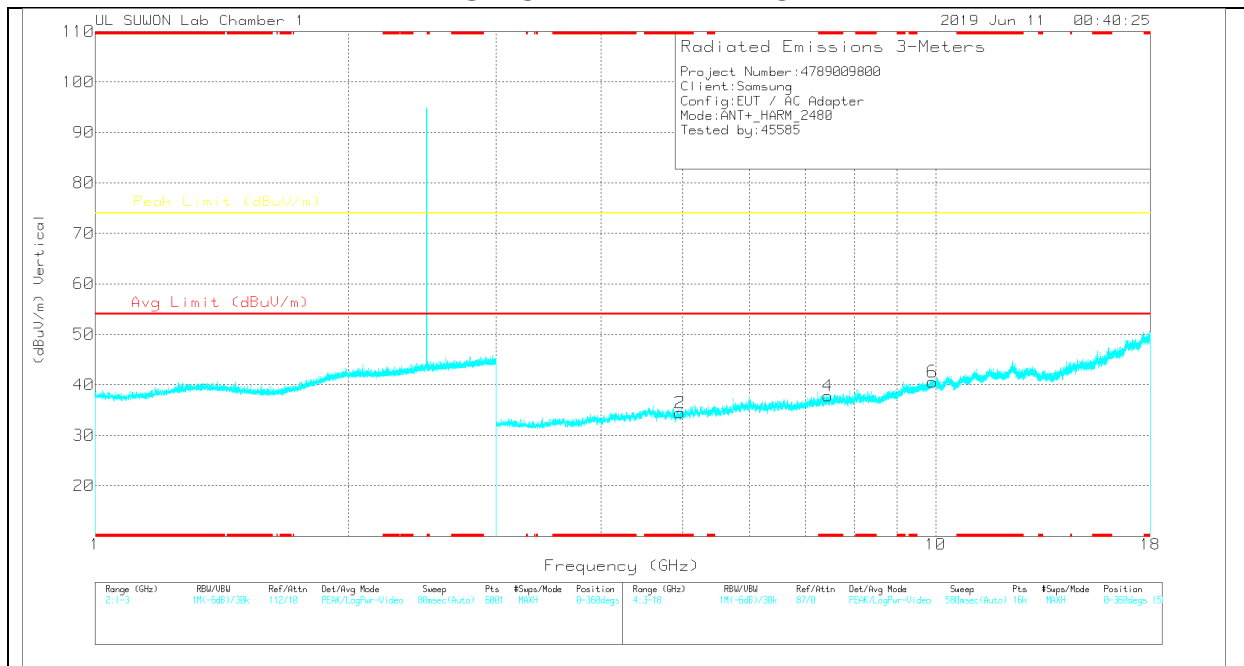
PK – Peak Detector

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

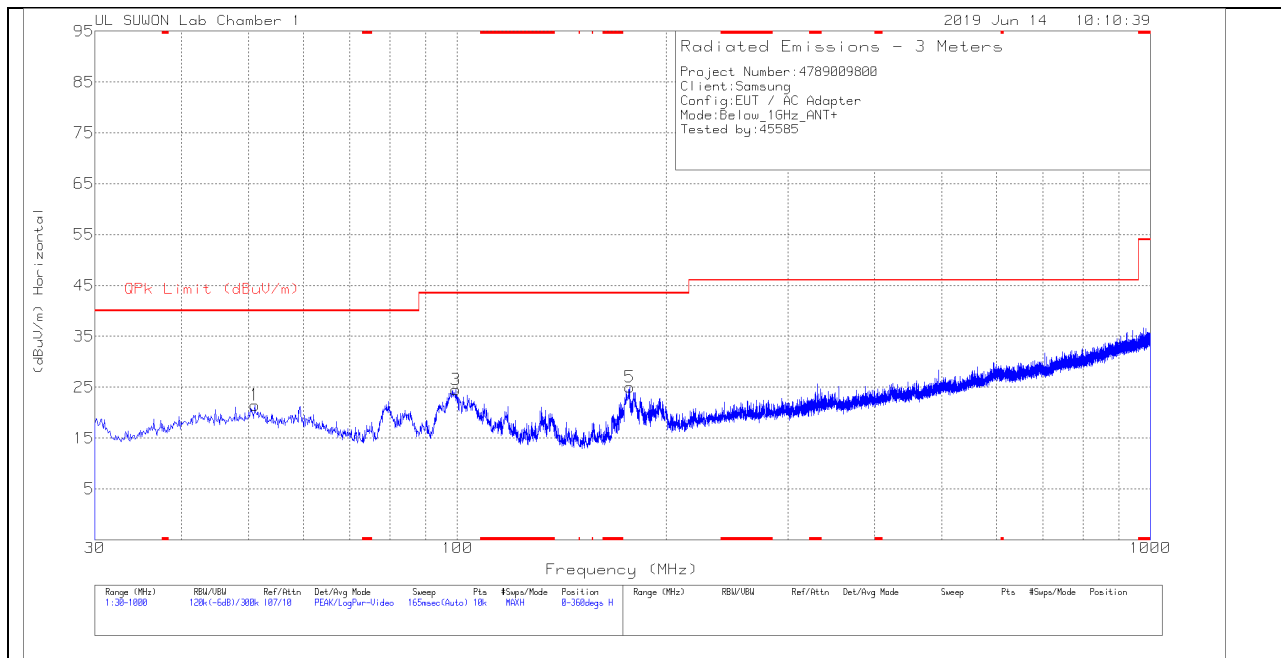
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_0016871 7 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-------------|----------------------------|--------------------|-------------|---------------------|-------------|----------------|-------------|----------|
| 1      | * 4.95738       | 31.99                | PK  | 34.2           | -31.4       | 34.79                      | -                  | -           | 74                  | -39.21      | 0-360          | 250         | H        |
| 3      | * 7.44066       | 28.16                | PK  | 35.8           | -27         | 36.96                      | -                  | -           | 74                  | -37.04      | 0-360          | 150         | H        |
| 5      | 9.91457         | 25.3                 | PK  | 37.5           | -22.3       | 40.5                       | -                  | -           | 74                  | -33.5       | 0-360          | 250         | H        |
| 2      | * 4.96206       | 31.65                | PK  | 34.2           | -31.4       | 34.45                      | -                  | -           | 74                  | -39.55      | 0-360          | 250         | V        |
| 4      | * 7.43972       | 29                   | PK  | 35.8           | -27         | 37.8                       | -                  | -           | 74                  | -36.2       | 0-360          | 150         | V        |
| 6      | 9.91082         | 25.37                | PK  | 37.5           | -22.3       | 40.57                      | -                  | -           | 74                  | -33.43      | 0-360          | 250         | V        |

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

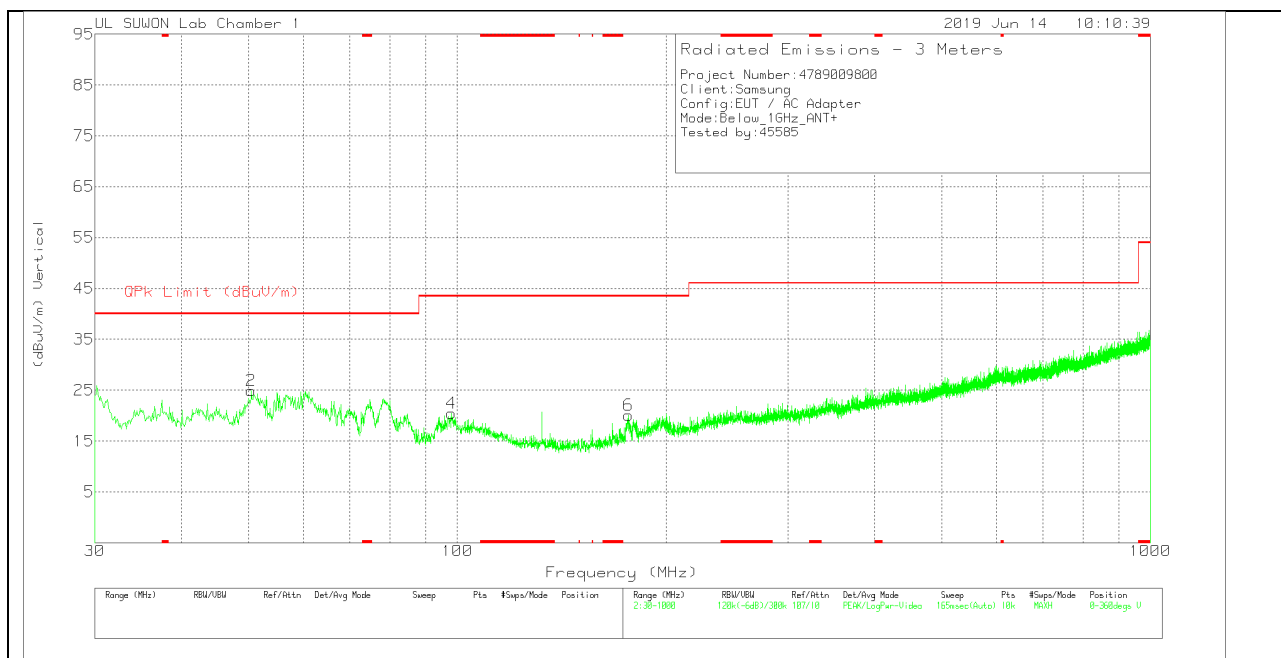
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

## 7.2.4. 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 | VULB9163_750 | Below_1G[dB] | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|--------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 1      | 51.049          | 32.2                 | Pk  | 19.8         | -30.5        | 21.5                       | 40                 | -18.5       | 0-360          | 400         | H        |
| 3      | 99.549          | 36.47                | Pk  | 17.8         | -29.7        | 24.57                      | 43.52              | -18.95      | 0-360          | 300         | H        |
| 5      | 177.246         | 38.48                | Pk  | 15.2         | -28.7        | 24.98                      | 43.52              | -18.54      | 0-360          | 100         | H        |
| 2      | 50.467          | 35.65                | Pk  | 19.7         | -30.5        | 24.85                      | 40                 | -15.15      | 0-360          | 100         | V        |
| 4      | 97.997          | 32.5                 | Pk  | 17.7         | -29.7        | 20.5                       | 43.52              | -23.02      | 0-360          | 100         | V        |
| 6      | 176.761         | 33.56                | Pk  | 15.2         | -28.7        | 20.06                      | 43.52              | -23.46      | 0-360          | 200         | V        |

Pk - Peak detector

## 8. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ 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.

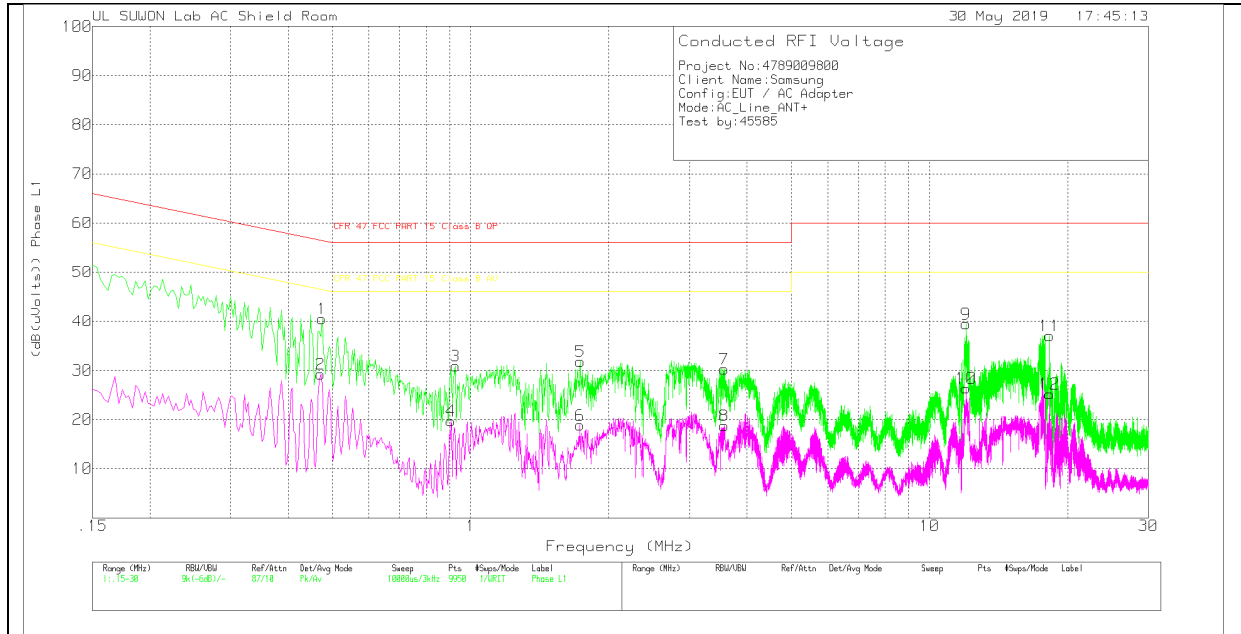
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

## RESULTS

### 6 WORST EMISSIONS

#### LINE 1 PLOT



#### LINE 1 RESULTS

##### Trace Markers

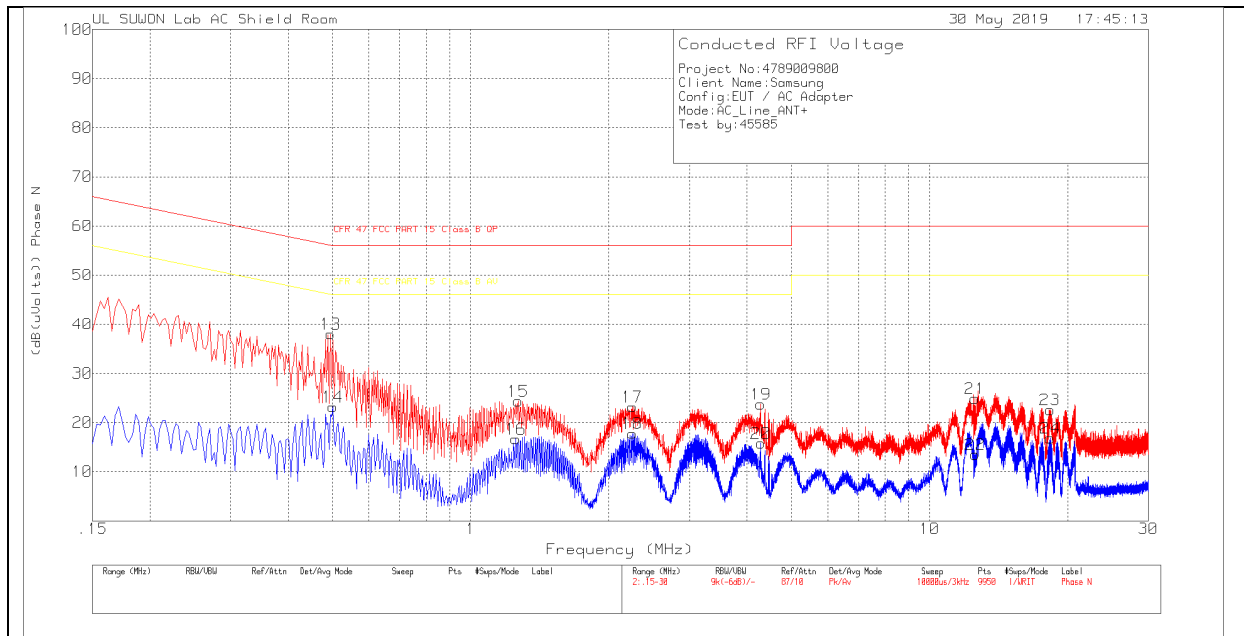
##### Range 1: Phase L1 .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | ENV216_10183 6_With ex-cord_L1 | 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      | .474            | 30.45                | Pk  | 9.9                            | .2            | 40.55                          | 56.44                         | -15.89      | -                             | -           |
| 2      | .471            | 19.17                | Av  | 9.9                            | .2            | 29.27                          | -                             | -           | 46.5                          | -17.23      |
| 3      | .927            | 20.81                | Pk  | 9.8                            | .3            | 30.91                          | 56                            | -25.09      | -                             | -           |
| 4      | .906            | 9.62                 | Av  | 9.8                            | .3            | 19.72                          | -                             | -           | 46                            | -26.28      |
| 5      | 1.734           | 21.72                | Pk  | 9.8                            | .3            | 31.82                          | 56                            | -24.18      | -                             | -           |
| 6      | 1.731           | 8.74                 | Av  | 9.8                            | .3            | 18.84                          | -                             | -           | 46                            | -27.16      |
| 7      | 3.57            | 20.11                | Pk  | 9.9                            | .3            | 30.31                          | 56                            | -25.69      | -                             | -           |
| 8      | 3.57            | 8.58                 | Av  | 9.9                            | .3            | 18.78                          | -                             | -           | 46                            | -27.22      |
| 9      | 12              | 29.04                | Pk  | 10.1                           | .3            | 39.44                          | 60                            | -20.56      | -                             | -           |
| 10     | 12.006          | 15.96                | Av  | 10.1                           | .3            | 26.36                          | -                             | -           | 50                            | -23.64      |
| 11     | 18.264          | 26.24                | Pk  | 10.4                           | .4            | 37.04                          | 60                            | -22.96      | -                             | -           |
| 12     | 18.252          | 14.4                 | Av  | 10.4                           | .4            | 25.2                           | -                             | -           | 50                            | -24.8       |

Pk - Peak detector

Av - Average detection

## LINE 2 PLOT



## LINE 2 RESULTS

### Trace Markers

#### Range 2: Phase N .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | ENV216_10183 6_With ex-cord_N | 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     | .495            | 27.92                | Pk  | 9.9                           | .2            | 38.02                          | 56.08                         | -18.06      | -                             | -           |
| 14     | .501            | 13.08                | Av  | 9.9                           | .2            | 23.18                          | -                             | -           | 46                            | -22.82      |
| 15     | 1.269           | 14.25                | Pk  | 9.8                           | .3            | 24.35                          | 56                            | -31.65      | -                             | -           |
| 16     | 1.254           | 6.56                 | Av  | 9.8                           | .3            | 16.66                          | -                             | -           | 46                            | -29.34      |
| 17     | 2.25            | 13.18                | Pk  | 9.7                           | .3            | 23.18                          | 56                            | -32.82      | -                             | -           |
| 18     | 2.25            | 7.78                 | Av  | 9.7                           | .3            | 17.78                          | -                             | -           | 46                            | -28.22      |
| 19     | 4.287           | 13.66                | Pk  | 9.8                           | .3            | 23.76                          | 56                            | -32.24      | -                             | -           |
| 20     | 4.29            | 5.68                 | Av  | 9.8                           | .3            | 15.78                          | -                             | -           | 46                            | -30.22      |
| 21     | 12.558          | 14.5                 | Pk  | 10.1                          | .3            | 24.9                           | 60                            | -35.1       | -                             | -           |
| 22     | 12.573          | 3.14                 | Av  | 10.1                          | .3            | 13.54                          | -                             | -           | 50                            | -36.46      |
| 23     | 18.3            | 11.82                | Pk  | 10.4                          | .4            | 22.62                          | 60                            | -37.38      | -                             | -           |
| 24     | 18.324          | 6.05                 | Av  | 10.4                          | .4            | 16.85                          | -                             | -           | 50                            | -33.15      |

Pk - Peak detector

Av - Average detection