

# TEST REPORT



## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970  
Fax: +82-31-624-9501

Report No.:  
CTK-2018-01059  
Page (1) / (28) Pages

### 1. Client

- Name : SOLUM CO.,LTD.
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea
- Date of Receipt : 2017-09-04

### 2. Manufacturer

- Name : SOLUM CO.,LTD.
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea

### 3. Use of Report : For FCC Certification

### 4. Test Sample / Model: Electronic Shelf Label Gateway / SLG-CS101

### 5. Date of Test : 2017-09-20 to 2018-04-24

### 6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.249

### 7. Testing Environment: Temp.: (20 ± 5) °C, Humidity: (51 ± 3) % R.H.

### 8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

|             |                                                                                                                |                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Affirmation | Tested by                                                                                                      | Technical Manager                                                                                                  |
|             | Bongseok, Kim: (Signature)  | Young-taek, Lee: (Signature)  |

2018-04-24

Republic of KOREA **CTK Co., Ltd.**



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## REPORT REVISION HISTORY

| Date       | Revision                | Page No |
|------------|-------------------------|---------|
| 2018-04-24 | Issued (CTK-2018-01059) | all     |
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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--|

## 1. General Product Description

### 1.1 Client Information

|                       |                                                                                   |
|-----------------------|-----------------------------------------------------------------------------------|
| <b>Company</b>        | SOLUM CO.,LTD.                                                                    |
| <b>Contact Point</b>  | 4,5,6th F, 357, Guseong-ro, Giheung-gu, Gyeonggi-do, Yongin-si, Republic of Korea |
| <b>Contact Person</b> | Name : Kim Jun Young<br>E-mail : jy.kim1216@solu-m.com<br>Tel : +82-31-8006-0960  |

### 1.2 Product Information

|                            |                                                              |
|----------------------------|--------------------------------------------------------------|
| <b>FCC ID</b>              | 2AFWN-SLG-CS101                                              |
| <b>Product Description</b> | Electronic Shelf Label Gateway                               |
| <b>Model name</b>          | SLG-CS101                                                    |
| <b>Variant Model name</b>  | -                                                            |
| <b>Operating Frequency</b> | 902.4 MHz, 915.2 MHz, 927.6 MHz                              |
| <b>RF Output Power</b>     | Below 94 dBuV/m @ 3 m                                        |
| <b>Antenna type</b>        | Antenna A type : FPC antenna<br>Antenna B type : FPC antenna |
| <b>Antenna gain</b>        | Antenna A : 3.9 dBi<br>Antenna B : 3.9 dBi                   |
| <b>Channel Spacing</b>     | 0.4 MHz                                                      |
| <b>Number of channels</b>  | 64                                                           |
| <b>Type of Modulation</b>  | 2-GFSK                                                       |
| <b>Power Source</b>        | DC 5 V, POE                                                  |

### 1.3 Peripheral Devices

| Device     | Manufacturer | Model No.  | Serial No.   |
|------------|--------------|------------|--------------|
| Notebook   | HP Inc.      | 15-BS563TU | CND7253R6N   |
| AC Adapter | HP Inc.      | HSTNN-LA40 | PA-1450-36HC |

## 2. Facility and Accreditations

### 2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

### 2.2 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation                                                                           | Registration Number                | Logo                                                                                  |
|---------|--------|--------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------|
| USA     | FCC    | FCC Part 15 & 18<br>EMI (Electromagnetic Interference / Emission)                                | 805871                             |    |
| CANADA  | ISED   | ISED<br>EMI (3/10m test site)                                                                    | 8737A-2                            |    |
| JAPAN   | VCCI   | VCCI V-3<br>EMI (Electromagnetic Interference / Emission)                                        | C-986<br>T-1843<br>R-3627<br>G-387 |   |
| KOREA   | MSIP   | EMI (Electromagnetic Interference / Emission)<br>EMS (Electromagnetic Susceptibility / Immunity) | KR0025                             |  |

### 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

### 3. Test Specifications

#### 3.1 Standards

| FCC Part Section(s)                                                                                               | Requirement(s)                                              | Status (Note 1) |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------|
| 15.249(a)                                                                                                         | Field Strength of emissions from intentional radiators      | C               |
| 15.249(d)                                                                                                         | Emissions radiated outside of the specified frequency bands | C               |
| 15.209                                                                                                            | Radiated Emissions                                          | C               |
| 15.207                                                                                                            | AC Conducted Emission                                       | Line Conducted  |
| <i>Note 1:</i> C=Complies   NC=Not Complies   NT=Not Tested   NA=Not Applicable                                   |                                                             |                 |
| <i>Note 2:</i> The data in this test report are traceable to the national or international standards.             |                                                             |                 |
| <i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.249, ANSI C63.10-2013. |                                                             |                 |

### 3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments.  
During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests.  
The results are only attached worst cases.

#### Test Frequency

| Lowest channel | Middle channel | Highest channel |
|----------------|----------------|-----------------|
| 902.4 MHz      | 915.2 MHz      | 927.6 MHz       |

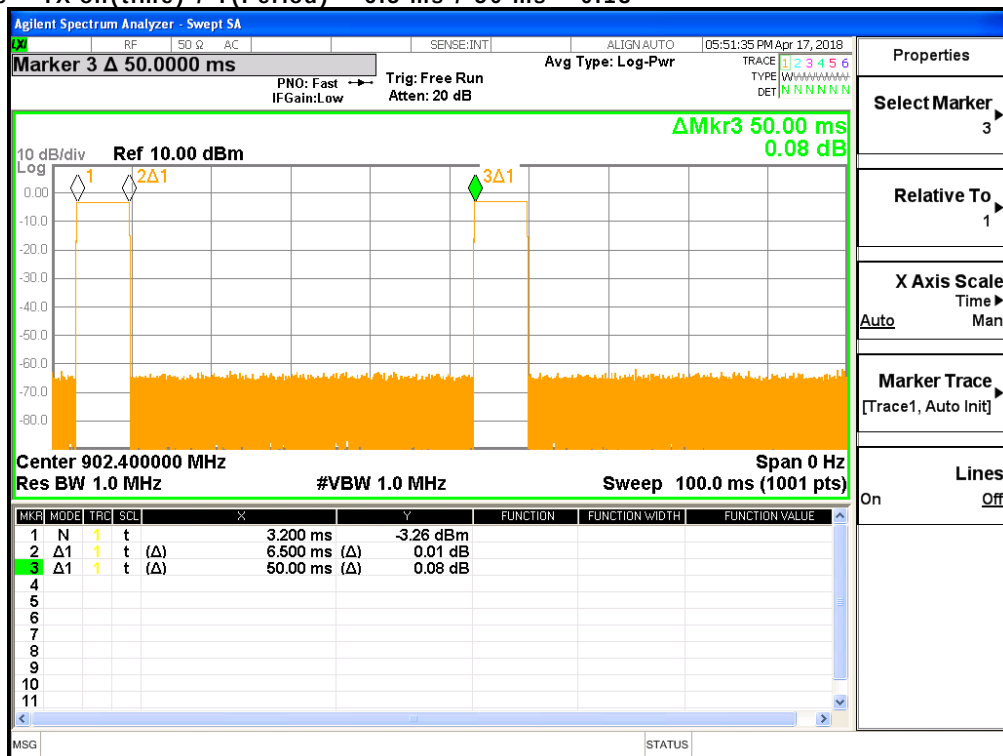
#### Test antenna

| Antenna 1 | Antenna 2 |
|-----------|-----------|
| ANT-A     | ANT-B     |

#### Test mode

| TX mode    | Duty cycle * |
|------------|--------------|
| Continuous | 0.13 (13%)   |

\*Duty cycle = TX on(time) / T(Period) = 6.5 ms / 50 ms = 0.13



### 3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.  
 Coverage factor  $k = 2$ , Confidence levels of 95 %

| Description                          | Uncertainty |
|--------------------------------------|-------------|
| Conducted RF Output Power            | 1.5 dB      |
| Unwanted Emission(conducted)         | 3.0 dB      |
| Radiated Emissions ( $f \leq 1$ GHz) | 4.0 dB      |
| Radiated Emissions ( $f > 1$ GHz)    | 5.0 dB      |

|                                                                                                                                                                       |                                                                                                                                                          |                                                                 |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--|
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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--|

## 4. Technical Characteristic Test

### 4.1 Band Edge

#### Requirement

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.

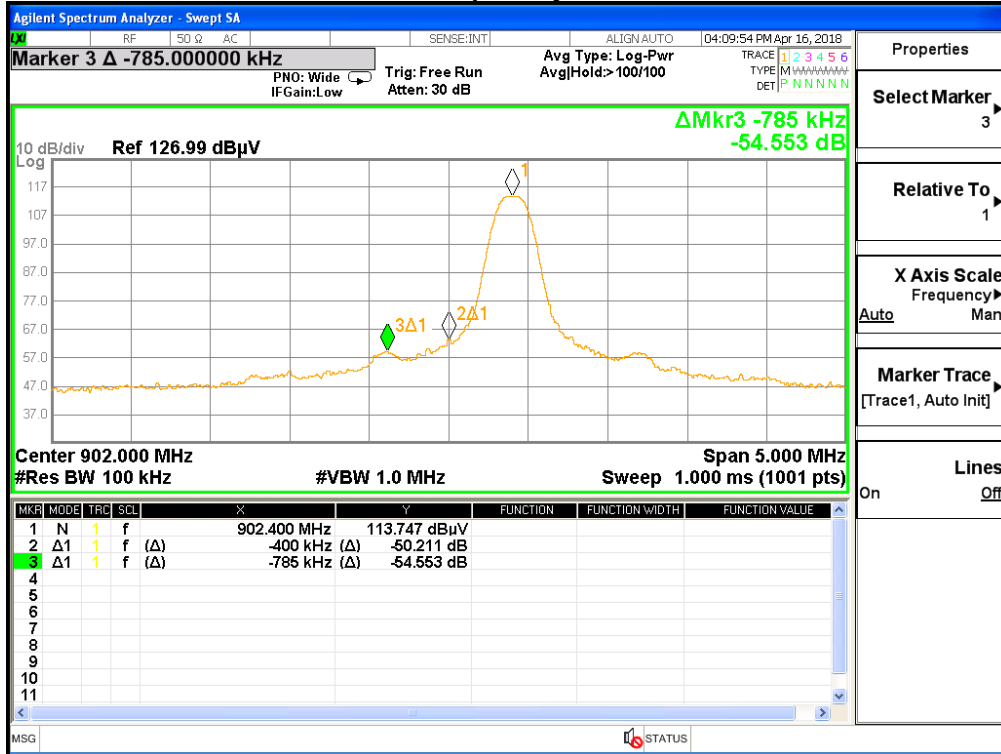
#### Test Procedures(ANSI C63.10-2013 6.10)

- a) Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
- b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
- c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent "normal mode of operation".
- d) Perform the test as follows:
  - 1) Span : Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
  - 2) RBW : 100 kHz
  - 3) VBW : 300 kHz
  - 4) Detector : Peak
  - 5) Sweep time = Coupled
  - 6) Trace : Max hold
  - 7) Attenuation : Auto(at least 10 dB preferred)
  - 8) Allow trace to fully stabilize
- e) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- f) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
- g) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

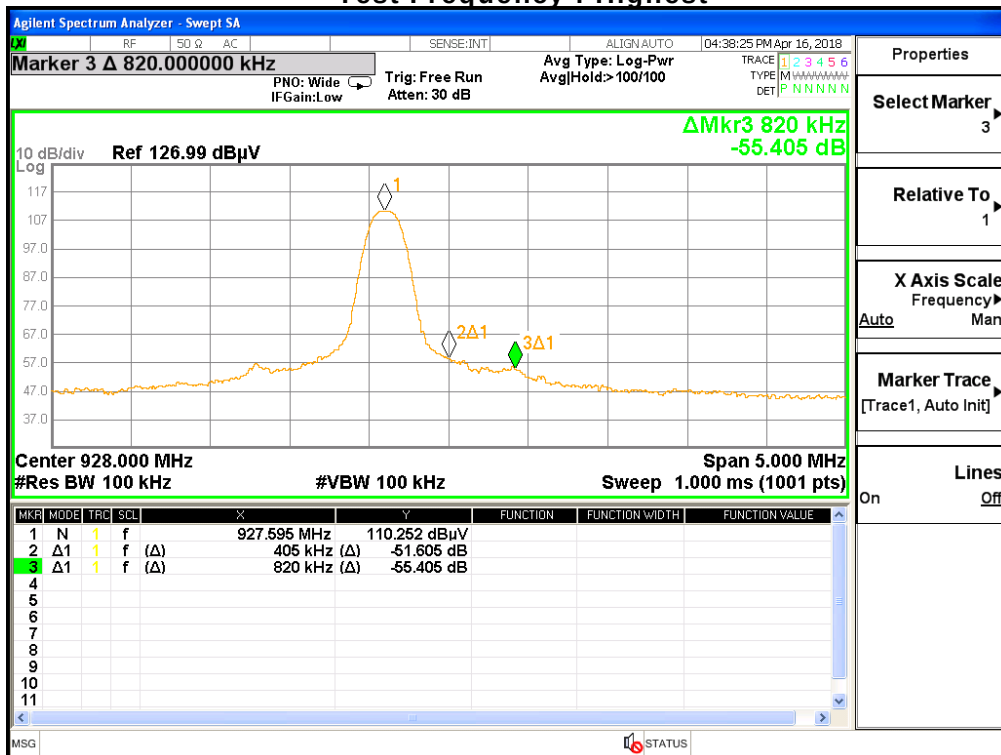
#### Test results: Complies

See next pages for actual measured spectrum plots.

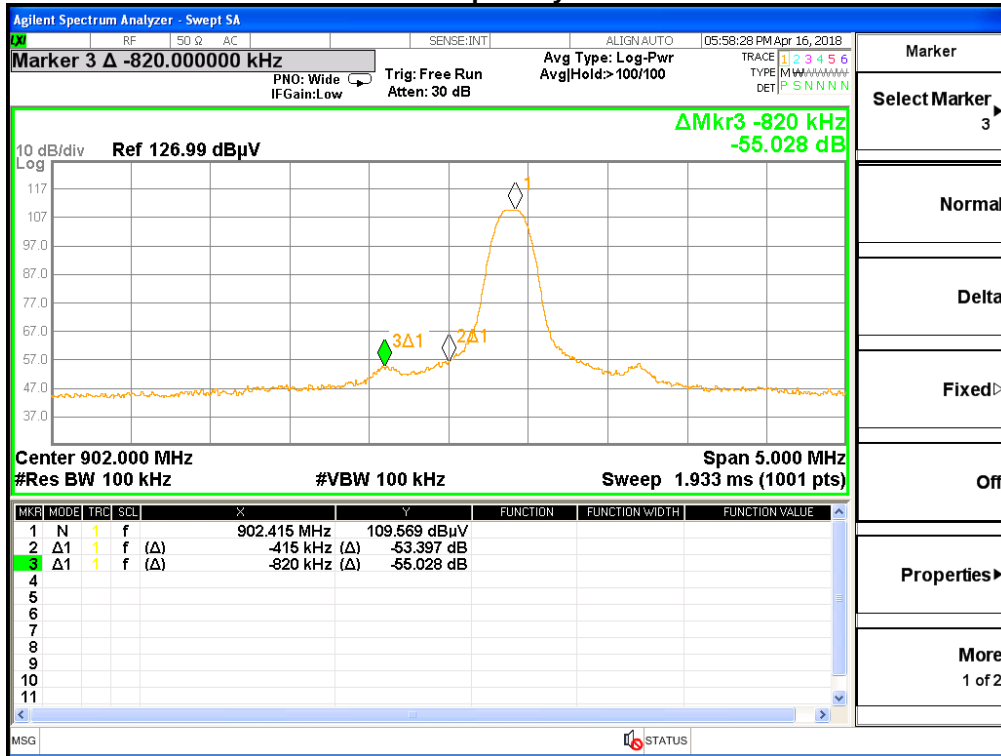
**Band-edge  
ANT-A  
Test Frequency : Lowest**



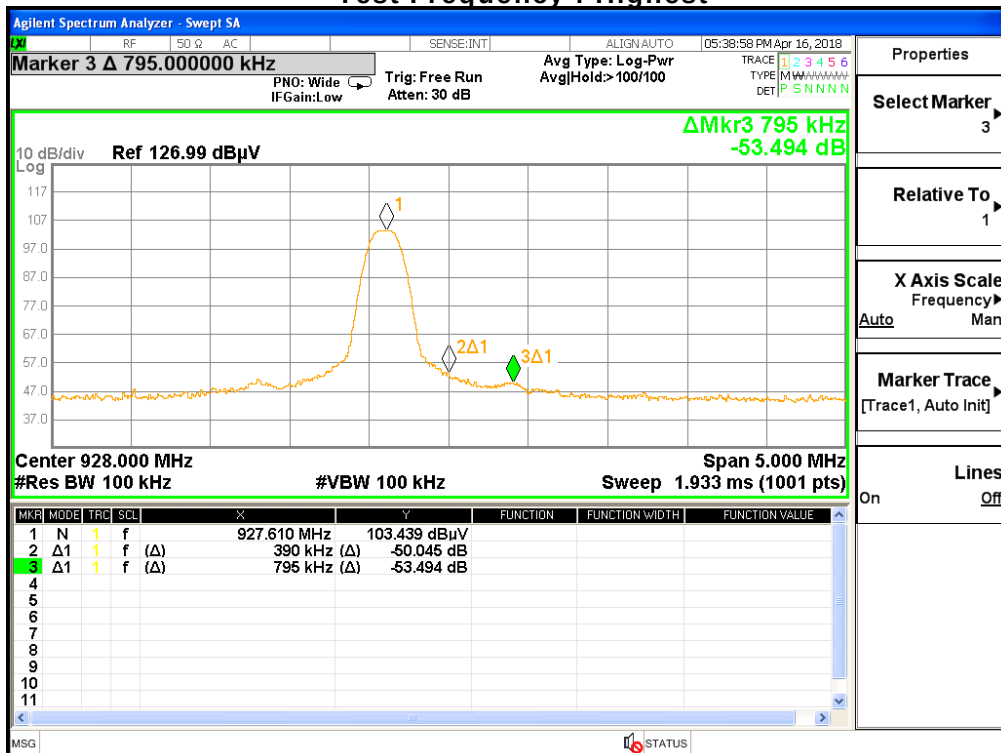
**Test Frequency : Highest**



**Band-edge  
ANT-B  
Test Frequency : Lowest**



**Test Frequency : Highest**



|                                                                                                                                                                       |                                                                                                                                                          |                                                                  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--|
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## 4.2 Field strength

### Test Location

- ☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)  
☒ 3 m SAC (test distance : 3 m)

### Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

#### Test Settings:

Frequency Range = 9 kHz ~ 12.75 GHz (10<sup>th</sup> harmonic)

- a) RBW = 1 MHz for  $f \geq 1$  GHz, 120 kHz for  $f < 1$  GHz, 9 kHz for  $f < 30$  MHz
- b) VBW  $\geq$  RBW
- c) Sweep time = auto couple

## Requirement :

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental | Field strength of harmonics |
|-----------------------|-------------------------------|-----------------------------|
| 902-928 MHz           | 50 mV/m (94 dBuV/m)           | 500 uV/m (54 dBuV/m)        |

Field strength limits are specified at a distance of 3 meters.

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.

FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

| Frequency(MHz) | Field Strength<br>uV / m@3m | Field Strength<br>dBuV / m@3m | Measurement<br>Distance (meters) |
|----------------|-----------------------------|-------------------------------|----------------------------------|
| 0.009-0.490    | 2400/F(kHz)                 | -                             | 300                              |
| 0.490-1.705    | 24000/F(kHz)                | -                             | 30                               |
| 1.705-30       | 30                          | -                             | 30                               |
| 30-88          | 100**                       | 40                            | 3                                |
| 88-216         | 150**                       | 43.5                          | 3                                |
| 216-960        | 200**                       | 46                            | 3                                |
| Above 960      | 500                         | 54                            | 3                                |

\*\* Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) Average value = Peak value + Duty cycle correction factor(For pulse timing characteristics such as fundamental and harmonic emissions)

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                      | MHz               | MHz                 | MHz           | MHz         | GHz                     |
|--------------------------|-------------------|---------------------|---------------|-------------|-------------------------|
| 0.09-0.11                | 8.37626-8.38675   | 73-74.6             | 399.9-410     | 2690-2900   | 10.6-12.7               |
| <sup>1</sup> 0.495-0.505 | 8.41425-8.41475   | 74.8-75.2           | 608-614       | 3260-3267   | 13.25-13.4              |
| 2.1735-2.1905            | 12.29-12.293      | 108-121.94          | 960-1240      | 3332-3339   | 14.47-14.5              |
| 4.125-4.128              | 12.51975-12.52025 | 123-138             | 1300-1427     | 3345.8-3358 | 15.35-16.2              |
| 4.17725-4.17775          | 12.57675-12.57725 | 149.9-150.05        | 1435-1626.5   | 3600-4400   | 17.7-21.4               |
| 4.20725-4.20775          | 13.36-13.41       | 156.52475-156.52525 | 1645.5-1646.5 | 4500-5150   | 22.01-23.12             |
| 6.215-6.218              | 16.42-16.423      | 156.7-156.9         | 1660-1710     | 5350-5460   | 23.6-24                 |
| 6.26775-6.26825          | 16.69475-16.69525 | 162.0125-167.17     | 1718.8-1722.2 | 7250-7750   | 31.2-31.8               |
| 6.31175-6.31225          | 16.80425-16.80475 | 167.72-173.2        | 2200-2300     | 8025-8500   | 36.43-36.5              |
| 8.291-8.294              | 25.5-25.67        | 240-285             | 2310-2390     | 9000-9200   | <sup>2</sup> Above 38.6 |
| 8.362-8.366              | 37.5-38.25        | 322-335.4           | 2483.5-2500   | 9300-9500   |                         |

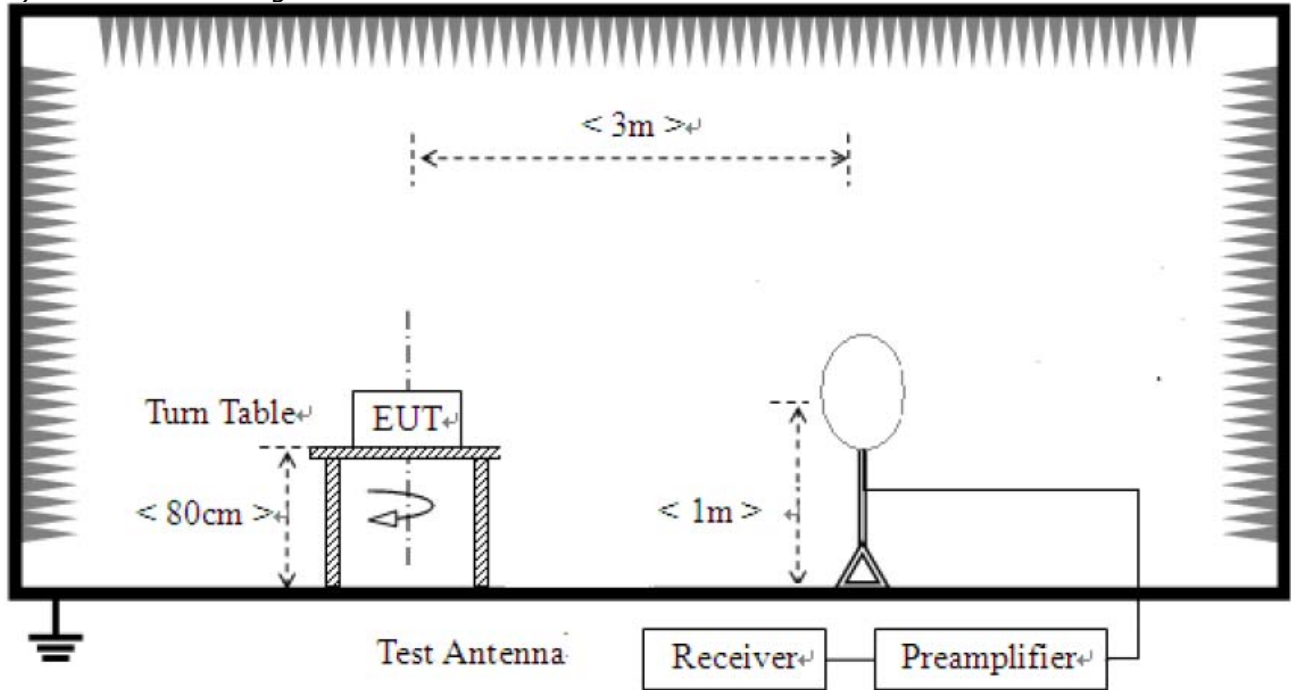
<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

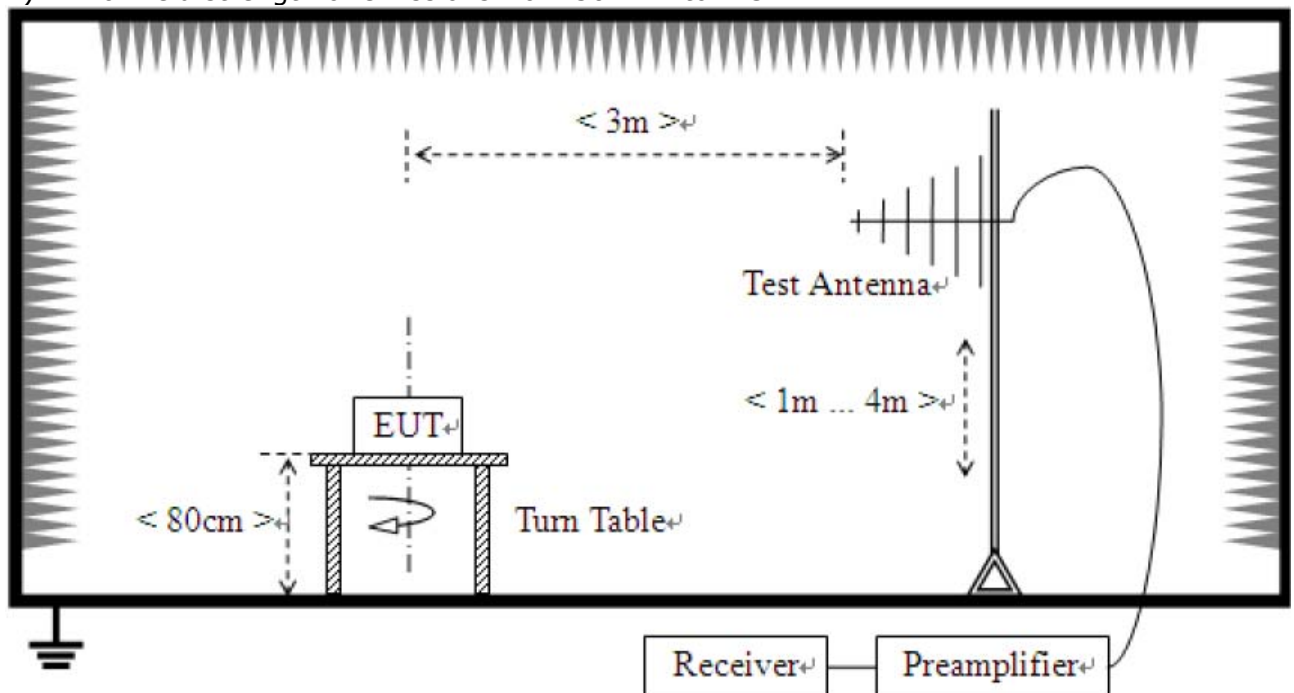
§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## Test Setup:

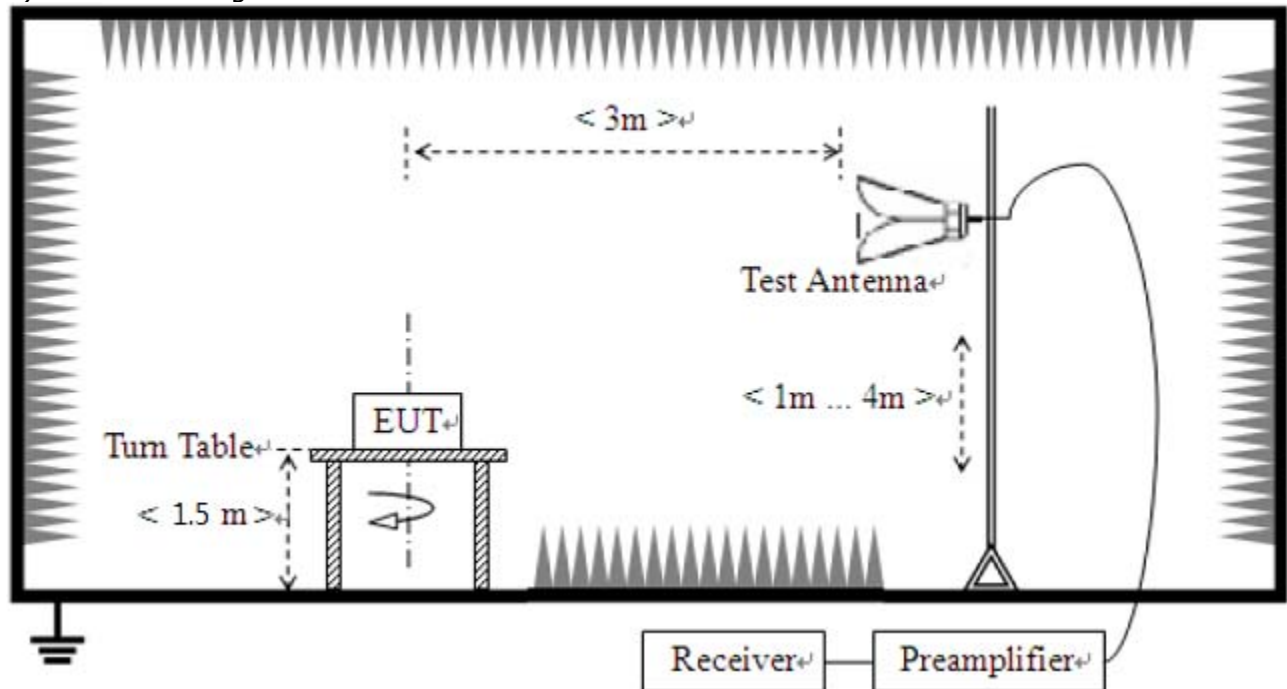
- 1) For field strength of emissions from 9 kHz to 30 MHz



- 2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



## Test Data :

### 1) Field strength of fundamental

The requirements are:

☒ Complies

#### Test mode : Transmit, ANT-A

| Frequency [MHz] | Ant. Pol. (V/H) | Reading * [dBuV/m] | C.F [dB/m] | Duty Cycle c.f [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|-----------------|-----------------|--------------------|------------|---------------------|-----------------|----------------|-------------|--------|
| 902.4           | V               | 105.69             | -3.30      | -17.70              | <b>84.69</b>    | 94             | 9.31        |        |
| 915.2           | V               | 104.69             | -3.80      | -17.70              | <b>83.19</b>    | 94             | 10.81       |        |
| 927.6           | V               | 104.18             | -3.70      | -17.70              | <b>82.78</b>    | 94             | 11.22       |        |

#### Test mode : Transmit, ANT-B

| Frequency [MHz] | Ant. Pol. (V/H) | Reading * [dBuV/m] | C.F [dB/m] | Duty Cycle c.f [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|-----------------|-----------------|--------------------|------------|---------------------|-----------------|----------------|-------------|--------|
| 902.4           | V               | 104.69             | -3.30      | -17.70              | <b>83.69</b>    | 94             | 10.31       |        |
| 915.2           | V               | 103.57             | -3.80      | -17.70              | <b>82.07</b>    | 94             | 11.93       |        |
| 927.6           | V               | 103.22             | -3.70      | -17.70              | <b>81.82</b>    | 94             | 12.18       |        |

1. Result = Reading + c.f(correction factor) + Duty cycle c.f
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. Duty cycle c.f =  $20\log(\text{Duty cycle}) = 20\log(0.13) = -17.7 \text{ dB}$
4. The Unwanted emission was measured in the following position: EUT stand-up position(X, Y axis), lie-down position(Z axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

\* Reading data is the peak value.

## 2) Field strength of outside of the specified frequency bands – 9 kHz to 30 MHz

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV / m) | Margin<br>(dB) | Remark   |
|--------------------|-----------------------------|----------------|----------|
| -                  | -                           | -              | See note |

### Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB)

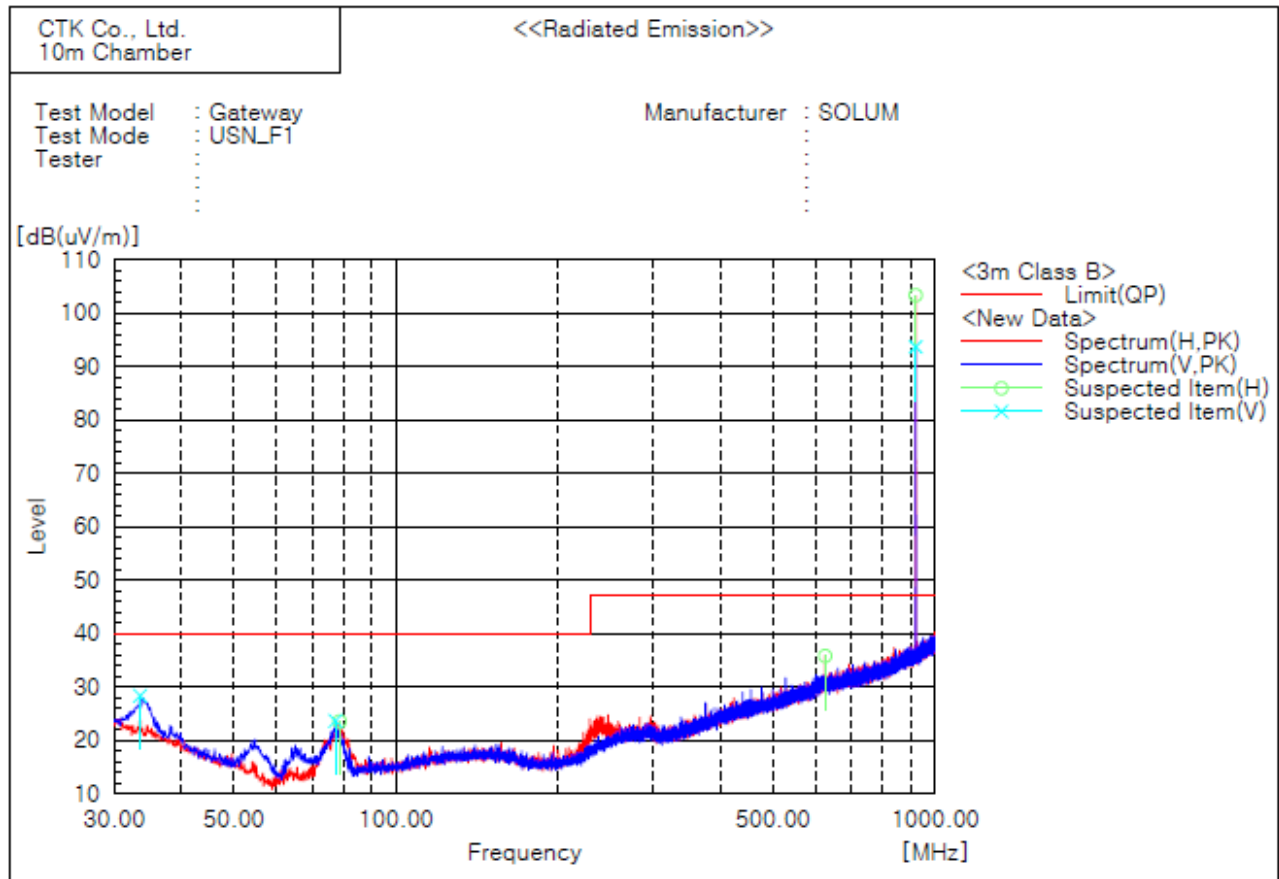
### 3) Field strength of outside of the specified frequency bands – 30MHz to 1GHz

**Test mode : Transmit, ANT-A, low channel(Worst case)**

The requirements are:

☒ Complies

**Test Frequency : Lowest**



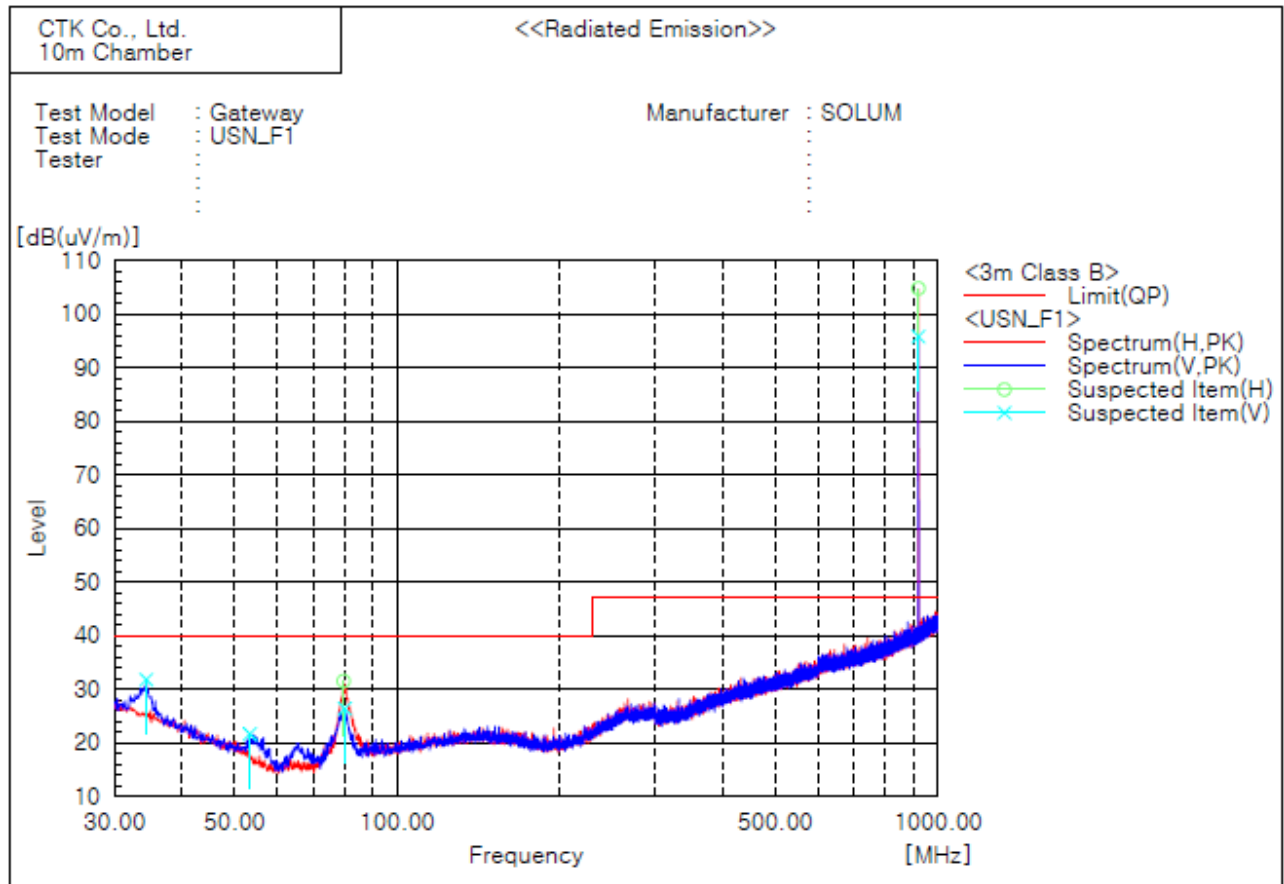
#### Spectrum Selection

| No. | Frequency [MHz] | (P) | Reading [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1   | 33.516          | V   | 36.8             | -8.5          | 28.3                 | 40.0                | 11.7           | 101.0       | 0.0         |
| 2   | 77.166          | V   | 41.6             | -18.0         | 23.6                 | 40.0                | 16.4           | 101.0       | 117.0       |
| 3   | 78.621          | H   | 41.1             | -17.6         | 23.5                 | 40.0                | 16.5           | 399.0       | 39.0        |
| 4   | 624.974         | H   | 35.3             | 0.5           | 35.8                 | 47.0                | 11.2           | 200.0       | 39.0        |
| 5   | 920.217         | H   | 97.3             | 6.0           | 103.3                | 47.0                | -56.3          | 200.0       | 170.0       |
| 6   | 920.217         | V   | 87.7             | 6.0           | 93.7                 | 47.0                | -46.7          | 200.0       | 321.0       |

#### Remark :

1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. This data is the peak(PK) value.
4. No.5 and No.6 are the carrier frequencies.
5. The Unwanted emission was measured in the following position: EUT stand-up position(X, Y axis), lie-down position(Z axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

**Test mode : Transmit, ANT-B, low channel(Worst case)**



**Spectrum Selection**

| No. | Frequency [MHz] | (P) | Reading [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1   | 34.365          | V   | 40.6             | -8.8          | 31.8                 | 40.0                | 8.2            | 101.0       | 321.0       |
| 2   | 53.401          | V   | 38.2             | -16.6         | 21.6                 | 40.0                | 18.4           | 101.0       | 321.0       |
| 3   | 79.591          | H   | 48.8             | -17.3         | 31.5                 | 40.0                | 8.5            | 400.0       | 322.0       |
| 4   | 79.955          | V   | 43.6             | -17.2         | 26.4                 | 40.0                | 13.6           | 400.0       | 65.0        |
| 5   | 920.217         | H   | 98.8             | 6.0           | 104.8                | 47.0                | -57.8          | 101.0       | 0.0         |
| 6   | 920.217         | V   | 89.8             | 6.0           | 95.8                 | 47.0                | -48.8          | 101.0       | 321.0       |

**Remark :**

1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. This data is the peak(PK) value.
4. No.5 and No.6 are the carrier frequencies.
5. The Unwanted emission was measured in the following position: EUT stand-up position(X, Y axis), lie-down position(Z axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

#### 4) Field strength of outside of the specified frequency bands – 1 GHz to 12.75 GHz

The requirements are:

☒ Complies

**Test mode : Transmit, ANT-A**

**Test Frequency : Lowest(902.4 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 804.8         | H               | 72.73             | -4.94      | -17.70             | 50.09           | 54             | 3.91        | Harmonic |

**Test Frequency : Middle(915.2 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 830.4         | V               | 73.56             | -4.94      | -17.70             | 50.92           | 54             | 3.08        | Harmonic |

**Test Frequency : Highest(927.6 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 855.2         | V               | 72.29             | -4.94      | -17.70             | 49.65           | 54             | 4.35        | Harmonic |

**Test mode : Transmit, ANT-B**

**Test Frequency : Lowest(902.4 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 804.8         | V               | 71.34             | -4.94      | -17.7              | 48.70           | 54             | 5.30        | Harmonic |

**Test Frequency : Middle(915.2 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 830.4         | V               | 73.79             | -4.94      | -17.70             | 51.15           | 54             | 2.85        | Harmonic |

**Test Frequency : Highest(927.6 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Duty cycle c.f[dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark   |
|-----------------|-----------------|-------------------|------------|--------------------|-----------------|----------------|-------------|----------|
| 1 855.2         | V               | 69.53             | -4.94      | -17.70             | 46.89           | 54             | 7.11        | Harmonic |

#### Remarks

1. Result = Reading + c.f(correction factor) + Duty cycle c.f
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. Duty cycle c.f =  $20\log(\text{Duty cycle}) = 20\log(0.13) = -17.7 \text{ dB}$
4. The Unwanted emission was measured in the following position: EUT stand-up position(X, Y axis), lie-down position(Z axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

\* Reading data is the peak value.

### 4.3 AC Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

#### Instrument Settings

IF Band Width: 9 kHz

#### Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

#### Limit

| Frequency<br>(MHz) | Conducted Limit (dBuV) |            |
|--------------------|------------------------|------------|
|                    | Quasi-peak             | Average ** |
| 0.15 ~ 0.5         | 66 to 56*              | 56 to 46*  |
| 0.5 ~ 5            | 56                     | 46         |
| 5 ~ 30             | 60                     | 50         |

\* The level decreases linearly with the logarithm of the frequency.

\*\* A linear average detector is required.

#### Test Results

The requirements are:

☒ Complies

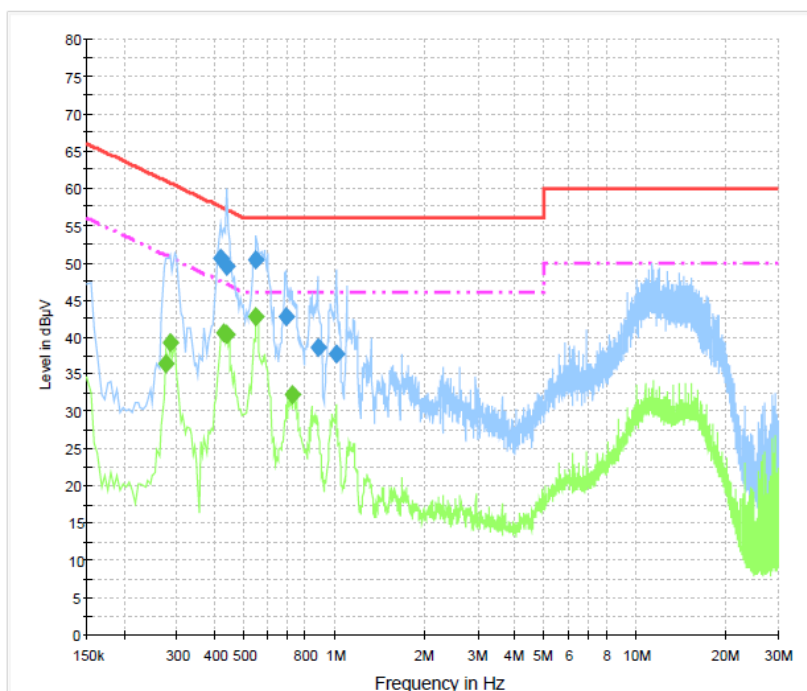
**Test mode : Transmit, 5Vdc, ANT-A, low channel(Worst case)**

| Frequency<br>[MHz] | Measured Data<br>[dBuV] | Margin<br>[dB] | Remark  |
|--------------------|-------------------------|----------------|---------|
| 0.550              | 42.6                    | 3.4            | Average |

## Test Data

[LINE]

Class B\_L1



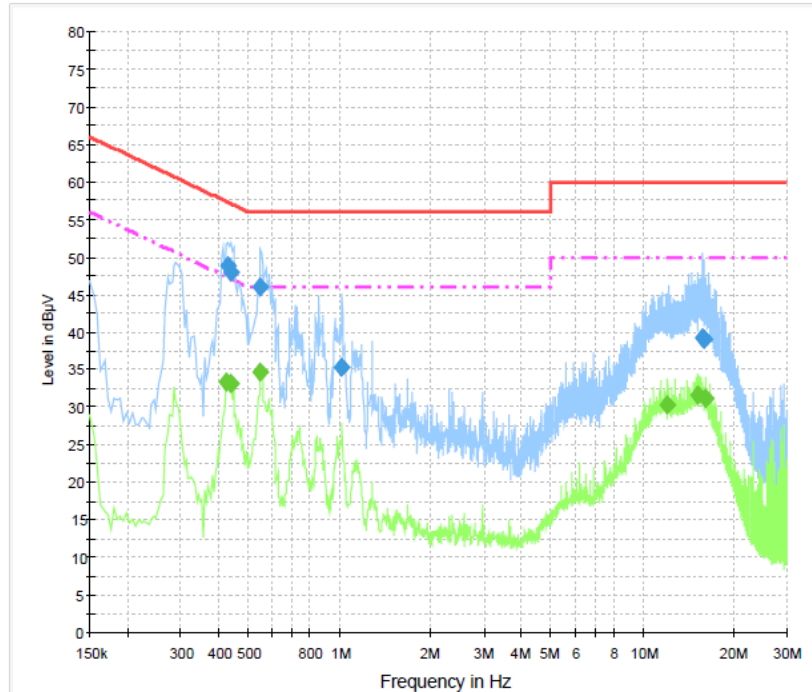
## Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.420000        | 50.5             | 1000.0          | 9.000           | On     | L1   | 9.9        | 6.9         | 57.4         |
| 0.438000        | 49.5             | 1000.0          | 9.000           | On     | L1   | 9.9        | 7.6         | 57.1         |
| 0.550500        | 50.4             | 1000.0          | 9.000           | On     | L1   | 9.9        | 5.6         | 56.0         |
| 0.690000        | 42.7             | 1000.0          | 9.000           | On     | L1   | 9.8        | 13.3        | 56.0         |
| 0.879000        | 38.5             | 1000.0          | 9.000           | On     | L1   | 9.8        | 17.5        | 56.0         |
| 1.014000        | 37.8             | 1000.0          | 9.000           | On     | L1   | 9.7        | 18.2        | 56.0         |

## Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.276000        | 36.4            | 1000.0          | 9.000           | On     | L1   | 9.7        | 14.5        | 50.9         |
| 0.285000        | 39.3            | 1000.0          | 9.000           | On     | L1   | 9.7        | 11.3        | 50.7         |
| 0.429000        | 40.6            | 1000.0          | 9.000           | On     | L1   | 9.9        | 6.6         | 47.3         |
| 0.438000        | 40.2            | 1000.0          | 9.000           | On     | L1   | 9.9        | 6.9         | 47.1         |
| 0.550500        | 42.6            | 1000.0          | 9.000           | On     | L1   | 9.9        | 3.4         | 46.0         |
| 0.721500        | 32.2            | 1000.0          | 9.000           | On     | L1   | 9.8        | 13.8        | 46.0         |

[NEUTRAL]  
Class B\_N



## Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.429000        | 48.9             | 1000.0          | 9.000           | On     | N    | 9.9        | 8.4         | 57.3         |
| 0.438000        | 48.0             | 1000.0          | 9.000           | On     | N    | 9.9        | 9.1         | 57.1         |
| 0.550500        | 45.9             | 1000.0          | 9.000           | On     | N    | 9.9        | 10.1        | 56.0         |
| 1.018500        | 35.2             | 1000.0          | 9.000           | On     | N    | 9.8        | 20.8        | 56.0         |
| 15.756000       | 39.2             | 1000.0          | 9.000           | On     | N    | 10.0       | 20.8        | 60.0         |
| 15.985500       | 39.0             | 1000.0          | 9.000           | On     | N    | 10.0       | 21.0        | 60.0         |

## Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.424500        | 33.3            | 1000.0          | 9.000           | On     | N    | 9.9        | 14.0        | 47.4         |
| 0.438000        | 33.2            | 1000.0          | 9.000           | On     | N    | 9.9        | 13.9        | 47.1         |
| 0.550500        | 34.6            | 1000.0          | 9.000           | On     | N    | 9.9        | 11.4        | 46.0         |
| 12.142500       | 30.4            | 1000.0          | 9.000           | On     | N    | 9.9        | 19.6        | 50.0         |
| 15.315000       | 31.6            | 1000.0          | 9.000           | On     | N    | 10.0       | 18.4        | 50.0         |
| 16.116000       | 31.1            | 1000.0          | 9.000           | On     | N    | 10.0       | 18.9        | 50.0         |

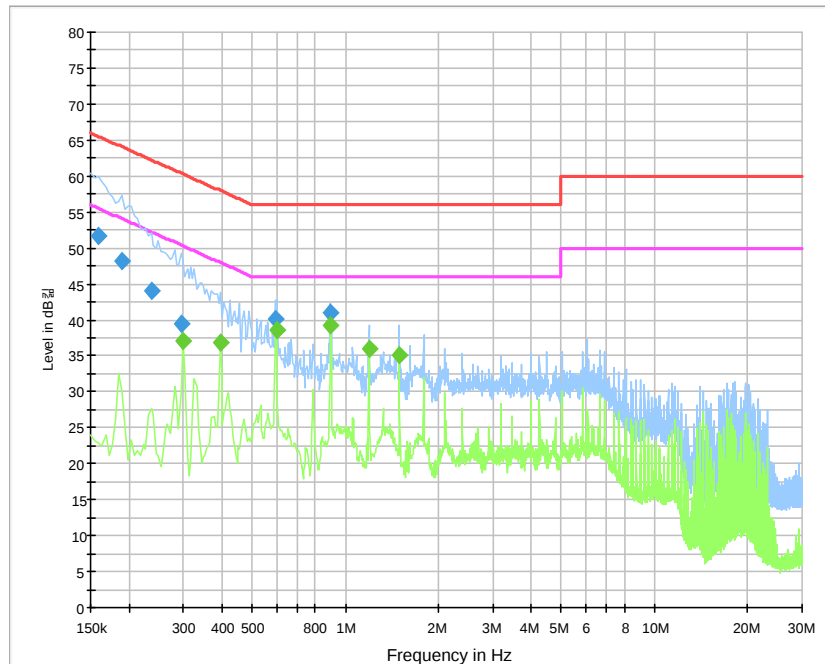
**Test mode : Transmit, POE, ANT-B, low channel(Worst case)**

| Frequency [MHz] | Measured Data [dBμV] | Margin [dB] | Remark     |
|-----------------|----------------------|-------------|------------|
| 0.897           | 39.3                 | 6.7         | Quasi-peak |

**Test Data**

[LINE]

Class B\_L1



**Final Result 1**

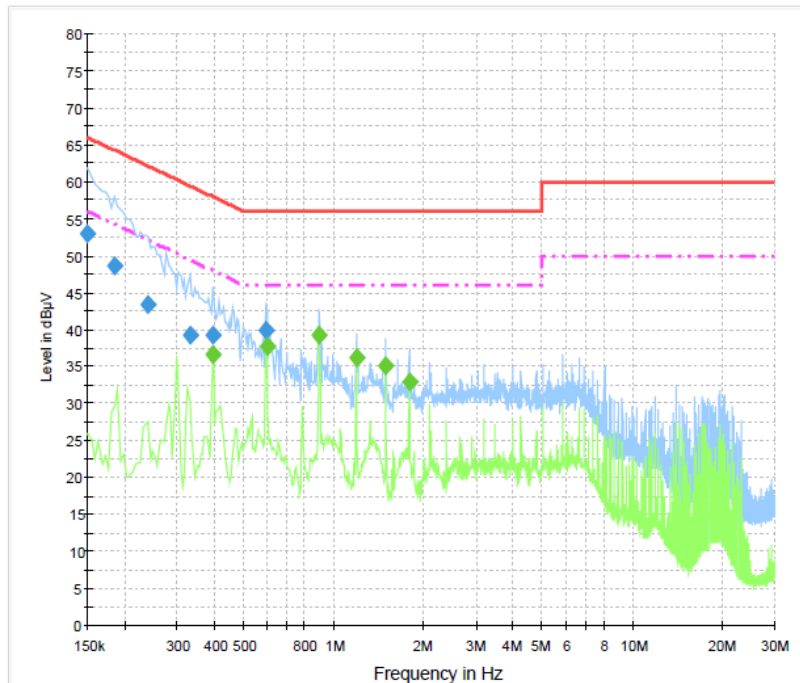
| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.159000        | 51.6             | 1000.0          | 9.000           | On     | L1   | 9.8        | 13.9        | 65.5         |
| 0.190500        | 48.2             | 1000.0          | 9.000           | On     | L1   | 9.9        | 15.8        | 64.0         |
| 0.235500        | 44.1             | 1000.0          | 9.000           | On     | L1   | 9.7        | 18.1        | 62.3         |
| 0.294000        | 39.5             | 1000.0          | 9.000           | On     | L1   | 9.7        | 20.9        | 60.4         |
| 0.595500        | 40.1             | 1000.0          | 9.000           | On     | L1   | 9.9        | 15.9        | 56.0         |
| 0.897000        | 41.0             | 1000.0          | 9.000           | On     | L1   | 9.8        | 15.0        | 56.0         |

**Final Result 2**

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.298500        | 37.1            | 1000.0          | 9.000           | On     | L1   | 9.7        | 13.2        | 50.3         |
| 0.393000        | 36.8            | 1000.0          | 9.000           | On     | L1   | 9.9        | 11.2        | 48.0         |
| 0.600000        | 38.5            | 1000.0          | 9.000           | On     | L1   | 9.9        | 7.5         | 46.0         |
| 0.897000        | 39.3            | 1000.0          | 9.000           | On     | L1   | 9.8        | 6.7         | 46.0         |
| 1.194000        | 36.0            | 1000.0          | 9.000           | On     | L1   | 9.7        | 10.0        | 46.0         |
| 1.495500        | 35.1            | 1000.0          | 9.000           | On     | L1   | 9.7        | 10.9        | 46.0         |

[NEUTRAL]

Class B\_N



## Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.150000        | 52.9             | 1000.0          | 9.000           | On     | N    | 9.8        | 13.1        | 66.0         |
| 0.186000        | 48.6             | 1000.0          | 9.000           | On     | N    | 9.9        | 15.6        | 64.2         |
| 0.240000        | 43.4             | 1000.0          | 9.000           | On     | N    | 9.7        | 18.7        | 62.1         |
| 0.330000        | 39.3             | 1000.0          | 9.000           | On     | N    | 9.8        | 20.2        | 59.5         |
| 0.393000        | 39.3             | 1000.0          | 9.000           | On     | N    | 9.9        | 18.7        | 58.0         |
| 0.595500        | 40.0             | 1000.0          | 9.000           | On     | N    | 9.9        | 16.0        | 56.0         |

## Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.393000        | 36.7            | 1000.0          | 9.000           | On     | N    | 9.9        | 11.3        | 48.0         |
| 0.600000        | 37.7            | 1000.0          | 9.000           | On     | N    | 9.9        | 8.3         | 46.0         |
| 0.897000        | 39.1            | 1000.0          | 9.000           | On     | N    | 9.8        | 6.9         | 46.0         |
| 1.194000        | 36.3            | 1000.0          | 9.000           | On     | N    | 9.7        | 9.7         | 46.0         |
| 1.495500        | 35.1            | 1000.0          | 9.000           | On     | N    | 9.7        | 10.9        | 46.0         |
| 1.792500        | 32.9            | 1000.0          | 9.000           | On     | N    | 9.7        | 13.1        | 46.0         |

## APPENDIX A – Test Equipment Used For Tests

|    | Name of Equipme<br>nt         | Manufactur<br>er                      | Model<br>No. | Serial No.    | Date of Calibrat<br>ion-1 | Due<br>Date-1 | Date of Calibrat<br>ion-2 | Due<br>Date-2 |
|----|-------------------------------|---------------------------------------|--------------|---------------|---------------------------|---------------|---------------------------|---------------|
| 1  | Signal Analyzer               | Agilent                               | N9020A       | MY50510324    | 2017-02-03                | 2018-02-03    | 2018-01-26                | 2019-01-26    |
| 2  | Signal Generator              | Rohde & Schwarz                       | SMB100A      | 175528        | 2016-11-01                | 2017-11-01    | 2017-11-01                | 2018-11-01    |
| 3  | EMI Test Receiver             | Rohde & Schwarz                       | ESCI7        | 100814        | 2016-11-01                | 2017-11-01    | 2017-10-25                | 2018-10-25    |
| 4  | AMPLIFIER                     | SONOMA                                | 310          | 291721        | 2017-02-02                | 2018-02-02    | 2018-02-02                | 2019-02-02    |
| 5  | Bilog Antenna                 | Schaffner                             | CBL6111C     | 2551          | 2016-05-13                | 2018-05-13    | 2016-05-13                | 2018-05-13    |
| 6  | Active Loop Antenna           | SCHWARZBECK                           | FMZB 1513    | 1513-126      | 2016-05-25                | 2018-05-25    | 2016-05-25                | 2018-05-25    |
| 7  | 6dB Attenuator                | R&S                                   | DNF          | 272.4110.50-2 | 2016-11-01                | 2017-11-01    | 2017-10-25                | 2018-10-25    |
| 8  | Preamplifier                  | Agilent                               | 8449B        | 3008A02011    | 2016-12-01                | 2017-12-01    | 2017-11-30                | 2018-11-30    |
| 9  | EMI Test Receiver             | Rohde & Schwarz                       | ESU40        | 100336        | 2017-05-12                | 2018-05-12    | 2018-02-01                | 2019-02-01    |
| 10 | LISN                          | Rohde & Schwarz                       | ENV216       | 101235        | 2017-05-09                | 2018-05-09    | 2018-01-31                | 2019-01-31    |
| 11 | Dual-Tracking DC Power Supply | Topward Electric Instruments Co.,Ltd. | 6303D        | 711196        | 2017-02-02                | 2018-02-02    | 2018-01-30                | 2019-01-30    |
| 12 | Horn Antenna                  | ETS-Lindgren                          | 3117         | 00154525      | 2017-09-14                | 2019-09-14    | 2017-09-14                | 2019-09-14    |

## APPENDIX B – EUT Photographs

