

**FCC ID:2AW9D-HUB**

# FCC Verification Test Report

## Client Information:

Applicant: Skylo Technologies

Applicant add.: 268, Lambert Avenue, Palo Alto, CA, 94306, USA

Manufacturer: VVDN Technologies Pvt. Ltd.

Manufacturer add.: D-22, Infocity-II, Sector 33, Gurgaon-122001, Haryana, India

## Product Information:

Product Name: IoT Hub

Model No.: S-111 Mk I

Derivative Model No.: S-101 Mk I

Brand Name: Skylo Technologies

## Applied Standard:

FCC Part15-B:2014

## Prepared By:

*Abhinav Kumar*

Abhinav Kumar

## Laboratory Details:

AA Electro Magnetic Test Laboratory Private Limited

PlotNo174, Udyog Vihar-Phase4, Sector18, Gurgaon, Haryana, India

Date of Receipt: May 11, 2020

Date of Test: May 15, 2020

Date of Issue: Jul. 06, 2020

Test Result: **In Compliance/Pass**

This device has been tested and found to comply with the stated standard(s), which is(are) required by the council directive of 2014/53/EU and indicated in the test report and are applicable only to the tested sample identified in the report.

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**Reviewed by:**

*Dr R Lenin Raja*

(Dr R Lenin Raja) (Authorized Representative) (/ lenin83/)

**Approved by:**

*Steven Wu*

(Steven Wu)



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## 2 Test Summary

| Test                                                                                                                                                                   | Test Requirement                                  | Test Method                | Criterion | Result      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------|-----------|-------------|
| Conducted Emission<br>150kHz to 30MHz                                                                                                                                  | FCC Part15-B:2014,<br>CISPR 32:2015+AMD1:2019 CSV | Clause 7 of CISPR 16-2-1   | Limits    | <b>PASS</b> |
| Radiated Emissions<br>30MHz to 1GHz                                                                                                                                    | FCC Part15-B:2014,<br>CISPR 32:2015+AMD1:2019 CSV | Clause 7.3 of CISPR 16-2-3 | Limits    | <b>PASS</b> |
| <p><b>N/A is an abbreviation for Not Applicable.</b></p> <p><b>Model description:</b><br/>ANSI C63.4 : the detail version is ANSI C63.4 :2014 in the whole report.</p> |                                                   |                            |           |             |

### Product documentation

The specification used by the manufacturer to define the performance criteria for the testing required by this standard shall be made available to the user upon request.

## 2.1 Measurement Uncertainty

The report uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty Multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

| No. | Item                          | Frequency Range | U , Value |
|-----|-------------------------------|-----------------|-----------|
| 1   | Power Line Conducted Emission | 150KHz~30MHz    | 2.77 dB   |
| 2   | Disturbance Power Emission    | 30MHz~300MHz    | 2.96 dB   |
| 3   | Radiated Emission Test        | 30MHz~1GHz      | 2.77 dB   |
| 4   | Radiated Emission Test        | 1GHz~18GHz      | 2.80 dB   |

### 3 Test Facility

AA Electro Magnetic Test Laboratory is an ISO 17025:2017 certified lab by NABL, Certification No.TC-8597, CE Marking Certificate from Phoenix Germany #800058\_00 and ILC-MRA #0366.

We are also accredited ISO17025:2017 by A2LA(American association for laboratory accreditation) #5593.01 , FCC Recognized #0029402088, ISED recognized for wireless product #26046, VCCI(Japan) supporting member #4053.

#### 3.1 Deviation from standard

None

#### 3.2 Abnormalities from standard conditions

None

## 4 General Information

### 4.1 General Description of EUT

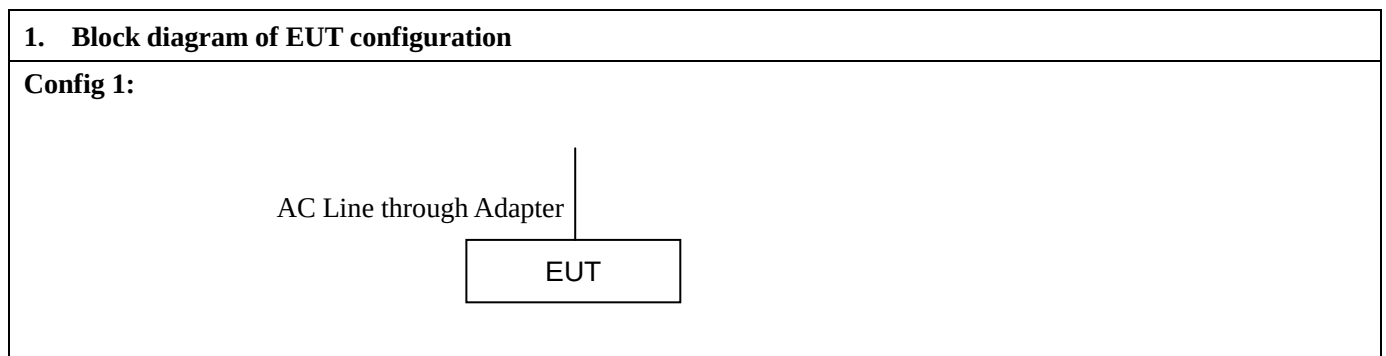
|                       |                                                                                                |
|-----------------------|------------------------------------------------------------------------------------------------|
| Manufacturer:         | VVDN Technologies Pvt. Ltd.                                                                    |
| Manufacturer Address: | D-22, Infocity-II, Sector 33, Gurgaon-122001, Haryana, India                                   |
| EUT Name:             | IoT Hub                                                                                        |
| Model No:             | S-111 Mk I                                                                                     |
| Serial Model:         | S-101 Mk I                                                                                     |
| Serial Number:        | N/A                                                                                            |
| Brand Name:           | Skylo Technologies                                                                             |
| H/W No.:              | 901-1-00624 (Rev B1)                                                                           |
| S/W No.:              | 1.4.1                                                                                          |
| Power Supply Range:   | Input : 9-36VDC, 2.5A<br><b><u>Adapter:</u></b><br>Input: 100-240VAC, 50/60Hz<br>Output: 24VDC |
| Battery:              | 3.7V / 12000mAh                                                                                |

## 4.2 EUT Test Mode

|        |                                    |
|--------|------------------------------------|
| Mode 1 | The EUT in full transmission mode. |
|--------|------------------------------------|

## 4.3 Description of Test setup

EUT was tested in normal configuration (Please See following Block diagrams)





### 4.3 Test Peripheral List

| No. | Equipment | Manufacturer | EMC Compliance | Model No. | Serial No. | Power cord | signal cable |
|-----|-----------|--------------|----------------|-----------|------------|------------|--------------|
| 1   | N/A       | N/A          | N/A            | N/A       | N/A        | N/A        | N/A          |

### 4.4 EUT Peripheral List

| No. | Equipment | Manufacturer | EMC Compliance | Model No. | Serial No. | Power cord | signal cable |
|-----|-----------|--------------|----------------|-----------|------------|------------|--------------|
| 1   | N/A       | N/A          | N/A            | N/A       | N/A        | N/A        | N/A          |



## 5 Equipments List for All Test Items

| <input checked="" type="checkbox"/> <b>Radiation Test Equipment</b> |                    |                   |             |            |            |               |
|---------------------------------------------------------------------|--------------------|-------------------|-------------|------------|------------|---------------|
| No                                                                  | Test Equipment     | Manufacturer      | Model No    | Serial No  | Cal. Date  | Cal. Due Date |
| 1                                                                   | EMI TEST Receiver  | Rohde and schwarz | ESIB26      | 838786/010 | 2020/01/28 | 2021/01/27    |
| 2                                                                   | Loop antenna       | DA ZE Beijing     | ZN30900C    | 18052      | 2020/01/29 | 2021/01/28    |
| 3                                                                   | Horn antenna       | DA ZE Beijing     | ZN30701     | 18012      | 2020/01/30 | 2021/01/29    |
| 4                                                                   | Horn antenna       | DA ZE Beijing     | ZN30702     | 18006      | 2020/01/30 | 2021/01/29    |
| 5                                                                   | Horn antenna       | DA ZE Beijing     | ZN30703     | 18005      | 2020/01/30 | 2021/01/29    |
| 6                                                                   | Pre Amplifier      | KELIANDA          | LNA-0009295 | -          | 2020/01/28 | 2021/01/27    |
| 7                                                                   | Pre Amplifier      | KELIANDA          | CF-00218    | -          | 2020/01/28 | 2021/01/27    |
| 8                                                                   | Bi conical Antenna | DA ZE Beijing     | ZN30505C    | 17038      | 2020/01/29 | 2021/01/30    |

| <input checked="" type="checkbox"/> <b>Conduction Test equipment</b> |                    |                   |             |               |            |               |
|----------------------------------------------------------------------|--------------------|-------------------|-------------|---------------|------------|---------------|
| No                                                                   | Test Equipment     | Manufacturer      | Model No    | Serial No     | Cal. Date  | Cal. Due Date |
| 1                                                                    | EMI-RECEIVER       | Schwarzbeck       | FCKL        | 1528194       | 2020/01/28 | 2021/01/27    |
| 2                                                                    | Spectrum Analyzer  | ADVANTEST         | R3361       | -             | 2019/05/15 | 2021/05/14    |
| 4                                                                    | LISN               | Kyoritsu          | KNW-407     | 8-1789-5      | 2020/01/28 | 2021/01/27    |
| 5                                                                    | Network – LISN     | Schwarzbeck       | NNBM8125    | 81251314      | 2020/01/28 | 2021/01/27    |
| 6                                                                    | Network – LISN     | Schwarzbeck       | NNBM8125    | 81251315      | 2020/01/28 | 2021/01/27    |
| 7                                                                    | ISN                | Schwarzbeck       | ISN T8 CAT5 | CATS-8158#225 | 2020/01/28 | 2021/01/27    |
| 8                                                                    | ISN                | Schwarzbeck       | ISN T8 CAT6 | NTFM8158#184  | 2020/01/28 | 2021-01-27    |
| 9                                                                    | ISN                | Schwarzbeck       | ISN T8 CAT3 | CAT3-8158#120 | 2020/01/28 | 2021/01/27    |
| 10                                                                   | PULSE LIMITER      | Rohde and schwarz | ESH3-Z2     | 100681        | 2019/05/13 | 2021/05/12    |
| 11                                                                   | 50Ω Coaxial Switch | DAIWA             | 1565157     | -             | 2019/05/13 | 2021/05/12    |
| 12                                                                   | 50Ω Coaxial Switch | -                 | -           | -             | 2019/05/13 | 2021/05/12    |

## 6 Emission Test Results

### 6.1 Mains Terminals Disturbance Voltage Measurement

Limits for AC mains Port :

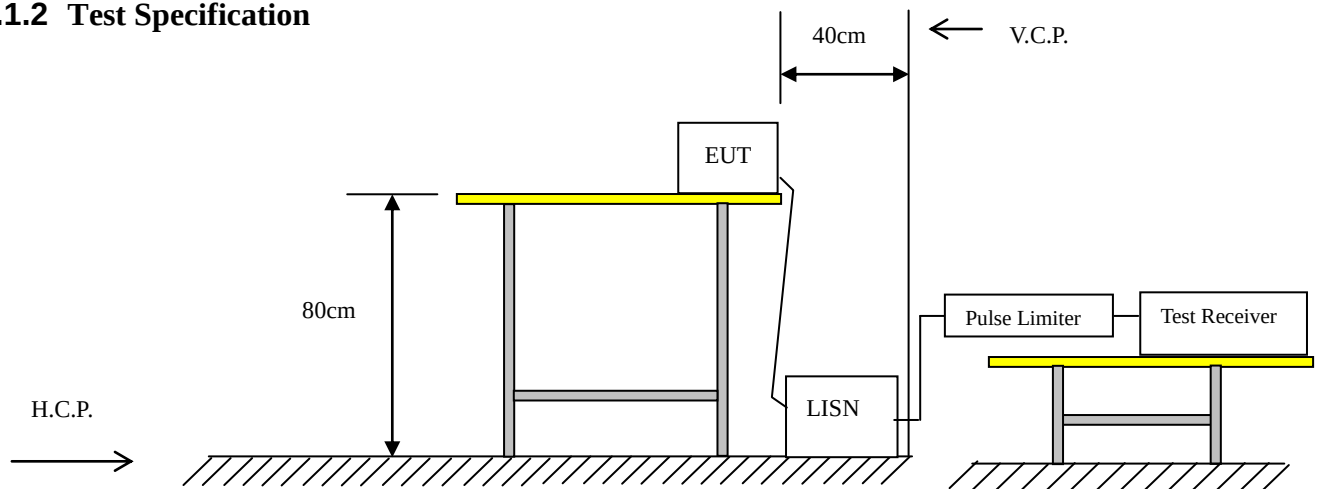
| Frequency (MHz) | <input checked="" type="checkbox"/> Class A (dB $\mu$ V) |                | <input type="checkbox"/> Class B (dB $\mu$ V) |                |
|-----------------|----------------------------------------------------------|----------------|-----------------------------------------------|----------------|
|                 | Q.P. (Quasi-Peak)                                        | A.V. (Average) | Q.P. (Quasi-Peak)                             | A.V. (Average) |
| 0.15 ~ 0.50     | 79                                                       | 66             | 66 to 56                                      | 56 to 46       |
| 0.50 ~ 5.0      | 73                                                       | 60             | 56                                            | 46             |
| 5.0 ~ 30        | 73                                                       | 60             | 60                                            | 50             |

Detector: Peak for pre-scan (9kHz Resolution Bandwidth)  
Quasi-Peak & Average if maximized peak within 6dB of Average Limit

#### 6.1.1 E.U.T. Operation

|              |        |           |        |                       |     |     |
|--------------|--------|-----------|--------|-----------------------|-----|-----|
| Temperature: | 24°C   | Humidity: | 52% RH | Atmospheric Pressure: | 101 | Kpa |
| Test Mode:   | Mode 1 |           |        |                       |     |     |

### 6.1.2 Test Specification



EUT was placed upon a wooden test table 0.8m above the horizontal metal reference plane and 0.4m from the vertical ground plane, and it was connected to an AMN. The closest distance between the boundary of the EUT and the surface of the AMN is 0.8m. All peripherals were connected to another AMN, and placed at a distance of 10cm from each other. A spectrum and receiver was connected to the RF output port of the AMN. Both average and quasi-peak value were detected.

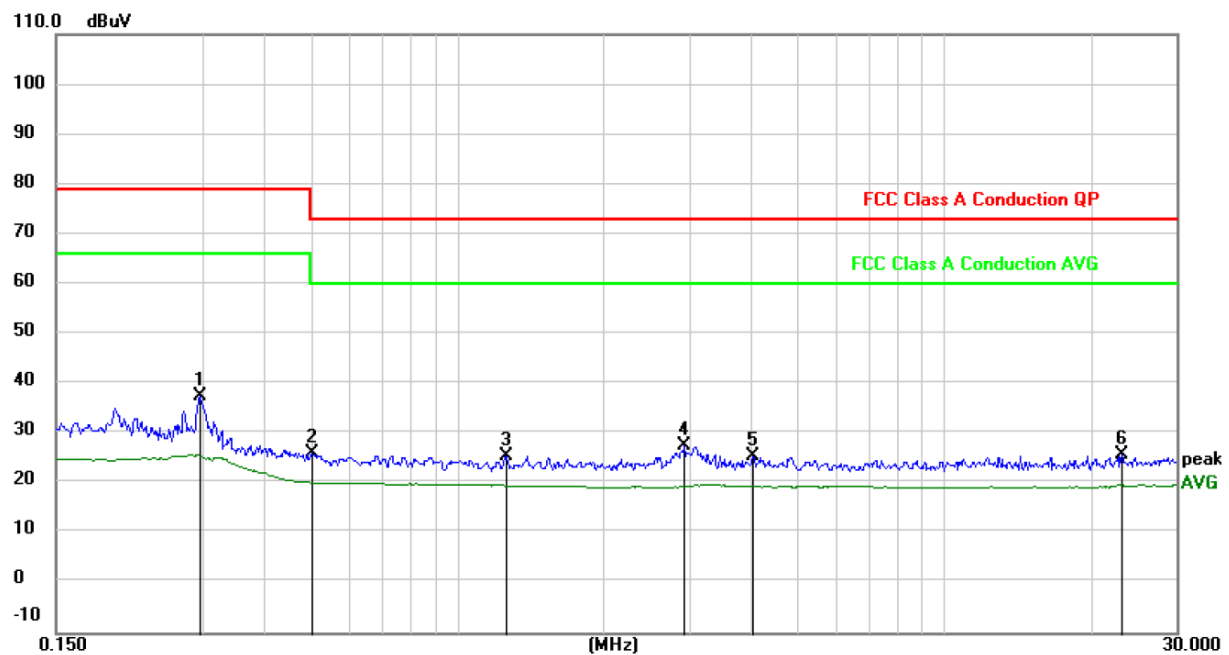
### 6.1.3 Measurement Data

An initial pre-scan was performed on the live and neutral lines.

Quasi-peak or average measurements were performed at the frequency which maximum peak emissions were detected.

Please refer to the attached quasi-peak & average measurement data for reference.

|               |              |             |            |
|---------------|--------------|-------------|------------|
| Mode:         | Mode 1       | Test Date : | 2020-05-15 |
| Test Voltage: | AC 120V,60Hz | Phase :     | Ambient    |

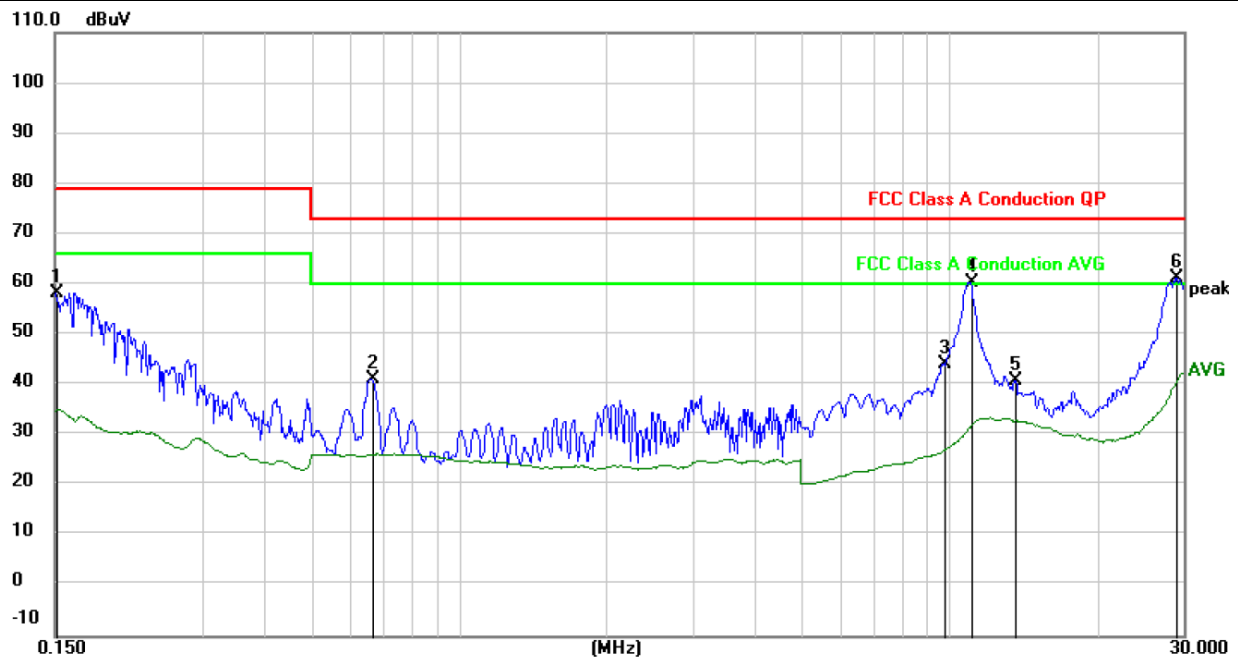


Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   | *   | 0.2941       | 21.41                    | 16.25                   | 37.66                    | 79.00         | -41.34     | peak     |
| 2   |     | 0.5044       | 10.01                    | 16.12                   | 26.13                    | 73.00         | -46.87     | peak     |
| 3   |     | 1.2559       | 9.81                     | 15.87                   | 25.68                    | 73.00         | -47.32     | peak     |
| 4   |     | 2.9210       | 11.93                    | 15.84                   | 27.77                    | 73.00         | -45.23     | peak     |
| 5   |     | 4.0280       | 9.77                     | 15.88                   | 25.65                    | 73.00         | -47.35     | peak     |
| 6   |     | 23.0249      | 9.89                     | 15.88                   | 25.77                    | 73.00         | -47.23     | peak     |

\*Maximum Data

|               |              |             |            |
|---------------|--------------|-------------|------------|
| Mode:         | Mode 1       | Test Date : | 2020-05-15 |
| Test Voltage: | AC 120V,60Hz | Phase :     | Line       |

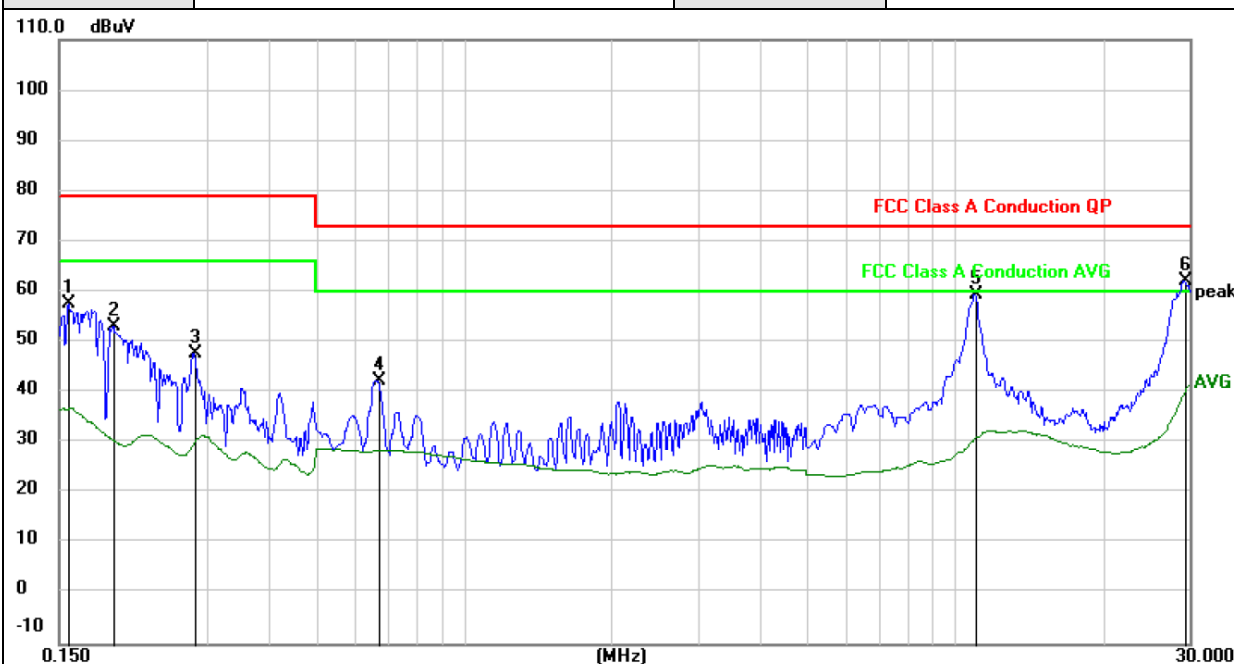


Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1510       | 42.10                    | 16.28                   | 58.38                    | 79.00         | -20.62     | peak     |
| 2   |     | 0.6664       | 25.06                    | 16.05                   | 41.11                    | 73.00         | -31.89     | peak     |
| 3   |     | 9.7250       | 28.35                    | 15.85                   | 44.20                    | 73.00         | -28.80     | peak     |
| 4   |     | 11.0250      | 44.64                    | 15.85                   | 60.49                    | 73.00         | -12.51     | peak     |
| 5   |     | 13.5750      | 24.92                    | 15.85                   | 40.77                    | 73.00         | -32.23     | peak     |
| 6   | *   | 28.9249      | 45.27                    | 16.03                   | 61.30                    | 73.00         | -11.70     | peak     |

\*Maximum Data

|               |              |             |            |
|---------------|--------------|-------------|------------|
| Mode:         | Mode 1       | Test Date : | 2020-05-15 |
| Test Voltage: | AC 120V,60Hz | Phase :     | Neutral    |



Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1566       | 41.24                    | 16.28                   | 57.52                    | 79.00         | -21.48     | peak     |
| 2   |     | 0.1927       | 36.82                    | 16.27                   | 53.09                    | 79.00         | -25.91     | peak     |
| 3   |     | 0.2819       | 31.54                    | 16.25                   | 47.79                    | 79.00         | -31.21     | peak     |
| 4   |     | 0.6710       | 26.18                    | 16.05                   | 42.23                    | 73.00         | -30.77     | peak     |
| 5   |     | 10.9750      | 43.63                    | 15.85                   | 59.48                    | 73.00         | -13.52     | peak     |
| 6   | *   | 29.2250      | 46.03                    | 16.02                   | 62.05                    | 73.00         | -10.95     | peak     |

\*Maximum Data

#### 6.1.4 Test Setup photograph



## 6.2 Radiated Emission Measurement

### Limits of Radiated Emission Measurement (Below 1GHz)

| Frequency (MHz) | <input checked="" type="checkbox"/> Class A (3m) | <input type="checkbox"/> Class B (3m) |
|-----------------|--------------------------------------------------|---------------------------------------|
|                 | Quasi-Peak dB( $\mu$ V/m)                        | Quasi-Peak dB( $\mu$ V/m)             |
| 30 ~ 230        | 50.0                                             | 40.0                                  |
| 230 ~ 1000      | 57.0                                             | 47.0                                  |

### Limits of Radiated Emission Measurement (Above 1GHz)

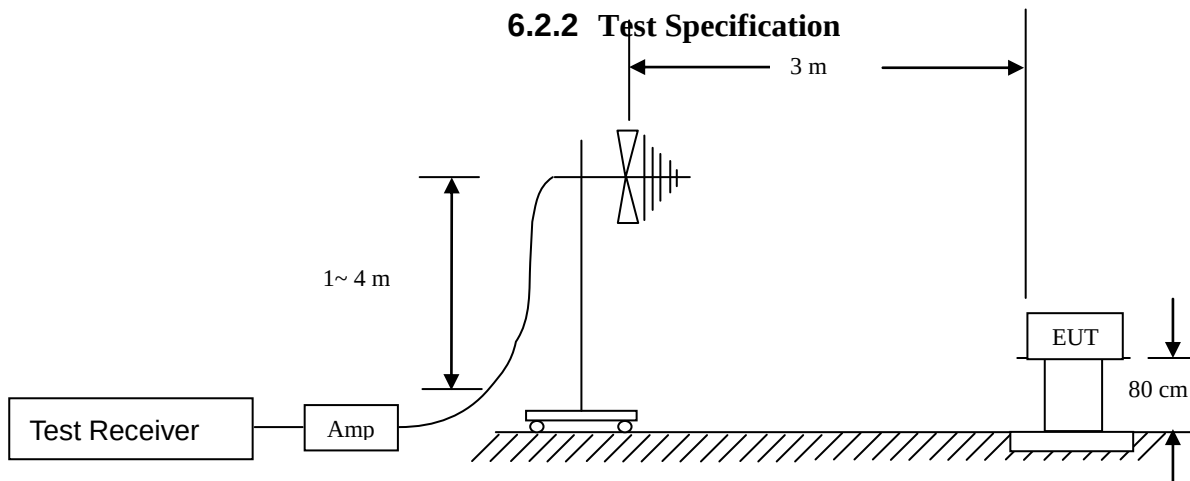
| Frequency (MHz) | <input type="checkbox"/> Class A (3m) |                        | <input type="checkbox"/> Class B (3m) |                        |
|-----------------|---------------------------------------|------------------------|---------------------------------------|------------------------|
|                 | Peak dB( $\mu$ V/m)                   | Average dB( $\mu$ V/m) | Peak dB( $\mu$ V/m)                   | Average dB( $\mu$ V/m) |
| 1000~3000       | 76                                    | 56                     | 70                                    | 50                     |
| 3000~6000       | 80                                    | 60                     | 74                                    | 54                     |

Detector: Peak for pre-scan (120kHz resolution bandwidth)  
Quasi-Peak if maximum peak within 6dB of limit

### 6.2.1 E.U.T. Operation

|              |        |           |        |                       |      |     |
|--------------|--------|-----------|--------|-----------------------|------|-----|
| Temperature: | 24.5°C | Humidity: | 51% RH | Atmospheric Pressure: | 98.6 | Kpa |
| Test Mode:   | Mode 1 |           |        |                       |      |     |

### 6.2.2 Test Specification





EUT was placed upon a wooden test table which was placed on the turn table 0.8m above the horizontal metal ground plane, and operating in the mode as mentioned above. A receiving antenna was placed 3m away from the EUT. During testing, turn around the turn table and move the antenna from 1m to 4m to find the maximum field-strength reading. All peripherals were placed at a distance of 10cm between each other. Both horizontal and vertical antenna polarities were tested.

### 6.2.3 Measurement Data

An initial pre-scan was performed in the 3m chamber using the spectrum analyzers in peak detection mode. The EUT was measured by Biolog antenna with 2 orthogonal polarities and peak emissions from the EUT were detected within 6dB of the class B limit line.

The following quasi-peak measurements were performed on the EUT.



**Between 30 MHz - 1000 MHz**

|                |              |                |            |
|----------------|--------------|----------------|------------|
| Test Mode:     | Mode 1       | Test Date :    | 2020-05-15 |
| Test Voltage : | AC 120V,60Hz | Polarization : | Ambient    |

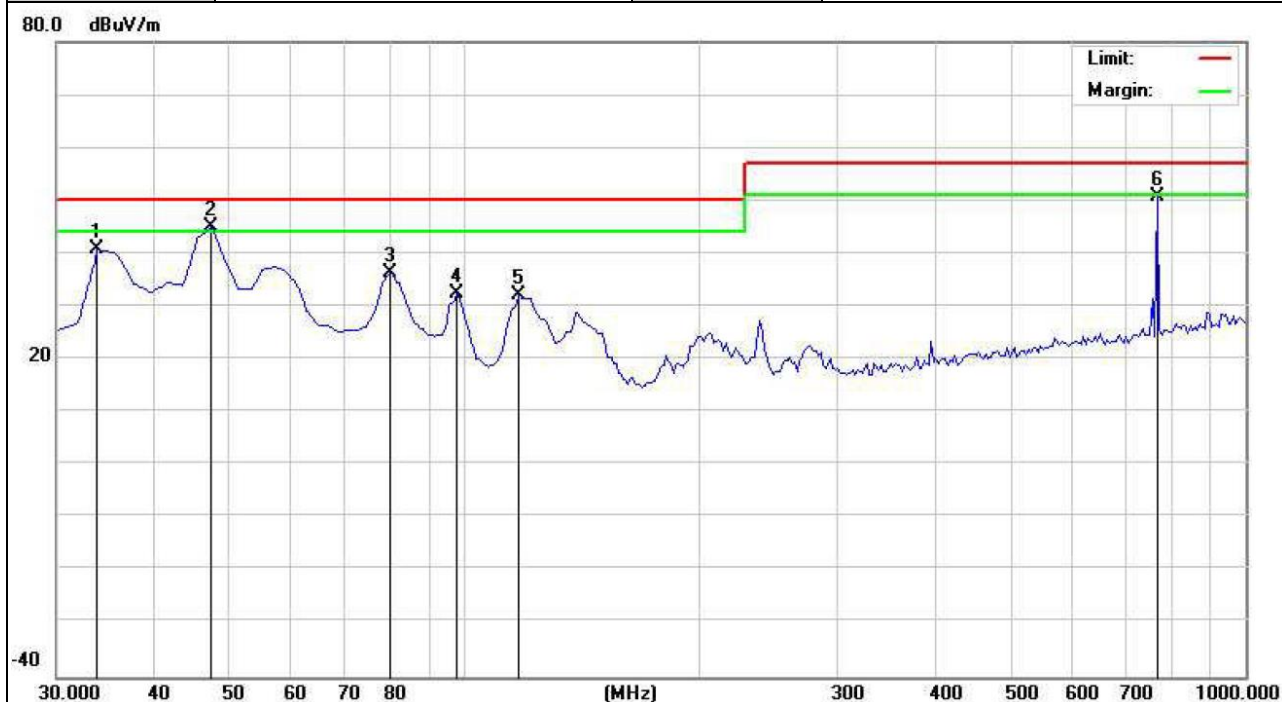


Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dB/m | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|---------------|------------|----------|
| 1   |     | 817.2745     | 30.89                    | -3.75                   | 27.14                      | 57.00         | -29.86     | peak     |
| 2   |     | 852.2645     | 30.47                    | -3.72                   | 26.75                      | 57.00         | -30.25     | peak     |
| 3   |     | 875.5911     | 31.37                    | -3.69                   | 27.68                      | 57.00         | -29.32     | peak     |
| 4   |     | 896.9739     | 30.13                    | -3.67                   | 26.46                      | 57.00         | -30.54     | peak     |
| 5   | *   | 945.5711     | 31.23                    | -2.58                   | 28.65                      | 57.00         | -28.35     | peak     |
| 6   |     | 990.2805     | 29.68                    | -1.53                   | 28.15                      | 57.00         | -28.85     | peak     |

\*Maximum Data

|                |              |                |            |
|----------------|--------------|----------------|------------|
| Test Mode:     | Mode 1       | Test Date :    | 2020-05-15 |
| Test Voltage : | AC 120V,60Hz | Polarization : | Vertical   |

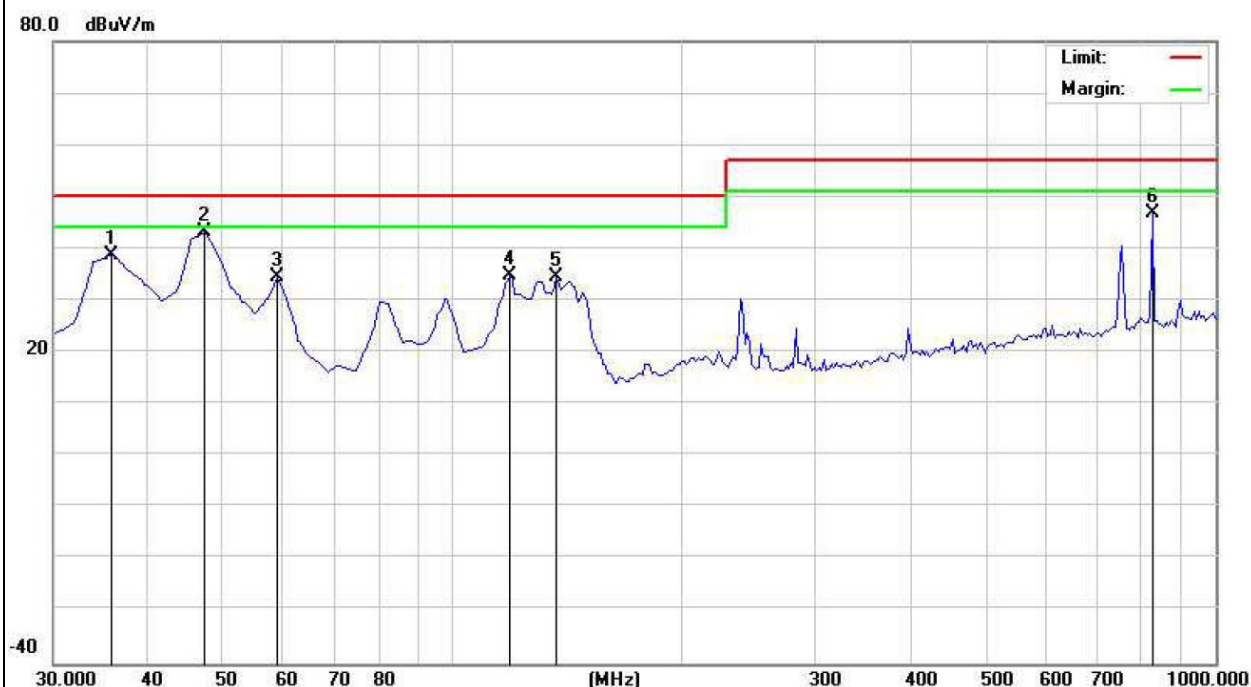


Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measure-ment | Limit | Over   |          |
|-----|-----|----------|---------------|----------------|--------------|-------|--------|----------|
|     |     | MHz      | dBuV          | dB             | dBuV/m       | dB/m  | dB     | Detector |
| 1   |     | 33.8878  | 75.31         | -34.45         | 40.86        | 50.00 | -9.14  | peak     |
| 2   | *   | 47.4950  | 74.31         | -29.27         | 45.04        | 50.00 | -4.96  | peak     |
| 3   |     | 80.5411  | 62.48         | -26.03         | 36.45        | 50.00 | -13.55 | peak     |
| 4   |     | 98.0361  | 56.26         | -23.89         | 32.37        | 50.00 | -17.63 | peak     |
| 5   |     | 117.4750 | 54.28         | -22.24         | 32.04        | 50.00 | -17.96 | peak     |
| 6   |     | 772.5651 | 54.95         | -4.32          | 50.63        | 57.00 | -6.37  | peak     |

\*Maximum Data

|               |              |                |            |
|---------------|--------------|----------------|------------|
| Test Mode:    | Mode 1       | Test Date :    | 2020-05-15 |
| Test Voltage: | AC 120V,60Hz | Polarization : | Horizontal |

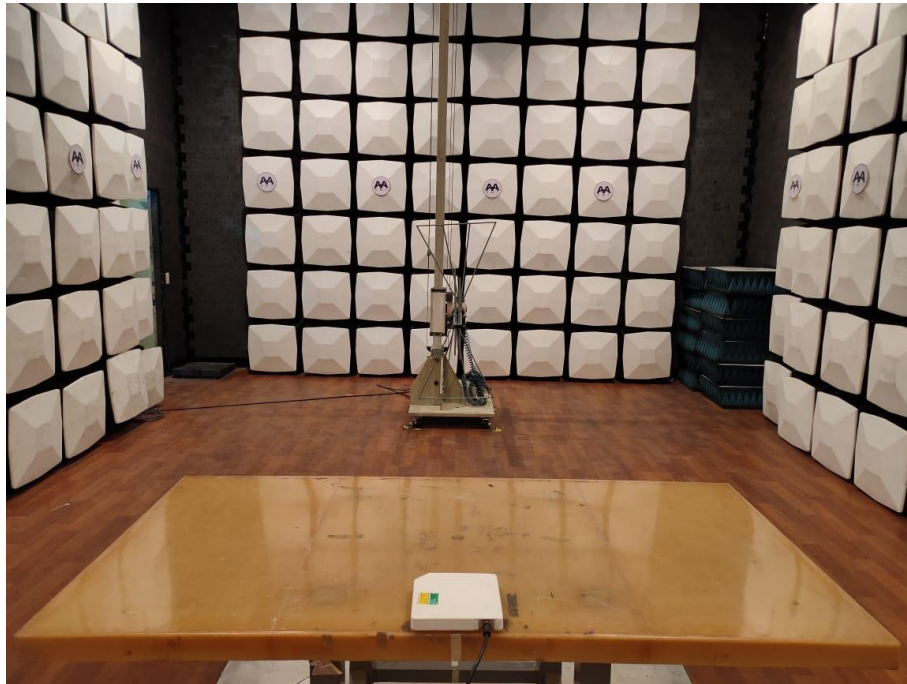


Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit | Over   |          |
|-----|-----|----------|---------------|----------------|-------------|-------|--------|----------|
|     |     | MHz      | dBuV          | dB             | dBuV/m      | dB/m  | dB     | Detector |
| 1   |     | 35.8316  | 72.01         | -33.15         | 38.86       | 50.00 | -11.14 | peak     |
| 2   | *   | 47.4950  | 72.23         | -29.12         | 43.11       | 50.00 | -6.89  | peak     |
| 3   |     | 59.1583  | 62.59         | -28.14         | 34.45       | 50.00 | -15.55 | peak     |
| 4   |     | 119.4188 | 56.56         | -21.58         | 34.98       | 50.00 | -15.02 | peak     |
| 5   |     | 136.9138 | 54.57         | -20.08         | 34.49       | 50.00 | -15.51 | peak     |
| 6   |     | 830.8817 | 50.69         | -3.87          | 46.82       | 57.00 | -10.18 | peak     |

\*Maximum Data

#### 6.2.4 Test Setup photograph



**\*\*END OF REPORT\*\***