

# FCC PART 15.249 TEST REPORT

For

## Keeson Technology Corporation Limited

No. 158, Qiumao Road, Wangjiangjing Xiuzhou district Jiaxing, Zhejiang China

**FCC ID: 2AK23MC220**

|                                                                                                                                                                                                                                                    |                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                             | <b>Product Type:</b><br>CONTROL BOX |
| <b>Test Engineer:</b> Sam Ye <i>Sam Ye</i>                                                                                                                                                                                                         |                                     |
| <b>Report Number:</b> RSHA190614004-00B                                                                                                                                                                                                            |                                     |
| <b>Report Date:</b> 2019-08-09                                                                                                                                                                                                                     |                                     |
| <b>Reviewed By:</b> Kyle Xu <i>Kyle Xu</i><br>RF Leader                                                                                                                                                                                            |                                     |
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

|                  |                                                      |
|------------------|------------------------------------------------------|
| Applicant        | Keeson Technology Corporation Limited                |
| Tested Model     | MC220                                                |
| Series Model     | MC220BS, MC220TS, MC220SP, MC220KL, MC220LT, MC220BK |
| Model Difference | Model names                                          |
| Product Type     | CONTROL BOX                                          |
| Dimension        | 146mm(L)*63 mm(W) *37mm(H)                           |
| Power Supply     | AC100-240V/ DC 2*9V from batteries                   |

*All measurement and test data in this report was gathered from production sample serial number: 20190614004. (Assigned by BACL, Kunshan). The EUT was received on 2019-06-14.*

### Objective

This type approval report is prepared on behalf of *Keeson Technology Corporation Limited* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15.249 DXX grant with FCC ID: PCU-RF365B.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Measurement Uncertainty**

| Item                               |             | Uncertainty |
|------------------------------------|-------------|-------------|
| AC Power Lines Conducted Emissions |             | 3.19 dB     |
| RF conducted test with spectrum    |             | 0.9dB       |
| RF Output Power with Power meter   |             | 0.5dB       |
| Radiated emission                  | 30MHz~1GHz  | 6.11dB      |
|                                    | 1GHz~6GHz   | 4.45dB      |
|                                    | 6GHz~18GHz  | 5.23dB      |
|                                    | 18GHz~40GHz | 5.65dB      |
| Occupied Bandwidth                 |             | 0.5kHz      |
| Temperature                        |             | 1.0°C       |
| Humidity                           |             | 6%          |

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

**Test Facility**

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

## SYSTEM TEST CONFIGURATION

### Justification

Channel list:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 1       | 2403            | 40      | 2442            |
| 2       | 2404            | ...     | ...             |
| ...     | ...             | ...     | ...             |
| 38      | 2440            | 77      | 2479            |
| 39      | 2441            | 78      | 2480            |

EUT was tested with Channel 1, 40 and 78.

### EUT Exercise Software

RF test tool: Engineering mode.

### Support Equipment List and Details

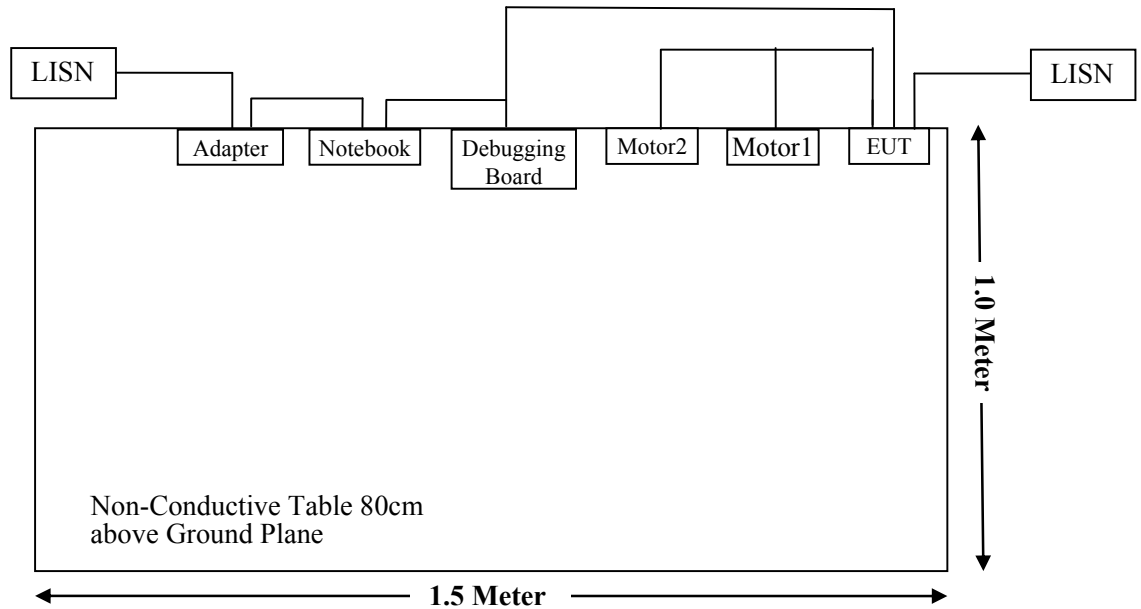
| Manufacturer | Description     | Model          | Serial Number        |
|--------------|-----------------|----------------|----------------------|
| KEESON       | Motor1          | E10068         | 68001097150186040004 |
| KEESON       | Motor2          | JLDQ.10.381.93 | 68000313150189110336 |
| KEESON       | Debugging Board | /              | /                    |
| DELL         | Notebook        | GX620          | D65874152            |
| DELL         | Adapter         | LA65NS0-00     | DF263                |

### External I/O Cable

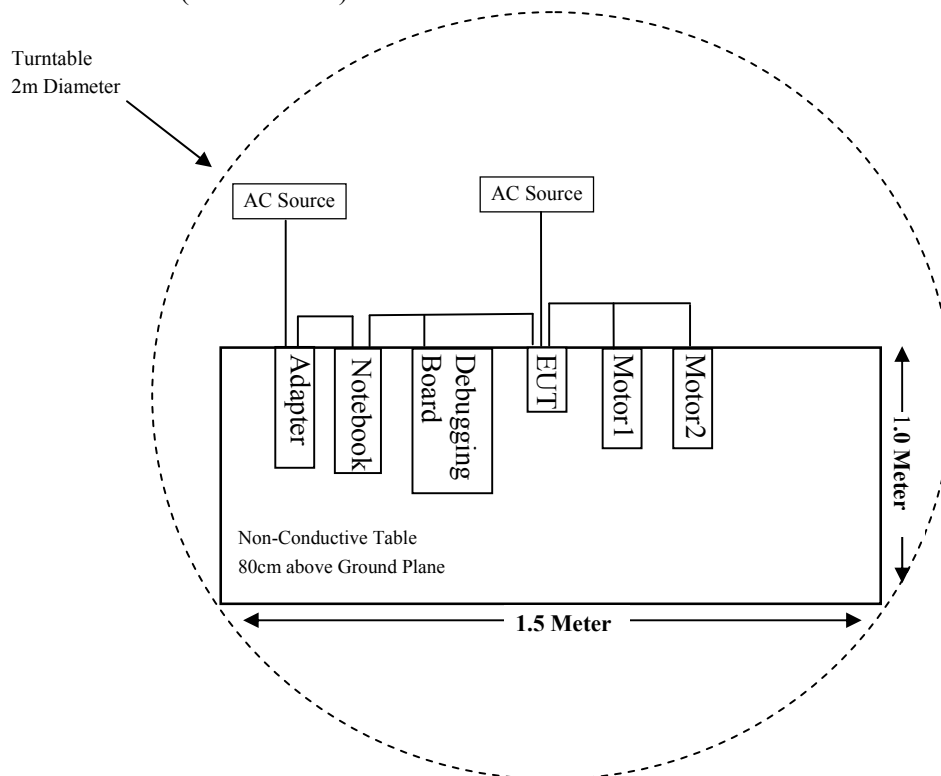
| Cable Description | Length (m) | From Port       | To        |
|-------------------|------------|-----------------|-----------|
| SYNC Cable        | 1.5        | Debugging Board | Notebook  |
|                   |            |                 | EUT       |
| Power Cable       | 1.0        | Adapter         | AC Source |
| Power Cable       | 1.0        | EUT             | AC Source |

## Block Diagram of Test Setup

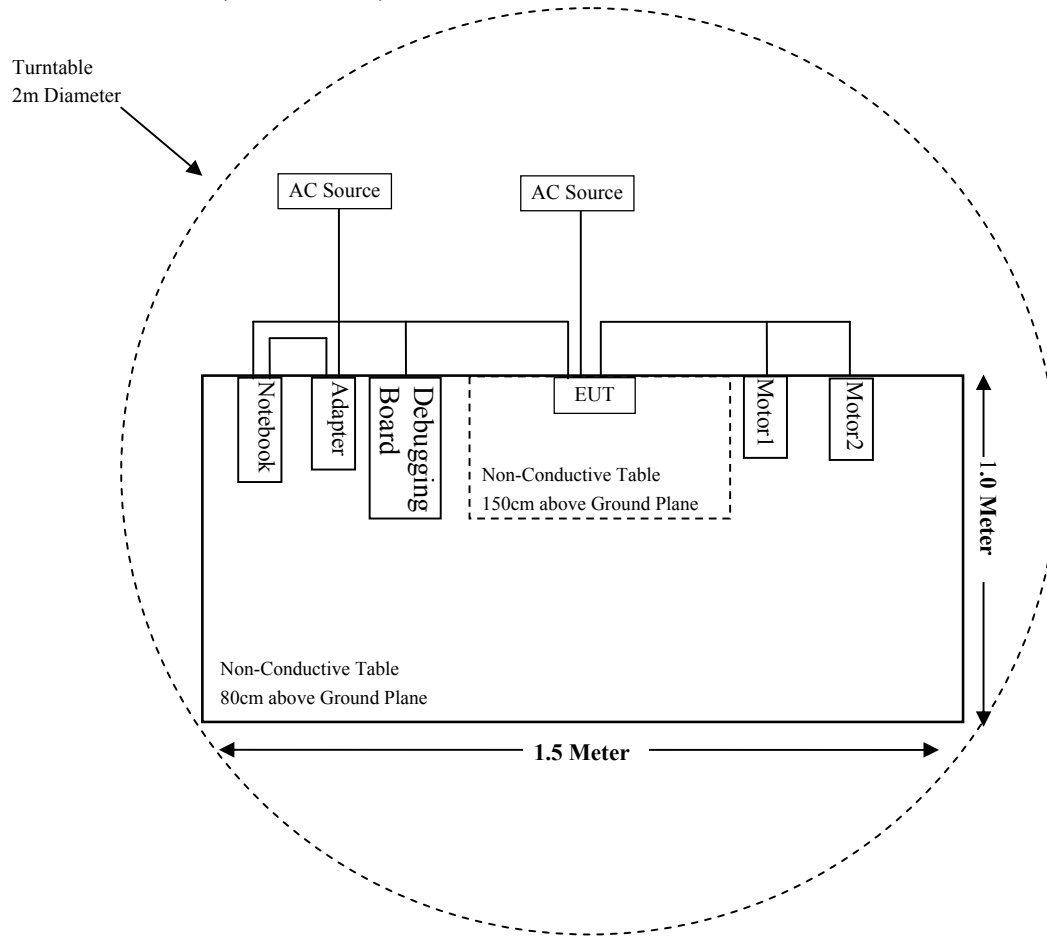
For Conducted Emissions



For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



**SUMMARY OF TEST RESULTS**

| FCC Rules                | Description of Test                      | Result    |
|--------------------------|------------------------------------------|-----------|
| §15.203                  | Antenna Requirement                      | Compliant |
| §15.207(a)               | AC Line Conducted Emissions              | Compliant |
| 15.205, §15.209, §15.249 | Radiated Emissions& Out of Band Emission | Compliant |
| §15.215 (c)              | 20 dB Bandwidth                          | Compliant |

**TEST EQUIPMENT LIST**

| Manufacturer                               | Description        | Model      | Serial Number          | Calibration Date | Calibration Due Date |
|--------------------------------------------|--------------------|------------|------------------------|------------------|----------------------|
| <b>Radiated Emission Test (Chamber 1#)</b> |                    |            |                        |                  |                      |
| Rohde & Schwarz                            | EMI Test Receiver  | ESCI       | 100195                 | 2018-11-30       | 2019-11-29           |
| Sunol Sciences                             | Broadband Antenna  | JB3        | A090413-1              | 2016-12-26       | 2019-12-25           |
| Sonoma Instrument                          | Pre-amplifier      | 310N       | 171205                 | 2018-08-14       | 2019-08-13           |
| Rohde & Schwarz                            | Auto test Software | EMC32      | 100361                 | /                | /                    |
| MICRO-COAX                                 | Coaxial Cable      | Cable-8    | 008                    | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-9    | 009                    | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-10   | 010                    | 2018-08-15       | 2019-08-14           |
| <b>Radiated Emission Test (Chamber 2#)</b> |                    |            |                        |                  |                      |
| Rohde & Schwarz                            | Signal Analyzer    | FSIQ26     | 836131/009             | 2018-11-30       | 2019-11-29           |
| ETS-LINDGREN                               | Horn Antenna       | 3115       | 9207-3900              | 2017-07-15       | 2020-07-14           |
| ETS-LINDGREN                               | Horn Antenna       | 3116       | 00084159               | 2016-12-12       | 2019-12-11           |
| MICRO-TRONICS                              | Notch Filter       | BRM50702   | G024                   | 2018-08-05       | 2019-08-04           |
| A.H.Systems, inc                           | Amplifier          | 2641-1     | 491                    | 2019-02-20       | 2020-02-19           |
| SELECTOR                                   | Amplifier          | EM18G40G   | 060726                 | 2019-03-22       | 2020-03-21           |
| Rohde & Schwarz                            | Auto test Software | EMC32      | 100361                 | /                | /                    |
| MICRO-COAX                                 | Coaxial Cable      | Cable-6    | 006                    | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-11   | 011                    | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-12   | 012                    | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-13   | 013                    | 2018-08-15       | 2019-08-14           |
| <b>RF Conducted Test</b>                   |                    |            |                        |                  |                      |
| Rohde & Schwarz                            | Signal Analyzer    | ESIB26     | 100146                 | 2018-11-30       | 2019-11-29           |
| Narda                                      | Attenuator         | 10dB       | 010                    | 2018-08-15       | 2019-08-14           |
| KEESON                                     | RF Cable           | KEESON C01 | C01                    | Each Time        | /                    |
| <b>Conducted Emission Test</b>             |                    |            |                        |                  |                      |
| Rohde & Schwarz                            | EMI Test Receiver  | ESR        | 1316.3003K03-101746-zn | 2019-07-11       | 2020-07-10           |
| ROHDE&SCHWARZ                              | LISN               | ENV216     | 3560655016             | 2018-11-30       | 2019-11-29           |
| Rohde & Schwarz                            | LISN               | ESH3-Z5    | 862770/011             | 2018-11-30       | 2019-11-29           |
| Audix                                      | Test Software      | e3         | V9                     | /                | /                    |
| Narda                                      | Attenuator/6dB     | 10690812-2 | 26850-6                | 2019-01-10       | 2020-01-09           |
| MICRO-COAX                                 | Coaxial Cable      | Cable-15   | 015                    | 2018-08-15       | 2019-08-14           |

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

### **Antenna Connector Construction**

The EUT has a PCB antenna and antenna gain is 0dBi, which was permanently attached, fulfill the requirement of this section, please refer to the EUT photos.

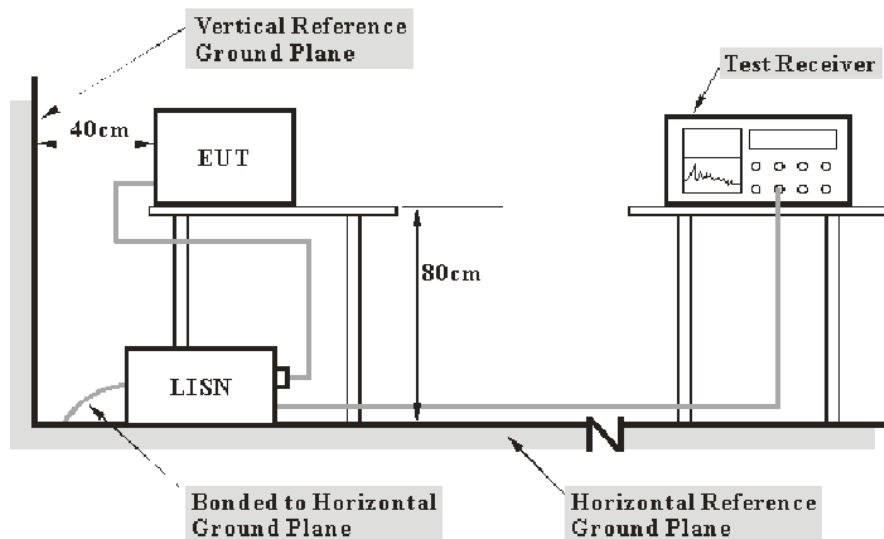
**Result:** Compliant.

## FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207

### EUT Setup



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range  | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz  |

### Test Procedure

During the conducted emission test, the EUT was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Corrected Factor & Over Limit Calculation

The Corrected Factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Corrected Factor (dB)} = \text{LISN VDF (dB)} + \text{Cable Loss (dB)} + \text{Transient Limiter Attenuation (dB)}$$

The “**Over Limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB above the limit. The equation for margin calculation is as follows:

$$\text{Over Limit (dB)} = \text{Read level (dB}\mu\text{V)} + \text{Factor (dB)} - \text{Limit (dB}\mu\text{V)}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

### Test Data

#### Environmental Conditions

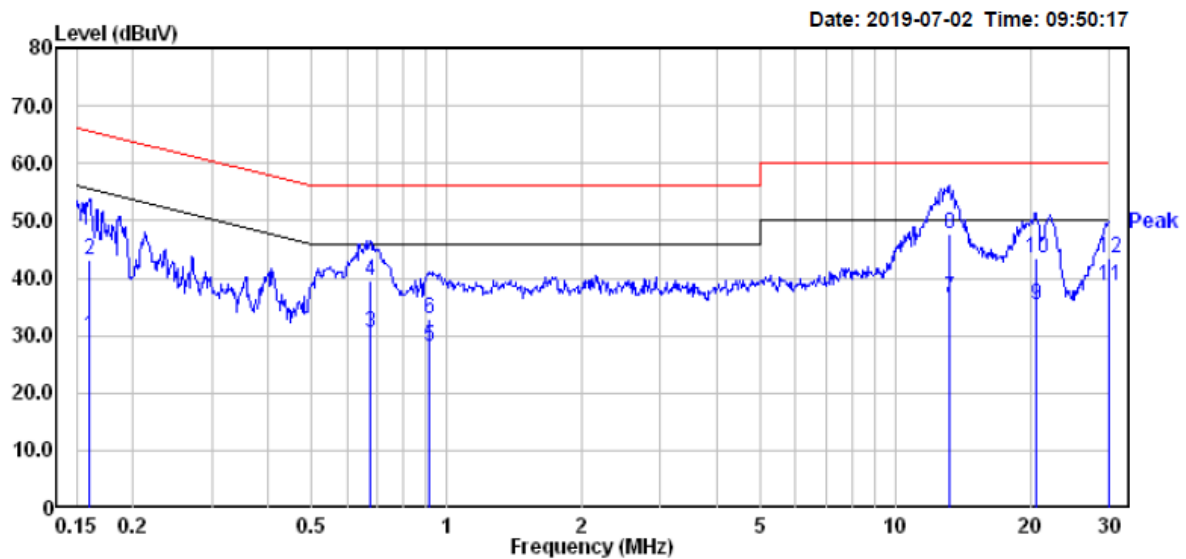
|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25.0℃     |
| <b>Relative Humidity:</b> | 48 %      |
| <b>ATM Pressure:</b>      | 101.2 kPa |

*The testing was performed by Sam Ye on 2019-07-02.*

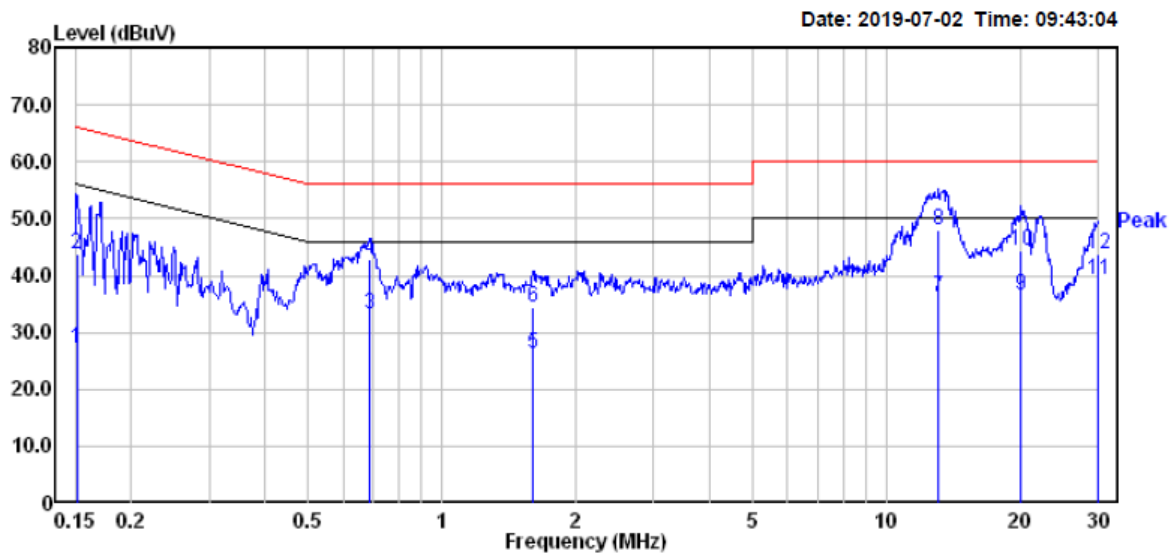
**Test Result:** Compliant.

*EUT operation mode: Transmitting in middle channel. (Worst case)*

## AC 120V/60Hz, Line



|    |        | Read  |        | Limit | Over  |                |
|----|--------|-------|--------|-------|-------|----------------|
|    | Freq   | Level | Factor | Level | Line  | Limit Remark   |
|    | MHz    | dBuV  | dB     | dBuV  | dBuV  | dB             |
| 1  | 0.160  | 10.00 | 19.83  | 29.83 | 55.47 | -25.64 Average |
| 2  | 0.160  | 23.30 | 19.83  | 43.13 | 65.47 | -22.34 QP      |
| 3  | 0.675  | 10.60 | 19.75  | 30.35 | 46.00 | -15.65 Average |
| 4  | 0.675  | 19.80 | 19.75  | 39.55 | 56.00 | -16.45 QP      |
| 5  | 0.914  | 8.20  | 19.74  | 27.94 | 46.00 | -18.06 Average |
| 6  | 0.914  | 13.10 | 19.74  | 32.84 | 56.00 | -23.16 QP      |
| 7  | 13.267 | 16.91 | 19.60  | 36.51 | 50.00 | -13.49 Average |
| 8  | 13.267 | 28.21 | 19.60  | 47.81 | 60.00 | -12.19 QP      |
| 9  | 20.594 | 15.50 | 19.92  | 35.42 | 50.00 | -14.58 Average |
| 10 | 20.594 | 23.60 | 19.92  | 43.52 | 60.00 | -16.48 QP      |
| 11 | 30.000 | 19.00 | 19.78  | 38.78 | 50.00 | -11.22 Average |
| 12 | 30.000 | 23.60 | 19.78  | 43.38 | 60.00 | -16.62 QP      |

**AC 120V/60Hz, Neutral**

|    | Freq   | Read Level | Factor | Level | Limit Line | Over Limit | Remark  |
|----|--------|------------|--------|-------|------------|------------|---------|
|    | MHz    | dBuV       | dB     | dBuV  | dBuV       | dB         |         |
| 1  | 0.151  | 7.20       | 19.82  | 27.02 | 55.96      | -28.94     | Average |
| 2  | 0.151  | 24.10      | 19.82  | 43.92 | 65.96      | -22.04     | QP      |
| 3  | 0.690  | 13.50      | 19.75  | 33.25 | 46.00      | -12.75     | Average |
| 4  | 0.690  | 23.10      | 19.75  | 42.85 | 56.00      | -13.15     | QP      |
| 5  | 1.602  | 6.29       | 19.85  | 26.14 | 46.00      | -19.86     | Average |
| 6  | 1.602  | 14.59      | 19.85  | 34.44 | 56.00      | -21.56     | QP      |
| 7  | 13.127 | 16.70      | 19.60  | 36.30 | 50.00      | -13.70     | Average |
| 8  | 13.127 | 28.40      | 19.60  | 48.00 | 60.00      | -12.00     | QP      |
| 9  | 20.162 | 16.60      | 19.95  | 36.55 | 50.00      | -13.45     | Average |
| 10 | 20.162 | 24.40      | 19.95  | 44.35 | 60.00      | -15.65     | QP      |
| 11 | 30.000 | 19.40      | 19.78  | 39.18 | 50.00      | -10.82     | Average |
| 12 | 30.000 | 23.90      | 19.78  | 43.68 | 60.00      | -16.32     | QP      |

**Note:**

- 1) Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
- 2) Over Limit (dB) = Read level (dBuV) + Factor (dB) - Limit (dBuV)

## FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS& OUT OF BAND EMISSION

### Applicable Standard

As per FCC§15.249 (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:

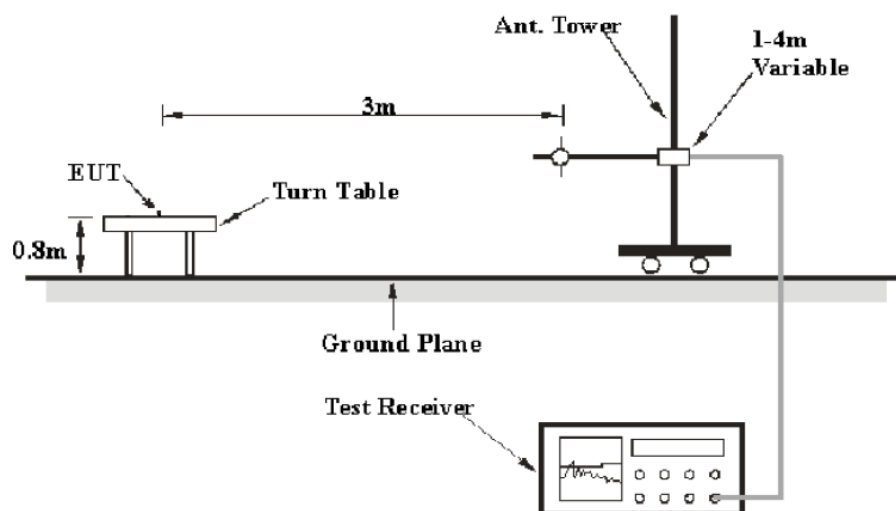
| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|-----------------------|--------------------------------------------------|------------------------------------------------|
| 902–928 MHz           | 50                                               | 500                                            |
| 2400–2483.5 MHz       | 50                                               | 500                                            |
| 5725–5875 MHz         | 50                                               | 500                                            |
| 24GHz-24.25GHz        | 250                                              | 2500                                           |

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

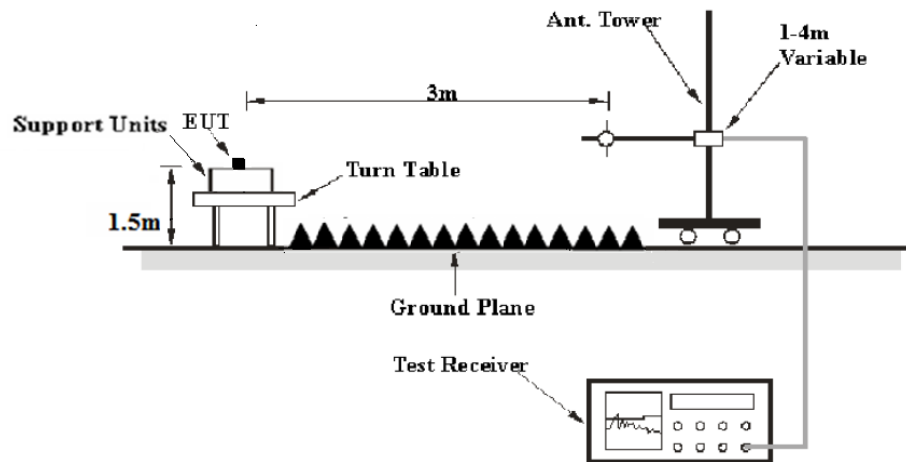
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

### Test Equipment Setup

The system was investigated from 30 MHz to 25GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

| Frequency Range   | RBW     | Video B/W | IF B/W  | Detector |
|-------------------|---------|-----------|---------|----------|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz   | 120 kHz | QP       |
| Above 1GHz        | 1MHz    | 3 MHz     | /       | PK       |
|                   | 1MHz    | 3 MHz     | /       | Ave      |

### Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

### Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dB $\mu$ V /m) = Meter Reading (dB $\mu$ V) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dB $\mu$ V/m) – Corrected Amplitude (dB $\mu$ V /m)

### Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 &15.205 & 15.249.

### Test Data

#### Environmental Conditions

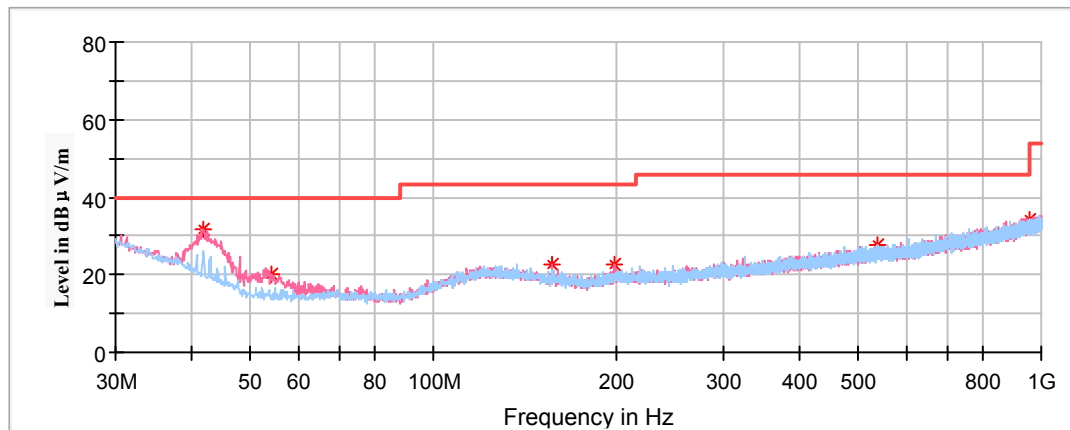
|                    |          |
|--------------------|----------|
| Temperature:       | 24°C     |
| Relative Humidity: | 50%      |
| ATM Pressure:      | 101.1kPa |

*The testing was performed by Sam Ye on 2019-07-12.*

*Test Mode: Transmitting (AC power supply-worse case)*

**Spurious Emission Test:****30MHz-1GHz**

(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **middle channel of operation in X-axis of orientation** was recorded.)



| Frequency (MHz) | Corrected Amplitude | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|-------------|-------------|------------------|-------------------------|----------------|-------------|
|                 | Quasi-peak (dBμV/m) | Height (cm) | Polar (H/V) |                  |                         |                |             |
| 41.88           | 31.85               | 100         | V           | 86               | -12.0                   | 40.00          | 8.15        |
| 54.25           | 20.09               | 100         | V           | 253              | -17.7                   | 40.00          | 19.91       |
| 157.19          | 22.62               | 100         | V           | 175              | -12.6                   | 43.50          | 20.88       |
| 198.05          | 22.56               | 200         | V           | 341              | -12.4                   | 43.50          | 20.94       |
| 536.83          | 27.77               | 100         | H           | 124              | -5.8                    | 46.00          | 18.23       |
| 953.44          | 34.30               | 200         | V           | 54               | 1.4                     | 46.00          | 11.70       |

**1GHz-18GHz**

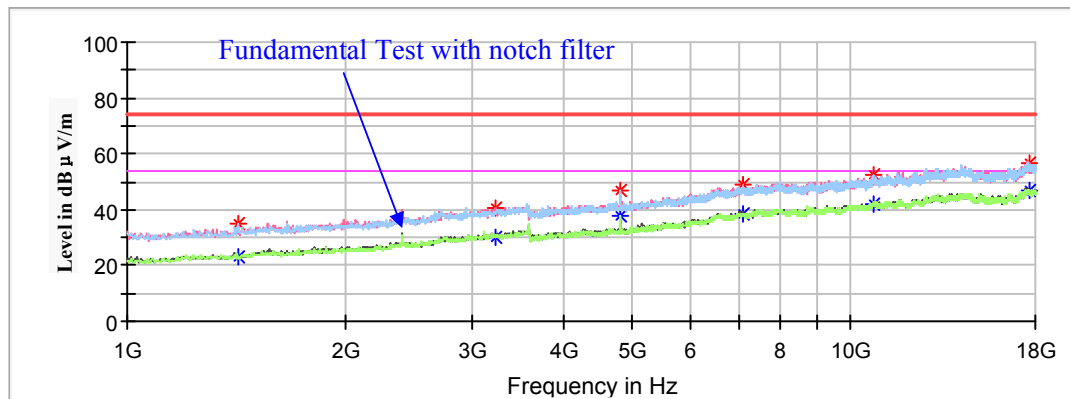
(Pre-scan in the X,Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded.)

Note:

1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)  
 Corrected Amplitude (dB $\mu$ V /m) = Corrected Factor (dB/m) + Reading (dB $\mu$ V)  
 Margin (dB) = Limit (dB $\mu$ V/m) – Corrected Amplitude (dB $\mu$ V /m)

**Low Channel: 2403MHz**

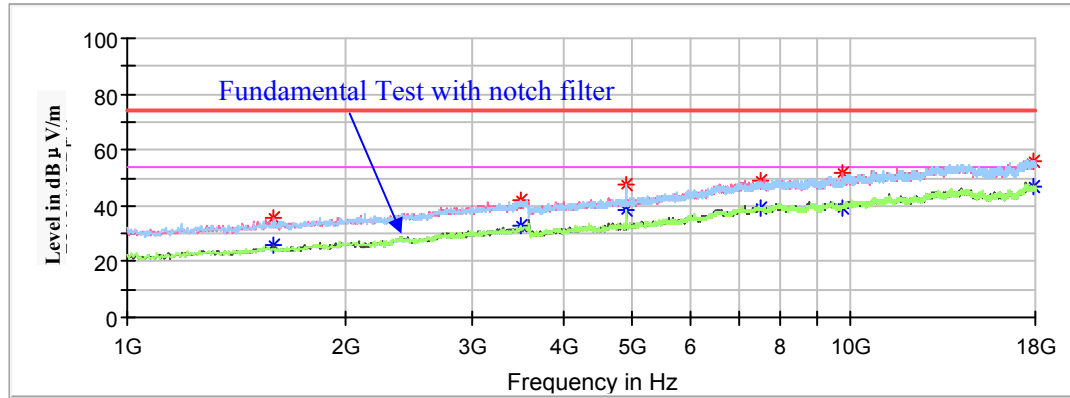
Full Spectrum



| Frequency (MHz) | Corrected Amplitude    |                        | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|------------------------|------------------------|-------------|-------------|------------------|-------------------------|----------------------|-------------|
|                 | MaxPeak (dB $\mu$ V/m) | Average (dB $\mu$ V/m) | Height (cm) | Polar (H/V) |                  |                         |                      |             |
| 1421.60         | ---                    | 23.32                  | 150         | H           | 2                | -10.4                   | 54.00                | 30.68       |
| 1421.60         | 34.76                  | ---                    | 150         | H           | 2                | -10.4                   | 74.00                | 39.24       |
| 3227.00         | ---                    | 30.25                  | 250         | V           | 0                | -4.0                    | 54.00                | 23.75       |
| 3227.00         | 40.78                  | ---                    | 250         | V           | 0                | -4.0                    | 74.00                | 33.22       |
| 4806.00         | ---                    | 37.51                  | 200         | H           | 220              | -0.6                    | 54.00                | 16.49       |
| 4806.00         | 46.94                  | ---                    | 200         | H           | 220              | -0.6                    | 74.00                | 27.06       |
| 7089.40         | ---                    | 38.38                  | 250         | V           | 227              | 5.5                     | 54.00                | 15.62       |
| 7089.40         | 48.85                  | ---                    | 250         | V           | 227              | 5.5                     | 74.00                | 25.15       |
| 10724.00        | ---                    | 41.90                  | 150         | H           | 130              | 9.3                     | 54.00                | 12.10       |
| 10724.00        | 52.40                  | ---                    | 150         | H           | 130              | 9.3                     | 74.00                | 21.60       |
| 17711.00        | ---                    | 46.79                  | 100         | V           | 294              | 13.9                    | 54.00                | 7.21        |
| 17711.00        | 56.44                  | ---                    | 100         | V           | 294              | 13.9                    | 74.00                | 17.56       |

**Middle Channel: 2442MHz**

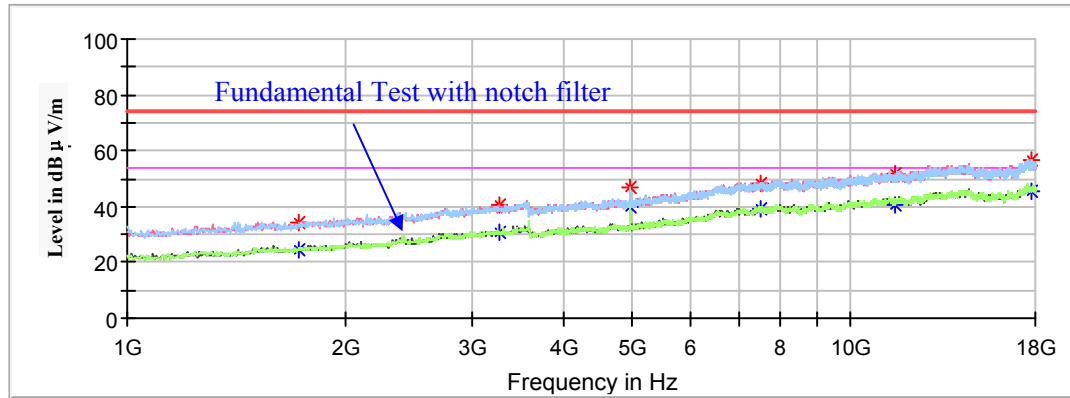
Full Spectrum



| Frequency (MHz) | Corrected Amplitude    |                        | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|------------------------|------------------------|-------------|-------------|------------------|-------------------------|----------------------|-------------|
|                 | MaxPeak (dB $\mu$ V/m) | Average (dB $\mu$ V/m) | Height (cm) | Polar (H/V) |                  |                         |                      |             |
| 1595.00         | ---                    | 25.60                  | 250         | V           | 218              | -9.6                    | 54.00                | 28.40       |
| 1595.00         | 35.35                  | ---                    | 250         | V           | 218              | -9.6                    | 74.00                | 38.65       |
| 3492.20         | ---                    | 33.01                  | 150         | H           | 174              | -3.6                    | 54.00                | 20.99       |
| 3492.20         | 41.81                  | ---                    | 150         | H           | 174              | -3.6                    | 74.00                | 32.19       |
| 4884.00         | ---                    | 38.38                  | 100         | H           | 221              | -0.4                    | 54.00                | 15.62       |
| 4884.00         | 47.31                  | ---                    | 100         | H           | 221              | -0.4                    | 74.00                | 26.69       |
| 7497.40         | ---                    | 39.27                  | 200         | V           | 305              | 6.1                     | 54.00                | 14.73       |
| 7497.40         | 48.93                  | ---                    | 200         | V           | 305              | 6.1                     | 74.00                | 25.07       |
| 9731.20         | ---                    | 39.50                  | 250         | V           | 312              | 7.9                     | 54.00                | 14.50       |
| 9731.20         | 51.87                  | ---                    | 250         | V           | 312              | 7.9                     | 74.00                | 22.13       |
| 17938.80        | ---                    | 47.03                  | 200         | H           | 330              | 13.6                    | 54.00                | 6.97        |
| 17938.80        | 55.62                  | ---                    | 200         | H           | 330              | 13.6                    | 74.00                | 18.38       |

**High Channel: 2480MHz**

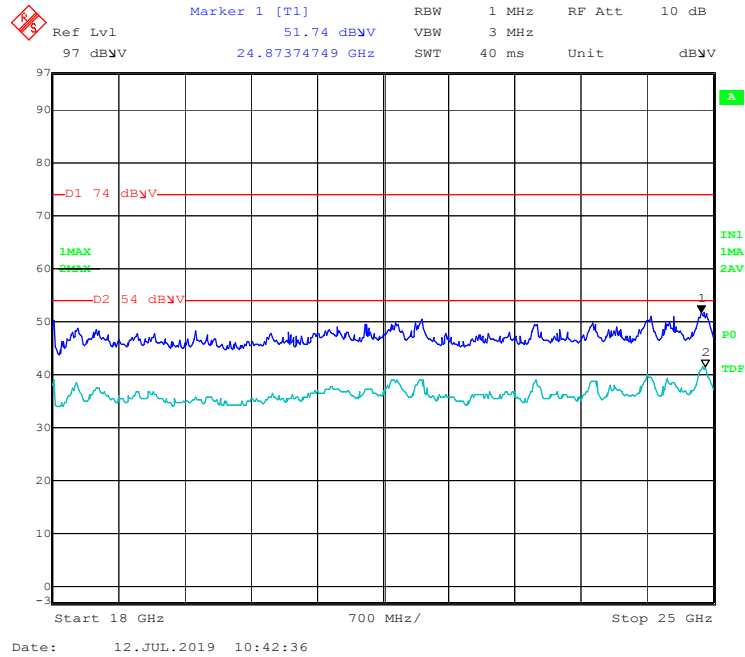
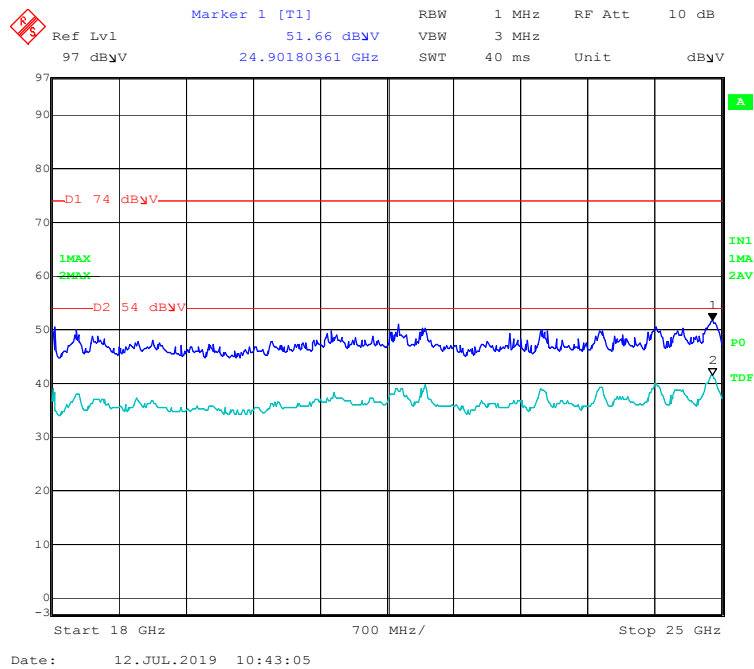
Full Spectrum



| Frequency (MHz) | Corrected Amplitude |                  | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|-------------|-------------|------------------|-------------------------|----------------|-------------|
|                 | MaxPeak (dBμV/m)    | Average (dBμV/m) | Height (cm) | Polar (H/V) |                  |                         |                |             |
| 1731.00         | ---                 | 24.33            | 150         | V           | 302              | -9.1                    | 54.00          | 29.67       |
| 1731.00         | 34.42               | ---              | 150         | V           | 302              | -9.1                    | 74.00          | 39.58       |
| 3261.00         | ---                 | 30.89            | 100         | V           | 232              | -3.9                    | 54.00          | 23.11       |
| 3261.00         | 40.53               | ---              | 100         | V           | 232              | -3.9                    | 74.00          | 33.47       |
| 4960.00         | ---                 | 39.72            | 200         | H           | 222              | -0.3                    | 54.00          | 14.28       |
| 4960.00         | 47.10               | ---              | 200         | H           | 222              | -0.3                    | 74.00          | 26.90       |
| 7521.20         | ---                 | 39.14            | 250         | H           | 287              | 6.2                     | 54.00          | 14.86       |
| 7521.20         | 48.28               | ---              | 250         | H           | 287              | 6.2                     | 74.00          | 25.72       |
| 11492.40        | ---                 | 40.78            | 200         | V           | 346              | 9.8                     | 54.00          | 13.22       |
| 11492.40        | 51.64               | ---              | 200         | V           | 346              | 9.8                     | 74.00          | 22.36       |
| 17792.60        | ---                 | 45.29            | 200         | H           | 269              | 13.8                    | 54.00          | 8.71        |
| 17792.60        | 56.85               | ---              | 200         | H           | 269              | 13.8                    | 74.00          | 17.15       |

**18GHz-25GHz:**

(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **middle** channel of operation in X-axis of orientation was recorded)

**Horizontal****Vertical**

**Fundamental Test & Restricted Bands Emissions Test:**(Pre-scan in the X, Y and Z axes of orientation, the worst case **X-axis of orientation** was recorded.)

Note:

1. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)

Corrected Amplitude (dB $\mu$ V /m) = Corrected Factor (dB/m) + Reading (dB $\mu$ V)Margin (dB) = Limit (dB $\mu$ V/m) – Corrected Amplitude (dB $\mu$ V /m)

| Frequency<br>(MHz)      | Corrected Amplitude |                     | Rx Antenna     |                | Turntable | Corrected<br>Factor<br>(dB/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|-------------------------|---------------------|---------------------|----------------|----------------|-----------|-------------------------------|-------------------|----------------|
|                         | MaxPeak<br>(dBμV/m) | Average<br>(dBμV/m) | Height<br>(cm) | Polar<br>(H/V) | Degree    |                               |                   |                |
| Low Channel: 2403MHz    |                     |                     |                |                |           |                               |                   |                |
| 2403.00                 | ---                 | 93.56               | 150.0          | H              | 176.0     | 2.8                           | 94.00             | 0.44           |
| 2403.00                 | 95.55               | ---                 | 150.0          | H              | 176.0     | 2.8                           | 114.00            | 18.45          |
| 2403.00                 | ---                 | 91.09               | 100.0          | V              | 51.0      | 2.8                           | 94.00             | 2.91           |
| 2403.00                 | 93.42               | ---                 | 100.0          | V              | 51.0      | 2.8                           | 114.00            | 20.58          |
| 2400.00                 | ---                 | 40.82               | 200.0          | H              | 172.0     | 2.8                           | 54.00             | 13.18          |
| 2400.00                 | 51.31               | ---                 | 200.0          | H              | 172.0     | 2.8                           | 74.00             | 22.69          |
| Middle Channel: 2442MHz |                     |                     |                |                |           |                               |                   |                |
| 2442.00                 | ---                 | 93.32               | 150.0          | H              | 189.0     | 2.9                           | 94.00             | 0.68           |
| 2442.00                 | 95.36               | ---                 | 150.0          | H              | 189.0     | 2.9                           | 114.00            | 18.64          |
| 2442.00                 | ---                 | 91.05               | 250.0          | V              | 237.0     | 2.9                           | 94.00             | 2.95           |
| 2442.00                 | 93.23               | ---                 | 250.0          | V              | 237.0     | 2.9                           | 114.00            | 20.77          |
| High Channel: 2480MHz   |                     |                     |                |                |           |                               |                   |                |
|                         |                     |                     |                |                |           |                               |                   |                |
| 2480.00                 | ---                 | 92.46               | 150.0          | H              | 261.0     | 3.1                           | 94.00             | 1.54           |
| 2480.00                 | 94.43               | ---                 | 150.0          | H              | 261.0     | 3.1                           | 114.00            | 19.57          |
| 2480.00                 | ---                 | 90.12               | 250.0          | V              | 313.0     | 3.1                           | 94.00             | 3.88           |
| 2480.00                 | 92.25               | ---                 | 250.0          | V              | 313.0     | 3.1                           | 114.00            | 21.75          |
| 2483.50                 | ---                 | 45.54               | 150.0          | V              | 208.0     | 3.1                           | 54.00             | 8.46           |
| 2483.50                 | 54.64               | ---                 | 150.0          | V              | 208.0     | 3.1                           | 74.00             | 19.36          |

**FCC §15.215(c) – 20 dB BANDWIDTH TESTING****Applicable Standard**

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

**Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

**Test Data****Environmental Conditions**

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 24.4°C   |
| <b>Relative Humidity:</b> | 50%      |
| <b>ATM Pressure:</b>      | 101.3kPa |

*The testing was performed by Sam Ye on 2019-07-26.*

**Test Result:** Compliant.

*Test Mode: Transmitting*

| Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) |
|---------|-----------------|-----------------------|
| Low     | 2403            | 1.226                 |
| Middle  | 2442            | 1.172                 |
| High    | 2480            | 1.148                 |

Delta 1 [T1]

Ref Lvl 21 dBm

0.11 dB

1.22645291 MHz

RBW 30 kHz

VBW 100 kHz

SWT 8.5 ms

RF Att 20 dB

Unit dBm

11 dB Offset

-22.15 dBm

2.40244389 GHz

0.11 dB

1.22645291 MHz

D1 -1.3 dBm

1MAX

D2 -21.3 dBm

1

1

Center 2.403 GHz

300 kHz/

Span 3 MHz

Date: 26.JUL.2019 23:03:59

Delta 1 [T1] -0.33 dB  
 RBW 30 kHz RF Att 20 dB  
 Ref Lvl 21 dBm VBW 100 kHz  
 1.17234469 MHz SWT 8.5 ms Unit dBm

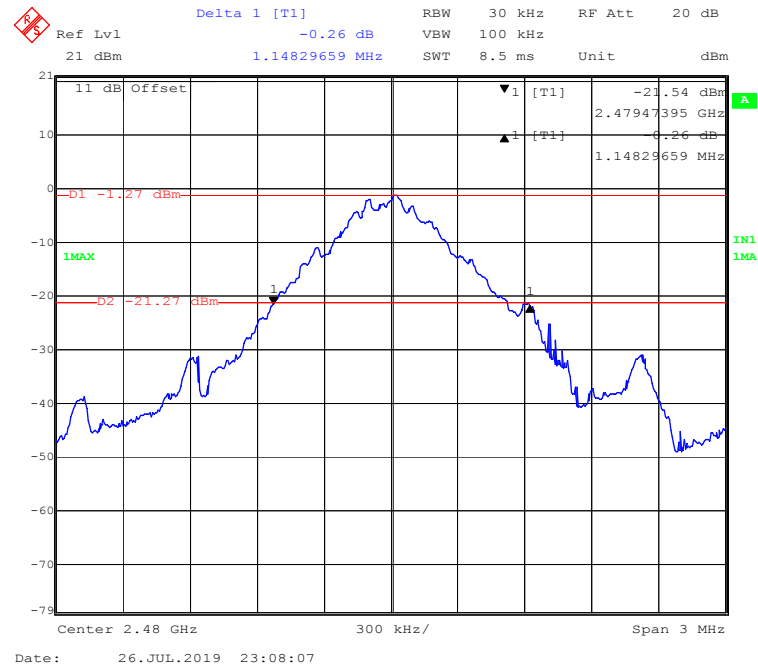
11 dB Offset  
 -21.33 dBm  
 2.44147996 GHz  
 -0.33 dB  
 1.17234469 MHz

D1 -1.1 dBm  
 1MAX  
 D2 -21.1 dBm  
 IN1  
 1MA

Center 2.442 GHz 300 kHz/  
 Span 3 MHz

Date: 26.JUL.2019 23:05:09

High Channel



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