

## TEST REPORT

**Report No.: 20061339HKG-001**

Musical Electronics Ltd.

Application For Certification  
(Original Grant)

**FCC ID: AUI-TBT01A**

Transceiver

**Prepared and Checked by:**

**Approved by:**

Signed On File  
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Date: November 27, 2020

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## TEST REPORT

### GENERAL INFORMATION

|                                  |                                                                                                                                 |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
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| <b>Trade Name:</b>               | circuit CUBES                                                                                                                   |
| <b>Model:</b>                    | 11111-00000                                                                                                                     |
| <b>Additional Model:</b>         | 11131-00000                                                                                                                     |
| <b>Type of EUT:</b>              | Transceiver                                                                                                                     |
| <b>Description of EUT:</b>       | STEM Educational Toys                                                                                                           |
| <b>Serial Number:</b>            | N/A                                                                                                                             |
| <b>FCC ID:</b>                   | AUI-TBT01A                                                                                                                      |
| <b>Date of Sample Submitted:</b> | June 23, 2020                                                                                                                   |
| <b>Date of Test:</b>             | June 23, 2020 to July 22, 2020                                                                                                  |
| <b>Report No.:</b>               | 20061339HKG-001                                                                                                                 |
| <b>Report Date:</b>              | November 27, 2020                                                                                                               |
| <b>Environmental Conditions:</b> | Temperature: +10 to 40°C<br>Humidity: 10 to 90%                                                                                 |
| <b>Conclusion:</b>               | Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification. |

## TEST REPORT

### SUMMARY OF TEST RESULT

| Test Specification                    | Reference      | Results |
|---------------------------------------|----------------|---------|
| Radiated Emission                     | 15.249, 15.209 | Pass    |
| Radiated Emission on the Bandedge     |                |         |
| Radiated Emission in Restricted Bands | 15.205         | Pass    |

The equipment under test is found to be complying with the following standards:  
FCC Part 15, October 1, 2019 Edition

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the provisions of this section.

2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

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## TEST REPORT

### 1.0 GENERAL DESCRIPTION

#### 1.1 Product Description

The Equipment Under Test (EUT) is STEM Educational Toys. The EUT has Bluetooth BLE feature. It is powered by a 3.7V internal rechargeable battery.

The Model: 11131-00000 is the same as the Model: 11111-00000 in electronics/electrical designs including software & firmware, PCB layout and construction design/physical design/enclosure as declared by client. The only differences between these models are model number, color and cosmetic details to be sold for marketing purpose as declared by client.

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

#### 1.2 Related Submittal(s) Grants

This is a single application for certification of a transceiver.

#### 1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “**Justification Section**” of this Application.

#### 1.4 Test Facility

The 3m Chamber used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong SAR, China. This test facility and site measurement data have been placed on file with the FCC.

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### 2.0 SYSTEM TEST CONFIGURATION

#### 2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The device was powered by DC 3.7V (1 x 3.7V fully charged internal rechargeable battery).

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was operated standalone and placed in the centre of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

#### 2.2 EUT Exercising Software

The EUT exercise program (if any) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

#### 2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

#### 2.4 Measurement Uncertainty

Decision Rule for compliance: For FCC/IC standard, the measured value must be within the limits of applicable standard without accounting for the measurement uncertainty. For EN/IEC/HKTA/HKTC standard, conformity rules will be used as per standard directly excepted EN/IEC 61000-3-2, EN/IEC 61000-3-3, HKTA1004, HKCA1008, HKTA1019, HKTA1020, HKTA1041 and HKTA1044. For these excepted or not mentioned standards, Cl 4.2.2 of ILAC-G8:09/2019 decision rules will be reference and guard band will be equal to our measurement uncertainty with 95% confidence level ( $k=2$ ). In case, the measured value is within guard band region, undetermined decision will be used.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

#### 2.5 Support Equipment List and Description

1. 2 x motor module
2. 1 x LED module  
(Provided by Applicant)

## TEST REPORT

### 3.0 EMISSION RESULTS

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

#### 3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - AV$$

where FS = Field Strength in dB $\mu$ V/m

RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB $\mu$ V/m

RR = RA - AG - AV in dB $\mu$ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V/m}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$AV = 5.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 18 + 9 = 27 \text{ dB}\mu\text{V/m}$$

$$RR = 18.0 \text{ dB}\mu\text{V}$$

$$LF = 9.0 \text{ dB}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

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### 3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 7206 MHz

For electronic filing, the worst-case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

### 3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 4.5 dB

## TEST REPORT

### RADIATED EMISSIONS

Model: 11111-00000

Date of Test: July 22, 2020

Worst-Case Operating Mode: Transmitting

Table 1  
Pursuant to FCC Part 15 Section 15.249 Requirement

#### Lowest Channel

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Average (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|------------------------------|------------------------------|--------------|
| V            | 2402.000         | 88.0           | 33                | 29.4                | 84.4                         | 94.0                         | -9.6         |
| <b>V</b>     | <b>4804.000</b>  | <b>35.9</b>    | <b>33</b>         | <b>34.9</b>         | <b>37.8</b>                  | <b>54.0</b>                  | <b>-16.2</b> |
| H            | 7206.000         | 44.6           | 33                | 37.9                | 49.5                         | 54.0                         | -4.5         |
| H            | 9608.000         | 37.0           | 33                | 40.4                | 44.4                         | 54.0                         | -9.6         |
| <b>H</b>     | <b>12010.000</b> | <b>27.3</b>    | <b>33</b>         | <b>40.5</b>         | <b>34.8</b>                  | <b>54.0</b>                  | <b>-19.2</b> |
| H            | 14412.000        | 30.2           | 33                | 40.0                | 37.2                         | 54.0                         | -16.8        |

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBμV/m) | Peak Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------------|--------------|
| V            | 2402.000         | 94.6           | 33                | 29.4                | 91.0                      | 114.0                     | -23.0        |
| <b>V</b>     | <b>4804.000</b>  | <b>44.6</b>    | <b>33</b>         | <b>34.9</b>         | <b>46.5</b>               | <b>74.0</b>               | <b>-27.5</b> |
| H            | 7206.000         | 50.3           | 33                | 37.9                | 55.2                      | 74.0                      | -18.8        |
| H            | 9608.000         | 44.6           | 33                | 40.4                | 52.0                      | 74.0                      | -22.0        |
| <b>H</b>     | <b>12010.000</b> | <b>40.5</b>    | <b>33</b>         | <b>40.5</b>         | <b>48.0</b>               | <b>74.0</b>               | <b>-26.0</b> |
| H            | 14412.000        | 43.2           | 33                | 40.0                | 50.2                      | 74.0                      | -23.8        |

- NOTES: 1. Peak Detector Data unless otherwise stated. Average measurement is according to ANSI C63.10 (2013).
2. All measurements were made at 3 meters.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

## TEST REPORT

Model: 11111-00000

Date of Test: July 22, 2020

Worst-Case Operating Mode: Transmitting

Table 2  
Pursuant to FCC Part 15 Section 15.249 Requirement

### Middle Channel

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Average (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|------------------------------|------------------------------|--------------|
| V            | 2440.000         | 87.8           | 33                | 29.4                | 84.2                         | 94.0                         | -9.8         |
| <b>H</b>     | <b>4880.000</b>  | <b>38.1</b>    | <b>33</b>         | <b>34.9</b>         | <b>40.0</b>                  | <b>54.0</b>                  | <b>-14.0</b> |
| <b>V</b>     | <b>7320.000</b>  | <b>39.3</b>    | <b>33</b>         | <b>37.9</b>         | <b>44.2</b>                  | <b>54.0</b>                  | <b>-9.8</b>  |
| V            | 9760.000         | 32.1           | 33                | 40.4                | 39.5                         | 54.0                         | -14.5        |
| <b>H</b>     | <b>12200.000</b> | <b>27.0</b>    | <b>33</b>         | <b>40.5</b>         | <b>34.5</b>                  | <b>54.0</b>                  | <b>-19.5</b> |
| V            | 14640.000        | 32.0           | 33                | 38.4                | 37.4                         | 54.0                         | -16.6        |

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBμV/m) | Peak Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------------|--------------|
| V            | 2440.000         | 94.8           | 33                | 29.4                | 91.2                      | 114.0                     | -22.8        |
| <b>H</b>     | <b>4880.000</b>  | <b>46.1</b>    | <b>33</b>         | <b>34.9</b>         | <b>48.0</b>               | <b>74.0</b>               | <b>-26.0</b> |
| <b>V</b>     | <b>7320.000</b>  | <b>47.7</b>    | <b>33</b>         | <b>37.9</b>         | <b>52.6</b>               | <b>74.0</b>               | <b>-21.4</b> |
| V            | 9760.000         | 41.2           | 33                | 40.4                | 48.6                      | 74.0                      | -25.4        |
| <b>H</b>     | <b>12200.000</b> | <b>40.7</b>    | <b>33</b>         | <b>40.5</b>         | <b>48.2</b>               | <b>74.0</b>               | <b>-25.8</b> |
| V            | 14640.000        | 45.4           | 33                | 38.4                | 50.8                      | 74.0                      | -23.2        |

- NOTES: 1. Peak Detector Data unless otherwise stated. Average measurement is according to ANSI C63.10 (2013).
2. All measurements were made at 3 meters.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

## TEST REPORT

Model: 11111-00000

Date of Test: July 22, 2020

Worst-Case Operating Mode: Transmitting

Table 3  
Pursuant to FCC Part 15 Section 15.249 Requirement

### Highest Channel

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Average (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|------------------------------|------------------------------|--------------|
| H            | 2480.000         | 88.8           | 33                | 29.4                | 85.2                         | 94.0                         | -8.8         |
| <b>V</b>     | <b>4960.000</b>  | <b>39.3</b>    | <b>33</b>         | <b>34.9</b>         | <b>41.2</b>                  | <b>54.0</b>                  | <b>-12.8</b> |
| <b>H</b>     | <b>7440.000</b>  | <b>33.3</b>    | <b>33</b>         | <b>37.9</b>         | <b>38.2</b>                  | <b>54.0</b>                  | <b>-15.8</b> |
| V            | 9920.000         | 25.4           | 33                | 40.4                | 32.8                         | 54.0                         | -21.2        |
| <b>H</b>     | <b>12400.000</b> | <b>26.1</b>    | <b>33</b>         | <b>40.5</b>         | <b>33.6</b>                  | <b>54.0</b>                  | <b>-20.4</b> |
| V            | 14880.000        | 31.0           | 33                | 38.4                | 36.4                         | 54.0                         | -17.6        |

| Polarization | Frequency (MHz)  | Reading (dBμV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBμV/m) | Peak Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------------|--------------|
| H            | 2480.000         | 95.2           | 33                | 29.4                | 91.6                      | 114.0                     | -22.4        |
| <b>V</b>     | <b>4960.000</b>  | <b>46.3</b>    | <b>33</b>         | <b>34.9</b>         | <b>48.2</b>               | <b>74.0</b>               | <b>-25.8</b> |
| <b>H</b>     | <b>7440.000</b>  | <b>42.7</b>    | <b>33</b>         | <b>37.9</b>         | <b>47.6</b>               | <b>74.0</b>               | <b>-26.4</b> |
| V            | 9920.000         | 41.8           | 33                | 40.4                | 49.2                      | 74.0                      | -24.8        |
| <b>H</b>     | <b>12400.000</b> | <b>39.9</b>    | <b>33</b>         | <b>40.5</b>         | <b>47.4</b>               | <b>74.0</b>               | <b>-26.6</b> |
| V            | 14880.000        | 44.6           | 33                | 38.4                | 50.0                      | 74.0                      | -24.0        |

- NOTES: 1. Peak Detector Data unless otherwise stated. Average measurement is according to ANSI C63.10 (2013).
2. All measurements were made at 3 meters.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

## TEST REPORT

Model: 11111-00000

Date of Test: July 22, 2020

Worst-Case Operating Mode: Bluetooth Searching

Table 4  
Pursuant to FCC Part 15 Section 15.209 Requirement

| Polarization | Frequency (MHz) | Reading (dBμV) | Pre-amp (dB) | Antenna Factor (dB) | Net at 3m (dBμV/m) | Limit at 3m (dBμV/m) | Margin (dB)  |
|--------------|-----------------|----------------|--------------|---------------------|--------------------|----------------------|--------------|
| V            | 95.932          | 17.5           | 16           | 12.0                | 13.5               | 43.5                 | -30.0        |
| <b>V</b>     | <b>112.750</b>  | <b>25.4</b>    | <b>16</b>    | <b>14.0</b>         | <b>23.4</b>        | <b>43.5</b>          | <b>-20.1</b> |
| <b>V</b>     | <b>119.210</b>  | <b>21.4</b>    | <b>16</b>    | <b>14.0</b>         | <b>19.4</b>        | <b>43.5</b>          | <b>-24.1</b> |
| <b>V</b>     | <b>131.642</b>  | <b>26.5</b>    | <b>16</b>    | <b>14.0</b>         | <b>24.5</b>        | <b>43.5</b>          | <b>-19.0</b> |
| H            | 150.654         | 23.4           | 16           | 14.0                | 21.4               | 43.5                 | -22.1        |
| V            | 224.144         | 21.4           | 16           | 18.0                | 23.4               | 46.0                 | -22.6        |

- NOTES:
1. Quasi-Peak Detector Data unless otherwise stated.
  2. All measurements were made at 3 meters.
  3. Negative sign in the column shows value below limit.
  4. Horn antenna is used for the emission over 1000MHz.
  5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
  6. Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

## TEST REPORT

### 4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

### 5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

### 6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

### 7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

## TEST REPORT

### 8.0 MISCELLANEOUS INFORMATION

The miscellaneous information includes details of the test procedure and measured bandwidth / calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

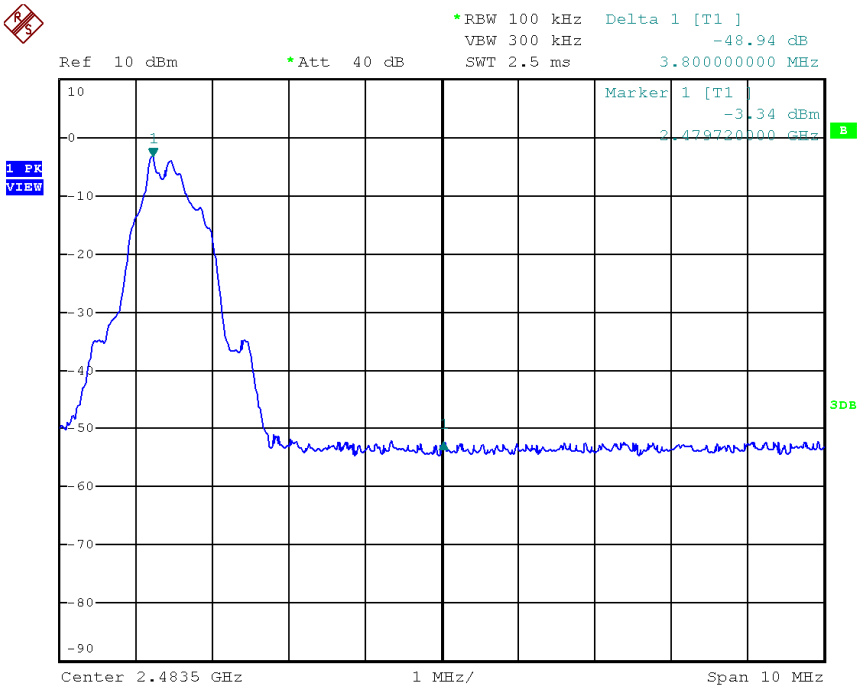
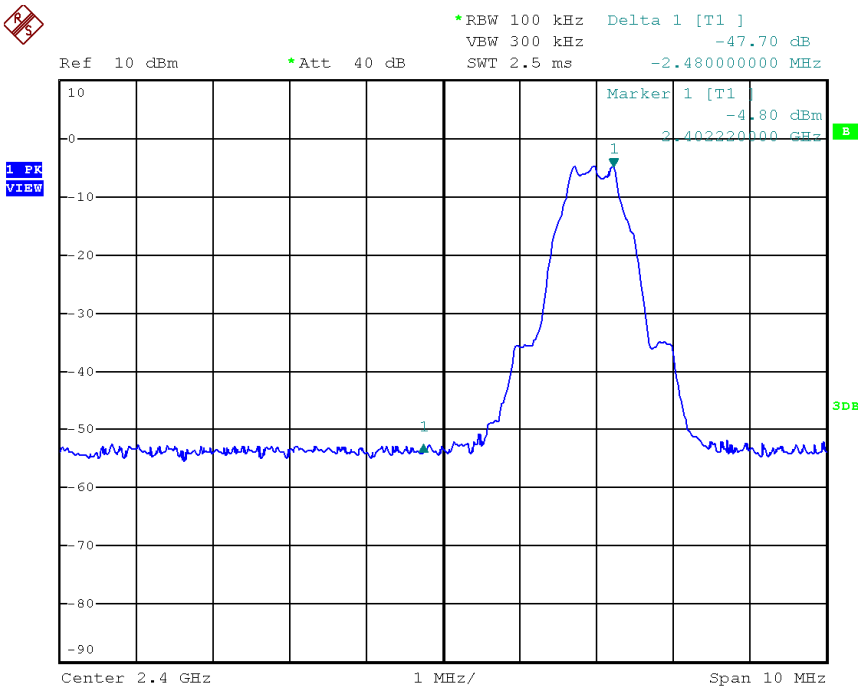
#### 8.1 Radiated Emission on the Bandedge

From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz to 2483.5MHz). In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard bandwidth is the bandwidth specified by ANSI C63.10 (2013) for frequency being measured.

Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50dB below the level of the fundamental or to the general radiated emissions limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).

TEST REPORT

PEAK MEASUREMENT



## TEST REPORT

### PEAK MEASUREMENT

Bandedge compliance is determined by applying marker-delta method, i.e. (Bandedge Plot).

Lower bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

=91.0 dB $\mu$ V/m – 47.7 dB

=43.3 dB $\mu$ V/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

=84.4 dB $\mu$ V/m – 47.7 dB

=36.7 dB $\mu$ V/m

Upper bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

=91.6 dB $\mu$ V/m – 48.9 dB

=42.7 dB $\mu$ V/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

=85.2 dB $\mu$ V/m – 48.9 dB

=36.3 dB $\mu$ V/m

The resultant field strength meets the general radiated emission limit in Section 15.209, which does not exceed 74 dB $\mu$ V/m (Peak Limit) and 54 dB $\mu$ V/m (Average Limit).

## TEST REPORT

### 8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period ( $T_{eff}$ ) is approximately  $100\mu s$  for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 3MHz, so the pulse desensitivity factor is 0dB.

### 8.3 Calculation of Average Factor

The average factor is not applicable for this device as the transmitted signal is a continuously signal.

## TEST REPORT

### 8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

## TEST REPORT

### 8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

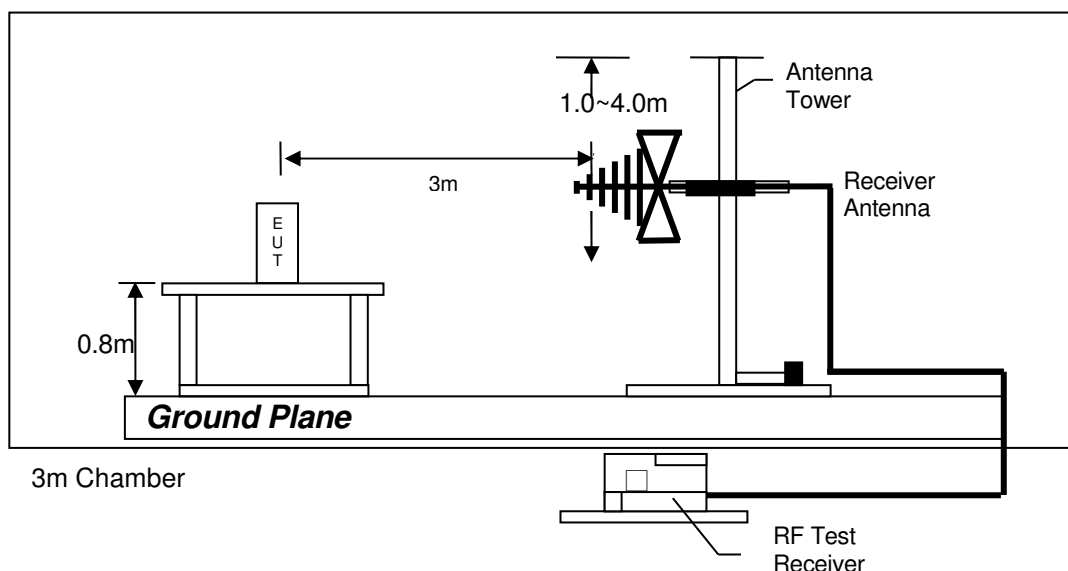
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 3 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

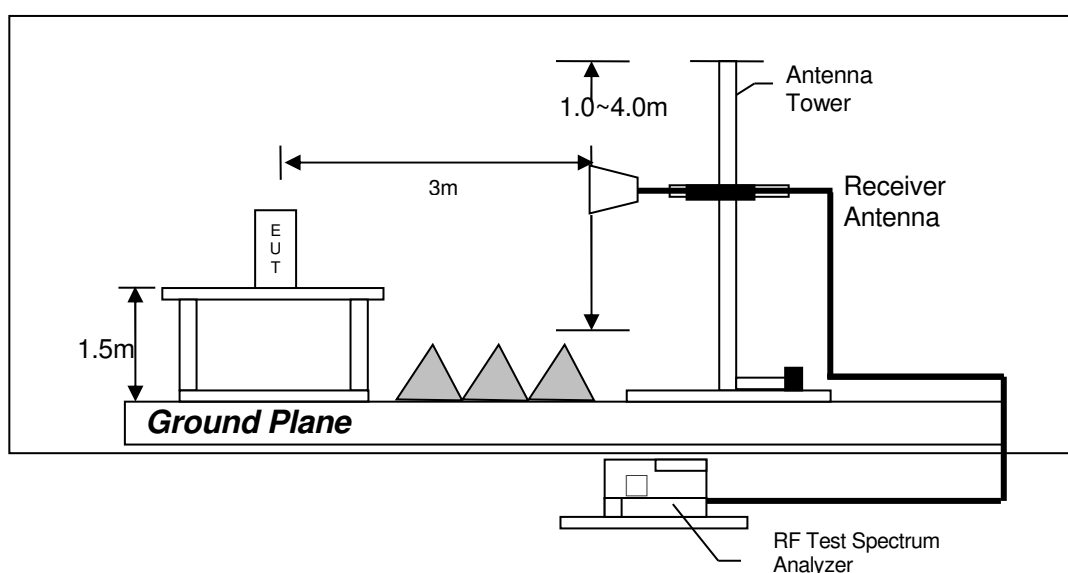
## TEST REPORT

### 8.4.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

## TEST REPORT

### 9.0 EQUIPMENT LIST

#### 1) Radiated Emissions Test

| Equipment            | EMI Test Receiver | Spectrum Analyzer | Biconical Antenna |
|----------------------|-------------------|-------------------|-------------------|
| Registration No.     | EW-3666           | EW-2253           | EW-0571           |
| Manufacturer         | R&S               | ROHDESCHWARZ      | EMCO              |
| Model No.            | ESCI7             | FSP40             | 3104C             |
| Calibration Date     | August 28, 2019   | 18 Nov 2019       | July 23, 2019     |
| Calibration Due Date | August 28, 2020   | 18 Nov 2020       | July 23, 2021     |

| Equipment            | Log Periodic Antenna | Double Ridged Guide Antenna | 14m Double Shield RF Cable<br>(20MHz - 6GHz) |
|----------------------|----------------------|-----------------------------|----------------------------------------------|
| Registration No.     | EW-0447              | EW-1015                     | EW-2528                                      |
| Manufacturer         | EMCO                 | EMCO                        | RADIALL                                      |
| Model No.            | 3146                 | 3115                        | Nm-RG142-                                    |
| Calibration Date     | September 25, 2019   | 16 May 2019                 | 30 Sep 2019                                  |
| Calibration Due Date | March 25, 2021       | 16 Nov 2020                 | 30 Sep 2020                                  |

| Equipment            | Active Loop H-field<br>(9kHz to 30MHz) | RF Preamplifier (9kHz to<br>6000MHz) | RF Cable 14m<br>(1GHz to 26.5GHz) |
|----------------------|----------------------------------------|--------------------------------------|-----------------------------------|
| Registration No.     | EW-3326                                | EW-3006b                             | EW-3151                           |
| Manufacturer         | EMCO                                   | SCHWARZBECK                          | GREATBILLION                      |
| Model No.            | 6502                                   | BBV9718                              | SMA m/SHF5MPU /SMA m<br>ra14m,26G |
| Calibration Date     | March 21, 2019                         | 25 Nov 2019                          | March 04, 2020                    |
| Calibration Due Date | September 21, 2020                     | 25 Nov 2020                          | March 04, 2021                    |

| Equipment            | 2.4GHz Notch Filter | Pyramidal Horn Antenna |
|----------------------|---------------------|------------------------|
| Registration No.     | EW-3435             | EW-0905                |
| Manufacturer         | MICROWAVE           | EMCO                   |
| Model No.            | N0324413            | 3160-09                |
| Calibration Date     | 16 Nov 2019         | July 23, 2019          |
| Calibration Due Date | 16 Nov 2020         | January 23, 2021       |

#### 2) Bandedge Measurement

| Equipment            | RF Cable (up to 40GHz)<br>1.5m length | Spectrum Analyzer |
|----------------------|---------------------------------------|-------------------|
| Registration No.     | EW-3104                               | EW-2253           |
| Manufacturer         | N/A                                   | ROHDESCHWARZ      |
| Model No.            | SMA-M to SMA-M                        | FSP40             |
| Calibration Date     | August 26, 2019                       | 18 Nov 2019       |
| Calibration Due Date | August 26, 2020                       | 18 Nov 2020       |

**END OF TEST REPORT**