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Intertek Testing Services Hong Kong Limited

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## TEST REPORT

Report No.: 15071375HKG-001

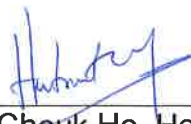
S.E.M. Industries

Application  
For  
Certification  
(Original Grant)  
(FCC ID: 2AANA-SEM-Z255)

Transceiver

Prepared and Checked by:

Approved by:

  
\_\_\_\_\_  
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Lead Engineer  
\_\_\_\_\_  
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Senior Supervisor  
Date: August 17, 2015

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## GENERAL INFORMATION

|                           |                                                                                      |
|---------------------------|--------------------------------------------------------------------------------------|
| Grantee:                  | S.E.M. Industries                                                                    |
| Grantee Address:          | 35/F., Tower A, Billion Centre,<br>No. 1 Wang Kwong Road, Kowloon Bay,<br>Hong Kong. |
| Contact Person:           | Manoj Sabnani                                                                        |
| Tel:                      | (852) 3761-8000                                                                      |
| Fax:                      | (852) 3761-8039                                                                      |
| e-mail:                   | N/A                                                                                  |
| Manufacturer:             | N/A                                                                                  |
| Manufacturer Address:     | N/A                                                                                  |
| Brand Name:               | S.E.M., S-LOGO, NIL, SDIGITAL,<br>S.E.M. AUDIO LABORATORIES, S-DIGITAL /<br>MEMOREX  |
| Model:                    | Z-255-BTPFU5W                                                                        |
|                           | Z-255-BT, Z-255-PM3UCi, Z-255-PFM3Ui, Z-255 /<br>MXCD512                             |
| Type of EUT:              | Transceiver                                                                          |
| Description of EUT:       | Micro Hi-Fi System                                                                   |
| Serial Number:            | N/A                                                                                  |
| FCC ID:                   | 2AANA-SEM-Z255                                                                       |
| Date of Sample Submitted: | July 27, 2015                                                                        |
| Date of Test:             | July 27, 2015 to August 11, 2015                                                     |
| Report No.:               | 15071375HKG-001                                                                      |
| Report Date:              | August 17, 2015                                                                      |
| Environmental Conditions: | Temperature: +10 to 40°C<br>Humidity: 10 to 90%                                      |



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## SUMMARY OF TEST RESULT

| TEST SPECIFICATION                         | REFERENCE      | RESULTS |
|--------------------------------------------|----------------|---------|
| Transmitter Power Line Conducted Emissions | 15.207         | Pass    |
| 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, 2014 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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## 1.0 General Description

### 1.1 Product Description

The Equipment Under Test (EUT) is a Micro Hi-Fi System that can accept audio sources including CD, FM Tuner, analog line-in and Bluetooth devices. The Bluetooth module in the EUT is operating in the frequency range from 2402MHz TO 2480MHz (79 channels with 1MHz channel spacing). The EUT contains USB port for 5V DC charging, The EUT is powered by 100-240VAC.

The Model: Z-255-BT, Z-255-PM3UCi, Z-255-PFM3Ui, Z-255 and MXCD512 are the same as the Model: Z-255-BTPFU5W in hardware aspect. The difference in color, cosmetic details, model number and brand name serves as marketing strategy.

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

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2009). 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 and conducted measurement facility 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. 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 C63.4 (2009).

The device was powered by 120VAC.

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 rear of unit shall be flushed with the rear of the table.

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

There was no special software to exercise the device. Once the unit is powered up, it transmits the RF signal continuously.

### 2.3 Special Accessories

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



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## 2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

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. Resistive Load (5-ohm)
2. USB cable of 1.2m long (for charging purpose)  
(Provided by Intertek)
3. Stereo Loudspeaker with cable of 2m long
4. Software: Beken BK3256  
(Provided by Applicant)

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### 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 32 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 317.932 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 2.0 dB

### 3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.168 MHz

For electronic filing, the worst case line-conducted configuration photographs are saved with filename: conducted photo.pdf.

### 3.5 Conducted Emission Data

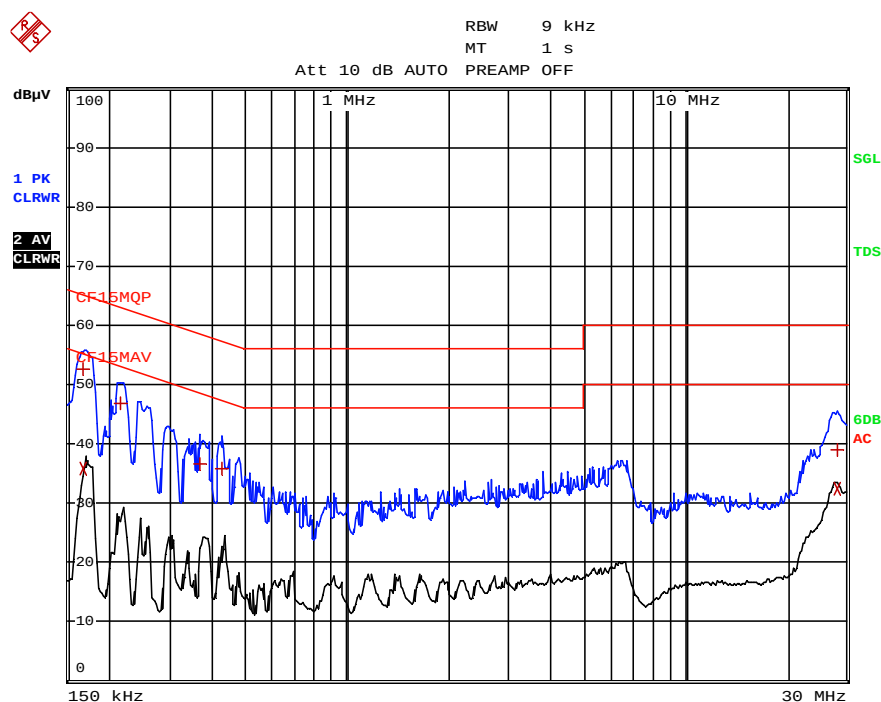
For electronic filing, the graph and data table of conducted emission is saved with filename: conducted.pdf.

Judgment: Pass by 12.5 dB

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Worst-Case Operating Mode: Bluetooth Transmitting



| EDIT PEAK LIST (Final Measurement Results) |            |            |    |                |
|--------------------------------------------|------------|------------|----|----------------|
| Trace1:                                    | CF15MQP    |            |    |                |
| Trace2:                                    | CF15MAV    |            |    |                |
| Trace3:                                    | ---        |            |    |                |
| TRACE                                      | FREQUENCY  | LEVEL dBμV |    | DELTA LIMIT dB |
| 1 Quasi Peak                               | 168 kHz    | 52.58      | L1 | -12.47         |
| 2 CISPR Average                            | 168 kHz    | 35.84      | N  | -19.21         |
| 1 Quasi Peak                               | 217.5 kHz  | 46.90      | N  | -16.00         |
| 1 Quasi Peak                               | 366 kHz    | 36.70      | N  | -21.88         |
| 1 Quasi Peak                               | 424.5 kHz  | 35.82      | L1 | -21.53         |
| 2 CISPR Average                            | 28.104 MHz | 32.38      | L1 | -17.61         |
| 1 Quasi Peak                               | 28.149 MHz | 38.86      | N  | -21.13         |

Note: Measurement Uncertainty is  $\pm 4.2$  dB at a level of confidence of 95%.

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Applicant: S.E.M. Industries  
Model: Z-255-BTPFU5W  
Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Date of Test: August 11, 2015

Table 1  
**Radiated Emissions**  
**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 - Peak (dBμV/m) | Average Factor (dB) | Calculated at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB) |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------|---------------------------|------------------------------|-------------|
| V            | 2402.000         | 92.4           | 33                | 29.4                | 88.8                      | 24                  | 64.8                      | 94.0                         | -29.2       |
| <b>V</b>     | <b>4804.000</b>  | <b>54.8</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.7</b>               | <b>24</b>           | <b>32.7</b>               | <b>54.0</b>                  | -21.3       |
| V            | 7206.000         | 58.4           | 33                | 37.9                | 63.3                      | 24                  | 39.3                      | 54.0                         | -14.7       |
| V            | 9608.000         | 50.1           | 33                | 40.4                | 57.5                      | 24                  | 33.5                      | 54.0                         | -20.5       |
| <b>V</b>     | <b>12010.000</b> | <b>50.8</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.3</b>               | <b>24</b>           | <b>34.3</b>               | <b>54.0</b>                  | -19.7       |
| V            | 14412.000        | 53.0           | 33                | 40.0                | 60.0                      | 24                  | 36.0                      | 54.0                         | -18.0       |

| 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         | 92.4           | 33                | 29.4                | 88.8                      | 114.0                     | -25.2        |
| <b>V</b>     | <b>4804.000</b>  | <b>54.8</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.7</b>               | <b>74.0</b>               | <b>-17.3</b> |
| V            | 7206.000         | 58.4           | 33                | 37.9                | 63.3                      | 74.0                      | -10.7        |
| V            | 9608.000         | 50.1           | 33                | 40.4                | 57.5                      | 74.0                      | -16.5        |
| <b>V</b>     | <b>12010.000</b> | <b>50.8</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.3</b>               | <b>74.0</b>               | <b>-15.7</b> |
| V            | 14412.000        | 53.0           | 33                | 40.0                | 60.0                      | 74.0                      | -14.0        |

NOTES: 1. Peak Detector Data unless otherwise stated.

- All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- Negative sign in the column shows value below limit.
- Horn antenna is used for the emission over 1000MHz.
- Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
- Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

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Applicant: S.E.M. Industries

Date of Test: August 11, 2015

Model: Z-255-BTPFU5W

Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Table 2  
**Radiated Emissions**  
**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 - Peak (dBμV/m) | Average Factor (dB) | Calculated at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB) |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------|---------------------------|------------------------------|-------------|
| V            | 2442.000         | 93.0           | 33                | 29.4                | 89.4                      | 24                  | 65.4                      | 94.0                         | -28.6       |
| <b>V</b>     | <b>4884.000</b>  | <b>54.3</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.2</b>               | <b>24</b>           | <b>32.2</b>               | <b>54.0</b>                  | -21.8       |
| <b>V</b>     | <b>7326.000</b>  | <b>58.1</b>    | <b>33</b>         | <b>37.9</b>         | <b>63.0</b>               | <b>24</b>           | <b>39.0</b>               | <b>54.0</b>                  | -15.0       |
| V            | 9768.000         | 49.9           | 33                | 40.4                | 57.3                      | 24                  | 33.3                      | 54.0                         | -20.7       |
| <b>V</b>     | <b>12210.000</b> | <b>51.3</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.8</b>               | <b>24</b>           | <b>34.8</b>               | <b>54.0</b>                  | -19.2       |
| V            | 14652.000        | 54.8           | 33                | 38.4                | 60.2                      | 24                  | 36.2                      | 54.0                         | -17.8       |

| 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            | 2442.000         | 93.0           | 33                | 29.4                | 89.4                      | 114.0                     | -24.6        |
| <b>V</b>     | <b>4884.000</b>  | <b>54.3</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.2</b>               | <b>74.0</b>               | <b>-17.8</b> |
| <b>V</b>     | <b>7326.000</b>  | <b>58.1</b>    | <b>33</b>         | <b>37.9</b>         | <b>63.0</b>               | <b>74.0</b>               | <b>-11.0</b> |
| V            | 9768.000         | 49.9           | 33                | 40.4                | 57.3                      | 74.0                      | -16.7        |
| <b>V</b>     | <b>12210.000</b> | <b>51.3</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.8</b>               | <b>74.0</b>               | <b>-15.2</b> |
| V            | 14652.000        | 54.8           | 33                | 38.4                | 60.2                      | 74.0                      | -13.8        |

NOTES: 1. Peak Detector Data unless otherwise stated.

- All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- Negative sign in the column shows value below limit.
- Horn antenna is used for the emission over 1000MHz.
- Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
- Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

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Applicant: S.E.M. Industries

Date of Test: August 11, 2015

Model: Z-255-BTPFU5W

Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Table 3  
**Radiated Emissions**  
**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 - Peak (dBμV/m) | Average Factor (dB) | Calculated at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) | Margin (dB) |
|--------------|------------------|----------------|-------------------|---------------------|---------------------------|---------------------|---------------------------|------------------------------|-------------|
| V            | 2480.000         | 93.4           | 33                | 29.4                | 89.8                      | 24                  | 65.8                      | 94.0                         | -28.2       |
| <b>V</b>     | <b>4960.000</b>  | <b>54.5</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.4</b>               | <b>24</b>           | <b>32.4</b>               | <b>54.0</b>                  | -21.6       |
| <b>V</b>     | <b>7440.000</b>  | <b>58.5</b>    | <b>33</b>         | <b>37.9</b>         | <b>63.4</b>               | <b>24</b>           | <b>39.4</b>               | <b>54.0</b>                  | -14.6       |
| V            | 9920.000         | 50.3           | 33                | 40.4                | 57.7                      | 24                  | 33.7                      | 54.0                         | -20.3       |
| <b>V</b>     | <b>12400.000</b> | <b>51.4</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.9</b>               | <b>24</b>           | <b>34.9</b>               | <b>54.0</b>                  | -19.1       |
| V            | 14880.000        | 55.1           | 33                | 38.4                | 60.5                      | 24                  | 36.5                      | 54.0                         | -17.5       |

| 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            | 2480.000         | 93.4           | 33                | 29.4                | 89.8                      | 114.0                     | -24.2        |
| <b>V</b>     | <b>4960.000</b>  | <b>54.5</b>    | <b>33</b>         | <b>34.9</b>         | <b>56.4</b>               | <b>74.0</b>               | <b>-17.6</b> |
| <b>V</b>     | <b>7440.000</b>  | <b>58.5</b>    | <b>33</b>         | <b>37.9</b>         | <b>63.4</b>               | <b>74.0</b>               | <b>-10.6</b> |
| V            | 9920.000         | 50.3           | 33                | 40.4                | 57.7                      | 74.0                      | -16.3        |
| <b>V</b>     | <b>12400.000</b> | <b>51.4</b>    | <b>33</b>         | <b>40.5</b>         | <b>58.9</b>               | <b>74.0</b>               | <b>-15.1</b> |
| V            | 14880.000        | 55.1           | 33                | 38.4                | 60.5                      | 74.0                      | -13.5        |

NOTES: 1. Peak Detector Data unless otherwise stated.

- All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- Negative sign in the column shows value below limit.
- Horn antenna is used for the emission over 1000MHz.
- Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
- Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.

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Applicant: S.E.M. Industries  
Model: Z-255-BTPFU5W  
Worst-Case Operating Mode: Bluetooth Sound Playing

Date of Test: August 11, 2015

Table 4  
**Radiated Emissions**  
**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            | 32.242          | 34.5           | 16           | 10.0                | 28.5               | 40.0                 | -11.5        |
| V            | 40.948          | 42.0           | 16           | 10.0                | 36.0               | 40.0                 | -4.0         |
| V            | 85.490          | 36.3           | 16           | 8.0                 | 28.3               | 40.0                 | -11.7        |
| V            | 159.279         | 29.5           | 16           | 16.0                | 29.5               | 43.5                 | -14.0        |
| V            | 188.219         | 25.5           | 16           | 16.0                | 25.5               | 43.5                 | -18.0        |
| V            | 237.968         | 35.3           | 16           | 19.0                | 38.3               | 46.0                 | -7.7         |
| V            | <b>277.728</b>  | <b>34.6</b>    | <b>16</b>    | <b>22.0</b>         | <b>40.6</b>        | <b>46.0</b>          | <b>-5.4</b>  |
| V            | 317.932         | 37.0           | 16           | 23.0                | 44.0               | 46.0                 | -2.0         |
| V            | 356.992         | 26.2           | 16           | 24.0                | 34.2               | 46.0                 | -11.8        |
| V            | 397.000         | 32.4           | 16           | 25.0                | 41.4               | 46.0                 | -4.6         |
| V            | 437.249         | 22.5           | 16           | 26.0                | 32.5               | 46.0                 | -13.5        |
| V            | 467.827         | 31.8           | 16           | 26.0                | 41.8               | 46.0                 | -4.2         |
| V            | 516.918         | 22.8           | 16           | 27.0                | 33.8               | 46.0                 | -12.2        |
| V            | 595.568         | 23.4           | 16           | 29.0                | 36.4               | 46.0                 | -9.6         |
| V            | 677.406         | 24.4           | 16           | 29.0                | 37.4               | 46.0                 | -8.6         |
| V            | 755.751         | 25.2           | 16           | 30.0                | 39.2               | 46.0                 | -6.8         |
| V            | 835.055         | 26.0           | 16           | 31.0                | 41.0               | 46.0                 | -5.0         |
| V            | 913.813         | 22.4           | 16           | 33.0                | 39.4               | 46.0                 | -6.6         |
| V            | <b>996.786</b>  | <b>18.7</b>    | <b>16</b>    | <b>33.0</b>         | <b>35.7</b>        | <b>54.0</b>          | <b>-18.3</b> |

NOTES: 1. Peak Detector Data unless otherwise stated.

- All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- Negative sign in the column shows value below limit.
- Horn antenna is used for the emission over 1000MHz.
- Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
- Measurement Uncertainty is  $\pm 5.3$ dB at a level of confidence of 95%.



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#### 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.

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## 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.

### 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 C63.4 (2009) for frequency being measured.

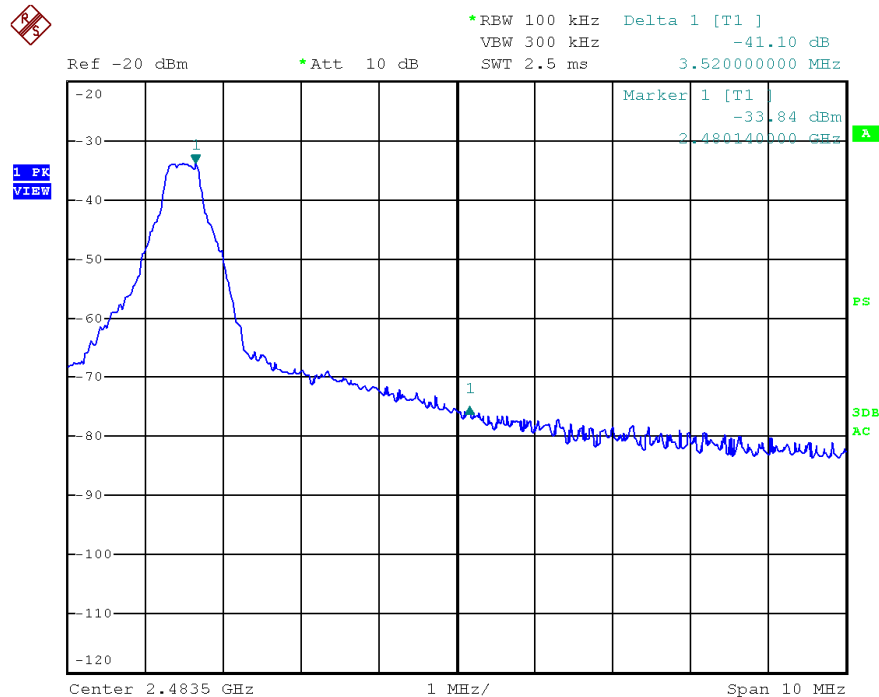
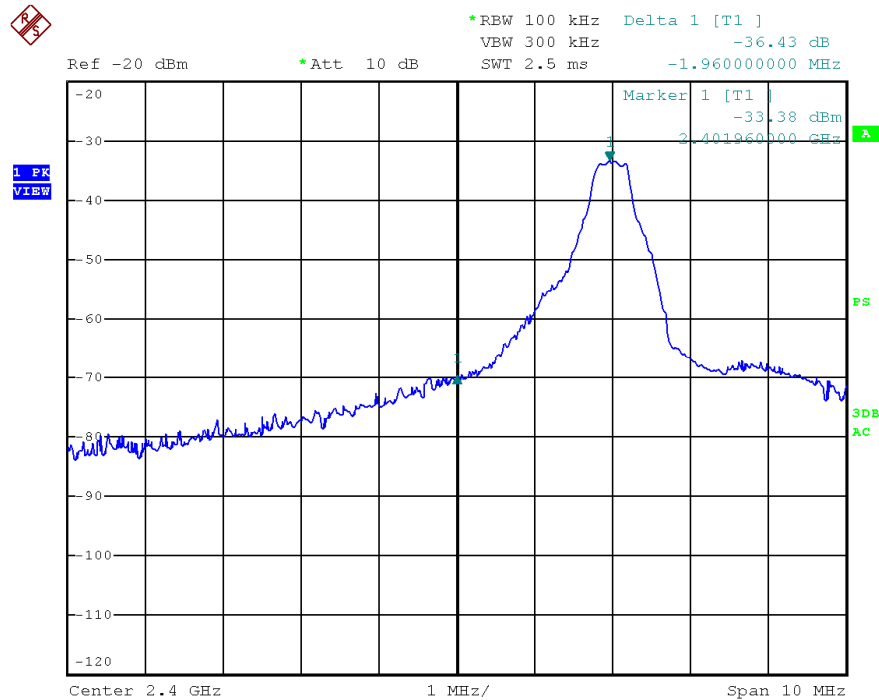
Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50dB below the level of the fundamental or to the general radiated emissions limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).

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### Peak Measurement (Bluetooth 3.0)



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Peak Measurement (Bluetooth 3.0)

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

=88.8 dB $\mu$ V/m - 36.4 dB

=52.4 dB $\mu$ V/m

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

=64.8 dB $\mu$ V/m - 36.4 dB

=28.4 dB $\mu$ V/m

Upper bandedge

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

=89.8 dB $\mu$ V/m - 41.1 dB

=48.7 dB $\mu$ V/m

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

=65.8 dB $\mu$ V/m - 41.1 dB

=24.7dB $\mu$ 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).

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## 8.2 Discussion of Pulse Desensitization

(Bluetooth 3.0)

Pulse desensitivity is not applicable for this device. The effective period ( $T_{eff}$ ) is approximately 0.625ms for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

## 8.3 Calculation of Average Factor

(Bluetooth 3.0)

Based on the Bluetooth Specification Version 3.0 + EDR, the transmitter ON time for each timeslot of Bluetooth is 625 $\mu$ s. DH5 has the maximum duty cycle, which consists of 5 continuous Tx slots and 1 Rx slot. Therefore one hopset take  $(5+1) \times 625\mu s = 3.75ms$ . For one period for a pseudo-random hopping through at least 20 RF channels in adaptive mode (worse case), it take:  $20 \times 3.75ms = 75ms$ .

The dwell time for DH5 is  $5 \times 625\mu s = 3.125ms$ .

For the worst case calculation, there are two transmissions might occur in 100ms. Therefore,

$$\begin{aligned}\text{Duty Cycle (DC)} &= \text{Maximum On time in } 100ms/100ms \\ &= 3.125ms \times 2/100ms \\ &= 0.0625\end{aligned}$$

$$\begin{aligned}\text{Average Factor (AF) of Bluetooth in dB} &= 20 \log_{10} (0.0625) \\ &= -24 \text{ dB}\end{aligned}$$



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## 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 one meter in height above the ground plane. 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. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.



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#### 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 C63.4 (2009).

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 1 MHz is used.

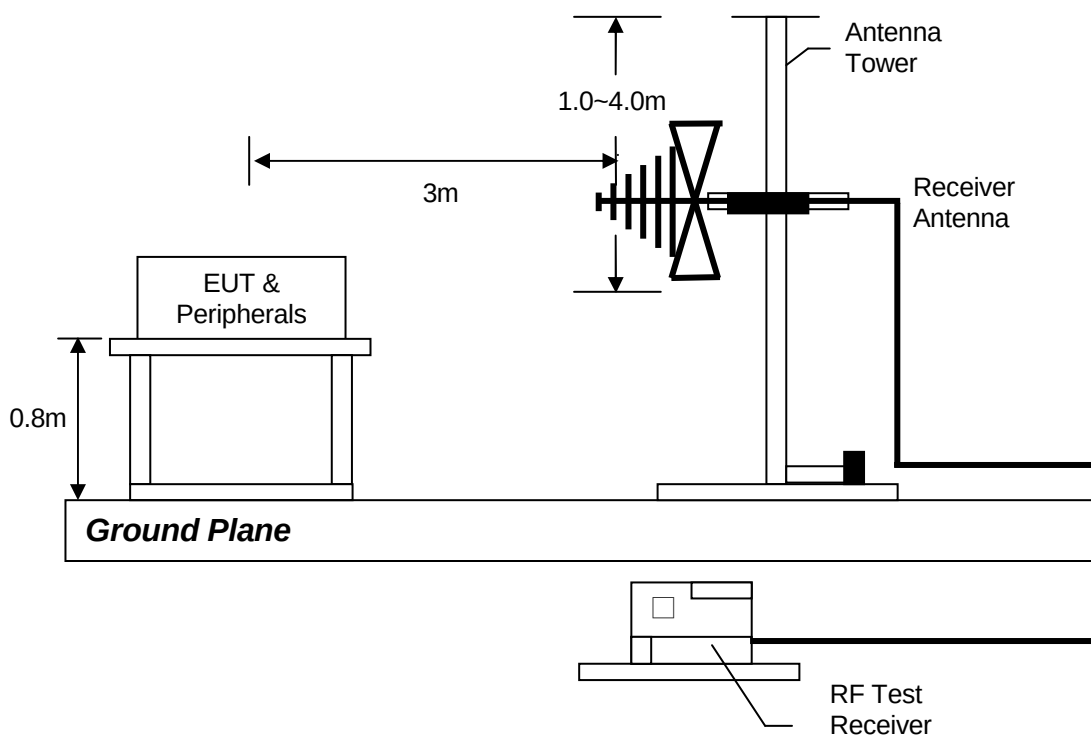
Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling,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

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#### 8.4.1 Radiated Emission Test Setup

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



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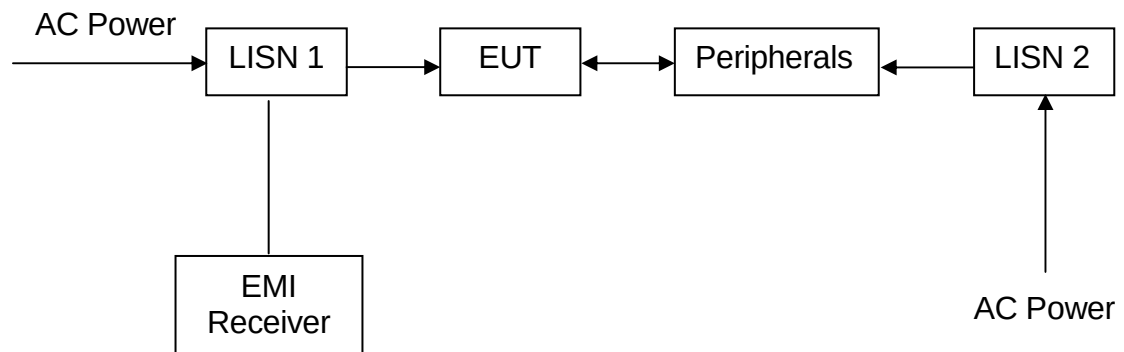
HKAS has accredited this laboratory (Reg. No. HOKLAS 005) under HOKLAS for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories.

#### 8.4.2 Conducted Emission Test Procedures

For tabletop equipment, the EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table. For floor-standing equipment, the EUT and all cables were insulated, if required, from the ground plane by up to 12 mm of insulating material. The EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were moved to find the maximum emission.

#### 8.4.3 Conducted Emission Test Setup



#### 9.0 Confidentiality Request

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

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## 10.0 Equipment List

### 1) Radiated Emissions Test

| Equipment            | EMI Test Receiver | Biconical Antenna | Log Periodic Antenna |
|----------------------|-------------------|-------------------|----------------------|
| Registration No.     | EW-3095           | EW-2512           | EW-0447              |
| Manufacturer         | R&S               | EMCO              | EMCO                 |
| Model No.            | ESCI              | 3104C             | 3146                 |
| Calibration Date     | Oct. 16, 2014     | Jan. 22, 2015     | Mar. 16, 2015        |
| Calibration Due Date | Oct. 16, 2015     | Jul. 22, 2016     | Sep. 16, 2016        |

| Equipment            | Spectrum Analyzer | Pyramidal Horn Antenna | Double Ridged Guide Antenna |
|----------------------|-------------------|------------------------|-----------------------------|
| Registration No.     | EW-2466           | EW-0905                | EW-1015                     |
| Manufacturer         | R&S               | EMCO                   | EMCO                        |
| Model No.            | FSP30             | 3160-09                | 3115                        |
| Calibration Date     | Sep. 02, 2014     | Jun. 05, 2014          | Oct. 28, 2014               |
| Calibration Due Date | Sep. 02, 2015     | Dec. 05, 2015          | Apr. 28, 2016               |

### 2) Conducted Emissions Test

| Equipment            | EMI Test Receiver | LISN          |
|----------------------|-------------------|---------------|
| Registration No.     | EW-2500           | EW-2501       |
| Manufacturer         | R&S               | R&S           |
| Model No.            | ESCI              | ENV-216       |
| Calibration Date     | Nov. 06, 2014     | Jan. 15, 2015 |
| Calibration Due Date | Nov. 06, 2015     | Jan. 15, 2016 |

### 3) Bandedge Measurement

| Equipment            | Spectrum Analyzer |
|----------------------|-------------------|
| Registration No.     | EW-2249           |
| Manufacturer         | R&S               |
| Model No.            | FSP30             |
| Calibration Date     | Nov. 19, 2014     |
| Calibration Due Date | Nov. 19, 2015     |

END OF TEST REPORT