

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer: OHSUNG ELECTRONICS CO., LTD.

Date of Issue: July 25, 2011

#181 Gongdan-dong, Gumi-si, Gyeongbuk

Order Number: GETEC-C1-11-128

Republic of Korea.

Test Report Number: GETEC-E3-11-051

Attn : Mr. Hak-Ki Kim / General Manager

Test Site: Gumi College EMC Center

FCC Registration Number: (100749, 443957)

FCC ID. : OZ5URCMX780

Applicant : OHSUNG ELECTRONICS CO., LTD.

Rule Part(s) : FCC Part 15 Subpart C-Intentional Radiator § 15.231

Equipment Class : Remote Control Transmitter (DSC)

EUT Type : RF REMOTE CONTROLLER

Type of Authority : Certification

Model Name : MX-780

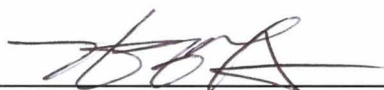
Trade Name : UNIVERSAL Remote Control

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Reviewed by,



Hyoung-Seop Kim, Senior Engineer
GUMI College EMC center



Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



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Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: OHSUNG ELECTRONICS CO., LTD.

Applicant Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea.

Manufacturer: OHSUNG ELECTRONICS CO., LTD.

Manufacturer Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea.

Contact Person: Mr. Hak-Ki Kim / General Manager

Tel. Number: +82-54-468-0831 Fax Number: +82-54-461-8368

- **FCC ID.** OZ5URCMX780
- **Equipment Class** Remote Control Transmitter (DSC)
- **EUT Type** RF REMOTE CONTROLLER
- **Model Name** MX-780
- **Trade Name** UNIVERSAL Remote Control
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart C
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** July 5, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749, 443957)
407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-11-051
- **Dates of Issue** July 19, 2011

EUT Type: RF REMOTE CONTROLLER

FCC ID.: OZ5URCMX780



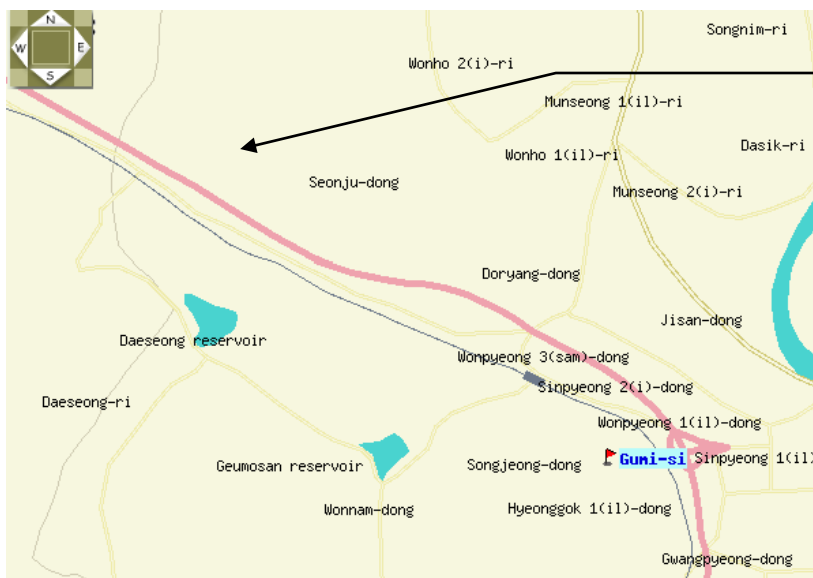
2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER(Model Name: MX-780) FCC ID.: OZ5URCMX780**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.

This test site is one of the highest point of Gumi 1 college at about 200 km away from Seoul city and 40 km away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of FCC §2.948 according to ANSI C63.4 (2003)



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Fig 1. The map above shows the Gumi College in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER (Model Name: MX-780) FCC ID.: OZ5URCMX780**

Specifications

Microprocessor: ARM7TDMI

FLASH: 32Mbit Nor FLASH

Display: 1.46" PMOLED (128 x 128)

Total Customization Capability: Up to 48 devices and up to 8 pages each for a total of 384 pages.

Learning Capability: Standard frequencies (15kHz to 460kHz)

Macro Capability: Up to 255 steps each

IR Range (Line of Sight via Infrared): 30-50 feet, depending on the environment

RF Range (radio frequency): 50 to 100 feet, depending upon the environment

RF Frequency: 418MHz

Weight: 8.5 oz. (with battery)

Size: 8.7"H x 2.2"W x 1.3"D

Batteries: Four AA Alkaline Batteries (included)

RF Frequency : Main board: 8 MHz, 18.432 MHz
RF module board: 13.0625 MHz



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

| Description | Manufacturer | Model Name | S/N & FCC ID |
|-------------|--------------|------------|---------------------|
| None. | - | - | S/N: - FCC ID: - |

See "Appendix D- Test Setup Photographs" for actual system test set-up

3.2.2 System configuration

| Description | Manufacturer | Model Name | S/N & FCC ID. |
|-------------|--------------|------------|----------------------|
| None. | - | - | S/N: - FCC ID.: - |

3.2.3 Used Cable(s)

| Cable Name | Condition | Description |
|------------|-----------|-------------|
| None. | - | - |

3.3 Modification Item(s)

- None



4. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

4.1 Description of Antenna

The **OHSUNG ELECTRONICS CO., LTD. / RF Transmitter Universal Remote Control** comply with the requirement of §15.203 with a built-in looped antenna permanently attached to the transmitter.

5. Description of tests

5.1 Test Condition

- Test Voltage / Frequency : DC 6 V supplied from the four DC 1.5 V AA size batteries
- Test Mode(s): Continuous RF transmitting mode



5.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).

The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.

The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

Each EME reported was calibrated using the R/S signal generator

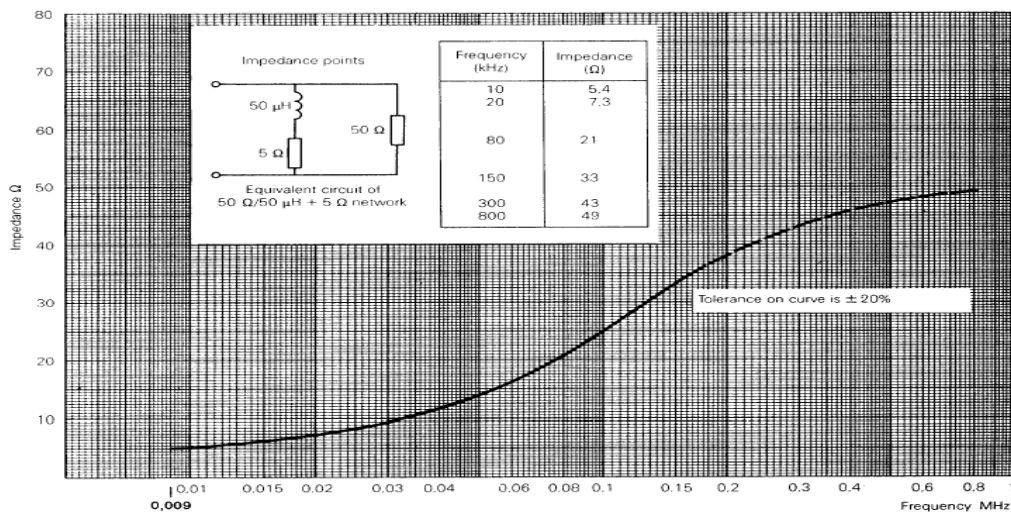


Fig 2. Impedance of LISN



5.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal.

The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m × 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator

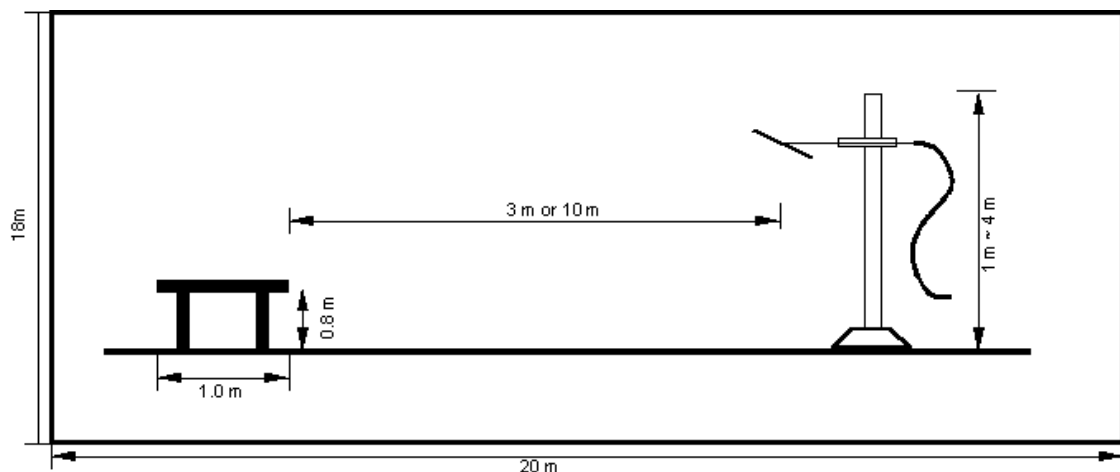


Fig 3. Dimensions of test site.



5.4 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity. This calculation is applied to limits for pulsed licensed and unlicensed devices.

For unlicensed intentional radiator under 47CFR Part 15 §15.35, all duty cycle measurements are compared to a 100 millisecond period.

On time = $N_1L_1 + N_2L_2 + \dots + N_nL_n$, where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.

Duty Cycle = On time/100 millisecond.

5.5 Occupied Bandwidth

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for device operating above 70 MHz and below 900 MHz. For device operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. The bandwidth is determined at the points 20 dB down from the modulated carrier.



6. Duty Cycle Correction

6.1 Operating Environment

Temperature : 24.0 °C
 Relative humidity : 42.0 % R.H.

6.2 Test Set-up

The spectrum analyzer was set to Zero span and the video triggered to collect the pulse train of the modulation. Calculations of the duty cycle correction factor were obtained from time data provided by the plots.

6.3 Test Equipment used

| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|--------------|-----------------|------------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |
| ■ - VULB9160 | Schwarzbeck | Broadband Test Antenna | 3193 | 03. 15. 2012 |

6.4 Test result of Duty Cycle

- Test Date : July 5, 2011
 - Reference Standard : Part 15 Subpart C, Sec. 15.231 (a)(1)
 - Operating Condition : RF transmitting mode
 - Spectrum Resolution Bandwidth (6 dB) : 100 kHz

6.4.1 Test Frequency: 418 MHz

Define of duty cycle

- Number of Code groups per 100 ms = 1
- Number of Wide Pulse = 335
- Width of Pulses = 0.006 ms
- Number of Narrow Pulse = 693
- Width of Pulses = 0.006 ms

Calculation of duty cycle

- Total width of pulse train: $(335 \times 0.006 \text{ ms}) + (693 \times 0.006 \text{ ms}) = 6.17 \text{ ms}$
- Duty Cycle (%): $6.168 \text{ ms} / 100 \text{ ms} = 6.17 \%$
- Duty Cycle (dB): - 24.20 dB

| Fundamental Frequency | Total width of ON-Time | Duty Cycle (%) | Duty Cycle (dB) |
|-----------------------|------------------------|----------------|-----------------|
| 418 MHz | 6.17 ms | 6.17 % | - 24.20 dB |

Refer to APPENDIX B: Test Plots of complete Pulse Train



7. Activation time

7.1 Operating Environment

Temperature : 24.0 °C
 Relative humidity : 42.0 % R.H.

7.2 Limit

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

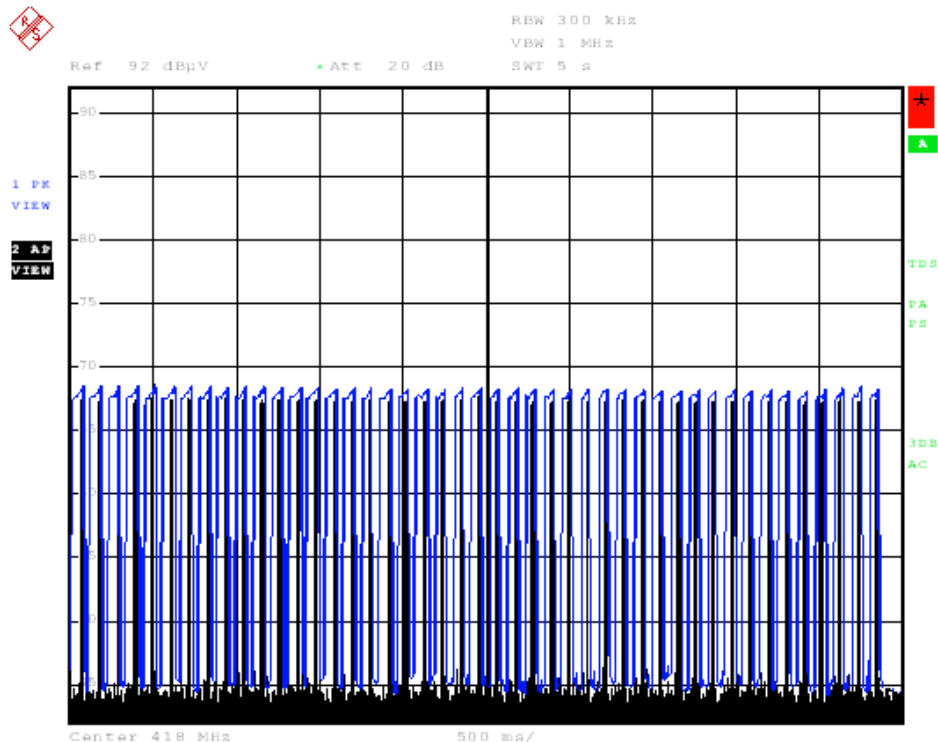
7.3 Test Equipment used

| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|--------------|-----------------|------------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |
| ■ - VULB9160 | Schwarzbeck | Broadband Test Antenna | 3193 | 03. 15. 2012 |

7.4 Test result of Activation time

- Test Date : July 5, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.35
- Operating Condition : RF transmitting mode
- Spectrum Resolution Bandwidth (6 dB) : 300 kHz

| Fundamental Frequency | Activate ON-Time | Limit | Result |
|-----------------------|------------------|-------|--------|
| 418 MHz | 4.80 s | < 5 s | PASS |





8. Radiated Emission

8.1 Operating environment

Temperature : 24.0 °C
Relative humidity : 42.0 % R.H.

8.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.

The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

8.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

| Test items(Anechoic Chamber) | Uncertainty | Remark |
|--|-------------|---------------------------------------|
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical) | ± 4.38 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal) | ± 3.50 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical) | ± 3.75 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal) | ± 3.59 dB | Confidence levels of 95 % ($k = 2$) |



8.4 Limit

| Fundamental Frequency (MHz) | Field strength of Fundamental | | | Field strength of Spurious Emission | |
|-----------------------------|-------------------------------|--------------------|-------------------------|-------------------------------------|--------------------|
| | $\mu\text{V/m}$ | dB $\mu\text{V/m}$ | $\mu\text{V/m}$ | $\mu\text{V/m}$ | dB $\mu\text{V/m}$ |
| 40.66 ~ 40.7 | 2 250 | 67.04 | | 225 | 47.04 |
| 70 ~ 130 | 1 250 | 61.94 | | 125 | 41.94 |
| 130 ~ 174 | 1 250 to 3 750 | 61.94 to 71.48 | 56.818 18(F)-6136.363 6 | 125 to 375 | 41.94 to 51.48 |
| 174 ~ 260 | 3 750 | 71.48 | | 375 | 51.48 |
| 260 ~ 470 | 3 750 to 12 500 | 71.48 to 81.94 | 41.666 7(F)-7083.333 3 | 375 to 1 250 | 51.48 to 61.94 |
| Above 470 | 12 500 | 81.94 | | 1 250 | 61.94 |
| Restricted Band | N/A | | | 500 | 54.0 |

8.5 Test Equipment used

| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|-------------------------------|-----------------|------------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |
| ■ - VULB9160 | Schwarzbeck | Broadband Test Antenna | 3193 | 03. 15. 2012 |
| ■ - BBHA9120D | Schwarzbeck | Horn Antenna | 207 | 12. 22. 2011 |
| ■ - MCU066 | maturo GmbH | Position Controller | 1390306 | N/A |
| ■ - TT2.5SI | maturo GmbH | Turntable | 1390307 | N/A |
| ■ - AM 4.0 | maturo GmbH | Antenna Mast | 1390308 | N/A |
| ■ - AFS 44 00101800-25-10P-44 | MITEQ | Preamplifier | 1258943 | 11. 12. 2011 |



8.6 Test data for Radiated Emission

- Test Date : July 5, 2011
- Reference Standard : Part 15 Subpart C, Sec.15.231
- Measuring Distance : 3 m
- Spectrum Resolution Bandwidth (6 dB): 120 kHz/1 MHz
- Note : Through three orthogonal axes were investigated and the worst case is reported.

8.6.1 Operating condition: Continuous RF transmitting mode (418 MHz)

- ♦ Field Strength of the fundamental & harmonic frequencies.
 Detector mode: Peak detector mode / Average detector mode

| Frequency (MHz) | Measurement Level | | | | | Limit | | Margin | | Positioning System | | |
|--------------------|-------------------|-----------------|-----------------|---------------|------------------|---------------|-----------------|---------------|---------------|--------------------|------------|-------------|
| | Reading (dBuV) | Tranduce (dB/m) | Duty cycle (dB) | Peak (dBuV/m) | Average (dBuV/m) | Peak (dBuV/m) | Aveage (dBuV/m) | Peak (dBuV/m) | Averag (dBuV/ | Pol. (H/V) | Heigh (cm) | Angle (deg) |
| Fundamental | | | | | | | | | | | | |
| 418.00 | 79.44 | 20.06 | -24.20 | 99.50 | 75.30 | 100.28 | 80.28 | 0.78 | 4.98 | H | 100 | 90 |
| Spurious | | | | | | | | | | | | |
| 836.00 | 20.90 | 27.90 | -24.20 | 48.80 | 24.60 | 80.28 | 60.28 | 31.48 | 35.68 | H | 100 | 248 |
| 1254.00 | 93.72 | -13.72 | -24.20 | 80.00 | 55.80 | 80.28 | 60.28 | 0.28 | 4.48 | V | 100 | 0 |
| 1672.00 | 80.56 | -12.56 | -24.20 | 68.00 | 43.80 | 74.00 | 54.00 | 6.00 | 10.20 | H | 100 | 188 |
| 2090.00 | 63.06 | -11.26 | -24.20 | 51.80 | 27.60 | 80.28 | 60.28 | 28.48 | 32.68 | V | 150 | 0 |
| 2508.00 | 71.78 | -9.48 | -24.20 | 62.30 | 38.10 | 80.28 | 60.28 | 17.98 | 22.18 | H | 116 | 109 |
| 2926.00 | 67.89 | -7.69 | -24.20 | 60.20 | 36.00 | 80.28 | 60.28 | 20.08 | 24.28 | H | 100 | 16 |
| 3344.00 | 67.58 | -5.98 | -24.20 | 61.60 | 37.40 | 80.28 | 60.28 | 18.68 | 22.88 | V | 113 | 357 |
| 3762.00 | 65.90 | -4.30 | -24.20 | 61.60 | 37.40 | 74.00 | 54.00 | 12.40 | 16.60 | V | 150 | 0 |
| 4180.00 | 62.9 | -2.94 | -24.20 | 60.00 | 35.80 | 74.00 | 54.00 | 14.00 | 18.20 | V | 145 | 0 |

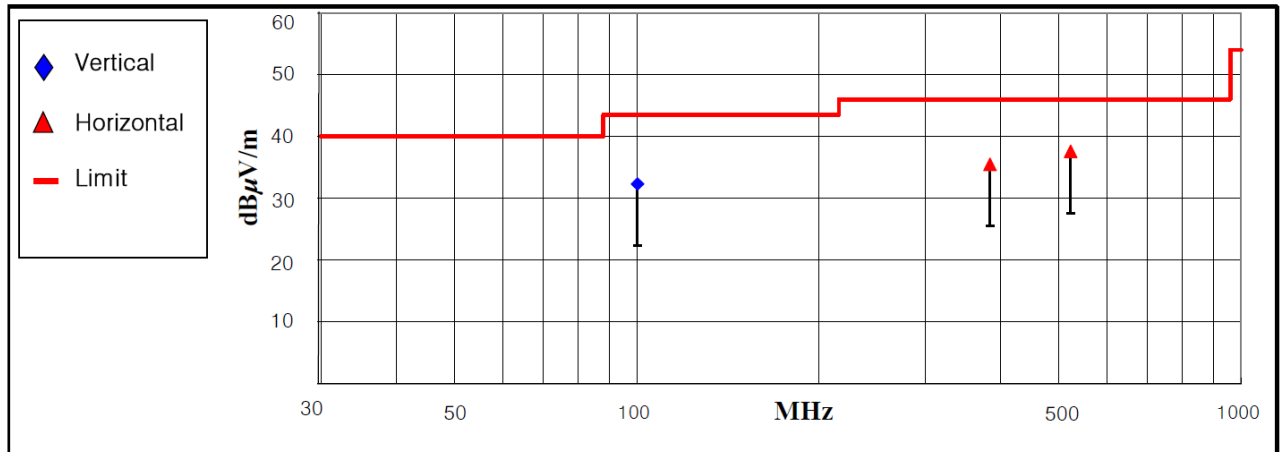
*Comment ; below 1GHz : Tranduce = ANT factor + cable loss
 above 1GHz : Tranduce = ANT factor + cable loss + AMP gain

Note: "H": Horizontal, "V": Vertical



- ♦ Field Strength of the spurious emission except the harmonic frequencies
Detector mode: Quasi-peak detector mode

| Frequency (MHz) | Measurement Level | | | | Limit (dB μ V/m) | Margin (dB) | Positioning System | | |
|-----------------|-------------------|--------------|----------|----------------|----------------------|-------------|--------------------|-------------|-----------|
| | Reading | Antenna | Cable | Test Result | | | Pol. (H/V) | Height (cm) | Angle (°) |
| | Value(dB μ V) | Factor(dB/m) | Loss(dB) | (dB μ V/m) | | | | | |
| 100.24 | 21.06 | 9.42 | 1.82 | 32.30 | 43.50 | 11.20 | V | 100 | 155 |
| 384.44 | 16.22 | 15.66 | 3.62 | 35.50 | 46.00 | 10.50 | H | 100 | 100 |
| 522.49 | 15.55 | 17.79 | 4.26 | 37.60 | 46.00 | 8.40 | H | 200 | 103 |



< Fig 4. Radiated emission result (30 MHz ~ 1 000 MHz) >



9. Occupied Bandwidth Measurement

9.1 Operating Environment

Temperature : 24.0 °C
 Relative humidity : 42.0 %R.H.

9.2 Test Set-up

This measurement is performed with the antenna located close enough to give a full-scale deflection of the modulated carrier on the spectrum analyzer. The plot is taken at 200 kHz/division frequency span, 10 kHz 3 dB resolution bandwidth and 5 dB/division logarithmic display from an ESI spectrum analyzer.

The measuring bandwidth shall be set to a value greater than 5 % of the allowed bandwidth (ANSI C63.4-1992 I6)

9.3 Limit

| Frequency Range(MHz) | Occupied Bandwidth Limit |
|----------------------|--------------------------|
| 70 ~ 900 | 0.25 % |
| > 900 | 0.5 % |

9.4 Test Equipment used

| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|--------------|-----------------|-------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |
| ■ - VULB9160 | Schwarzbeck | Bi-log antenna | 3193 | 03. 15. 2012 |

9.5 Test result of occupied bandwidth

- Test Date : July 5, 2011
 - Reference standard : Part 15 Subpart C, Sec. 15.231
 - Operating condition : RF transmitting mode
 - Spectrum resolution bandwidth(3dB) : 10 kHz

9.5.1 Test Frequency: 418 MHz

Allowed Bandwidth: $418 \times 0.0025 = 1.045$ kHz

| Fundamental Frequency | Bandwidth | Allowed Bandwidth | Result |
|-----------------------|------------|-------------------|--------|
| 418 MHz | 541.08 kHz | 1.045 kHz | PASS |

Refer to APPENDIX B: Test Plots of occupied bandwidth



10. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

10.1 Example 1 :

■ 20.3 MHz

| | |
|--------------------------------------|--|
| Class B Limit | = 250 μV = 48 $\text{dB}\mu\text{V}$ |
| Reading | = 39.2 $\text{dB}\mu\text{V}$ |
| $10^{(39.2\text{dB}\mu\text{V}/20)}$ | = 91.2 μV |
| Margin | = 48 $\text{dB}\mu\text{V}$ - 39.2 $\text{dB}\mu\text{V}$ = 8.8 dB |

10.2 Example 2 :

■ 66.7 MHz

| | |
|--|--|
| Class B Limit | = 100 $\mu\text{V}/\text{m}$ = 40.0 $\text{dB}\mu\text{V}/\text{m}$ |
| Reading | = 31.0 $\text{dB}\mu\text{V}$ |
| Antenna Factor + Cable Loss = 5.8 dB | |
| Total | = 36.8 $\text{dB}\mu\text{V}/\text{m}$ |
| Margin | = 40.0 $\text{dB}\mu\text{V}/\text{m}$ - 36.8 $\text{dB}\mu\text{V}/\text{m}$ = 3.2 dB |



11. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER (Model Name: MX-780)** complies with §15.231 of the FCC Rules.