FCC EVALUATION REPORT FOR CERTIFICATION

Applicant : OHSUNG ELECTRONICS CO., LTD.
#181 Gongdan-dong, Gumi-si, Gyeongbuk,
Republic of Korea.
Attn: Mr. Hak-Ki Kim / General Manager

Date of Issue : April 11, 2011
Order Number: GETEC-C1-11-074
Test Report Number: GETEC-E3-11-024
Test Site: Gumi College EMC Center
FCC Registration Number: (100749, 443957)

FCC ID. : OZ5URCMRF250C

Applicant : OHSUNG ELECTRONICS CO., LTD.

Rule Part(s)	**: FCC Part 15 Subpart B**
Equipment Class	**: Communications Receiver used with Part 15 Transmitter (CYY)**
EUT Type	**: RF BASE STATION**
Type of Authority	**: Certification**
Model Name	**: MRF-250C**
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,

SoonHoon

Soon-Hoon Jeong, Associate Engineer
GUMI College EMC center

Reviewed by,

Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center

CONTENTS

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

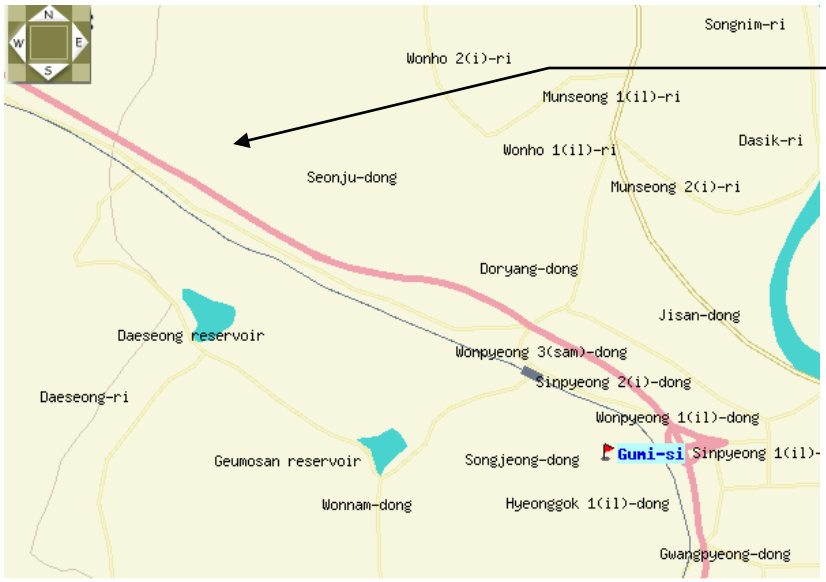
Tel. Number: +82-54-468-0831 Fax Number: +82-54-461-8368

- **FCC ID.** OZ5URCMRF250C
- **EUT Type** RF BASE STATION
- **Model Name** MRF-250C
- **Trade Name** UNIVERSAL remote control
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15 Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** April 4 ~ 5, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration Number: 100749, 443957) 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-11-024
- **Dates of Issue** April 11, 2011

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 BASE STATION (Model Name: MRF-250C)**

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 §2.948 according to ANSI C63.4 (2003)



GUMI COLLEGE EMC CENTER
407, Bugok-dong, Gumi-si,
Gyeongbuk 730-711, Korea.
Tel: +82-54-440-1195
Fax: +82-54-440-1199

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 BASE STATION (Model Name: MRF-250C) FCC ID.: OZ5URCMRF250C**

-. Rate of Power Supply	: Adapter, DC 9.0 V, 300 mA
-. IR Flasher Line Outputs	: 2.5 mm mono mini jack
-. RF Frequency	: 418 MHz
-. Crystal & Clock Frequency	: 4 MHz on main board 6.364 063 MHz on RF module board
-. Number of Layer	: Main board: 2 layer RF module board: 2 layer
-. External Connector	: IR Emitter cable 6 ea port
-. Size	: 1.80 inch × 3.50 inch × 1.25 inch

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
IR sensor	OHSUNG ELECTRONICS CO., LTD.	IR sensor	S/N: N/A FCC ID.: N/A

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.
AC/DC Adapter[1)]	HON KWANG Electronics Co., Ltd.	D9300	S/N: 0305K FCC ID.: N/A

1) Input ratings: AC 120 V, 60 Hz, 9 W / Output ratings: DC 9 V, 300 mA

3.2.3 Used Cable(s)

Cable Name	Condition	Description
Adapter cable	Connected to the EUT and adapter	1.80 m unshielded
IR sensor(6 EA) cable	Connected to the EUT and IR sensor	3.00 m unshielded

3.3 Modification Item(s)

- None

4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.
The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency : AC 120 V / 60 Hz
- Test Mode(s): RF receiving mode

4.2 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

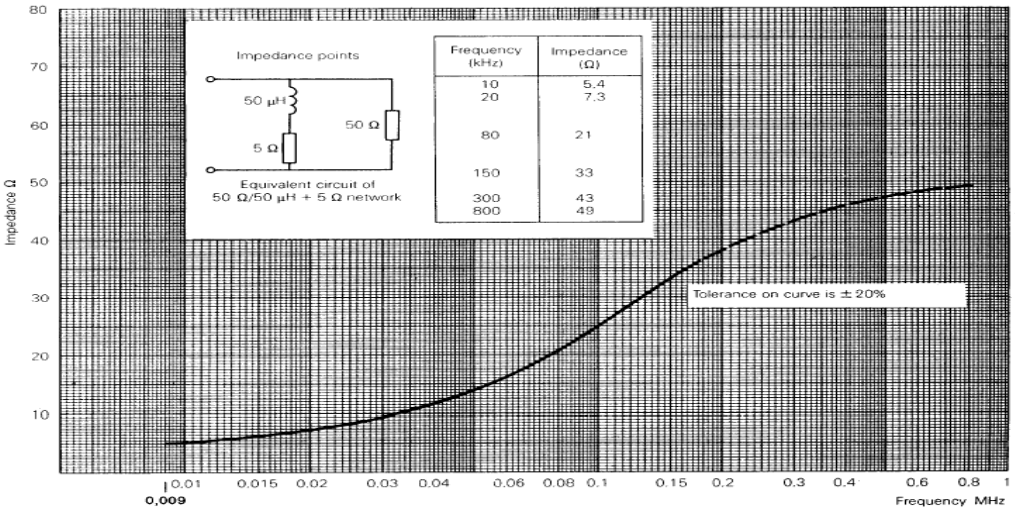


Fig 2. Impedance of LISN

4.3 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

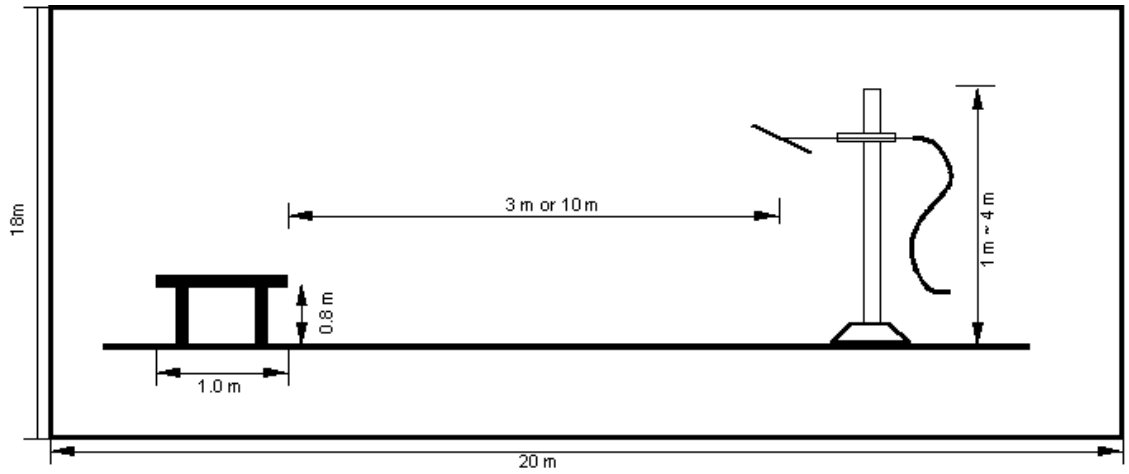


Fig 3. Dimensions of test site

5. Conducted Emission

5.1 Operating Environment

Temperature : 25 ℃
Relative Humidity : 39 % R.H.

5.2 Test Set-up

The conducted emission measurements were performed in the shielded room.
The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN &ISN.
AMN is bonded on horizontal reference ground plane.
The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

5.3 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	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	± 2.71 dB	Confidence levels of 95 % (k = 2)
Conducted emission (150 kHz ~ 30 MHz)	± 3.34 dB	Confidence levels of 95 % (k = 2)

5.4 Limit

RFI Conducted	FCC Limit(dB μV/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

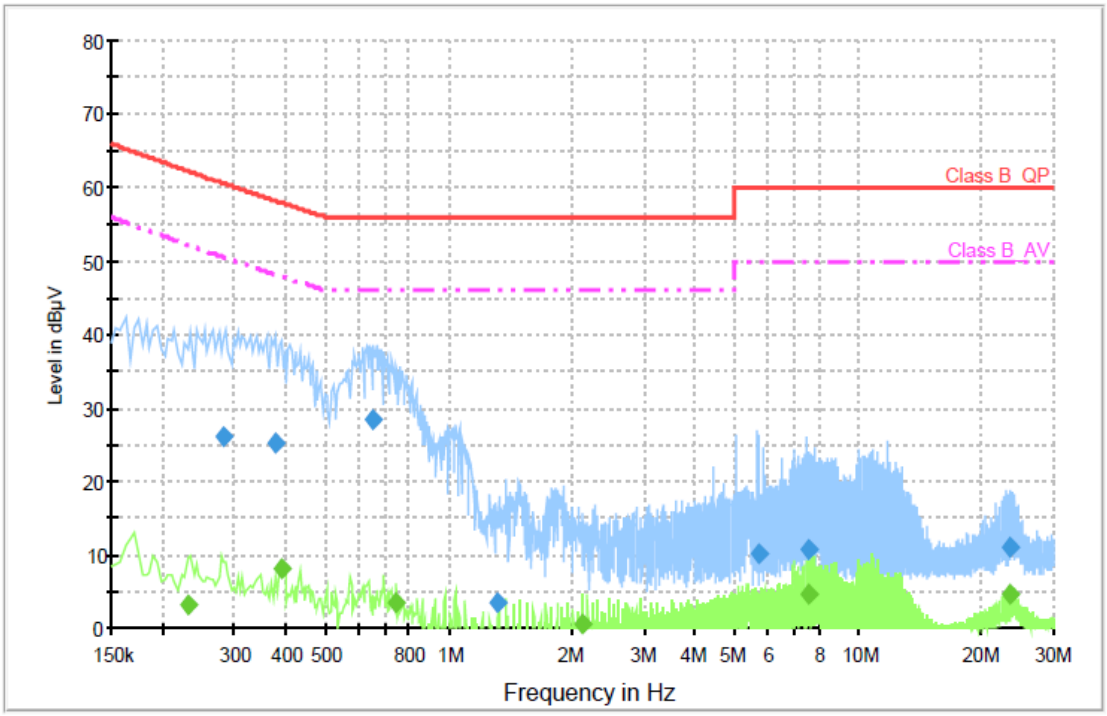
5.5 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2011
☐ -	ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2011
■ -	ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2011
☐ -	ISN T8	TESEQ. GmbH	ISN	24568	11. 09. 2011

5.6 Test data for Conducted Emission

-. Test Date : April 5, 2011
-. Resolution Bandwidth : 9 kHz
-. Frequency Range : 0.15 MHz ~ 30 MHz

Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

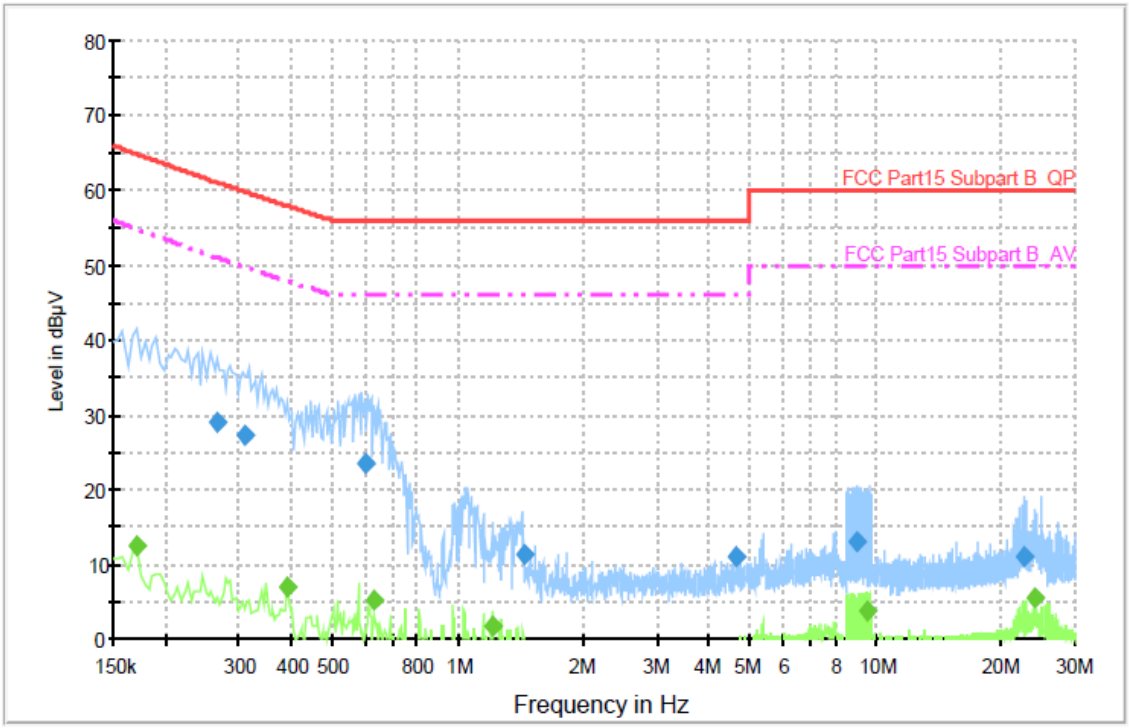
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.282000	26.0	1000.000	9.000	GND	L1	10.1	34.6	60.6	
0.378000	25.2	1000.000	9.000	GND	L1	10.1	33.0	58.2	
0.650000	28.3	1000.000	9.000	GND	L1	10.1	27.7	56.0	
1.322000	3.6	1000.000	9.000	GND	L1	10.1	52.4	56.0	
5.710000	10.3	1000.000	9.000	GND	L1	10.4	49.8	60.0	
7.546000	10.7	1000.000	9.000	GND	L1	10.5	49.3	60.0	
23.366000	11.0	1000.000	9.000	GND	L1	11.2	49.0	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.230000	3.1	1000.000	9.000	GND	L1	10.1	49.1	52.2	
0.390000	8.2	1000.000	9.000	GND	L1	10.1	39.7	47.9	
0.746000	3.6	1000.000	9.000	GND	L1	10.1	42.4	46.0	
2.130000	0.5	1000.000	9.000	GND	L1	10.2	45.5	46.0	
4.906000	-0.4	1000.000	9.000	GND	L1	10.3	46.4	46.0	
7.578000	4.5	1000.000	9.000	GND	L1	10.5	45.5	50.0	
23.602000	4.5	1000.000	9.000	GND	L1	11.2	45.5	50.0	

< Fig 4. Conducted emission result (Live line) >

Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.266000	28.9	1000.000	9.000	GND	N	10.1	32.1	61.0	
0.310000	27.4	1000.000	9.000	GND	N	10.1	32.4	59.8	
0.602000	23.6	1000.000	9.000	GND	N	10.1	32.4	56.0	
1.438000	11.2	1000.000	9.000	GND	N	10.1	44.8	56.0	
4.662000	11.1	1000.000	9.000	GND	N	10.3	44.9	56.0	
9.070000	13.0	1000.000	9.000	GND	N	10.5	47.0	60.0	
22.694000	11.0	1000.000	9.000	GND	N	10.9	49.0	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170000	12.3	1000.000	9.000	GND	N	10.1	42.6	54.9	
0.390000	7.0	1000.000	9.000	GND	N	10.1	40.9	47.9	
0.630000	5.3	1000.000	9.000	GND	N	10.1	40.7	46.0	
1.206000	1.8	1000.000	9.000	GND	N	10.1	44.2	46.0	
9.606000	3.8	1000.000	9.000	GND	N	10.5	46.2	50.0	
24.138000	5.5	1000.000	9.000	GND	N	10.8	44.5	50.0	

< Fig 5. Conducted emission result (Neutral line) >

6. Radiated Emission

6.1 Operating Environment

Temperature : 24 ℃
Relative Humidity : 43 % R.H.

6.2 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.

6.3 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)

6.4 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB μV/m	CISPR Limit @ 10 m. dB μV/m
30 ~ 88	40.0	30.0
88 ~ 216	43.5	30.0
216 ~ 230	46.0	30.0
230 ~ 960	46.0	37.0
960 ~ 1 000	54.0	37.0
> 1 000	54.0	No Specified limit

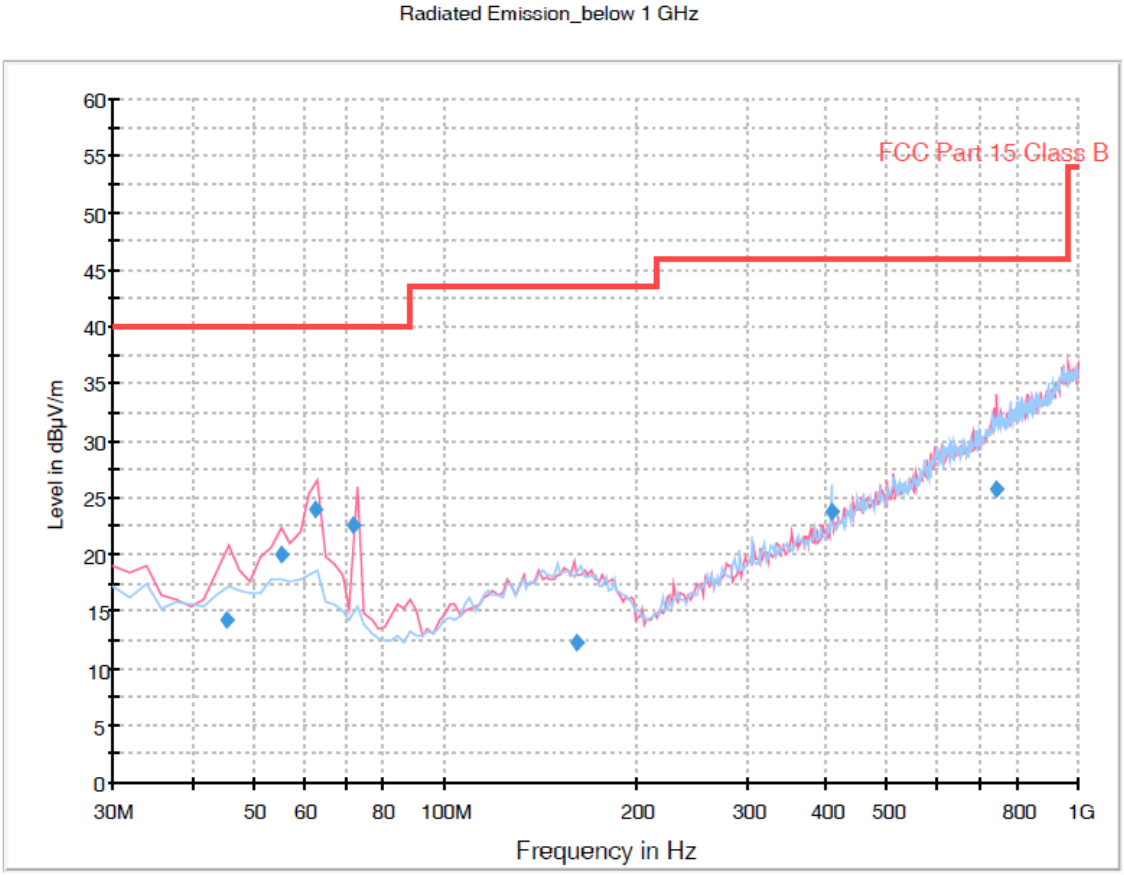
6.5 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 11. 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

6.6 Test data for Radiated Emission

-. Test Date : April 6, 2011
-. Resolution Bandwidth : 120 kHz
-. Frequency Range : 30 MHz ~ 1 000 MHz
-. Measurement Distance : 3 m
-. Note : The highest frequency of the internal source of the EUT is less than 108 MHz
The measurement was made up to 1 000 MHz

♦ Detector mode: Quasi-peak detector mode



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
45.451102	14.2	1000.0	120.000	127.0	V	3.0	13.4	25.8	40.0
55.330541	20.1	1000.0	120.000	100.0	V	156.0	13.6	19.9	40.0
62.666092	23.9	1000.0	120.000	100.0	V	187.0	13.0	16.1	40.0
72.065531	22.6	1000.0	120.000	179.0	V	16.0	11.3	17.4	40.0
161.380481	12.3	1000.0	120.000	148.0	V	-4.0	15.1	31.2	43.5
407.294228	23.7	1000.0	120.000	100.0	H	36.0	19.5	22.3	46.0
743.026814	25.8	1000.0	120.000	400.0	V	139.0	27.7	20.2	46.0

< Fig 6. Radiated emission result (30 MHz ~ 1 000 MHz) >

7. Sample Calculations

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

7.1 Example 1 :

■ **20.3 MHz**

Class B Limit = 250 μV = 48 dBμV

Reading = 39.2 dBμV

$10^{(39.2dB\mu V/20)}$ = 91.2 μV

Margin = 48 dBμV - 39.2 dBμV

= 8.8 dB

7.2 Example 2 :

■ **66.7 MHz**

Class B Limit = 100 μV/m = 40.0 dBμV/m

Reading = 31.0 dBμV

Antenna Factor + Cable Loss = 5.8 dB

Total = 36.8 dBμV/m

Margin = 40.0 dBμV/m – 36.8 dBμV/m

= 3.2 dB

8. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. RF BASE STATION (Model Name: MRF-250C)** was complies with §15.107 and 15.109 of the FCC Rules.