

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : OHSUNG ELECTRONICS CO., LTD

Date of Issue : April 20, 2007

#181 Gongdan-Dong, Gumi, GyeongBuk

Test Report S/N : GETEC-E3-07-029

Republic of Korea

Test Site : Gumi College EMC Center

Attn : Mr. Kwang-Jae Ok / Team Leader of Q.C

FCC ID

OZ5URCRFX250I

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 Receiver

Trade Name : UNIVERSAL remote control

Model No. : RFX-250i

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

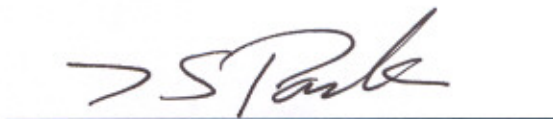
I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking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

Tested by,

Reviewed by,



Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



Tae-Sig Park, Technical Manager
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, Gyeongsangbuk-do, Korea

Manufacturer: OHSUNG ELECTRONICS CO., LTD

Manufacturer Address: #181 Gongdan-Dong, Gumi-Si, Gyeongsangbuk-do, Korea

Contact Person: Mr. Kwang-Jae Ok / Team Leader Q.C

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- **FCC ID.** OZ5URCRFX250I
- **Equipment Class** Communications Receiver used with Part 15 Transmitter (CYY)
- **EUT Type** RF Receiver
- **Power Source** DC 5V supplied from the MRF-350i
- **Model No.** RFX-250i
- **Rule Part(s)** FCC Part 15, Subpart B
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** April 12, 2007
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749)
407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report No.** GETEC-E3-07-029
- **Dates of Issue** April 20, 2007

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 9kHz to 40GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **OHSUNG ELECTRONICS CO., LTD. RF Receiver (Model No.: RFX-250i)**

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

The site address is 407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea

This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege 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 on October 19, 1992

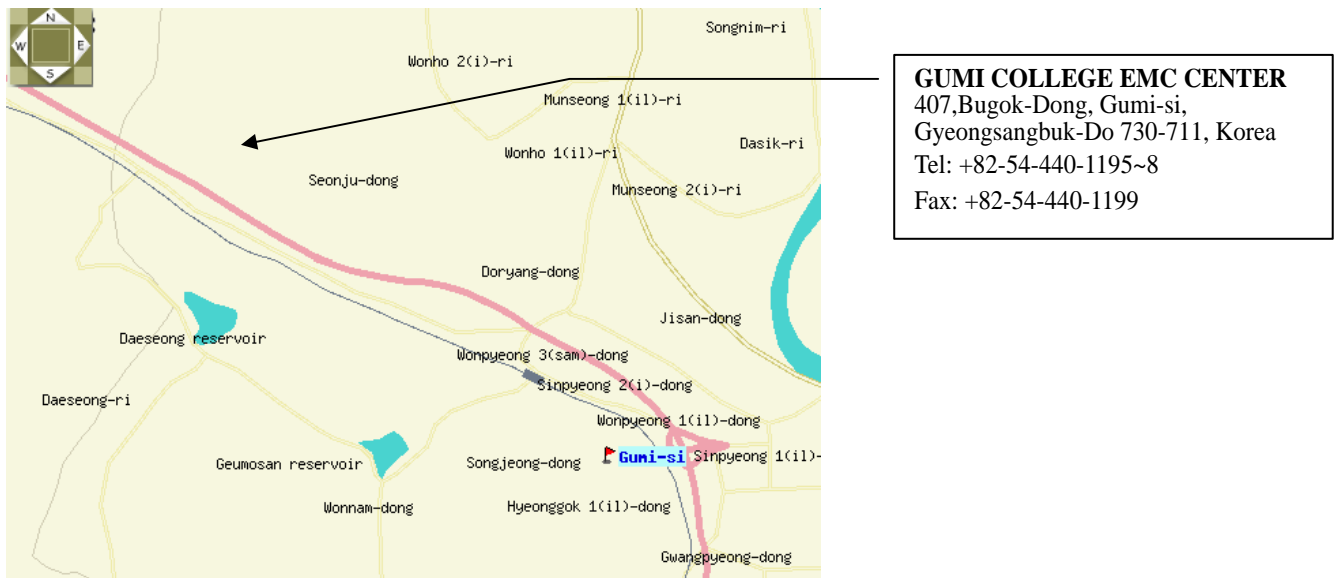


Fig 1. The map above shows the Gumi College in vicinity area.

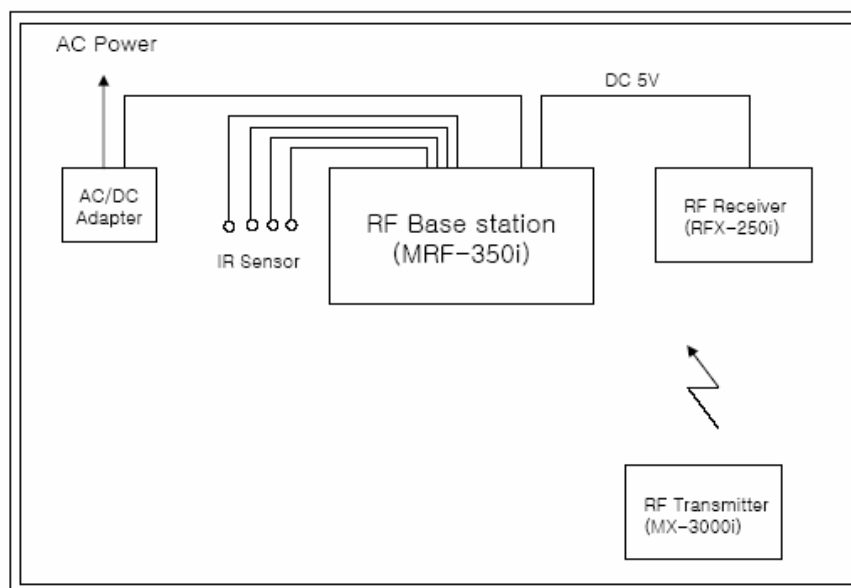
3. Product Information

3.1 Description of EUT

The Equipment Under Test (EUT) is the **OHSUNG ELECTRONICS CO., LTD. RF Receiver (Model No.: RFX-250i) FCC ID.:OZ5URCRFX250I**

Power Supply	: DC 5V supplied from the MRF-350i
RF Receiving Frequency	: 433.92MHz
External Connector	: Phone Jack, 3Pin terminal Wafer.
TV or FM Turner RF module	: PLCFH 0746C (OH SUNG ELECTRONICS CO.,LTD)
Crystal, Clock Frequency	: 6.6128125MHz on RF Module B' D
Number of Layer	: 2 Layer

Test Configuration



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model No.	S/N & FCC ID
RF Remote control	OH SUNG Electronics Inc	MX-3000i	S/N: N/A FCC ID: OZ5URCMX3000I
RF Base Station	OH SUNG Electronics Inc	MRF-350i	S/N: N/A FCC ID: DoC

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

3.2.2 Used Cable(s)

Cable No.	Condition	Description
IR output cable	Connected to the EUT and Base Station	3.0m 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 : DC 5V supplied from the MRF-350i

- Test Mode(s)
 - . RF receiving mode.

4.2 Conducted Emission

The Line conducted emission test facility is inside a 4×8×2.5 meter shielded enclosure.

The EUT was placed on a non-conducting 1.0 by 1.5 meter table, which is 0.8 meters in height and 0.4 meters 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 150kHz to 30MHz with 20msec 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 9kHz. 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 – 40 centi-meters.

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

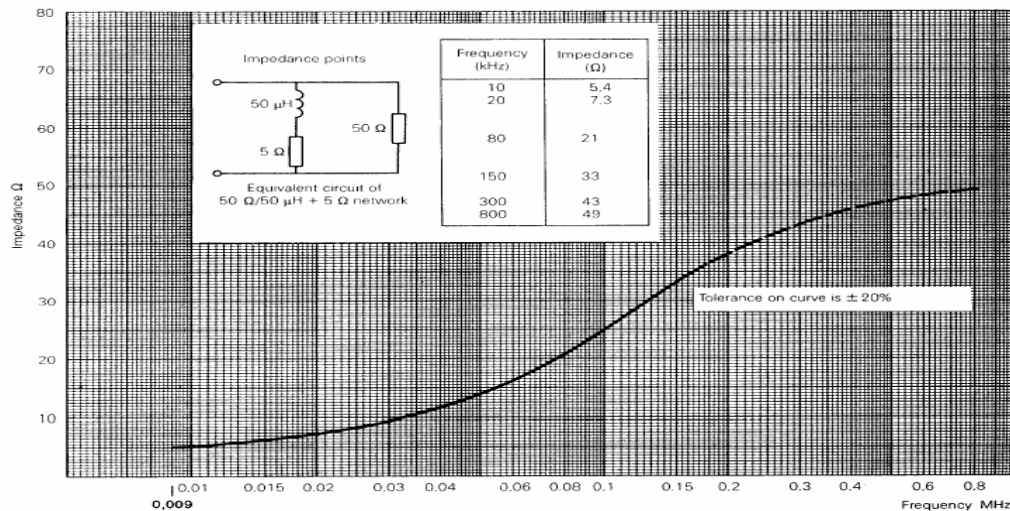


Fig 2. Impedance of LISN

4.3 Radiated Emission

Preliminary measurements were conducted 3m 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.

The spectrum was scanned from 30 to 1000MHz using bicornical log antenna (Schwarzbeck, VULB9160). Above 1GHz, horn antenna (Schwarzbeck, BBHA9120D) was used.

Final measurements were made outdoors at 3m/10m-test range.

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 120kHz or 1MHz 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 0.8m high non-metallic 1.0×1.5 meter 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

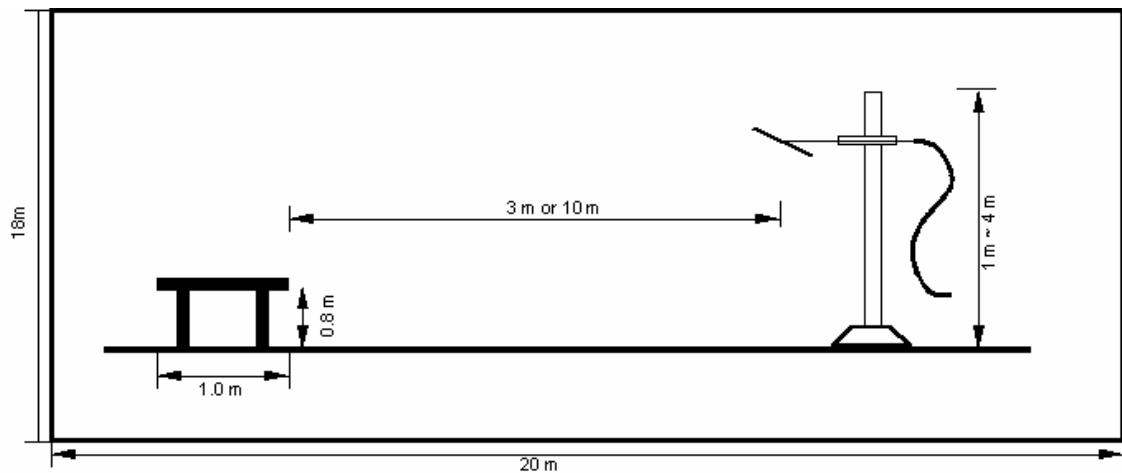


Fig 3. Dimensions of Open Site Test Area

5. Conducted Emission

5.1 Operating environment

Temperature : 23°C
 Relative humidity : 39 %

5.2 Test set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall and 0.8m from AMN.

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%.

Contribution	Probability Distribution	Uncertainty (±dB)	
		Power Port	Communication port
Receiver specification	Rectangular	0.50	0.50
LISN coupling specification	Rectangular	1.50	
ISN coupling specification	Rectangular		1.50
Mismatch LISN VRC : $\Gamma_{l=}$ 0.20 ISN VRC : $\Gamma_{l=}$ 0.20 ATT VRC(IN) : $\Gamma_{g=}$ 0.03 Uncertainty limits $20\log(1\pm \Gamma_{l=} \Gamma_{g=})$	U-shaped	0.05 -0.05	0.05 -0.05
Mismatch Receiver VRC : $\Gamma_{l=}$ 0.09 ATT VRC : $\Gamma_{g=}$ 0.11 Uncertainty limits $20\log(1\pm \Gamma_{l=} \Gamma_{g=})$	U-shaped	0.09 -0.09	0.09 -0.09
System repeatability	Std Deviation	0.55	0.55
Cable and input attenuator calibration	Normal (k=2)	0.08	0.08
Repeatability of EUT			
Combined standard uncertainty $U_c(y)$	Normal	1.07 -1.07	1.07 -1.07
Extended uncertainty U	Normal (k=2)	2.15 -2.15	2.15 -2.15

5.4 Limit

RFI Conducted	FCC Limit(dB) Class B	
	Quasi-Peak	Average
150kHz – 0.5MHz	66 – 56*	56 – 46*
0.5MHz – 5MHz	56	46
5MHz – 30MHz	60	50

*Limits decreases linearly with the logarithm of frequency.

5.5 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	11. 27. 2007
■ - ESH3-Z5	Rohde & Schwarz	Artificial mains network	838979/020	12. 09. 2007
■ - ESH2-Z5	Rohde & Schwarz	Artificial mains network	829991/009	12. 09. 2007

5.6 Test data for power line conducted emission

5.6.1 Test mode: RF Receiving mode

- Test Date : April 12, 2007
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15MHz ~ 30MHz

Frequency (MHz)	Insertion Loss	Cable Loss	Pol.	Quasi-Peak[dBuV]			Average[dBuV]			Margin[dBuV]	
				Limit	Reading	Result	Limit	Reading	Result	Quasi	Average
0.170	0.11	-0.18	L1	64.96	37.3	37.24	54.96	<<	-	27.72	-
0.215	0.11	-0.22	N	63.01	34.2	34.09	53.01	<<	-	28.92	-
0.230	0.12	-0.21	L1	62.45	37.2	37.11	52.45	<<	-	25.34	-
0.305	0.13	-0.17	L1	60.11	34.2	34.15	50.11	<<	-	25.95	-
0.420	0.13	-0.13	L1	57.45	31.3	31.30	47.45	12.4	12.40	26.14	35.04
0.490	0.14	-0.17	L1	56.17	30.7	30.67	46.17	<<	-	25.50	-
0.545	0.14	-0.20	L1	56.00	29.1	29.04	46.00	<<	-	26.96	-
0.810	0.14	-0.23	L1	56.00	24.8	24.71	46.00	<<	-	31.29	-
1.100	0.14	-0.24	L1	56.00	19.3	19.20	46.00	<<	-	36.80	-
1.465	0.14	-0.27	L1	56.00	15.5	15.37	46.00	<<	-	40.63	-
1.545	0.15	-0.28	L1	56.00	12.2	12.07	46.00	<<	-	43.93	-
2.140	0.09	-0.29	N	56.00	16.0	15.80	46.00	25.8	25.60	40.20	20.40

*Comment : Pol : H (Live), N(Neut)
 Insertion Loss : Insertion Loss of LISN
 Cable Loss : Cable Loss + Pulse Limiter Insertion loss value

"<<" The margin is more than 30dB

Comments)

The EUT was powered from MRF-350i (Base station).
 Therefore, the conducted emission measurement was performed at the MRF-350i AC/DC Adapter port.
 Refer to the "Test configuration" of page 5.

6. Radiated Emission

6.1 Operating environment

Temperature : 20°C
Relative humidity : 35 %

6.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber using the procedure in ANSI C63.4/2003 13.1.4.1 and found frequency for open area test site.

The formal radiated emission was measured at 3m-distance open area test site.

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

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters 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%.

Contribution	Probability Distribution	Uncertainty (dB)			
		Biconical Ant.		Log-periodic Ant.	
		3m	10m	3m	10m
Ambient signal					
Antenna factor calibration	Normal (k=2)	0.50	0.50	0.50	0.50
Receiver specification	Rectangular	0.50	0.50	0.50	0.50
Antenna directivity	Rectangular	0.25	0.00	1.50	0.25
Antenna phase center variation	Rectangular	0.00	0.00	1.00	0.20
Antenna factor frequency interpolation	Rectangular	0.25	0.25	0.25	0.25
Measure distance variation	Rectangular	0.60	0.40	0.60	0.40
Site imperfections	Rectangular	1.46	-2.32	2.26	2.94
Mismatch					
Receiver VRC : $\Gamma_l = 0.09$	U-shaped	0.33	0.33	0.33	0.33
Antenna VRC : $\Gamma_g = 0.43$ (Bi) 0.23 (Lp)		-0.35	-0.35	-0.18	-0.18
Uncertainty limits $20\log(1 \pm \Gamma_l \Gamma_g)$					
System repeatability	Std Deviation	0.18	0.18	0.17	0.17
Cable loss calibration	Normal (k=2)	0.05	0.05	0.05	0.05
Combined standard uncertainty $U_c(y)$	Normal	1.05	1.45	1.78	1.80
		-1.05	-1.45	-1.77	-1.78
Extended uncertainty U	Normal (k=2)	2.11	2.90	3.55	3.59
		-2.11	-2.90	-3.53	-3.57

6.4 Limit

Frequency (MHz)	FCC Limit @ 3m. dB μ V/m	CISPR Limit @ 10m. dB μ V/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 – 1000	54.0	37.0

6.5 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	11. 27. 2007
■ - ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2007
■ - HK116	Rohde & Schwarz	Biconical ANT	826861/018	11. 27. 2007
■ - HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 27. 2007
■ - HD100	HD GmbH	Position Controller	100/692/01	N/A
■ - DS415S	HD GmbH	Turntable	415/657/01	N/A
■ - MA240	HD GmbH	Antenna Mast	240/565/01	N/A

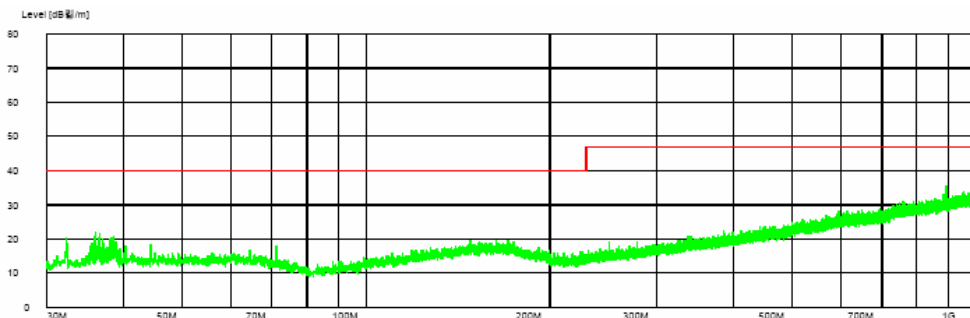
6.6 Radiated emission test data

- Test Date : April 12, 2007
- Reference standard : Part 15 Subpart B
- Operating condition : RF Receiving mode
- Measuring Distance : 3m
- Detector mode : Quasi-peak detector mode
- Power Source : DC 5V supplied from the MRF-350i (Base Station)

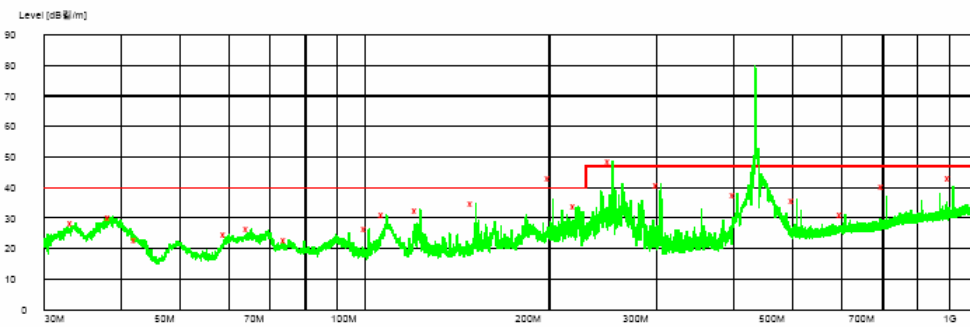
Frequency (MHz)	Measurement Level				Limit (dBuV/m)	Margin (dBuV/m)	Positioning System		
	Reading	Antenna	Cable	Test Result			Pol. (H/V)	Height (cm)	Angle (deg)
	Value(dBuV)	Factor(dB)	Loss(dB)	(dBuV/m)					
All frequency	-	-	-	<<	-	-	-	-	-

"<<" The margin is more than 30dB

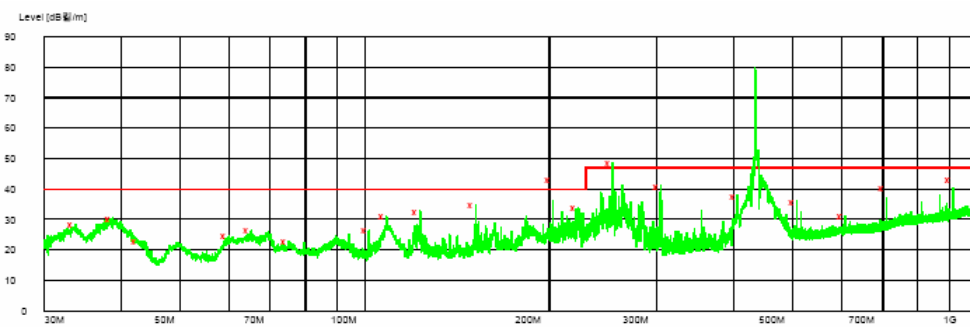
- (A preliminary scan data): EUT(Stand-by mode)



- (A preliminary scan data): EUT with MX-3000i (RF remote transmitter)



- (A preliminary scan data): MX-3000i only



7. Antenna power conduction

7.1 Operating environment

Temperature : 23 °C
Relative humidity : 38 %

7.2 Test set-up

The Antenna power conduction measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8m heights above the floor, 0.4m from the reference ground plane (GRP) wall

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

7.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	11. 27. 2007

7.4 Test data for Antenna power conduction

- Test Date : April 25, 2007
- Resolution bandwidth : 120kHz
- Frequency range : 30MHz ~ 2000MHz

◆ Antenna power conduction due to the local oscillator
Fundamental frequency

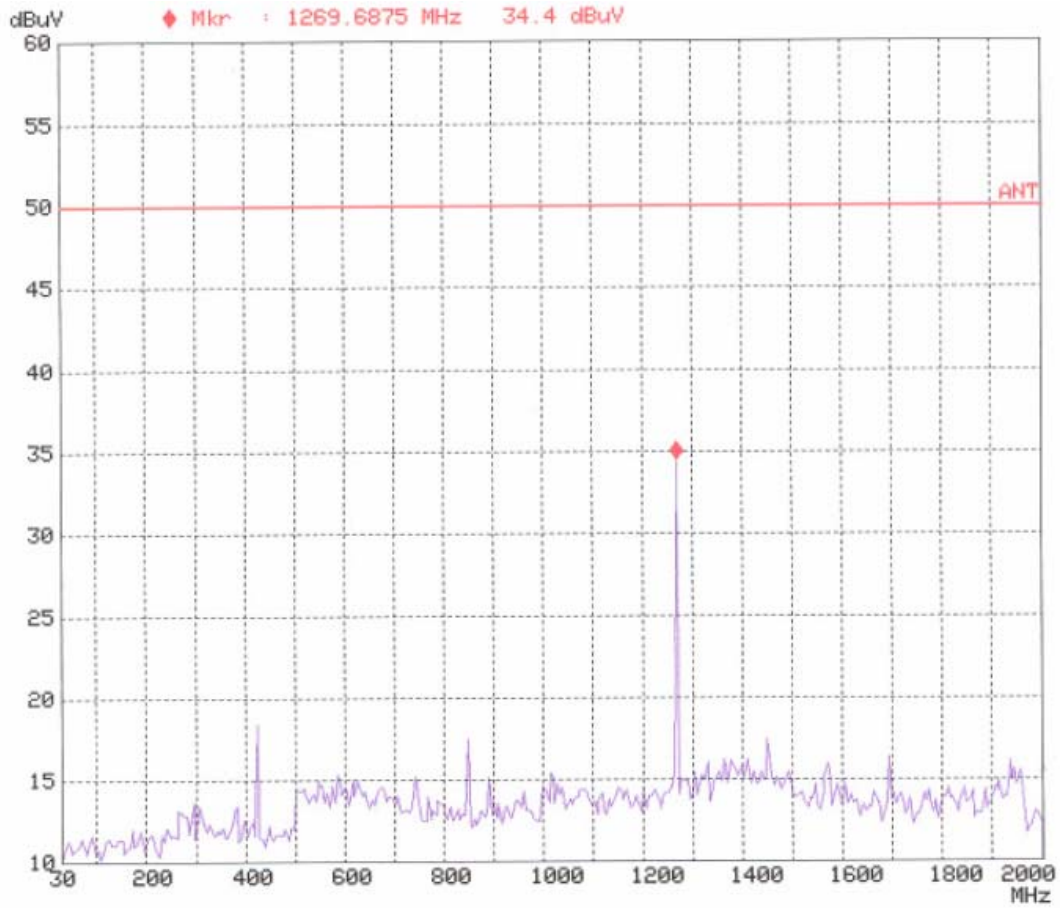
Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV)	Limits (dBuV)	Margin (dB)
423.215	1	423.215	-	50.0	<<

“<<” : The margin is more than 30dB

◆ Antenna power conduction due to the local oscillator
Harmonic frequency

Frequency (MHz)	Harmonics	Measuring Frequency(MHz)	Emission Level(dBuV)	Limits (dBuV)	Margin (dB)
846.43	2	846.43	35.3	50.0	14.7
1269.645	3	1269.645	-	50.0	<<

“<<” : The margin is more than 30dB



< Fig 4. Antenna power conduction result >

8. Sample Calculations

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

8.1 Example 1 :

■ 20.3 MHz

Class B Limit	= 250 μV	= 48 $\text{dB}\mu\text{V}$
Reading	= - 67.8 dBm (Calibrated level)	
Convert to $\text{dB}\mu\text{V}$	= - 67.8 $\text{dBm} + 107 = 39.2 \text{ dB}\mu\text{V}$	
$10^{(39.2\text{dB}\mu\text{V}/20)}$	= 91.2 μV	
Margin	= 39.2 – 48 = -8.8	
	= 8.8 dB below Limit	

8.2 Example 2 :

■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$	= 40.0 $\text{dB}\mu\text{V}/\text{m}$
Reading	= - 76.0 dBm (Calibrated level)	
Convert to $\text{dB}\mu\text{V}/\text{m}$	= - 76.0 $\text{dBm} + 107 = 31.0 \text{ dB}\mu\text{V}/\text{m}$	
Antenna Factor + Cable Loss	= 5.8 dB	
	Total = 36.8 $\text{dB}\mu\text{V}/\text{m}$	
Margin	= 36.8 – 40.0 = -3.2	
	= 3.2 dB below Limit	

9. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.

OH SUNG ELECTRONICS CO., LTD. RF Receiver (Model No.: RFX-250i) was complies with §15.107, 15.109 and §15.111 of the FCC Rules.