

FCC EVALUATION REPORT FOR CERTIFICATION

FCC Class B (Class II Permissive Change)

Applicant: OHSUNG ELECTRONICS CO., LTD.

Date of Issue: June 03, 2015

#181 Gongdan-dong, Gumi-si, Gyeongbuk,

Order Number: GETEC-C1-15-247

Republic of Korea

Test Report Number: GETEC-E3-15-015

Attn: Mr. Hak-Ki, Kim / General Manager

Test Site: GUMI UNIVERSITY EMC CENTER

FCC Registration Number: (269701)

FCC ID. : OZ5URCMRF260I

Applicant : OHSUNG ELECTRONICS CO., LTD.

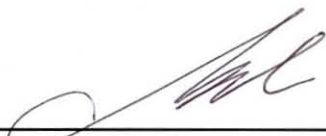
Rule Part(s)	: FCC Part 15 Subpart B
Equipment Class	: Communications Receiver used w/Pt 15 Transmitter(CYY)
EUT Type	: RF Receiver
Type of Authority	: Certification
Model Name	: MRF-260i
Trade Name	: UNIVERSAL remote control

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 (2009) / Canadian standard ICES-003

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,


Seung-Chul Lee, Senior Engineer
GUMI UNIVERSITY EMC CENTER


Jae-Hoon Jeong, Technical Manager
GUMI UNIVERSITY 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
Telephone Number: +82-54-468-0831 Fax Number: +82-54-461-8368

- **FCC ID** OZ5URCMRF260I
 - **EUT Type** RF Receiver
 - **Equipment Class** Communications Receiver used w/Pt 15 Transmitter(CYY)
 - **Model Name** MRF-260i
 - **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 (2009)
 - **Dates of Test** June 02 ~ June 03, 2015
 - **Place of Test** **GUMI UNIVERSITY EMC CENTER**
(FCC Test Firm Registration Number: 269701)
37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea.
 - **Test Report Number** GETEC-E3-15-015
 - **Date of Issue** June 03, 2015
 - **Class II Change(s)** Changed Main board & AC/DC adaptor
- **GUMI UNIVERSITY EMC CENTER is an FCC Test Firm registered (Reg. No. 269701) test facility has met all the requirements specified in Section 2.948 of the FCC rules.**
 - **GUMI UNIVERSITY EMC CENTER has accredited as Conformity Assessment Body (CAB) notified by Radio Research Laboratories (Designation No.: KR0033) in compliance with ISO/IEC 17025. Therefore, Gumi UNIVERSITY EMC Center is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) under Parts 15 and 18 of the commissions Rules**





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 (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **OHSUNG ELECTRONICS CO., LTD. RF Receiver (Model Name: MRF-260i)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea.

This test site is one of the highest point of Gumi UNIVERSITY 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 (2009)

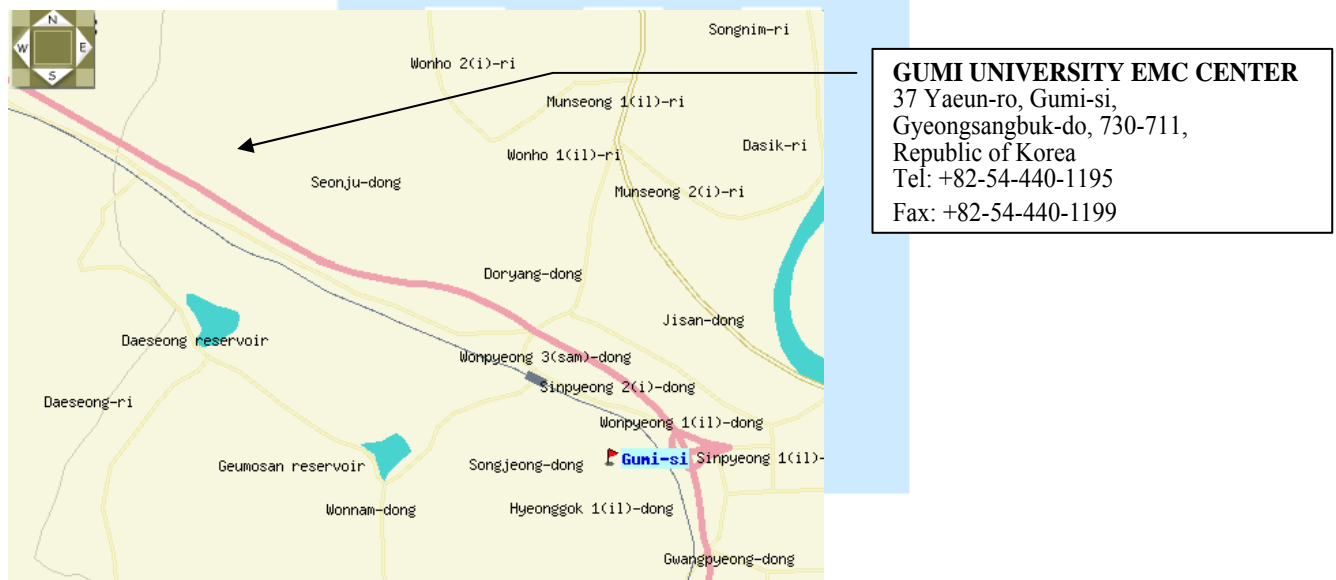


Fig 1. The map above shows the Gumi UNIVERSITY in vicinity area.





3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **OHSUNG ELECTRONICS CO., LTD.**
RF Receiver (Model Name: MRF-260i)

Type of product	RF Receiver
Model Name	MRF-260i
Rate of Power supply	DC 9V, 300 mA(AC/DC Adaptor) ¹⁾
RF Receiving Frequency	433.92 MHz
External Connector	DC input Jack 1 EA, IR emitter output 4 EA
Crystal, Clock Frequency	12 MHz on The Main board 6.6128125 MHz on The RF module board
Number of Layer	Main board : 2 Layer RF module board : 2 Layer

Note

1) AC/DC adaptor information: Please refer to clause 3.2.2 in this report





3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
RF Remote Controller	OHSUNG ELECTRONICS Co., LTD.	MX-900i	S/N: N/A FCC ID.:OZ5URCMX900I
IR Emitter	OHSUNG ELECTRONICS Co., LTD.	-	S/N: None FCC ID.: None

See “Appendix C – Test Setup Photographs” for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
AC/DC Adaptor ¹⁾	MEILE GROUP LTD	MFL-A00060900300E0061	S/N: 1407230008 FCC ID.:None
IR Emitter	OHSUNG ELECTRONICS Co., LTD.	-	S/N: None FCC ID.: None

Note:

1) Input rating: AC (100~240) V~ (50/60) Hz, 0.18A max, Output rating: DC 9V, 0.3 A

3.2.3 Used Cable(s)

Cable Name	Condition	Description
AC power cable	Connected to the EUT(AC/DC Adaptor) and AC Power	1.50 m Unshielded
Adaptor DC cable	Connected to the EUT(RF Receiver) and EUT(AC/DC Adaptor)	1.80 m Unshielded
IR emitter cable 1	Connected to the EUT(RF Receiver) and IR emitter	2.90 m Unshielded
IR emitter cable 2	Connected to the EUT(RF Receiver) and IR emitter	2.90 m Unshielded
IR emitter cable 3	Connected to the EUT(RF Receiver) and IR emitter	2.90 m Unshielded
IR emitter cable 4	Connected to the EUT(RF Receiver) and IR emitter	2.90 m Unshielded

3.3 Modification Item(s)

- None





4. Description of tests

4.1 Test Condition

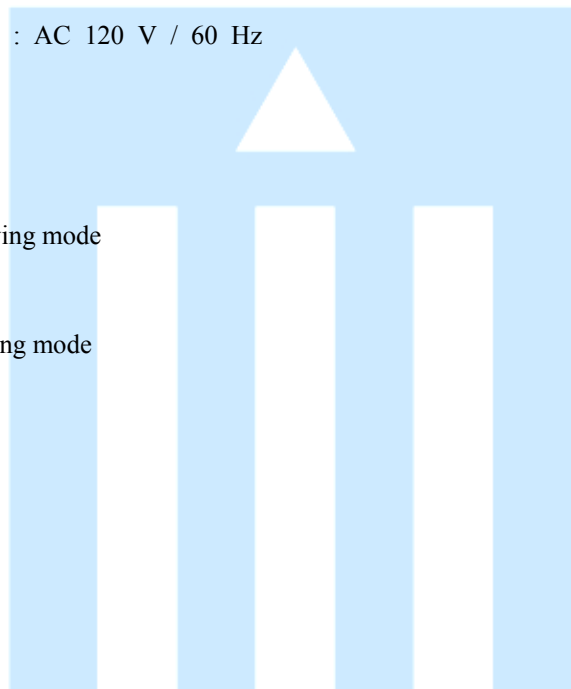
The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

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.

The test conditions of the noted test mode(s) in this test report are;

- Test Voltage / Frequency : AC 120 V / 60 Hz
- Test Mode(s)
 - **Conducted Emission**
 - Continuous RF Receiving mode
 - **Radiated Emission**
 - Continuous 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 Test Film Registration No.: 269701)

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 (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). 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, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

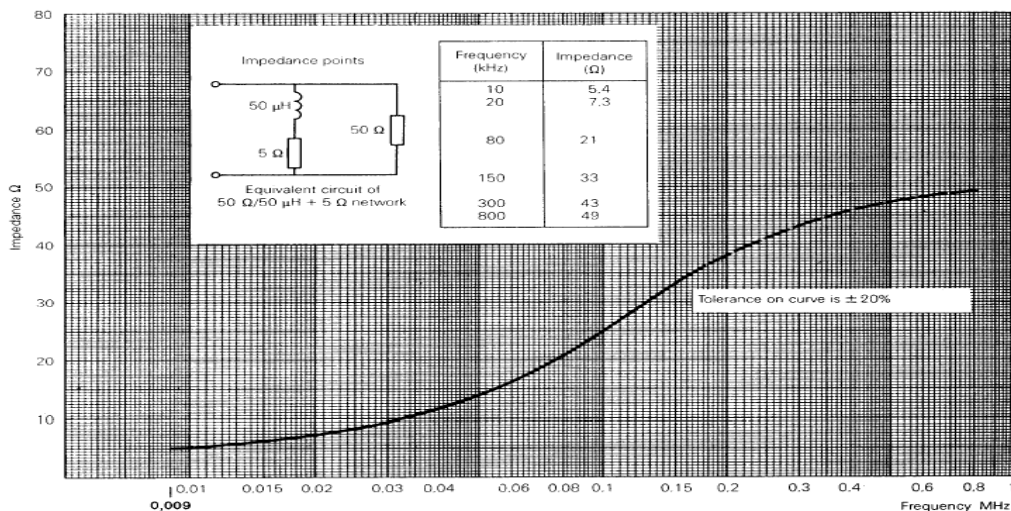


Fig 2. Impedance of LISN





4.3 Radiated Emission

Exploratory Radiated measurements were conducted at the 3 m or 10 m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1 GHz were made at 3 m or 10 m Chamber (FCC Test Firm Registration No.: 269701) or Open area test site (FCC Test Firm Registration No.: 269701) that complies with CISPR 16/ANSI C63.4.

Above 1 GHz final measurements were conducted at the 3m Chamber (FCC Test Firm Registration No.: 269701) only.

For measurements above 1GHz, the bottom side of 3 m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1 GHz) and Peak & Average mode (Above 1 GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

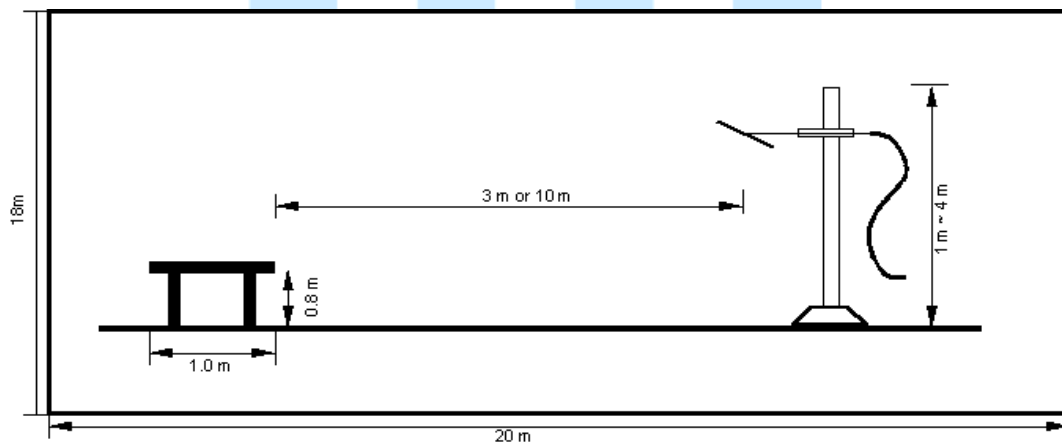


Fig 3. Dimensions of test site (Below 1 GHz)

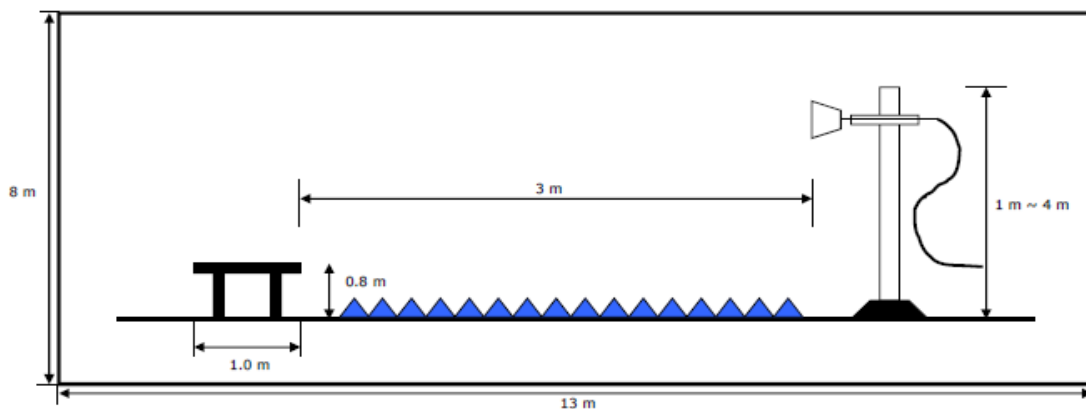


Fig 4. Dimensions of test site (Above 1 GHz)





5. Conducted Emission

5.1 Operating Environment

Temperature : 22.3 °C
Relative Humidity : 46.4 % 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)	3.94 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	3.43 dB	Confidence level of approximately 95 % ($k = 2$)





5.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
	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
■ - ESCI	Rohde & Schwarz	EMI Test Receiver	100237	Apr 23, 2016
■ - ENV216	Rohde & Schwarz	LISN	100173	Apr 23, 2016
□ - ENV216	Rohde & Schwarz	LISN	100172	Apr 23, 2016
□ - ENY81-CA6	Rohde & Schwarz	ISN	101573	Jul 16, 2015
□ - ISN T8	TESEQ.GmbH	ISN	24568	May 27, 2016

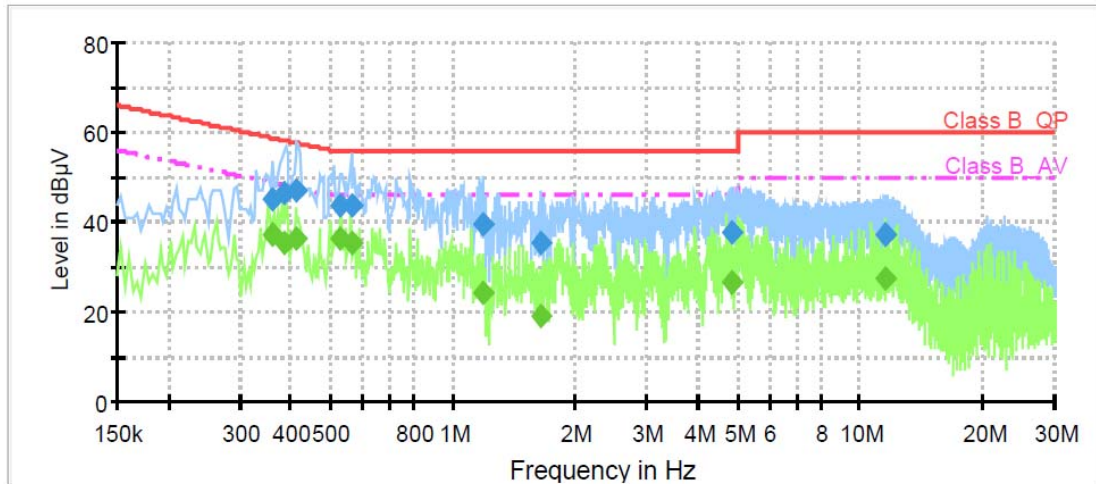
5.6 Test data for Conducted Emission

- Test Date : June 02, 2016
- Resolution Bandwidth : 9 kHz
- Frequency Range : 0.15 MHz ~ 30 MHz
- Line : L1: Live, N: Neutral





▪ Operating condition: RF receiving mode



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.362681	45.2	100.0	9.000	Off	L1	9.7	13.4	58.7	
0.385069	46.5	100.0	9.000	Off	L1	9.7	11.7	58.2	
0.414919	47.0	100.0	9.000	Off	N	9.7	10.6	57.5	
0.530588	43.8	100.0	9.000	Off	L1	9.7	12.2	56.0	
0.564169	43.6	100.0	9.000	Off	L1	9.7	12.4	56.0	
1.183556	39.5	100.0	9.000	Off	L1	9.7	16.5	56.0	
1.649963	35.5	100.0	9.000	Off	N	9.8	20.5	56.0	
4.866300	37.9	100.0	9.000	Off	N	9.8	18.1	56.0	
11.530313	37.1	100.0	9.000	Off	N	10.0	22.9	60.0	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.362681	37.0	100.0	9.000	Off	L1	9.7	11.7	48.7	
0.385069	35.4	100.0	9.000	Off	L1	9.7	12.8	48.2	
0.414919	36.2	100.0	9.000	Off	N	9.7	11.4	47.5	
0.530588	36.1	100.0	9.000	Off	L1	9.7	9.9	46.0	
0.564169	35.2	100.0	9.000	Off	L1	9.7	10.8	46.0	
1.183556	24.3	100.0	9.000	Off	L1	9.7	21.7	46.0	
1.649963	19.3	100.0	9.000	Off	N	9.8	26.7	46.0	
4.866300	26.4	100.0	9.000	Off	N	9.8	19.6	46.0	
11.530313	27.6	100.0	9.000	Off	N	10.0	22.4	50.0	

< Fig 5. Graph of continuous disturbance >





6. Radiated Emission

6.1 Operating Environment

Temperature : 22.6 °C
 Relative Humidity : 47.9 % R.H.

6.2 Test Set-up

A preliminary and final measurement was at 10 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)	4.66 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	4.65 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	4.91 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	4.88 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m)	5.32 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 18 000 MHz, 3 m)	5.45 dB	Confidence level of approximately 95 % ($k = 2$)





6.4 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB μ V/m	CISPR Limit @ 10 m. 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 ~ 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	Apr 23, 2016
■ - VULB9160	Schwarzbeck	Broad Band Test Antenna	3193	Mar 25 2016
□ - BBHA9120D	Schwarzbeck	Horn ANT	207	Mar 06, 2016
■ - MCU066	matur GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	matur GmbH	Turntable	1390307	N/A
■ - AM 4.0	matur GmbH	Antenna Mast	1390308	N/A
□ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	Jan. 13. 2016

6.6 Test data for Radiated Emission

- Test Date : June 03 2015
- 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

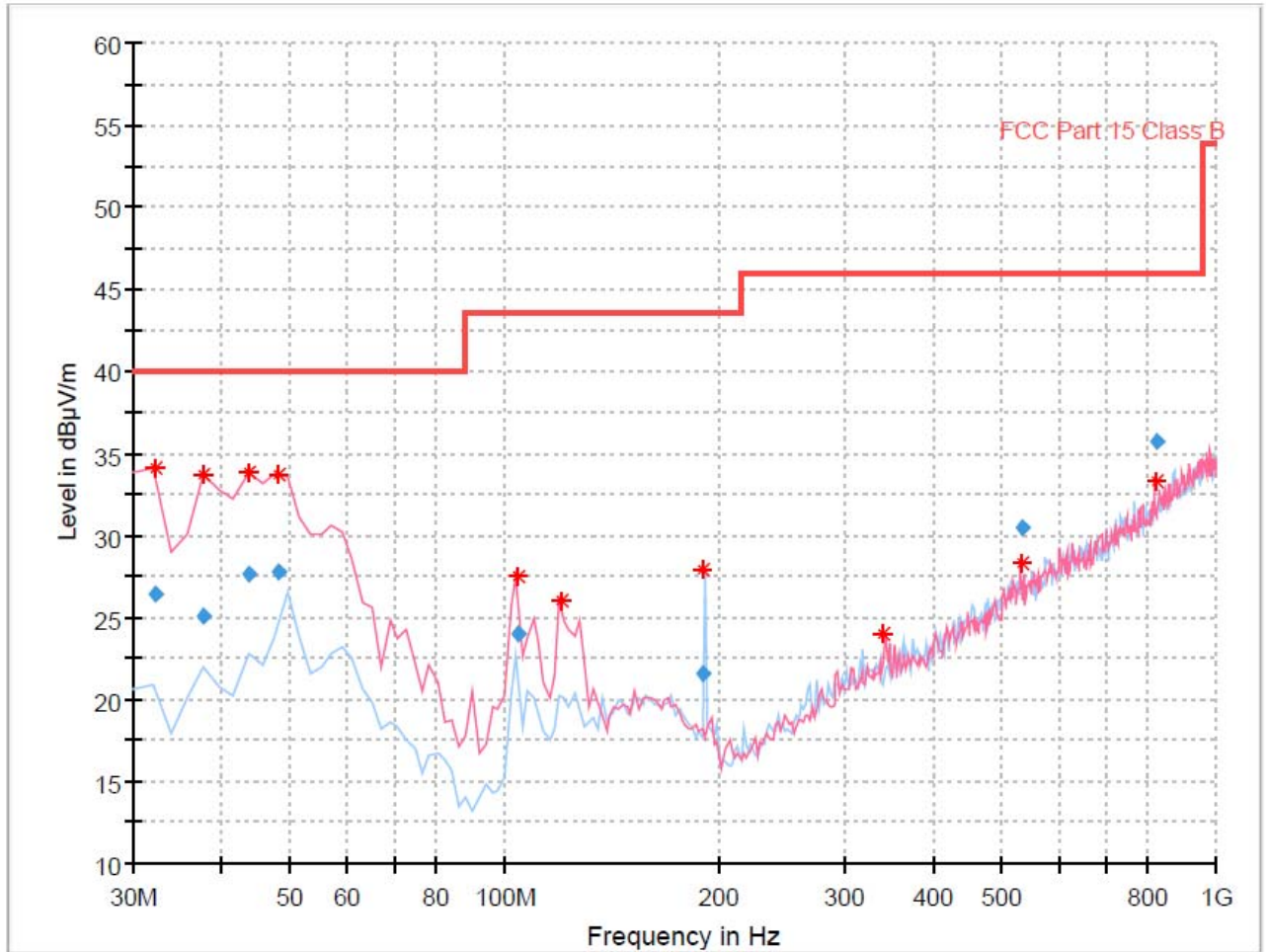
- Measurement

Frequency range	30 MHz ~ 1 GHz	Above 1 GHz
Detector mode	Quasi peak	Peak / Average
Resolution bandwidth	120 kHz	1 MHz





Operating condition: RF Receiving mode



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.263327	26.39	40.00	13.61	1000.0	120.000	225.0	V	309.0	13.1
37.757796	25.16	40.00	14.84	1000.0	120.000	125.0	V	302.0	13.6
43.851143	27.59	40.00	12.41	1000.0	120.000	125.0	V	14.0	14.1
47.969940	27.74	40.00	12.26	1000.0	120.000	100.0	V	46.0	14.4
104.509236	23.98	43.50	19.52	1000.0	120.000	125.0	V	320.0	12.2
189.549185	21.65	43.50	21.85	1000.0	120.000	225.0	H	0.0	13.5
533.448046	30.48	46.00	15.52	1000.0	120.000	184.0	H	4.0	22.2
824.186437	35.71	46.00	10.29	1000.0	120.000	184.0	V	282.0	26.8

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





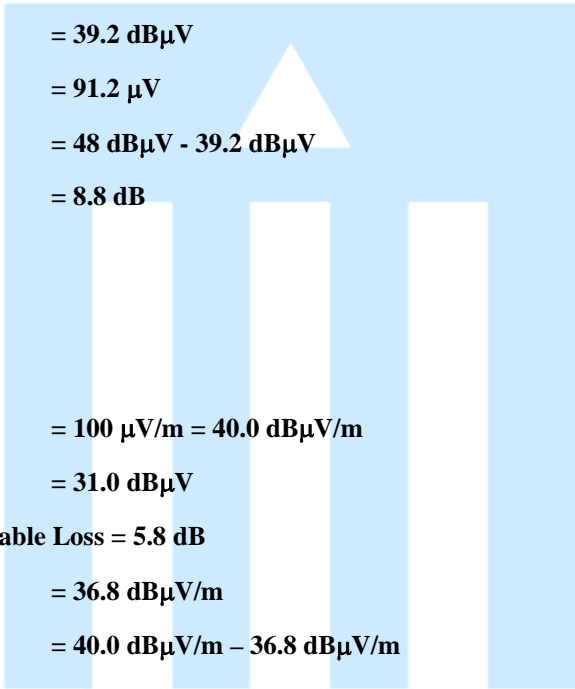
7. Sample Calculations

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

7.1 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



7.2 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





8. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. RF Receiver (Model Name: MRF-260i)** was complies with §15.107 and 15.109 of the FCC Rules.

- The end -

