

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

**Manufacturer: OHSUNG ELECTRONICS CO., LTD.**

**Date of Issue: January 15, 2013**

**#181 Gongdan-dong, Gumi-si, Gyeongbuk,  
Republic of Korea.**

**Order Number: GETEC-C1-12- 375**

**Test Report Number: GETEC-E3-12-134**

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

**Test Site: GUMI COLLEGE EMC CENTER**

**FCC Registration Number: (100749, 443957)**

**FCC ID. : OZ5URCMX890I**

**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-890i**  
**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)**

**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, Associate Engineer**  
**GUMI COLLEGE EMC CENTER**

  
**Jae-Hoon Jeong, Senior Engineer**  
**GUMI COLLEGE EMC CENTER**





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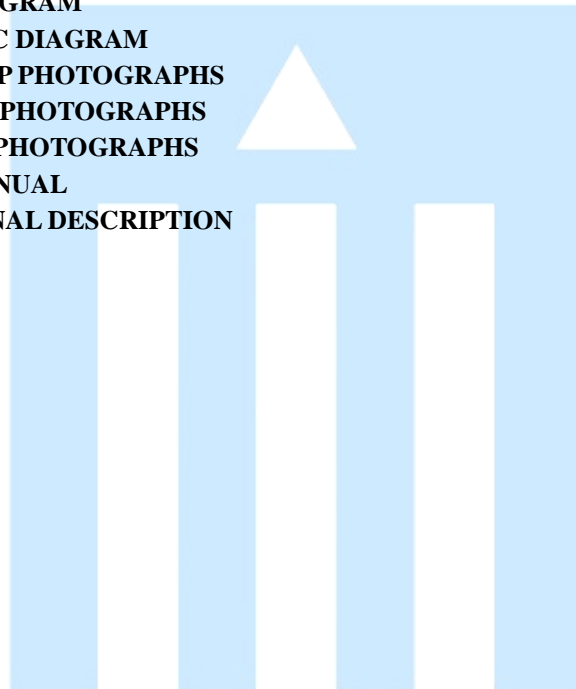
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*Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

## 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**

● <b>FCC ID.</b>	OZ5URCMX890I
● <b>Equipment Class</b>	Remote Control Transmitter (DSC)
● <b>EUT Type</b>	RF REMOTE CONTROLLER
● <b>Model Name</b>	MX-890i
● <b>Trade Name</b>	UNIVERSAL Remote Control
● <b>Serial Number</b>	Prototype
● <b>Rule Part(s)</b>	FCC Part 15 Subpart C
● <b>Type of Authority</b>	Certification
● <b>Test Procedure(s)</b>	ANSI C63.4 (2009)
● <b>Dates of Test</b>	December 25, 2012 ~ January 7, 2013
● <b>Place of Test</b>	<b>GUMI COLLEGE EMC CENTER</b> (FCC Registration No.: 100749, 443957) 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
● <b>Test Report Number</b>	GETEC-E3-12-134
● <b>Dates of Issue</b>	January 15, 2013

**EUT Type: RF REMOTE CONTROLLER**

**FCC ID: OZ5URCMX890I**





## 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 REMOTE CONTROLLER (Model Name: MX-890i) FCC ID.: OZ5URCMX890I**

These measurement tests were conducted at **GUMI COLLEGE 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 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 (2009)

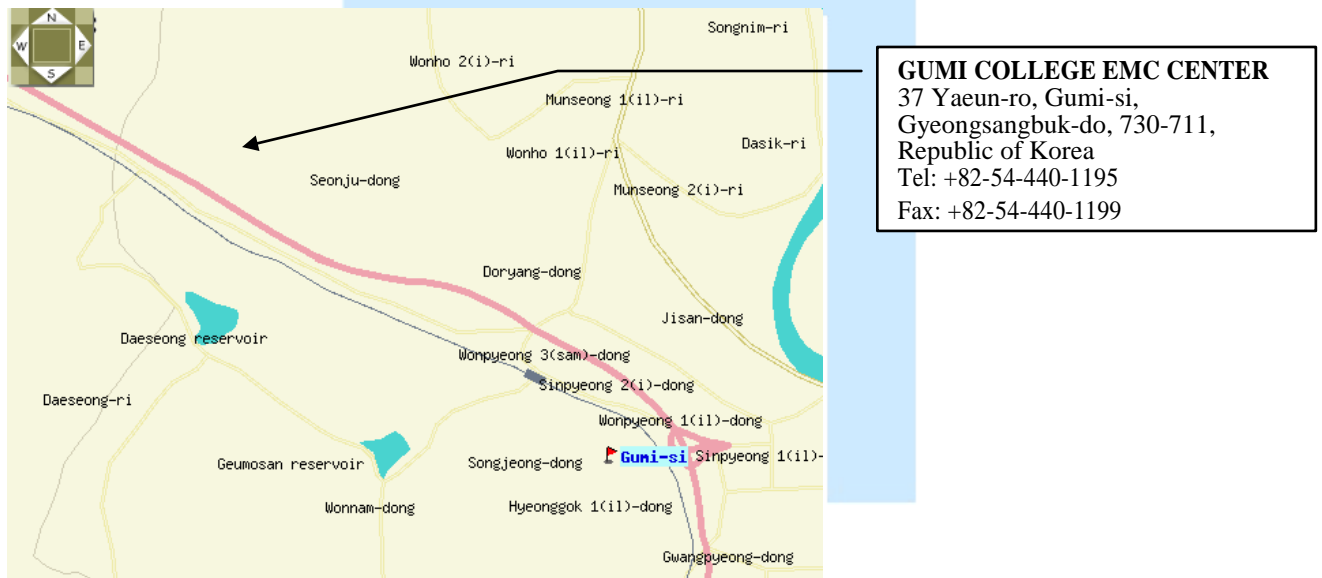


Fig 1. The map above shows the Gumi College in vicinity area.





### 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-890i) FCC ID.: OZ5URCMX890I**

- **CPU** : ARM 32-bit Cortex-M3 (72 MHz)
- **Memory** : 8 Mbit SRAM, 64Mbit Flash
- **Learning Capability** : Standard frequencies (50 kHz to 460 kHz)
- **Macro Capability** : Up to 255 steps each
- **RF Range** : 50 to 100 feet, depending upon the environment
- **IR Range** : 30 to 50 feet, depending upon the environment
- **Power** : DC 5.0 V, 1.0 A
- **I/O Port** : DC Jack 1 EA, LAN port 1 EA
- **RF Frequency** : 433.92 MHz
- **Weight** : 5.73 ounces
- **Size** : 8.46 × 1.97 × 1.02
- **Crystal & Clock Frequency** : Main board: 32.768 kHz, 8 MHz  
RF: 13.560 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 E- 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.

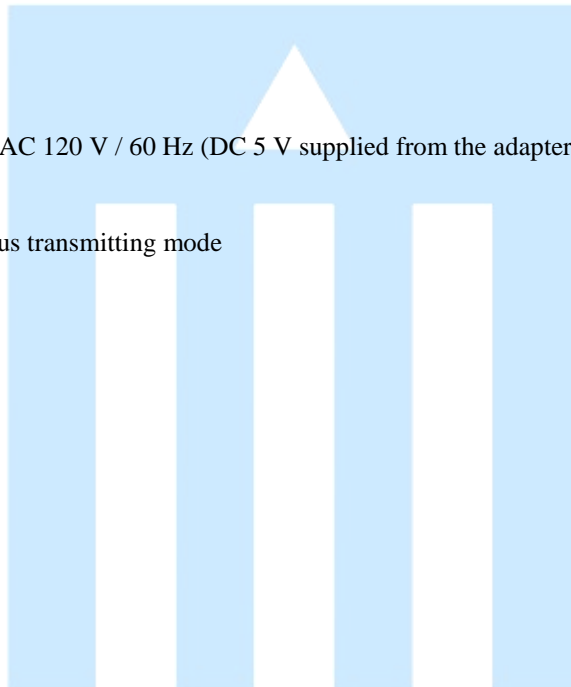
##### 4.1 Description of Antenna

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 : AC 120 V / 60 Hz (DC 5 V supplied from the adapter)
- Test Mode(s): RF continuous 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).

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.

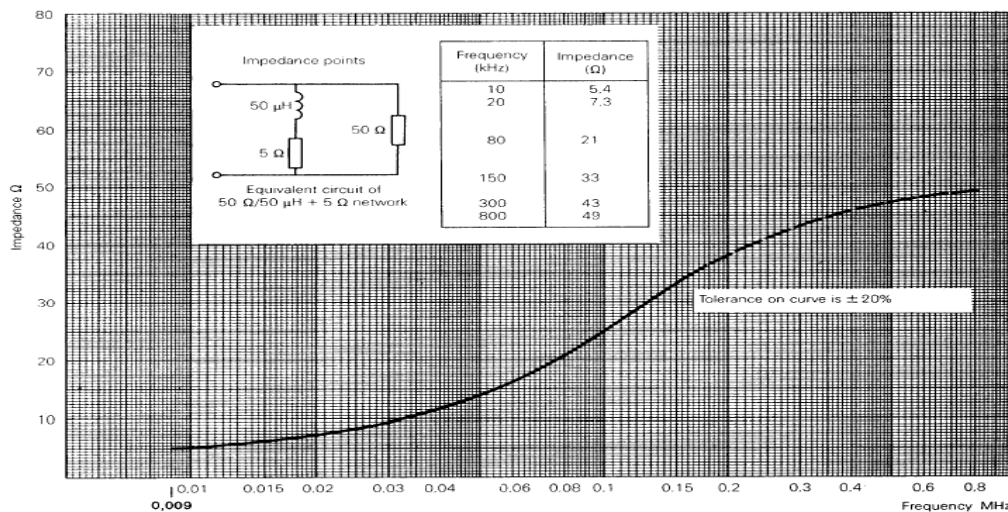


Fig 2. Impedance of LISN





### 5.3 Radiated Emission

Exploratory Radiated measurements were conducted at the 3m 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 1GHz were made at 3m Chamber (FCC Registration No.: 443957) or Open area test site (FCC Registration No.: 100749) that complies with CISPR 16/ANSI C63.4.

Above 1GHz final measurements were conducted at the 3m Chamber (FCC Registration No.: 443957) only.

For measurements above 1GHz, the bottom side of 3m 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 1GHz) and Peak & Average mode (Above 1GHz).

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.

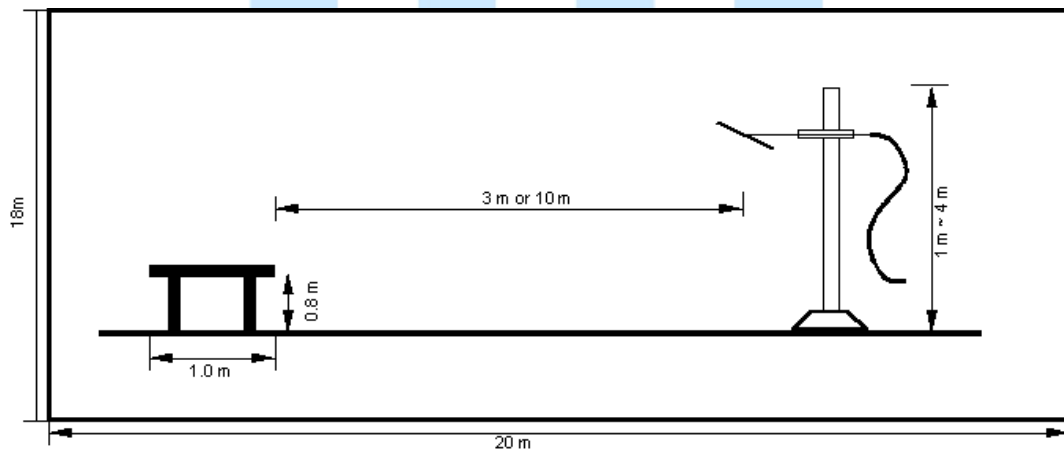


Fig 3. Dimensions of test site (Below 1GHz)

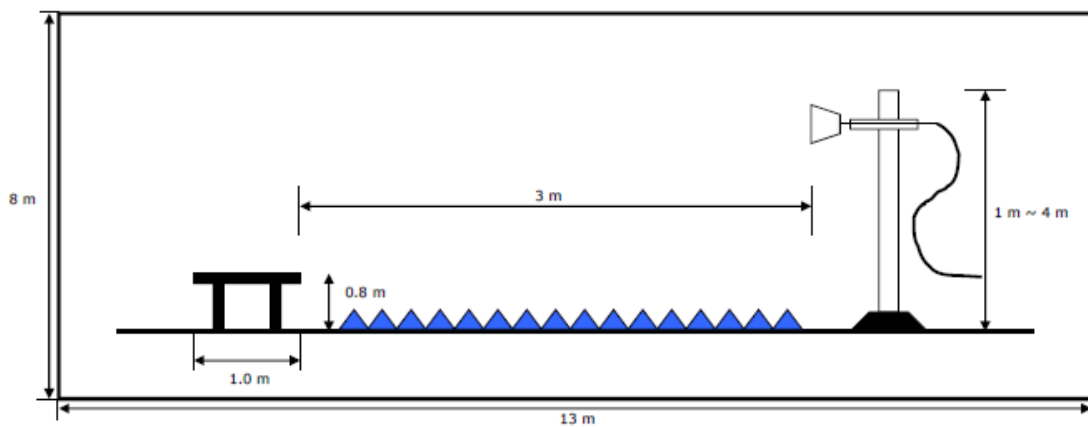


Fig 4. Dimensions of test site (Above 1GHz)





#### 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. Conducted Emission

### 6.1 Operating Environment

Temperature : 23.0 °C  
Relative Humidity : 43.0 % R.H.

### 6.2 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.

### 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	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	± 2.74 dB	Confidence level of approximately 95 % ( $k = 2$ )
Conducted emission (150 kHz ~ 30 MHz)	± 4.25 dB	Confidence level of approximately 95 % ( $k = 2$ )





#### 6.4 Limit

RFI Conducted	FCC Limit (dB $\mu$ 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.

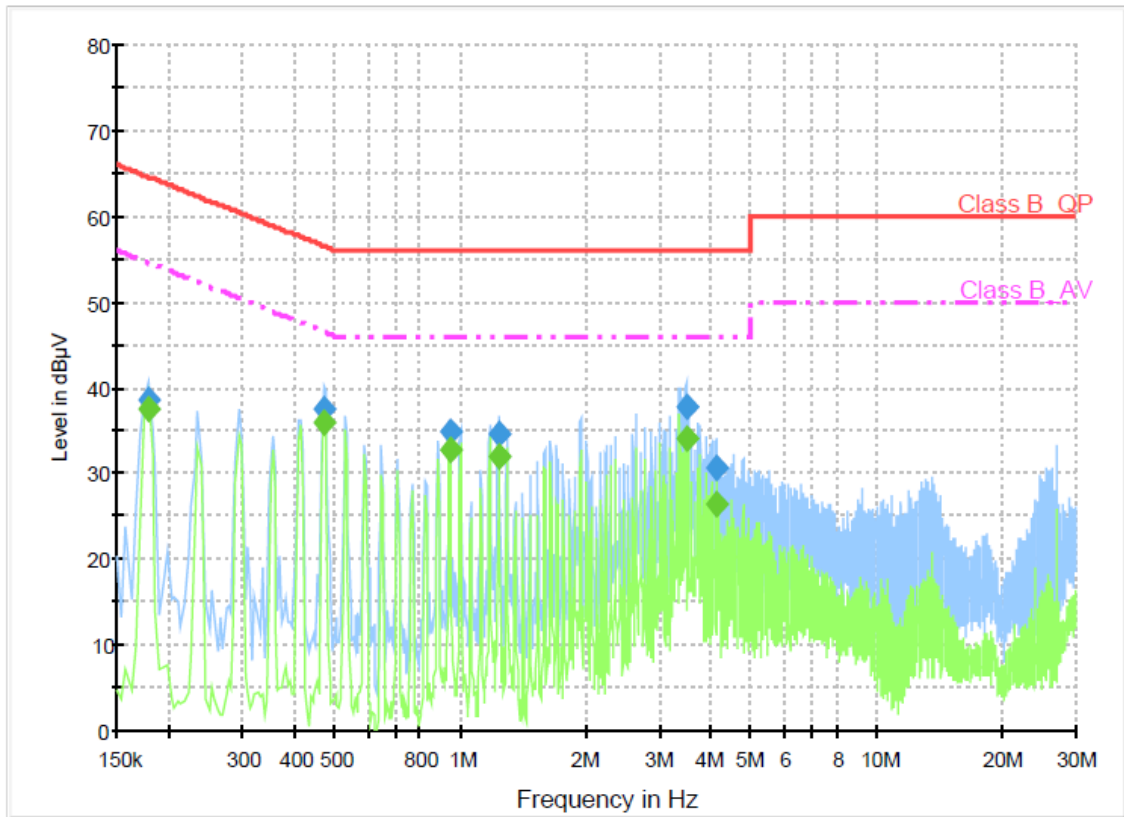
#### 6.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	05. 22. 2013
□ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	05. 23. 2013
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	05. 23. 2013
□ - ENY81-CA6	Rohde & Schwarz	ISN	101573	07. 19. 2013

#### 6.6 Test data for Conducted Emission

- Test Date : January 7, 2013
- Resolution Bandwidth : 9 kHz
- Frequency Range : 0.15 MHz ~ 30 MHz
- Line : L1: Live, N: Neutral





### Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.178000	38.7	1000.0	9.000	GND	L1	10.1	25.9	64.6	
0.472000	37.6	1000.0	9.000	GND	N	10.1	18.9	56.5	
0.944000	34.7	1000.0	9.000	GND	L1	10.1	21.3	56.0	
1.240000	34.6	1000.0	9.000	GND	N	10.1	21.4	56.0	
3.488000	37.7	1000.0	9.000	GND	N	10.1	18.3	56.0	
4.132000	30.7	1000.0	9.000	GND	L1	10.1	25.3	56.0	

### Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.178000	37.6	1000.0	9.000	GND	L1	10.1	17.0	54.6	
0.472000	35.9	1000.0	9.000	GND	N	10.1	10.6	46.5	
0.944000	32.9	1000.0	9.000	GND	L1	10.1	13.1	46.0	
1.240000	32.1	1000.0	9.000	GND	N	10.1	13.9	46.0	
3.488000	33.9	1000.0	9.000	GND	N	10.1	12.1	46.0	
4.132000	26.3	1000.0	9.000	GND	L1	10.1	19.7	46.0	

< Fig 5. Conducted emission result >





## 7. Duty Cycle Correction

### 7.1 Operating Environment

Temperature : 23.0 °C  
 Relative humidity : 43.0 % R.H.

### 7.2 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.

### 7.3 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	05. 23. 2013
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 14. 2013

### 7.4 Test result of Duty Cycle

- Test Date : December 25, 2012
- Reference Standard : Part 15 Subpart C, Sec. 15.231 (a)(1)
- Operating Condition : RF transmitting mode
- Spectrum Resolution Bandwidth (6 dB) : 100 kHz

#### 7.4.1 Test Frequency: 433.92 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

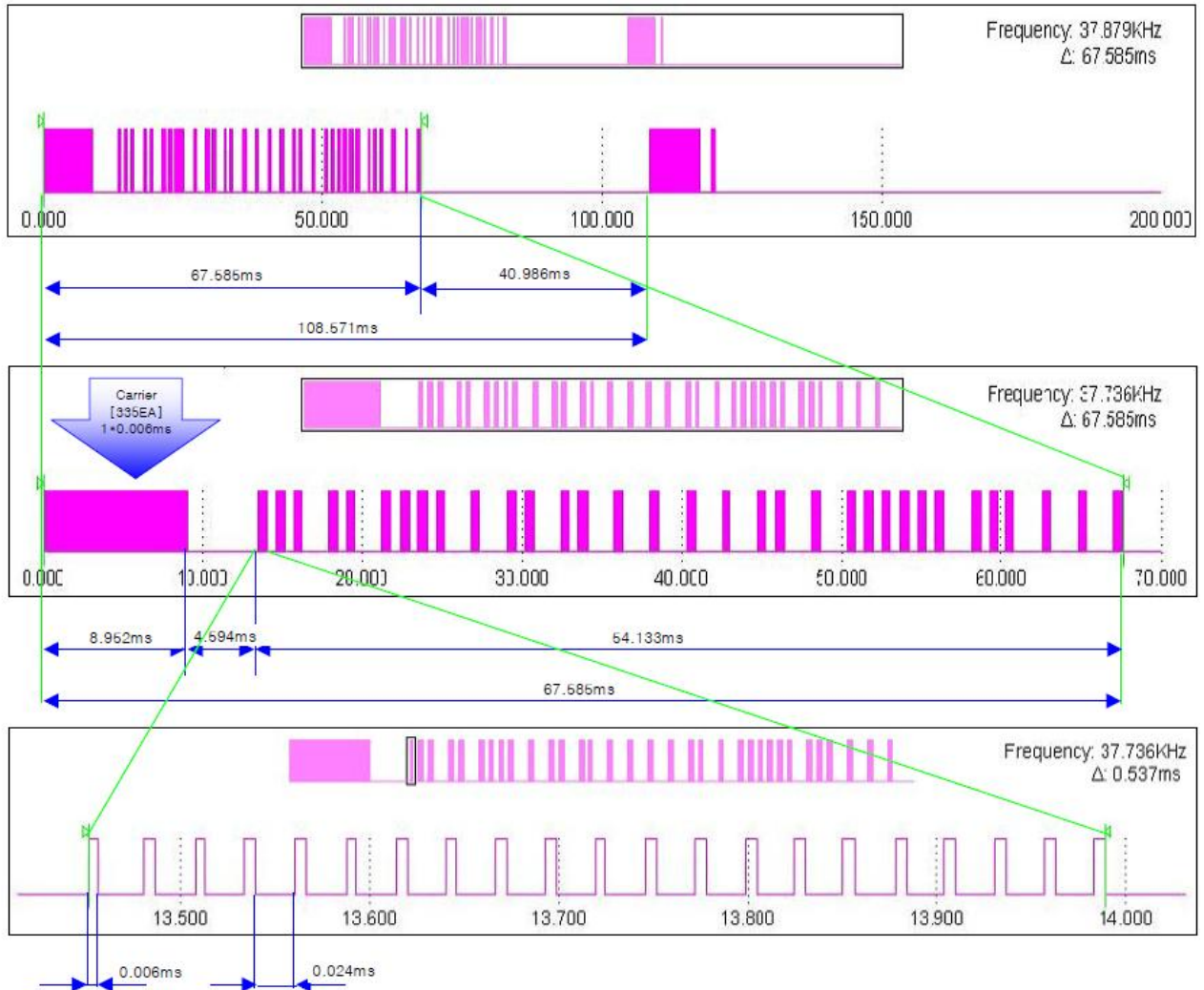
Fundamental Frequency	Total width of ON-Time	Duty Cycle (%)	Duty Cycle (dB)
433.92 MHz	6.17 ms	6.17 %	- 24.20 dB





### 7.4.2 Complete Pulse Train / On-time of the Head

#### 1. NEC Format (15A\_002)



No. of code GR. Per 100ms	Head		Data		Total	Duty Cycle	
	No. of pulse	Width of pulse(ms)	No. of pulse	Width of pulse(ms)	Width(ms)	(%)	(dB)
	335	0.006ms	693	0.006ms	6.168	6.17%	-24.19

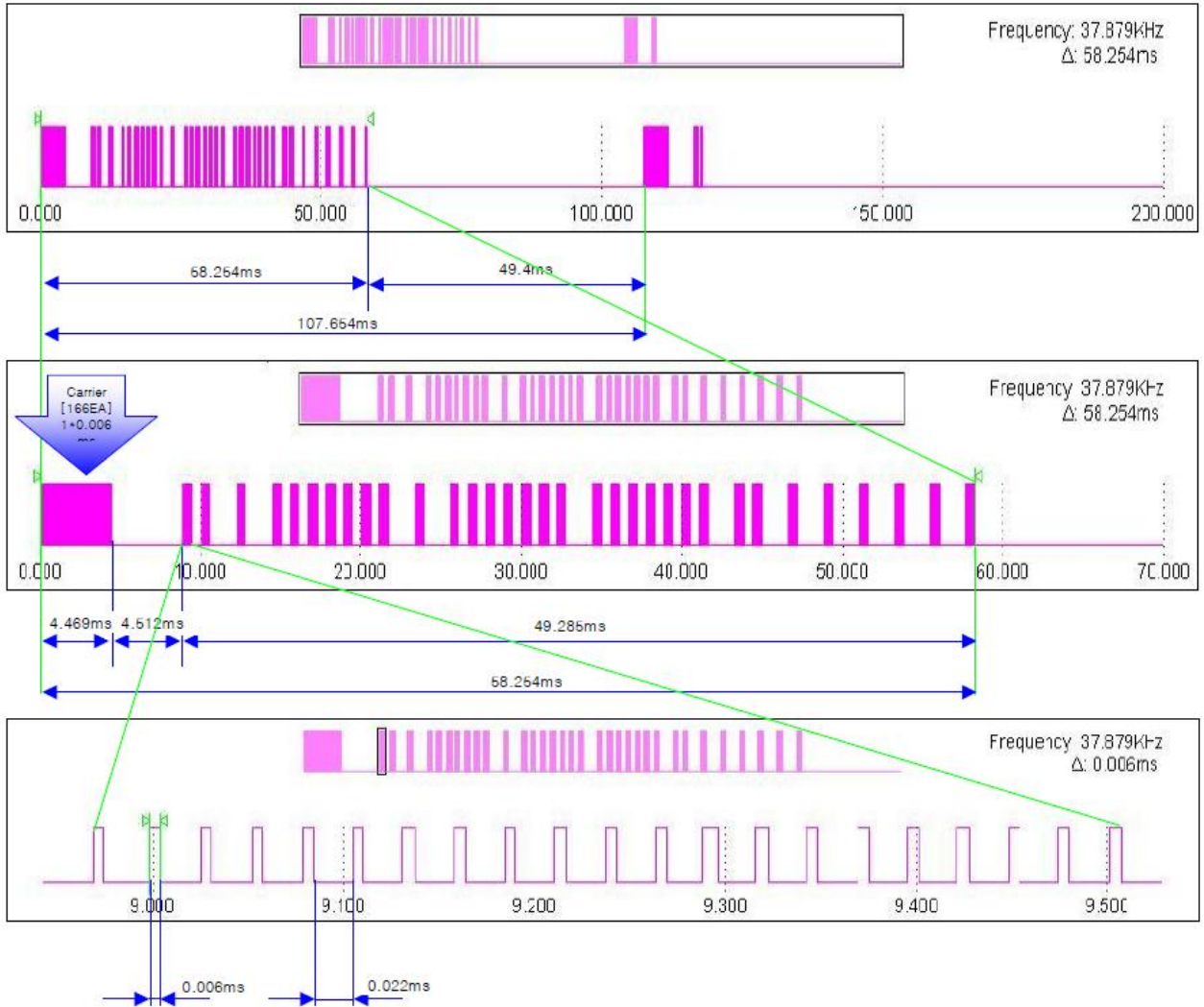
계산식 : (335\*0.006)+(693\*0.006) = 6.168 [693 = (1\*33\*21)]







2. TC9012 Format (14A\_044)



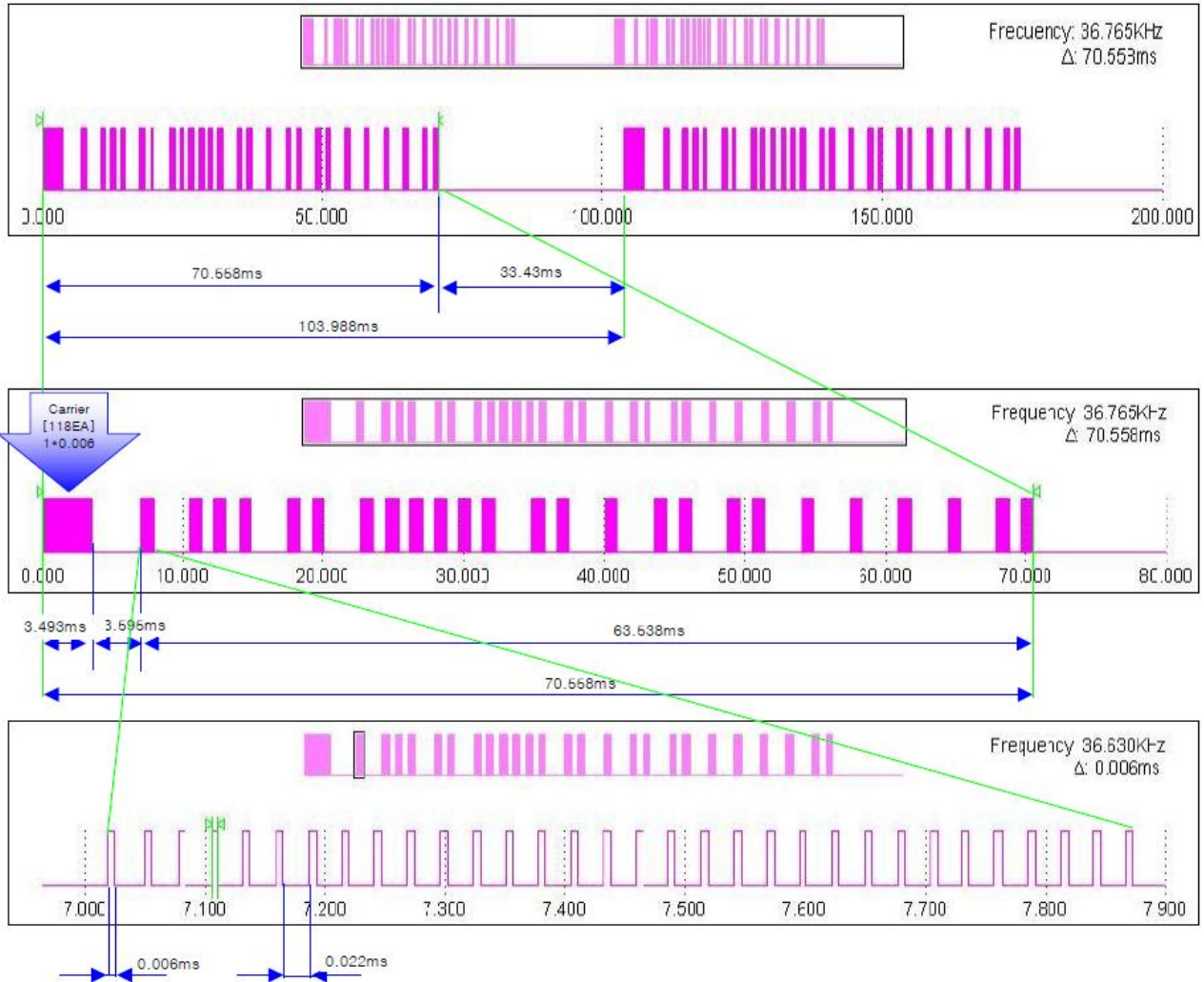
No. of code GR. Per 100ms	Head		Data		Total	Duty Cycle	
	No. of pulse	Width of pulse(ms)	No. of pulse	Width of pulse(ms)	Width(ms)	(%)	(dB)
	166	0.006ms	693	0.006ms	5.15	5.15%	-25.757

계산식 : (166\*0.006)+(693\*0.006) = 5.154 [693 = (1\*33\*21)]





3. MN6014 Format (18A\_052)



No. of code GR. Per 100ms	Head		Data		Total	Duty Cycle	
	No. of pulse	Width of pulse(ms)	No. of pulse	Width of pulse(ms)	Width(ms)	(%)	(dB)
	118	0.006ms	693	0.006ms	5.658	5.66%	-24.94

계산식 :  $(118 \times 0.006) + (693 \times 0.006) = 5.658$  [825 =  $(1 \times 33 \times 25)$ ]





## 8. Activation time

### 8.1 Operating Environment

Temperature : 23.0 °C  
 Relative humidity : 43.0 % R.H.

### 8.2 Limit

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

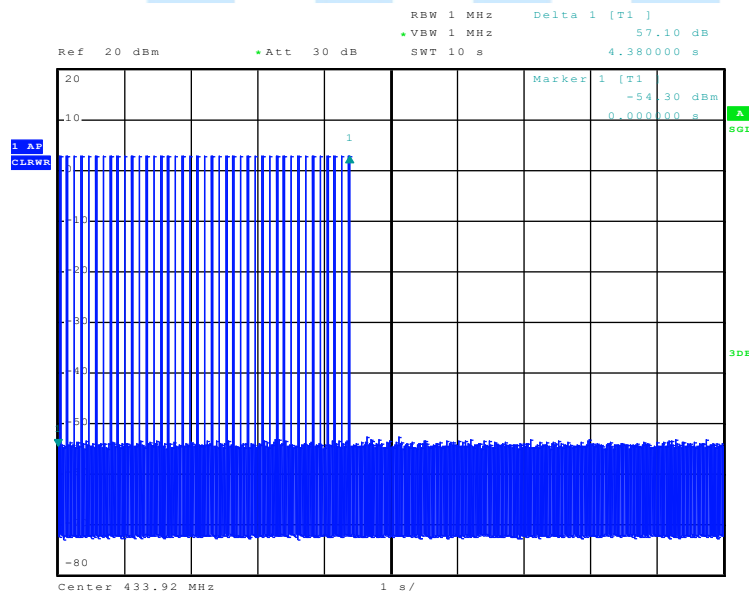
### 8.3 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	03. 14. 2013
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	01. 23. 2013

### 8.4 Test result of Activation time

- Test Date : January 7, 2013
- Reference Standard : Part 15 Subpart C, Sec. 15.35
- Operating Condition : RF transmitting mode
- Spectrum Resolution Bandwidth (6 dB) : 1 MHz

Fundamental Frequency	Activate ON-Time	Limit	Result
433.92 MHz	4.38 s	< 5 s	PASS



Date: 7.JAN.2013 06:22:55

< Fig 6. Activation time >





## 9. Radiated Emission

### 9.1 Operating environment

Temperature : 23.0 °C  
Relative humidity : 43.0 % R.H.

### 9.2 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.

### 9.3 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)	± 4.35 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 4.29 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 4.43 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 4.21 dB	Confidence level of approximately 95 % ( $k = 2$ )





**9.4 Limit**

Fundamental Frequency (MHz)	Field strength of Fundamental			Field strength of Spurious Emission	
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\mu\text{V/m}$	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
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

**9.5 Test Equipment used**

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	05. 23. 2013
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3193	03. 14. 2013
■ - BBHA9120D	Schwarzbeck	Horn Antenna	597	01. 23. 2013
■ - 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. 2013





### 9.6 Test data for Radiated Emission

- Test Date : December 25, 2012
- Reference Standard : Part 15 Subpart C, Sec.15.231
- Measuring Distance : 3 m
- Note : 1. Through three orthogonal axes were investigated and the worst case is reported.  
 2. The signal bandwidth was measured around 40kHz and it less than 100 kHz.  
 Therefore, PDCF is not required the fundamental signal peak result.
- Measurement

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

#### 8.6.1 Operating condition: Continuous RF transmitting mode (433.92 MHz)

- ♦ Field Strength of the fundamental & harmonic frequencies.

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)	Average (dBuV/)	Pol. (H/V)	Height (cm)	Angle (deg)
<b>Fundamental</b>												
433.92	79.37	20.33	-24.20	99.70	75.50	100.83	80.83	1.13	5.32	H	200	99
<b>Spurious</b>												
867.98	12.42	28.08	-24.20	40.50	16.30	80.83	60.83	40.33	44.52	H	100	309
1735.69	66.88	-12.38	-24.20	54.50	30.30	80.83	60.83	26.33	30.52	H	125	312
2169.73	71.92	-10.92	-24.20	61.00	36.80	80.83	60.83	19.83	24.02	H	100	91
2603.85	74.97	-9.07	-24.20	65.90	41.70	80.83	60.83	14.93	19.12	H	115	339
3034.07	64.63	-7.23	-24.20	57.40	33.20	80.83	60.83	23.43	27.62	H	100	266
3471.20	65.07	-5.47	-24.20	59.60	35.40	80.83	60.83	21.23	25.42	H	100	36
3905.72	62.92	-3.72	-24.20	59.20	35.00	74.00	54.00	14.80	19.00	H	100	36
4339.36	68.79	-2.59	-24.20	66.20	42.00	74.00	54.00	7.80	12.00	V	100	110

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

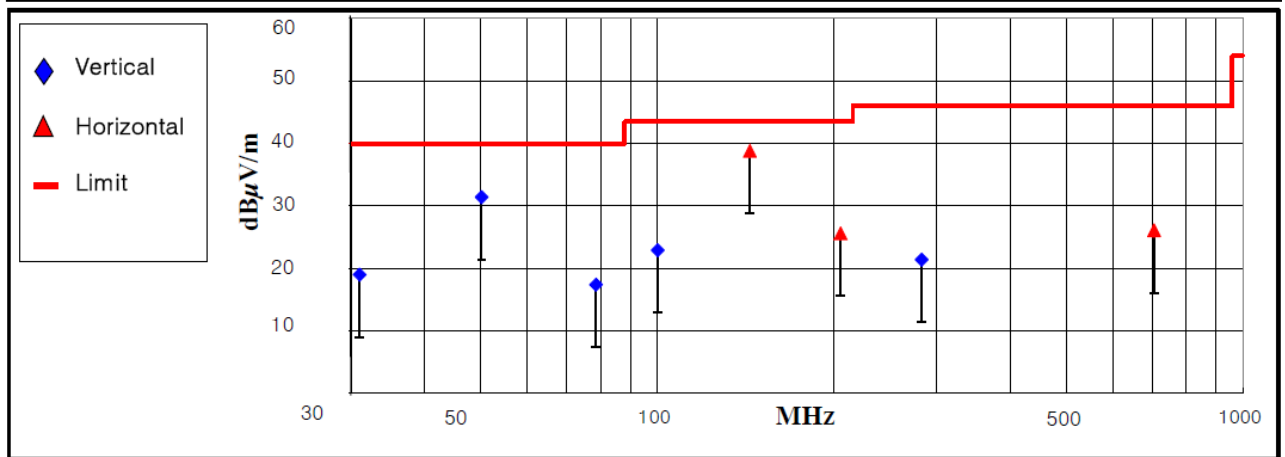
Note: "H": Horizontal, "V": Vertical





♦ Field Strength of the spurious emission except the harmonic frequencies

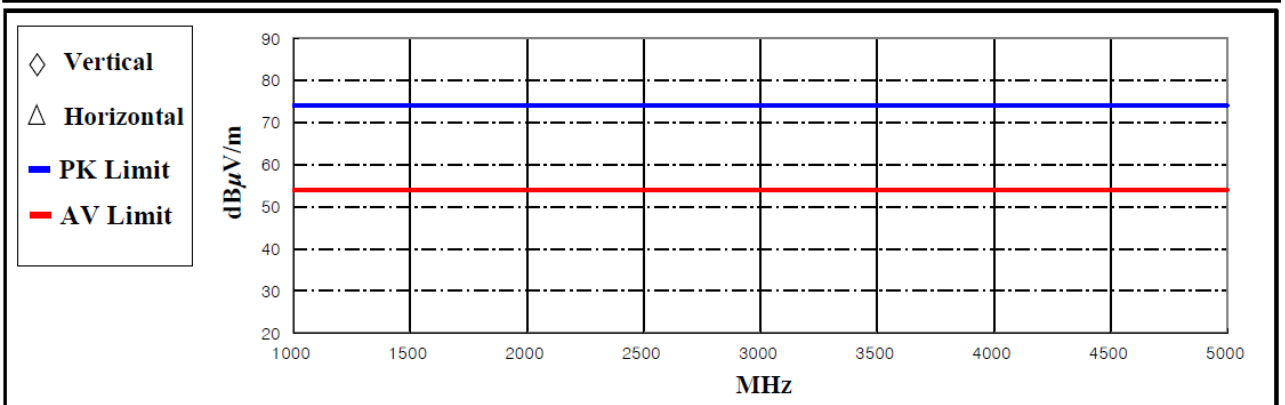
Frequency (MHz)	Measurement Level				Limit (dBμV/m)	Margin (dB)	Positioning System		
	Reading	Antenna	Cable	Test Result			Pol. (H/V)	Height (cm)	Angle (°)
	Value(dBμV)	Factor(dB/m)	Loss(dB)	(dBμV/m)					
31.04	7.58	10.37	1.05	19.00	40.00	21.00	V	150	289
50.14	17.87	12.00	1.53	31.40	40.00	8.60	V	100	2332
78.62	7.94	7.86	1.60	17.40	40.00	22.60	V	100	359
100.22	11.67	9.41	1.82	22.90	43.50	20.60	V	125	0
143.96	24.32	12.31	2.17	38.80	43.50	4.70	H	237	335
205.71	13.80	9.16	2.64	25.60	43.50	17.90	H	145	338
282.86	5.58	12.72	3.10	21.40	46.00	24.60	V	126	148
705.50	0.53	20.60	4.97	26.10	46.00	19.90	H	115	121



< Fig 7. Radiated emission result (30 MHz ~ 1 000 MHz) >

♦ Field Strength of the spurious emission except the harmonic frequencies

Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV/m)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
All frequency	-	-	-	-	<<	<<	-	-	-	-	-	-	-



\*Comment : AMP/CL\_Cable loss value + AMP gain value  
 AF : Antenna factor value  
 Pol. : H(Horizontal), V(Vertical)

< Fig 8. Radiated emission result (1 GHz ~ 5 GHz) >





## 9. Occupied Bandwidth Measurement

### 9.1 Operating Environment

Temperature : 23.0 °C  
 Relative humidity : 43.0 %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 C63.4-2009)

### 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	05. 23. 2013
■ - VULB9160	Schwarzbeck	Bi-log antenna	3193	03. 14. 2013

### 9.5 Test result of occupied bandwidth

- Test Date : December 29, 2012  
 - Reference standard : Part 15 Subpart C, Sec. 15.231  
 - Operating condition : RF transmitting mode  
 - Spectrum resolution bandwidth(3 dB) : 30 kHz



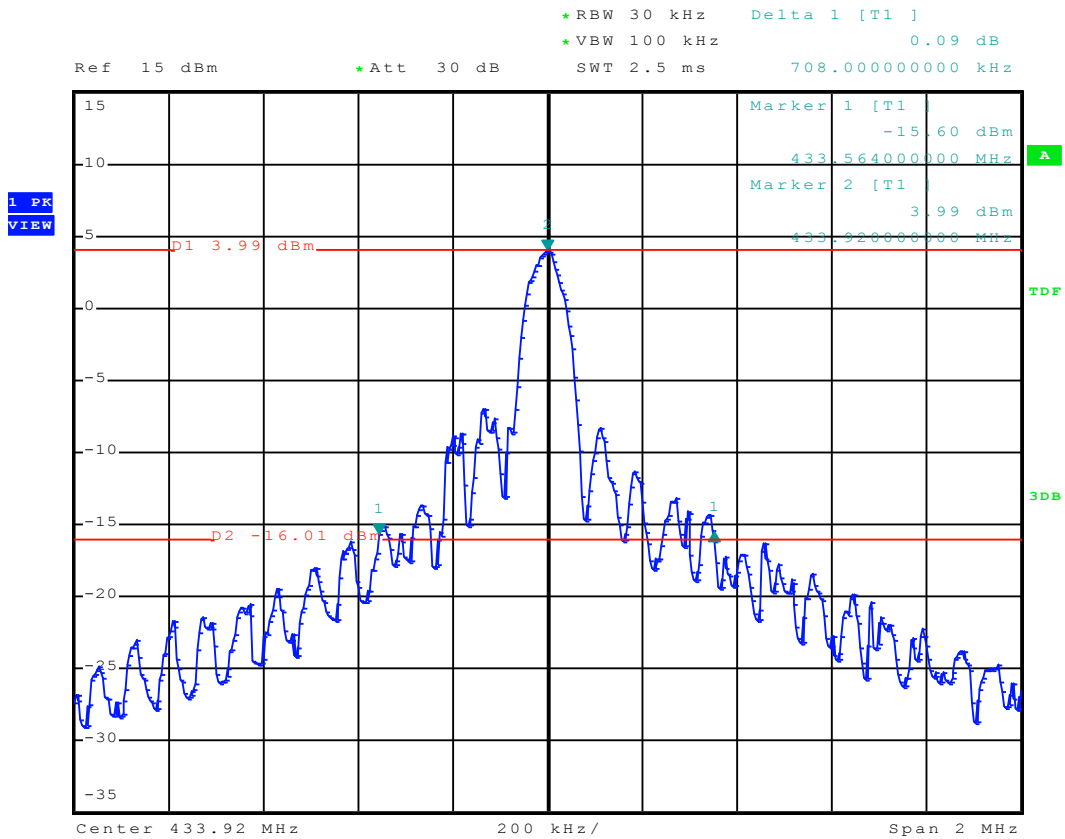




### 9.5.1 Test Frequency: 433.92 MHz

Allowed Bandwidth: Test frequency  $\times$  0.002 5

Fundamental Frequency	Bandwidth	Allowed Bandwidth	Result
433.92 MHz	708 kHz	1 084 kHz	PASS



Date: 29.DEC.2012 10:56:00

< Fig 9. Occupied bandwidth >





## 10. Sample Calculations

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

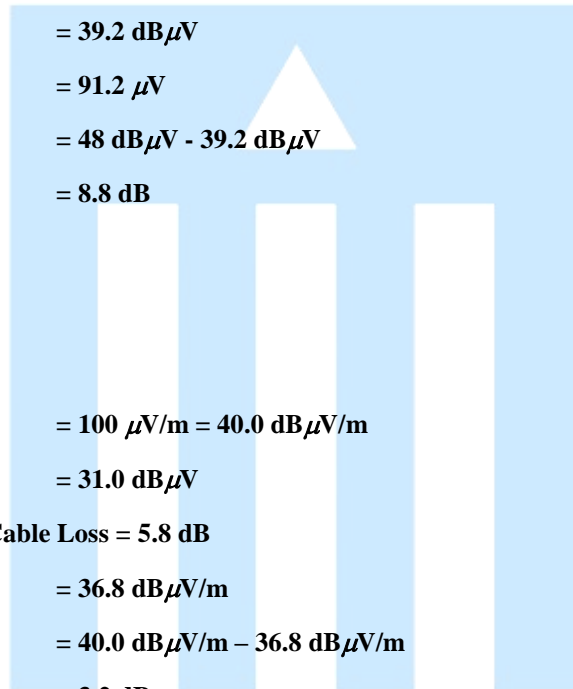
$$\text{dB}\mu\text{V} = \text{dBm} + 107$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

### 10.1 Example 1 :

#### ■ 20.3 MHz

<b>Class B Limit</b>	<b>= 250 <math>\mu\text{V}</math> = 48 dB<math>\mu\text{V}</math></b>
<b>Reading</b>	<b>= 39.2 dB<math>\mu\text{V}</math></b>
<b><math>10^{(39.2\text{dB}\mu\text{V}/20)}</math></b>	<b>= 91.2 <math>\mu\text{V}</math></b>
<b>Margin</b>	<b>= 48 dB<math>\mu\text{V}</math> - 39.2 dB<math>\mu\text{V}</math></b>
	<b>= 8.8 dB</b>



### 10.2 Example 2 :

#### ■ 66.7 MHz

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





## 11. Recommendation & Conclusion

The data collected shows that the **OHSUNG ELECTRONICS CO., LTD. RF REMOTE CONTROLLER (Model Name: MX-890i)** was complies with §15.231 of the FCC Rules.

- The end -

