Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT	:	Remote Control
MODEL/TYPE NO	:	WR730-RaySat / Proto-type
FCC ID	:	WXRWR730-RAYSAT
APPLICANT	:	YUWON TRONIX Co., Ltd.
		Rm.1213, Opus, #611-26, Gurobon-dong, Guro-gu, Seoul, 152-865 Korea
		Attn.: Mr. Young Jin Kim / Manager
MANUFACTURER 1	:	YUWON TRONIX Co., Ltd.
		Rm.1213, Opus, #611-26, Gurobon-dong, Guro-gu, Seoul, 152-865 Korea
MANUFACTURER 2	:	YUWON ELECTRONICS(HuiZhou)Co., Ltd.
		Puzai Industrial, Lilin Town, Huicheng District, Huizhou City Guangdong, China
FCC CLASSIFICATION	:	DXT : Part 15 Low Power Transceiver, Rx Verified
FCC RULE PART(S)	:	FCC Title 47, Part 15 Subpart C
FCC PROCEDURE	:	ANSI C63.4-2003
TEST REPORT No.	:	ETLE081118.870
DATES OF TEST	:	December 17 to 22, 2008
REPORT ISSUE DATE	:	December 24, 2008
TEST LABORATORY	:	ETL Inc. (FCC Designation Number : KR0022)

This is Remote Control; Model WR730-RaySat has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C section 15.249
I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is 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.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Hyung Seok, Lee / Chief Engineer

ETL Inc.
#371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
Tel: 82-2-858-0786 Fax: 82-2-858-0788

Table of Contents

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

FCC MEASUREMENT REPORT

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

General Information

Applicant Name : YUWON TRONIX Co., Ltd.

Address : Rm.1213, Opus, #611-26, Gurobon-dong, Guro-gu, Seoul, 152-865 Korea

Attention : Mr. Young Jin Kim / Manager

- **EUT Type :** Remote Control
- **Model Number :** WR730-RaySat
- **FCC ID :** WXRWR730-RAYSAT
- **S/N :** Proto-type
- **Freq. Range :** 2 402 MHz – 2 473 MHz
- **FCC Rule Part(s) :** FCC Part 15 Subpart C section 15.249
- **Test Procedure :** ANSI C63.4-2003
- **FCC Classification :** DXT : Part 15 Low Power Transceiver, Rx Verified
- **Dates of Tests :** December 17 to 22, 2008
- **Place of Tests :** ETL Inc. Testing Lab. (FCC Designation Number : KR0022)

  Radiated Emission test;
  #499-1, Sagot-ri, Seosin-myeon, Hwaseong-si,
  Gyeonggi-do, 445-882, Korea

  Conducted Emission test;
  ETL Inc. Testing Lab. (FCC Designation Number : KR0022)
  371-51, Gasan-donzg, Geumcheon-gu, Seoul, 153-803, Korea
- **Test Report No. :** ETLE081118.870

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC Designation Number : KR0022).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the YUWON TRONIX Co., Ltd. Model: WR730-RaySat

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

2. PRODUCT INFORMATION

2.1 Equipment Description

This specification is applied to the specified RF(Radio Frequency) remote control unit.

2.2 General Specification

Measurement Voltage: 3 V

Measurement Temperature: 25 ℃ ±10 ℃

Measurement humility: 65 % ±10 %

Resonator: 8 MHz

Operational Frequency: 2.402 GHz, 2.415 GHz, 2.428 GHz, 2.442 GHz, 2.458 GHz, 2.473 GHz
: 6ch

Operation Temperature: -20 ℃ to +50 ℃

Modulation Method: GFSK

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

3. DESCRIPTION OF TESTS

3.1 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 13 in ANSI C63.4-2003 "Measurement of Intentional radiators" and § 11 in ANSI C63.4-2003 "Measurement of Information Technology Equipment". The measurements were performed over the frequency ranges of 30 MHz to 25 GHz using antenna as the input transducer to a spectrum analyzer or a field intensity meter. The measurements were made with the detector set for "Quasi-peak or Peak" within a bandwidth of 120 kHz or 1 MHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determine the frequency producing the max emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1 000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double broad-band horn antennas were used. Final measurements were made open site at 3 m. The test equipment was placed on a wooden turn-table. 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 by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. Emission for the frequency and were placed on top of a 0,8 m high nonmetallic 1 m x 1,5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the max emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

3.2 FCC Part 15.205 Restricted Bands of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

4. TEST CONDITION

4.1 Test Configuration

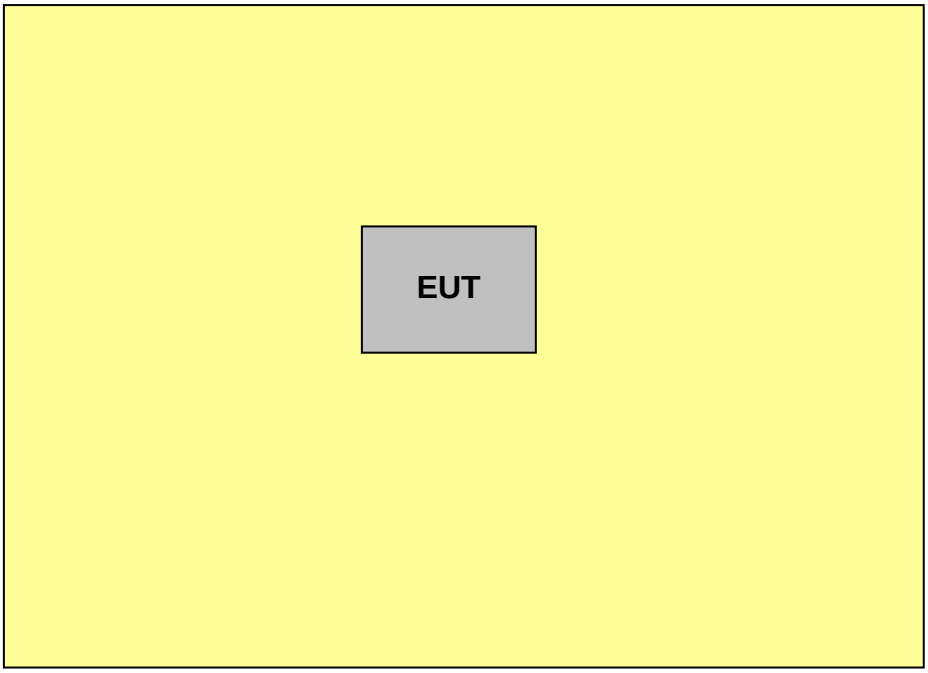
The device was configured for testing in a typical fashion (as a customer would normally use it). During the test, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner and which tends to maximize its emission level in a typical application.

4.2 EUT operation

The EUT was connected as user's guide. And during the test executed EUT is operating on the following

- Function of transmitter
The EUT (model: WR730-RaySat) has been tested under operating condition.
Fixed Channel (2 402MHz, 2 442MHz, 2 473MHz) was chosen for testing.

4.3 The setup drawing(s)



: Data Line
: Power Line
: Outside table

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5. TEST RESULTS

5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

Applied Standard : 47 CFR Part 15, Subpart C			
FCC Rule	**Measurement Required**	**Result**	**Remarks**
15.207(a)	Power line Conducted Emissions	**-**	***N/A**
15.209(a)	Radiated Emissions	**Pass**	
15.249	Radiated Emissions	**Pass**	
15.205	Restricted Bands	**Pass**	

Notes:

1) The frequency range of EUT is 2.402 GHz to 2.473 GHz
2) *N/A: Test not applicable(Power supply from to battery(DC 3 V)

The data collected shows that the **YUWON TRONIX Co., Ltd. / Remote Control / WR730-RaySat** complied with technical requirements of above rules part 15.209, 15.205 and 15.249 limits.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.2 Radiated Emissions Measurement

EUT	Remote Control / WR730-RaySat
Limit apply to	FCC Part 15.209(a)
Test Date	December 17, 2008
Operating Condition	Continues transmitter(2.402 MHz: 1ch, 2.442 MHz: 4ch, 2.473 MHz: 6ch)
Result	Passed

Limit

Part 15.209(a) except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequencies (MHz)	15.209 Radiated Limits (dB μN/m@3 m)
30 – 88	40
88 – 216	43.5
216 – 960	46
Above 960	54

Test Results

- Refer to see the measured plot in next page.

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.2.1 Radiated Emissions and Harmonics Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: Quasi-Peak mode (RBW: 120 kHz) below 1 GHz

Frequency [MHz]	Reading [dBμN]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dBμN]	Result [dBμN/m]	Limit [dBμN/m]	Margin [dB]
30							
Other frequencies	**All emissions not reported were more than 20 dB below the permitted limit.**						
1 000	-	–	-	-	-	-	-

Detector mode: Peak (74 dBuV/m@3) and AV (54 dBuV/m@3) mode above 1 GHz

Frequency [MHz]	Reading [dBμN]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dBμN]	Result [dBμN/m]	Limit [dBμN/m]	Margin [dB]
1 000							
Other frequencies	**All emissions not reported were more than 20 dB below the permitted limit.**						
25 000	-	–	-	-	-	-	-

NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss**
3. **Margin value = Limit – Result**
4. **Results found to be 20dB or greater under the limit have not been included.**
5. **The measurement was performed for the frequency range 30 MHz – 25 GHz according to the FCC Part 15.209(a)**
6. **below 1 GHz = Ant factor + cable loss, above 1 GHz = Ant factor + cable loss + AMP gain**

Test Engineer: Kug Kyoung, Yoon

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.3 Radiated Emissions Measurement

EUT	Remote Control / WR730-RaySat
Limit apply to	FCC Part 15.249
Test Date	December 17, 2008
Operating Condition	Continues transmitter(2.402 MHz: 1ch, 2.442 MHz: 4ch, 2.473 MHz: 6ch)
Result	Passed

Fundamental Frequency (MHz)	Field Strength of Fundamental microvolts/meter(dBμN/m@3 m)	Field Strength of Harmonics Emission microvolts/meter(dBμN/m@3 m)
902-928	50 000μN/m (94dBμN/m)	500μN/m (54dBμN/m)
2 400-2 483.5	50 000μN/m (94dBμN/m)	500μN/m (54dBμN/m)
5 725-5 875	50 000μN/m (94dBμN/m)	500μN/m (54dBμN/m)
24 000.00-24 000.25	250 000μN/m (108dBμN/m)	2 500μN/m (68dBμN/m)

Test Results
- Refer to see the measured plot in next page.

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.3.1 Radiated Emissions of Fundamental

Peak Mode Test Data

Frequency [MHz]	Polarization (*H/**V)	Result [dBμV/m]	Peak Limit [dBμV/m]	Margin [dB]
2 402	H	74.40	114.00	39.60
2 402	V	79.10	114.00	34.90
2 442	H	78.20	114.00	35.80
2 442	V	79.50	114.00	34.50
2 473	H	71.30	114.00	42.70
2 473	V	70.80	114.00	43.20

Average Mode Test Data

Frequency [MHz]	Polarization (*H/**V)	Result [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]
2 402	H	73.40	94.00	20.60
2 402	V	77.90	94.00	16.10
2 442	H	77.50	94.00	16.50
2 442	V	78.20	94.00	15.80
2 473	H	70.60	94.00	23.40
2 473	V	69.90	94.00	24.10

NOTES:

1. **Above 1 GHz = Ant factor + cable loss + AMP gain**

Test Engineer : Kug Kyoung, Yoon

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.4 Restricted Bands

EUT	Remote Control / WR730-RaySat
Limit apply to	FCC Part 15.249
Test Date	December 22, 2008
Operating Condition	Continues transmitter(2.402 MHz: 1ch, 2.473 MHz: 6ch)
Result	Passed
Notes	The emission of the carrier radiated field strength is measured for (Peak and AV)as following: 1. The transmitter was then configured with the worst case antenna and setup to transmit at the lowest channel (ch1). Then the field strength was measured at 2 310-2 390 MHz. 2. The transmitter was configured with the worst case antenna and setup to transmit at the highest channel (ch6). Then the field strength was measured at 2 483.5-2 500 MHz.

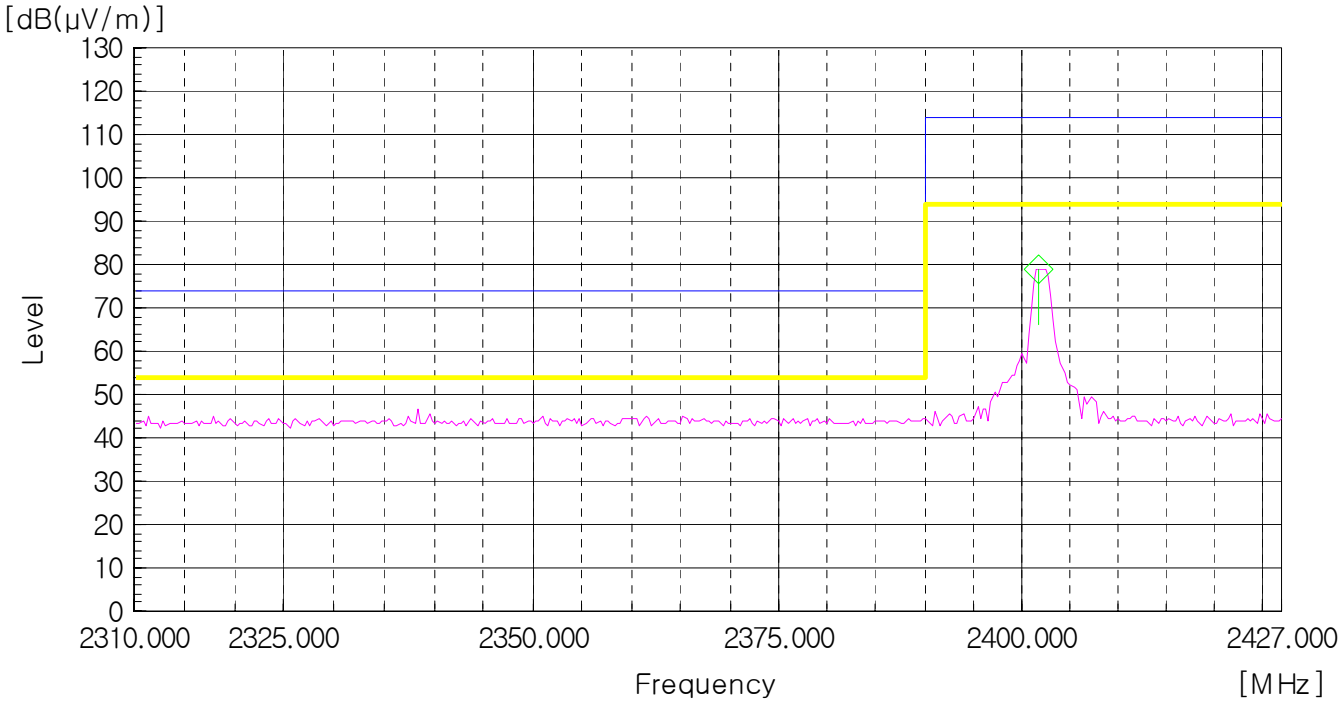
Test Results
- Refer to see the measured plot in next page.

Test Engineer : Kug Kyoung, Yoon

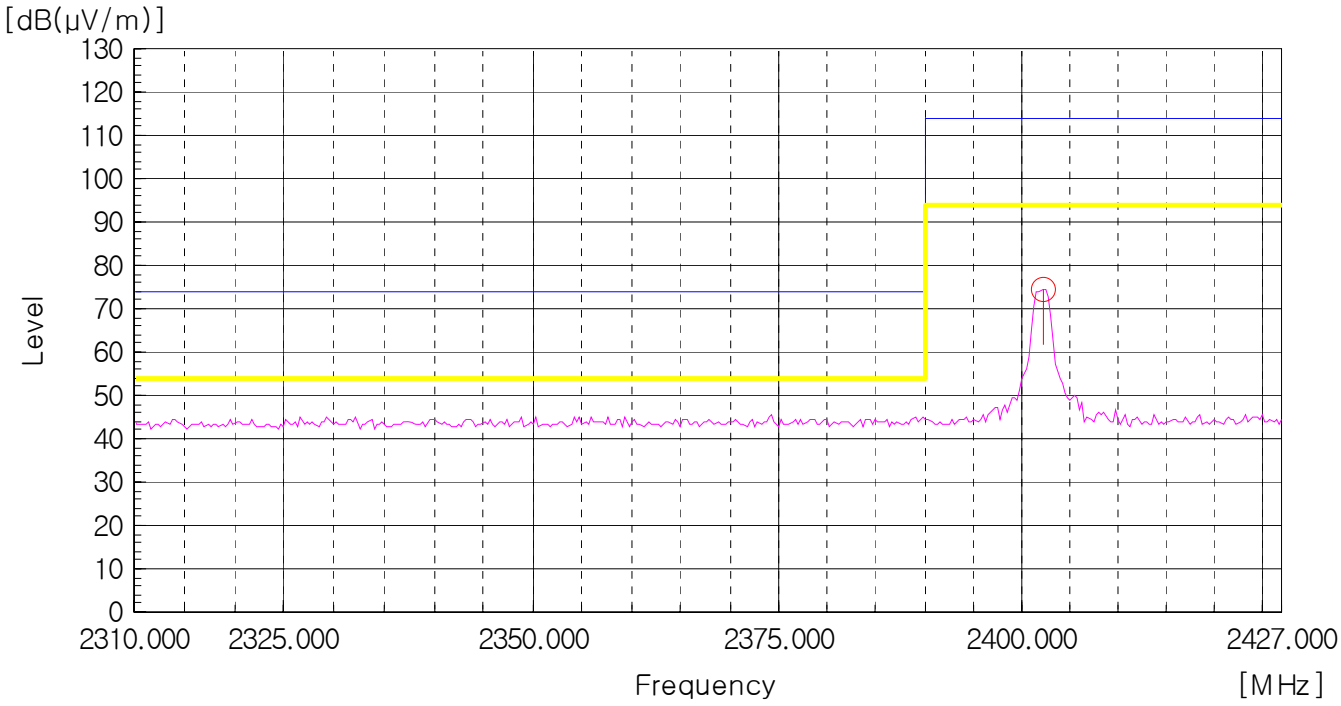
Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.4.1 Restricted Bands data.

Ch1: 2 402 MHz, Vertical



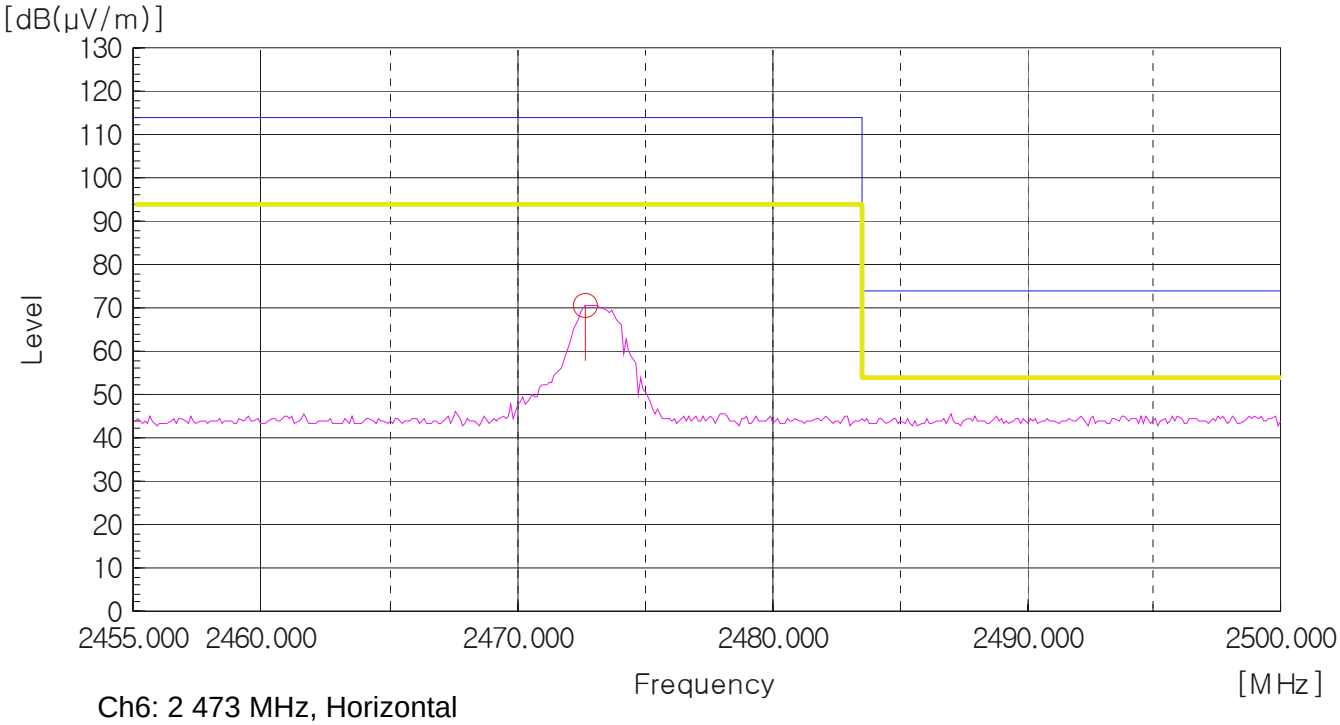
Ch1: 2 402 MHz, Horizontal



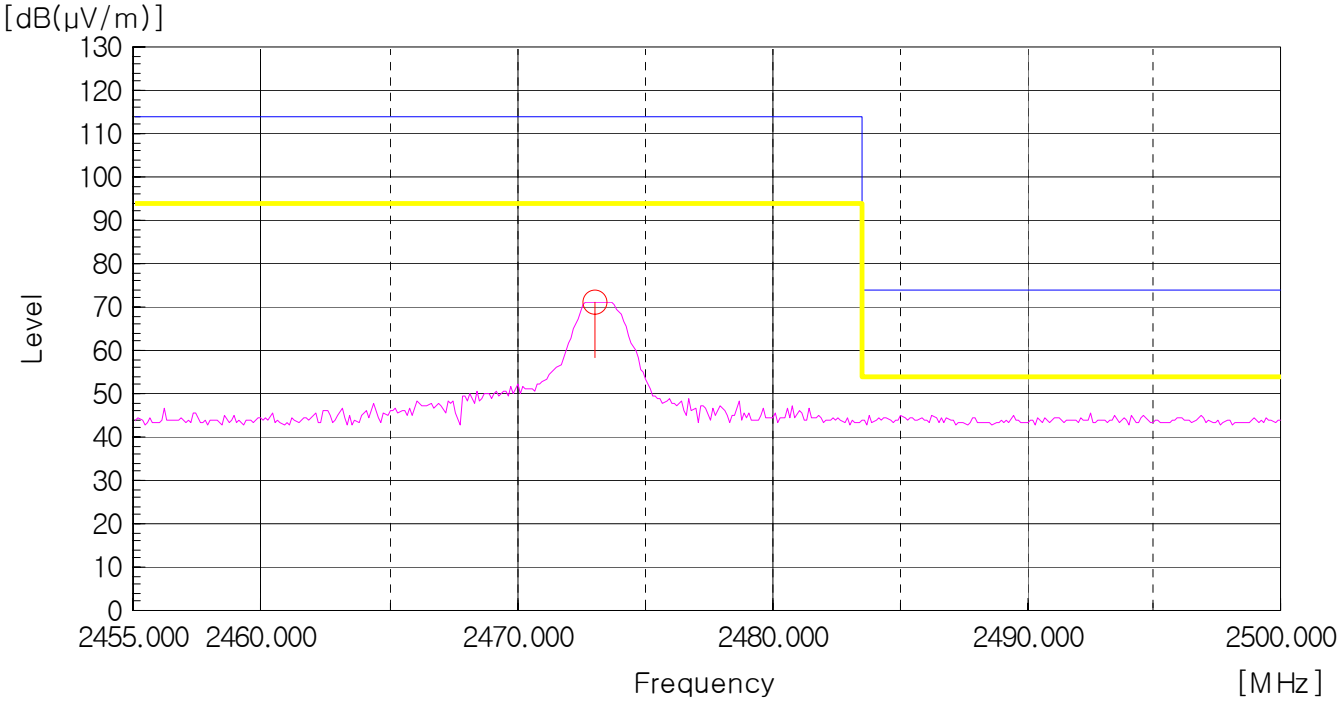
Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

5.4.1 Restricted Bands data.

Ch6: 2 473 MHz, Vertical



Ch6: 2 473 MHz, Horizontal



Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788

6. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
☒	SPECTRUM ANALYZER	E7405A	H.P	US41160290	09.10.02
☒	EMI TEST RECEIVER	ESVS10	R&S	835165/001	09.04.04
☒	EMI TEST RECEIVER	ESPI3	R&S	100478	09.10.02
☒	Turn-Table	MFT-120S	Max-Full Antenna Corp	-	N/A
☒	Antenna Master	MFA-440E	Max-Full Antenna Corp	-	N/A
☒	LogBicon Antenna	VULB9160	Schwarzbeck	3082	10.01.25
☒	Broad band Horn antenna	BBHA 9120D	Schwarzbeck	227	09.03.15
☒	Preamplifier	8447D	H.P	3307A02865	09.10.02

Head Office: # 371-51 Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea Tel : 82-2-858-0786 Fax : 82-2-858-0788