ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No.	**: W158R-D004**
AGR No	**: A158A-033**
Applicant	**: Remotesolution Co., Ltd.**
Address	**: 92, Chogokri, Nammyun, Kimchon city, Kyungbuk, Korea, 740-871**
Manufacturer	**: Remotesolution Co., Ltd.**
Address	**: 92, Chogokri, Nammyun, Kimchon city, Kyungbuk, Korea, 740-871**
Type of Equipment	**: IR&RF Remote**
FCC ID.	**: TX4CRB85A**
Model Name	**: CRB85A00**
Multiple Model Name	**: RCU-WC-U-4-RF-N**
Serial number	**: N/A**
Total page of Report	**: 21 pages (including this page)**
Date of Incoming	**: August 19, 2015**
Date of issue	**: August 25, 2015**

SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.249.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: Ki-Hong, Nam / Asst, Chief Engineer
ONETECH Corp.

Approved by: Sung-Ik, Han/ Managing Director
ONETECH Corp.

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CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE 5

2. TEST SUMMARY 6

2.1 TEST ITEMS AND RESULTS 6

2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS 6

2.3 RELATED SUBMITTAL(S) / GRANT(S) 6

2.4 PURPOSE OF THE TEST 6

2.5 TEST METHODOLOGY 6

2.6 TEST FACILITY 6

3. GENERAL INFORMATION 7

3.1 PRODUCT DESCRIPTION 7

3.2 MODEL DIFFERENCES 7

4. EUT MODIFICATIONS 7

5. SYSTEM TEST CONFIGURATION 8

5.1 JUSTIFICATION 8

5.2 PERIPHERAL EQUIPMENT 8

5.3 MODE OF OPERATION DURING THE TEST 8

5.4 CONFIGURATION OF TEST SYSTEM 8

5.5 ANTENNA REQUIREMENT 8

6. PRELIMINARY TEST 9

6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS 9

6.2 GENERAL RADIATED EMISSIONS TESTS 9

7. RADIATED EMISSION TEST 10

7.1 TEST SET-UP 10

7.2 MEASUREMENT UNCERTAINTY 10

7.3 TEST EQUIPMENT USED 10

7.4 FINAL RESULT OF MEASUREMENT 11

7.4.1 Field Strength of the Fundamental Frequency 11

7.4.2 Emissions Radiated Outside of the Specified Frequency Bands 12

8. 20 DB BANDWIDTH 19

8.1 OPERATING ENVIRONMENT 19

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8.2 TEST SET-UP 19
8.3 TEST EQUIPMENT USED 19
8.4 TEST DATA FOR BANDWIDTH 19

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Revision History

Issue Report No.	Issued Date	Revisions	Effect Section
W158R-D004	August 25, 2015	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

APPLICANT	: Remotesolution Co., Ltd.
ADDRESS	: 92, Chogokri, Nammyun, Kimchon city, Kyungbuk, Korea, 740-871
CONTACT PERSON	: Hong Bum, Shin / CEO
TELEPHONE NO	: +82-54-420-4500
FCC ID	: TX4CRB85A
MODEL NAME	: CRB85A00
BRAND NAME	: N/A
SERIAL NUMBER	: N/A
DATE	: August 25, 2015

EQUIPMENT CLASS	**DXX – Low Power Communications Transmitter**
KIND OF EQUIPMENT	IR&RF Remote
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.249
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.249 (a)	Field Strength of Emission	Met the Limit / PASS
15.249 (c)	Measurement distance	Met the Requirement / PASS
15.249 (d)	Emissions Radiated Outside of the Specified Frequency Band	Met the Limit / PASS
15.249 (e)	Radiated Emissions above 1 000 MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note)
15.203	Antenna Requirement	Met the Requirement / PASS

Note: This test is not performed because the EUT is operated by DC battery.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.10: 2013 at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The Remotesolution Co., Ltd., Model: CRB85A00 (referred to as the EUT in this report) is an IR&RF Remote. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Portable Device
OPERATING FREQUENCY	2 425 MHz ~ 2 475 MHz
RATED RF OUTPUT POWER	0 dBm
ANTENNA TYPE	Inserted into the main board(Pattern Antenna)
MODULATION	O-QPSK
Tx DATA SPEED	250 kbps
USED RF CHIP	Maker: GreenPeak Technologies, Model Name:GP561
LIST OF EACH OSC. OR CRY. FREQ.(FREQ. >= 1 MHz)	16 MHz
RATED SUPPLY VOLTAGE	1.5 V Mangan Battery * 2

3.2 Model Differences

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
CRB85A00	Basic Model	☑
RCU-WC-U-4-RF-N	These models are identical to basic model except for the model name only.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacturer is responsible for the compliance of all variants.

4. EUT MODIFICATIONS

-. None

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5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	1BF-1028A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested: None

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.
For final testing, the EUT was set at Low Channel (2 425 MHz), Middle Channel (2 450 MHz), and High Channel (2 475 MHz). To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is "XY" axis.

5.4 Configuration of Test System

Line Conducted Test **:** It is not need to test this requirement, because the EUT shall be operated by DC battery.

Radiated Emission Test **:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m open area test site.
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

According to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The antenna of the EUT is a pattern antenna on the main board in the EUT, so no consideration of replacement by the user.

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6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by battery.	

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
TX Mode	X

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7. RADIATED EMISSION TEST

7.1 Test set-up

The radiated emissions measurements were on the 3 m, semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from up to 25 GHz was scanned and emission levels maximized at each frequency recorded. The system 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.

Test set-up photos are included in appendix I.

7.2 Measurement uncertainty

Radiated emission electric field intensity, 0.15 MHz ~ 30 MHz : ± 2.61 dB

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.40 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, k = 2.

7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 03, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2015(1Y)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2015(1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Oct. 08, 2014(1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 29, 2015(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2015(1Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2015(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Nov. 25, 2014(1Y)
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
■ -	HFH2-Z2	Rohde & Schwarz	Loop Antenna	879285/26	Dec. 09, 2014(2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May 02, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Apr. 30, 2015(2Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2015(2Y)

All test equipment used is calibrated on a regular basis.

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7.4 Final Result of Measurement

7.4.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48.9 % R.H. Temperature: 22.5 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : IR&RF Remote Date: August 20, 2015

Operating Condition : TX mode

Distance : 3 m

Channel	Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
	Carrier Freq. (MHz)	Reading (dBμV)	Detector Mode	Pol.	Antenna (dB/m)	Cable (dB)	Pre-Amp (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low	2 425.00	96.84	Peak	H	27.15	5.02	43.10	85.91	113.98	28.07
		93.45	Average	H				82.52	93.98	11.46
		90.76	Peak	V				79.83	113.98	34.15
		87.77	Average	V				76.84	93.98	17.14
Middle	2 450.00	95.48	Peak	H	27.22	5.04	43.10	84.64	113.98	29.34
		93.04	Average	H				82.20	93.98	11.78
		90.26	Peak	V				79.42	113.98	34.56
		88.23	Average	V				77.39	93.98	16.59
High	2 475.00	93.27	Peak	H	27.28	5.06	43.10	82.51	113.98	31.47
		90.04	Average	H				79.28	93.98	14.70
		88.27	Peak	V				77.51	113.98	36.47
		85.37	Average	V				74.61	93.98	19.37

*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes, but the worst plane data were recorded in the report.

Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.

Tested by: Tae-Ho, Kim / Project Engineer

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7.4.2 Emissions Radiated Outside of the Specified Frequency Bands

7.4.2.1 Test Data for Harmonic

Humidity Level : 48.9 % R.H. Temperature: 22.5 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : IR&RF Remote Date: August 20, 2015

Operating Condition : TX mode

Distance : 3 m

Channel	Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Pre-Amp (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low	4 850.00*	59.67	Peak	H	31.14	6.90	42.80	54.91	73.98	19.07
		52.20	Average	H				47.44	53.98	6.54
		50.68	Peak	V				45.92	73.98	28.06
		41.87	Average	V				37.11	53.98	16.87
	Other frequencies were not found up to 25 GHz.									
Middle	4 900.00*	58.24	Peak	H	31.22	6.93	42.80	53.59	73.98	20.39
		50.48	Average	H				45.83	53.98	8.15
		50.17	Peak	V				45.52	73.98	28.46
		41.37	Average	V				36.72	53.98	17.26
	Other frequencies were not found up to 25 GHz.									
High	4 950.00*	57.27	Peak	H	31.30	6.97	42.80	52.74	73.98	21.24
		49.55	Average	H				45.02	53.98	8.96
		49.37	Peak	V				44.84	73.98	29.14
		40.94	Average	V				36.41	53.98	17.57
	Other frequencies were not found up to 25 GHz.									

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical, “*” Frequency fall in restricted band

Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.

Tested by: Tae-Ho, Kim / Project Engineer

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7.4.2.2 Test Data for Frequency range: 30 MHz ~ 1 000 MHz

Humidity Level : 48.9 % R.H. Temperature: 22.5 ℃

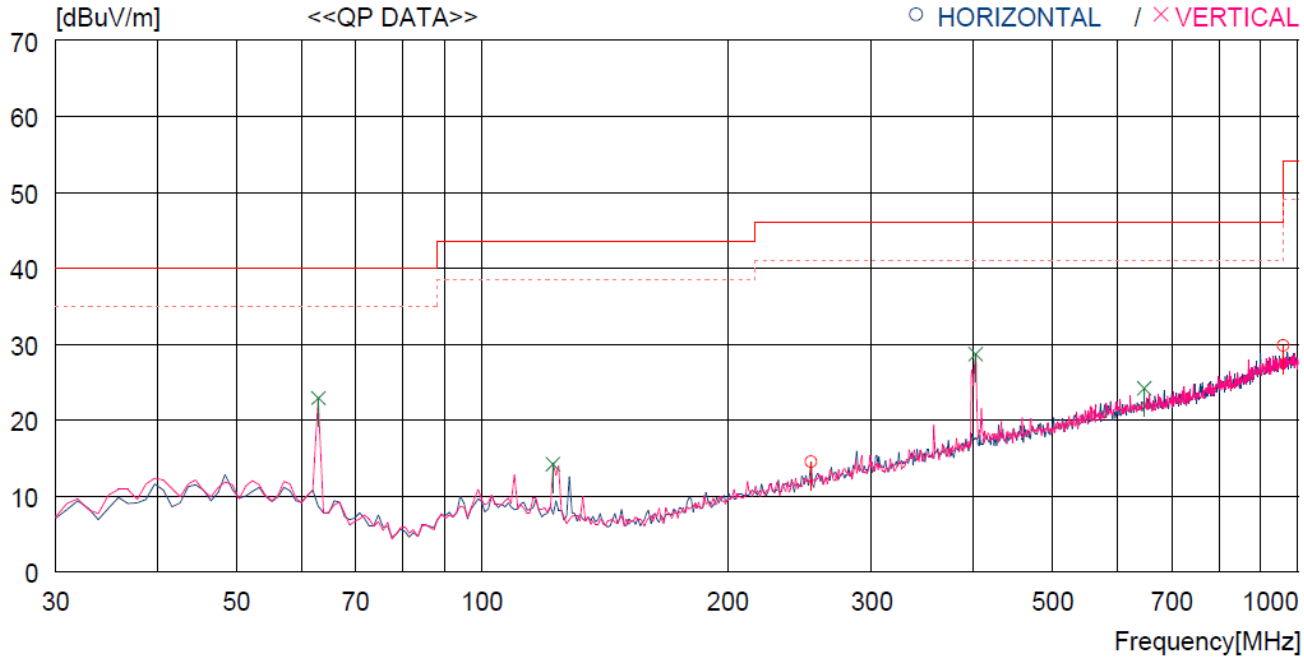
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)

Result : PASSED

EUT : IR&RF Remote Date: August 20, 2015

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	253.100	30.3	12.5	4.6	32.9	14.5	46.0	31.5	200	0
2	958.277	29.7	22.5	9.5	31.9	29.8	46.0	16.2	300	62
----- Vertical ------										
3	62.980	41.5	12.2	2.3	33.1	22.9	40.0	17.1	300	257
4	122.150	34.1	10.0	3.2	33.1	14.2	43.5	29.3	200	359
5	402.480	39.9	15.9	5.9	33.0	28.7	46.0	17.3	100	325
6	647.887	30.4	19.4	7.7	33.3	24.2	46.0	21.8	100	0

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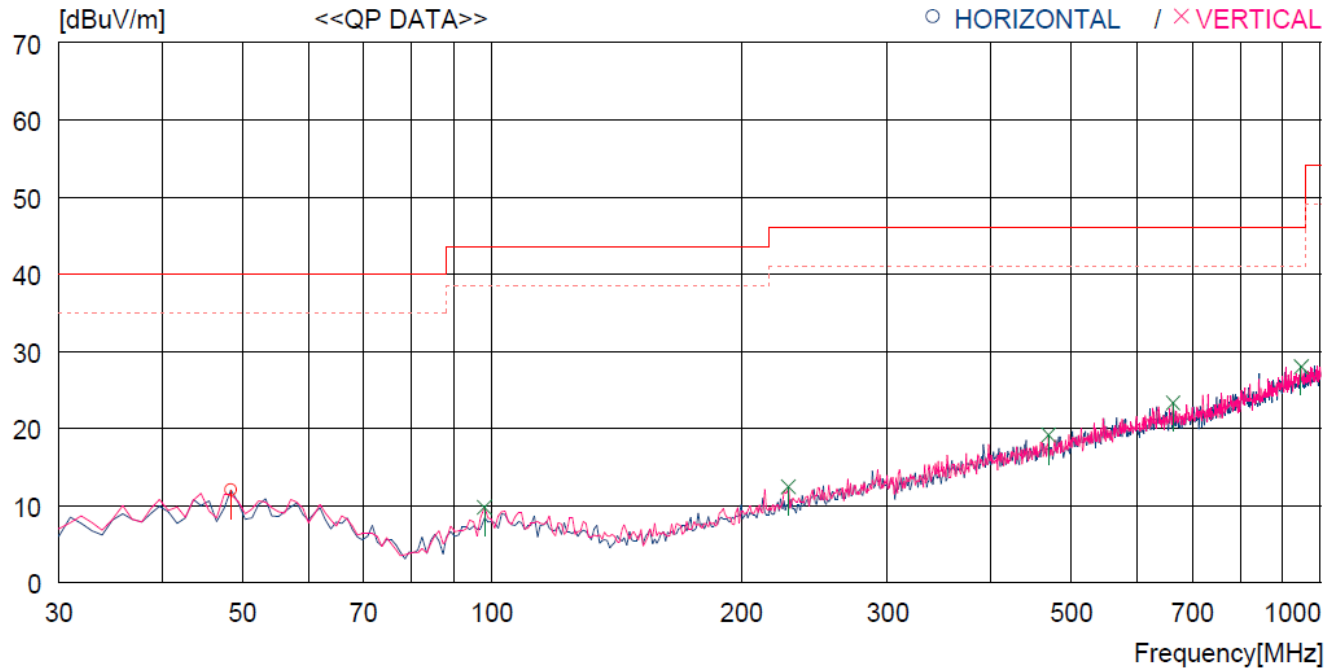
Operating condition : Middle Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	48.430	29.2	13.8	2.0	33.0	12.0	40.0	28.0	100	160
----- Vertical ------										
2	97.900	28.7	11.6	2.8	33.3	9.8	43.5	33.7	100	115
3	227.880	29.1	11.7	4.4	32.8	12.4	46.0	33.6	100	235
4	469.411	28.6	16.9	6.4	32.8	19.1	46.0	26.9	100	285
5	663.406	29.5	19.5	7.8	33.5	23.3	46.0	22.7	100	115
6	947.607	28.3	22.5	9.5	32.3	28.0	46.0	18.0	100	115

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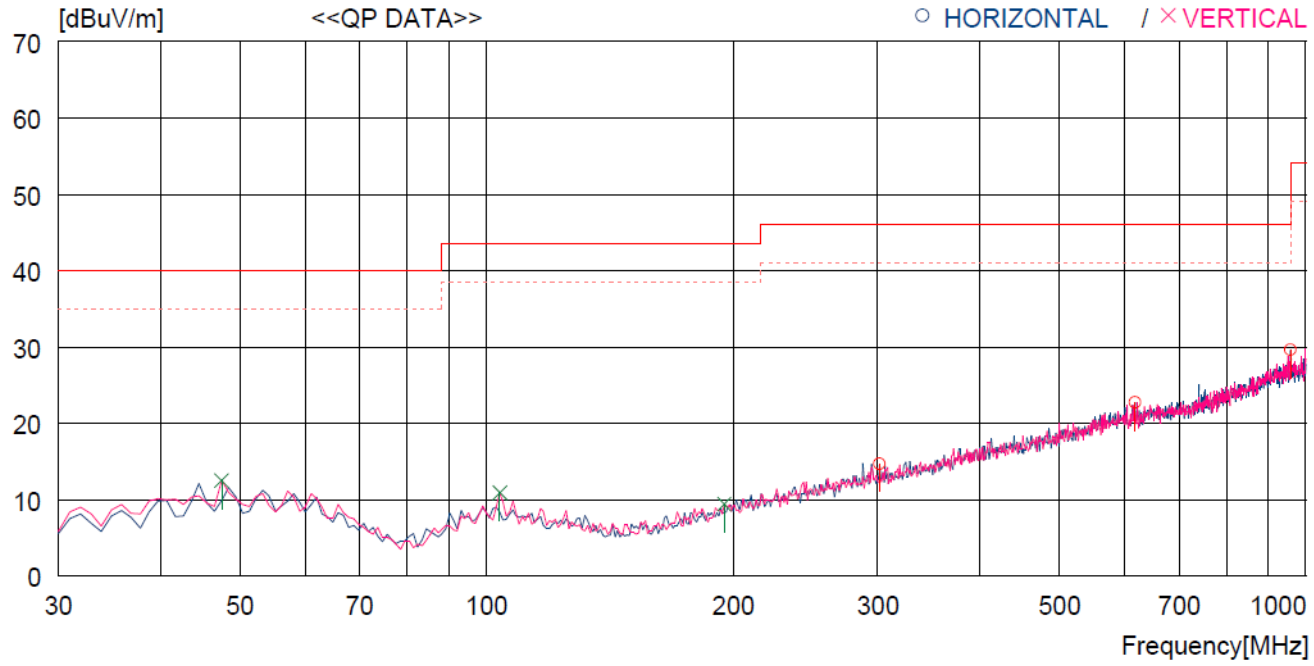
Operating condition : High Channel



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	301.600	28.9	13.6	5.1	32.9	14.7	46.0	31.3	100	82
2	618.787	29.3	19.3	7.4	33.3	22.7	46.0	23.3	100	182
3	957.307	29.5	22.5	9.5	31.9	29.6	46.0	16.4	100	246
----- Vertical ------										
4	47.460	29.7	13.8	2.0	33.0	12.5	40.0	27.5	100	66
5	103.720	29.5	11.6	2.9	33.1	10.9	43.5	32.6	100	313
6	194.900	27.8	10.5	4.0	32.9	9.4	43.5	34.1	100	348

Tested by: Tae-Ho, Kim / Project Engineer

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7.4.2.3 Test Data for Below 30 MHz

Humidity Level : 48.9 % R.H. Temperature: 22.5 ℃

Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

Frequency range : 9 kHz ~ 30 MHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)

Result : PASSED

EUT : IR&RF Remote Date: August 20, 2015

Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: Tae-Ho, Kim / Project Engineer

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7.4.2.4 Test Data above 1 GHz except for harmonic

Humidity Level : 48.9 % R.H. Temperature: 22.5 ℃

Resolution bandwidth : 1 MHz for Peak and Average Mode

Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

Frequency range : 1 GHz ~ 25 GHz

Measurement distance : 3 m

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)

Result : PASSED

EUT : IR&RF Remote Date: August 20, 2015

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

Tested by: Tae-Ho, Kim / Project Engineer

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7.4.2.5 Band Edge

-. Test Date : August 20, 2015

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Measurement distance : 3 m

-. Operating Condition : Low / High Channel

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Pre-Amp (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2 377.54	48.31	Peak	H	27.05	3.14	43.10	35.40	74.00	38.60
	35.27	Average	H				22.36	54.00	31.64
2 325.68	48.12	Peak	V				35.21	74.00	38.79
	35.14	Average	V				22.23	54.00	31.77
Test Data for High Channel									
2 483.53	49.35	Peak	H	27.31	3.17	43.10	36.73	74.00	37.27
	38.61	Average	H				25.99	54.00	28.01
2 485.45	47.85	Peak	V				35.23	74.00	38.77
	35.26	Average	V				22.64	54.00	31.36

Remark. Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.

Tested by: Tae-Ho, Kim / Project Engineer

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8. 20 dB BANDWIDTH

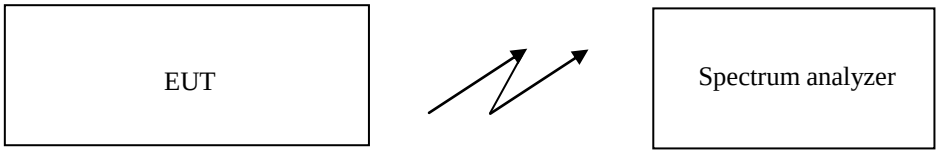
8.1 Operating environment

Temperature : 22.5℃

Relative humidity : 48.9 % R.H.

8.2 Test set-up

The output signal of EUT was received by the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2015(1Y)

8.4 Test data for Bandwidth

-. Test Date : August 20, 2015

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215(c)

Channel	Operating Freq. (MHz)	20 dB Bandwidth (MHz)	Result
Low	2 425	2.622 4	Met the requirement / PASS
Middle	2 450	2.617 4	
High	2 475	2.607 4	

Remark: See next page for 20 dB Bandwidth test data.

The 20 dB bandwidth is within the assigned frequency band from 2 400 MHz to 2 483.5 MHz.

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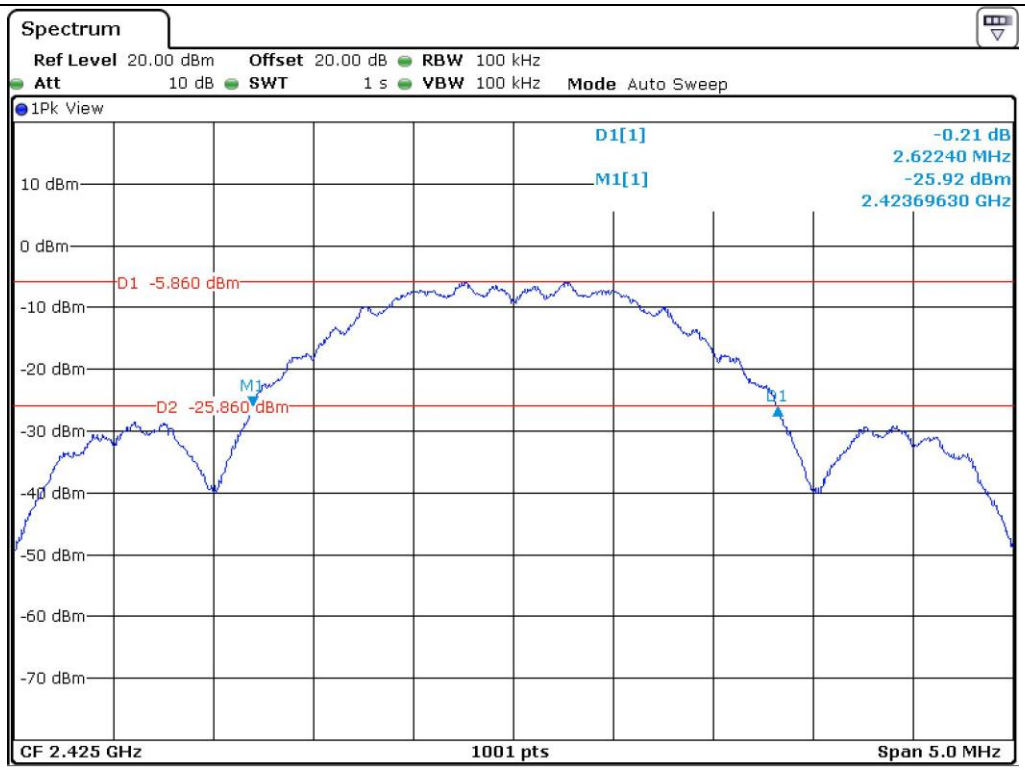
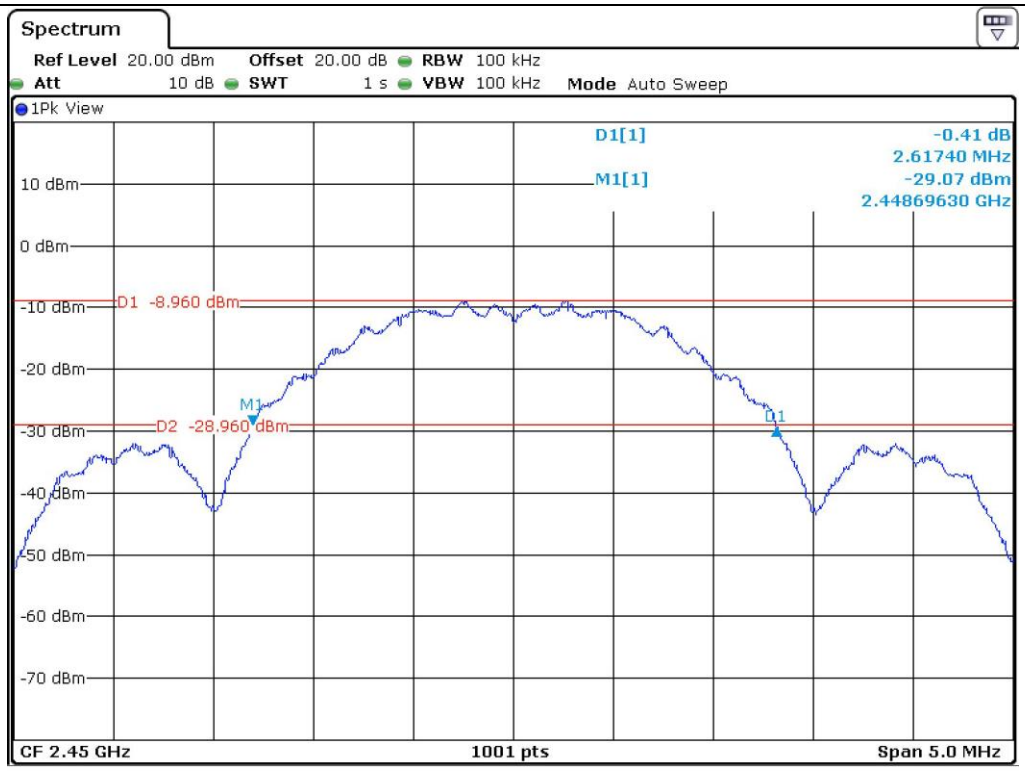


Low Channel



Middle Channel

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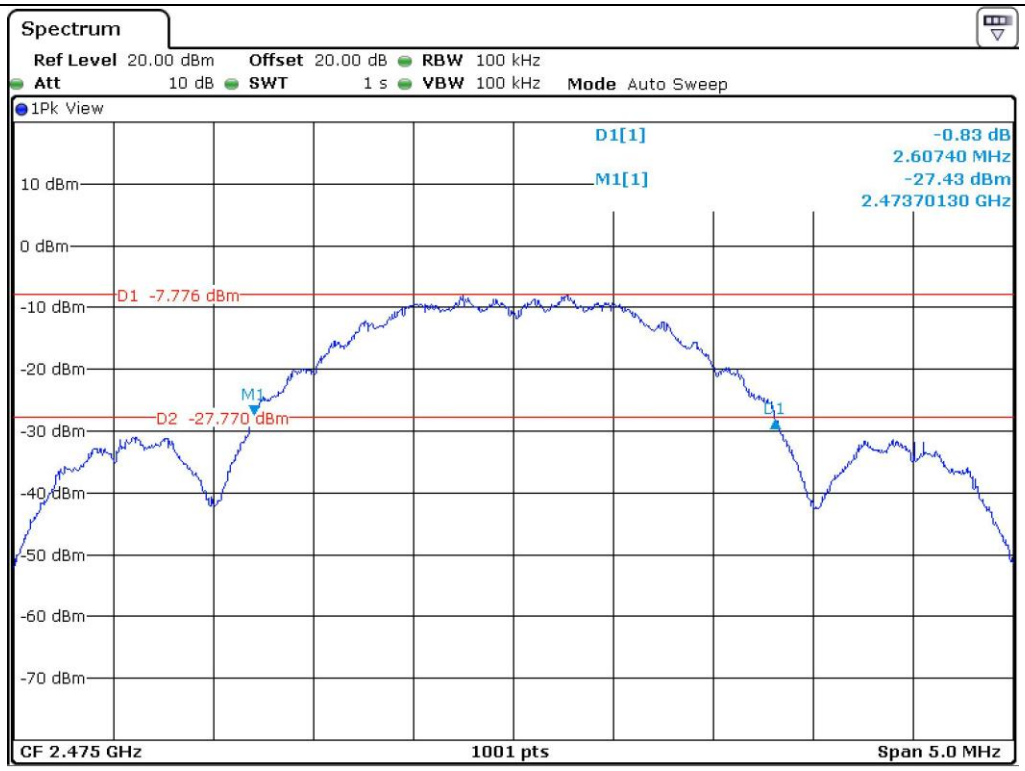

High Channel

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