

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

Test Report No. : W17NR-D045

AGR No. : A17OA-093

Applicant : UNION COMMUNITY

Address : Hyundai Topics Bldg. Bangi 2-dong, Songpa-gu, Seoul, South Korea

Manufacturer : UNION COMMUNITY

Address : Hyundai Topics Bldg. Bangi 2-dong, Songpa-gu, Seoul, South Korea

Type of Equipment : Access controller

FCC ID : XX2-AC5100

Model Name : AC-5100

Multiple Model Name : AC-5000PLUS

Serial number : N/A

Total page of Report : 21 pages (including this page)

Date of Incoming : October 20, 2017

Date of Issuing : November 15, 2017

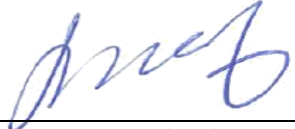
SUMMARY

The equipment complies with the requirements of **FCC CFR 47 PART 15 SUBPART C Section 15.225**

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

It is not a general 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: 
Keun-Young, Choi / Vice President
ONETECH Corp.

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REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
W17NR-D045	November 15, 2017	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

- . APPLICANT : UNION COMMUNITY
- . ADDRESS : Hyundai Topics Bldg. Bangi 2-dong, Songpa-gu, Seoul, South Korea
- . CONTACT PERSON : Dong-Ho, Lee / Junior Research Engineer
- . TELEPHONE NO : +82-02-6488-3054
- . FCC ID : XX2-AC5100
- . MODEL NO/NAME : AC-5100
- . SERIAL NUMBER : N/A
- . DATE : November 15, 2017

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Access controller
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 CFR47 Part 15 Subpart C Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	10 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.

2. GENERAL INFORMATION

2.1 Product Description

The UNION COMMUNITY, Model AC-5100 (referred to as the EUT in this report) is an Access controller, Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Access controller
TRANSMITTING FREQUENCY	13.560 4 MHz
NUMBER OF CHANNELS	1
MODULATION	ASK
ANTENNA TYPE	PCB Pattern Antenna
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)	25 MHz

2.2 Model Differences:

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

Model Name	Differences	Tested
AC-5100	Basic Model	<input checked="" type="checkbox"/>
AC-5000PLUS	The model is identical to basic model except for the model name only.	<input type="checkbox"/>

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.

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 FCC PART 15 SUBPART C Section 15.225.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiate d testing was performed 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 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. SYSTEM TEST CONFIGURATION

3.1 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	UNION COMMUNITY	PAC5000MA01 V31	N/A
SUB BOARD(1)	UNION COMMUNITY	PAC5000PW01 V30	N/A
SUB BOARD(2)	UNION COMMUNITY	PAC5000SC01 V10	N/A
FINGERPRINT BOARD(1)	UNION COMMUNITY	PFCS02MA01 V22	N/A
FINGERPRINT BOARD(2)	UNION COMMUNITY	PPF0S02TS03 V34	N/A
TOUCH BOARD	UNION COMMUNITY	PAC5000KP01 V11	N/A
DISPLAY	UNION COMMUNITY	PAC5000LI01 V12	N/A
CAMERA	UNION COMMUNITY	BJ-PT-100B01-V1.0	N/A
ANTENNA	UNION COMMUNITY	PAC5000SA01 V10	N/A
Bluetooth LE Module	PROCHILD INC.	PBLN51822m	2AEEY- PBLN51822m
ADAPTER	Dee Van Electronics(Longchuan)Co., Ltd.	DSA-42D-12 1 120350	N/A

3.2 Peripheral equipment

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

3.3 Mode of operation during the test

-. The EUT has 13.560 4 MHz RF boards for reading Card and program was used for making continuous transmission mode during the test.

3.4 Equipment Modifications

-. None

3.5 Configuration of Test System

Line Conducted Test : The EUT was connected to adaptor and the power of adaptor was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test : Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber.
 For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna.
 The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the 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.

3.6 Antenna Requirement

For intentional device, 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 transmitter antenna of the EUT is a PCB pattern antenna so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 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)
Tx Mode	X

4.2 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

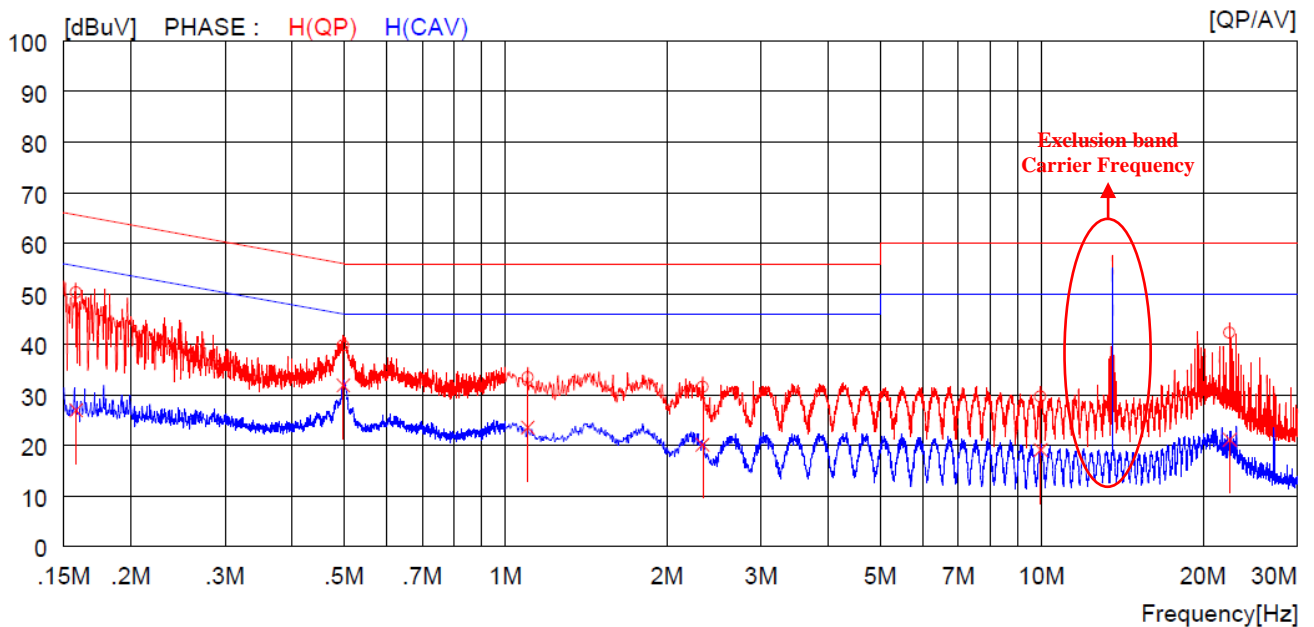
5. FINAL RESULT OF MEASUREMENT

Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 CONDUCTED EMISSION TEST

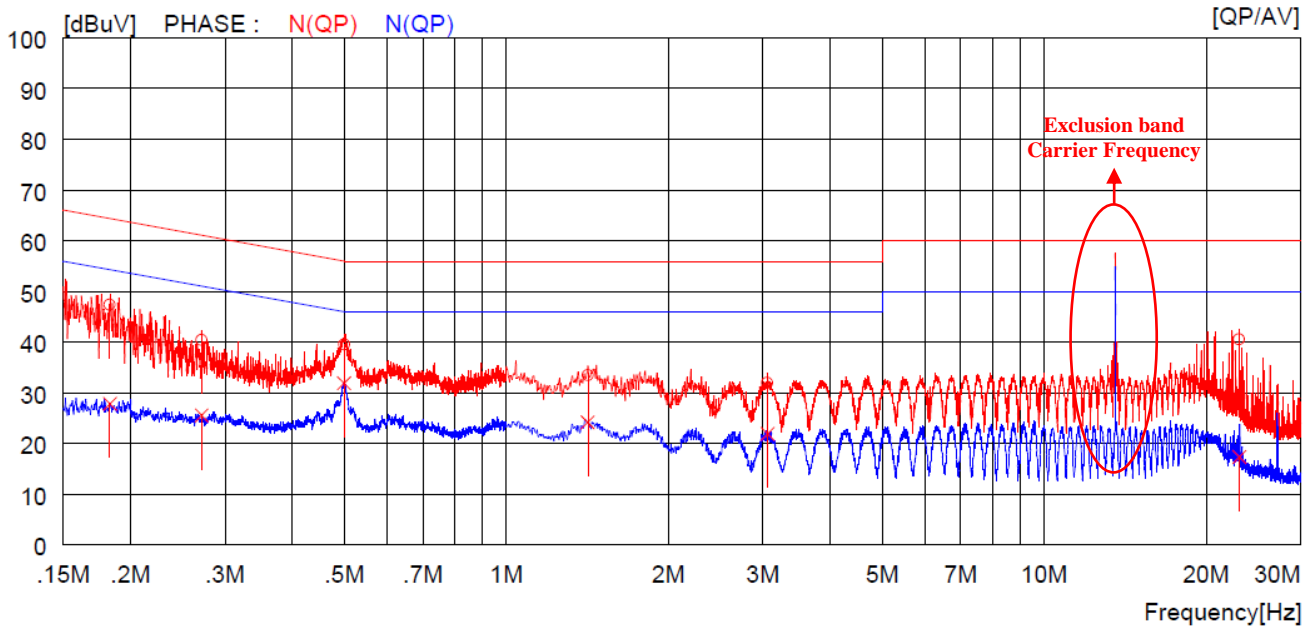
Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.207(a)
 Result : PASSED

EUT : Access controller Date: November 08, 2017
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)
 Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.15800	40.2	----	10.0	50.2	----	65.6	----	15.4	----	H (QP)
2	0.49800	29.8	----	10.0	39.8	----	56.0	----	16.2	----	H (QP)
3	1.10000	23.4	----	10.1	33.5	----	56.0	----	22.5	----	H (QP)
4	2.33200	21.5	----	10.1	31.6	----	56.0	----	24.4	----	H (QP)
5	9.96000	19.3	----	10.4	29.7	----	60.0	----	30.3	----	H (QP)
6	22.43000	31.5	----	10.8	42.3	----	60.0	----	17.7	----	H (QP)
7	0.15800	----	17.0	10.0	----	27.0	----	55.6	----	28.6	H (CAV)
8	0.49800	----	21.9	10.0	----	31.9	----	46.0	----	14.1	H (CAV)
9	1.10000	----	13.4	10.1	----	23.5	----	46.0	----	22.5	H (CAV)
10	2.33200	----	10.0	10.1	----	20.1	----	46.0	----	25.9	H (CAV)
11	9.96000	----	8.7	10.4	----	19.1	----	50.0	----	30.9	H (CAV)
12	22.43000	----	10.3	10.8	----	21.1	----	50.0	----	28.9	H (CAV)

Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.18300	37.4	----	10.0	47.4	----	64.3	----	16.9	----	N (QP)
2	0.27100	30.4	----	10.0	40.4	----	61.1	----	20.7	----	N (QP)
3	0.49900	29.5	----	10.0	39.5	----	56.0	----	16.5	----	N (QP)
4	1.41600	23.4	----	10.1	33.5	----	56.0	----	22.5	----	N (QP)
5	3.05600	21.7	----	10.2	31.9	----	56.0	----	24.1	----	N (QP)
6	23.04000	29.7	----	10.8	40.5	----	60.0	----	19.5	----	N (QP)
7	0.18300	----	17.9	10.0	----	27.9	----	54.3	----	26.4	N (CAV)
8	0.27100	----	15.6	10.0	----	25.6	----	51.1	----	25.5	N (CAV)
9	0.49900	----	21.9	10.0	----	31.9	----	46.0	----	14.1	N (CAV)
10	1.41600	----	14.1	10.1	----	24.2	----	46.0	----	21.8	N (CAV)
11	3.05600	----	11.7	10.2	----	21.9	----	46.0	----	24.1	N (CAV)
12	23.04000	----	6.6	10.8	----	17.4	----	50.0	----	32.6	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Tae-Ho, Kim / Manager

5.2 RADIATED EMISSION TEST

5.2.1 Operation frequency band: (13.553 ~ 13.567) MHz

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

Humidity Level : 49.0 % R.H. Temperature: 24.1 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : Access controller Date: November 08, 2017

Operating Condition : Transmitting Mode

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Distance : 3 m

Radiated Emission		Ant	Correction Factors		Total	FCC	
Freq. (MHz)	Amplitud (dBμV)	Pol.	Antenna (dB/m)	Cable (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.560 4	17.64	H	19.98	1.09	38.71	124	85.29
13.560 4	17.08	V	19.98	1.09	38.15	124	85.85

Note: According to the distance of measurements was reduced to 3 m, the limit was extrapolated by using the square of an inverse linear distance extrapolation factor (40 dB/decade) as follows.

Limit calculation: Limit at specified distance + $40\log(30/3) = 84 \text{ dB}\mu\text{V/m} + 40 \text{ dB}$



Tested by: Tae-Ho, Kim / Manager

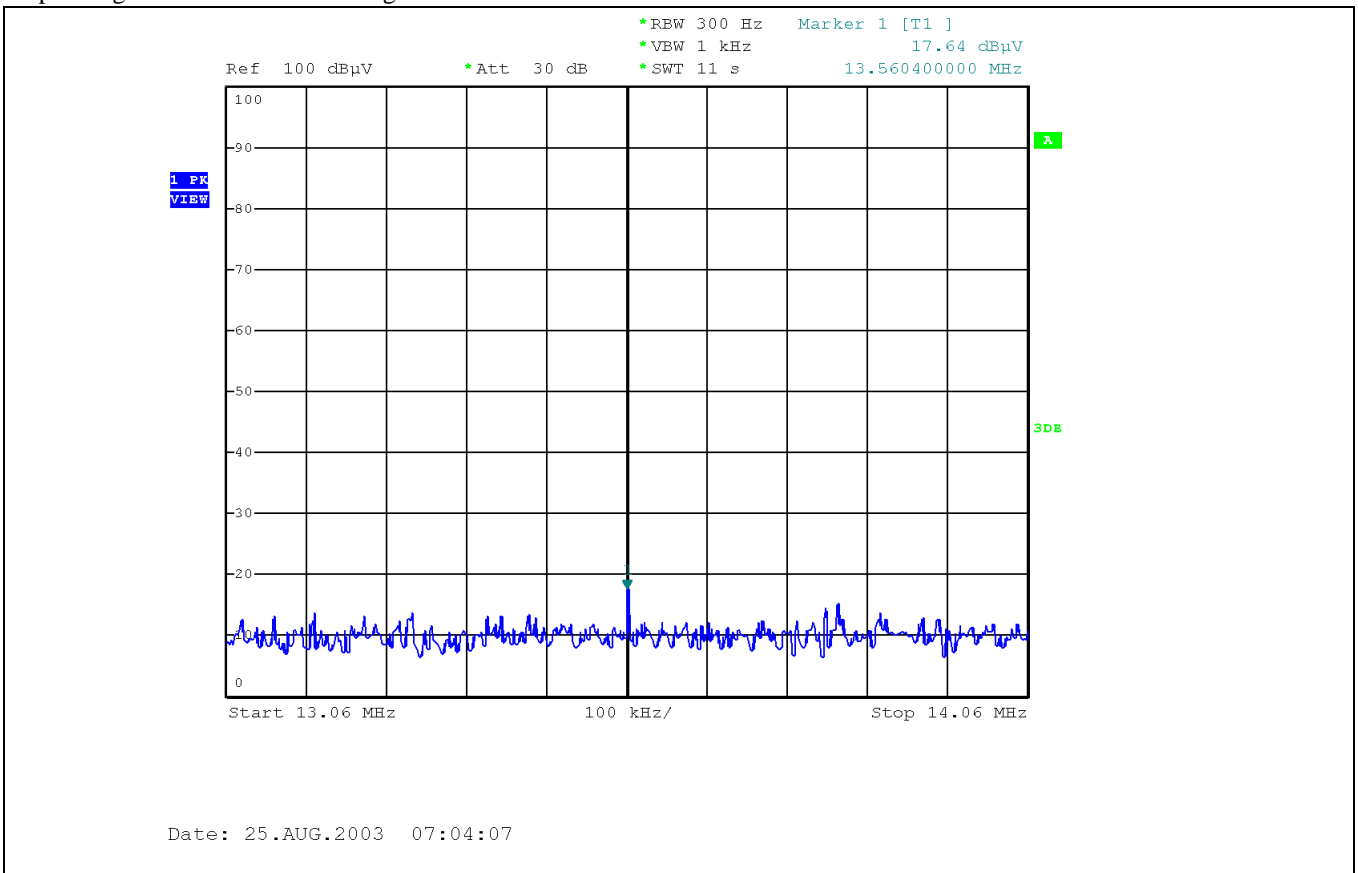
5.2.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

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

Humidity Level : 49.0 % R.H. Temperature: 24.1 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : Access controller Date: November 08, 2017

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.560 4 MHz is 17.64 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 80.5 dBuV/m, so the EUT meets the requirement.

Tested by: Tae-Ho, Kim / Manager

5.3 SPURIOUS EMISSION TEST

5.3.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 49.0 % R.H. Temperature: 24.1 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Frequency Range : 9 kHz ~ 30 MHz
 Result : PASSED

EUT : Access controller Date: November 08, 2017

Operating Condition : Transmitting Mode

Distance : 3 m

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 / Manager**

5.3.2 Spurious Radiated Emission below 1 GHz

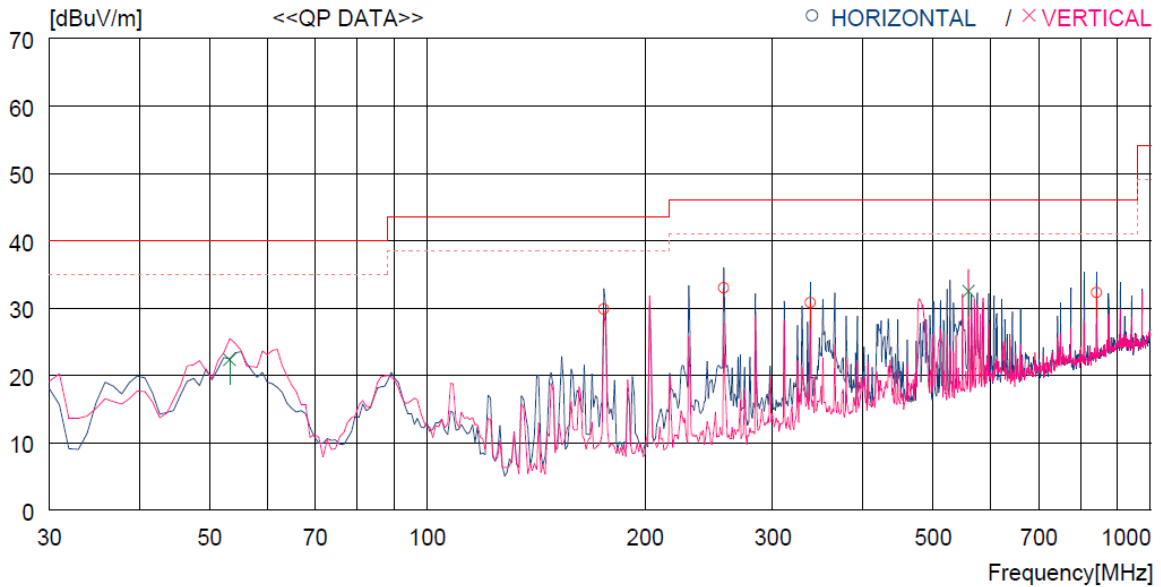
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz
 Frequency range : 30 MHz ~ 1 000 MHz
 Result : PASSED

EUT : Access controller Date: November 06, 2017

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	175.500	50.5	9.2	3.2	33.1	29.8	43.5	13.7	200	139
2	256.980	50.1	12.3	3.7	33.1	33.0	46.0	13.0	100	359
3	338.460	45.0	14.6	4.3	33.1	30.8	46.0	15.2	100	359
4	841.881	37.6	21.0	6.7	33.0	32.3	46.0	13.7	100	149
----- Vertical -----										
5	53.280	39.8	13.8	1.8	33.1	22.3	40.0	17.7	300	154
6	559.619	42.7	17.7	5.4	33.3	32.5	46.0	13.5	300	82

Tested by: Tae-Ho, Kim / Manager

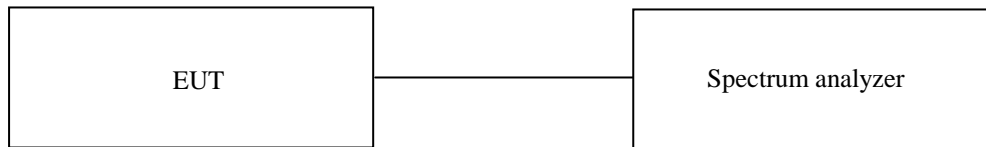
5.4 20 dB BANDWIDTH

5.4.1 Operating environment

Temperature : 24.1 °C
Relative humidity : 49.0 % R.H.

5.4.2 Test set-up

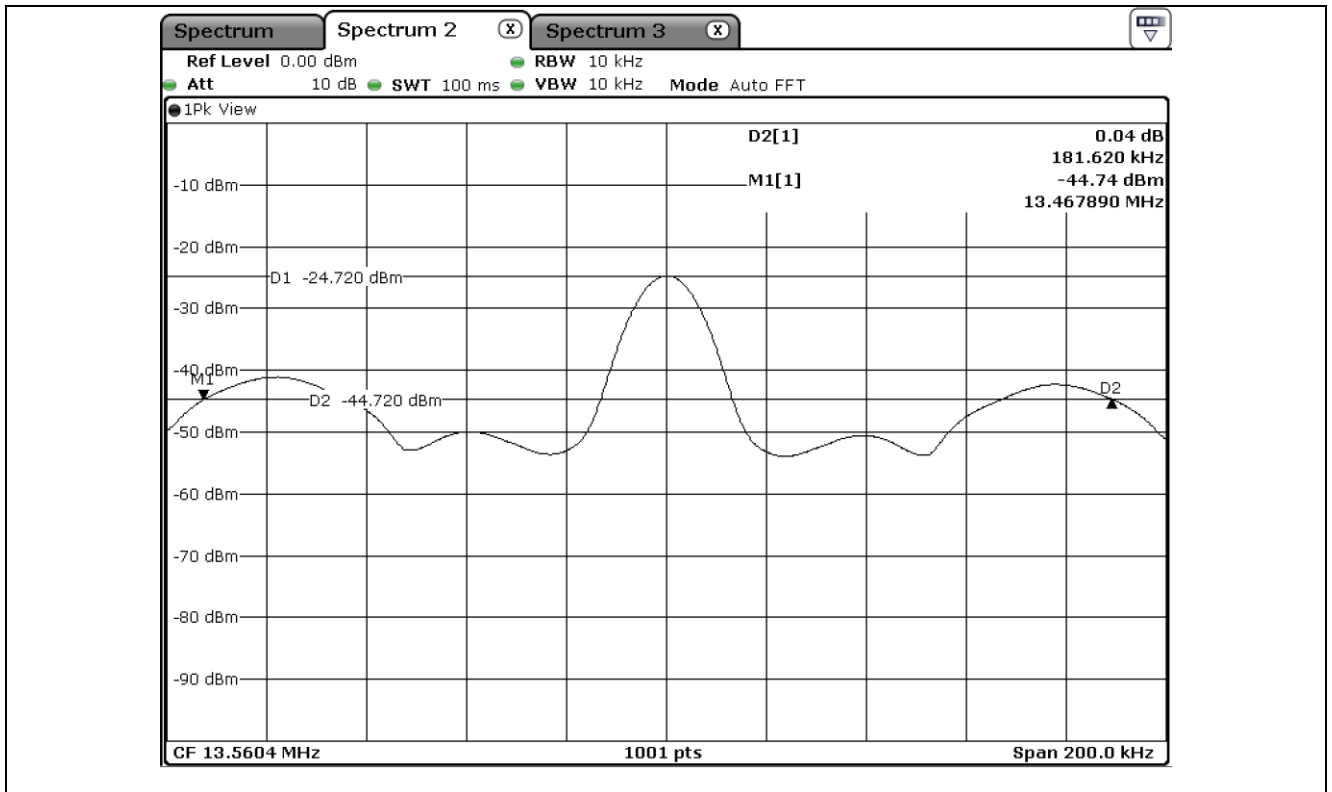
The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 10 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



5.4.3 Test data

- Test Date : November 08, 2017
- Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Operating Freq. (MHz)	Measured Value (kHz)	Assigned Operating Frequency Band (kHz)	Result
13.560 4	181.62	900	PASS



Tested by: Tae-Ho, Kim / Manager

5.5 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.5.1 Operating environment

Temperature : 24.1 °C
 Relative humidity : 49.0 % R.H.

5.5.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50°C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

5.5.3 Test data

-. Test Date : November 08, 2017
 -. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 560 400	13 560 427	1 329.04	± 1 356.04
-10		13 560 415	1 341.04	
0		13 560 437	1 319.04	
10		13 560 423	1 333.04	
20		13 560 421	1 335.04	
30		13 560 418	1 338.04	
40		13 560 409	1 347.04	
50		13 560 411	1 345.04	



Tested by: Tae-Ho, Kim / Manager

5.6 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.6.1 Operating environment

Temperature : 24.1 °C
 Relative humidity : 49.0 % R.H.

5.6.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.

5.6.3 Test data

-. Test Date : November 08, 2017
 -. Result : PASSED

Voltage (Vac)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
264.5(115 %)	13 560 400	13 560 429	1 327.04	± 1 356.04
230(100 %)		13 560 416	1 340.04	
195.5(85 %)		13 560 435	1 321.04	



Tested by: Tae-Ho, Kim / Manager

6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses.

+ Meter reading	(dB μ V)
- Amplifier Gain	(dB)
+ Cable Loss	(dB)
- Antenna Factor	(dB/m)
<hr/>	
= Corrected Result	(dB μ V/m)

Margin (dB)

Specification Limit	(dB μ V/m)
- Corrected Result	(dB μ V/m)
<hr/>	
= dB Relative to Spec	(\pm dB)

7. LIST OF TEST EQUIPMENT

No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R/S	ESCI	101013	Apr. 04, 2017	One Year	<input type="checkbox"/>
2.		R/S	ESPI	101278	Oct. 26, 2017	One Year	<input checked="" type="checkbox"/>
3.		R/S	ESU	100261	Apr. 05, 2017	One Year	<input type="checkbox"/>
4.	Spectrum analyzer	R/S	FSU26	200319	Apr. 04, 2017	One Year	<input type="checkbox"/>
5.	Spectrum analyzer	R/S	FSV30	101199	Apr. 05, 2017	One Year	<input checked="" type="checkbox"/>
6.	Amplifier	Sonoma Instrument	310N	312544	Apr. 04, 2017	One Year	<input checked="" type="checkbox"/>
7.	Amplifier	Sonoma Instrument	310N	312545	Apr. 04, 2017	One Year	<input type="checkbox"/>
8.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-255	May. 20, 2016	Two Year	<input type="checkbox"/>
9.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-419	Aug. 05, 2016	Two Year	<input checked="" type="checkbox"/>
10.	Controller	Innco System	CO3000	CO3000/904/ 37211215/L	N/A	N/A	<input checked="" type="checkbox"/>
11.	LISN	EMCO	3825/2	9109-1867	Apr. 07, 2017	One Year	<input type="checkbox"/>
				9109-1869	Apr. 06, 2017	One Year	<input type="checkbox"/>
		Schwarzbeck	NSLK8126	8126-404	Apr. 03, 2017	One Year	<input type="checkbox"/>
		Schwarzbeck	NSLK8128	8128-216	Apr. 05, 2017	One Year	<input type="checkbox"/>
12.	Turn Table	Innco System	DT3000	930611	N/A	N/A	<input checked="" type="checkbox"/>
13.	Antenna Master	Innco System	MA-4000XPET	MA4000/509/ 37211215/L	N/A	N/A	<input checked="" type="checkbox"/>
14.	Antenna Master	Innco System	MA4000-EP	MA4000/332/ 27030611/L	N/A	N/A	<input type="checkbox"/>
15.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-235	Jun. 10, 2016	Two Year	<input checked="" type="checkbox"/>
16.	Frequency Counter	HP	53152A	US39270295	Sep. 05, 2017	One Year	<input checked="" type="checkbox"/>
17.	Chamber	ESPEC	EBE- 5E30W6PT2L- 22	3015006449	Mar. 22, 2017	One Year	<input checked="" type="checkbox"/>
18.	DC Power Supply	Protek	PWS-3003D	4020409	Sep. 01, 2017	One Year	<input checked="" type="checkbox"/>
19.	Slidacs	Dea Kwang Elec.	DH-60	N/A	Sep. 01, 2017	One Year	<input type="checkbox"/>