TEST REPORT

KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr	Report No.: KR18-SRF0083-C Page (1) of (24)	KCTL

1. Client

- Name : Continental Automotive Systems Corporation
- Address : 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
- Date of Receipt : 2018-06-04

2. Use of Report : -

3. Name of Product and Model : Remote Keyless Entry System(Transmitter) / SVI-IGRGE03

4. Manufacturer and Country of Origin : Continental Automotive Systems Corporation / Korea

5. FCC ID : SY5IGRGE03

6. IC : 8325A-IGRGE03

7. Date of Test : 2018-06-12 to 2018-06-18

8. Test Standards : FCC Part 15 Subpart C
Section 15.209, Section 15.231
RSS-210 Issue 9, August 2016
RSS-Gen Issue 5, April 2018

9. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Jinhwa Cho (Signature)	Technical Manager Name : Jongha Choi (Signature)

2018-08-22

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2018-06-22	Original Issued	-
2018-07-17	Revised center frequency, worst-case configuration and mode and added a note	13 ~ 15, 18 ~ 19
2018-07-25	Revised test result and plot of Bandwidth Measurement	20, 21
2018-08-22	Revised test result and test equipment	13 ~ 15, 18, 24

[Contents]

1. Client information

Applicant:	Continental Automotive Systems Corporation
Address:	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Telephone number:	+82 31 645 4864
Contact person:	Sungmin Jang / Sungmin.Jang@continental-corporation.com

Manufacturer:	Continental Automotive Systems Corporation
Address:	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea

2. Laboratory information

Address

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

Telephone Number: +82 31 285 0894

Facsimile Number: +82 505 299 8311

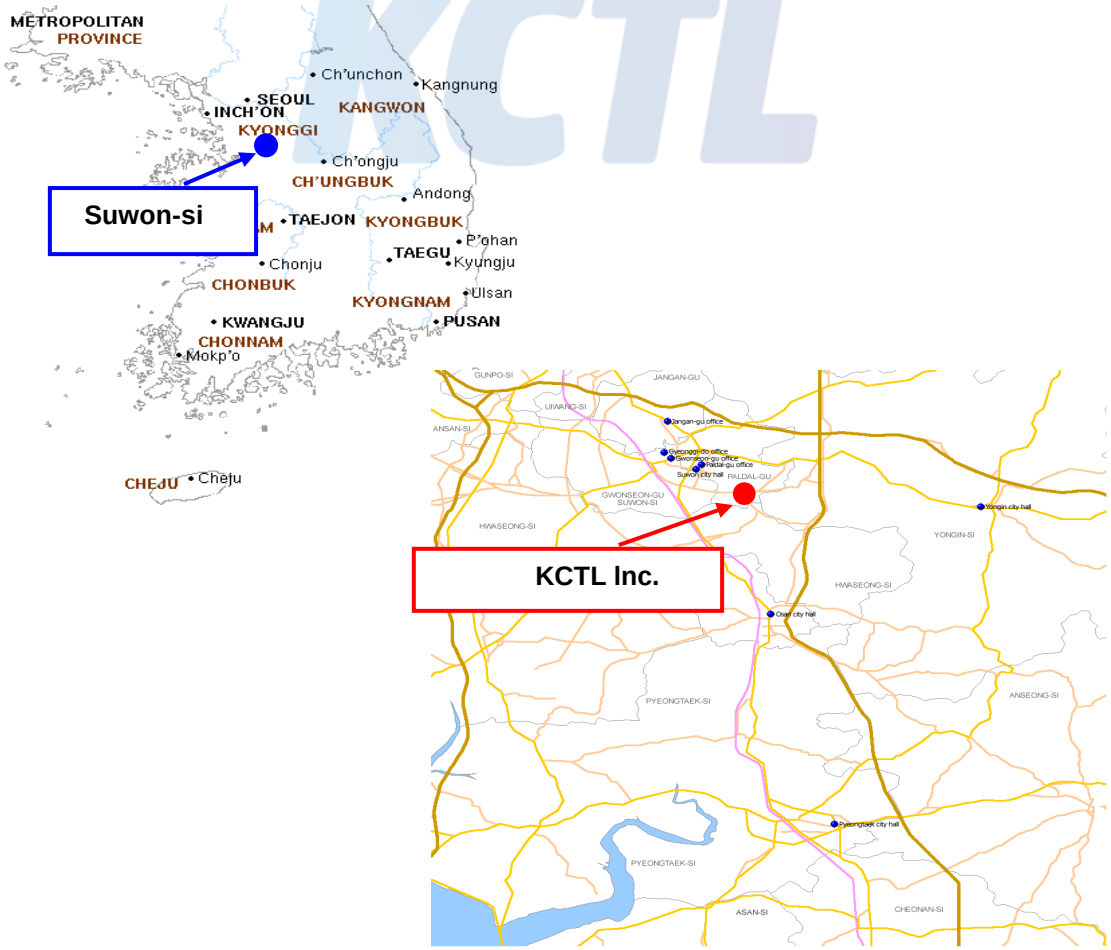
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	Continental Automotive Systems Corporation
Address of Applicant	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Manufacturer	Continental Automotive Systems Corporation
Address of Manufacturer	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Type of equipment	Remote Keyless Entry System(Transmitter)
Basic Model	SVI-IGRGE03
Serial number	N/A

3.2 General description

Frequency Range	433.92 ㎒ (Tx)
Type of Modulation	FSK
The number of channels	1 Channel
Type of Antenna	PCB Pattern Antenna
Antenna Gain	-24.14 ㏈i
Power supply	DC 3 Ⅴ
Product SW/HW version	1.0 / 1.0
Radio SW/HW version	1.0 / 1.0
Test SW Version	N/A$_{1)}$
RF power setting in TEST SW	N/A$_{2)}$

Note$_{1)}$: The above EUT information was declared by the manufacturer.
Note$_{2)}$: N/A$_{1)}$ No test SW was used during testing.
N/A$_{2)}$ RF power setting was not able to alter during testing.

3.3 Test frequency

Test Frequency [㎒]
433.92 ㎒

3.4 Normal and extreme test conditions

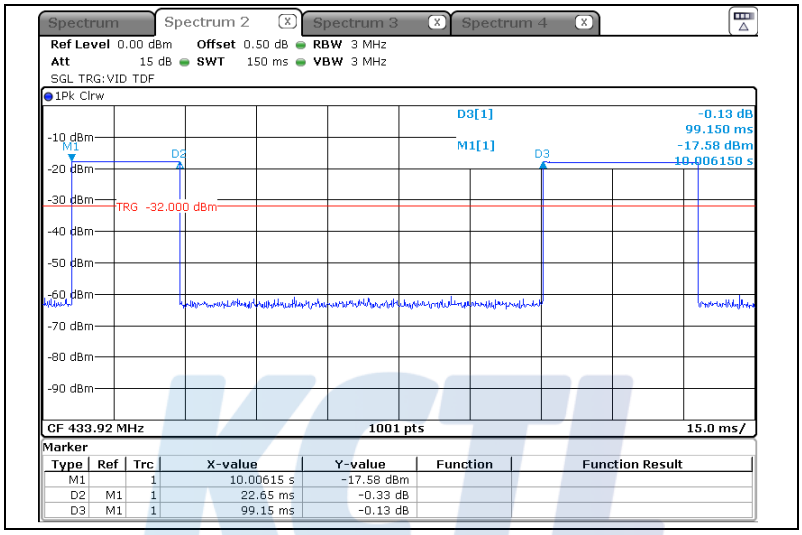
Test condition	Temperature [℃]	Voltage [V]
NTNV	21	3

Note 1 : N:Normal T:Temperature V:Voltage

- Duty Cycle

Tx On time : 22.65 ms
Tx On time+Off time : 100 ms (pulse train is 100 ms instead of 99.15 ms)
Duty cycle Correction factor = 20log(22.65/100) = -12.90 dB

- **Tx On time:**



4. Summary of test results

4.1 Standards & results

FCC Rule	IC Rule	Parameter	Test Result
15.203	-	Antenna Requirement	C
15.209(a) 15.231(b)	RSS-210, Issue 9, Table A1	Radiated emission, Spurious Emission and Field Strength of Fundamental	C
15.231(c)	RSS-210, Issue 9, A1.3 RSS-GEN Issue 5, 6.7	Bandwidth Measurement	C
15.231(a)	RSS-210, Issue 9, A1,1(a)	Transmission Time	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	N/A (Note$_2$)
Note$_{1)}$: C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable Note$_{2)}$: This test is not applicable because the EUT uses battery and it's not to be connected to the public utility(AC) power line.			

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 ㎒ ~ 300 ㎒:	+4.94 dB, -5.06 dB
		+4.93 dB, -5.05 dB
	300 ㎒ ~ 1 000 ㎒:	+4.97 dB, -5.08 dB
		+4.84 dB, -4.96 dB
	1 ㎓ ~ 25 ㎓:	+6.03 dB, -6.05 dB
Conducted Emissions	9 ㎑ ~ 150 ㎑:	3.75 dB
	150 ㎑ ~ 30 ㎒:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.1.2 Result

-Complied

The PCB Pattern Antenna is an integral antenna, and no antenna other than that furnished by the responsible party shall be used with the device.

5.2 Field strength of Fundamental

5.2.1 Regulation

According to §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: 83

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241..

According to §15.231(b)
In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (㎒)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

Where F is the frequency in ㎒, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 ㎒, ㎶/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 ㎒, ㎶/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 ㏈ below the maximum permitted fundamental level.

5.2.2 Test procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.
h. normally, output is measured with average result. but in this case, average result is calculated by measuring peak result and applying DCCF.

5.2.3 Test Result

- Complied

- X-axis

Peak DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	89.40	12.68	-32.13	16.45	-3.00	86.40	100.83	14.43

NOTE:
1. Peak Limit = 80.83 dB㎶/m + 20 dB = 100.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. X is worst-case configuration among 3 axis.

Average DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	76.50	12.68	-32.13	16.45	-3.00	73.50	80.83	7.33

NOTE:
1. Average Limit = 80.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. Average reading = Peak Reading + Duty Cycle Correction Factor
4. Duty Cycle Correction Factor : -12.90 dB
5. X is worst-case configuration among 3 axis.

- Y-axis

Peak DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	89.10	12.68	-32.13	16.45	-3.00	86.10	100.83	14.73

NOTE:
1. Peak Limit = 80.83 dB㎶/m + 20 dB = 100.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. X is worst-case configuration among 3 axis.

Average DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	76.20	12.68	-32.13	16.45	-3.00	73.20	80.83	7.63

NOTE:
1. Average Limit = 80.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. Average reading = Peak Reading + Duty Cycle Correction Factor
4. Duty Cycle Correction Factor : -12.90 dB
5. X is worst-case configuration among 3 axis.

- Z-axis

Peak DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	86.80	12.68	-32.13	16.45	-3.00	83.80	100.83	17.03

NOTE:
1. Peak Limit = 80.83 dB㎶/m + 20 dB = 100.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. X is worst-case configuration among 3 axis.

Average DATA.

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
433.92	120	H	73.90	12.68	-32.13	16.45	-3.00	70.90	80.83	9.93

NOTE:
1. Average Limit = 80.83 dB㎶/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. Average reading = Peak Reading + Duty Cycle Correction Factor
4. Duty Cycle Correction Factor : -12.90 dB
5. X is worst-case configuration among 3 axis.

5.3 Spurious Emission

5.3.1 Regulation

According to §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: 83

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241..

According to §15.231(b)
In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (㎒)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

5.3.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

a. The EUT was placed on the top of a rotating table 0.8 meters, 1.5 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1/T for Average detection (AV) at frequency above 1 ㎓. **(**where T = pulse width)
4. The radiated restricted band edge and Spurious radiated emissions average measurements use a duty cycle correction factor (DCCF).

5.3.3 Test Result

- Complied

- Below 1 ㎓ data

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒										
Not Detected										
Quasi-Peak DATA. Emissions below 1 ㎓										
54.01	120	V	32.50	6.97	-32.11	13.44	-11.70	20.80	40.00	19.20
150.04	120	V	33.30	9.78	-32.03	12.95	-9.30	24.00	43.50	19.50
358.47	120	H	33.40	11.59	-32.08	14.79	-5.70	27.70	46.00	18.30
420.91	120	H	38.10	12.46	-32.12	16.16	-3.50	34.60	46.00	11.40
447.10	120	H	35.00	12.81	-32.15	16.74	-2.60	32.40	46.00	13.60
867.96	120	H	35.10	15.03	-31.91	23.28	6.40	41.50	46.00	4.50

NOTE:
1. According to exploratory test no any obvious emission were detected from 9kHz to 30MHz. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
2. X is worst-case configuration among 3 axis.

- Above 1 ㎓ data

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Cable Loss [dB]	Amp Gain [dB]	Antenna Factor [dB]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓										
1 301.78	1 000	H	73.95	2.76	-60.98	25.01	-33.21	40.74	74.00	33.26
2 169.44	1 000	H	73.43	3.55	-59.00	28.12	-27.33	46.10	80.82	34.72
3 037.66	1 000	H	74.40	4.16	-59.51	29.80	-25.55	48.84	80.82	31.98
3 471.63	1 000	H	73.14	4.44	-60.11	30.97	-24.70	48.45	80.82	32.37
3 905.31	1 000	H	74.94	4.72	-60.78	32.14	-23.92	51.01	74.00	22.99
4 339.56	1 000	H	69.89	5.02	-60.25	32.57	-22.66	47.23	74.00	26.77
4 773.25	1 000	H	78.93	5.32	-59.85	32.79	-21.74	57.19	74.00	16.81
5 207.22	1 000	H	70.32	5.60	-59.91	33.21	-21.10	49.23	80.82	31.59
Average DATA. Emissions above 1 ㎓										
1 301.78	1 000	H	61.13	2.76	-60.98	25.01	-33.21	27.92	54.00	26.08
2 169.44	1 000	H	60.61	3.55	-59.00	28.12	-27.33	33.28	60.82	27.54
3 037.66	1 000	H	61.58	4.16	-59.51	29.80	-25.55	36.02	60.82	24.80
3 471.63	1 000	H	60.32	4.44	-60.11	30.97	-24.70	35.63	60.82	25.19
3 905.31	1 000	H	62.12	4.72	-60.78	32.14	-23.92	38.19	54.00	15.81
4 339.56	1 000	H	57.07	5.02	-60.25	32.57	-22.66	34.41	54.00	19.59
4 773.25	1 000	H	66.11	5.32	-59.85	32.79	-21.74	44.37	54.00	9.63
5 207.22	1 000	H	57.50	5.60	-59.91	33.21	-21.10	36.41	60.82	24.41

NOTE:
1. X is worst-case configuration among 3 axis.

5.4 Bandwidth Measurement

5.4.1 Regulation

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 ㎒ and below 900 ㎒. Bandwidth is determined at the point 20 ㏈ down from the modulated carrier.

5.4.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=3 ㎑,VBW=10 ㎑ and Span= 300 ㎑.
3. The bandwidth of fundamental frequency was measured and recorded.

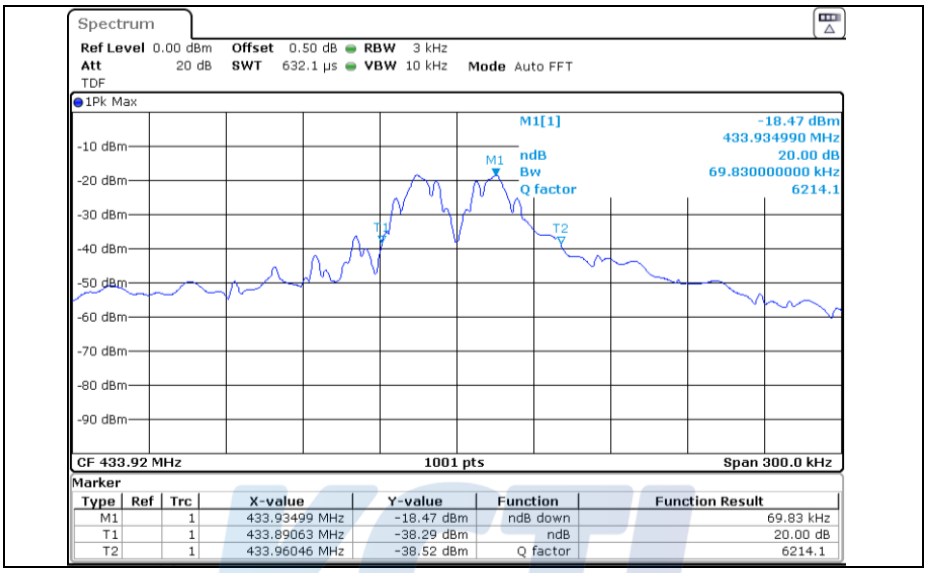
5.4.3 Test Result

- Complied

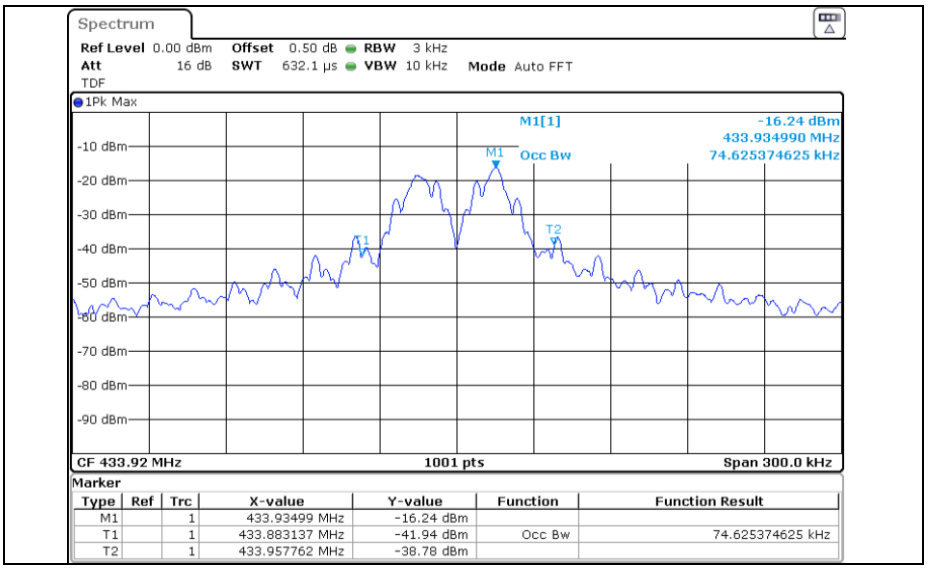
Frequency [㎒]	20 ㏈ Bandwidth [㎒]	Limit [㎒]	Occupied Bandwidth (99 % BW) [㎒]
433.92	0.070	1.085	0.075

5.4.4 Test plot

-20 dB Bandwidth



-OBW



5.5 Transmission Time

5.5.1 Regulation

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

5.5.2 Measurement Procedure

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

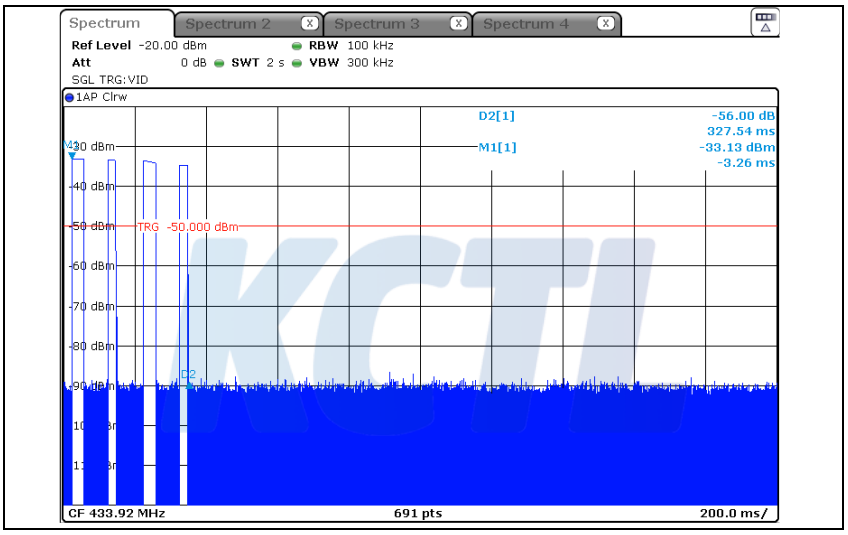
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑,VBW=300 ㎑, Span=0 ㎐.
3. The bandwidth of fundamental frequency was measured and recorded.

5.5.3 Test Result

- Complied

Frequency [㎒]	Transmission Time [ms]	Limit [s]
433.92	324.64	5.00

5.5.4 Test plot



6. Test equipment used for test

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	EMI TEST RECEIVER	R & S	ESCI	100732	18.08.24
■	DC Power Supply	AGILENT	E3632A	MY40016393	18.12.21
■	Signal Generator	R & S	SMR40	100007	19.05.15
■	Vector Signal Generator	R & S	SMBV100A	257566	19.01.05
■	Spectrum Analyzer	R & S	FSV30	100810	18.08.01
■	Spectrum Analyzer	R & S	FSV40	100989	19.01.05
■	Bilog Antenna	SCHWARZBECK	VULB 9168	583	20.04.13
■	COAXIAL FIXED ATTENUATOR	AGILENT	8491B-003	2708A18758	20.05.04
■	Amplifier	SONOMA INSTRUMENT	310N	186280	19.04.05
■	Amplifier	SONOMA INSTRUMENT	310N	284608	18.08.24
■	LOOP Antenna	R & S	HFH2-Z2	892665/035	19.01.25
■	Horn antenna	ETS.lindgren	3117	161225	19.05.18
■	Amplifier	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2003683	19.05.15
■	Highpass Filter	Wainwright Instruments GmbH	WHKX1.0/ 1.5S-10SS	14	19.01.31
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-