

FCC/ IC TEST REPORT


Test report No: EMC- FCC- R0089
FCC ID: SY5DMFNA433
IC ID: 8325A-DMFNA433
Type of equipment: Smart Key Fob
Model Name: SVI-DMFNA433
Applicant: Continental Automotive Systems Corporation
FCC Rule Part(s): FCC Part 15 Subpart C
Section 15.209, Section 15.231
IC RSS-210, Issue 8 : 2010
Frequency Range: 433.92 MHz (Tx)
125 kHz (Rx)
Test result: Complied


The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

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.

Date of test: January 7, 2013 ~ January 9, 2013

Issued date: January 10, 2013


Tested by: _____
SON, MIN GI


Approved by: _____
KIM, CHANG MIN

[Contents]

1. Client information	3
2. Laboratory information	4
3. Description of E.U.T.	5
3.1 Basic description.....	5
3.2 General description	5
3.3 Test frequency.....	6
3.4 Test Voltage	6
4. Summary of test results	7
4.1 Standards & results	7
4.2 Uncertainty	7
5. Test results	8
5.1 Field strength of Fundamental	8
5.2 Spurious Emission	10
5.3 Receiver Spurious Emission	13
5.4 Bandwidth of Operation Frequency.....	15
5.5 Transmission Time.....	16
5.6 Occupied Bandwidth	17
6. Test equipment used for test	18
Appendix 1 Test setup photos	
Appendix 2 External photos of EUT	
Appendix 3 Internal photos of EUT	
Appendix 4 Block diagram	
Appendix 5 Schematics	
Appendix 6 User manual	
Appendix 7 Part list	
Appendix 8 Layout diagram	
Appendix 9 Antenna Specification	

1. Client information

Applicant: Continental Automotive Systems Corporation
Address: 29, Siemens-Road, Icheon-City, Gyeonggi-Do, 467-080, Korea
Telephone number: +82-31-645-4864
Facsimile number : +82-31-637-0371
Contact person: SungMin Jang/Manager

Manufacturer: Continental Automotive Systems Corporation
Address : 29, Siemens-Road, Icheon-City, Gyeonggi-Do, 467-080, Korea

2. Laboratory information

Address

EMC Compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea,
Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate

CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 508785
IC Filing No.: 8035A-2
VCCI Registration No.: C-1713, R-1606, T-258

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant :	Continental Automotive Systems Corporation
Address of Applicant:	29, Siemens-Road, Icheon-City, Gyeonggi-Do, 467-080, Korea
Manufacturer:	Continental Automotive Systems Corporation
Address of Manufacturer:	29, Siemens-Road, Icheon-City, Gyeonggi-Do, 467-080, Korea
Type of equipment:	Smart Key Fob
Basic Model:	SVI-DMFNA433
Serial number:	N/A

3.2 General description

Frequency Range	433.92 MHz (Tx), 125 kHz (Rx)
Type of Modulation	FSK
Emission Designator	141k0F1D
Number of Channels	1 channel
Type of Antenna	PCB Antenna
Antenna Gain	-11.62 dBi
Transmit Power	70.4 dBuV
Power supply	Battery 3 V
Dimension	72 x 42 x 12 mm

3.3 Test frequency

	Frequency
Low frequency	-
Middle frequency	433.92 MHz
High frequency	-

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 3 V

4. Summary of test results

4.1 Standards & results

Section in FCC 15 Subpart C §15.209	Section in RSS-210, Issue 8 : 2010	Parameter	Test Result
15.209(a) 15.231(b)	RSS-210, Issue 8, Table B	Radiated emission, Spurious Emission and Field Strength of Fundamental	C
-	RSS-Gen, Issue 3,6	Receiver Spurious Emission (Radiated)	C
15.231(c)	RSS-210, Issue 8, A1.1.3	Bandwidth of Operation frequency	C
15.231(a)	RSS-210, Issue 8, A1.1.1	Transmission Time	C
-	RSS-Gen, Issue 3, 4.6.1	Occupied Bandwidth	C

Note: C=complies
NC= Not complies
NT=Not tested
NA=Not Applicable

*The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line.

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty U _c	Expanded Uncertainty U = KU _c (K = 2)
Conducted RF power	± 0.29 dB	± 0.58 dB
Radiated disturbance	30 MHz ~ 300 MHz : + 2.43 dB, - 2.44 dB 300 MHz~1 000 MHz : + 2.49dB, - 2.495dB 1 GHz ~ 6 GHz : + 3.095 dB, - 3.10 dB 6 GHz ~ 18 GHz : + 3.205 dB, - 3.265 dB	30 MHz ~ 300 MHz : + 4.86 dB, - 4.88 dB 300 MHz ~ 1 000 MHz : + 4.98dB, - 4.99dB 1 GHz ~ 6 GHz : + 6.19 dB, - 6.20 dB 6 GHz ~ 18 GHz : + 6.41 dB, - 6.53 dB

5. Test results

5.1 Field strength of Fundamental

5.1.1 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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. 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 (MHz)	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 MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

5.1.2 Test procedure

- 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 GHz, 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 GHz, 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 dB 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 dB 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.

5.1.2 Test Result

-Complied

Frequency [MHz]	Receiver Bandwidth [kHz]	Detector	Pol. [V/H]	Reading [dB(μV)]	Factor (Amp Gain + Attenuator + AF + CL)	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
433.92	120	Quasi – Peak	H	78.9	-8.5	70.4	80.8	10.4

NOTE:

1. **Limit = 20log(41.6667(F)-7083.3333) = 80.8**

5.2 Spurious Emission

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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. 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 (MHz)	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 MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V}/\text{m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V}/\text{m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

5.2.2 Measurement Procedure

- 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 GHz, 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 GHz, 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 dB 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 dB 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.

5.2.3 Test Result -complied

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor (Amp Gain + Attenuator + AF + CL)	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30MHz							
			Not detected (In the noise floor)				
Quasi-Peak DATA. Emissions below 1GHz							
867.98	120	H	37.1	0.3	37.4	61.0	23.6
Peak DATA. Emissions above 1GHz							
Above 1000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Above 1000.00	Not Detected	-	-	-	-	-	-

NOTE:

1. **Factor(dB) = ANT Factor+ Amp Gain + Cable Loss**

2. **Margin (dB) = Limit - Result**

[Result = Reading – Factor]

H = Horizontal, V = Vertical Polarization

ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.3 Receiver 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 (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 – 216	150
216 -960	200
Above 960	500

5.3.2 Measurement Procedure

- 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 GHz, 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 GHz, 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 dB 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 dB 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.

5.3.3 Test Result

-complied

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor (Amp Gain + Attenuator + AF + CL)	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30MHz							
Below 1000.00	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1GHz							
2437.19	1000	H	52.4	-1.1	51.3	81.0	29.7
Above 3000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
2437.19	1000	H	38.4	-1.1	37.3	61.0	23.7
Above 3000.00	Not Detected	-	-	-	-	-	-

NOTE:

3. Factor(dB) = ANT Factor+ Amp Gain + Cable Loss

4. Margin (dB) = Limit - Result

[Result = Reading – Factor]

H = Horizontal, V = Vertical Polarization

ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.4 Bandwidth of Operation Frequency

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 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

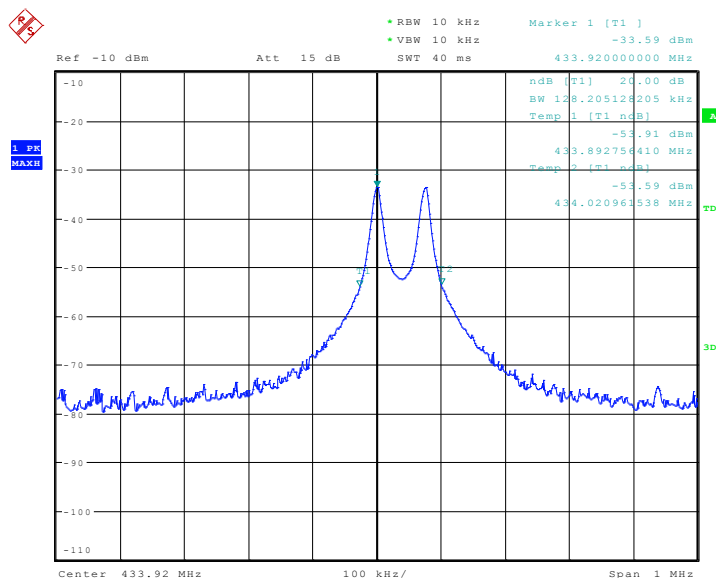
5.4.2 Measurement Procedure

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=10 kHz, VBW=10 kHz and Span=1 MHz.
3. The bandwidth of fundamental frequency was measured and recorded.

5.4.3 Test Result -complied

Frequency [MHz]	Bandwidth of the emission [kHz]	Limit [kHz]
433.92	128.0	1 082.5

5.4.4 Test plot



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

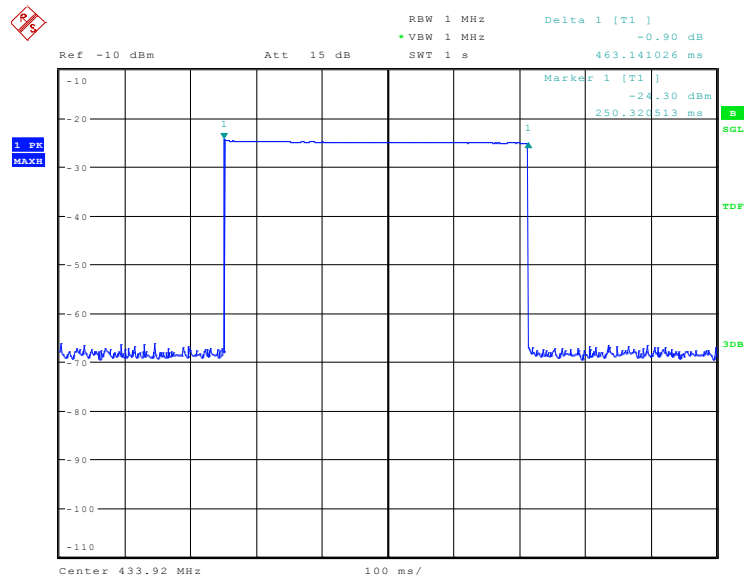
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=1 MHz, VBW=1 MHz, Span=0 Hz, Sweep Time=10 sec
3. The bandwidth of fundamental frequency was measured and recorded.

5.5.3 Test Result

-complied

Frequency [MHz]	Transmission Time [s]	Limit [s]
433.92	0.463	5

5.5.4 Test plot



5.6 Occupied Bandwidth

5.3.1 Regulation

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

5.3.2 Measurement Procedure

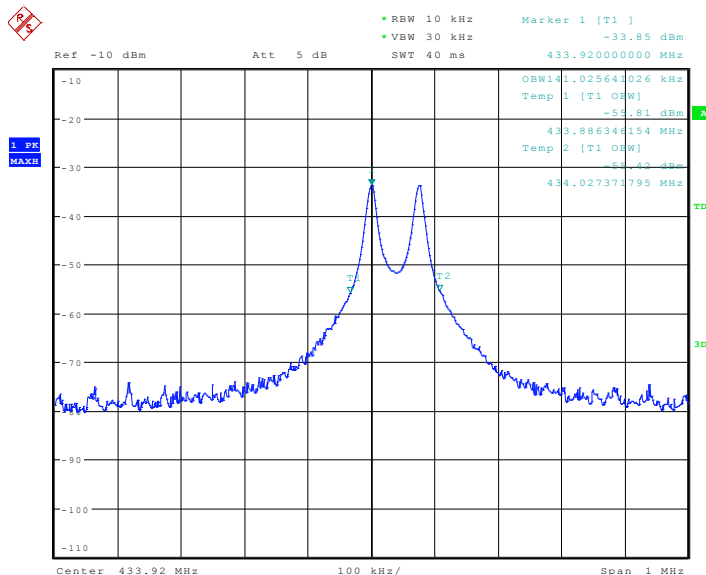
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using $RBW \geq 1\%$ of Span, VBW to 3 times RBW.
3. The bandwidth of fundamental frequency was measured and recorded.

5.3.3 Test Result

-complied

Frequency [MHz]	Occupied Bandwidth [kHz]	Limit [kHz]	Remark
433.92	141.0	1 082.5	99% Occupied Bandwidth

5.3.3 Test plot

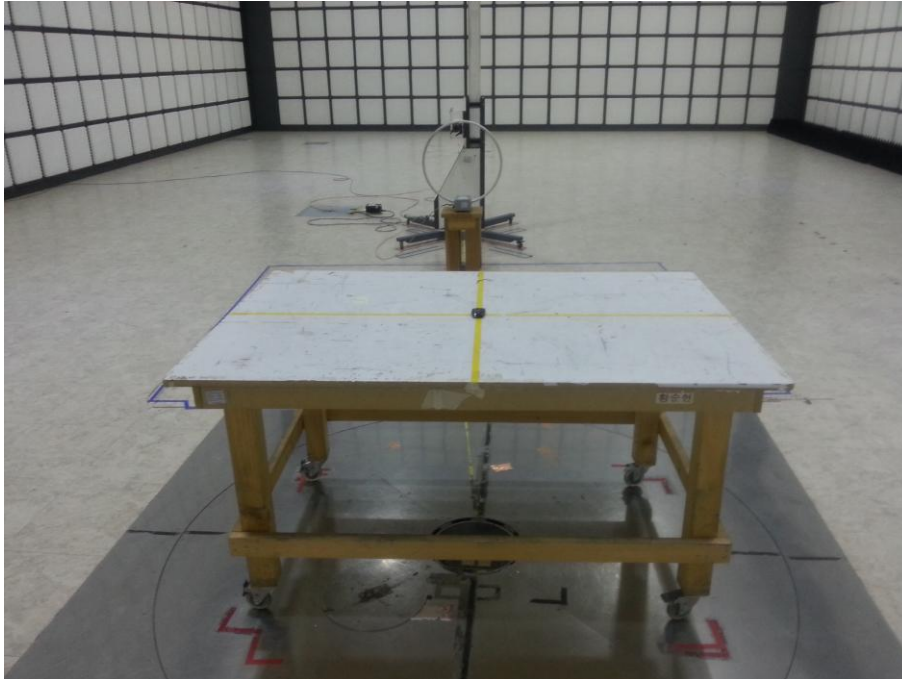


6. Test equipment used for test

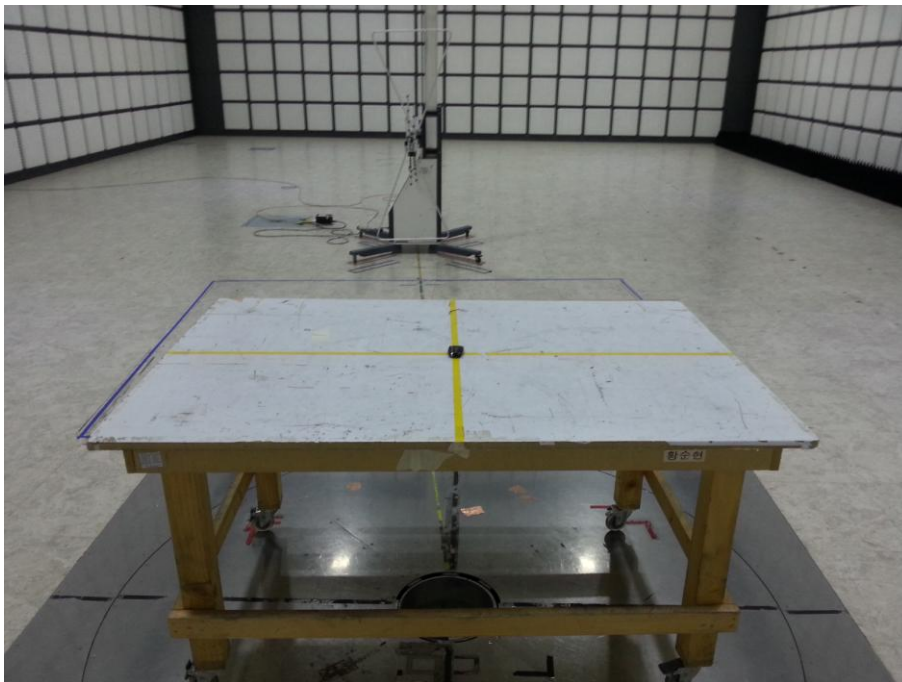
	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
<input type="checkbox"/>	Temp & humidity chamber	taekwang	TK-04	TK001	13.12.07
<input type="checkbox"/>	Temp & humidity chamber	taekwang	TK-500	TK002	13.09.03
<input type="checkbox"/>	Frequency Counter	HP	53150A	US39250565	13.09.04
<input type="checkbox"/>	Spectrum Analyzer	Agilent	E4407B	US39010142	13.10.23
<input checked="" type="checkbox"/>	Spectrum Analyzer	R & S	FSP40	100209	13.06.27
<input type="checkbox"/>	Modulation Analyzer	HP	8901B	3538A05527	13.10.25
<input type="checkbox"/>	Audio Analyzer	HP	8903B	3729A19213	13.10.23
<input type="checkbox"/>	AC Power Supply	KIKUSUI	PCR2000W	GB001619	13.10.23
<input type="checkbox"/>	DC Power Supply	Tektronix	PS2520G	TW50517	13.02.06
<input type="checkbox"/>	DC Power Supply	Tektronix	PS2521G	TW53135	13.10.23
<input type="checkbox"/>	Dummy Load	BIRD	8141	7560	13.09.09
<input type="checkbox"/>	Dummy Load	BIRD	8401-025	799	13.09.09
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESCI	100001	13.11.06
<input type="checkbox"/>	Attenuator	HP	8494A	2631A09825	12.10.24
<input type="checkbox"/>	Attenuator	HP	8496A	3308A16640	12.10.24
<input type="checkbox"/>	Attenuator	R&S	RBS1000	D67079	12.10.24
<input type="checkbox"/>	WIDEBAND POWER SENSOR	R & S	NRP-Z81	100677	13.05.04
<input checked="" type="checkbox"/>	LOOP Antenna	EMCO	EMCO6502	9205-2745	13.05.22
<input checked="" type="checkbox"/>	BILOG Antenna	Schwarzbeck	VULB 9168	375	13.09.21
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3115	00086706	13.11.21
<input checked="" type="checkbox"/>	HORN Antenna	ETS	3115	00062589	13.09.06
<input type="checkbox"/>	HORN Antenna	ETS	3116	00086632	13.11.15
<input type="checkbox"/>	HORN Antenna	ETS	3116	00086632	13.11.15
<input type="checkbox"/>	Amplifier	SONOMA INSTRUMENT	310N	293004	13.11.06
	PREAMPLIFIER	AGILENT	8449B	3008A01802	13.05.08
<input checked="" type="checkbox"/>	Signal Generator	R & S	SMR40	100007	13.06.27
<input type="checkbox"/>	Power Divider	Weinschel	1580-1	NX380	13.09.09
<input type="checkbox"/>	Power Divider	Weinschel	1594	671	13.09.10

Test Setup Photos

Below 30 MHz



Below 1 GHz



Above 1 GHz

