

# TEST REPORT

OF

FCC Part 15 Subpart C §15.209 / IC RSS-210 Issue 8, RSS-Gen Issue 3  
FCC ID/IC Certification: SY5SMK27 / 8325A-SMK27

Equipment Under Test : Smart Key ECU  
Model Name : SMK 2.7  
Serial No. : N/A  
Applicant : Continental Automotive Systems Corporation  
Manufacturer : Continental Automotive Systems Corporation  
Date of Test(s) : 2011. 10. 17 ~ 2011. 11. 02  
Date of Issue : 2011. 11. 02

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date

2011. 11. 02

Alvin Kim

Approved By



Date

2011. 11. 02

Charles Kim

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## 1. General Information

### 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)  
 Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040  
[www.ee.sgs.com/korea](http://www.ee.sgs.com/korea)

Telephone : +82 +31 428 5700  
 FAX : +82 +31 427 2371

### 1.2. Details of Applicant

Applicant : Continental Automotive Systems Corporation  
 Address : 29, Siemens-Road, Icheon-City, Gyeonggi-Do, 467-080, Korea  
 Contact Person : Jang Sung-Min  
 Phone No. : +82 31 645 4864  
 Fax No. : +82 31 637 0371

### 1.3. Description of EUT

<b>Kind of Product</b>	Smart Key ECU
<b>Model Name</b>	SMK 2.7
<b>Serial Number</b>	N/A
<b>Power Supply</b>	DC 12 V
<b>Frequency Range</b>	Tx : 125 kHz, Rx : 125 kHz (Only IMMO ANT)
<b>Modulation Technique</b>	ASK
<b>Number of Channels</b>	1
<b>Operating Conditions</b>	-20 °C ~ 60 °C
<b>Antenna Type</b>	Fixed Type (Coil Antenna)

### 1.4. Declarations by the manufacturer

- Int1 and Int2 Antenna transmit at the same time.
- LF antennas do not have Rx function except for IMMO antenna

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### 1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Due.
Spectrum Analyzer	R&S	FSV30	100768	Mar. 31, 2012
Loop Antenna	R&S	HFH2-Z2	100118	Aug. 24, 2013
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Apr. 27, 2013
Test Receiver	R&S	ESU26	100109	Feb. 21, 2012
Antenna Master	INN-CO	MM4000	N.C.R.	N.C.R.
Turn Table	INN-CO	DS 1200 S	N.C.R.	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N.C.R.	N.C.R.

### 1.6. Test Report Revision

Revision	Report number	Description
0	F690501/RF-RTL005069	Initial
1	F690501/RF-RTL005069-1	Retested occupied bandwidth item

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### 1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

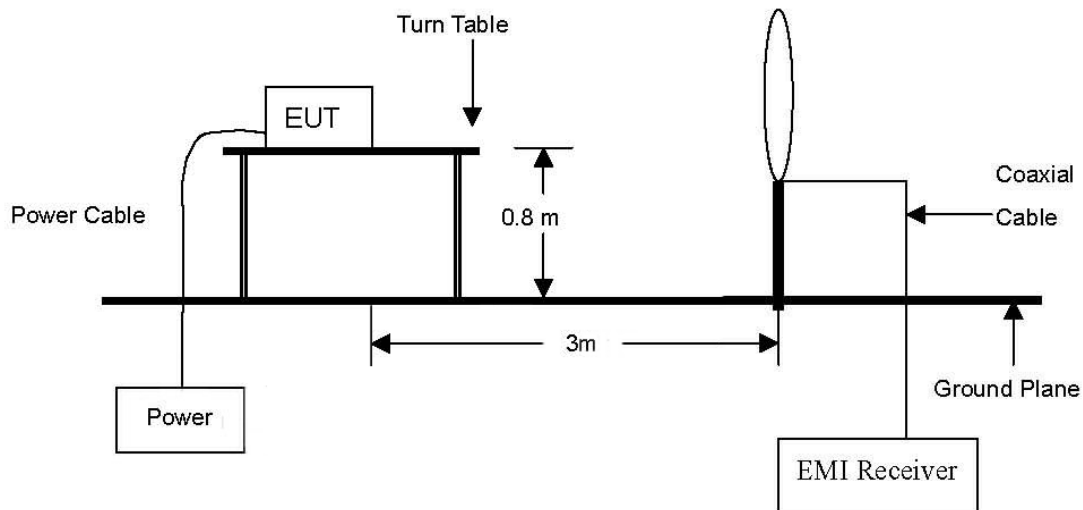
APPLIED STANDARD: FCC Part 15 Subpart C 15.203/ IC RSS-210 Issue8, RSS-Gen Issue3			
Section in FCC 15 Subpart C §15.209	Section in RSS-210, Issue	Test Item	Result
15.209(a)	RSS-210, Issue8 Table 3	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
-	RSS-Gen, Issue3, 4.6.1	Occupied Bandwidth	Complied
15.109(a)	RSS-Gen, Issue3, 6	Receiver Radiated Spurious Emission	Complied

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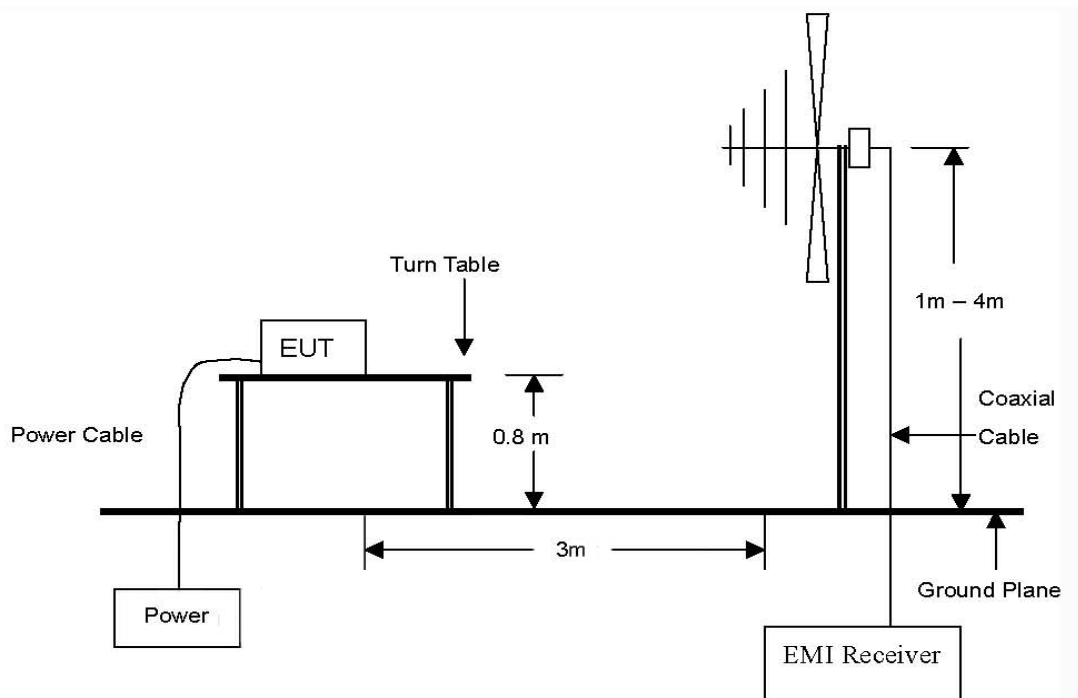
## 2. Field Strength of Fundamental

### 2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.

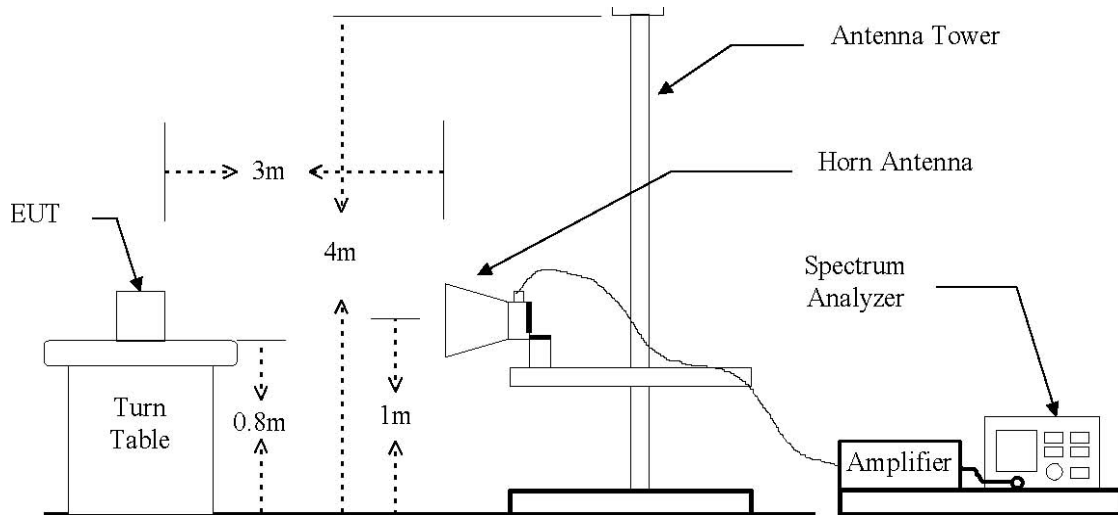


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



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## 2.2. Limit

### 2.2.1. Radiated emission limits, general requirements

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:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	2400/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

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## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

### 2.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- 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. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to average Detect Function and Specified Bandwidth with Maximum Hold Mode.

### 2.3.2. Test Procedures for emission from 30 MHz to 1000 MHz

- 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.

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## 2.4. Test Result

Ambient temperature : (23 ± 2) °C  
 Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. The field strength of spurious emission was measured in three orthogonal EUT position (x-axis, y-axis and z-axis). Worst case is x-axis.

### - DRV ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	57.50	Average	H	18.18	0.01	75.69	-4.31	25.67	29.98

### - AST ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	59.20	Average	H	18.18	0.01	77.39	-2.61	25.67	28.28

### - Bumper ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	59.90	Average	H	18.18	0.01	78.09	-1.91	25.67	27.58

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**- Int1 & Int2 ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	66.80	Average	H	18.18	0.01	84.99	4.99	25.67	20.68

**- Hatshelf ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	46.30	Average	H	18.18	0.01	64.49	-15.51	25.67	41.18

**- Int3 ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	59.50	Average	H	18.18	0.01	77.69	-2.31	25.67	27.98

**- IMMO ANT**

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.125	70.20	Average	H	18.18	0.01	88.39	8.39	25.67	17.28

**Note:**

1. 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)

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### 3. Spurious Emission

#### 3.1. Test Setup

Same as section 2.1 of this report

#### 3.2. Limit

Same as section 2.2 of this report

#### 3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

##### 3.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- 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. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to quasi-peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### 3.3.2. Test Procedures for emission from 30 MHz to 1000 MHz

- 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.

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### 3.4. Test Result

Ambient temperature : (24 ± 2) °C  
 Relative humidity : 47 % R.H.

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

#### - DRV ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.858	20.10	Q.P	H	18.02/0.01	38.13	-1.87	28.93	30.80
Above 0.900	Not detected	-	-	-	-	-	-	-

#### - AST ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.858	22.90	Q.P	H	18.02/0.01	40.93	0.93	28.93	29.86
Above 0.900	Not detected	-	-	-	-	-	-	-

#### - Bumper ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.890	19.00	Q.P	H	18.02/0.01	37.03	-2.97	28.62	31.59
Above 0.900	Not detected	-	-	-	-	-	-	-

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**- Int1 & Int2 ANT**

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.858	22.00	Q.P	H	18.02/0.01	40.03	0.03	28.93	28.96
Above 0.900	Not detected	-	-	-	-	-	-	-

**- Hatshelf ANT**

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.858	21.00	Q.P	H	18.02/0.01	39.03	-0.97	28.93	29.90
Above 0.900	Not detected	-	-	-	-	-	-	-

**- Int3 ANT**

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.874	18.20	Q.P	H	18.02/0.01	36.23	-3.77	28.77	32.54
Above 0.900	Not detected	-	-	-	-	-	-	-

**- Immo ANT**

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB $\mu$ V/m) at 3 m	Actual (dB $\mu$ V/m) at 300 m or 30 m	Limit (dB $\mu$ V/m)	Margin (dB)
0.374	1.20	Average	H	18.00/0.01	9.13	-70.87	16.15	87.02
Above 0.400	Not detected	-	-	-	-	-	-	-

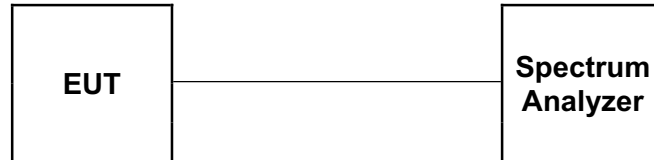
**Note:**

- 300 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(300/3) (dB $\mu$ V/m)
- 30 m Result(dB $\mu$ V/m) = 3 m Result(dB $\mu$ V/m) – 40log(30/3) (dB $\mu$ V/m)

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## 4. Occupied Bandwidth

### 4.1. Test Setup



### 4.2. Limit

None; for reporting purposed only

### 4.3. Test 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 kHz, VBW=3 kHz and Span=50 kHz and detector mode= Sample.
3. The bandwidth of fundamental frequency was measured and recorded.

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**SGS Korea Co., Ltd. (Gunpo Laboratory)** 8-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea, 435-040

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

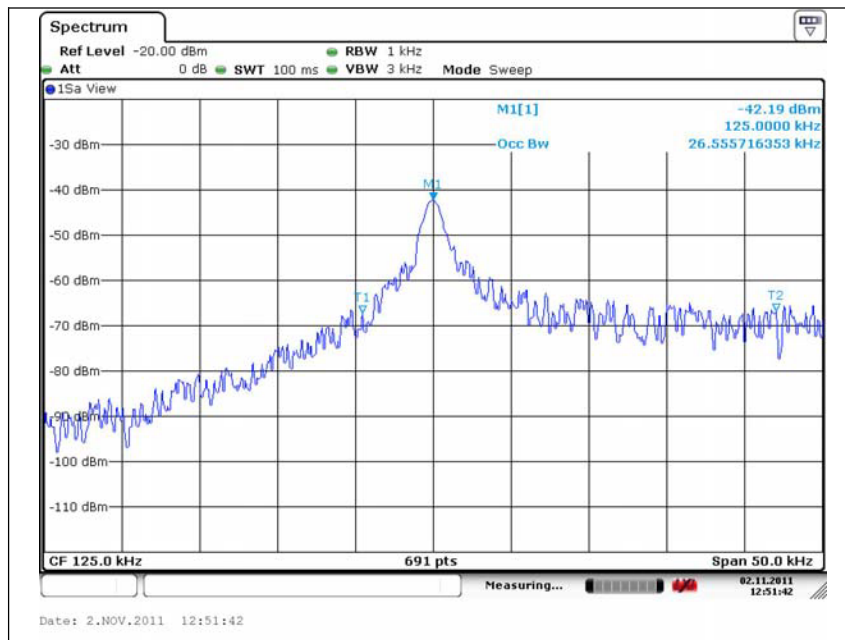
[www.ee.sgs.com/korea](http://www.ee.sgs.com/korea)

#### 4.4. Test Result

Ambient temperature : (24 ± 2) °C  
 Relative humidity : 47 % R.H.

**- DRV ANT**

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	26.56	-	99 % Occupied bandwidth

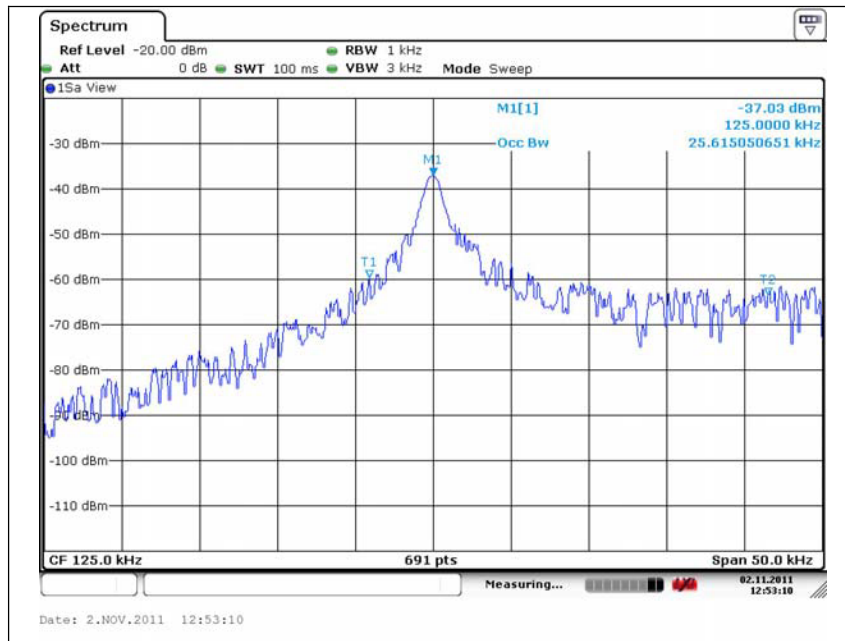


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**- AST ANT**

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	25.62	-	99 % Occupied bandwidth



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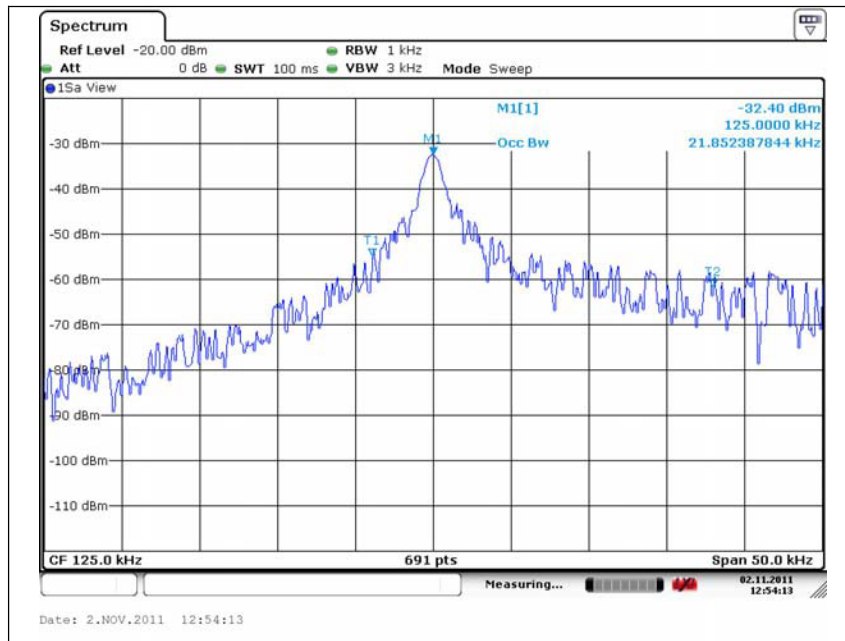
SGS Korea Co., Ltd. (Gunpo Laboratory) 8-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea, 435-040

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

[www.ee.sgs.com/korea](http://www.ee.sgs.com/korea)

**- Bumper ANT**

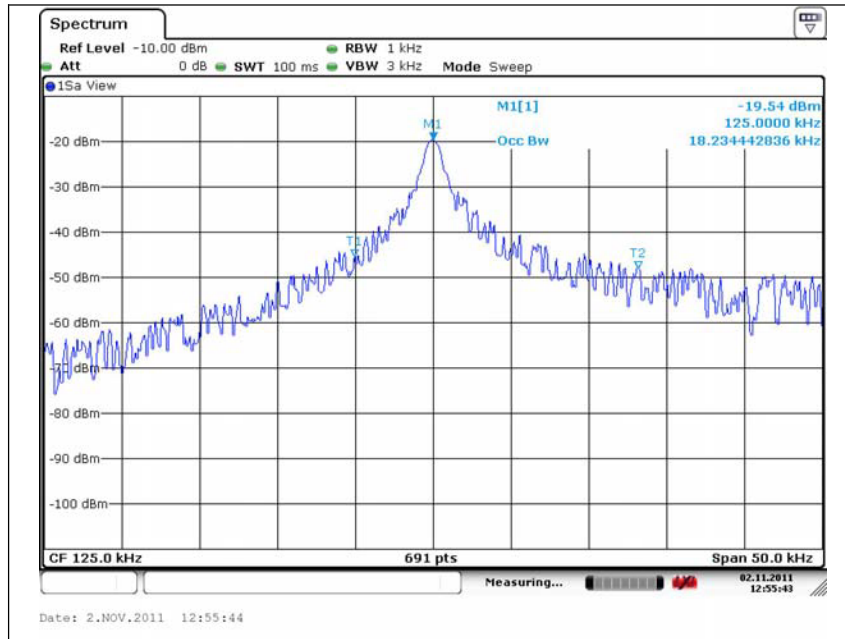
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	21.85	-	99 % Occupied bandwidth



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**- Int1 & Int2 ANT**

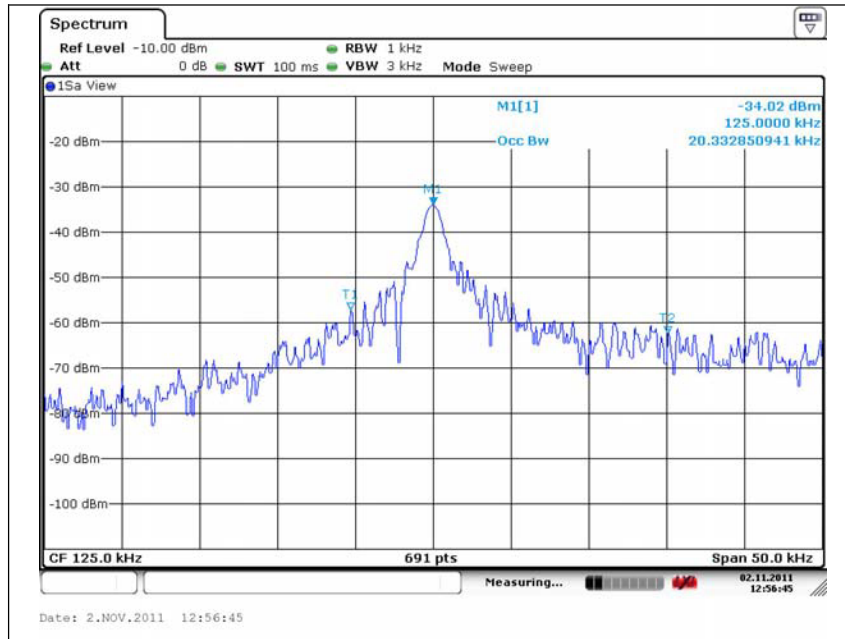
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	18.23	-	99 % Occupied bandwidth



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**- Hatshelf ANT**

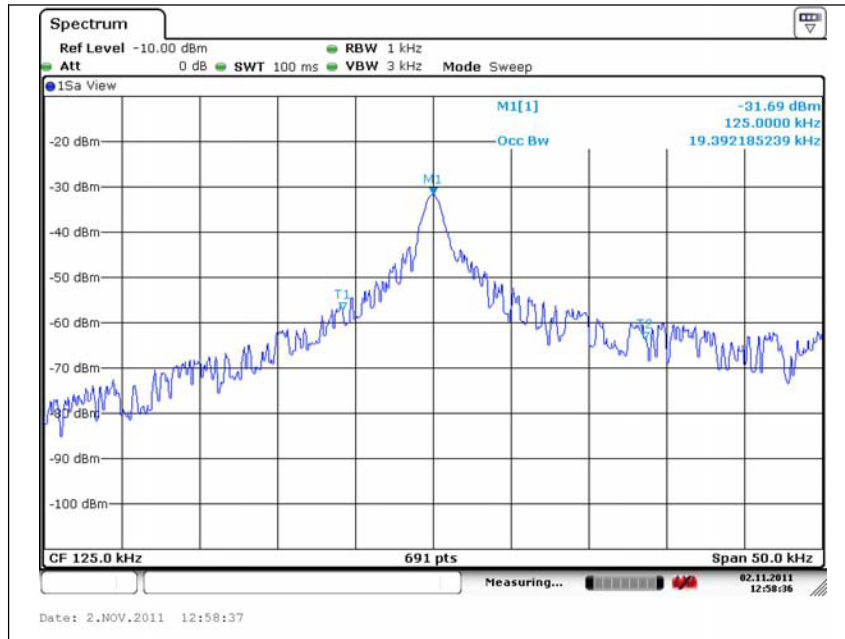
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	20.33	-	99 % Occupied bandwidth



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**- Int 3 ANT**

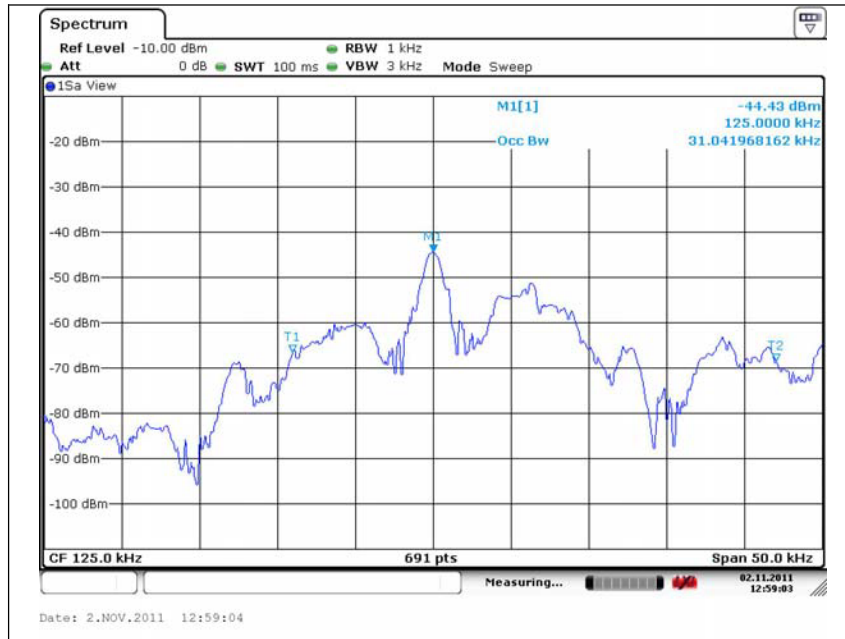
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	19.39	-	99 % Occupied bandwidth



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- Immo ANT

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	31.04	-	99 % Occupied bandwidth



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## 5. Receiver Radiated spurious emissions

### 5.1. Test setup

Same as section 2.1 of this report

### 5.2. Limit

According to §15.109(a), Except for Class A digital devices, the field strength of radiated emission from unintentional radiator at a distance of 3 m shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
30 – 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

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### 5.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

#### 5.3.1. Test Procedures for emission from 30 MHz to 1000 MHz

- 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.

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## 5.4. Test Results

Ambient temperature : 24 °C  
 Relative humidity : 47 % R.H.

### 5.4.1. Spurious Radiated Emission

The frequency spectrum from 30 MHz to 26.5 GHz was investigated. Emission levels are not reported much lower than the limits by over 30 dB. All reading values are peak values.

IMMO ANT (It has RX function)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
199.990	37.70	QP	H	11.00	-24.60	24.10	43.50	19.40
Above 200.000	Not detected	-	-	-	-	-	-	-

#### Remark:

- All spurious emission at channels are almost the same from 20 MHz to 26.5 GHz, so the channel was chosen as representative in final test.
- Actual = Reading + AF + AMP + CL

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