

# TEST REPORT

OF

FCC Part 15 Subpart C §15.209 /  
IC RSS-210, Issue 7 : 2007

FCC ID / IC Certification : SY5SMK20/ 8325A-SMK20

Equipment Under Test : Smart Key ECU  
Model Name : SMK 2.0  
Serial No. : N/A  
Applicant : Continental Automotive Systems Corporation  
Manufacturer : Continental Automotive Systems Corporation  
/ Hyundai MOBIS Co., Ltd.  
Date of Test(s) : 2009.07.29 ~ 2009.08.05  
Date of Issue : 2009.08.06

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

Tested By:



Date

2009.08.06

**Duke Ko**

Approved By



Date

2009.08.06

**Charles Kim**

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# INDEX

<u>TABLE OF CONTENTS</u>	Page
1. General Information -----	3
2. Field Strength of Fundamental -----	6
3. Spurious Emission-----	12
4. Occupied Bandwidth-----	15

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## 1. General Information

### 1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.  
 705, Dongchun-dong, Yongin-city, Gyeonggi-Do, Korea 449-840  
[www.electrolab.kr.sgs.com](http://www.electrolab.kr.sgs.com)  
 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 SungMin  
 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 2.0
<b>Serial Number</b>	N/A
<b>Power Supply</b>	DC 12 V
<b>Frequency Range</b>	125 kHz
<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 (Loop Antenna)

### 1.4. Declarations by the manufacturer

-N/A

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### 1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSP40	Oct. 01, 2009
Test Receiver	Rohde & Schwarz	ESU26	Apr. 21, 2010
Loop Antenna	Rohde & Schwarz	HFH2-Z2	Sep. 18, 2009
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jul. 22, 2010
Turn Table	Daeil EMC	DI-1500	N. C. R
Attenuator	Agilent	8495B	Apr. 01, 2010
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	Jan. 31, 2010

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## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD			
Section in FCC 15 Subpart C §15.209	Section in RSS-210, Issue 7 : 2007	Test Item	Result
15.209(a) 15.231(b)	RSS-210, Issue 7, Table 4	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
-	RSS-Gen, Issue 2, 4.6.1	Occupied Bandwidth	Complied

## 1.7 Test Report Revision

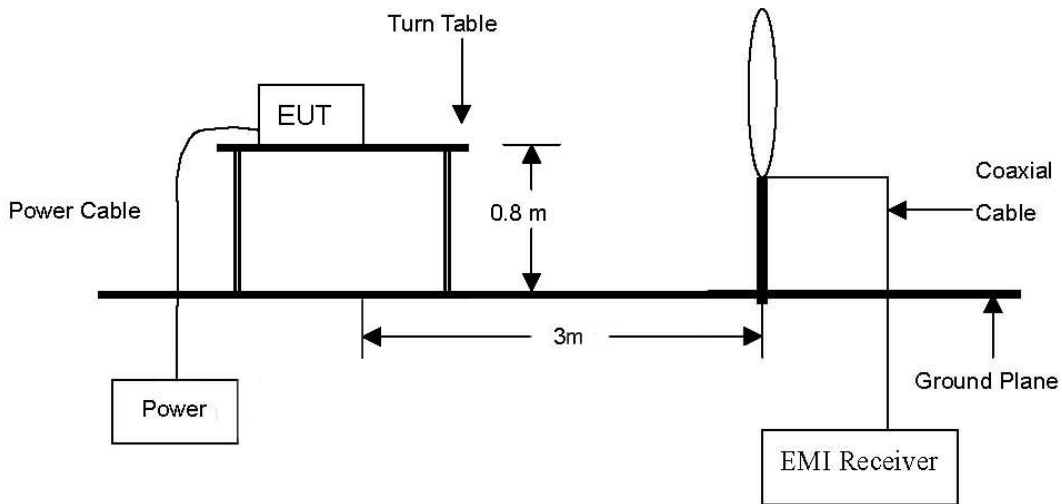
Revision	Report number	Description
0	F690501/RF-RTL003265	Initial

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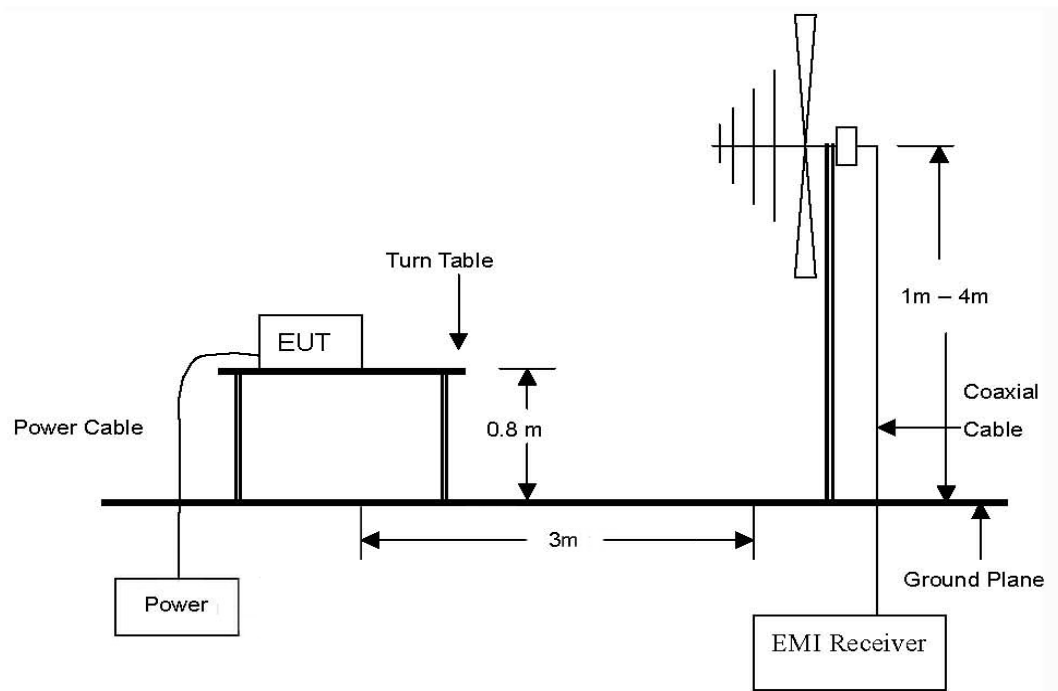
## 2. Field Strength of Fundamental

### 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.

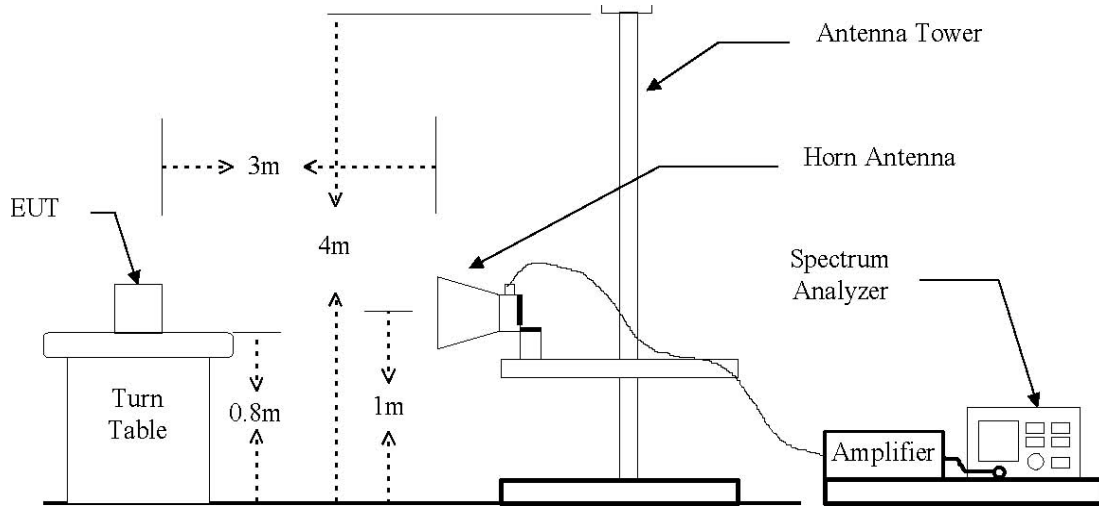


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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

### 2.2.2. Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

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 – 47.70	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 =  $41.6667(F)-7083.333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

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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 : 24°C

Relative humidity : 47 % R.H.

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

### - FL ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	51.41	Average	H	18.93	0.01	70.35	105.67	35.32

### - FR ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	49.48	Average	H	18.93	0.01	68.42	105.67	37.25

### - Bumper ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	58.73	Average	H	18.93	0.01	77.67	105.67	28.00

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**- Int ANT 1**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	55.21	Average	H	18.93	0.01	74.15	105.67	31.52

**- Int ANT 2**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	55.27	Average	H	18.93	0.01	74.21	105.67	31.46

**- Int ANT 3**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.125	55.10	Average	H	18.93	0.01	74.04	105.67	31.63

**Remark:**

To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

**Note:**

1. A Peak limit is 20 dB above the average limit.
2.  $3m \text{ Limit(dBuV/m)} = 20\log(2400/F_{(kHz)})+40\log(300/3)$   
 $= 20\log(2400/125)+40\log(300/3)$   
 $= 105.67$

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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 °C  
 Relative humidity : 47 % R.H.

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

#### - FLANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.17	Q.P.	H	18.95/0.01	-	49.13	68.42	19.29
Above 0.100	Not Detected	-	-	-	-	-	-	-

#### - FR ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.16	Q.P.	H	18.95/0.01	-	49.12	68.42	19.30
Above 0.100	Not Detected	-	-	-	-	-	-	-

#### - Bumper ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.17	Q.P.	H	18.95/0.01	-	49.13	68.42	19.29
Above 0.100	Not Detected	-	-	-	-	-	-	-

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**- Int ANT 1**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.19	Q.P.	H	18.95/0.01	-	49.15	68.42	19.27
Above 0.100	Not Detected	-	-	-	-	-	-	-

**- Int ANT 2**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.10	Q.P.	H	18.95/0.01	-	49.06	68.42	19.36
Above 0.100	Not Detected	-	-	-	-	-	-	-

**- Int ANT 3**

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.094	30.16	Q.P.	H	18.95/0.01	-	49.12	68.42	19.30
Above 0.100	Not Detected	-	-	-	-	-	-	-

**Remark:**

To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

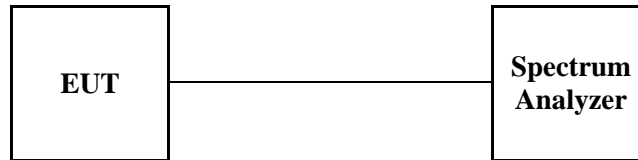
**Note:**

1. Other spurious Frequencies were not detected up to 1000 MHz
2. The limit is a lowest level of fundamental because level of any unwanted emissions shall not exceed the level of fundamental.

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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=1 kHz and Span=100 kHz.
3. The bandwidth of fundamental frequency was measured and recorded.

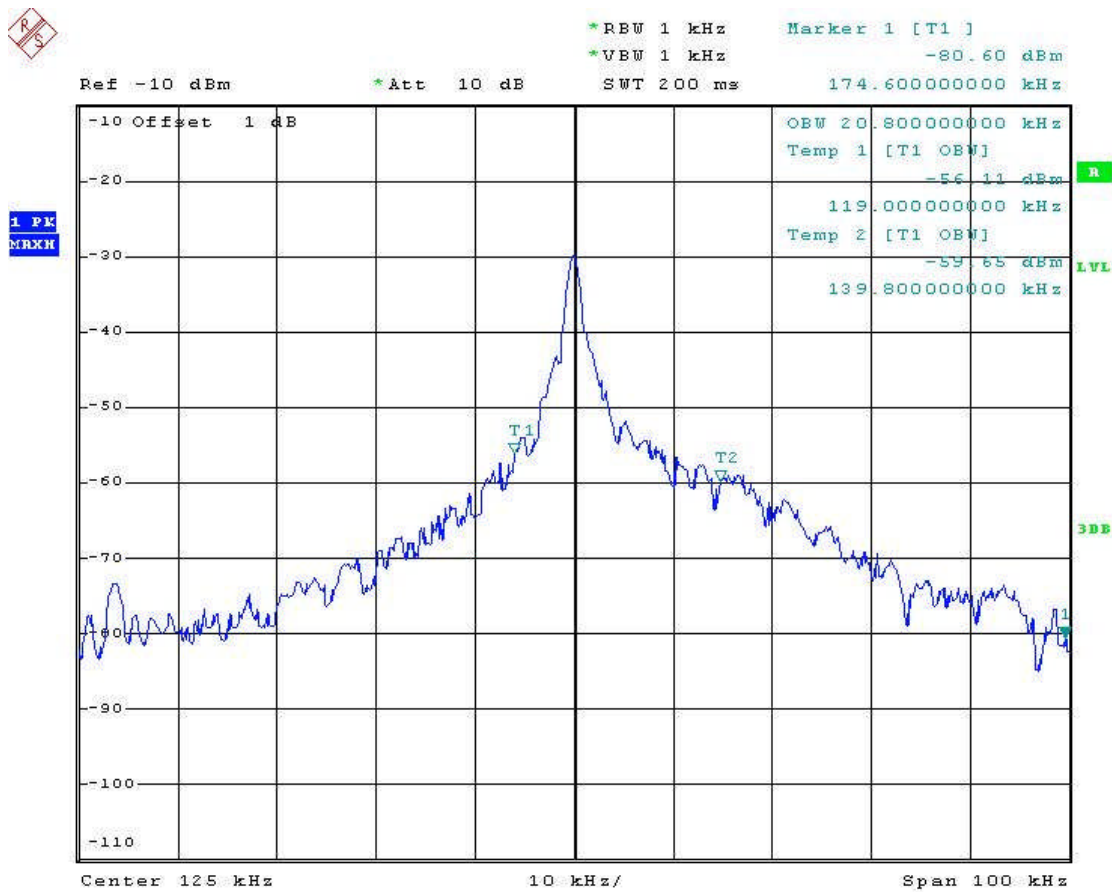
*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

### 4.4. Test Result

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

**- FLANT**

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	20.80	-	99 % Occupied bandwidth

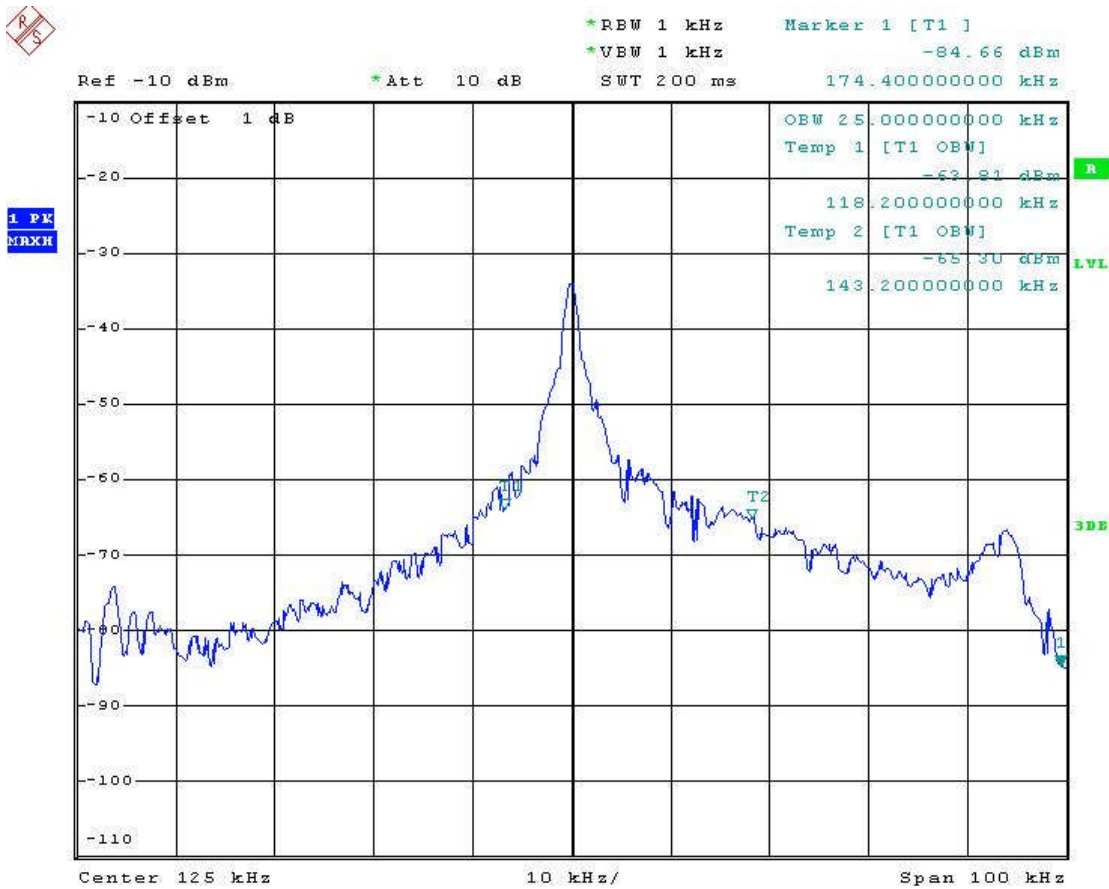


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- FR ANT

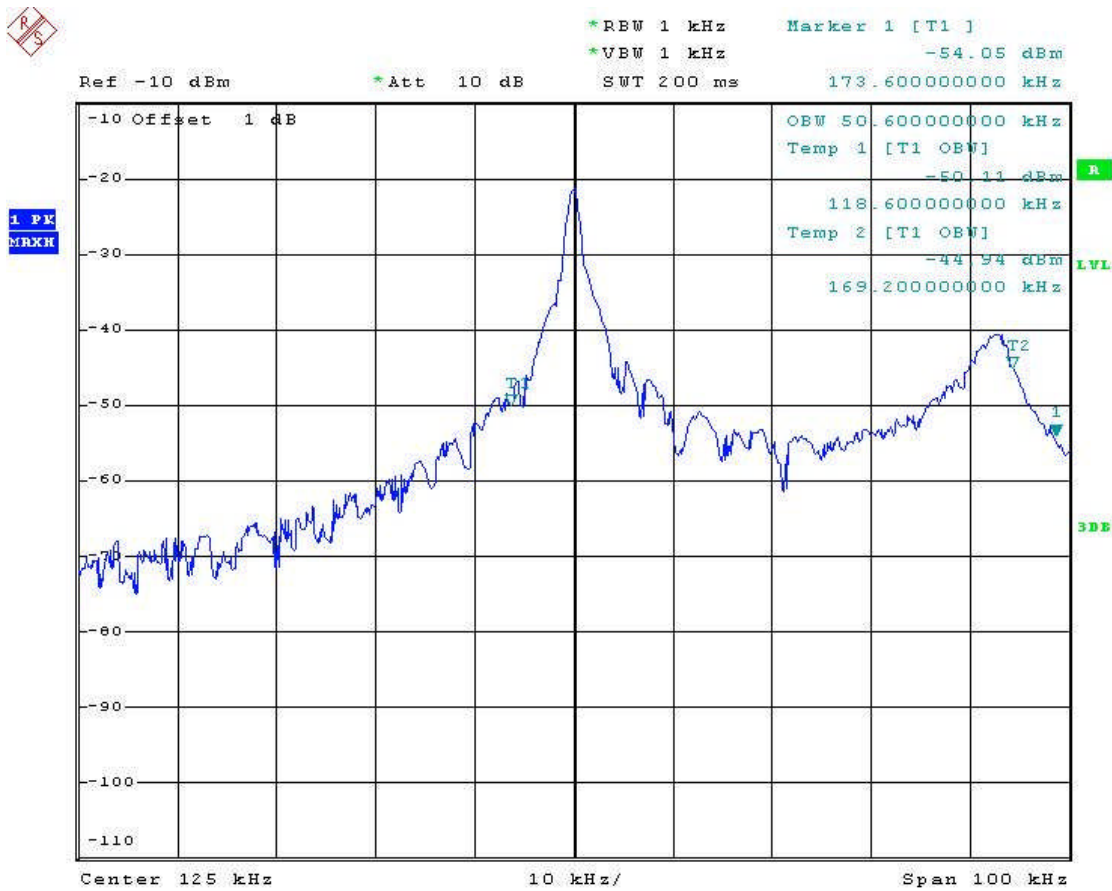
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	25.00	-	99 % Occupied bandwidth



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**- Bumper ANT**

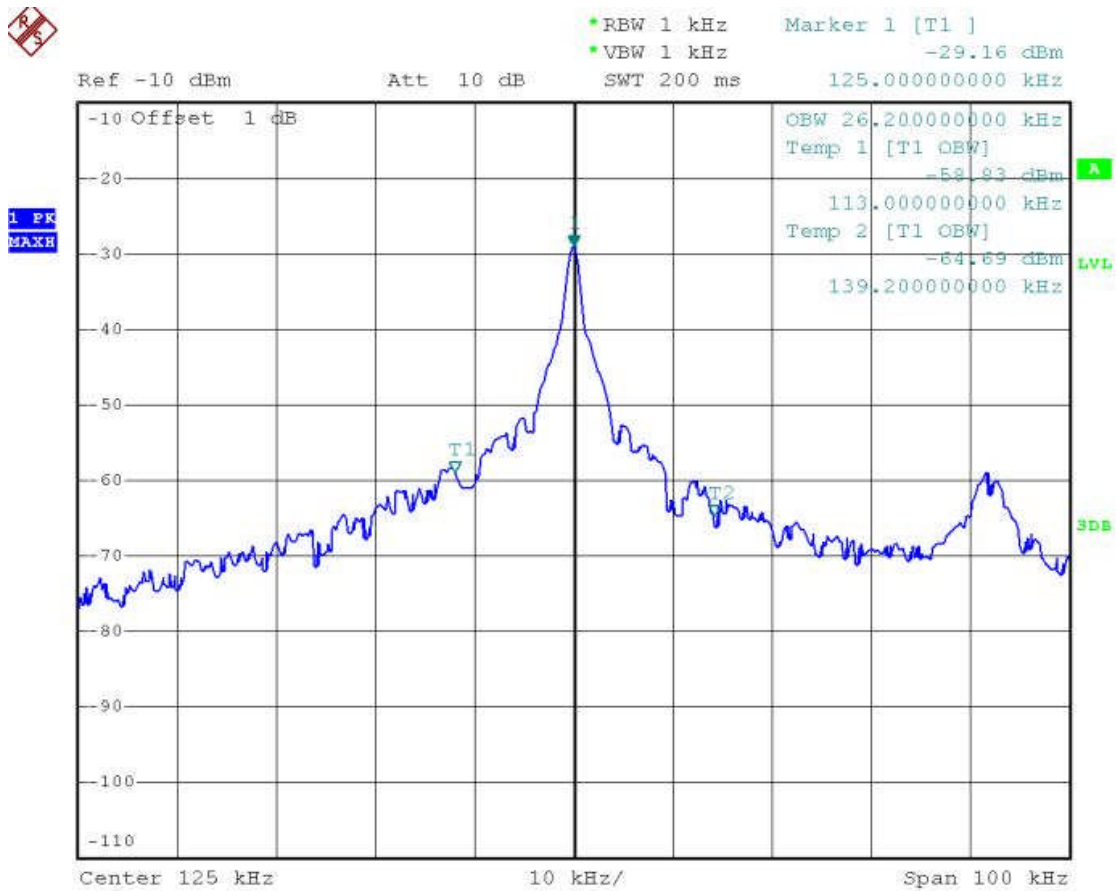
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	50.60	-	99 % Occupied bandwidth



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- Int ANT 1

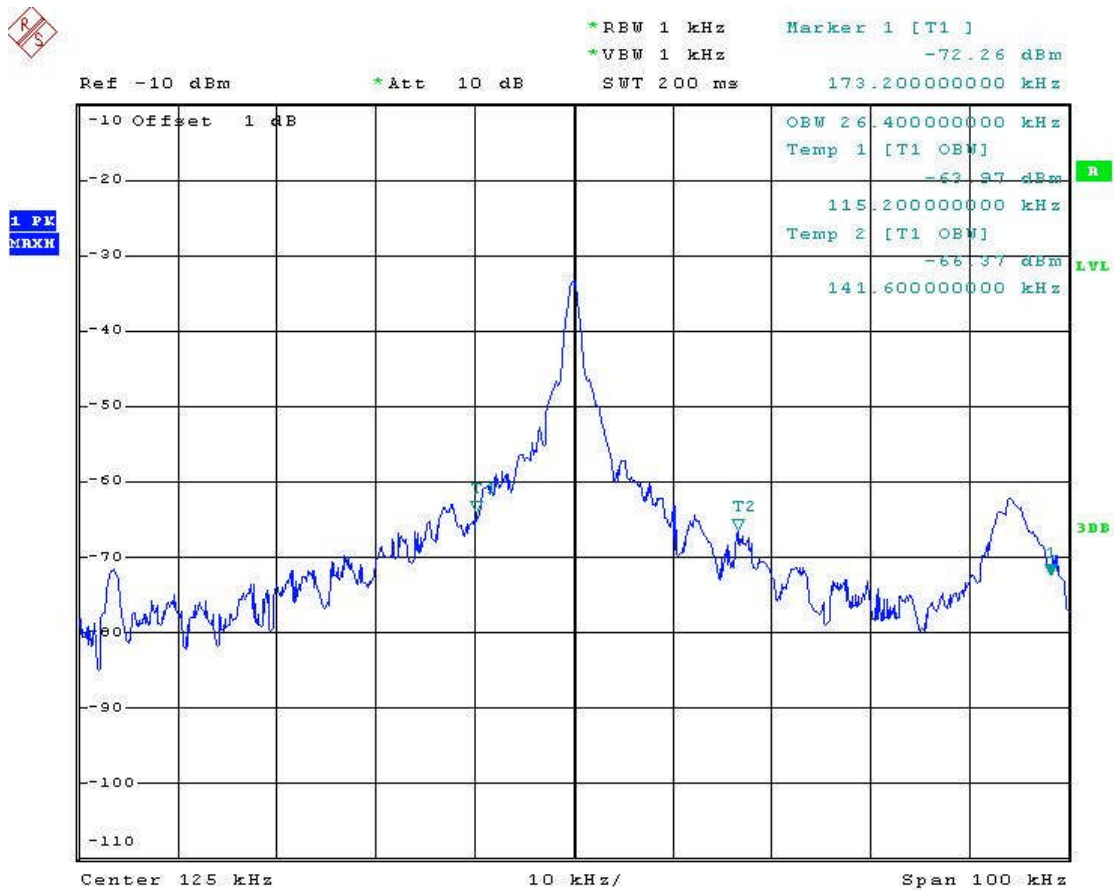
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	26.20	-	99 % Occupied bandwidth



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- Int ANT 2

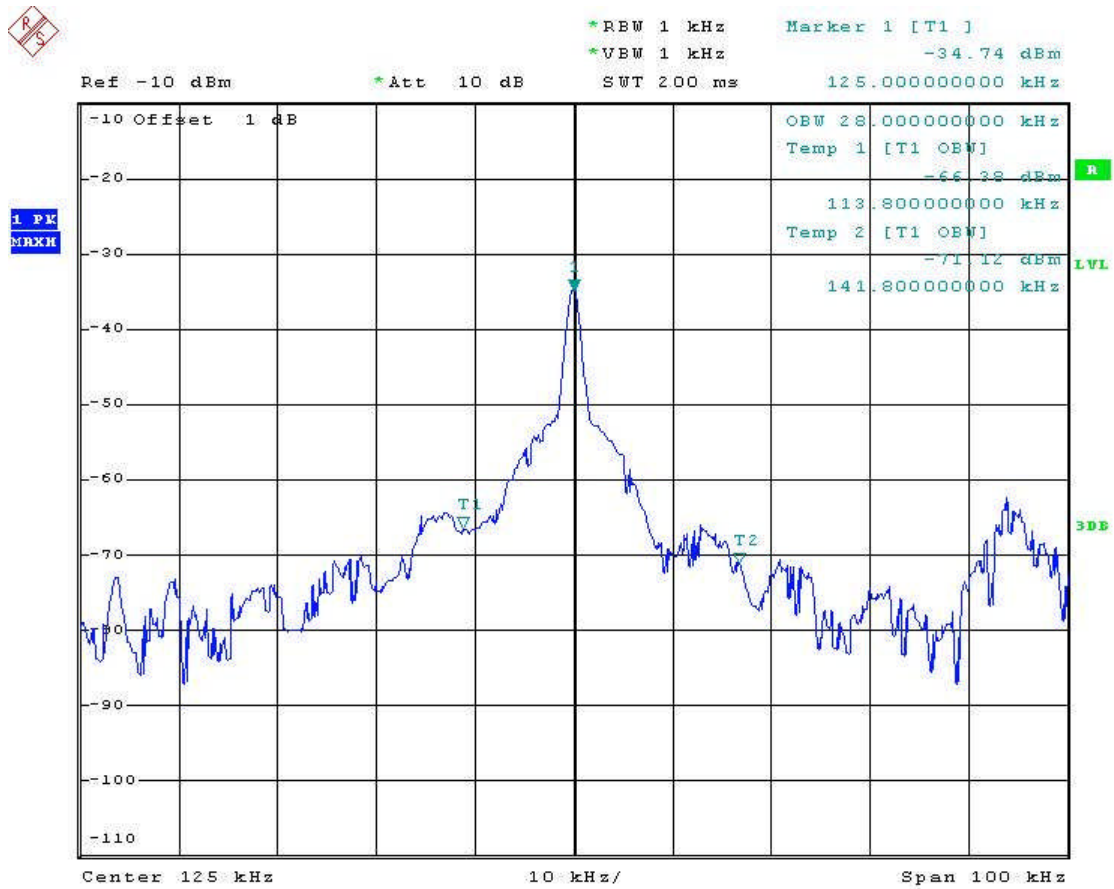
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	26.40	-	99 % Occupied bandwidth



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- Int ANT 3

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	28.00	-	99 % Occupied bandwidth



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***Test setup photos of EUT***

*Photo of Field Strength & Spurious Emission Test*

