

# TEST REPORT

OF

## FCC Part 15 Subpart C§15.209

FCC ID : SY5SMK

Equipment Under Test : Smart Key ECU  
Model Name : SMK  
Serial No. : N/A  
Applicant : Siemens Automotive Systems Corporation  
Manufacturer : Siemens Automotive Systems Corporation  
Date of Test(s) : 2006-10-11 ~ 2006-10-25  
Date of Issue : 2006-11-06

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



The above test certificate is the accredited test results by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

**Tested By:****Date****2006-11-06****Feel Jeong****Approved By****Date****2006-11-06****Albert Lim**

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## 1. General Information

### 1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.  
 Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-Si, Gyeonggi-do, Korea 435-040  
[www.sgstesting.co.kr](http://www.sgstesting.co.kr)  
 Telephone : +82 +31 428 5700  
 FAX : +82 +31 427 2371

### 1.2. Details of Applicant

Applicant : Siemens Automotive Systems Corporation  
 Address : 403-2, Saeum-dong, Ichon-city, Kyungki-do, Korea  
 Contact Person : Sung Min Jang  
 Phone No. : +82 +31 630 0864  
 Fax No. : +82 +31 630 0891

### 1.3. Description of EUT

<b>Kind of Product</b>	Smart Key ECU
<b>Model Name</b>	SMK
<b>Serial Number</b>	N/A
<b>Power Supply</b>	DC 12 V
<b>Frequency Range</b>	Tx: 125 kHz /Rx: 315 MHz
<b>Modulation Technique</b>	ASK(Tx) /FSK(Rx)
<b>Frequency Generation</b>	X-Tal
<b>Number of Channels</b>	1 CH(Tx)/1 CH(Rx)
<b>Operating Conditions</b>	-20 ~ + 60
<b>Antenna Type</b>	Fixed Type(Loop Coil Antenna)

### 1.4. Details of modification

-N/A

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**1.5. Test Equipment List**

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.	EQPT. USED
Spectrum Analyzer	Agilent	E4440A	May 2007	
Spectrum Analyzer	H.P	8565E	Nov. 2006	V
Loop Antenna	Rohde & Schwarz	HFH2-Z2	Sep. 2007	V
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Oct. 2007	V
Horn Antenna	Schwarzbeck	BBHA9120A	Jul. 2007	
Test Receiver	Rohde & Schwarz	ESHS10	Jun. 2007	
Test Receiver	Rohde & Schwarz	ESVS10	May 2007	
Test Receiver	Rohde & Schwarz	ESU26	Aug. 2007	V
Anechoic Chamber	SY Corporation	L W H 9.6 6.4 6.4	Jun. 2008	V

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## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15, Subpart C		
Standard Section	Test Item	Result
15.205(a) 15.209(a)	Band Edge, Radiated emission, Spurious Emission and Field Strength of Fundamental	Pass

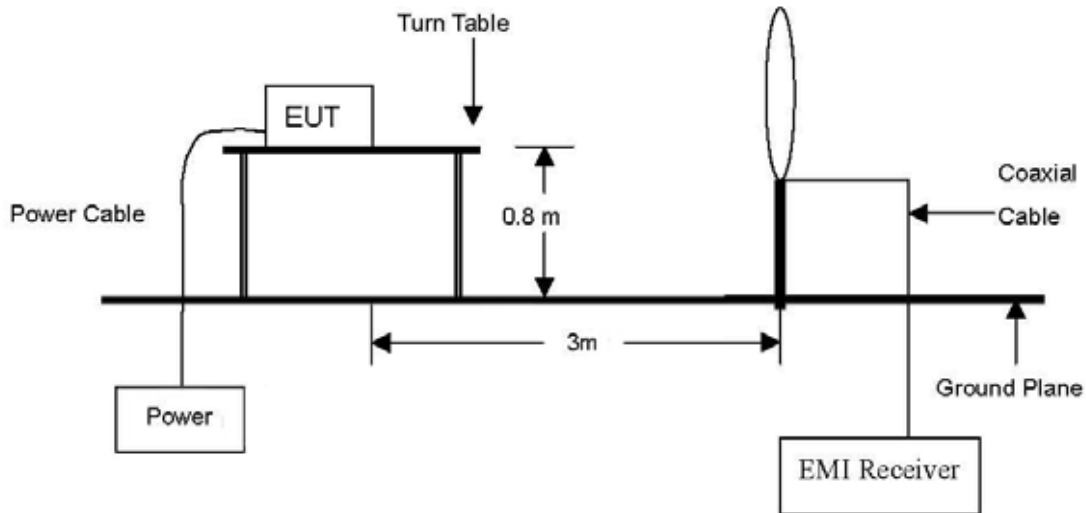
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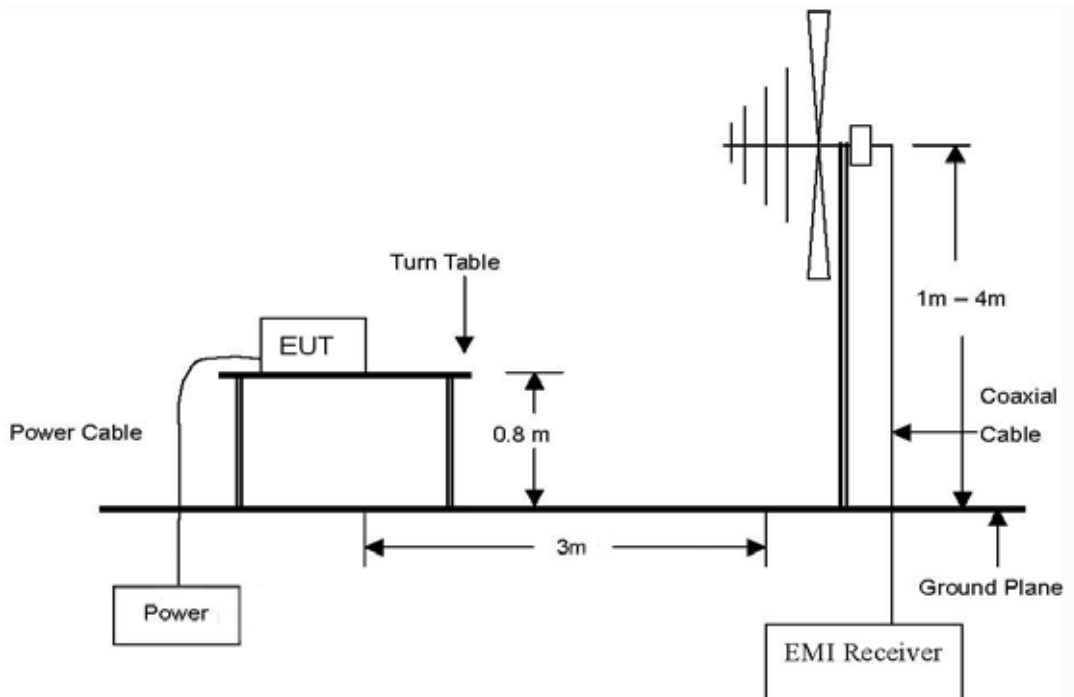
## 2. Field Strength of Fundamental

### 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.

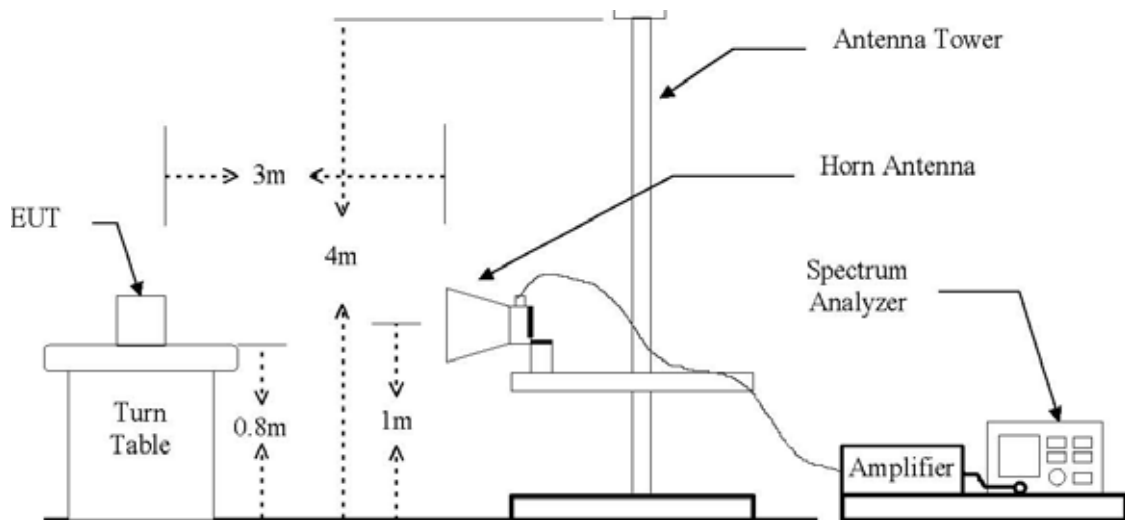


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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

### 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 Peak 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 1 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(Ant 1)**

Ambient temperature : 22 Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	58.2	Peak	H	20	0.01	78.21	106	27.79

**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. 3 meter Limit = 3 m Limit(dBuV/m) =  $20\log(2400/F_{(kHz)})+40\log(300/3)$   
 $= 25.67 + 80$   
 $= 106$

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## 2.5. Test Result(Ant 2)

Ambient temperature : 22      Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	60.9	Peak	H	20	0.01	80.91	106	25.09

**Remark:**

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

**Note:**

1. Same as Section Note 2.4 of this report

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**2.6. Test Result(Ant 3)**

Ambient temperature : 22 Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	60.2	Peak	H	20	0.01	80.21	106	25.79

**Remark:**

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

**Note:**

1. Same as Section Note 2.4 of this report

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**2.7. Test Result(Ant 4)**

Ambient temperature : 22 Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	60.6	Peak	H	20	0.01	80.61	106	25.39

**Remark:**

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

**Note:**

1. Same as Section Note 2.4 of this report

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**2.8. Test Result(Ant 5)**

Ambient temperature : 22 Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	51.9	Peak	H	20	0.01	71.91	106	34.09

**Remark:**

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

**Note:**

1. Same as Section Note 2.4 of this report

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## 2.9. Test Result(Ant 6)

Ambient temperature : 22 Relative humidity : 45 %

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

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
0.125	52	Peak	H	20	0.01	72.01	106	33.99

**Remark:**

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

**Note:**

1. Same as Section Note 2.4 of this report

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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 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 1 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(Ant 1)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	22.1	Peak	H	20/0.01	-	42.11	99.64	57.53
0.375	20.4	Peak	H	20/0.01	-	40.41	96.12	55.71
Above 0.500	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. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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### 3.5. Test Result(Ant 2)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	21.3	Peak	H	20/0.01	-	41.31	99.64	58.33
0.375	19.8	Peak	H	20/0.01	-	39.81	96.12	56.31
Above 0.500	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. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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### 3.6. Test Result(Ant 3)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	21.8	Peak	H	20/0.01	-	41.81	99.64	57.83
0.375	20.0	Peak	H	20/0.01	-	40.01	96.12	56.11
Above 0.500	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. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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### 3.7. Test Result(Ant 4)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	22.5	Peak	H	20/0.01	-	42.51	99.64	57.13
0.375	21.2	Peak	H	20/0.01	-	41.21	96.12	54.91
Above 0.500	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. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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### 3.8. Test Result(Ant 5)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	20.0	Peak	H	20/0.01	-	40.01	99.64	59.63
0.375	19.5	Peak	H	20/0.01	-	39.51	96.12	56.61
Above 0.500	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. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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### 3.9. Test Result(Ant 6)

Ambient temperature : 22 Relative humidity : 44 %

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

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)	AV Limit (dBuV/m)	Margin (dB)
0.250	19.8	Peak	H	20/0.01	-	39.81	99.64	59.83
0.375	20.4	Peak	H	20/0.01	-	40.41	96.12	55.71
Above 0.500	Not Detected							

**Remark:**

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

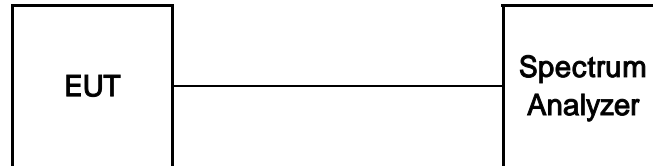
**Note:**

1. Same as Section Note 2.4 of this report
2. Other spurious frequencies were not detected up to 1000 MHz

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## 4. Bandwidth of Operation Frequency (Not Applicable)

### 4.1. Test Setup



### 4.2. Limit

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.

### 4.3. Test Procedure

Spectrum Analyzer setting:

RBW: 1 kHz

VBW: 1 kHz

Span: 500 kHz

Sweep Time: Auto

Detector Mode: Peak

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#### 4.4. Test Result

Ambient temperature : \_\_\_ Relative humidity : %

Carrier Frequency	Bandwidth of the emission (kHz)	Limit (kHz)	Remark
-	-	-	The point 20 dB down from the modulated carrier

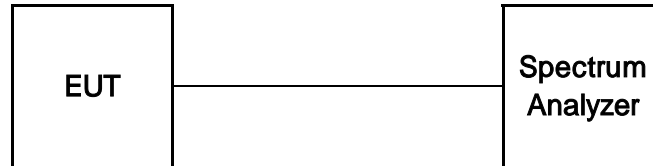
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## 5. Transmission Time (Not Applicable)

### 5.1. Test Setup



### 5.2. Limit

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

### 5.3. Test Procedure

Spectrum Analyzer setting:

RBW: 1 kHz

VBW: 1 kHz

Span: 0 Hz

Sweep Time: 5 sec

Detector Mode: Peak

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#### 5.4. Test Result

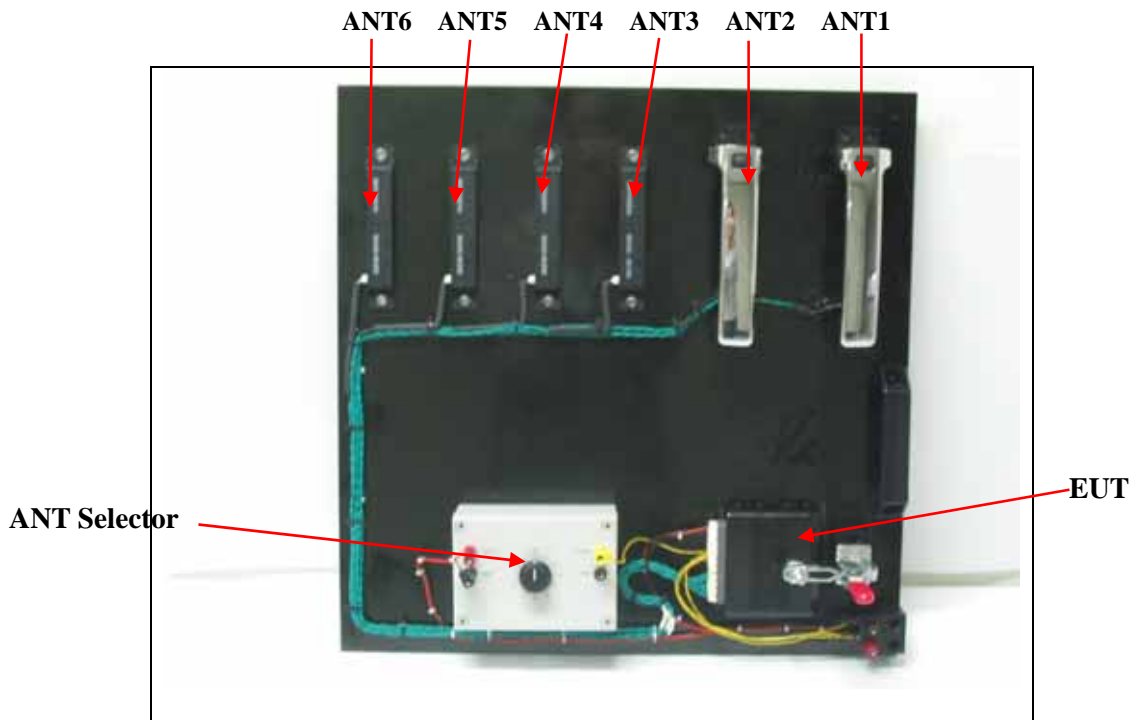
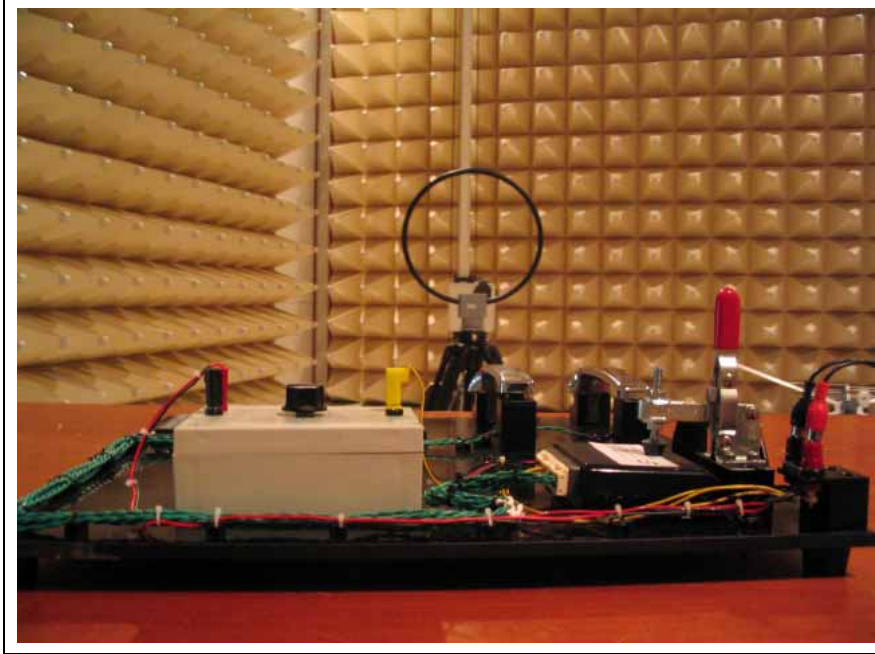
Ambient temperature : \_\_ Relative humidity : %

Carrier Frequency	Transmission Time (sec)	Limit (sec)	Remark
-	-	-	-

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**Appendix A. Photo of Field Strength & Spurious Emission Test**



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