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TEST REPORT

OF

FCC Part 15 Subpart B&C §15.209 / IC RSS-210 Issue 8, RSS-Gen Issue 3 FCC ID/IC Certification: CQOEN00040 / 1151E-EN00040

Equipment Under Test : Smart Key ECU

Model Name : EN00040

Serial No. : N/A

Applicant : DENSO PS Electronics Corp

Manufacturer : DENSO PS Electronics Corp

Date of Test(s) : 2012.04.17 ~ 2012.04.23

Date of Issue : 2012.06.20

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

Tested By: Of The 2012.06.20

Logan Lee

Approved By 2012.06.20

Feel Jeong

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

www.ee.sgs.com/korea

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

1.2. Details of Applicant

Applicant : DENSO PS Electronics Corp

Address : 853-11, Wae-dong, Chanwon-city, Kyungnam, Korea

Contact Person : Cho, Dong-Ki Phone No. : +82 31 349 9864 Fax No. : +82 31 349 5251

1.3. Description of EUT

Kind of Product	Smart Key ECU				
Model Name	EN00040				
Serial Number	N/A				
Power Supply	DC 12 V (Vehicle battery)				
Frequency Range	Tx: 134.2 址 Rx: 314.35 址 (RF Antenna)				
Modulation Technique	ASK				
Number of Channels	1				
Operating Conditions	-20℃ ~ 60℃				
Antenna Type	Internal type (Loop Coil ANT)				

1.4. Declarations by the manufacturer

- RF antenna is only Receiver antenna.
- The EUT of antennas cannot operate at the same time.



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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Spectrum Analyzer	R&S	FSL6	100768	Jul. 05, 2012	Annual	Jul. 05, 2013
Loop Antenna	R&S	HFH2-Z2	100118	Aug. 24, 2011	Biennial	Aug. 24, 2013
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Apr. 27, 2011	Biennial	Apr. 27, 2013
DC Power Supply	Agilent	U8002A	MY50070064	Mar. 29, 2012	Annual	Mar. 29, 2013
Test Receiver	R&S	ESU26	100109	Feb. 21, 2012	Annual	Feb. 21, 2013
Antenna Master	INN-CO	MM4000	N/A	N/A	N/A	N.C.R.
Turn Table	INN-CO	DS 1200 S	N/A	N/A	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N/A	N/A	N.C.R.

1.6. Test Report Revision

Revision	Report number	Description
0	F690501/RF-RTL005554	Initial
1	F690501/RF-RTL005554-1	Revised test setup and procedure of Section 4
2	F690501/RF-RTL005554-2	Add information of antennas operation

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STAN	APPLIED STANDARD: FCC Part 15 Subpart B&C 15.209/ IC RSS-210 Issue8, RSS-Gen Issue3											
Section in FCC 15 Subpart B&C §15.209	Section in IC RSS-210 Issue8, RSS-Gen Issue 3	Test Item	Result									
15.209(a)	RSS-210 Issue8, 2.5.1 RSS-Gen Issue3, 7.2.5 Table 6	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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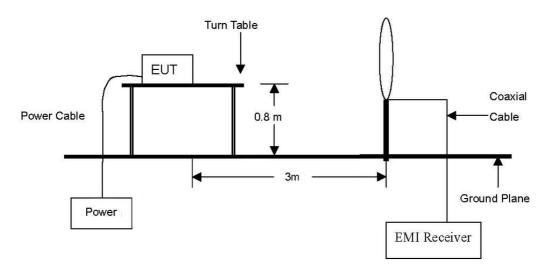


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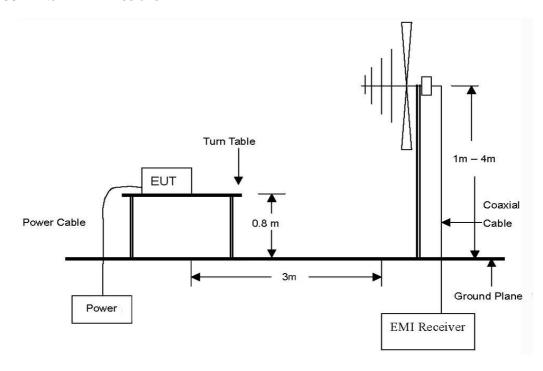
2. Field Strength of Fundamental

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 Mb to 1 Gb 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 (账)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 - 0.490	2400/F(kllz)	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 Mb, 76-88 Mb, 174-216 Mb or 470-806 Mb. 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 Mb to 1000 Mb

- 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 $\mbox{ }\mbox{ }\mbox{$
- 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.

- AST ANT

71017111									
Radiated Emissions			Ant	Corre Fact		То	tal	FCC	Limit
Frequency (썐)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dΒμV/m) at 3 m	Actual (dΒμV/m) at 300 m	Limit (dBµN/m)	Margin (dB)
0.134 2	56.30	Average	Н	18.17	0.01	74.48	-5.52	25.06	30.58

- BUM ANT

DOM 7 (141									
Radiated Emissions			Ant	Corre Fact		То	tal	FCC	Limit
Frequency (쌘)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dΒμV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBµN/m)	Margin (dB)
0.134 2	60.10	Average	Н	18.17	0.01	78.28	-1.72	25.06	26.78

- DRV ANT

Radiated Emissions			Ant		Correction Factors		Total		FCC Limit	
Frequency (岴)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBµV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBµN/m)	Margin (dB)	
0.134 2	56.10	Average	Н	18.17	0.01	74.28	-5.72	25.06	30.78	



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- INT ANT

Radia	Radiated Emissions			Corre Fact		То	tal	FCC	Limit
Frequency (飐)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBµN/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBµV/m)	Margin (dB)
0.134 2	63.40	Average	Н	18.17	0.01	81.58	1.58	25.06	23.48

- SSB ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (脏)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBµN/m)	Margin (dB)
0.134 2	40.60	Average	Н	18.17	0.01	58.78	-21.22	25.06	46.28

- TNK ANT

Radia	Radiated Emissions			Corre Fact		То	tal	FCC	Limit
Frequency (飐)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBµV/m) at 3 m	Actual (dBμV/m) at 300 m	Limit (dBµV/m)	Margin (dB)
0.134 2	59.70	Average	Н	18.17	0.01	77.88	-2.12	25.06	27.18

Note:

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



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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 km to 30 Mb

- 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 Mb to 1000 Mb

- 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 \pm 2) $^{\circ}$ C Relative humidity : 47 $^{\circ}$ R.H.

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

- AST ANT

Radiat	Radiated Emissions		Ant	Correction Factors	lotal		FCC Limit	
Frequency (贴)	Reading (dBµV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµN/m) at 3 m	Actual (dBµV/m) at 300 m or 30 m	Limit (dBµV/m)	Margin (dB)
0.402	16.40	Average	Н	18.00/0.01	34.41	-45.59	15.50	61.09
Above 0.500	Not detected	-	-	-	-	-	-	-

- BUM ANT

- DOM ANT								
Radiated Emissions		Ant	Correction Factors	Total		FCC Limit		
Frequency (脏)	Reading (dBµV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµV/m) at 3 m	Actual (dBµV/m) at 300 m or 30 m	Limit (dBµN/m)	Margin (dB)
0.403	20.20	Average	Н	18.00/0.01	38.21	-41.79	15.50	57.29
Above 0.500	Not detected	-	-	-	-	-	-	-

- DRV ANT

Radiat	Radiated Emissions A		Ant Correction Factors		Total		FCC Limit	
Frequency (贴)	Reading (dBµV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµN/m) at 3 m	Actual (dΒμ//m) at 300 m or 30 m	Limit (dBµN/m)	Margin (dB)
0.403	16.70	Average	Н	18.00/0.01	34.71	-45.29	15.50	60.79
Above 0.500	Not detected	-	-	-	-	-	-	-



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- INT ANT

Radiated Emissions		Ant	Correction Factors	Total		FCC Limit		
Frequency (脏)	Reading (dBμV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµV/m) at 3 m	Actual (dΒμ//m) at 300 m or 30 m	Limit (dBµV/m)	Margin (dB)
0.403	14.10	Average	Н	18.00/0.01	32.11	-47.89	15.50	63.39
Above 0.500	Not detected	-	-	-	-	-	-	-

- RF ANT

Radiat	Radiated Emissions		Ant	Correction Factors	Total		FCC Limit	
Frequency (쌘)	Reading (dBμV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµV/m) at 3 m	Actual (dBµV/m) at 300 m or 30 m	Limit (dBµN/m)	Margin (dB)
0.403	9.00	Average	Н	18.00/0.01	27.01	-52.99	15.50	68.49
Above 0.500	Not detected	-	-	-	-	-	-	-

- TNK ANT

Radiated Emissions		Ant	Correction Factors	Total		FCC Limit		
Frequency (썐)	Reading (dBμV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dBµV/m) at 3 m	Actual (dBµV/m) at 300 m or 30 m	Limit (dBµV/m)	Margin (dB)
0.403	19.30	Average	Н	18.00/0.01	37.31	-42.69	15.50	58.19
Above 0.500	Not detected	-	ı	-	-	-	-	-

Note:

- 1. 300 m Result($dB\mu V/m$) = 3 m Result($dB\mu V/m$) 40log(300/3) ($dB\mu V/m$)
- 2. 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 Occupied Bandwidth is measured with a spectrum analyzer connected via a receiving antenna placed near the EUT.
- 1. 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.
- 2. The bandwidth of fundamental frequency was measured and recorded.



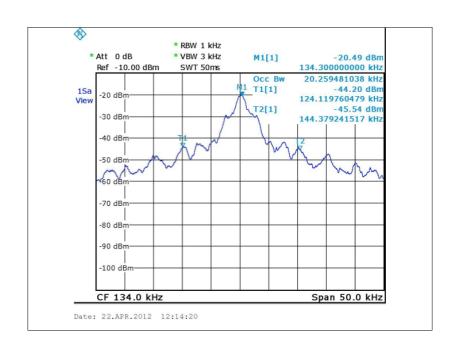
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4.4. Test Result

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

- AST ANT

Carrier Frequency	Occupied	Limit	Remark
(脈)	Bandwidth (쌦)	(klb)	
0.134 2	20.26	-	99 % Occupied bandwidth

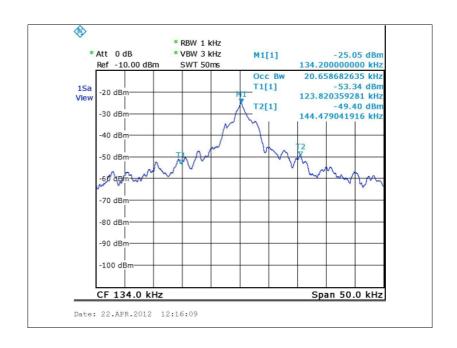




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- BUM ANT

Carrier Frequency (脈)	Occupied Bandwidth (朏)	Limit (紀)	Remark
0.134 2	20.66	-	99 % Occupied bandwidth

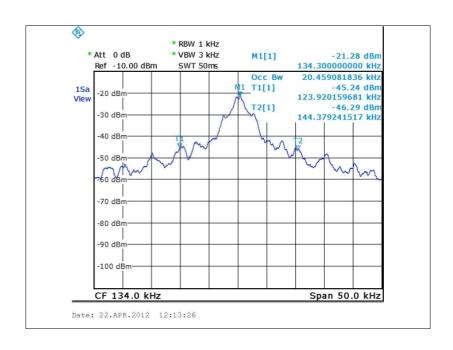




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- DRV ANT

Carrier Frequency (Mb)	Occupied Bandwidth (妣)	Limit (klb)	Remark
0.134 2	20.46	-	99 % Occupied bandwidth

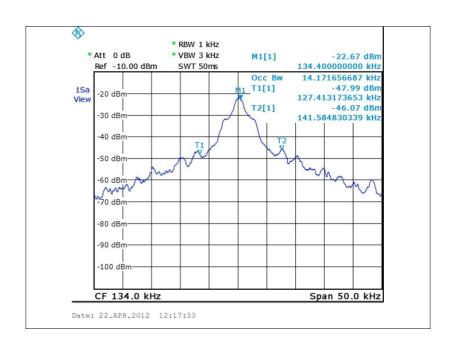




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- INT ANT

Carrier Frequency	Occupied	Limit	Remark
(쌘)	Bandwidth (쌦)	(㎞)	
0.134 2	14.17	-	99 % Occupied bandwidth

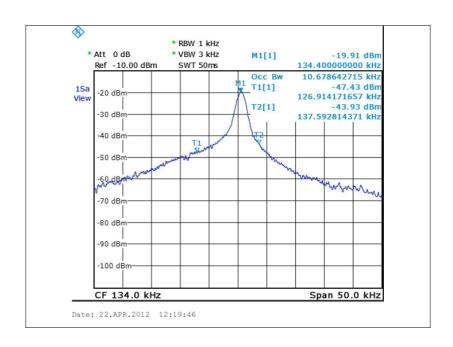




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- SSB ANT

Carrier Frequency (Mb)	Occupied Bandwidth (畑)	Limit (紀)	Remark
0.134 2	10.68	-	99 % Occupied bandwidth

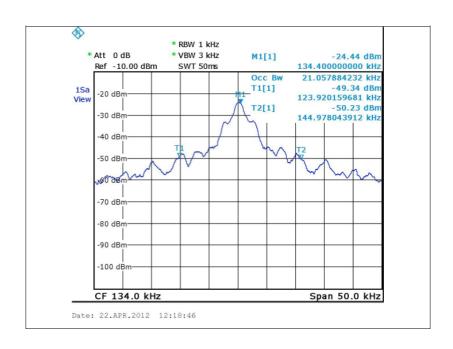




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- TNK ANT

Carrier Frequency	Occupied	Limit	Remark
(脈)	Bandwidth (朏)	(klb)	
0.134 2	21.06	-	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 (썐)	Distance (Meters)	Radiated (dB <i>W</i> /m)	Radiated (ﷺ)	
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 Mb to 1000 Mb

- 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 $\mbox{ }\mbox{ }\mbox{$
- 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 $^{\circ}$ C Relative humidity : 47 $^{\circ}$ R.H.

5.4.1. Spurious Radiated Emission

The frequency spectrum from 30 Mb to 1 Gb was investigated. Emission levels are not reported much lower than the limits by over 30 dB. All reading values are peak values.

RF ANT (It has RX function)

Radiated Emissions		Ant	Correction Factors		Total	FCC Limit		
Frequency (飐)	Reading (dB,W)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB/W/m)	Limit (dB/W/m)	Margin (dB)
Above 30.000	Not detected	-	-	-	-	-	-	-

Remark:

1. Actual = Reading + AF + AMP + CL