

TEST REPORT

OF

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

FCC ID / IC Certification : SY5SMK25/8325A-SMK25

Equipment Under Test : Smart Key ECU

Model Name : SMK 2.5

Serial No. : N/A

Applicant : Continental Automotive Systems Corporation

Manufacturer : Continental Automotive Systems Corporation

Date of Test(s) : 2010. 3. 18 ~ 2010. 3. 26

Date of Issue : 2010. 5. 07

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

Tested By:



Grant Lee

Date

2010. 5. 07

Approved By



Charles Kim

Date

2010. 5. 07

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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-----	16
5. Receiver Radiated Spurious Emission-----	24

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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.ccom
 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

Kind of Product	Smart Key ECU
Model Name	SMK 2.5
Serial Number	N/A
Power Supply	DC 12 V
Frequency Range	Tx : 125 kHz, Rx : 125 kHz (Only IMMO ANT)
Modulation Technique	ASK
Number of Channels	1
Operating Conditions	-20 °C ~ 60 °C
Antenna Type	Fixed Type (Loop Antenna)

1.4. Declarations by the manufacturer

- Each antenna does not transmit at the same time and has individual transmission.

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1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSP40	Sep. 25, 2010
Test Receiver	Rohde & Schwarz	ESU26	Jun. 03, 2010
Loop Antenna	Rohde & Schwarz	HFH2-Z2	Aug. 31, 2011
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jul. 22, 2010
Turn Table	Daeil EMC	DI-1500	N. C. R
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	Jan. 27, 2011

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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)	RSS-210, Issue7, Table 3	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
-	RSS-Gen, Issue2, 4.6.1	Occupied Bandwidth	Complied
15.109(a)	RSS-Gen, Issue2, 6	Receiver Radiated Spurious Emission	Complied

1.7 Test Report Revision

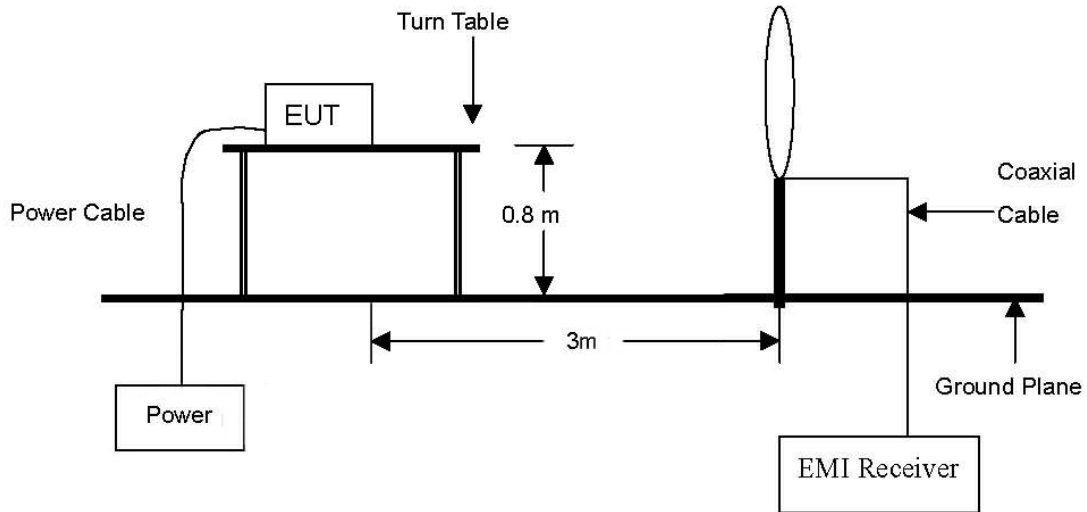
Revision	Report number	Description
0	F690501/RF-RTL003677	Initial
1	F690501/RF-RTL003677-1	Updated worst case limit

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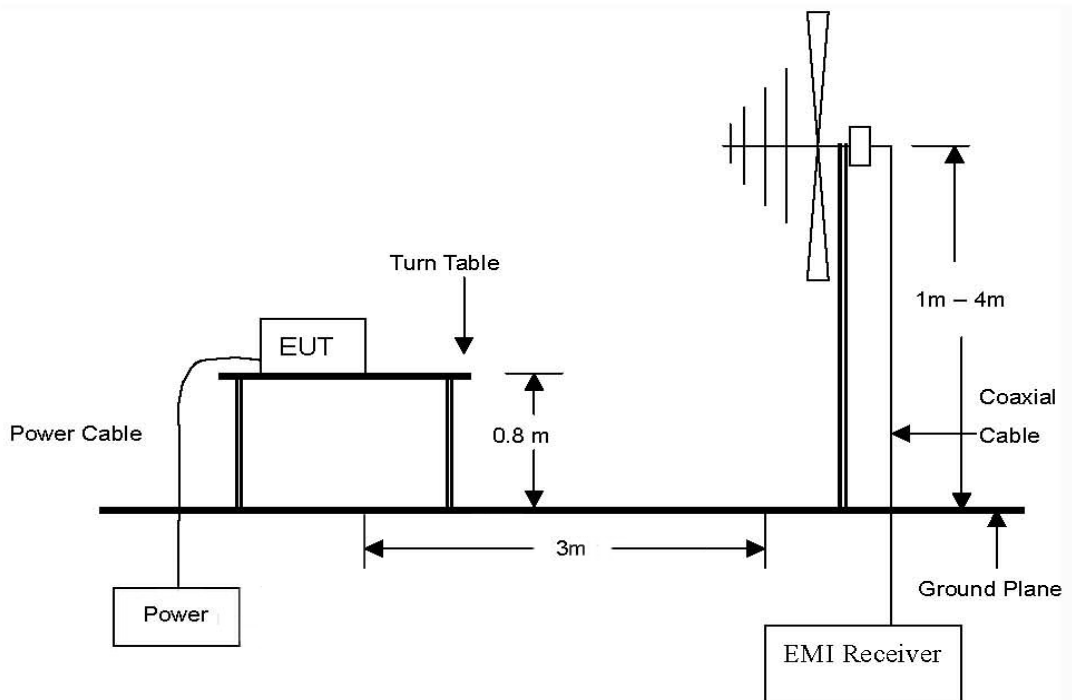
2. Field Strength of Fundamental

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.

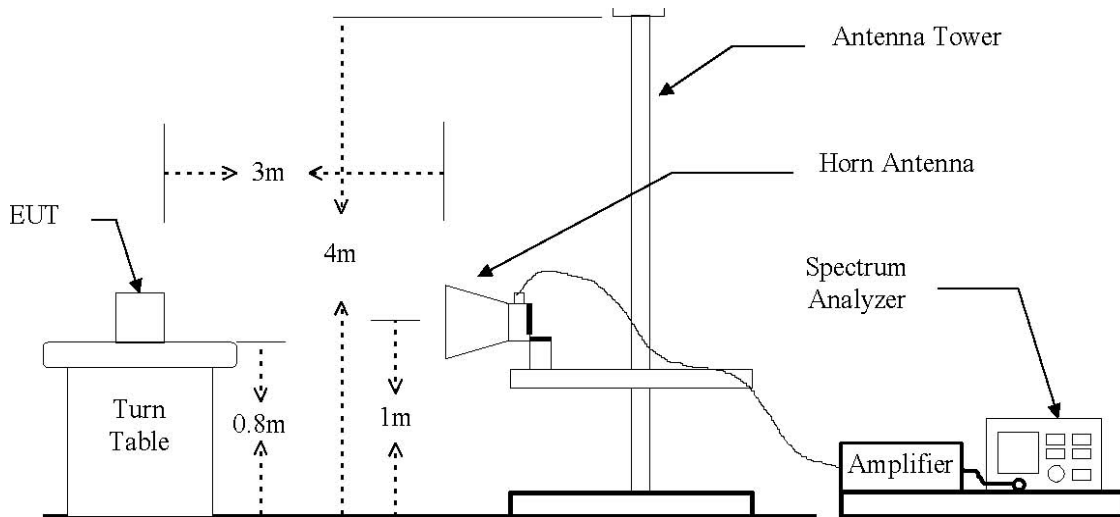


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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

- 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	65.74	Average	H	18.93	0.01	84.68	105.67	20.99

- 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	66.10	Average	H	18.93	0.01	85.04	105.67	20.63

- 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	66.19	Average	H	18.93	0.01	88.13	105.67	17.54

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- 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	68.27	Average	H	18.93	0.01	87.21	105.67	18.46

- AST 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	65.66	Average	H	18.93	0.01	84.60	105.67	21.07

- DRV 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	65.62	Average	H	18.93	0.01	84.56	105.67	21.11

- IMMO 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	40.13	Average	H	18.93	0.01	59.07	105.67	46.60

Remark:

To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes. The worst case of three types was XY plane effected a maximum emission during the test.

Note:

- 1 A Peak limit is 20 dB above the average limit.
- 2 3m 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 : (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.

- 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)
0.374	13.70	Q.P.	H	18.93/0.01	-	32.64	105.67	26.43
Above 0.400	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)
0.374	13.69	Q.P.	H	18.93/0.01	-	32.63	105.67	26.44
Above 0.400	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)
0.374	13.75	Q.P.	H	18.93/0.01	-	32.69	105.67	26.38
Above 0.400	Not detected	-	-	-	-	-	-	-

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- 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)
0.374	13.77	Q.P.	H	18.93/0.01	-	32.71	105.67	26.36
Above 0.400	Not detected	-	-	-	-	-	-	-

- AST 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)
0.374	13.86	Q.P.	H	18.93/0.01	-	32.80	105.67	26.27
Above 0.400	Not detected	-	-	-	-	-	-	-

- DRV 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)
0.374	13.72	Q.P.	H	18.93/0.01	-	32.66	105.67	26.41
Above 0.400	Not detected	-	-	-	-	-	-	-

- IMMO 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)
0.374	38.78	Q.P.	H	18.93/0.01	-	57.72	105.67	1.35
Above 0.400	Not detected	-	-	-	-	-	-	-

Remark:

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

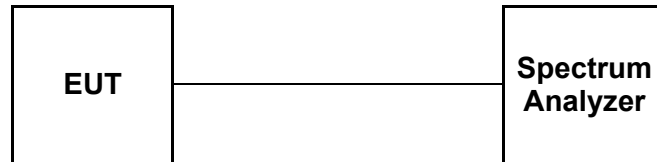
Note:

1. Other spurious Frequencies were not detected up to 1000 MHz

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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.

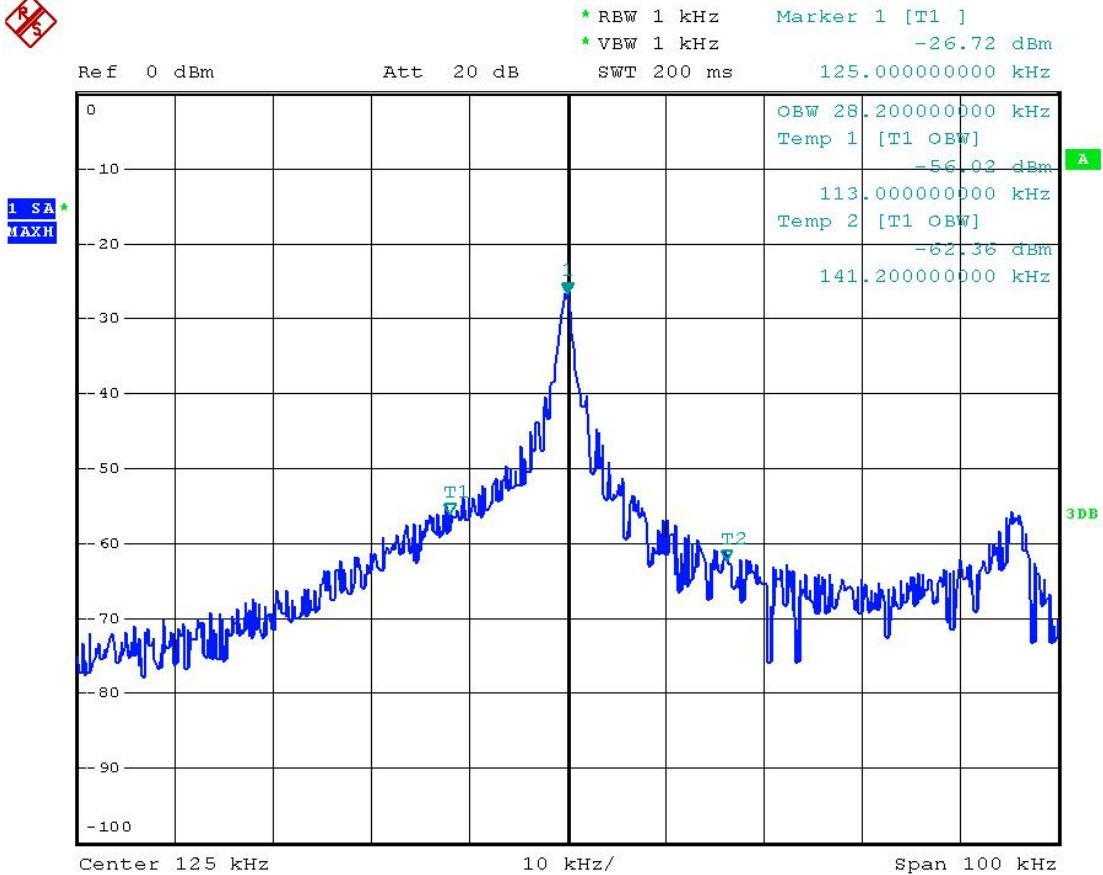
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4.4. Test Result

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

- Int ANT 1

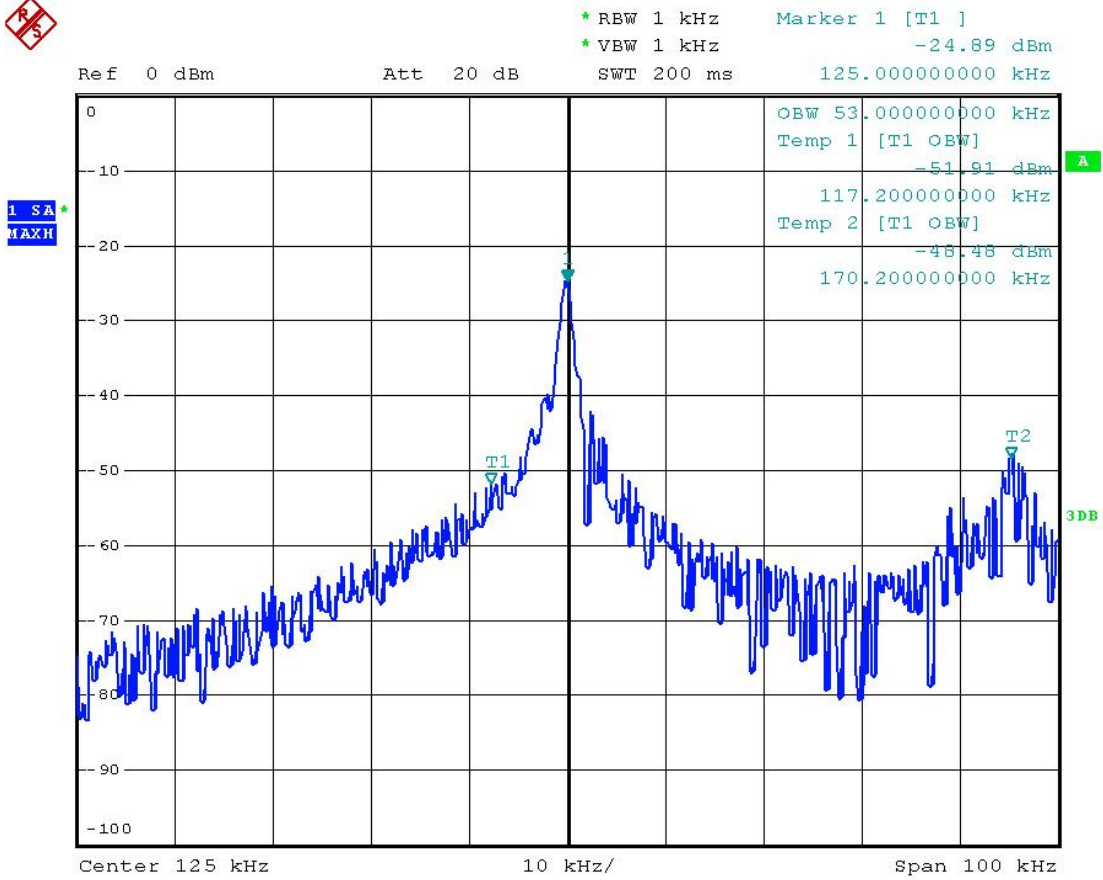
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	28.20	-	99 % Occupied bandwidth



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- Int ANT 2

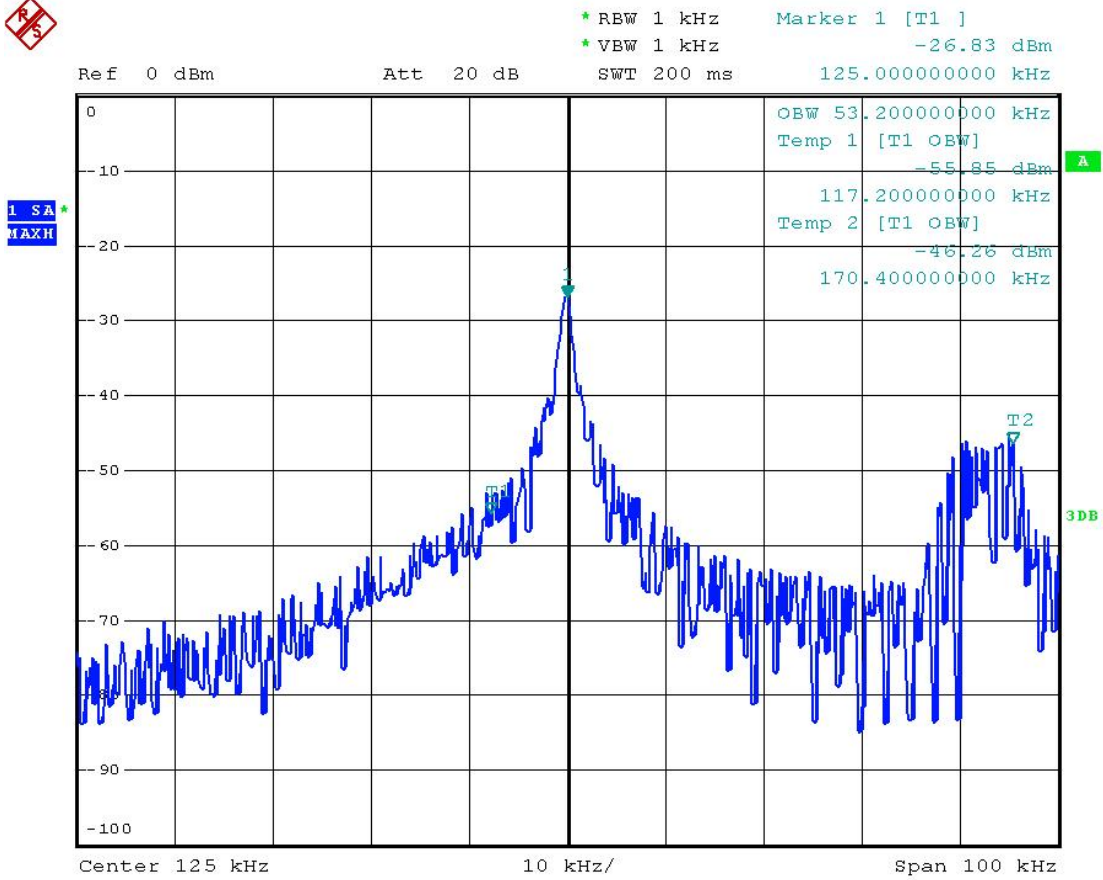
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	53.00	-	99 % Occupied bandwidth



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- Int ANT 3

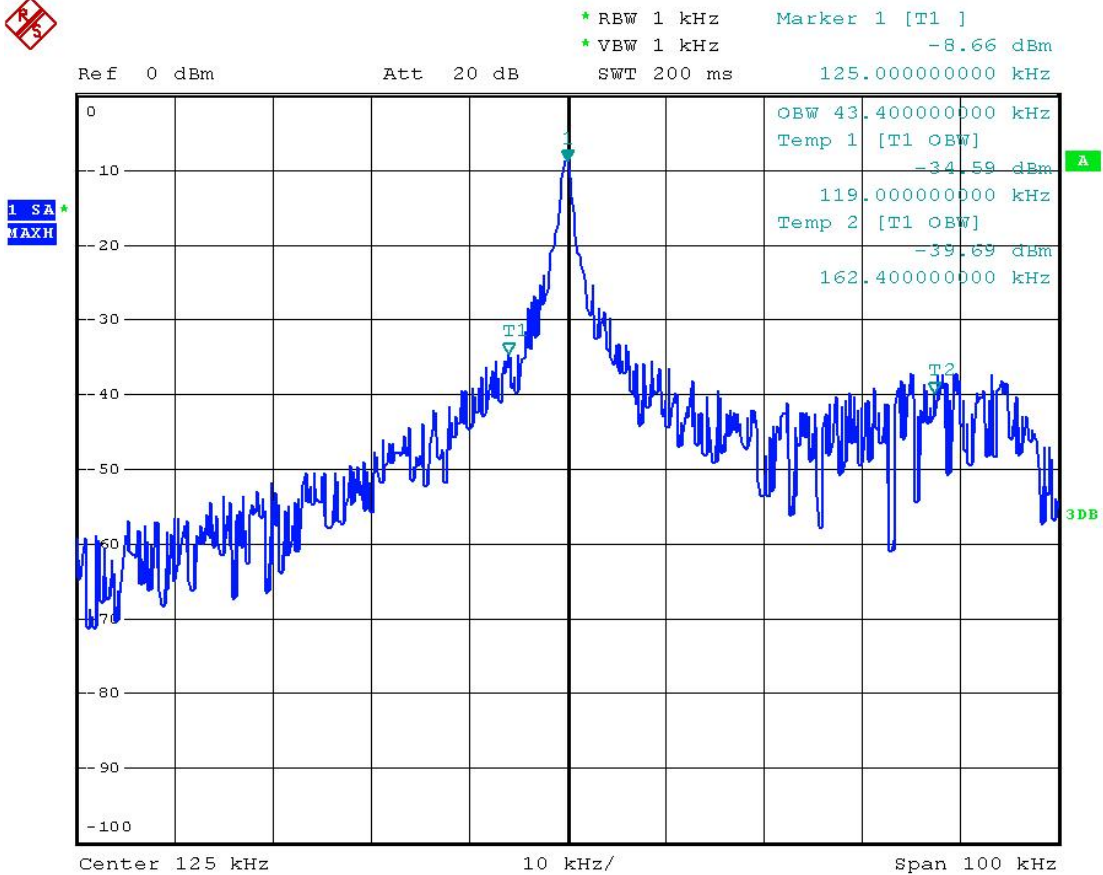
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	53.20	-	99 % Occupied bandwidth



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- Bumper ANT

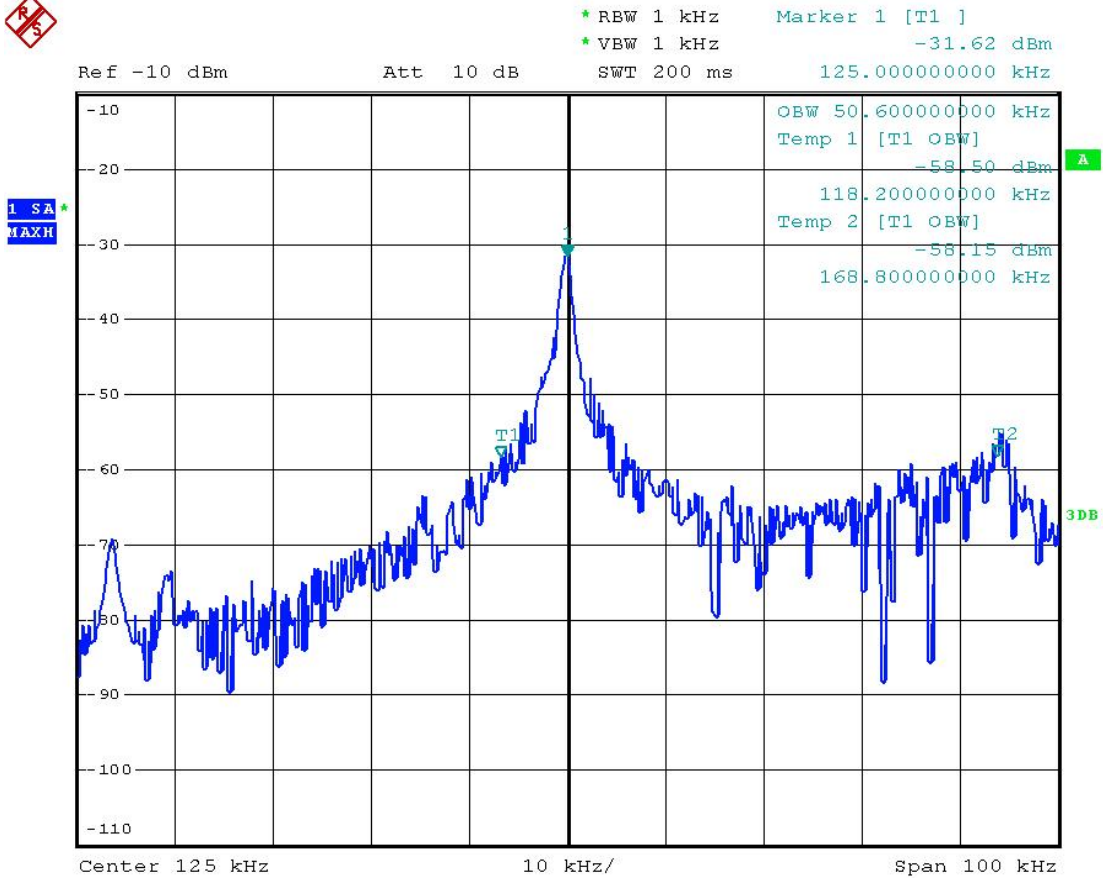
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	43.40	-	99 % Occupied bandwidth



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- AST ANT

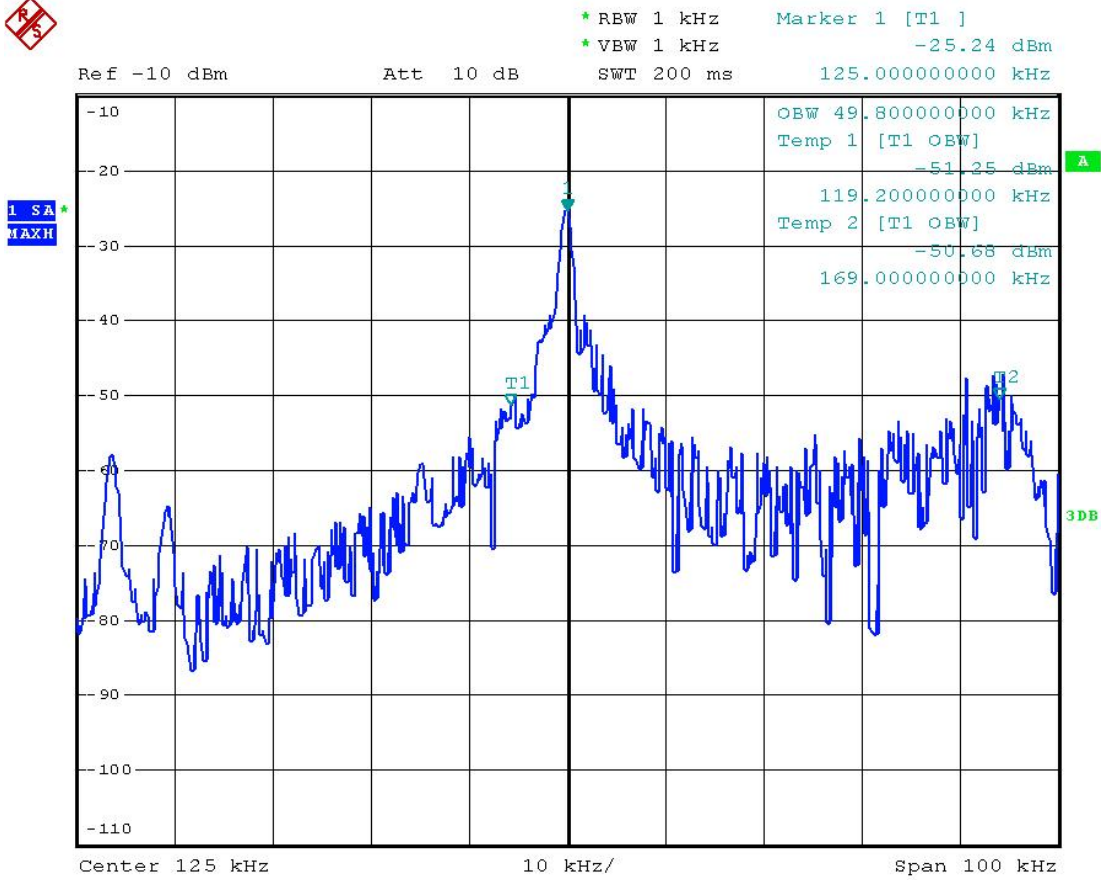
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	50.60	-	99 % Occupied bandwidth



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- DRV ANT

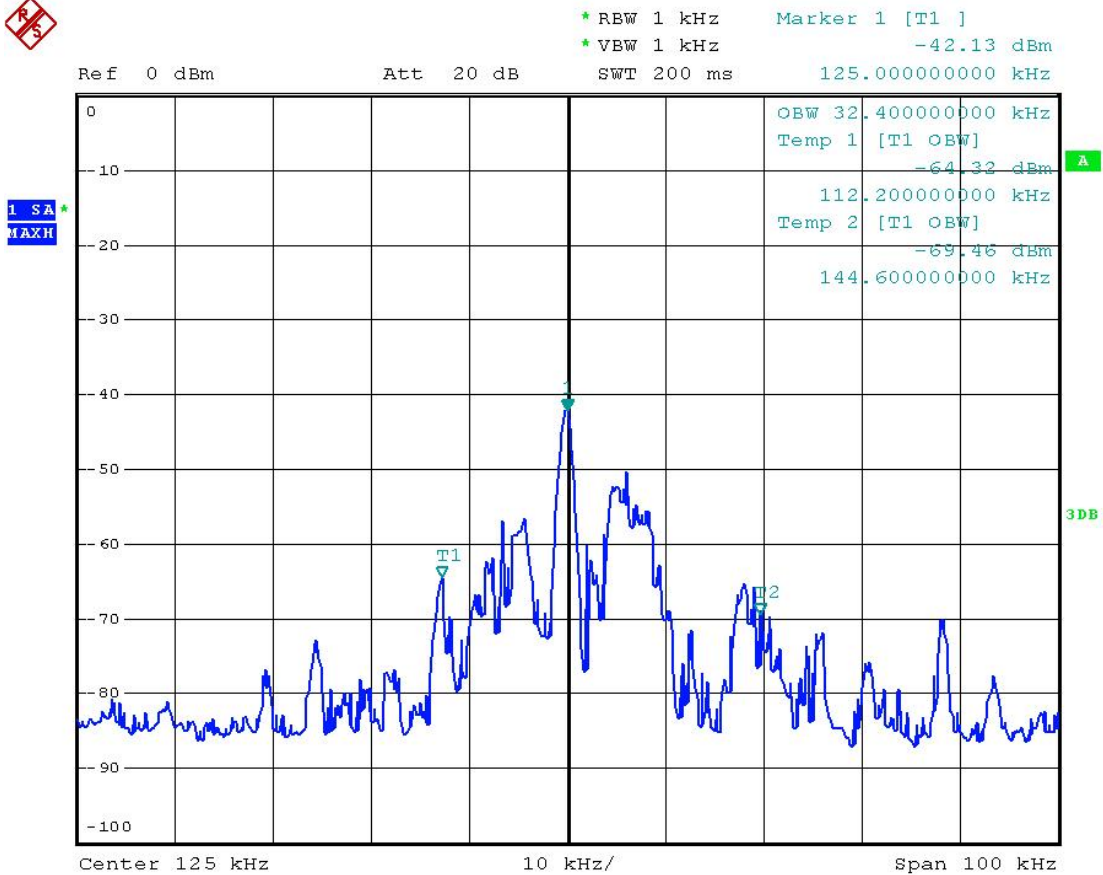
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	49.80	-	99 % Occupied bandwidth



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- IMMO ANT

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.125	32.40	-	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 μ V/m)	Radiated (μ 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)
408.02	40.50	Peak	H	15.81	-26.19	30.12	46.00	15.88
424.02	40.70	Peak	H	16.11	-26.30	30.51	46.00	15.49
974.30	32.60	Peak	H	22.64	-24.87	30.37	54.00	23.63
995.80	32.20	Peak	H	22.82	-24.78	30.24	54.00	23.76
Above 1000.000	Not detected	-	-	-	-	-	-	-

Remark:

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

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