

TEST REPORT

OF

FCC Part 15 Subpart B&C §15.209 / IC RSS-210 Issue 8, RSS-Gen Issue 3
FCC ID/IC Certification: CQOED00250 / 1551E-ED00250

Equipment Under Test : Smart Key ECU
Model Name : ED00250
Applicant : DENSO KOREA ELECTRONICS CORPORATION
Manufacturer : DENSO KOREA ELECTRONICS CORPORATION
Date of Test(s) : 2013.12.30 ~ 2014.01.21
Date of Issue : 2014.02.13

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

Tested By:


Patrick Kang

Date:

2014.02.13

Approved By


Logan Lee

Date:

2014.02.13

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 3FL, 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-040

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 428 5700

FAX : +82 31 427 2370

1.2. Details of Applicant

Applicant : KOREA ELECTRONICS CORPORATION

Address : (Oe-dong) 631, Nammyeon-ro, Sungsan-Gu, Chang-won-si, Gyeongsangnam-do, Korea

Contact Person : Cho, Dong-Ki

Phone No. : +82 31 340 1938

1.3. Description of EUT

Kind of Product	Smart Key ECU
Model Name	ED00250
Power Supply	DC 12 V (Vehicle battery)
Frequency Range	Tx: 134.20 kHz (LF Antenna) Rx: 433.92 MHz (RF Antenna)
Modulation Technique	ASK
Number of Channels	1
Operating Conditions	-30°C ~ 80°C
Antenna Type	Internal type (Loop Coil Antenna)

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	FSV30	101004	Jul. 20, 2013	Annual	Jul. 20, 2014
Signal Generator	R&S	SMR40	100540	Jan. 08, 2014	Annual	Jan. 08, 2015
Loop Antenna	R&S	FMZB 1519	1519-039	Jul. 09, 2013	Biennial	Jul. 09, 2015
Bilog Antenna	SCHWARZBECK	VULB9163	9163-437	Oct. 04, 2012	Biennial	Oct. 04, 2014
DC Power Supply	Agilent	U8002A	MY48490027	Jan. 03, 2014	Annual	Jan. 03, 2015
Test Receiver	R & S	ESU40	100075	Feb. 15, 2013	Annual	Feb. 15, 2014
Preamplifier	H.P.	8447D	2727A05143	Aug. 08, 2013	Annual	Aug. 08, 2014
Antenna Master	MA4000-EP	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Turn Table	DT-3000S-3T	INN-CO	N/A	N.C.R.	N.C.R.	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (21.5 m x 13.0 m x 9.0 m)	N/A	N.C.R.	N.C.R.	N.C.R.

1.6. Test Report Revision

Revision	Report number	Description
0	F690501/RF-RTL007351	Initial
1	F690501/RF-RTL007351-1	1. Changed model name. 2. Correct the typo.

1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

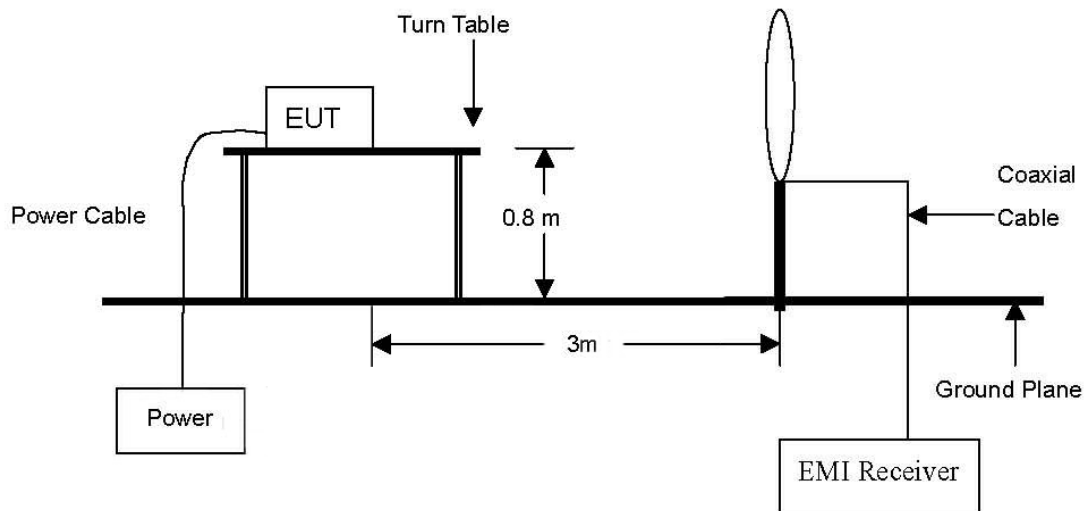
APPLIED STANDARD: FCC Part 15 Subpart B&C 15.209/ IC RSS-210 Issue8, RSS-Gen Issue3			
Section in FCC 15 Subpart B&C §15.209	Section in IC RSS-210 Issue8, RSS-Gen Issue 3	Test Item	Result
15.209(a)	RSS-210 Issue8, 2.5.1 RSS-Gen Issue3, 7.2.5 Table 6	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
-	RSS-Gen Issue3, 4.6.1	Occupied Bandwidth	Complied

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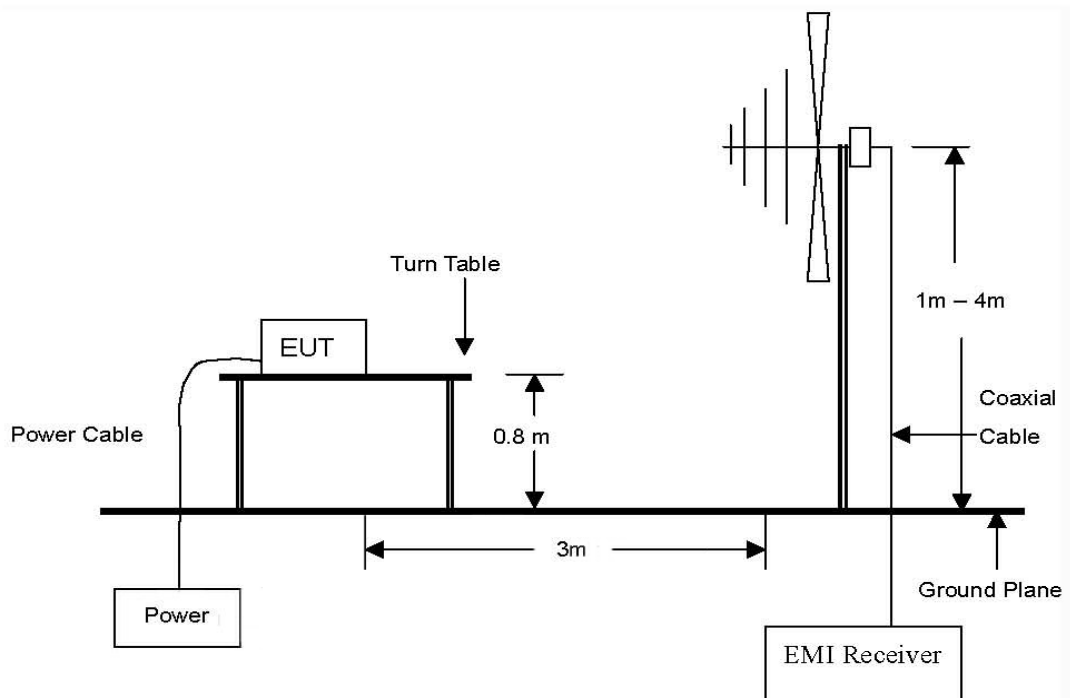
2. Field Strength of Fundamental

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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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	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 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

- 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.
- 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.
- 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.
- 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 1 000 MHz

- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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 ± 1) °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

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	55.10	Average	H	20.02	0.48	75.60	-4.40	25.05	29.45

- BUM ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	56.40	Average	H	20.02	0.48	76.90	-3.10	25.05	28.15

- DRV ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	55.00	Average	H	20.02	0.48	75.50	-4.50	25.05	29.55

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- INT1 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	56.80	Average	H	20.02	0.48	77.30	-2.70	25.05	27.75

- INT2 ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	56.60	Average	H	20.02	0.48	77.10	-2.90	25.05	27.95

- TNK ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	56.90	Average	H	20.02	0.48	77.40	-2.60	25.05	27.65

- SSB ANT

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.134 2	38.30	Average	H	20.02	0.48	58.80	-21.20	25.05	46.25

Note:

1. 300 m Result(dB μ V/m) = 3 m Result(dB μ V/m) – 40log(300/3) (dB μ 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

- 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.
- 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.
- 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.
- 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 1 000 MHz

- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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 ± 1) °C
Relative humidity : 47 % R.H.

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

3.4.1. Spurious emission from 9 kHz to 30 MHz

- AST ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	15.60	Average	H	20.00/0.50	36.10	-43.90	18.97	62.87
Above 0.30	Not detected	-	-	-	-	-	-	-

- BUM ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	18.60	Average	H	20.00/0.50	39.10	-40.90	18.97	59.87
Above 0.30	Not detected	-	-	-	-	-	-	-

- DRV ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	15.80	Average	H	20.00/0.50	36.30	-43.70	18.97	62.67
Above 0.30	Not detected	-	-	-	-	-	-	-

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- INT1 ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	15.90	Average	H	20.00/0.50	36.40	-43.60	18.97	62.57
Above 0.30	Not detected	-	-	-	-	-	-	-

- INT2 ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	18.80	Average	H	20.00/0.50	39.30	-40.70	18.97	59.67
Above 0.30	Not detected	-	-	-	-	-	-	-

- TNK ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	16.50	Average	H	20.00/0.50	37.00	-43.00	18.97	61.97
Above 0.30	Not detected	-	-	-	-	-	-	-

- SSB ANT

Radiated Emissions			Ant	Correction Factors	Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m	Limit (dB μ V/m)	Margin (dB)
0.27	13.10	Average	H	20.00/0.50	33.60	-46.40	18.97	65.37
Above 0.30	Not detected	-	-	-	-	-	-	-

Note:

1. 300 m Result(dB μ V/m) = 3 m Result(dB μ V/m) – 40log(300/3) (dB μ V/m)

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3.4.1. Spurious emission from 30 MHz to 1 000 MHz

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. All reading values are peak values.

- AST ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
163.57	42.47	Peak	V	8.85	-25.07	26.25	43.5	17.25
491.33	35.92	Peak	H	16.45	-25.26	27.11	46.0	18.89
875.26	34.33	Peak	H	20.84	-23.94	31.23	46.0	14.77
987.58	36.14	Peak	V	21.66	-23.19	34.61	54.0	19.39
Above 990.00	Not detected	-	-	-	-	-	-	-

- BUM ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
276.67	42.81	Peak	V	12.47	-24.51	30.77	43.5	12.73
415.19	34.21	Peak	H	15.29	-24.88	24.62	46.0	21.38
529.07	38.13	Peak	V	17.12	-25.27	29.98	46.0	16.02
880.59	35.56	Peak	H	20.89	-23.92	32.53	46.0	13.47
Above 890.00	Not detected	-	-	-	-	-	-	-

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- DRV ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
163.57	44.34	Peak	V	8.85	-25.07	28.12	43.5	15.38
283.36	39.96	Peak	V	12.64	-24.49	28.11	46.0	17.89
874.58	34.90	Peak	H	20.83	-23.96	31.77	46.0	14.23
Above 880.00	Not detected	-	-	-	-	-	-	-

- INT1 ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
269.59	39.46	Peak	V	12.29	-24.55	27.20	46.0	18.80
415.28	34.85	Peak	H	15.29	-24.88	25.26	46.0	20.74
875.94	35.22	Peak	V	20.84	-23.94	32.12	46.0	13.88
888.74	33.28	Peak	H	20.97	-23.86	30.39	46.0	15.61
Above 890.00	Not detected	-	-	-	-	-	-	-

- INT2 ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
389.97	35.16	Peak	H	14.86	-24.76	25.26	46.0	20.74
528.10	38.07	Peak	V	17.11	-25.28	29.90	46.0	16.10
560.58	36.43	Peak	H	17.71	-25.24	28.90	46.0	17.10
Above 570.00	Not detected	-	-	-	-	-	-	-

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- TNK ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
267.67	41.47	Peak	V	12.47	-24.51	29.43	46.0	16.57
876.03	33.58	Peak	H	20.84	-23.94	30.48	46.0	15.52
882.15	33.22	Peak	V	20.91	-23.90	30.23	46.0	15.77
Above 890.00	Not detected	-	-	-	-	-	-	-

- SSB ANT

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
34.27	40.85	Peak	H	12.30	-26.15	27.00	40.0	13.00
52.60	44.83	Peak	V	13.10	-25.96	31.97	40.0	8.03
112.06	26.96	Peak	H	11.54	-25.42	13.08	43.5	30.42
Above 120.00	Not detected	-	-	-	-	-	-	-

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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.

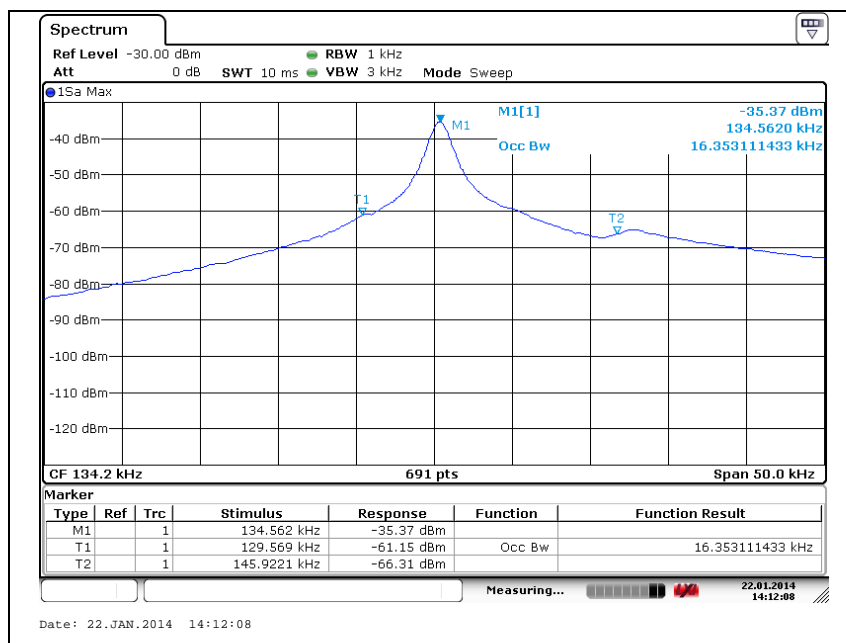
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4.4. Test Result

Ambient temperature : (24 ± 1) °C
Relative humidity : 47 % R.H.

- AST ANT

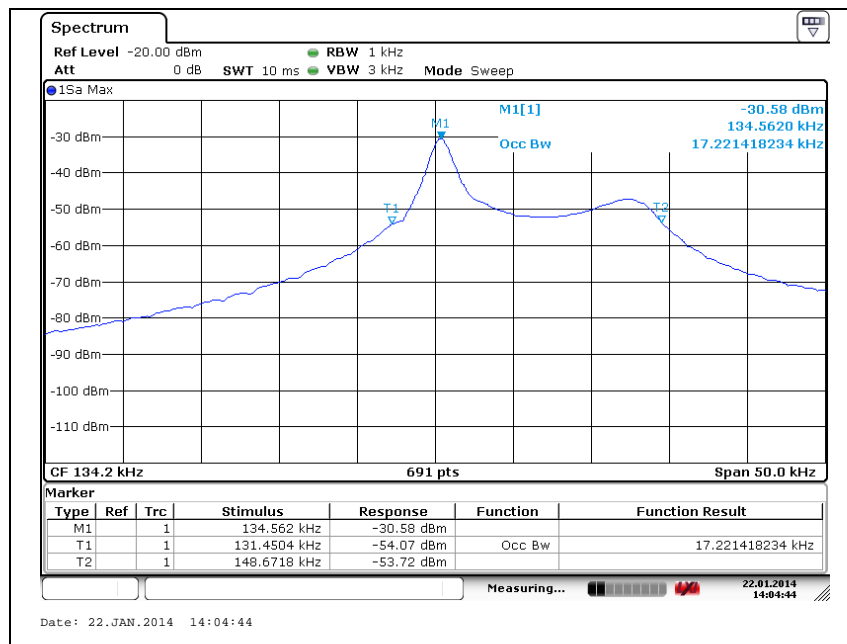
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	16.35	-	99 % Occupied bandwidth



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- BUM ANT

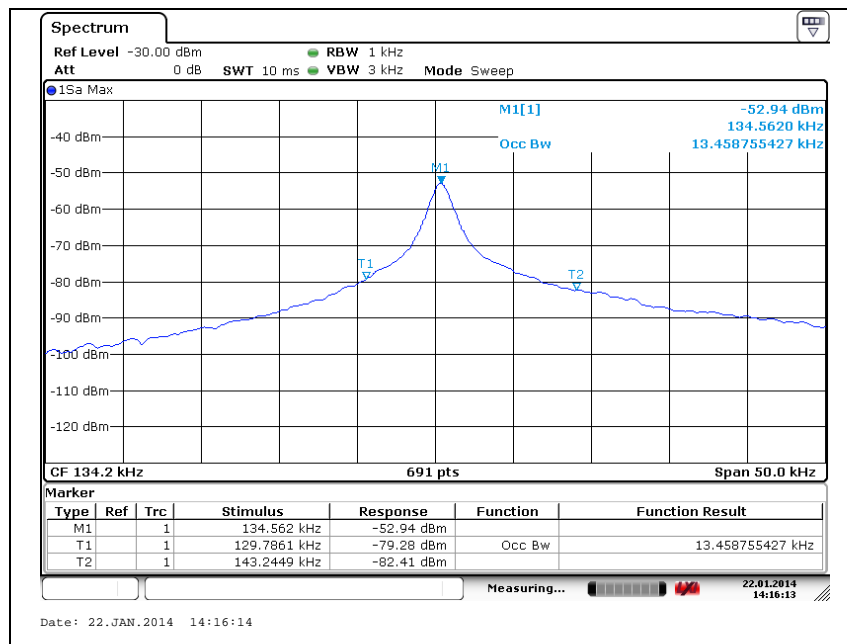
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	17.22	-	99 % Occupied bandwidth



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- DRV ANT

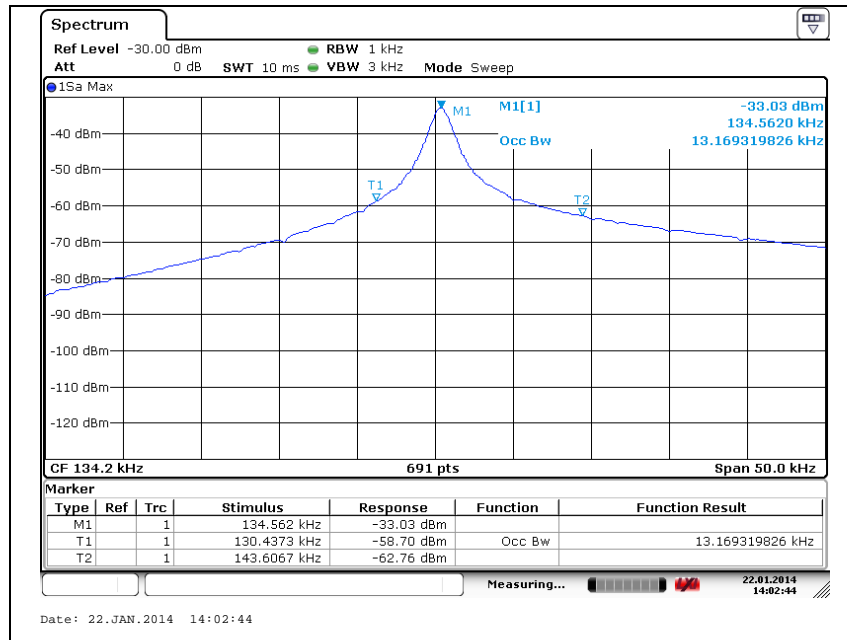
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	13.46	-	99 % Occupied bandwidth



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- INT1 ANT

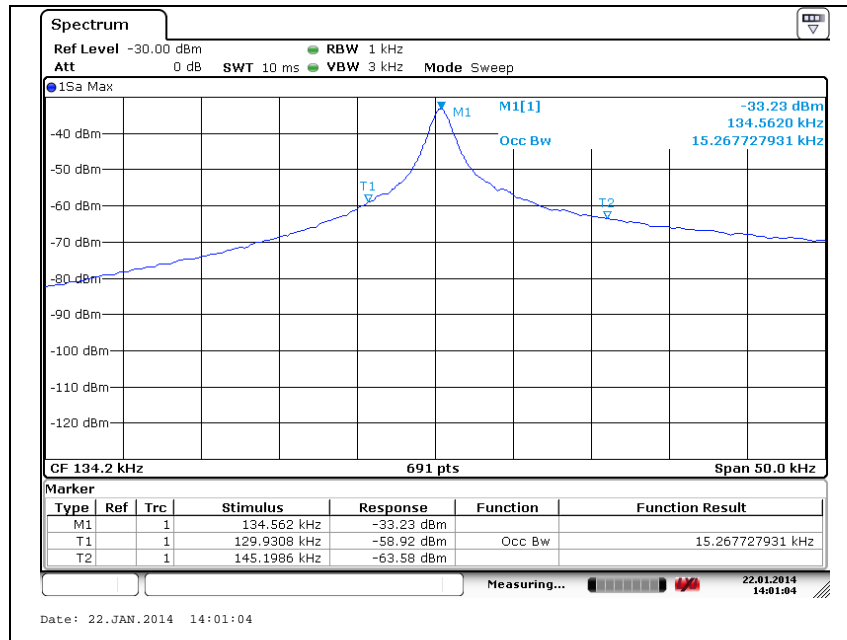
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	13.17	-	99 % Occupied bandwidth



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- INT2 ANT

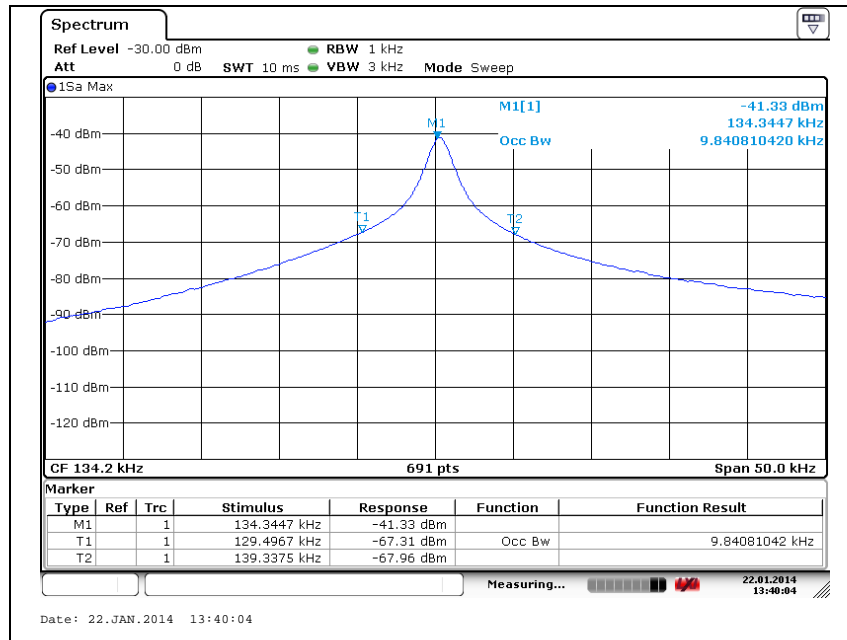
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	15.27	-	99 % Occupied bandwidth



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- SSB ANT

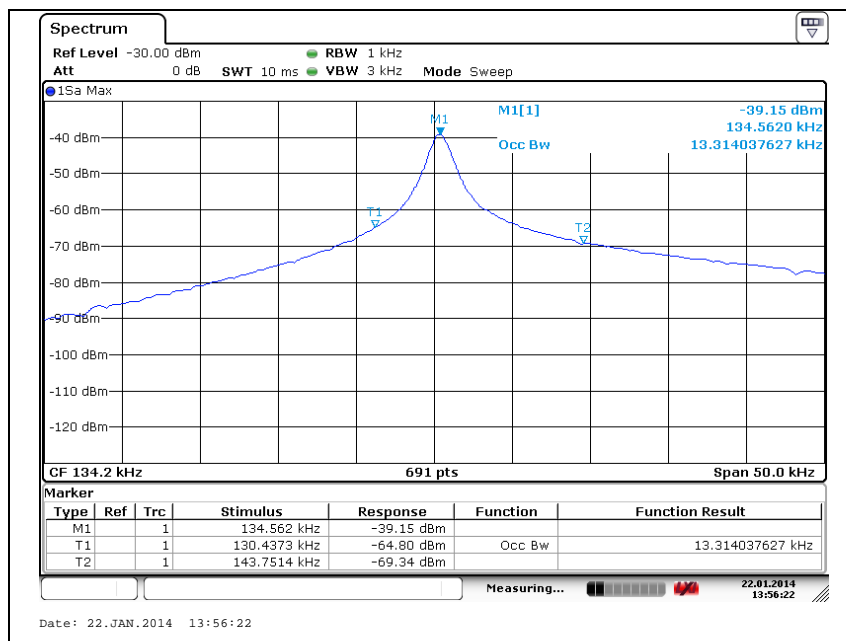
Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	9.84	-	99 % Occupied bandwidth



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- TNK ANT

Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Remark
0.134 2	13.31	-	99 % Occupied bandwidth



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