

TEST REPORT

of

FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

Product : NFC Smart Lock

Brand: LEON

Model: PL-7000, RS-2000

Model Difference: For different external look

FCC ID: 2ADR8GC780736

FCC Rule Part: §15.225, Cat:DXX

Applicant: LEON SPECIALTY INC.

Address: 7F, No. 95, Minquan Road, Xindian Dist.,
New Taipei City 23141, Taiwan (R.O.C.)

Test Performed by:

International Standards Laboratory

<Lung-Tan LAB>

*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3;

*Address:

No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd.

Lung-Tan Hsiang, Tao Yuan County 325, Taiwan

*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-14LR306FC**

Issue Date : **2014/12/16**

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report **MUST** not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory.



VERIFICATION OF COMPLIANCE

Applicant: LEON SPECIALTY INC.

Product Description: NFC Smart Lock

Brand Name: LEON

Model No.: PL-7000, RS-2000

Model Difference: For different external look

FCC ID: 2ADR8GC780736

Date of test: 2014/12/04 ~ 2014/12/15

Date of EUT Received: 2014/12/04

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:



Date:

2014/12/16

Dion Chang / Engineer

Prepared By:



Date:

2014/12/16

Eva Kao / Technical Supervisor

Approved By:



Date:

2014/12/16

Vincent Su / Technical Manager

Version

Version No.	Date	Description
00	2014/12/16	Initial creation of document

Table of Contents

1	GENERAL INFORMATION	5
1.1	PRODUCT DESCRIPTION	5
1.2	RELATED SUBMITTAL(S) / GRANT (S)	6
1.3	TEST METHODOLOGY.....	6
1.4	TEST FACILITY	6
1.5	SPECIAL ACCESSORIES.....	6
1.6	EQUIPMENT MODIFICATIONS	6
2	SYSTEM TEST CONFIGURATION	7
2.1	EUT CONFIGURATION.....	7
2.2	EUT EXERCISE	7
2.3	TEST PROCEDURE.....	7
2.4	LIMITATION	8
2.5	CONFIGURATION OF TESTED SYSTEM.....	10
3	SUMMARY OF TEST RESULTS	11
4	DESCRIPTION OF TEST MODES	11
5	CONDUCTED EMISSIONS TEST	12
5.1	MEASUREMENT PROCEDURE:	12
5.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	12
5.3	MEASUREMENT EQUIPMENT USED:	12
5.4	MEASUREMENT RESULT:	12
6	RADIATED EMISSION TEST	13
6.1	MEASUREMENT PROCEDURE.....	13
6.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	13
6.3	MEASUREMENT EQUIPMENT USED:	14
6.4	FIELD STRENGTH CALCULATION	14
6.5	MEASUREMENT RESULT	15
7	FREQUENCY TOLERANCE	19
7.1	MEASUREMENT PROCEDURE.....	19
7.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	19
7.3	MEASUREMENT EQUIPMENT USED:	19
7.4	MEASUREMENT RESULTS.....	19

1 GENERAL INFORMATION

1.1 Product Description

Product Name	NFC Smart Lock
Brand Name	LEON
Model Name	PL-7000, RS-2000
Model Difference	For different external look
Power Supply	6Vdc(1.5Vdc AA battery*4)

NFC:

Operating Frequency	13.56MHz
Transmit Power	66.28 dBuV/m Peak at 3m
Number of Channels	1
Antenna Type	Loop Antenna
Module Type	ASK

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2ADR8GC780736 filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2009 was used for test. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, San Ho Tsuen, Hsin Ho Rd., Lung-Tan Hsiang, Tao Yuan County 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number is: TW1036, Canada Registration Number: 4067B-3.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

2 System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was tested with a test program to fix the Tx frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 13 of ANSI C63.4-2009 and RSS-Gen:2010. Conducted emissions from the EUT measured in the frequency range between 0.1

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 of ANSI C63.4-2009.

2.4 Limitation

(1) Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

(2) Radiated Emission

1. The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (124dBuV/m at 3m)
2. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (90.47dBuV/m at 3m.)
3. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (80.5dBuV/m at 3m.)
4. The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209(Intentional Radiators general limit).as below.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m dB $\mu\text{V/m}$
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

- Remark:
1. Emission level in dBuV/m = $20 \log (\mu\text{V/m})$
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of ξ 15.205, then the general radiated emission limits in ξ 15.209 apply.
 - 5.

Limitation Calculation:

15,848 microvolts/meter at 30 meters = $20 \log(15,848)$ dBuV/m at 30m = 84dBuV/m at 30m
= 124dBuV/m at 3m

30m to 3m distance correction factor: $40 \log(30/3) = 40\text{dB}$

(3) Frequency Tolerance

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

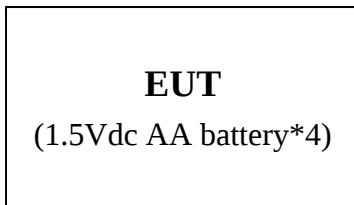


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	N/A					

3 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207	Conducted Emission	N/A
§15.225 (a)-(d)	Radiated Emission	Compliant
§15.225 (e)	Frequency Stability	Compliant

4 Description of test modes

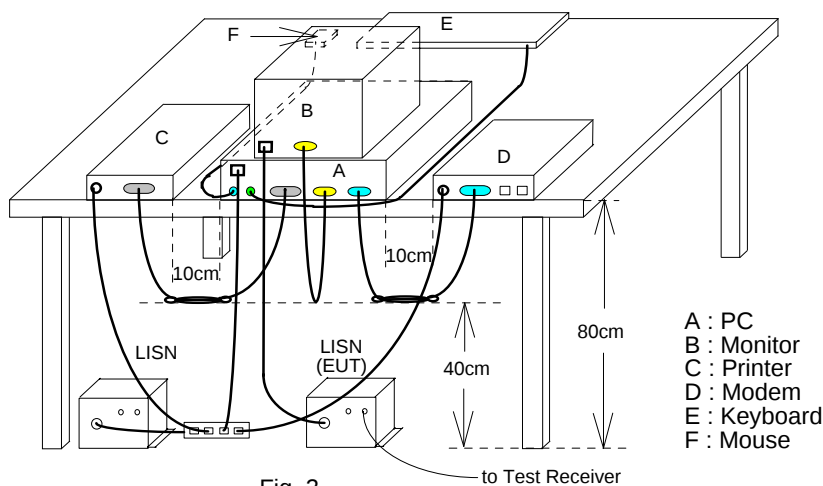
The EUT was tested when placed vertically on the table and the EUT stay in continuous transmitting mode.

5 Conducted Emissions Test

5.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Conduction 04-1 Cable	WOKEN	CFD 300-NL	Conduction 04 -1	09/24/2014	09/23/2015
EMI Receiver 16	Rohde & Schwarz	ESCI	101221	06/13/2014	06/12/2015
LISN 18	ROHDE & SCHWARZ	ENV216	101424	03/13/2014	03/12/2015
LISN 19	ROHDE & SCHWARZ	ENV216	101425	03/13/2014	03/12/2015

5.4 Measurement Result:

N/A, the device is powered from battery.

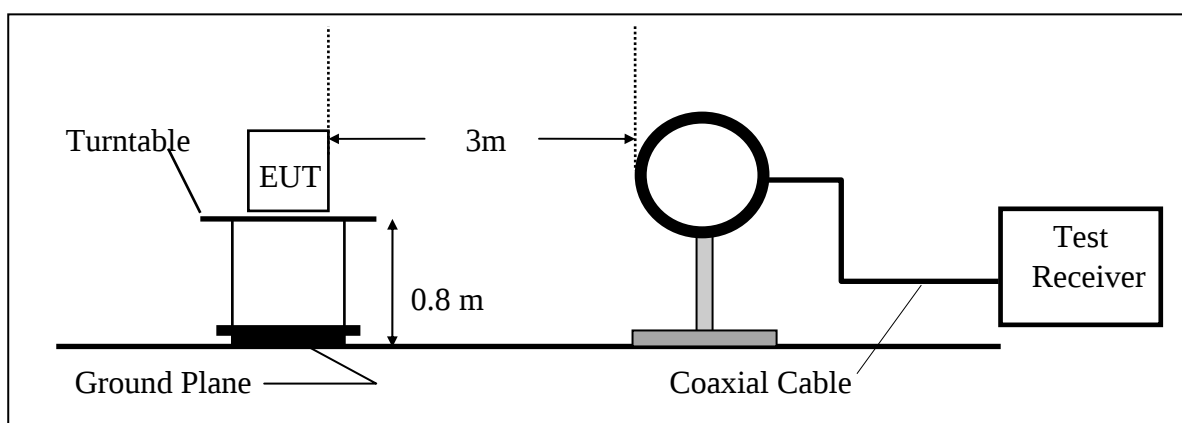
6 Radiated Emission Test

6.1 Measurement Procedure

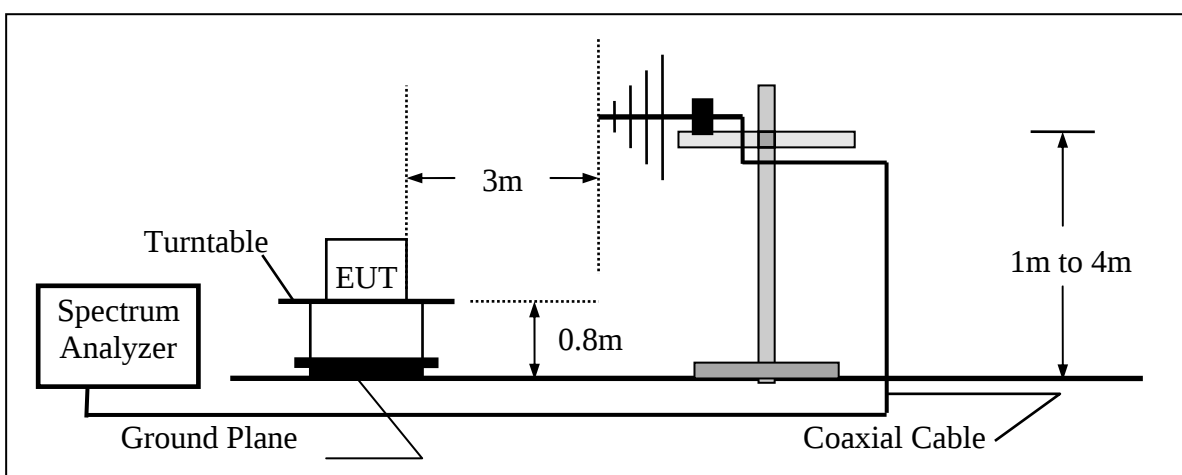
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



6.3 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY49060537	07/18/2014	07/17/2015
Spectrum Analyzer 20(6.5GHz)	Agilent	E4443A	MY48250315	05/26/2014	05/25/2015
Spectrum Analyzer 22(43GHz)	R&S	FSU43	100143	05/03/2014	05/02/2015
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	03/07/2013	03/06/2015
Bilog Antenna30-1G	Schaffner	CBL 6112B	2756	01/08/2014	01/07/2015
Horn antenna1-18G(06)	EMCO	3117	0006665	11/04/2014	11/03/2015
Horn antenna18-26G(04)	Com-power	AH-826	081001	05/15/2013	05/14/2015
Preamplifier9-1000M	HP	8447D	NA	02/20/2014	02/19/2015
Preamplifier1-18G	MITEQ	AFS44-001018 00-25-10P-44	1329256	07/18/2014	07/17/2015
Preamplifier1-26G	EM	EM01M26G	NA	02/20/2014	02/19/2015
Cable1-18G	HUBER SUHNER	Sucoflex 106	NA	02/17/2014	02/16/2015
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	10/14/2014	10/13/2015
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&3742 1/2	10/03/2013	10/02/2015

6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

6.5 Measurement Result

Fundamental Measurement Result

Operation Mode	: TX mode	Test Date	: 2014/12/10
Fundamental Frequency	: 13.56 MHz	Test By	: Dino
Temp	: 25 °C	Hum.	: 60%

Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
13.56	54.63	11.65	66.28	124.00	-57.72	Peak	VERTICAL
13.56	44.55	11.65	56.20	124.00	-67.80	Peak	HORIZONTAL

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode: Transmitting Mode

Test Date: 2014/12/10

Fundamental Frequency: 13.56MHz

Test By: Dino

Temperature : 25 °C

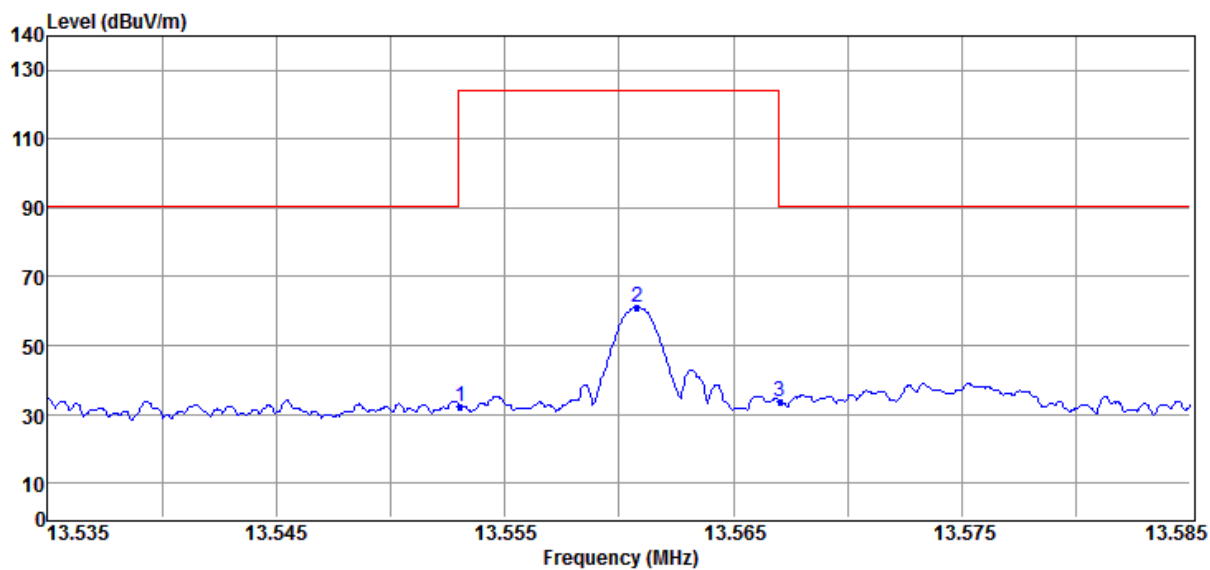
Humidity : 65 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	17.80	42.55	12.75	55.30	69.54	-14.24	Peak	VERTICAL
2	27.12	33.87	6.95	40.82	69.54	-28.72	Peak	VERTICAL
3	650.80	44.82	-4.77	40.05	46.00	-5.95	Peak	VERTICAL
4	677.96	46.64	-4.35	42.29	46.00	-3.71	Peak	VERTICAL
5	705.12	44.72	-3.91	40.81	46.00	-5.19	Peak	VERTICAL
6	745.86	36.14	-2.99	33.15	46.00	-12.85	Peak	VERTICAL
7	786.60	38.00	-2.38	35.62	46.00	-10.38	Peak	VERTICAL
8	813.76	35.49	-1.99	33.50	46.00	-12.50	Peak	VERTICAL
1	18.00	41.06	12.75	53.81	69.54	-15.73	Peak	HORIZONTAL
2	27.12	32.61	6.95	39.56	69.54	-29.98	Peak	HORIZONTAL
3	623.64	37.14	-5.20	31.94	46.00	-14.06	Peak	HORIZONTAL
4	650.80	43.38	-4.77	38.61	46.00	-7.39	Peak	HORIZONTAL
5	677.96	42.20	-4.35	37.85	46.00	-8.15	Peak	HORIZONTAL
6	705.12	41.28	-3.91	37.37	46.00	-8.63	Peak	HORIZONTAL
7	718.70	35.02	-3.59	31.43	46.00	-14.57	Peak	HORIZONTAL
8	813.76	33.54	-1.99	31.55	46.00	-14.45	Peak	HORIZONTAL

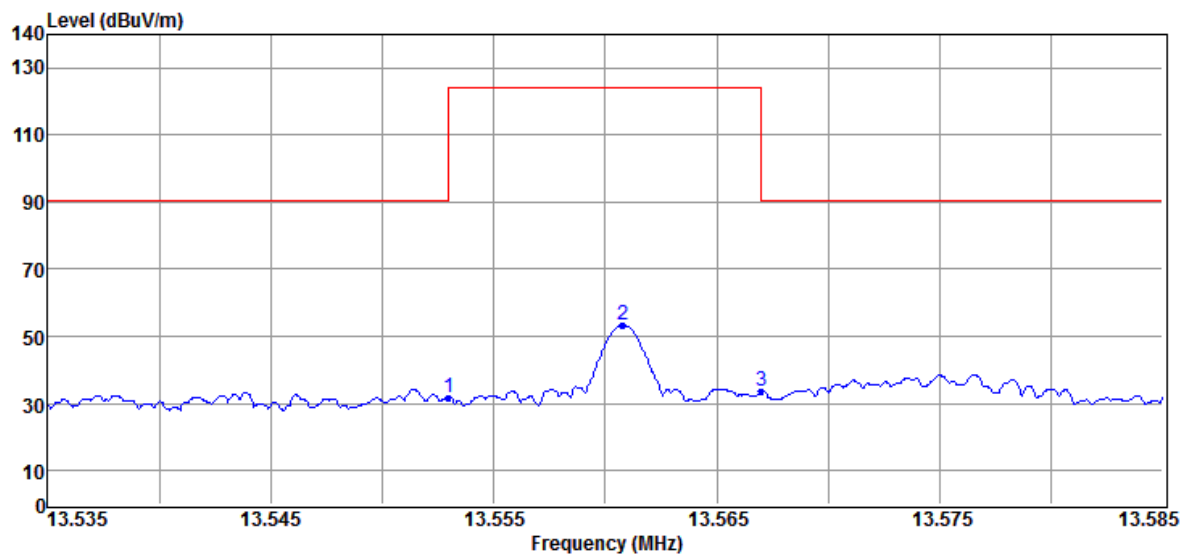
Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.
- 6 Peak is below the average limit, so that the average result is not measured

Radiated Mask



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	13.55	20.47	11.65	32.12	124.00	-91.88	Peak	VERTICAL
2	13.56	49.53	11.65	61.18	124.00	-62.82	Peak	VERTICAL
3	13.57	22.06	11.65	33.71	90.47	-56.76	Peak	VERTICAL



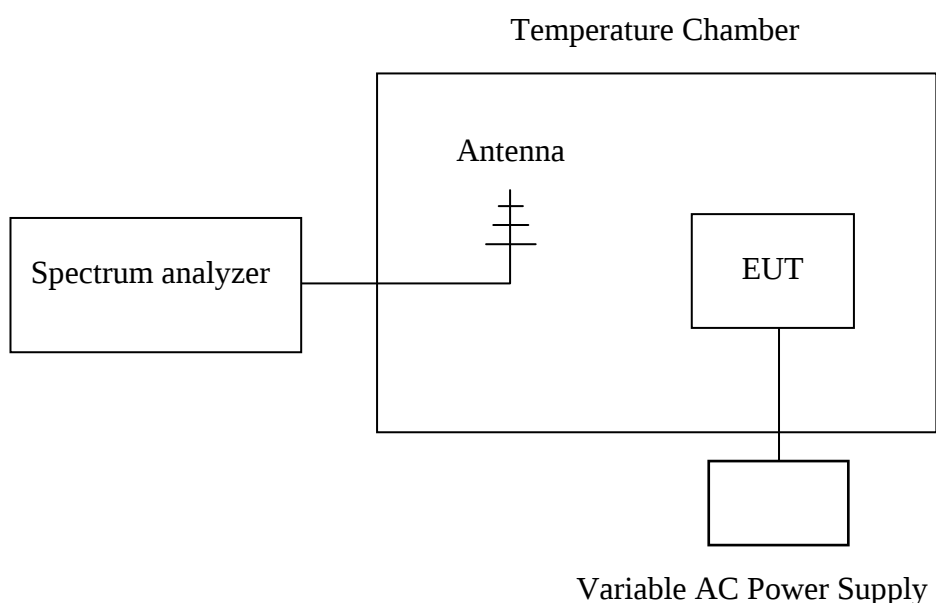
No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	13.55	20.18	11.65	31.83	90.47	-58.64	Peak	HORIZONTAL
2	13.56	41.61	11.65	53.26	124.00	-70.74	Peak	HORIZONTAL
3	13.57	22.07	11.65	33.72	90.47	-56.75	Peak	HORIZONTAL

7 Frequency Tolerance

7.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.
- 5.

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9030A	MY51360021	05/02/2014	05/01/2015
Temperature Chamber	KSON	THS-B4H100	2287	03/17/2014	03/16/2015
DC Power supply	ABM	8185D	N/A	07/16/2014	07/15/2015

7.4 Measurement Results

Refer to attached data chart.

A. Temperature Variation

Limit: +/- 0.01%					
Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)	Result
Vdc	Temperature (°C)	(MHz)			
6	-20	13.564	0.8000	1.356	Pass
	-10	13.5639	0.7000		Pass
	0	13.5629	-0.3000		Pass
	10	13.5627	-0.5000		Pass
	20	13.5632	0.0000		Pass
	30	13.5625	-0.7000		Pass
	40	13.5629	-0.3000		Pass
	50	13.5641	0.9000		Pass

B. Supply Voltage Variation

voltage test					
Limit: +/- 0.01%					
Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)	Result
Vdc	Temperature (°C)	(MHz)			
6	20	13.5632	0.0000	1.356	Pass
6.6	20	13.5638	0.6000		Pass
5.4	20	13.5635	0.3000		Pass