SGS Korea Co., Ltd.
4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
Tel. +82 31 428 5700 / Fax. +82 31 427 2370
http://www.sgsgroup.kr

TEST REPORT

of

FCC Part 15 Subpart C §15.225
RSS-210 Issue 10, RSS-Gen Issue 5

FCC ID: 2ABFG-NTB600TSACC
IC Certification: 11626A-NTB600TSACC

Equipment Under Test	:	Digital Door Lock
Model Name	:	NTB622-ACC
Variant Model Name(s)	:	NTB642-ACC
Applicant	:	iRevo-ASSA ABLOY Korea
Manufacturer	:	iRevo-ASSA ABLOY Korea
Date of Receipt	:	2021.02.17
Date of Test(s)	:	2021.02.17 ~ 2021.04.01
Date of Issue	:	2021.04.06

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
3) This test report cannot be reproduced, except in full, without prior written permission of the Company.

Tested by: **Murphy Kim**

Technical Manager: **Jinhyoung Cho**

SGS Korea Co., Ltd. Gunpo Laboratory

INDEX

Table of contents

1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
-10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
-4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
-Designation number: KR0150
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Phone No. : +82 31 688 0901
Fax No. : +82 31 688 0921

1.2. Details of Applicant

Applicant : iRevo-ASSA ABLOY Korea
Address : 205-29, Gasan Digital 1-ro, Geumcheon-gu, Seoul, Korea, 08052
Contact Person : Jang, Soo-kyung
Phone No. : +82 2 2107 5741

1.3. Details of manufacturer

Applicant : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product	Digital Door Lock
Model Name	NTB622-ACC
Variant Model	NTB642-ACC
Serial Number	Conducted: 003 Radiated: 004
Power Supply	DC 6.0 V
Frequency Range	13.56 ㎒ (NFC)
Modulation Technique	ASK
Number of Channels	1 channel
Antenna Type	PCB pattern antenna
Antenna Part Number	PC2K-L420B-F1
H/W Version	PV02
S/W Version	V3.0.4

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMBV100A	255834	Jun. 03, 2020	Annual	Jun. 03, 2021
Spectrum Analyzer	R&S	FSV30	103210	Dec. 07, 2020	Annual	Dec. 07, 2021
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 04, 2020	Annual	Sep. 04, 2021
High Pass Filter	Mini circuits	NHP-25+	V9741901107-1	Dec. 07, 2020	Annual	Dec. 07, 2021
DC Power Supply	Agilent	U8002A	MY54110041	Sep. 17, 2020	Annual	Sep. 17, 2021
Temperature Chamber	ESPEC CORP.	PL-1J	15000793	Jun. 02, 2020	Annual	Jun. 02, 2021
Preamplifier	H.P.	8447F	2944A03909	Aug. 06, 2020	Annual	Aug. 06, 2021
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Dec. 12, 2020	Biennial	Dec. 12, 2022
Test Receiver	R&S	ESU26	100368	Nov. 05, 2020	Annual	Nov. 05, 2021
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/38 330516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/38 330516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	MWX221-NMSNMS (4 m)	J1023142	Dec. 01, 2020	Semi-Annual	Jun. 01, 2021
Coaxial Cable	RFONE	PL520-NMNM-10M (10 m)	20200324001	Dec. 01, 2020	Semi-Annual	Jun. 01, 2021

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

Applied standard : FCC Part15 subpart C, IC RSS-210 Issue 10, RSS-Gen Issue 5			
Standard section(s)		**Test item(s)**	**Result**
15.225(a)(b)(c)(d) 15.209	RSS-210 Annex B Section B.6 RSS-Gen Section 8.9	Radiated Emission, Spurious Emission and Field Strength of Fundamental	Complied
15.225(e)	RSS-210 Annex B Section B.6 RSS-Gen Section 6.11	Frequency Stability	Complied
15.215(c)	RSS-Gen Section 6.7	20 dB Bandwidth & 99 % Bandwidth	Complied
15.207	RSS-Gen Section 8.8	AC Power Line Conducted Emissions	N/A[1)]

Note;

1) The AC power line test was not performed because the EUT use battery power for operation.

1.7. Sample calculation

Where relevant, the following sample calculation is provided:

1.7.1. Radiation test

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB) - amplifier (dB)

1.8. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501-RF-RTL001893	2021.04.06	Initial

1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Occupied Bandwidth	± 13.12 ㎑	
Radiated Emission, 9 ㎑ to 30 ㎒	H	± 3.66 ㏈
	V	± 3.66 ㏈
Radiated Emission, below 1 ㎓	H	± 4.90 ㏈
	V	± 4.82 ㏈

Uncertainty figures are valid to a confidence level of 95 %.

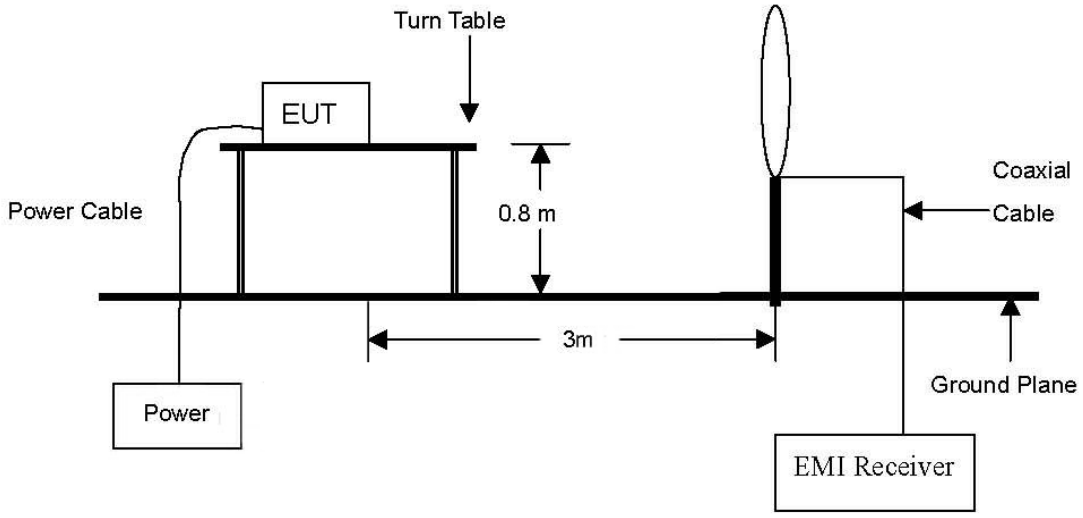
1.10. Description of variant model(s)

Model	Description
NTB622-ACC	- Basic model
NTB642-ACC	- Same to basic model except below - There is no key cylinder on handles.

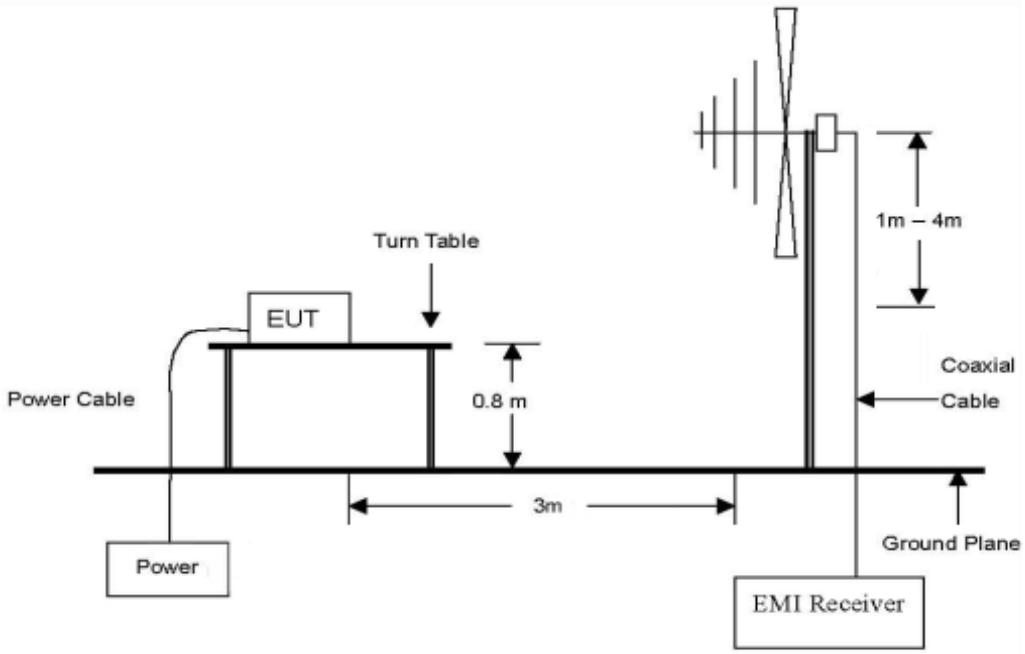
2. Radiated Emissions

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 000 ㎒ Emissions.



2.2. Limit

FCC

According to §15.225,

(a) The field strength of any emissions within the band 13.553-13.567 ㎒ shall not exceed 15 848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 ㎒ and 13.567-13.710 ㎒, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 ㎒ and 13.710-14.010 ㎒ the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 ㎒ band shall not exceed the general radiated emission limits in §15.209.

According to §15.209,

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 (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(㎑)	300
0.490-1.705	24000/F(㎑)	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 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

IC

According to RSS-210 Issue 10, B.6

The field strength of any emission shall not exceed the following limits:

(a) 15.848 millivolts/m (84 dBμV/m) at 30 m, within the band 13.553-13.567 MHz.

(b) 334 microvolts/m (50.5 dBμV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.

(c) 106 microvolts/m (40.5 dBμV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

(d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

According to RSS-Gen Issue 5, 8.9

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field Strength (μV/m at 3 m)
30-88	100
88-216	150
216-960	200
Above 960	500

Table 6 - General field strength limits at frequencies below 30 MHz

Frequency	Magnetic Field Strength (H-Field) (μA/m)	Measurement Distance (m)
9-490 kHz [1]	6.37/F (F in kHz)	300
490-1 705 kHz	63.7/F (F in kHz)	30
1.705-30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 ㎒

1. 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.
2. 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.
3. 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.
4. The test-receiver system was set to Quasi peak Detect Function with Maximum Hold Mode.

2.3.2. Test Procedures for emission above 30 ㎒

1. 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.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a Trilog 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.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

Definition of the test orthogonal plan for EUT was described in the test setup photo.
The test orthogonal plan of EUT is **X – axis** during radiation test.

2.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions.

- Fundamental within the band 13.553 ㎒ - 13.567 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
13.560	30.70	Peak	H	18.66	0.52	49.88	9.88	84.00	74.12

- Spurious emission within the bands 13.410 ㎒ - 13.553 ㎒ and 13.567 ㎒ - 13.710 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
13.553	24.18	Peak	H	18.66	0.52	43.36	3.36	50.47	47.11
13.567	24.29	Peak	H	18.66	0.52	43.47	3.47	50.47	47.00

- Spurious emission within the bands 13.110 ㎒ - 13.410 ㎒ and 13.710 ㎒ - 14.010 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
13.206	8.71	Peak	H	18.67	0.52	27.90	-12.10	40.51	52.61
*13.393	6.84	Peak	H	18.66	0.52	26.02	-13.98	29.54	43.52
13.710	8.28	Peak	H	18.65	0.52	27.45	-12.55	40.51	53.06

- Spurious emission within the bands 9 ㎑ - 13.110 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
Below 13.110	Not detected	-	-	-	-	-	-	-	-

- Spurious emission within the bands 14.010 ㎒ - 30 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
Above 14.010	Not detected	-	-	-	-	-	-	-	-

Remark;

1. Fundamental limit (㎶/m) = 20 log(15 848) = 84.00 dB㎶/m.
2. 30 m distance compensation = 40 log(3/30) = -40 dB㎶/m.
3. "*" means the restricted band.
4. If the spurious emissions are in the restricted band, the limit complied with §15.209.
5. All data were recorded using a spectrum analyzer employing a peak detector.
   If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

- Spurious emission above 30 ㎒

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Freq. (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	AMP + CL (dB)	Actual (dB㎶/m) at 3 m	Limit (dB㎶/m) at 3 m	Margin (dB)
40.67	37.40	Peak	V	18.90	-27.30	29.00	40.00	11.00
72.96	38.00	Peak	V	13.92	-26.98	24.94	40.00	15.06
184.80	36.20	Peak	V	15.38	-25.82	25.76	43.50	17.74
284.75	41.50	Peak	H	18.69	-25.13	**35.06**	46.00	10.94
338.99	37.70	Peak	H	20.34	-25.15	32.89	46.00	13.11
860.89	31.70	Peak	V	27.22	-24.36	34.56	46.00	11.44
Above 900.00	Not detected	-	-	-	-	-	-	-

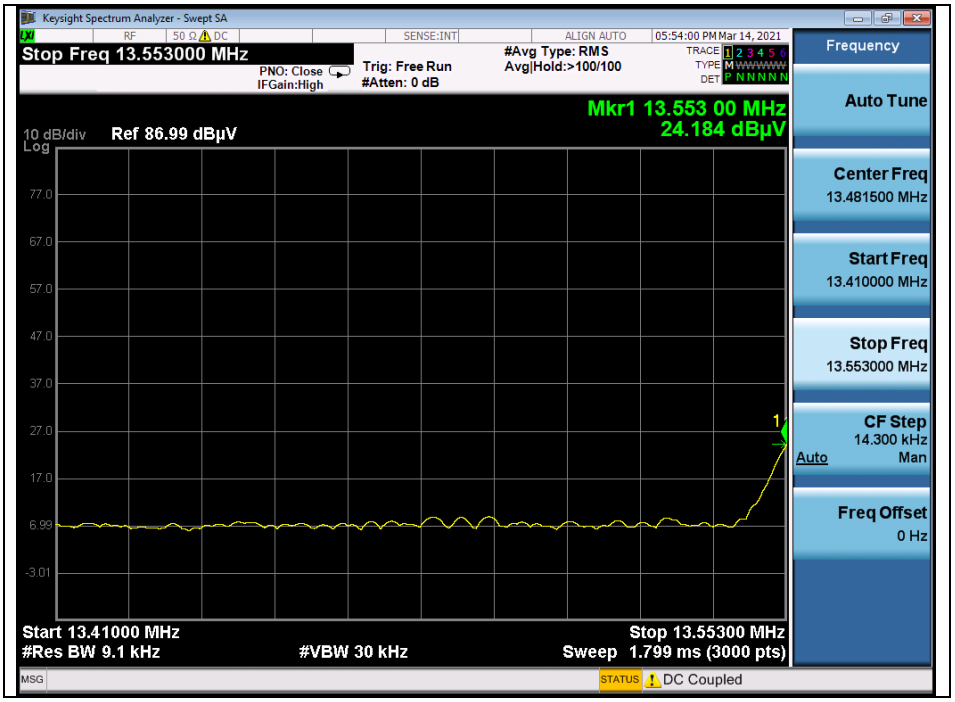
Remark;

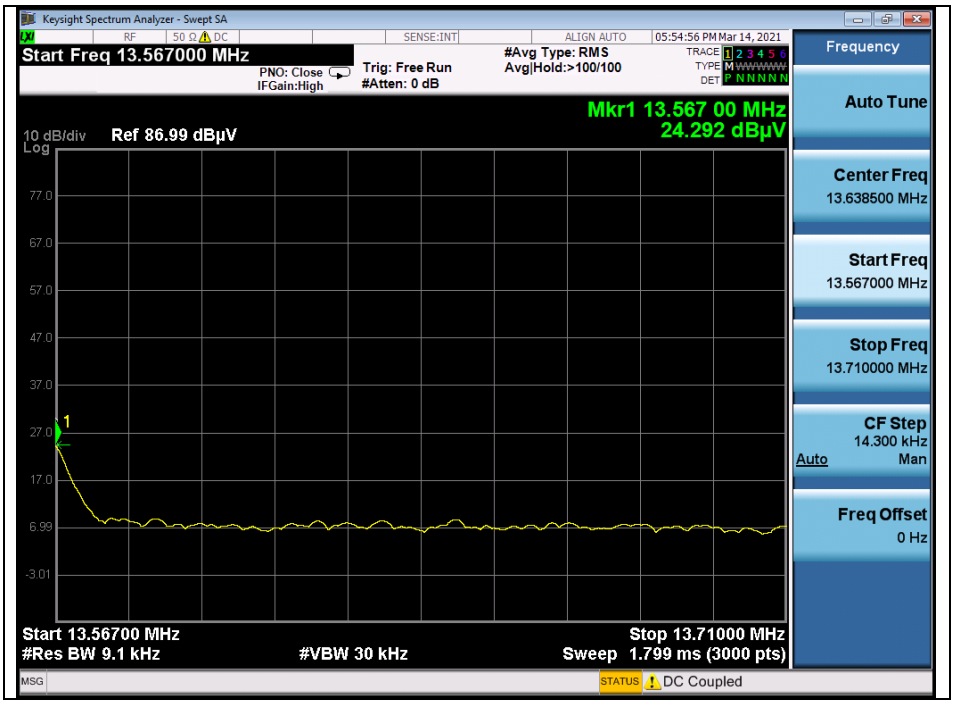
1. Radiated spurious emission measurement as below.
   (Actual = Reading + Antenna Factor + Amp + CL)
2. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

Test plots

- Fundamental within the band 13.553 ㎒ - 13.567 ㎒

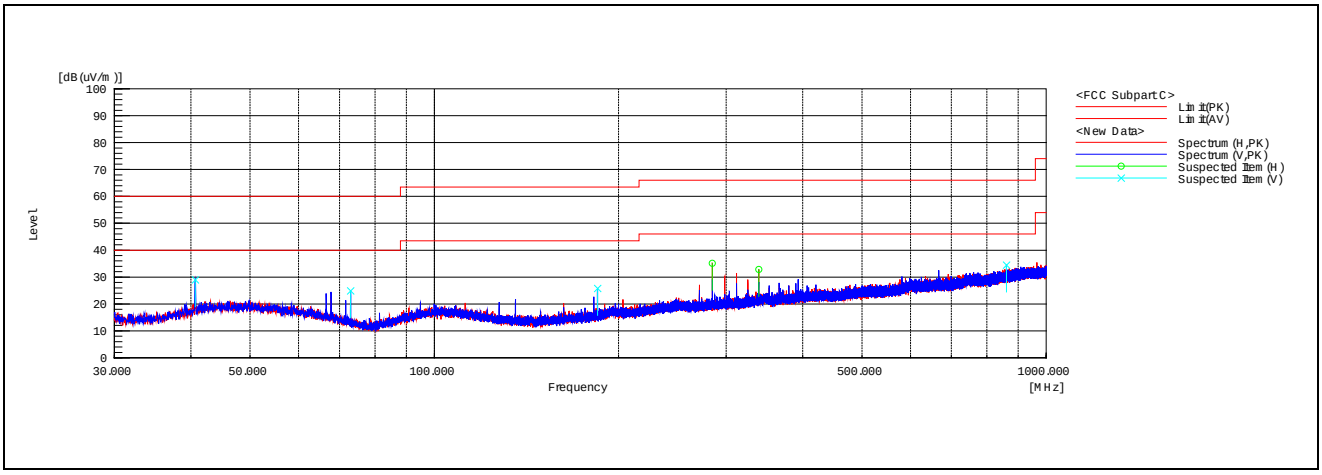
- Spurious emission within the bands 13.410 ㎒ - 13.553 ㎒ and 13.567 ㎒ - 13.710 ㎒





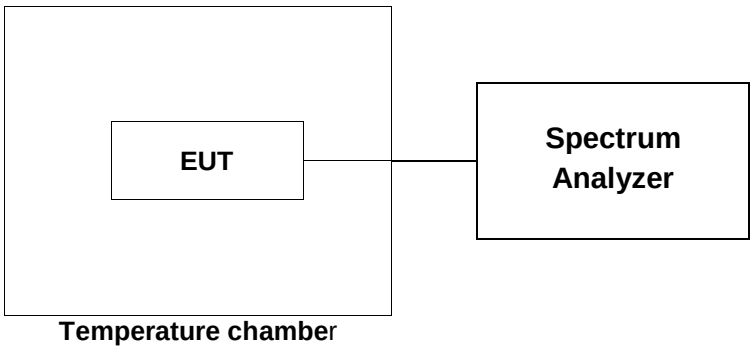
- Spurious emission within the bands 13.110 ㎒ - 13.410 ㎒ and 13.710 ㎒ - 14.010 ㎒

- Spurious emission above 30 ㎒



3. Frequency Stability

3.1. Test Setup



3.2. Limit

FCC

According to §15.225(e), 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.

IC

According to RSS-210, Annex B, Section B.6
Carrier frequency stability shall be maintained to ± 0.01 % (±100 ppm).

3.3. Test Procedures

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the environment into appropriate environment.
4. Set the spectrum analyzer as RBW = 100 ㎐, VBW = 100 ㎐, Span = 10 ㎑, Sweep time = auto.
5. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
6. Repeat until all the results are investigated.

3.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Operating Frequency : 13 560 000 Hz
Deviation Limit : ± 0.01 % = ± 1 356 Hz

Startup

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
6	-20	13 559 980	-20	-0.000 147
	-10	13 559 960	-40	-0.000 295
	0	13 559 930	-70	-0.000 516
	+10	13 559 910	-90	-0.000 664
	+20	13 559 910	-90	-0.000 664
	+30	13 559 900	-100	-0.000 737
	+40	13 559 920	-80	-0.000 590
	+50	13 559 930	-70	-0.000 516

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
115 % (6.90)	+20	13 559 910	-90	-0.000 664
85 % (5.10)	+20	13 559 920	-80	-0.000 590

2 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6	-20	13 559 980	-20	-0.000 147
	-10	13 559 960	-40	-0.000 295
	0	13 559 930	-70	-0.000 516
	+10	13 559 920	-80	-0.000 590
	+20	13 559 910	-90	-0.000 664
	+30	13 559 900	-100	-0.000 737
	+40	13 559 920	-80	-0.000 590
	+50	13 559 920	-80	-0.000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 559 910	-90	-0.000 664
85 % (5.10)	+20	13 559 920	-80	-0.000 590

5 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6	-20	13 559 990	-10	-0.000 074
	-10	13 559 960	-40	-0.000 295
	0	13 559 940	-60	-0.000 442
	+10	13 559 910	-90	-0.000 664
	+20	13 559 910	-90	-0.000 664
	+30	13 559 890	-110	-0.000 811
	+40	13 559 910	-90	-0.000 664
	+50	13 559 920	-80	-0.000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 559 910	-90	-0.000 664
85 % (5.10)	+20	13 559 910	-90	-0.000 664

10 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6	-20	13 559 980	-20	-0.000 147
	-10	13 559 960	-40	-0.000 295
	0	13 559 930	-70	-0.000 516
	+10	13 559 910	-90	-0.000 664
	+20	13 559 910	-90	-0.000 664
	+30	13 559 900	-100	-0.000 737
	+40	13 559 910	-90	-0.000 664
	+50	13 559 920	-80	-0.000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 559 910	-90	-0.000 664
85 % (5.10)	+20	13 559 910	-90	-0.000 664

4. 20 dB Bandwidth & 99 % Bandwidth

4.1. Test Setup

4.2. Limit

None; for reporting purposes only.

4.3. Test Procedures

20 dB Bandwidth

1. Span = set to capture all products of the modulation process, including the emission skirts. RBW = 50 Hz, VBW = 200 Hz, Sweep = auto, Detector = peak, Trace = max hold.
2. The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 20 dB bandwidth of the emission.

99 % Bandwidth

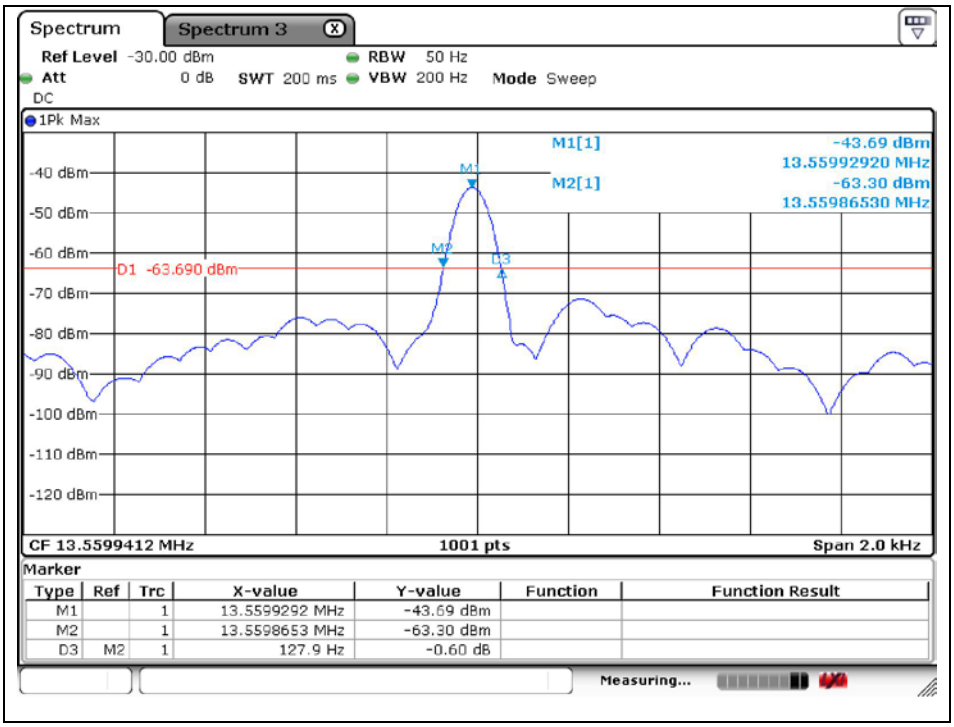
1. Set the spectrum analyzer as Span = set to capture all products of the modulation process, including the emission skirts, RBW = 50 Hz, VBW = 200 Hz, Detector = sampling, Trace mode = max hold.
2. Measure lowest and highest frequencies are placed in a running sum until 0.5 % and 99.5 % of the total is reached.
3. The difference between the two recorded frequencies is the occupied bandwidth.

4.3. Test Result

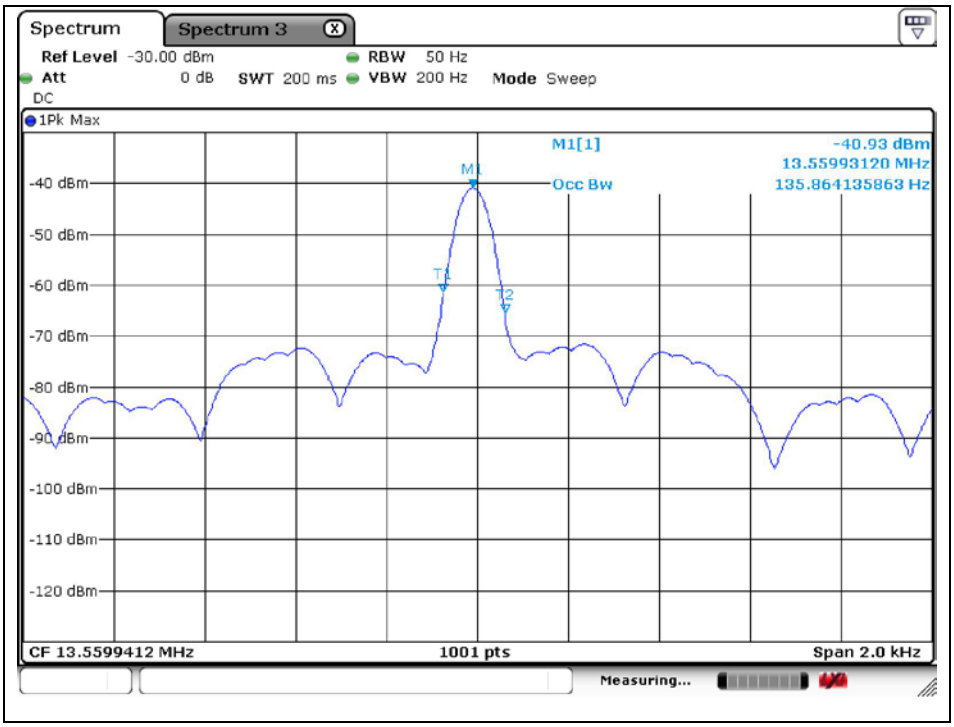
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Frequency (㎒)	20 ㏈ Bandwidth (㎑)	99 % Bandwidth (㎑)
13.560	0.128	0.136

- 20 ㏈ Bandwidth



- 99 % Bandwidth



-End of the Test report-