TEST REPORT

of

FCC Part 15 Subpart C §15.225
RSS-210 Issue 9, RSS-Gen Issue 5

FCC ID: 2ABFG-G100L
IC Certification: 11626A-G100L

Equipment Under Test	:	DIGITAL DOOR LOCK
Model Name	:	G100L
Applicant	:	iRevo-ASSA ABLOY Korea
Manufacturer	:	iRevo-ASSA ABLOY Korea
Date of Receipt	:	2018.08.13
Date of Test(s)	:	2018.09.11 ~ 2018.09.19
Date of Issue	:	2018.10.15

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

Tested By: **Date:** **2018.10.15**

Jinhyoung Cho

Technical Manager: **Date:** **2018.10.15**

Hyunchae You

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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.
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1.2. Details of Applicant

Applicant : iRevo-ASSA ABLOY Korea
Address : 205-29, Gasan digital 1-ro, Geumcheon-gu, Seoul, South Korea, 08503
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 LOOCK
Model Name	G100L
Power Supply	DC 6.0 V
Frequency Range	13.56 ㎒ (NFC)
Modulation Technique	ASK
Number of Channels	1 channel
Antenna Type	FPCB Antenna

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMBV100A	259067	Jun. 15, 2018	Annual	Jun. 15, 2019
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 25, 2017	Annual	Sep. 25, 2018
Spectrum Analyzer	R&S	FSV30	100768	Mar. 12, 2018	Annual	Mar. 12, 2019
High Pass Filter	Mini circuits	NHP-25+	V9741901107-1	Dec. 09, 2017	Annual	Dec. 09, 2018
DC Power Supply	R&S	HMP2020	020089489	May 30, 2018	Annual	May 30, 2019
Temperature Chamber	ESPEC CORP.	PL-1J	15000793	Jun. 14, 2018	Annual	Jun. 14, 2019
Preamplifier	H.P.	8447F	2944A03909	Aug. 07, 2018	Annual	Aug. 07, 2019
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2017	Biennial	Aug. 23, 2019
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	01126	Mar. 26, 2018	Biennial	Mar. 26, 2020
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Antenna Mast	Innco systems GmbH	MM4640-XP-ET	MA4640/536/ 38330516/L	N.C.R.	N/A	N.C.R.
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	CO300/963/ 38330516/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	SUCOFLEX	104 (3 m)	MY3258414	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 04, 2018	Semi-annual	Jan. 04, 2019

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 9, RSS-Gen Issue 5			
Standard section		**Test item**	**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 & Occupied Bandwidth	Complied

1.7. Sample calculation

Where relevant, the following sample calculation is provided:

1.7.1. Conducted test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.7.2. Radiation test

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

1.8. Measurement Uncertainty

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

Parameter	Uncertainty (dB)
Radiated Disturbance, 9 kHz to 30 MHz	± 3.59
Radiated Disturbance, below 1 GHz	± 5.88

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

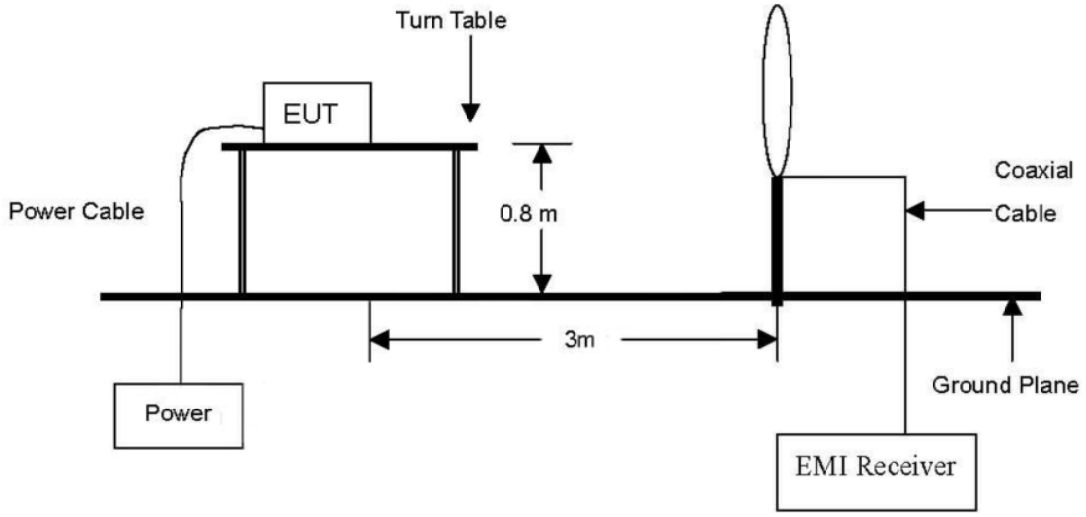
1.9. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013090	2018.10.15	Initial

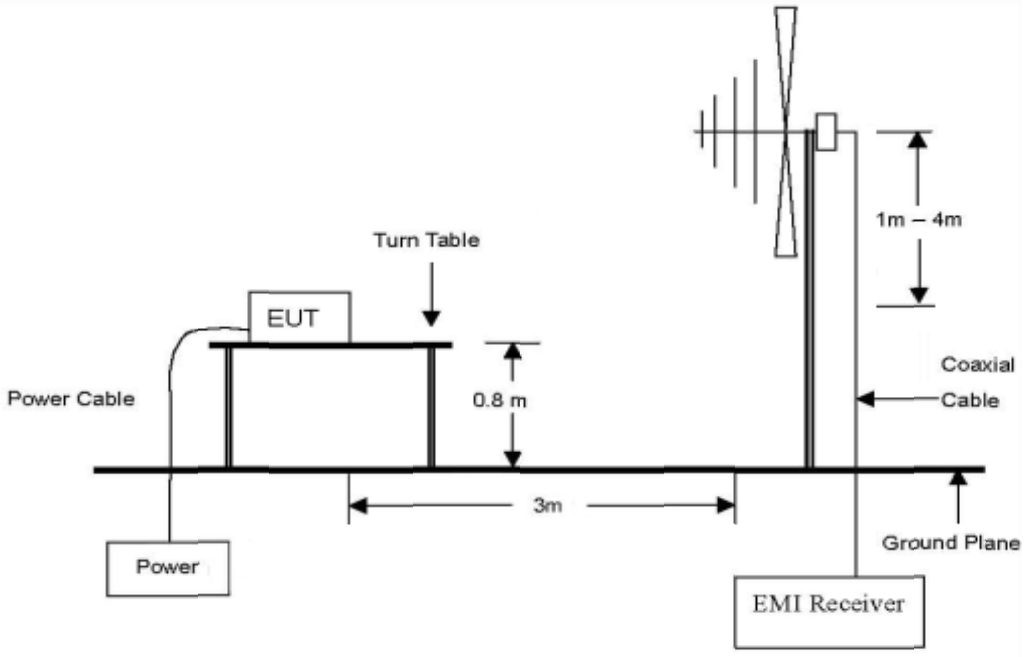
2. Radiated Emissions

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 135.6 ㎒ 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 9, 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 ㎒.

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

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

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

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 ㎒

Frequency (㎒)	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 ㎒

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

Note 1: The emission limits for the ranges 9-90 ㎑ and 110-490 ㎑ 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.
6. If the emission level of the EUT in peak mode was 10 ㏈ 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 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Note;

To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes (X, Y, Z). Worst orthogonal plan of EUT is **Y - 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	42.32	Peak	H	20.27	0.60	63.19	23.19	84.00	60.81

-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	36.21	Peak	H	20.27	0.60	57.08	17.08	50.47	33.39
13.567	36.86	Peak	H	20.27	0.60	57.73	17.73	50.47	32.74

- 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)
*13.405	8.69	Peak	H	20.27	0.60	29.56	-10.44	29.54	39.98
13.964	8.69	Peak	H	20.28	0.61	29.58	-10.42	40.51	50.93

- 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)
*12.291	6.94	Peak	H	20.25	0.58	27.77	-12.23	29.54	41.77

- Spurious emission within the bands 14.010 ㎒ - 30 ㎒

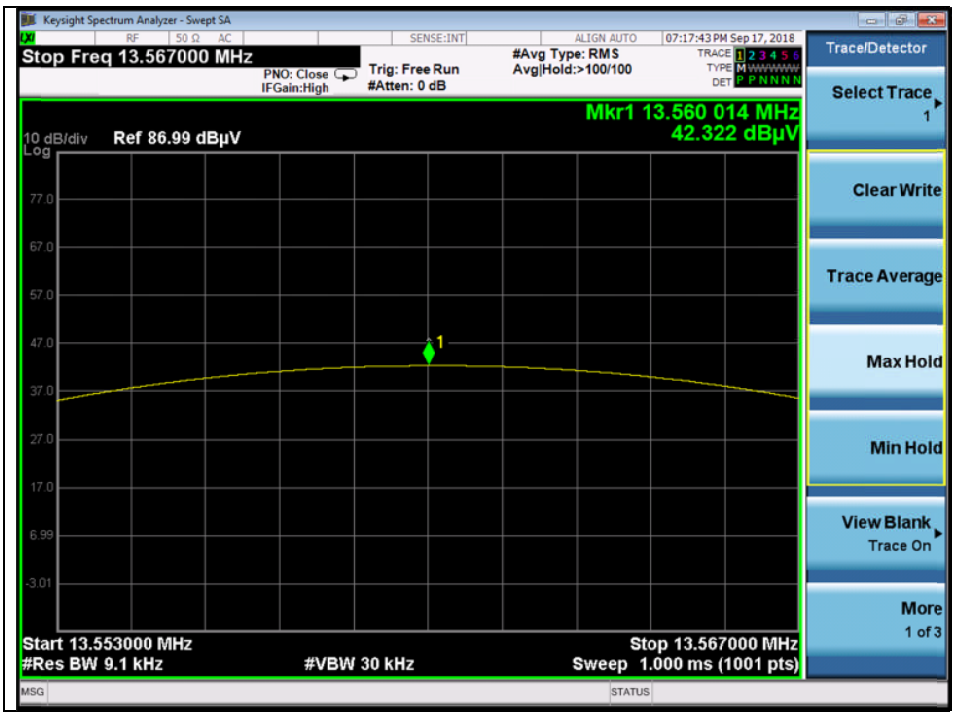
Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
17.208	8.21	Peak	H	20.39	0.66	29.26	-10.74	29.54	40.28
Above 20.000	Not detected	-	-	-	-	-	-	-	-

Remark;

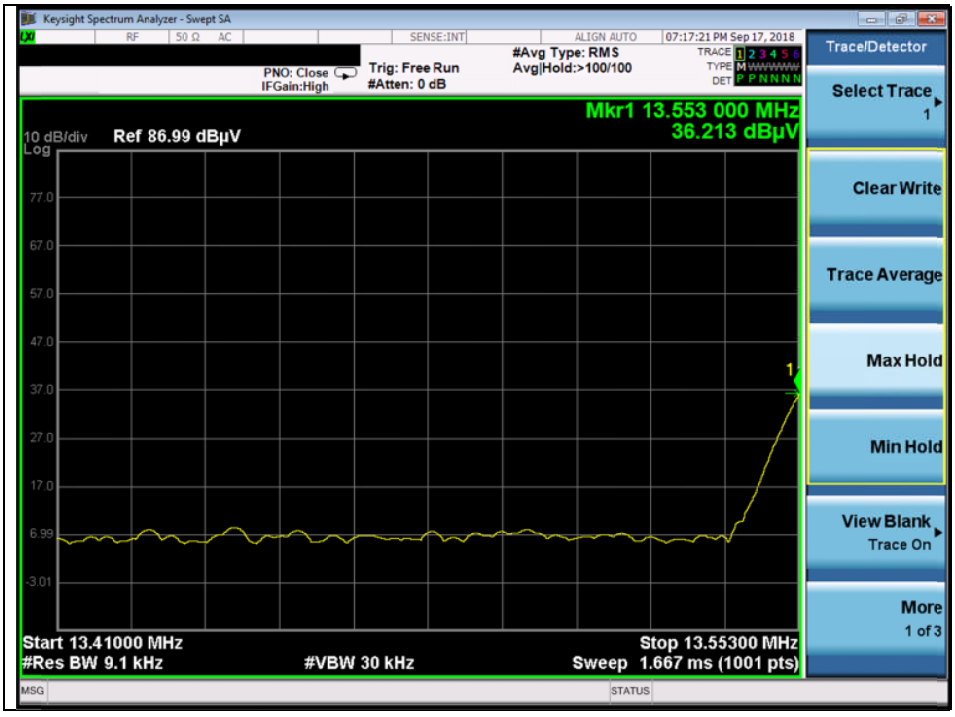
1. Fundamental limit (㎶/m) = 20 log(15 848) = 84.00 dB㎶/m.
2. 30 m distance compensation = 40 log(3/30) = -40 dB㎶/m.
3. "*" means the restricted band.
4. If the spurious emissions are in the restricted band, the limit complied with §15.209.
5. All data were recorded using a spectrum analyzer employing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

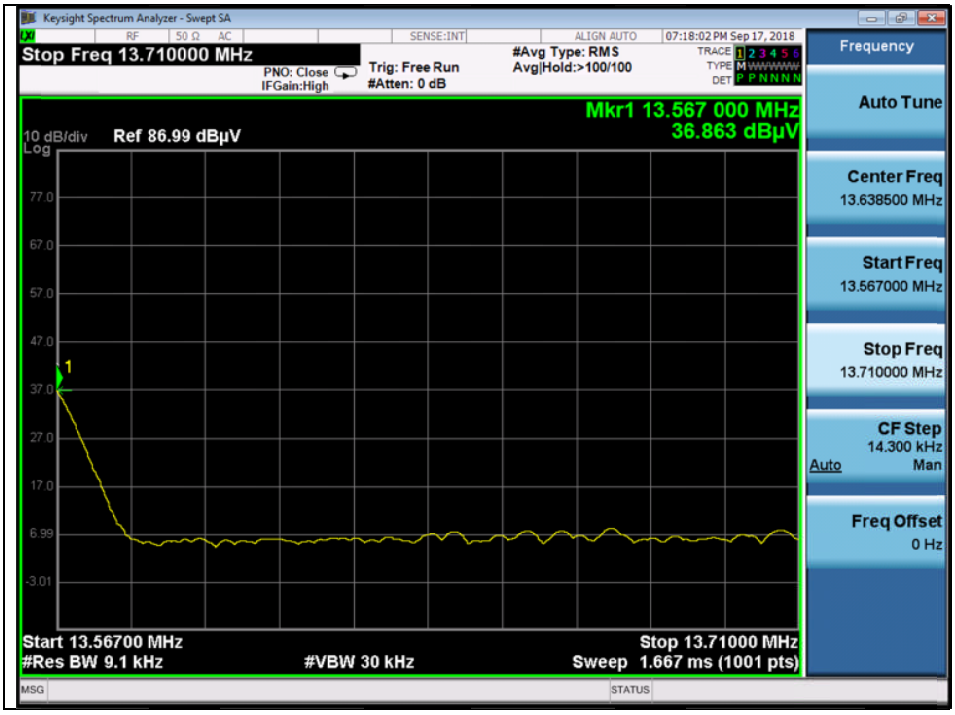
Plot

-Fundamental within the band 13.553 ㎒ - 13.567 ㎒

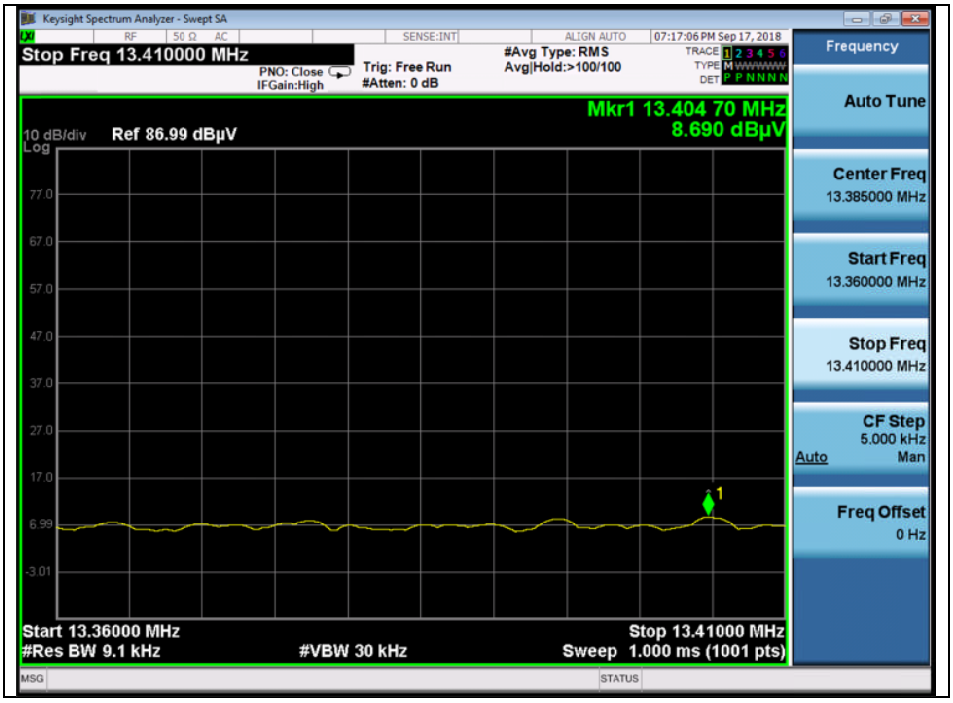


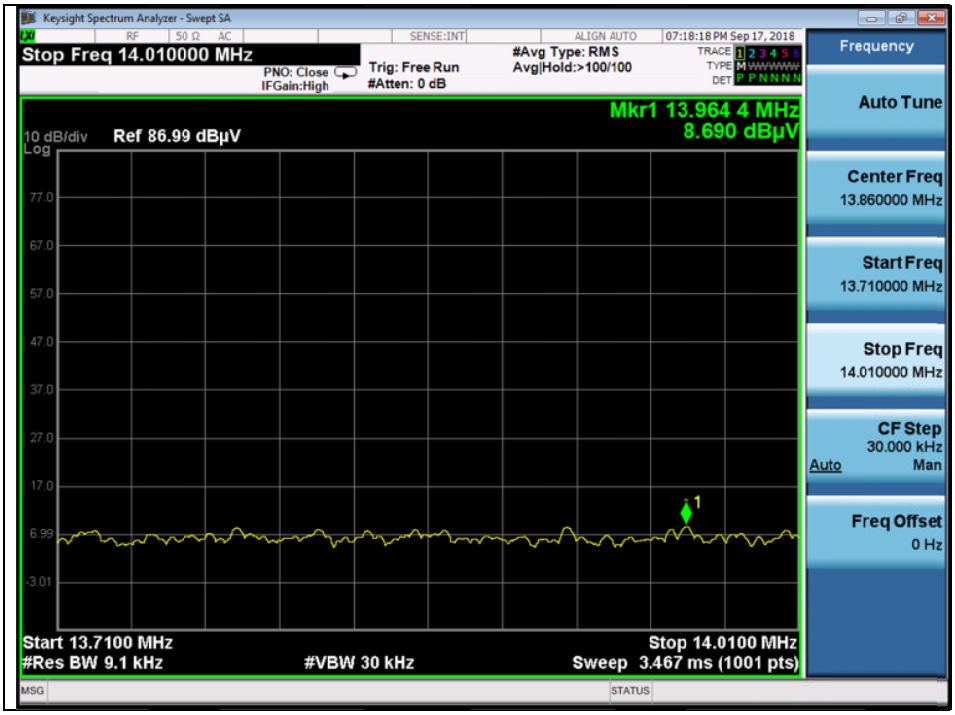
-Spurious emission within the bands 13.410 ㎒ - 13.553 ㎒ and 13.567 ㎒ - 13.710 ㎒



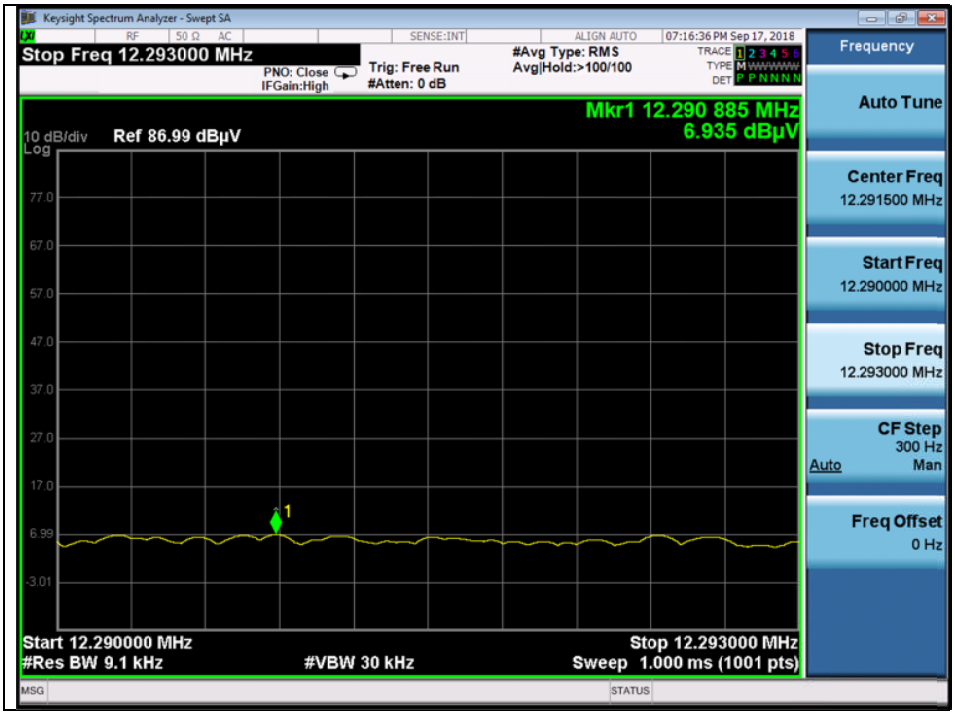


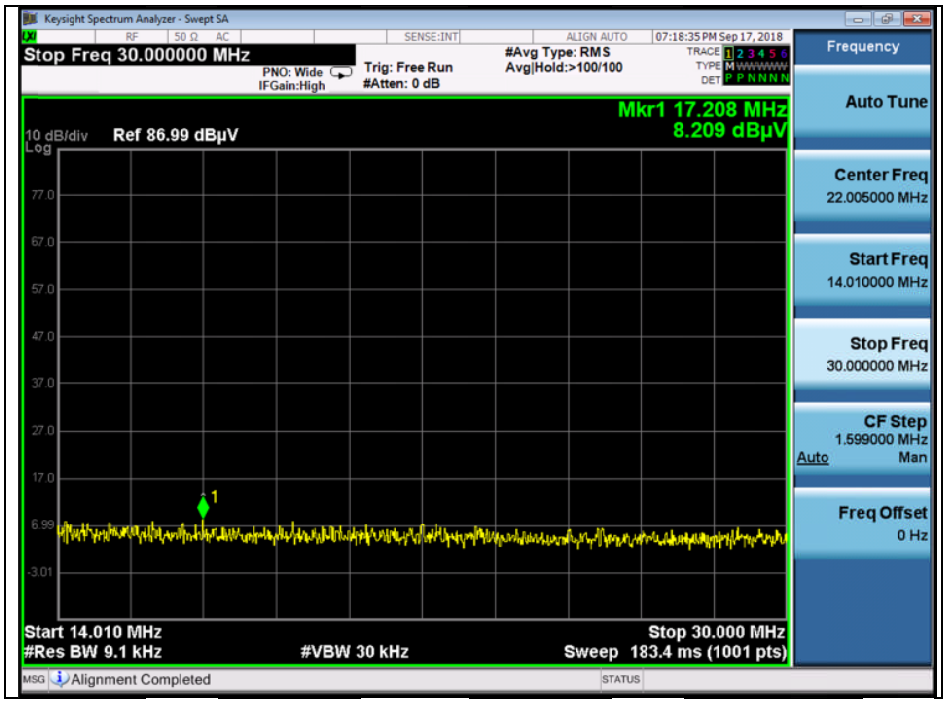
- Spurious emission within the bands 13.110 ㎒ - 13.410 ㎒ and 13.710 ㎒ - 14.010 ㎒





- Spurious emission within the bands 9 ㎑ - 13.110 ㎒ and 14.010 ㎒ - 30 ㎒





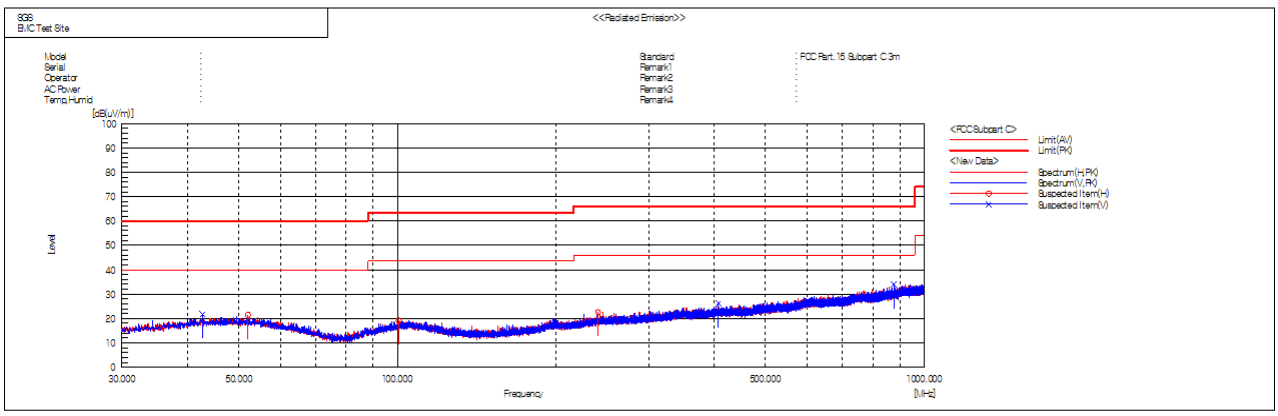
- Spurious emission above 30 ㎒

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Freq. (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss & Amp (dB)	Actual (dB㎶/m) at 3 m	Limit (dB㎶/m) at 3 m	Margin (dB)
42.69	34.20	Peak	V	13.98	-26.50	21.68	40.00	18.32
52.11	33.60	Peak	H	14.10	-26.42	21.28	40.00	18.72
876.65	35.20	Peak	V	21.87	-22.86	34.21	46.00	11.79
Above 900.00	Not detected	-	-	-	-	-	-	-

Remark;

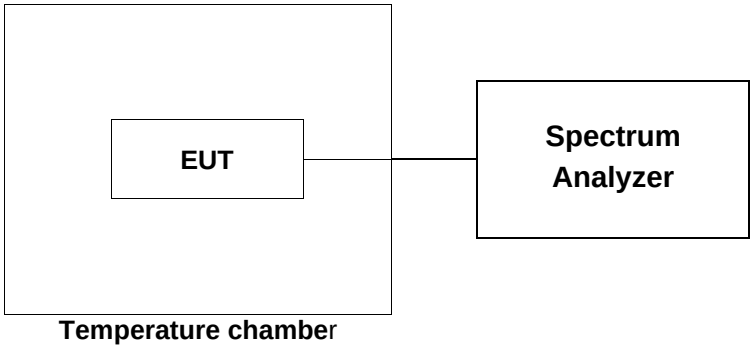
1. Radiated spurious emission measurement as below.
   (Actual = Reading + Antenna Factor + Amp + CL)
2. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

Test plot



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
Reference Voltage: DC 6.00 V
Deviation Limit : ± 0.01 % = ± 1 356 Hz

Startup

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
6.00	-20	13 560 080	80	0. 000 590
	-10	13 560 101	101	0. 000 745
	0	13 560 109	109	0. 000 804
	+10	13 560 101	101	0. 000 745
	+20	13 560 101	101	0. 000 745
	+30	13 560 094	94	0. 000 693
	+40	13 560 087	87	0. 000 642
	+50	13 560 080	80	0. 000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
115 % (6.90)	+20	13 560 101	101	0. 000 745
85 % (5.10)	+20	13 560 101	101	0. 000 745

2 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.00	-20	13 560 080	80	0. 000 590
	-10	13 560 101	101	0. 000 745
	0	13 560 109	109	0. 000 804
	+10	13 560 101	101	0. 000 745
	+20	13 560 094	94	0. 000 693
	+30	13 560 094	94	0. 000 693
	+40	13 560 087	87	0. 000 642
	+50	13 560 080	80	0. 000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 560 101	101	0. 000 745
85 % (5.10)	+20	13 560 101	101	0. 000 745

5 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.00	-20	13 560 080	80	0. 000 590
	-10	13 560 101	101	0. 000 745
	0	13 560 109	109	0. 000 804
	+10	13 560 101	101	0. 000 745
	+20	13 560 094	94	0. 000 693
	+30	13 560 094	94	0. 000 693
	+40	13 560 087	87	0. 000 642
	+50	13 560 080	80	0. 000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 560 101	101	0. 000 745
85 % (5.10)	+20	13 560 101	101	0. 000 745

10 minutes

Temperature Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.00	-20	13 560 080	80	0. 000 590
	-10	13 560 101	101	0. 000 745
	0	13 560 109	109	0. 000 804
	+10	13 560 101	101	0. 000 745
	+20	13 560 094	94	0. 000 693
	+30	13 560 094	94	0. 000 693
	+40	13 560 087	87	0. 000 642
	+50	13 560 080	80	0. 000 590

Voltage Variations

Power ($V_{d.c}$)	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.90)	+20	13 560 101	101	0. 000 745
85 % (5.10)	+20	13 560 101	101	0. 000 745

4. 20 ㏈ Bandwidth & Occupied Bandwidth

4.1. Test Setup

4.2. Limit

None; for reporting purposes only.

4.3. Test Procedures

4.3.1. 20 ㏈ Bandwidth

1. Span = set to capture all products of the modulation process, including the emission skirts. RBW = 200 ㎐, VBW = 200 ㎐, 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 ㏈ 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 ㏈ bandwidth of the emission.

4.3.2. Occupied Bandwidth

1. Set the spectrum analyzer as Span = set to capture all products of the modulation process, including the emission skirts, RBW = 200 ㎐, VBW = 200 ㎐, 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.

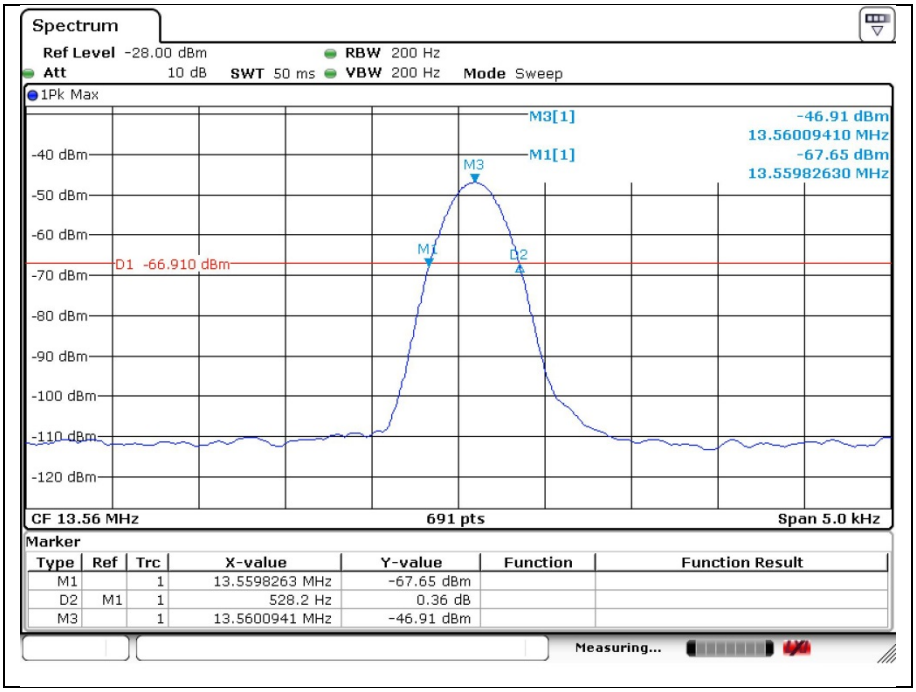
4.4. Test Result

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

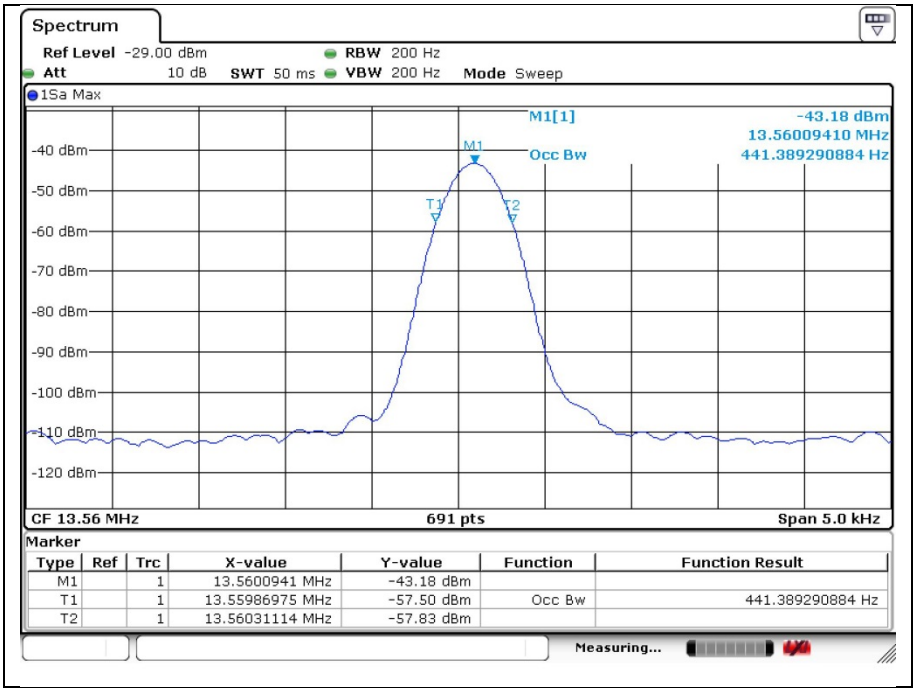
Frequency (㎒)	20 ㏈ Bandwidth (㎑)	Occupied Bandwidth (㎑)
13.560	0.528	0.441

- Test plots

20 dB Bandwidth



- Occupied Bandwidth



-End of the Test report-