TEST REPORT

of

FCC Part 15 Subpart C §15.225

FCC ID: 2AVPP-BTB-SN-100W

Equipment Under Test	:	Secure CARD A type
Model Name	:	BTB-SN-100W
Applicant	:	BTBL Co., Ltd.
Manufacturer	:	BTBL Co., Ltd.
Date of Receipt	:	2019.12.20
Date of Test(s)	:	2020.01.15 ~ 2020.01.28
Date of Issue	:	2020.02.12

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

Tested By: **Date:** **2020.02.12**

Jinhyoung Cho

Technical Manager: **Date:** **2020.02.12**

Jungmin Yang

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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
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1.2. Details of Applicant

Applicant : BTBL Co., Ltd.
Address : 117, Unjung-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea, 13461
Contact Person : Kim, James
Phone No. : +82 31 704 0333

1.3. Details of Manufacturer

Applicant : Sams as applicant
Address : Sams as applicant

1.4. Description of EUT

Kind of Product	Secure CARD A type
Model Name	BTB-SN-100W
Power Supply	DC 5.00 V
Frequency Range	13.56 ㎒ (NFC)
Modulation Technique	ASK
Number of Channels	1 channel
Antenna Type	Loop Coil Antenna

1.5. Declarations by The Manufacturer

When the EUT operates NFC mode, it is operated only co-located with support equipment.
For that reason, test was performed co-located with support equipment.

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1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMBV100A	259067	Jun. 10, 2019	Annual	Jun. 10, 2020
Spectrum Analyzer	R&S	FSV30	100768	Mar. 08, 2019	Annual	Mar. 08, 2020
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 11, 2019	Annual	Sep. 11, 2020
High Pass Filter	Mini circuits	NHP-25+	V9741901107-1	Dec. 04, 2019	Annual	Dec. 04, 2020
Temperature Chamber	ESPEC CORP.	PL-1J	15000793	Jun. 10, 2019	Annual	Jun. 10, 2020
Preamplifier	H.P.	8447F	2944A03909	Aug. 07, 2019	Annual	Aug. 07, 2020
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Test Receiver	R&S	ESU26	100109	Jan. 31, 2019	Annual	Jan. 31, 2020
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	Jan. 28, 2020	Semi-annual	Jul. 28, 2020
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jan. 28, 2020	Semi-annual	Jul. 28, 2020
Shield Room	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.

Note;

Test was performed before calibration.

1.7. Support Equipment

Description	Manufacturer	Model	FCC ID
Mobile phone	Samsung Electronics Co., Ltd.	SM-J415N	A3LSMJ415N

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1.8. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C		
Section	**Test Item**	**Result**
15.225(a)(b)(c)(d) 15.209	Radiated Emission, Spurious Emission and Field Strength of Fundamental	Complied
15.225(e)	Frequency Stability	Complied
15.215(c)	20 dB Bandwidth	Complied
15.207	AC Power Line Conducted Emissions	N/A[1)]

Note;

1) The AC power line test was not performed because the EUT does not operate while charging.

1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

1.9.1. Conducted Test

Offset value (dB) = Cable loss (dB)

1.9.2. Radiation Test

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

1.10. Measurement Uncertainty

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

Parameter	Uncertainty
20 dB Bandwidth	± 9.66 kHz
Radiated Disturbance, 9 kHz to 30 MHz	± 3.59 dB
Radiated Disturbance, below 1 GHz	± 5.88 dB

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

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1.11. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501/RF-RTL014697	2020.02.12	Initial

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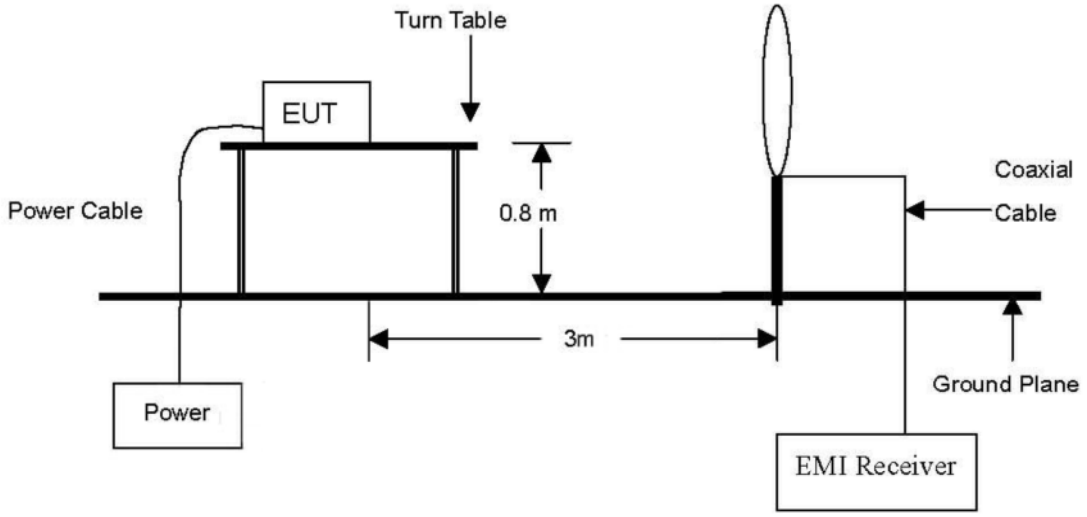
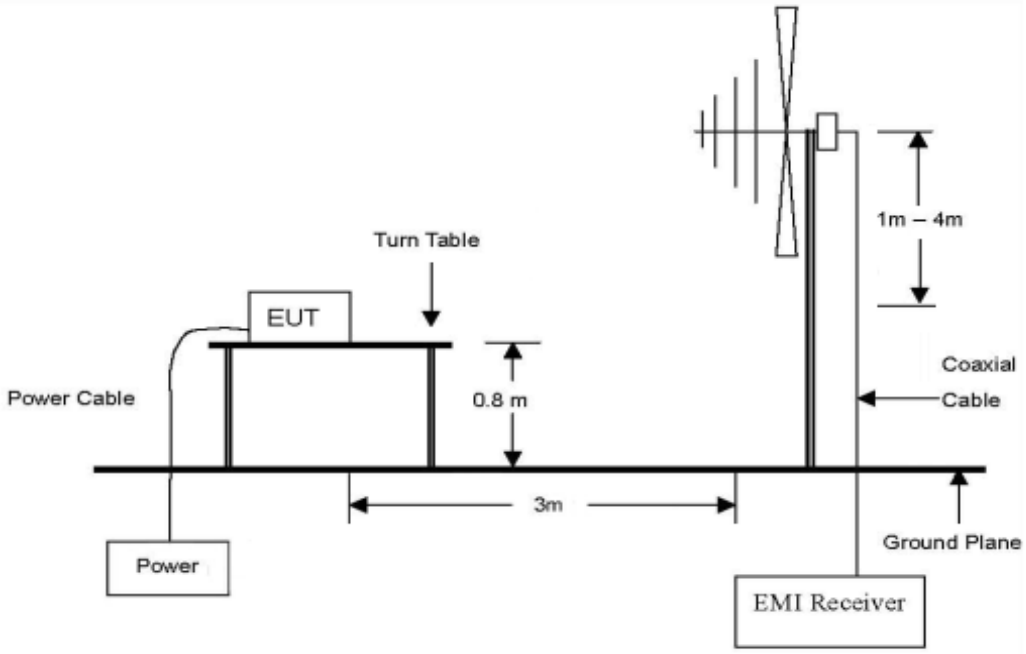
2. Radiated Emissions

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 300 ㎒ Emissions.



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2.2. Limit

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 (㎶/m)	Measurement Distance (Meters)
0.009-0.490	2 400/F(㎑)	300
0.490-1.705	24 000/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.

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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;

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.

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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 (dBμV)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m	Limit (dBμV/m) at 30 m	Margin (dB)
13.560	38.40	Peak	H	18.66	0.77	57.83	17.83	84.00	66.17

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

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m	Limit (dBμV/m) at 30 m	Margin (dB)
13.553	33.49	Peak	H	18.66	0.77	52.92	12.92	50.47	37.55
13.567	32.49	Peak	H	18.66	0.77	51.92	11.92	50.47	38.55

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

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 30 m	Limit (dBμV/m) at 30 m	Margin (dB)
13.347	20.10	Peak	H	18.67	0.76	39.53	-0.47	29.54	30.01
13.771	21.90	Peak	H	18.65	0.77	41.32	1.32	40.51	39.19

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- Spurious emission within the bands 9 ㎑ - 13.110 ㎒

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

Remark;

1. Fundamental limit (μV/m) = 20 log(15 848) = 84.00 dBμV/m.
2. Actual at 3 m = Reading + AF + CL.
3. Actual at 30 m = Actual at 3 m - 40 log(30/3).
4. "*" means the restricted band.
5. If the spurious emissions are in the restricted band, the limit complied with §15.209.
6. 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.

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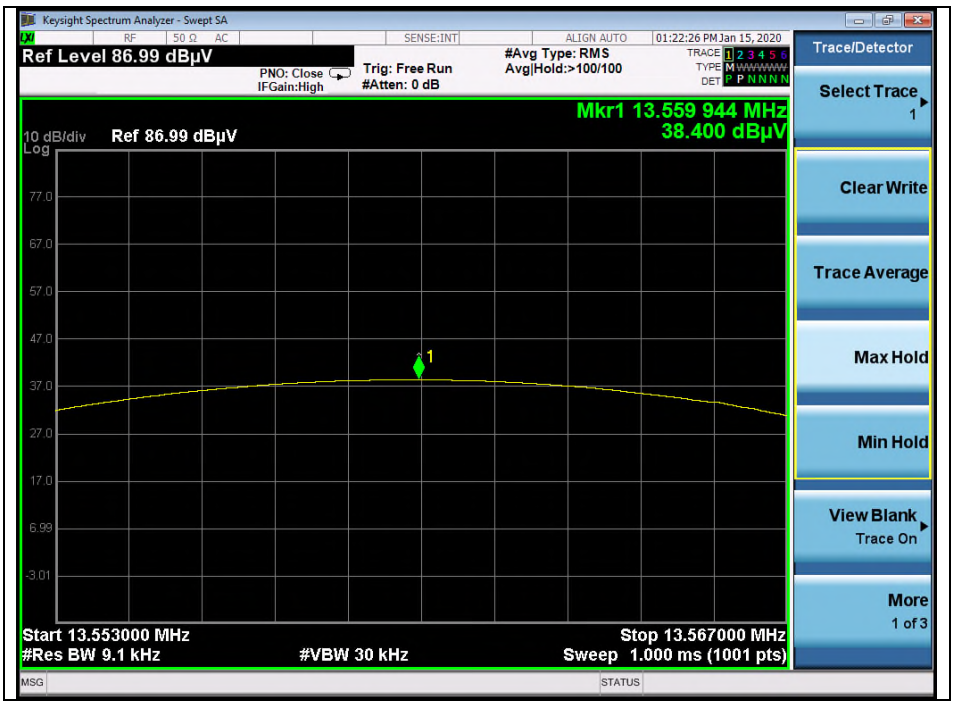
- Test plots

- Fundamental within the band 13.553 ㎒ - 13.567 ㎒



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

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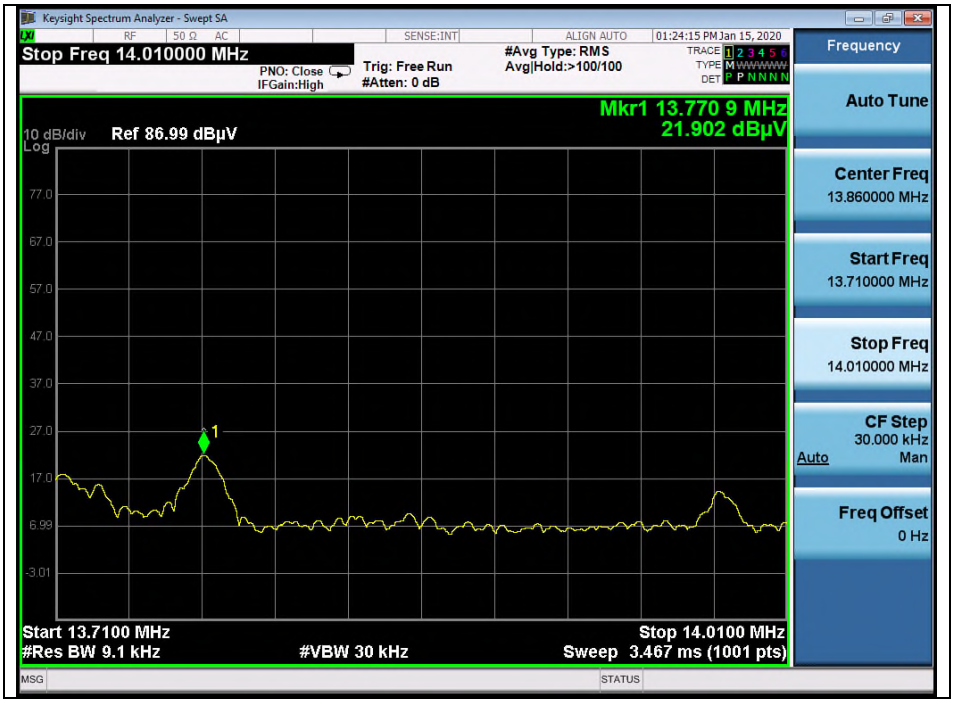
- Spurious emission within the bands 13.110 ㎒ - 13.410 ㎒ and 13.710 ㎒ - 14.010 ㎒



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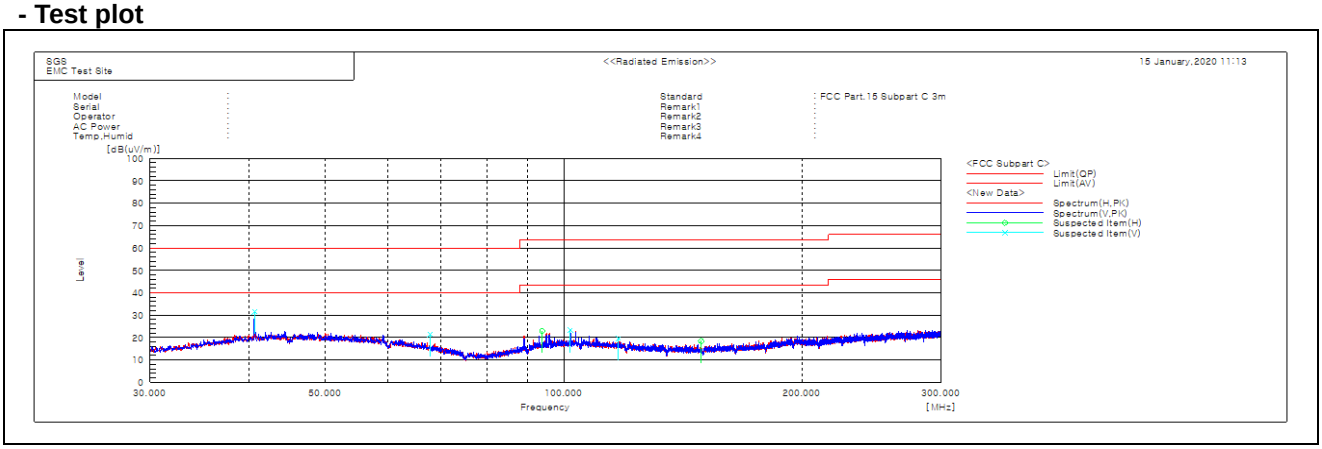
- Spurious emission above 30 ㎒

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m) at 3 m	Limit (dB㎶/m) at 3 m	Margin (dB)
40.68	38.10	Peak	V	20.10	-26.84	31.36	40.00	8.64
67.80	32.40	Peak	V	15.38	-26.20	21.58	40.00	18.42
101.90	32.20	Peak	V	17.09	-25.63	23.66	43.50	19.84
Above 200.00	Not detected	-	-	-	-	-	-	-

Remark;

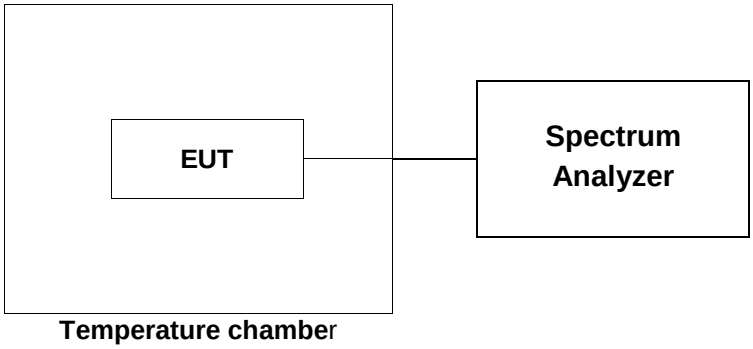
1. Radiated spurious emission measurement as below.
   (Actual = Reading + AF + AMP + CL)
2. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

- Test plot



3. Frequency Stability

3.1. Test Setup



3.2. Limit

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.

3.3. Test Procedures

The test follows section 6.8 Frequency stability tests of ANSI C63.10-2013.

Tests performed using section 6.8.1.

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.

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3.4. Test Result

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

Operating Frequency : 13 560 000 ㎐
Reference Voltage: Full charged battery
Deviation Limit : ± 0.01 % = ± 1 356 ㎐

Startup

Temperature Variations

Power	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
Full charged battery	-20	13 559 780	-220	-0.001 622
	-10	13 559 780	-220	-0.001 622
	0	13 559 770	-230	-0.001 696
	+10	13 559 730	-270	-0.001 991
	+20	13 559 730	-270	-0.001 991
	+30	13 559 720	-280	-0.002 065
	+40	13 559 720	-280	-0.002 065
	+50	13 559 700	-300	-0.002 212

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2 minutes

Temperature Variations

Power	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
Full charged battery	-20	13 559 770	-230	-0.001 696
	-10	13 559 760	-240	-0.001 770
	0	13 559 780	-220	-0.001 622
	+10	13 559 740	-260	-0.001 917
	+20	13 559 730	-270	-0.001 991
	+30	13 559 730	-270	-0.001 991
	+40	13 559 720	-280	-0.002 065
	+50	13 559 700	-300	-0.002 212

5 minutes

Temperature Variations

Power	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
Full charged battery	-20	13 559 750	-250	-0.001 844
	-10	13 559 780	-220	-0.001 622
	0	13 559 780	-220	-0.001 622
	+10	13 559 750	-250	-0.001 844
	+20	13 559 730	-270	-0.001 991
	+30	13 559 730	-270	-0.001 991
	+40	13 559 710	-290	-0.002 139
	+50	13 559 700	-300	-0.002 212

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10 minutes

Temperature Variations

Power	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
Full charged battery	-20	13 559 780	-220	-0.001 622
	-10	13 559 790	-210	-0.001 549
	0	13 559 780	-220	-0.001 622
	+10	13 559 760	-240	-0.001 770
	+20	13 559 730	-270	-0.001 991
	+30	13 559 730	-270	-0.001 991
	+40	13 559 710	-290	-0.002 139
	+50	13 559 690	-310	-0.002 286

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4. 20 ㎇ Bandwidth

4.1. Test Setup

4.2. Limit

None; for reporting purposes only.

4.3. Test Procedures

4.3.1. 20 ㎇ Bandwidth

The test follows ANSI C63.10-2013.

The 20 ㎇ bandwidth was measured with a spectrum analyzer connected to RF antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Use the following spectrum analyzer setting:

1. Span = approximately 2 to 5 times the 20 ㎇ bandwidth.
2. RBW ≥ 1 % to 5 % of the 20 ㎇ bandwidth.
3. VBW ≥ 3 x RBW
4. Sweep = auto
5. Detector = peak
6. Trace = max hold

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.

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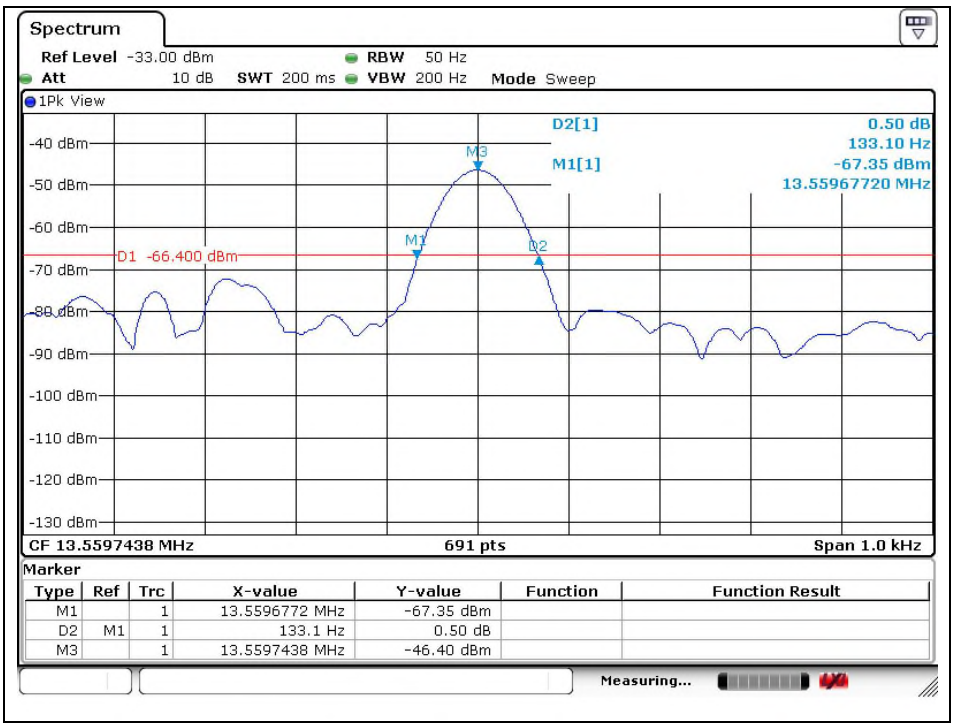
4.4. Test Result

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

Frequency (㎒)	20 ㏈ Bandwidth (㎑)
13.560	0.133

- Test plot



-End of the Test report-

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