TEST REPORT

of

FCC Part 15 Subpart C §15.225
RSS-210 Issue 9, RSS-Gen Issue 4

FCC ID: 2ABFGU4A-YRM600PB
IC Certification: 11626A-6982ANTMPB

Equipment Under Test	:	DIGITAL DOOR LOCK
Model Name	:	WGA10-PB(626)
Applicant	:	iRevo-ASSA ABLOY Korea
Manufacturer	:	iRevo-ASSA ABLOY Korea
Date of Receipt	:	2017.06.27
Date of Test(s)	:	2017.07.12 ~ 2017.07.21
Date of Issue	:	2018.02.12

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

Tested By: **Nancy Park** **Date:** **2018.02.12**

Technical Manager: **Harim Lee** **Date:** **2018.02.12**

INDEX

TABLE OF CONTENTS Page

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

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.

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, 08503, Korea
Contact Person : Jang, Soo-Kyung
Phone No. : +82 2 2107 5741

1.3. Description of EUT

Kind of Product	DIGITAL DOOR LOCK
Model Name	WGA10-PB(626)
Power Supply (EUT)	DC 6.0 V
Frequency Range	13.56 ㎒ (NFC)
Modulation Technique	ASK
Number of Channels	1 channel
Antenna Type	Internal type

1.4. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMBV100A	259067	Jun. 15, 2017	Annual	Jun. 15, 2018
Spectrum Analyzer	R&S	FSV30	100955	Mar. 20, 2017	Annual	Mar. 20, 2018
High Pass Filter	Mini circuits	NHP-25+	V9741901107	Jan. 21, 2017	Annual	Jan. 21, 2018
DC Power Supply	Agilent	U8002A	MY49030063	Nov. 29, 2016	Annual	Nov. 29, 2017
Temperature Chamber	ESPEC CORP.	PL-1J	15000793	Jun. 14, 2017	Annual	Jun. 14, 2018
Preamplifier	H.P.	8447F	2944A03909	Aug. 11, 2016	Annual	Aug. 11, 2017
Trilog Broadband Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	437	Oct. 21, 2016	Biennial	Oct. 21, 2018
Loop Antenna	SCHWARZBECK MESSELEKTRONIK	FMZB 1519	1519-039	Aug. 19, 2015	Biennial	Aug. 19, 2017
Test Receiver	R&S	ESU26	100109	Feb. 17, 2017	Annual	Feb. 17, 2018
Antenna Mast	Innco systems GmbH	MM4640-XP-ET	MA4640/536/ 38330516/L	N/A	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. 15, 2017	Semi-annual	Jan. 15, 2018
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 15, 2017	Semi-annual	Jan. 15, 2018
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 03/20	Mar. 10, 2017	Semi-annual	Sep. 10, 2017

1.5. 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 4			
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 6.6	20 dB Bandwidth & Occupied Bandwidth	Complied

1.6. Sample calculation

Where relevant, the following sample calculation is provided:

1.6.1. Conducted test

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

1.6.2. Radiation test

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

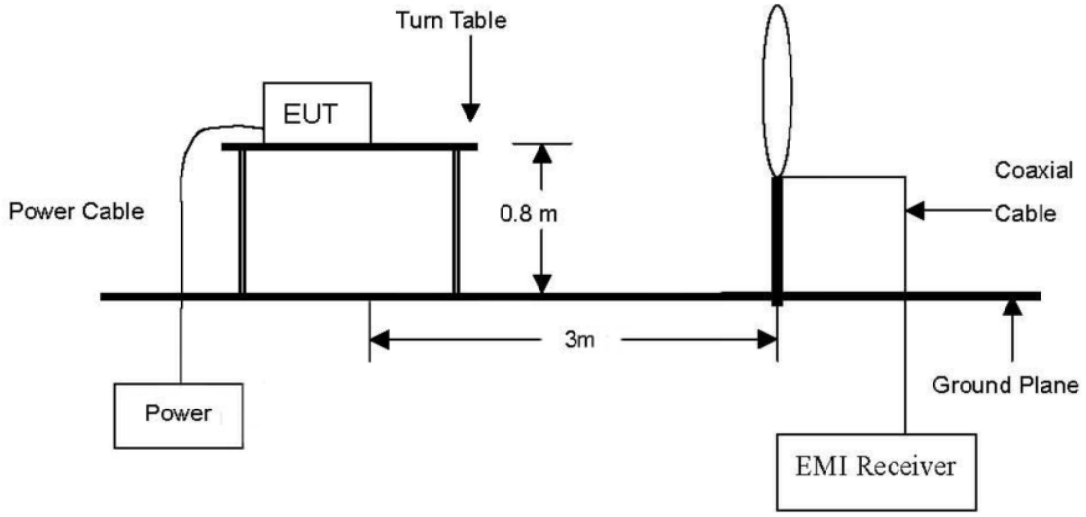
1.7. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL011662	2017.07.25	Initial
1	F690501/RF-RTL011662-1	2018.02.12	Added coaxial cable in the equipment list

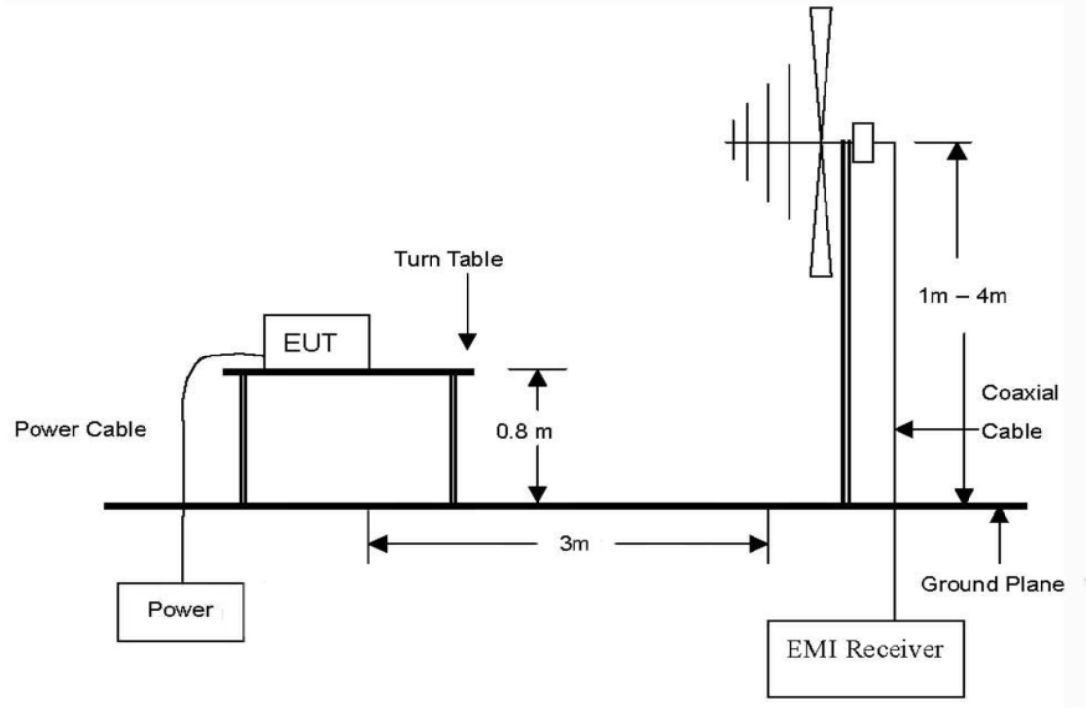
2. Radiated Emissions

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 ㎒ and 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., Sections 15.231 and 15.241

IC

According to RSS-210, Section 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, Section 8.9
Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below.
Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for License-Exempt Transmitters at Frequencies Above 30 ㎒

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

* Unless otherwise specified, for all frequencies greater than 1㎓, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 ㎒. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 ㏈ above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

Table 5 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 ㎒

Frequency	Electric Field Strength (㎶/m)	Magnetic Field Strength (H-Field) (㎂/m)	Measurement Distance (meters)
9-490 ㎑	2,400/F (F in ㎑)	2,400/377F (F in ㎑)	300
490-1,705 ㎑	24,000/ F (F in ㎑)	24,000/377F (F in ㎑)	30
1,705-30 ㎒	30	N/A	30

Note: The emission limits for the bands 9-90 ㎑ and 110-490 ㎑ are based on measurements employing a linear average detector. Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the relevant RSS.

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.

Note;
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788 D01 v01.

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;

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	
Freq. (㎒)	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	29.61	Quasi-Peak	H	18.67	0.40	48.68	8.68	84.00	75.32

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

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Freq. (㎒)	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	15.33	Quasi-Peak	H	18.67	0.40	34.40	-5.60	50.47	56.07
13.567	15.50	Quasi-Peak	H	18.67	0.40	34.57	-5.43	50.47	55.90

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

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Freq. (㎒)	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)
13.159	-0.10	Quasi-Peak	H	18.72	0.40	19.02	-20.98	40.51	61.49
*13.388	-0.20	Quasi-Peak	H	18.69	0.40	18.89	-21.11	29.54	50.65
13.863	-0.20	Quasi-Peak	H	18.64	0.40	18.84	-21.16	40.51	61.67

- Spurious emission within the bands 9 ㎑ – 13.110 ㎒

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Freq. (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 300 m	Limit (dB㎶/m) at 300 m	Margin (dB)
0.019	30.00	Average	H	19.99	0.01	50.00	-30.00	42.21	72.21

Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Freq. (㎒)	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)
*12.577	-0.10	Quasi-Peak	H	18.79	0.39	19.08	-20.92	29.54	50.46

- Spurious emission within the bands 14.010 ㎒ – 30 ㎒

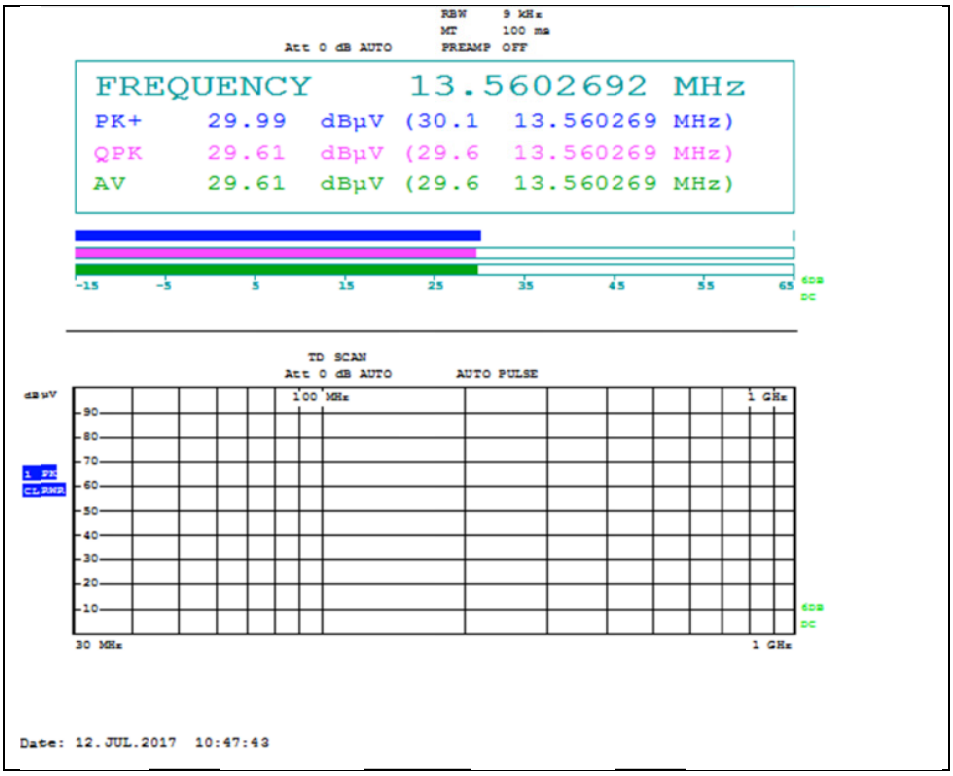
Radiated Emissions			Ant.	Correction Factors		Total		Limit	
Freq. (㎒)	Reading (dB㎶)	Detect Mode	Pol.	Ant. Factor (dB/m)	Cable loss (dB)	Actual (dB㎶/m) at 3 m	Actual (dB㎶/m) at 30 m	Limit (dB㎶/m) at 30 m	Margin (dB)
14.625	-0.40	Quasi-Peak	H	18.55	0.41	18.56	-21.44	29.54	50.98
*16.420	-0.60	Quasi-Peak	H	18.47	0.42	18.29	-21.71	29.54	51.25

Note:

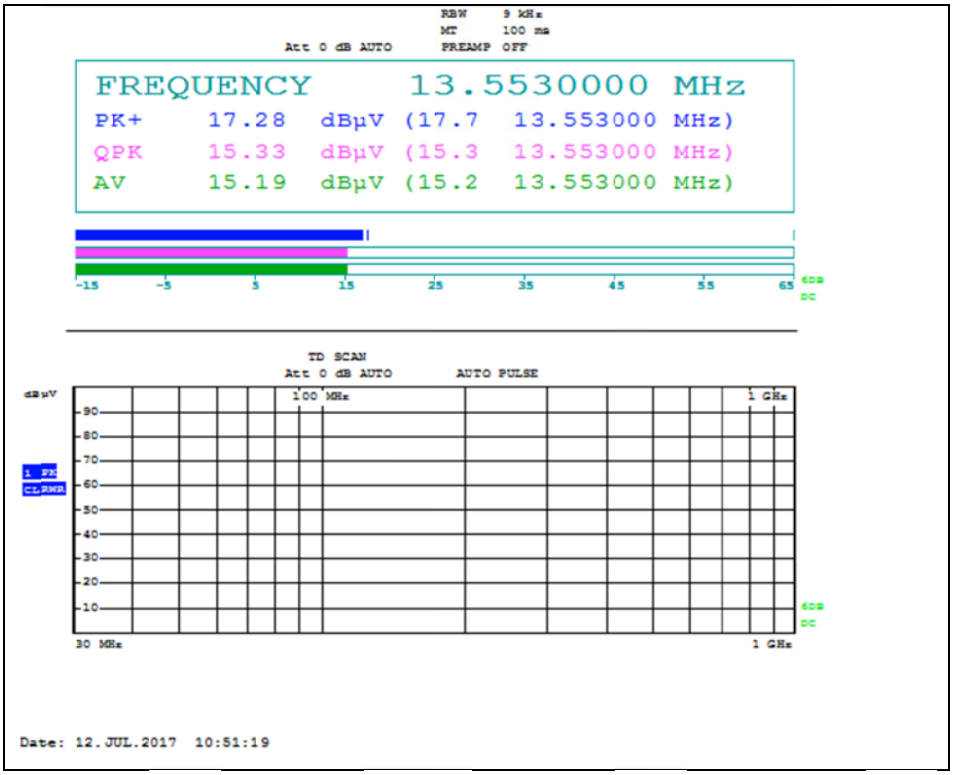
1. Fundamental limit (㎶/m) = 20 log (15 848) = 84.00 dB㎶/m.
2. 30 m distance compensation = 40 log (3/30) = -40 dB㎶/m.
3 300 m distance compensation = 40 log (3/300) = -80 dB㎶/m.
4. "*" means the restricted band.
5. If the spurious emissions are in the restricted band, the limit complied with §15.209.

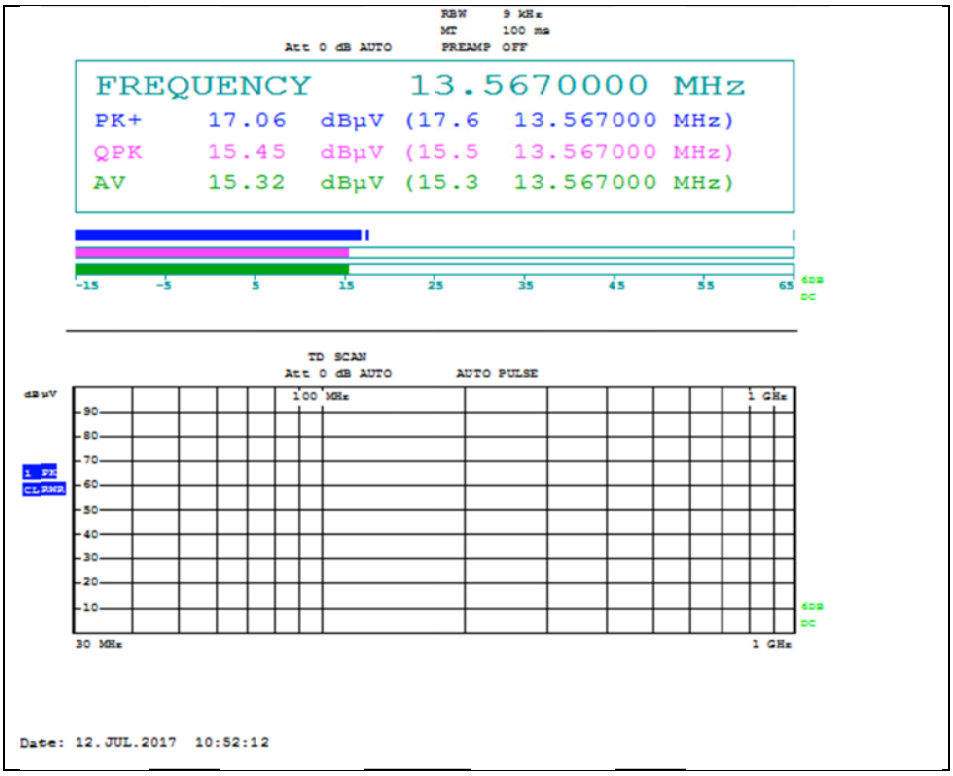
Plot

-Fundamental within the band 13.553 ㎒ – 13.567 ㎒

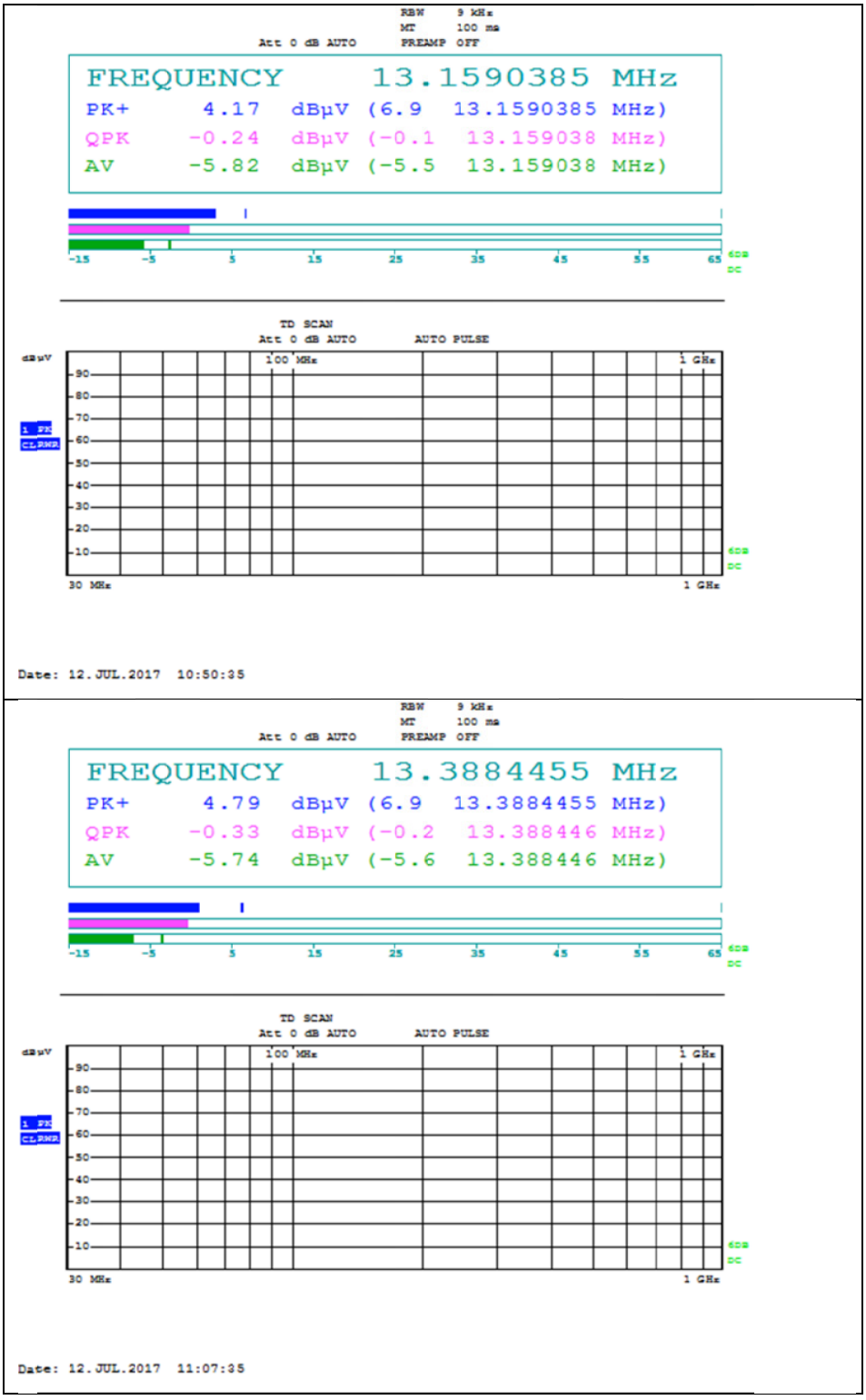


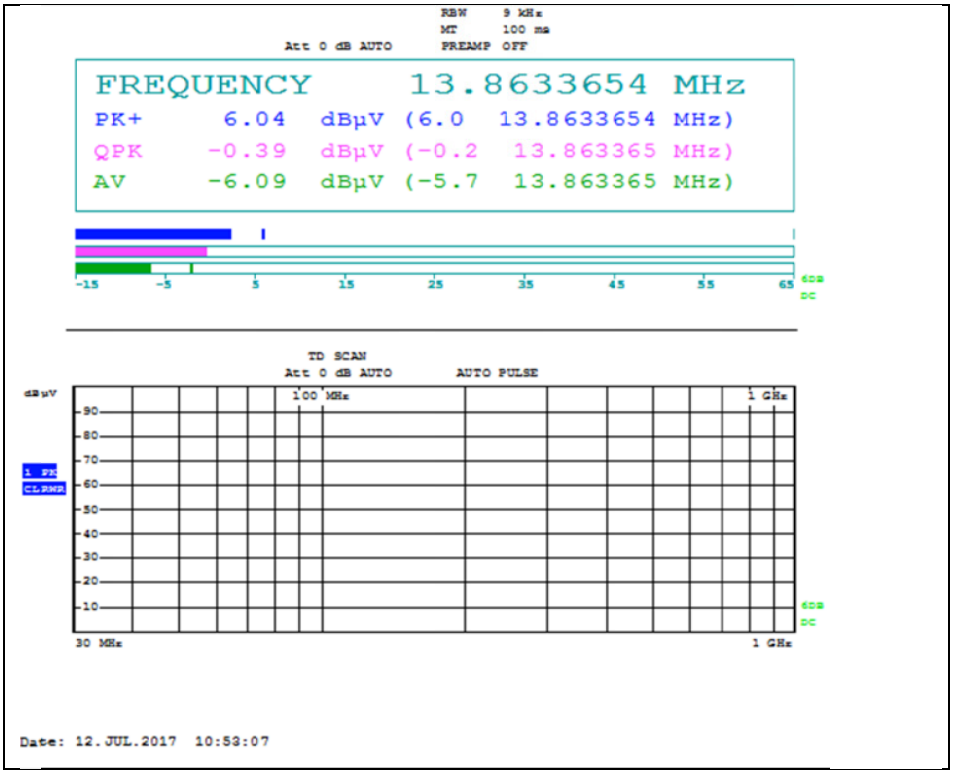
-Spurious emission within the bands 13.410 ㎒ – 13.553 ㎒ and 13.567 ㎒ – 13.710 ㎒



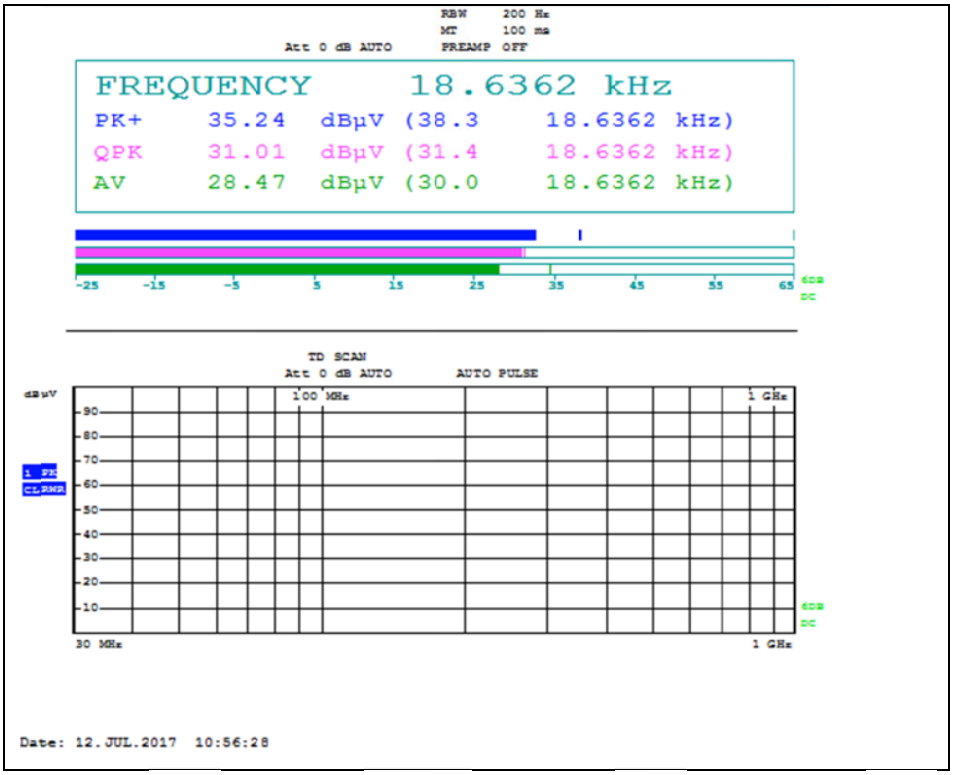


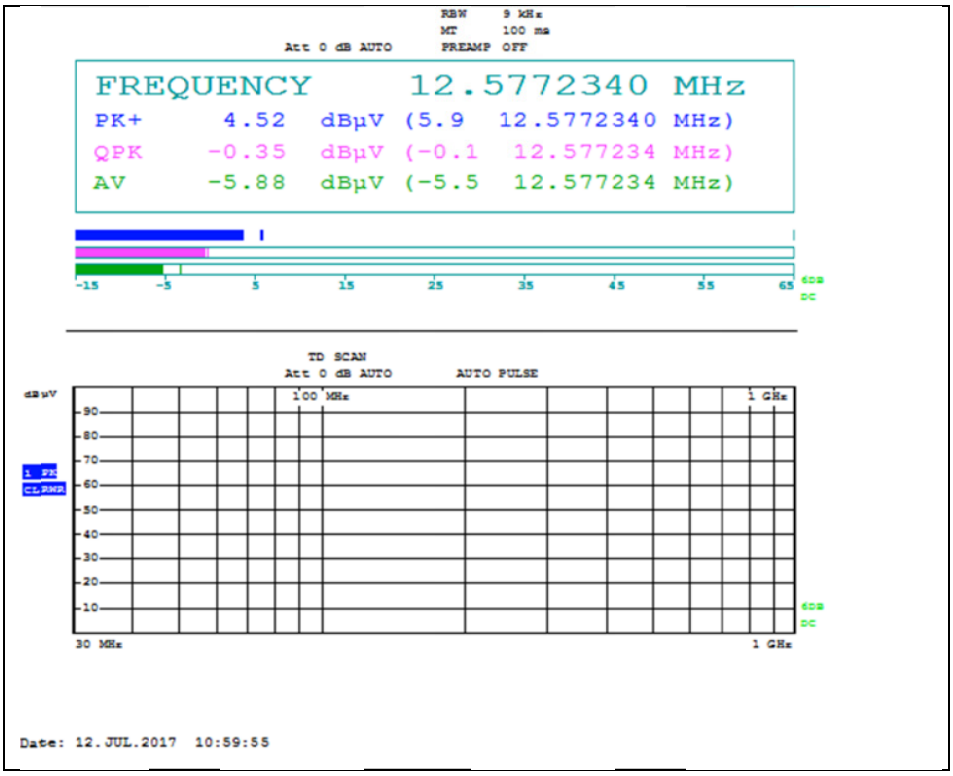
- Spurious emission within the bands 13.110 ㎒ – 13.410 ㎒ and 13.710 ㎒ – 14.010 ㎒



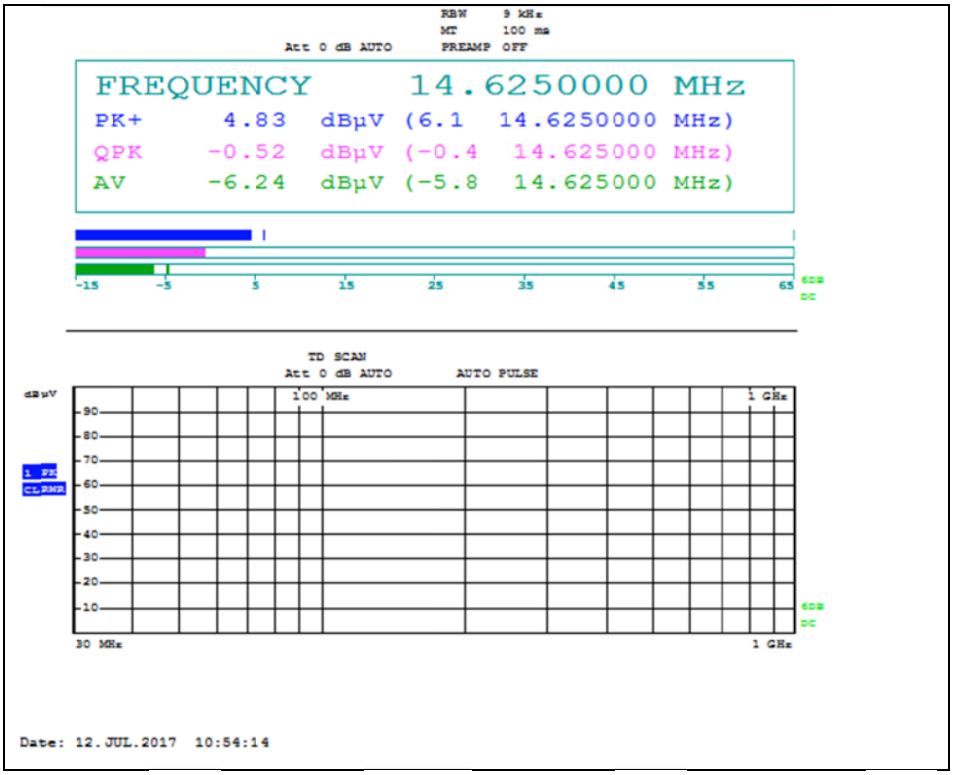


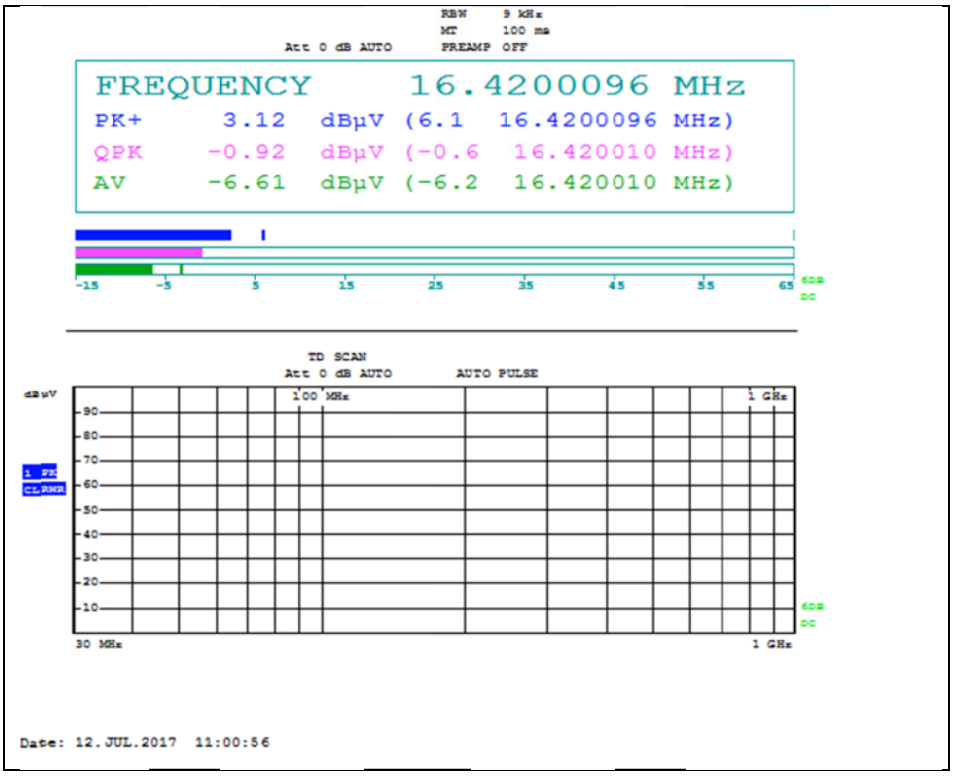
- Spurious emission within the bands 9 ㎑ – 13.110 ㎒





- Spurious emission within the bands 14.010 ㎒ – 30 ㎒





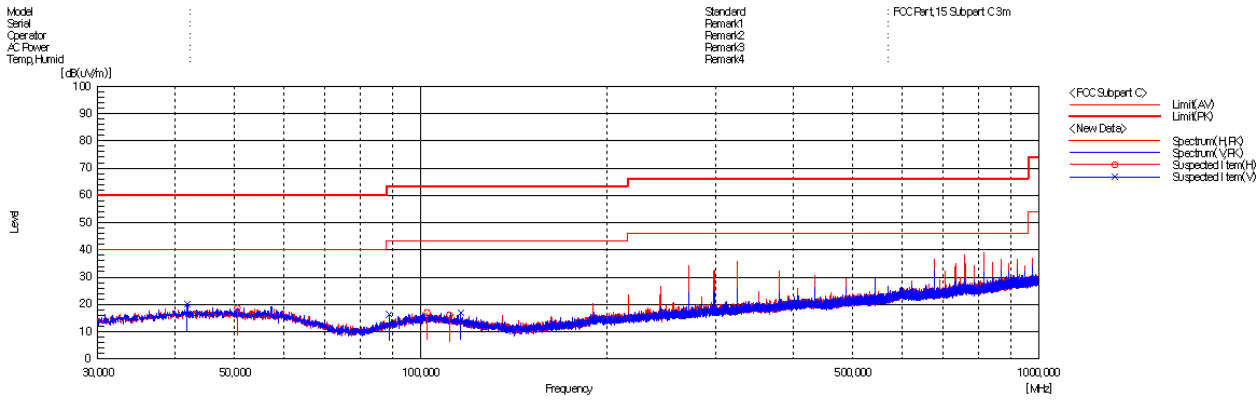
- Spurious emission above 30 ㎒

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)
41.92	32.90	Peak	V	14.15	-26.95	20.10	40.00	19.90
Above 100.00	Not Detected	-	-	-	-	-	-	-

Note:

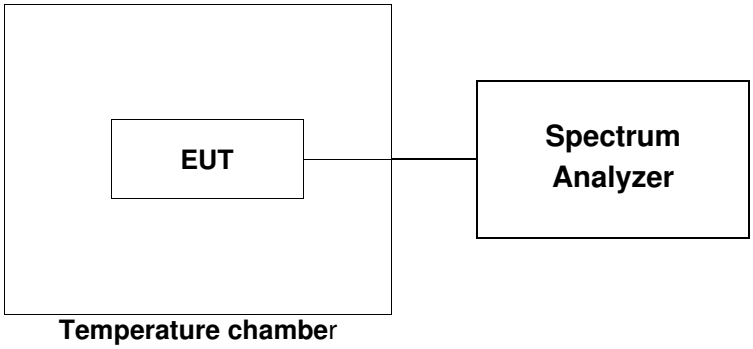
1. Radiated spurious emission measurement as below.
   (Actual = Reading + Antenna Factor + Amp + CL)
2. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

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 6.0 V
Deviation Limit : ± 0.01 % = ± 1 356 Hz

Startup

Temperature Variations

Power (V_{DC})	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
6.0	-30	13 560 080	80	0. 000 590
	-20	13 560 060	60	0. 000 442
	-10	13 560 090	90	0. 000 664
	0	13 560 090	90	0. 000 664
	+10	13 560 100	100	0. 000 737
	+20	13 560 060	60	0. 000 442
	+30	13 560 060	60	0. 000 442
	+40	13 560 050	50	0. 000 369
	+50	13 560 030	30	0. 000 221

Voltage Variations

Power (V_{DC})	Temperature (℃)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
115 % (6.9)	+20	13 560 040	40	0. 000 295
85 % (5.1)	+20	13 560 040	40	0. 000 295

2 minutes

Temperature Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.0	-30	13 560 080	80	0. 000 590
	-20	13 560 060	60	0. 000 442
	-10	13 560 090	90	0. 000 664
	0	13 560 090	90	0. 000 664
	+10	13 560 100	100	0. 000 737
	+20	13 560 060	60	0. 000 442
	+30	13 560 060	60	0. 000 442
	+40	13 560 050	50	0. 000 369
	+50	13 560 030	30	0. 000 221

Voltage Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.9)	+20	13 560 040	40	0. 000 295
85 % (5.1)	+20	13 560 040	40	0. 000 295

5 minutes

Temperature Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.0	-30	13 560 080	80	0. 000 590
	-20	13 560 060	60	0. 000 442
	-10	13 560 090	90	0. 000 664
	0	13 560 090	90	0. 000 664
	+10	13 560 100	100	0. 000 737
	+20	13 560 060	60	0. 000 442
	+30	13 560 060	60	0. 000 442
	+40	13 560 040	40	0. 000 295
	+50	13 560 030	30	0. 000 221

Voltage Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.9)	+20	13 560 040	40	0. 000 295
85 % (5.1)	+20	13 560 040	40	0. 000 295

10 minutes

Temperature Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
6.0	-30	13 560 090	90	0. 000 664
	-20	13 560 050	50	0. 000 369
	-10	13 560 090	90	0. 000 664
	0	13 560 090	90	0. 000 664
	+10	13 560 090	90	0. 000 664
	+20	13 560 060	60	0. 000 442
	+30	13 560 060	60	0. 000 442
	+40	13 560 040	40	0. 000 295
	+50	13 560 030	30	0. 000 221

Voltage Variations

Power (V_{DC})	Temperature (℃)	Frequency (㎐)	Freq. Dev. (㎐)	Deviation (%)
115 % (6.9)	+20	13 560 040	40	0. 000 295
85 % (5.1)	+20	13 560 040	40	0. 000 295

4. 20 dB Bandwidth & Occupied Bandwidth

4.1. Test Setup

4.2. Limit

None ; for reporting purposes only.

4.3. Test Procedures

4.3.1. 20 dB Bandwidth

The test follows DA 00-705.
The 20 dB 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 :

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.
RBW ≥ 1 % of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector = peak
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 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.

4.3.2. Occupied Bandwidth

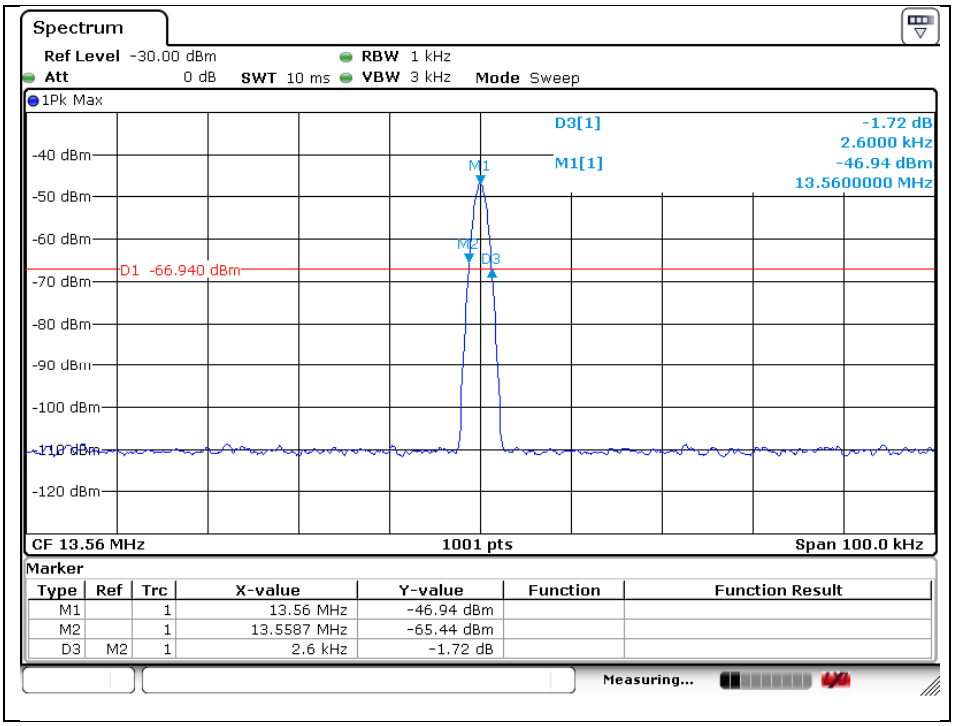
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW. Detector = sampling, Trace mode = max hold.
The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency).
This frequency is then recorded.

4.4. Test Result

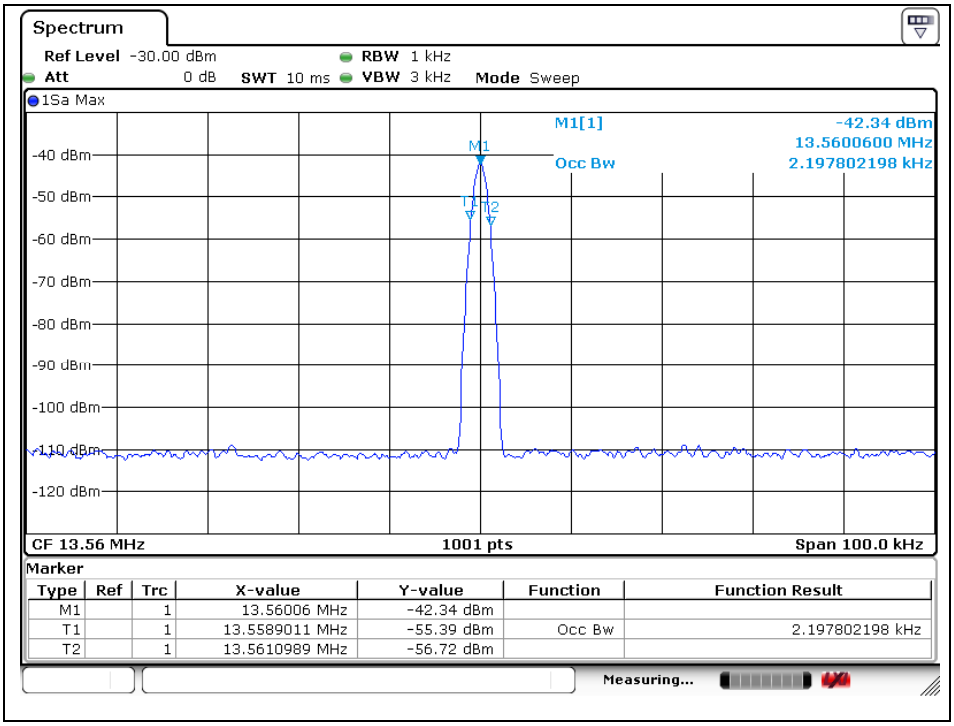
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Frequency (㎒)	20 ㏈ Bandwidth (㎑)	Occupied Bandwidth (㎑)
13.560	2.600	2.198

- 20 ㏈ Bandwidth



- Occupied Bandwidth



-End of the Test report-