

TEST REPORT



DT&C Co., Ltd.

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Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1712-0263(1)
2. Customer
 - Name : GARIN SYSTEM INC.
 - Address : 403, Nongogae-ro, Namdong-gu, Incheon, South Korea
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : FOB KEY / SMART KEY-HD1
FCC ID : 2AOBG-SMARTKEY-HD1
5. Test Method Used : ANSI C63.10-2013
Test Specification : FCC Part 15.231
6. Date of Test : 2017.08.16 ~ 2017.08.23, 2017.12.11 ~ 2017.12.12
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : JungWoo Kim	Technical Manager Name : GeunKi Son	 (Signature)
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The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2017 . 12 . 12 .

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If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1712-0263	Dec. 06, 2017	Initial issue
DRTFCC1712-0263(1)	Dec. 12, 2017	Revised the section 3.2.3 and appendix

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1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The site is constructed in conformance with the requirements.

- FCC MRA Accredited Test Firm No. : KR0034

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1.2. Testing Environment

Ambient Condition

▪ Temperature	22 ~ 24 °C
▪ Relative Humidity	46 % ~ 47 %

1.3. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, $k = 2$)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, $k = 2$)

1.4. Description of EUT

FCC Equipment Class	Part 15 Security/Remote Control Transmitter
EUT	FOB KEY
Model Name	SMART KEY-HD1
Hardware version	V1.1
Software version	HF-V3.0
Power Supply	DC 3 V(Battery)
Frequency Band	433.98 MHz
Modulation Type	FSK
Antenna type	PCB Pattern Antenna

2. Information about test items

2.1 Operating mode

Operating Mode	This device was tested with continuous TX mode for field strength of fundamental and spurious emissions measurements.
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2.2 Tested frequency

Mode	Frequency(MHz)
Transmitting mode	433.98
-	-

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status <small>Note 1</small>
I. Test Items			
15.231(b)	Field strength of fundamental and spurious emissions	Radiated	C
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		C
15.231(a)	Automatically deactivate	Conducted	C
15.231(c)	20dB bandwidth		C
15.207	AC Power Line Conducted Emission	AC Line Conducted	NA <small>Note 2</small>
15.203	Antenna Requirements	-	C
 Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: This device is used Battery for power supplying. Therefore this test item was not performed.			

The sample was tested according to the following specification:

ANSI C-63.10-2013

3.2 Transmitter requirements

3.2.1 20dB bandwidth

- Procedure:

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **ANIS 63.10-2013**.

RBW: 1% to 5% of the OBW

VBW: Approximately three times the RBW

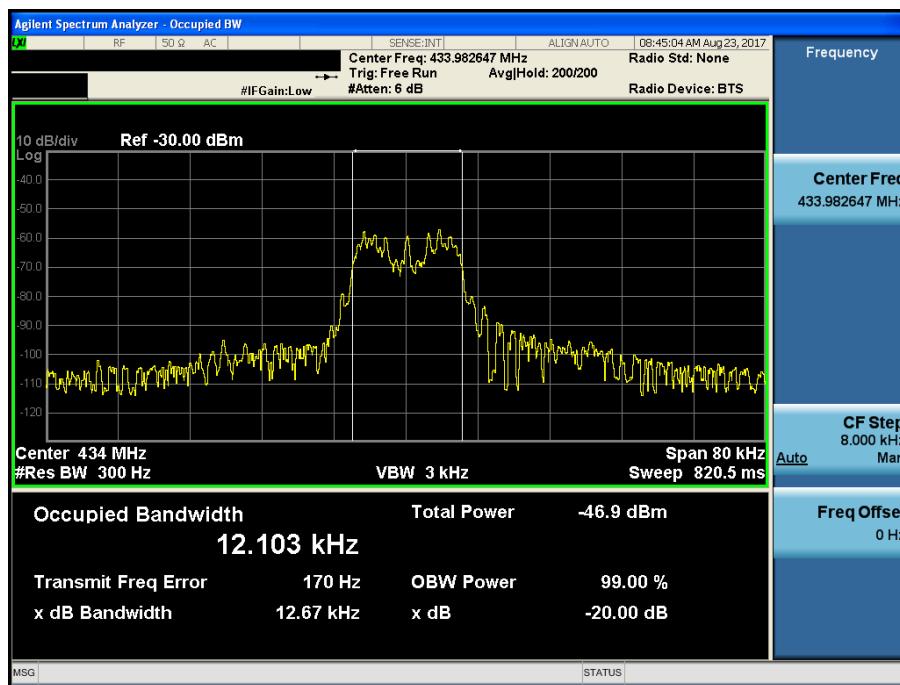
Detector: Peak

Trace: Max hold

Sweep: Auto couple

- Measurement Data: Comply

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
433.98	12.67	1084.95

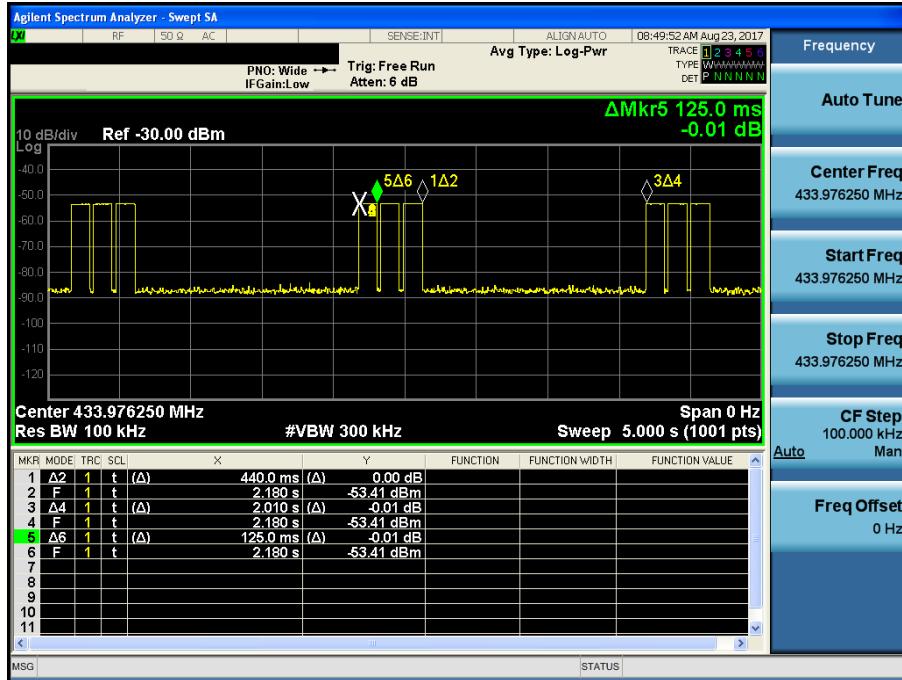


- Limit: § 15.209(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

3.2.3 Automatically deactivate

- Measurement Data:



One operation time (s)	Limit (s)
0.440	5

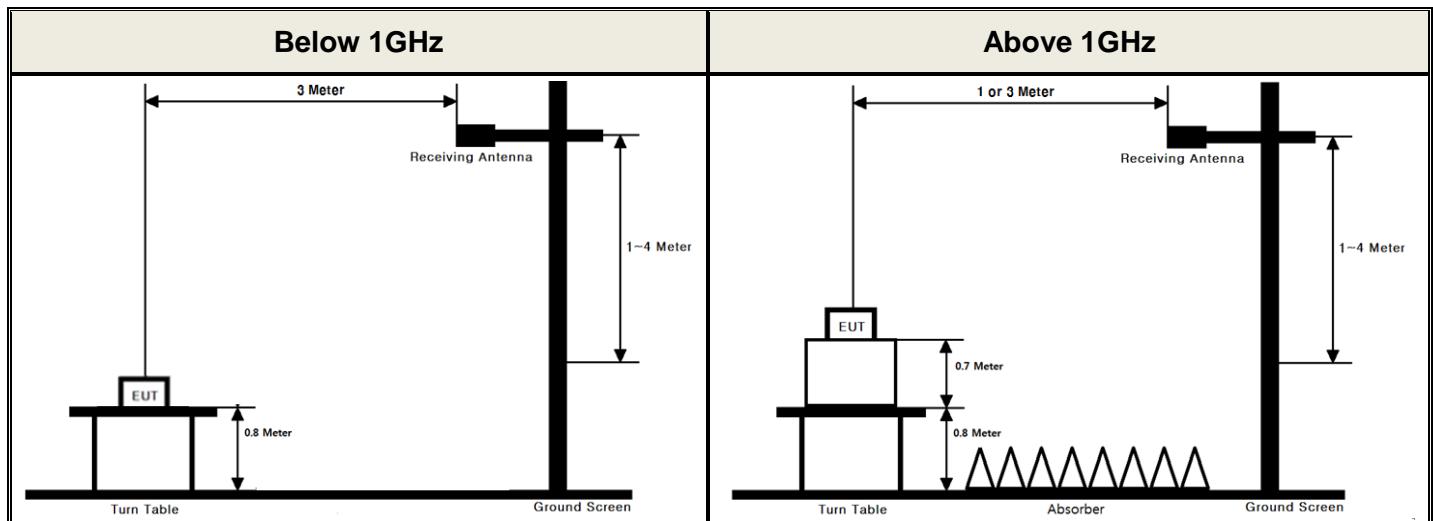
- Limit: § 15.231(a)

(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

- (1) **A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.**
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
- (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition
- (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

3.2.3 Field strength of fundamental and spurious emissions

- Test set up diagrams:



- Procedure:

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

- Limit:

§ 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

§ 15.209(a), 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 [MHz]	Field Strength of Fundamental Frequency [uV/m]	Measurement Distance [m]
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

§ 15.231(b), In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Field Strength of Spurious Emissions [uV/m]
40.66 ~ 40.70	2,250	225
70 ~ 130	1,250	125
130 ~ 174	¹ 1,250 to 3,750	¹ 125 to 375
174 ~ 260	3,750	375
260 ~ 470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹Linear interpolations

- Measurement Data: Refer to next page

- Measurement Data: **Comply**

Field strength of fundamental

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	D.C.F [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
Z	433.980	PK	V	87.80	-11.00	-	76.80	100.80	24.00
Z	433.976	QP	V	78.60	-11.00	-	67.60	80.80	13.20

Note 1. Sample calculation

$$T.F = AF + CL - AG$$

$$/ \quad \text{Field Strength} = \text{Reading} + T.F + D.C.F$$

Margin = Limit – Field Strength

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

D.C.F. = Duty Correction Factor

Field strength of spurious emissions

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	D.C.F [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
Y	1301.848	PK	V	56.28	-2.30	-	53.98	74.00	20.02
Y	1302.005	AV	V	53.94	-2.30	-	51.64	54.00	2.36
X	1735.602	PK	H	47.51	-1.22	-	46.29	74.00	27.71
X	1736.023	AV	H	39.30	-1.22	-	38.08	54.00	15.92
Z	2169.735	PK	H	50.67	0.51	-	51.18	74.00	22.82
Z	2169.878	AV	H	46.16	0.51	-	46.67	54.00	7.33
Y	2604.097	PK	V	46.71	1.61	-	48.32	74.00	25.68
Y	2603.970	AV	V	37.85	1.61	-	39.46	54.00	14.54
Y	3038.017	PK	H	49.02	1.39	-	50.41	74.00	23.59
Y	3037.848	AV	H	41.69	1.39	-	43.08	54.00	10.92
Y	3906.013	PK	H	49.77	2.59	-	52.36	74.00	21.64
Y	3905.910	AV	H	44.62	2.59	-	47.21	54.00	6.79

Note 1. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 2. Sample calculation

$$T.F = AF + CL - AG$$

$$/ \quad \text{Field Strength} = \text{Reading} + T.F + D.C.F$$

Margin = Limit – Field Strength

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

D.C.F. = Duty Correction Factor

3.2.4 AC power line conducted emission

- Procedure:

1. The test procedure is performed in a 6.5 m x 3.5 m x 3.5 m (L x W x H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) x 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Measurement Data: NA**- Limit:**

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

3.2.5 Antenna requirement

- Procedure:

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

- Measurement Data: Comply

The antenna is printed to the internal PCB (Refer to Internal Photo file.)
Therefore this E.U.T Complies with the requirement of §15.203.

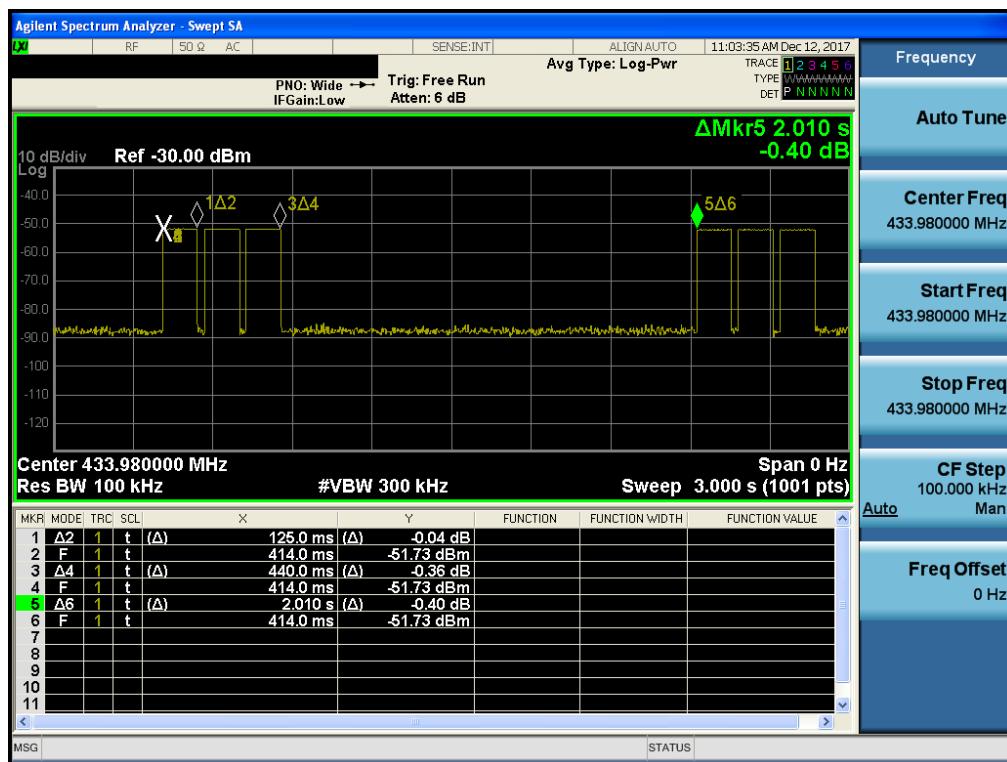
- Limit: § 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

APPENDIX I**TEST EQUIPMENT FOR TESTS**

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	16/10/11	17/10/11	MY46471251
			17/09/05	18/09/05	
EMI Test Receiver	Rohde Schwarz	ESR7	17/02/16	18/02/16	101061
Spectrum Analyzer	Agilent Technologies	N9020A	16/09/09	17/09/09	MY50200834
			17/09/06	18/09/06	
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	16/11/11	18/11/13	3151
Horn Antenna	ETS-LINDGREN	3117	16/05/03	18/05/03	00140394
PreAmplifier	TSJ	MLA-010K01-B01-27	17/03/06	18/03/06	1844539
Signal Generator	Rohde Schwarz	SMBV100A	17/01/04	18/01/04	255571
DC power supply	Agilent Technologies	66332A	16/09/08	17/09/08	US37473422
			17/09/05	18/09/05	
Multimeter	FLUKE	17B	17/04/12	18/04/12	26030065WS
Thermohygrometer	BODYCOM	BJ5478	17/01/11	18/01/11	1209
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	16/09/09	17/09/09	7
			17/09/05	18/09/05	
High-pass filter	Anristu	MP526D	16/09/09	17/09/09	M27756
			17/09/05	18/09/05	

APPENDIX II



Duty cycle

Pulse width	125 ms
Number of pulse	3
Transmission on time	125 x 3 = 375 ms
Transmission on+off time	2.01S
Duty cycle	18.66%

APPENDIX III

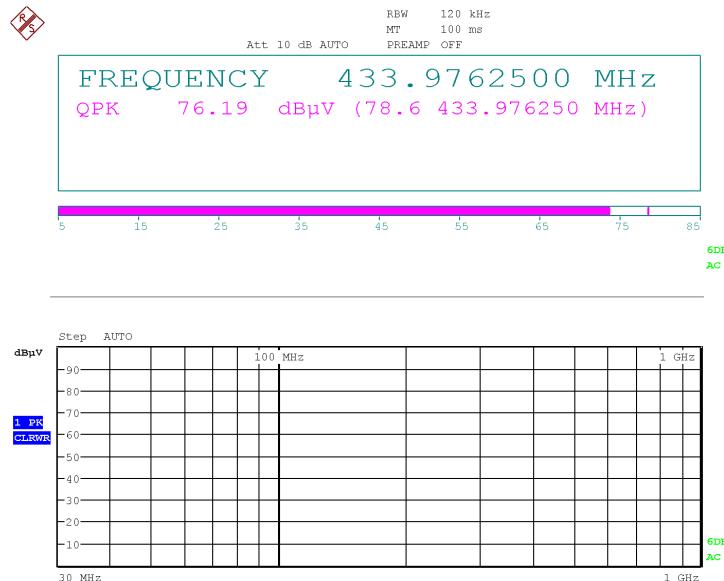
Worst data plot of radiated test

Note: The offset was not include in test plot(Reading value). The results refer to the section 3.2.3.

Field strength of fundamental

Z axis & Ver

Detector Mode : QP



Date: 20.AUG.2017 21:10:36

Spurious emission

Y axis & Ver

Detector Mode : AV

