

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1707-0128

2. Customer

• Name : SEGI LIMITED

• Address : UNIT S, 3-F, HARIBEST INDUSTRIAL BUILDING, 45-47, AU PUI WAN STREET,
SHATIN, NT HONGKONG China

3. Use of Report : FCC & IC Original Grant

4. Product Name / Model Name : Keyless Entry System / ANT-2WFMX

FCC ID / IC : VA5JA1000-2WFX / 7087A-2WA1000FX



5. Test Method Used : ANSI C63.10-2013

Test Specification : FCC Part 15.231
RSS-210 Issue 9

6. Date of Test : 2017.06.26 ~ 2017.07.03

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Technical Manager
	Name : Jaejin Lee  (Signature)	Name : Geunki Son  (Signature)

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2017 . 07 . 18 .

DT&C Co., Ltd.

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

Test Report Version

Test Report No.	Date	Description
DRTFCC1707-0128	Jul. 18, 2017	Initial issue

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1. General Information

1.1. Testing Laboratory

DT&C Co., Ltd.		
Standard	Site number	Address
FCC	<input checked="" type="checkbox"/> 165783	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 804488	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 596748	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 678747	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
IC	<input checked="" type="checkbox"/> 5740A-3	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/> 5740A-2	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.2. Testing Environment

Ambient Condition	
▪ Temperature	+24 °C
▪ Relative Humidity	40 %

1.3. Measurement Uncertainty

Test items	Measurement uncertainty
AC conducted emission	2.4 dB (The confidence level is about 95 %, k = 2)
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	Keyless Entry System
Model Name	ANT-2WFMX
Hardware version	1.0
Software version	1.0
Power Supply	DC 12 V
Frequency Band	433.92 MHz
Modulation Type	FSK
Antenna type	Helical Antenna

2. Information about test items

2.1 Operating mode

Operating Mode 1	This device was tested with continuous TX mode for field strength of fundamental and spurious emissions measurements.
Operating Mode 2	Normal operating mode was used for 20 dB BW and less than 5 second requirements.

2.2 Tested frequency

Mode	Frequency(MHz)
Transmitting mode	433.92
-	-

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)	RSS section(s)	Parameter	Test Condition	Status Note 1
I. Test Items				
15.231(b)	RSS-210[A1.2]	Field strength of fundamental and spurious emissions	Radiated	C
15.205 15.209	RSS-GEN [8.9] RSS-GEN [8.10]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		C
15.231(a)	RSS-210[A1.1]	Automatically deactivate	Conducted	C
15.231(c)	-	20dB bandwidth		C
-	RSS-210[A1.3]	Occupied bandwidth		C
15.207	RSS-Gen[8.8]	AC Power Line Conducted Emission	AC Line Conducted	NA ^{Note 2}
15.203	-	Antenna Requirements	-	C
Note 1: C =Comply NC =Not Comply NT =Not Tested NA =Not Applicable Note 2: This device is installed in a car. Therefore the power source is a battery of car.				

The sample was tested according to the following specification:
ANSI C-63.10-2013

3.2 Transmitter requirements

3.2.1 20dB & Occupied 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

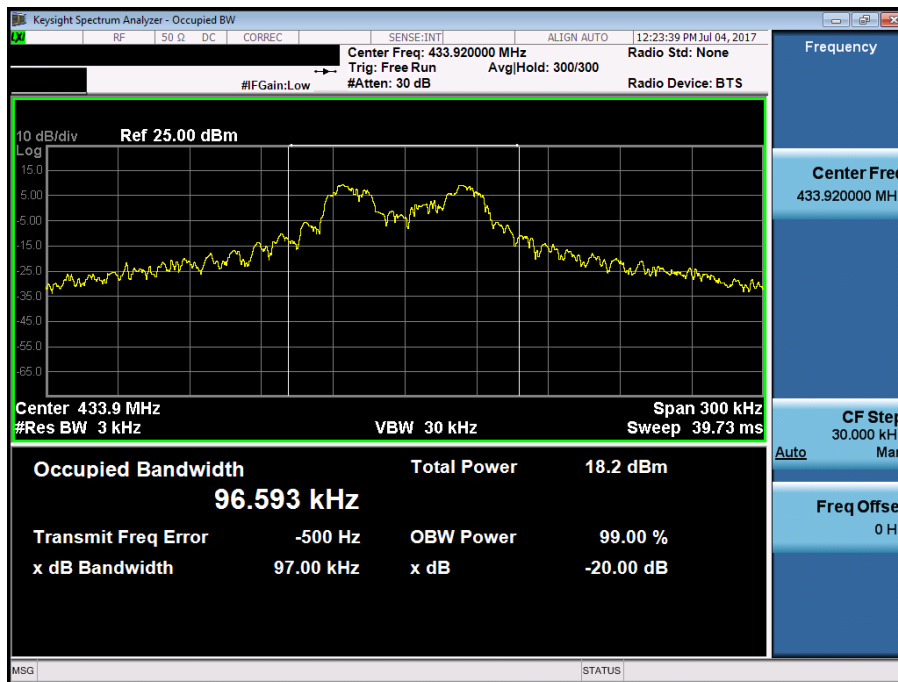
Detector: Peak

Trace: Max hold

Sweep: Auto couple

- Measurement Data: Comply

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
433.92	97.00	96.59	1084.80

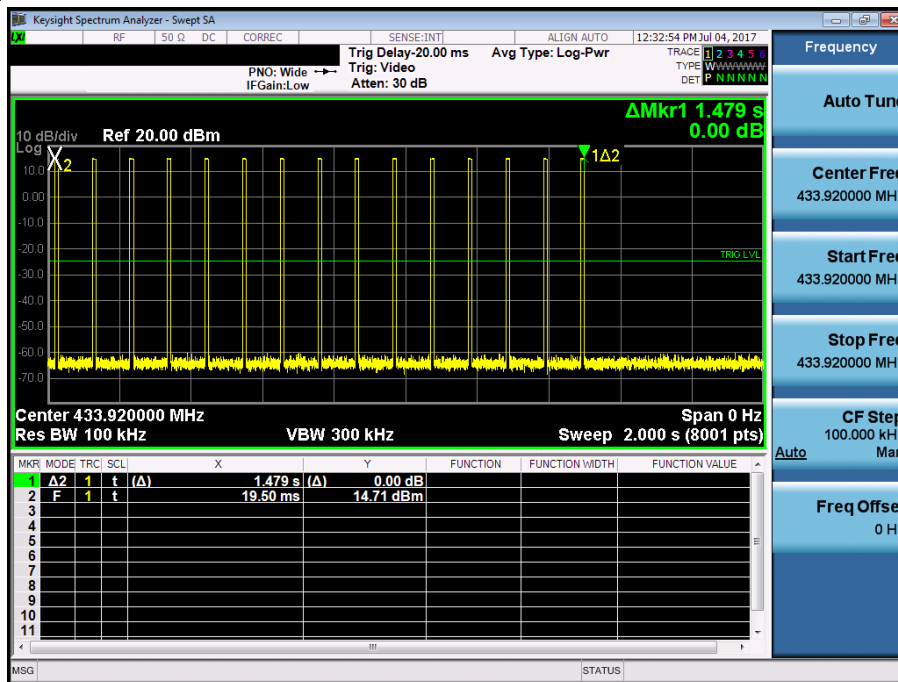


- Limit: § 15.209(c)

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.

3.2.2 Automatically deactivate

- Measurement Data:



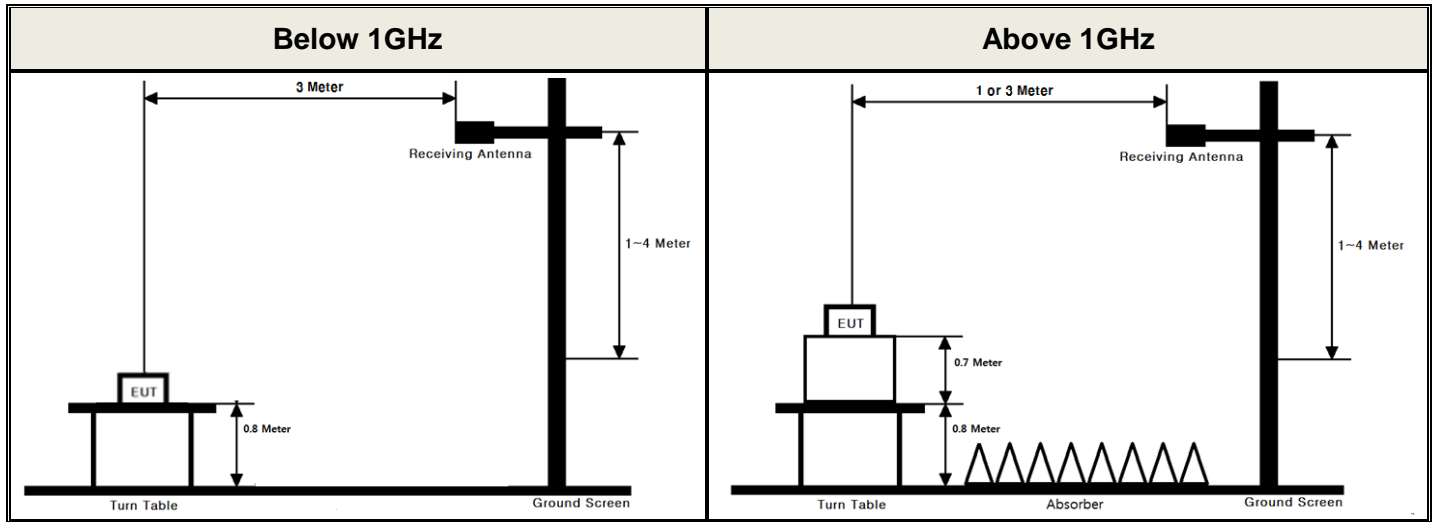
One operation time (s)	Limit (s)
1.4790	5

- 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

Radiated Emissions

Measurement Distance : 3 m

Frequency [MHz]	Detector Mode	EUT Position	ANT Pol	Reading [dBuV]	T.F [dB/m]	DCF [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
*433.94	PK	Y	V	79.82	19.10	NA	98.92	100.82	1.90
*433.94	AV	Y	V	79.82	19.10	-20.00	78.92	80.82	1.90
#241.90	PK	X	V	50.53	-17.26	NA	33.27	46.00	12.73
318.77	PK	X	V	51.60	-14.63	NA	36.97	80.82	43.85
318.77	AV	Y	V	51.60	-14.63	-20.00	16.97	60.82	43.85
466.49	PK	Y	V	46.80	-10.12	NA	36.68	80.82	44.14
466.49	AV	X	V	46.80	-10.12	-20.00	16.68	60.82	44.14
2169.77	AV	X	H	45.95	-0.01	NA	45.94	80.82	34.88
2169.77	PK	X	H	45.95	-0.01	-20.00	25.94	60.82	34.88
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

Note 1. The result of Average measurement was calculated using PK result and duty cycle reduction factor. Refer to the appendix II for duty reduction factor.

Note 2. * is fundamental frequency. And # is spurious emission at restricted band. The spurious emission was confirmed to be related to the fundamental emissions.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

$$T.F = AF + CL - AG \quad / \quad \text{Field Strength} = \text{Reading} + T.F + DCF$$

$$\text{Margin} = \text{Limit} - \text{Field Strength}$$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain
DCF = Duty cycle reduction factor

3.2.4 AC power line conducted emission

- Procedure:

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 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

- According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 of this section.

The antenna is permanently attached on PCB. (Refer to Internal photo file.)

Therefore this E.U.T Complies with the requirement of §15.203.

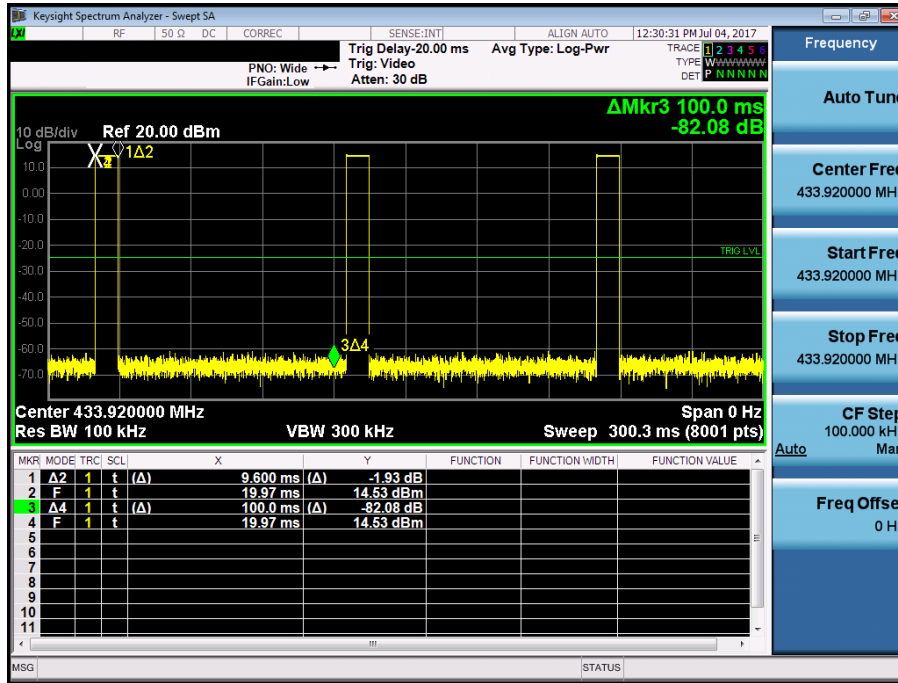
APPENDIX I

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
EMI Test Receiver	Rohde Schwarz	ESR7	17/02/16	18/02/16	101061
Spectrum Analyzer	Agilent Technologies	N9030A	16/10/18	17/10/18	MY53310140
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
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
High-pass filter	Anristu	MP526D	16/09/09	17/09/09	M27756

APPENDIX II

Duty cycle reduction factor



Measured worst case transmit time per 100ms	9.60ms
Declared worst case transmit time per 100ms	10.00ms
Duty cycle reduction factor	$20 \times \log(10.00\text{ms}/100\text{ms}) = -20.00\text{dB}$

Note: The worst duty cycle has been provided by the manufacturer's technical documentation.

APPENDIX III

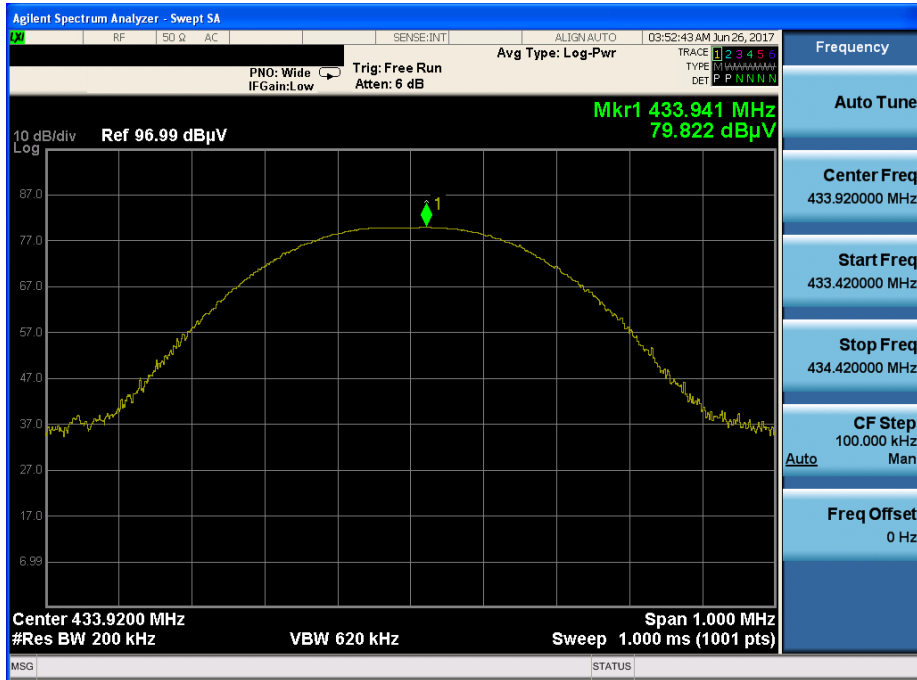
Worst data plot of radiated test

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

Field strength of fundamental

Y axis & Ver

Detector Mode : PK



Note: The resolution bandwidth was set larger than occupied bandwidth of fundamental.

Spurious emission

Y axis & Hor

Detector Mode : PK

