



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 : DRTFCC1807-0179
2. Customer
 - Name : Bitfinder, Inc.
 - Address : 814 SARATOGA AVE #J205 , SAN JOSE, California, United States 95129
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : AWAIR / AWAIR Rev2
FCC ID : 2AF65AWAIR0HD2
5. Test Method Used : ANSI C63.10-2013
Test Specification : FCC Part 15 Subpart C.249
6. Date of Test : 2018.07.03 ~ 2018.07.06
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Reviewed by
	Name : SunGeun Lee 	Name : GeunKi Son 

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.

2018 . 07. 16 .

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
DRTFCC1807-0179	Jul. 16, 2018	Initial issue

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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 test site comply with the requirements of § 2.948 according to ANSI C63.4-2014.		
- FCC MRA Accredited Test Firm No. : KR0034		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
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1.2 Test Environment

Ambient Condition	
▪ Temperature	+20 °C ~ +25 °C
▪ Relative Humidity	40 % ~ 45 %

1.3 Measurement Uncertainty

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)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

1.4 Details of Applicant

Applicant : Bitfinder, Inc.
 Address : 814 SARATOGA AVE #J205 , SAN JOSE, California, United States 95129
 Contact person : Kevin Cho

1.5 Description of EUT

EUT	AWAIR
Model Name	AWAIR Rev2
Add Model Name	NA
Power Supply	DC 5V
Hardware version	V 3.0
Software version	V 1.0.0
Frequency Range	915 MHz
Max. field strength (average)	77.76 dBuV/m
Modulation Type	GFSK
Antenna Specification	Antenna Type: PCB Pattern Antenna Gain: -0.3 dBi (PK) (1 dB Cable Loss excluded)

1.6 Test Mode

Test Mode	Description
TM1	Sub 1G (915MHz)

1.7 EMI Suppression Device(s)/Modifications

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

1.8 Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	17/12/28	18/12/28	US50200816
Spectrum Analyzer	Agilent Technologies	N9020A	18/01/03	19/01/03	MY48011700
DC Power Supply	Agilent Technologies	66332A	18/07/02	19/07/02	MY43000719
Multimeter	FLUKE	17B	17/12/26	18/12/26	26030065WS
Signal Generator	Rohde Schwarz	SMBV100A	17/12/27	18/12/27	255571
Signal Generator	ANRITSU	MG3695C	18/02/12	19/02/12	173501
Thermohygrometer	BODYCOM	BJ5478	17/09/11	18/09/11	N/A
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9168	18/03/26	20/03/26	9168-0819
Horn Antenna	ETS-Lindgren	3115	17/01/13	19/01/13	9202-3820
Horn Antenna	Schwarzbeck	BBHA 9120C	17/12/04	19/12/04	9120C-561
PreAmplifier	tsj	MLA-10K01-B01-27	18/01/11	19/01/11	2005354
PreAmplifier	tsj	MLA-0118-J01-45	18/02/08	19/02/08	17138
EMI Test Receiver	ROHDE&SCHWARZ	ESW44	17/08/21	18/08/21	101645
Attenuator	SMAJK	SMAJK-2-3	17/09/06	18/09/06	3
Attenuator	Aeroflex/Weinschel	56-3	17/12/27	18/12/27	Y2370
Attenuator	SRTechnology	F01-B0606-01	17/09/07	18/09/07	13092403
Attenuator	Hefei Shunze	SS5T2.92-10-40	17/12/27	18/12/27	16012202
Attenuator	SMAJK	SMAJK-50-10	17/09/06	18/09/06	15081903
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	17/12/26	18/12/26	3
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	17/09/05	18/09/05	8
EMI TEST RECEIVER	Rohde Schwarz	ESC17	18/02/12	19/02/12	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	17/09/29	18/09/29	101333
LISN	SCHWARZBECK	NNLK 8121	18/03/20	19/03/20	06183
Cable	DT&C	CABLE	18/03/26	19/03/26	RF-68
Cable	DT&C	CABLE	18/03/26	19/03/26	P-IN
Cable	DT&C	CABLE	18/03/26	19/03/26	RF-71
Cable	DT&C	CABLE	18/06/22	19/06/22	RF-82
Cable	DT&C	CABLE	18/06/22	19/06/22	C-016-4
Cable	DT&C	CABLE	18/06/22	19/06/22	RF-81
Cable	Radiall	TESTPRO3	18/06/22	19/06/22	RF-74
Cable	Radiall	TESTPRO3	18/06/22	19/06/22	RF-66
Cable	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-1
Cable	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-2
Cable	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-3
Cable	HUBER+SUHNER	SUCOFLEX	17/12/22	18/12/22	C-4

Note: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017

Note: The cable is not a regular calibration item, so it has been calibrated by DT & C itself

2. Summary of Test

FCC Part	Parameter	Limit	Test Condition	Status Note 1
15.249 (a)	Field Strength Limits	FCC 15.249(a)	Radiated	C
15.205 15.209 15.249	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	FCC 15.209, 249 limits		C
15.207	AC Conducted Emissions	FCC 15.207 limits	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C
Note 1: C =Comply NC =Not Comply NT =Not Tested NA =Not Applicable Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.				

3. Transmitter requirements

3.1 AC Conducted Emissions

3.1.1 Test Requirements and limit, §15.207

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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

3.1.2 Test Configuration

Refer to the next page.

3.1.3 Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10.

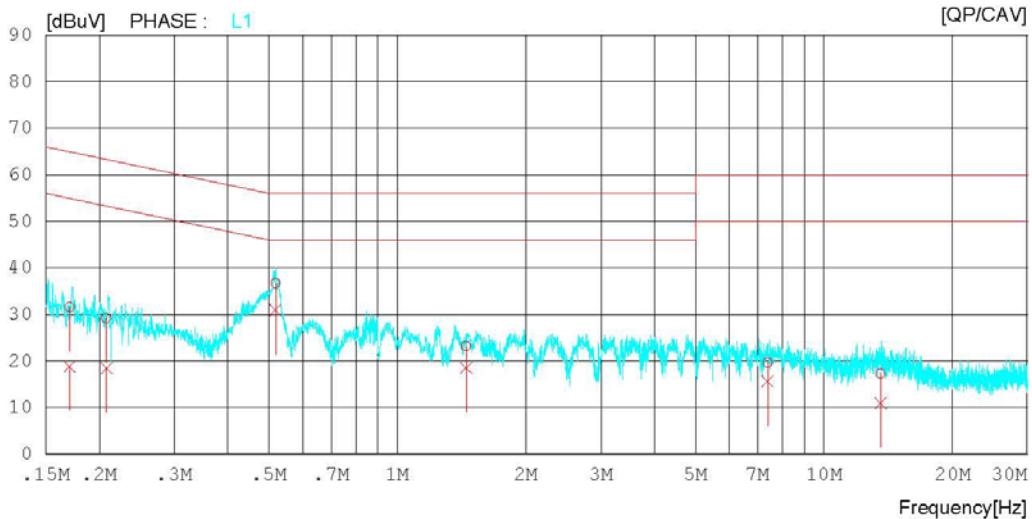
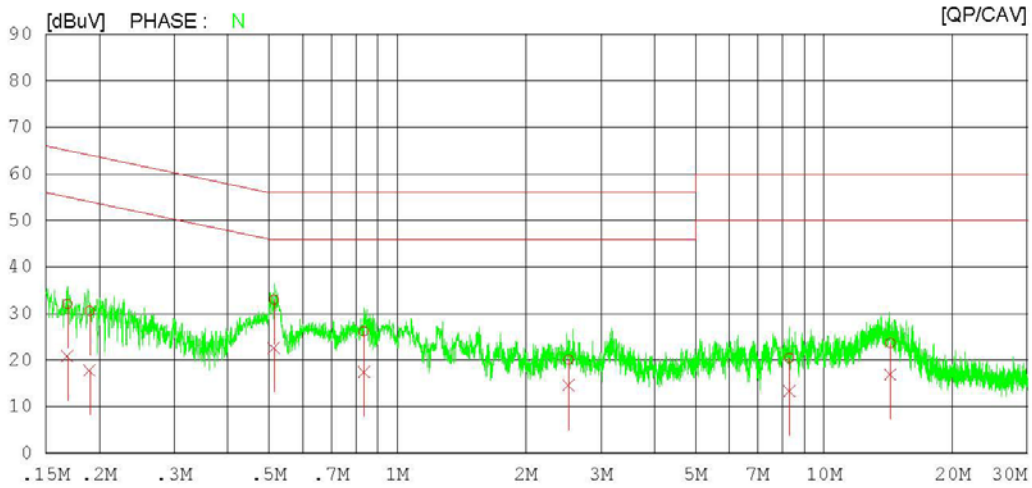
1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected 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.

3.1.4 Test Result

AC Line Conducted Emissions (Graph)

Results of Conducted Emission

DTNC			Date 2018-07-06
Order No.	AWAIR Rev2	Reference No.	
Model No.		Power Supply	120V 60Hz
Serial No.		Temp/Humi.	22'c , 45%
Test Condition		Operator	SunGeun Lee
Memo	915MHz		
LIMIT : FCC P15.207 QP			
FCC P15.207 AV			



AC Line Conducted Emissions (List)

Results of Conducted Emission

DTNC

Date 2018-07-06

Order No.		Reference No.	
Model No.	AWAIR Rev2	Power Supply	120V 60Hz
Serial No.		Temp/Humi.	22°C, 45%
Test Condition		Operator	SunGeun Lee

Memo 915MHz

 LIMIT : FCC P15.207 QP
 FCC P15.207 AV

NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.16846	22.15	10.93	9.89	32.04	20.82	65.04	55.04	33.00	34.22	N
2	0.18991	20.66	7.87	9.90	30.56	17.77	64.04	54.04	33.48	36.27	N
3	0.51336	23.11	12.71	9.90	33.01	22.61	56.00	46.00	22.99	23.39	N
4	0.83606	16.25	7.52	9.92	26.17	17.44	56.00	46.00	29.83	28.56	N
5	2.51720	10.14	4.62	9.96	20.10	14.58	56.00	46.00	35.90	31.42	N
6	8.28840	10.37	3.20	10.10	20.47	13.30	60.00	50.00	39.53	36.70	N
7	14.30980	13.44	6.72	10.21	23.65	16.93	60.00	50.00	36.35	33.07	N
8	0.17056	21.66	8.90	9.89	31.55	18.79	64.93	54.93	33.38	36.14	L1
9	0.20778	19.23	8.52	9.90	29.13	18.42	63.29	53.29	34.16	34.87	L1
10	0.51789	26.71	21.03	9.90	36.61	30.93	56.00	46.00	19.39	15.07	L1
11	1.44960	13.17	8.54	9.93	23.10	18.47	56.00	46.00	32.90	27.53	L1
12	7.37520	9.56	5.49	10.06	19.62	15.55	60.00	50.00	40.38	34.45	L1
13	13.57380	6.99	0.75	10.18	17.17	10.93	60.00	50.00	42.83	39.07	L1

3.2 Radiated Emission

Test Requirements and limit, §15.249, §15.205, §15.209

▪ FCC Part 15.249

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Limit @ 3m	
	Field strength of fundamental (mV/m)	Field strength of harmonics (uV/m)
902 ~ 908	50	500
2400 ~ 2483.5	50	500
5725 ~ 5825	50	500
24,000 ~ 24,250	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

According to § 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)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	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 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

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

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

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

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

3.2.1 Test Configuration

Refer to the APPENDIX I.

3.2.2 Test Procedures for Radiated Spurious Emissions

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.
The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
3. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
4. The antenna is a 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.
5. 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.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 10 dB 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 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

3.2.3 Test Result

Frequency Range : 9 kHz ~ 10 GHz

▪TM1

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
311.90	H	Y	QP	56.20	-11.80	N/A	N/A	44.40	46.02	1.62
359.91	H	Y	QP	55.70	-10.76	N/A	N/A	44.94	46.02	1.08
407.93	H	Y	QP	52.10	-9.17	N/A	N/A	42.93	46.02	3.09
914.99*	H	Z	PK	74.44	33.50	N/A	N/A	107.94	113.98	6.04
914.99*	H	Z	AV	74.44	33.50	-30.18	N/A	77.76	93.98	16.22
1829.97	H	X	PK	66.79	-0.93	N/A	N/A	65.86	74.00	8.14
1829.97	H	X	AV	66.79	-0.93	-30.18	N/A	35.68	54.00	18.32

▪ Note.

- No other spurious and harmonic emissions were found greater than listed emissions on above table.
- The result of average measurement was calculated using PK result and duty cycle reduction factor.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} + \text{D.C.F} \quad / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$

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

DCF = Duty Cycle Reduction Factor.

- * is fundamental frequency.

3.3 Antenna Requirements

- According to FCC 47 CFR §15.203:

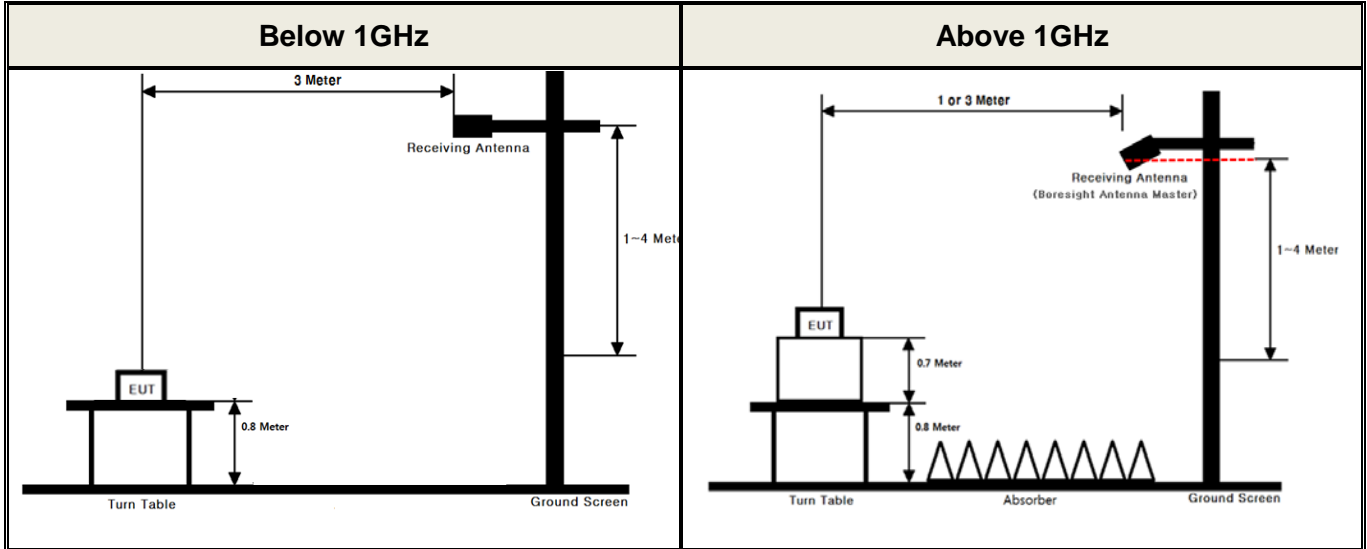
An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient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

**The antenna is attached on the device by means of unique connection type.
Therefore this E.U.T Complies with the requirement of §15.203**

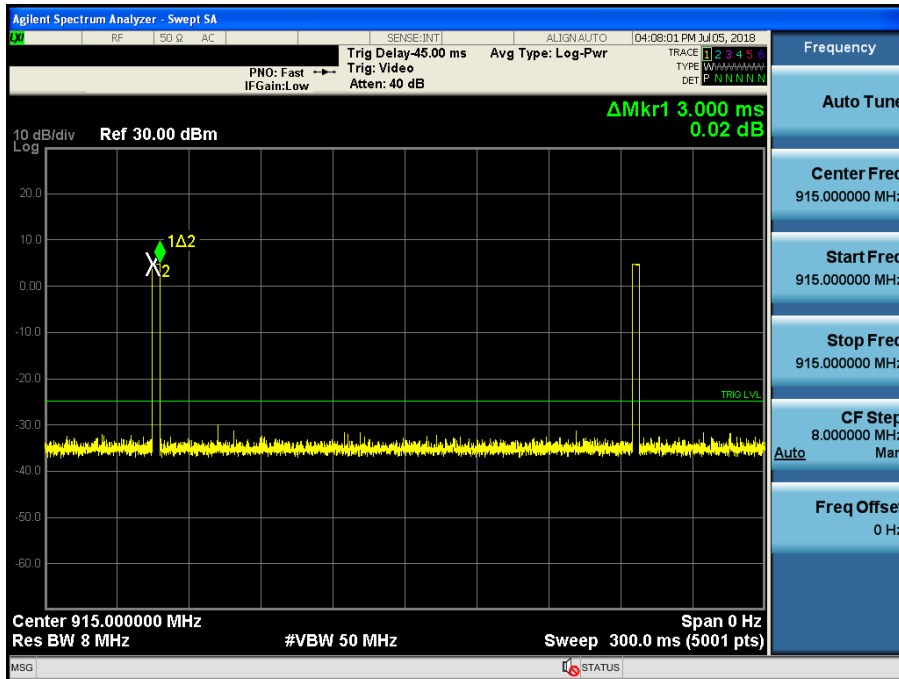
APPENDIX I

Test set up diagrams

▪ Radiated Measurement



▪ Duty cycle reduction factor



Measured worst case transmit time per 100ms	3.0 ms
Declared worst case transmit time per 100ms	3.04 ms
Duty cycle reduction factor(Worst case)	20 x log (3.04ms/100ms) = -30.18dB

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