

243 Jubug-Ri, Yangji-Myeon, Yongin-Si, Gyeonggi-Do, Korea 17159 Tel: +82-31-323-6008 Fax: +82-31-323-6010 <a href="http://www.ltalab.com">http://www.ltalab.com</a>

Dates of Tests: July 08, 2019 ~ July 19, 2019

Test Report S/N: LR500111907J Test Site: LTA CO., LTD.

# **CERTIFICATION OF COMPLIANCE**

FCC ID.

**APPLICANT** 

**2AGENWAYH** 

Waywearable, Inc.

Equipment Class : Digital Transmission System (DTS)

Manufacturing Description : Beauty Device

Manufacturer : Waywearable, Inc.

Model name : WAYH1WG

Test Device Serial No.: : Identical prototype

Rule Part(s) : FCC Part 15.247 Subpart C ; ANSI C63.10 - 2013

Frequency Range : 2402 ~ 2480 MHz

Max. Output Power : Max -0.40 dBm - Conducted

Data of issue : July 22, 2019

This test report is issued under the authority of:

Jabeom. Koo

Ja-Beom Koo, Manager

The test was supervised by:

Eun-Hwan Jung, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

NVLAP LAB Code.: 200723-0

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### 1. General information

### 1-1 Test Performed

Company name : LTA Co., Ltd.

Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 17159

Web site : <a href="http://www.ltalab.com">http://www.ltalab.com</a>
E-mail : <a href="mailto:chahn@ltalab.com">chahn@ltalab.com</a>
Telephone : +82-31-323-6008
Facsimile +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competents of calibration and testing laboratory".

### 1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2019-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	649054	Updating	FCC CAB
VCCI	JAPAN	C-4948, T-2416, R-4483(10 m), G-847	2020-09-10 2020-09-10 2020-10-15 2022-06-13	VCCI registration
IC	CANADA	5799A-1	2019-11-07	IC filing
KOLAS	KOREA	NO.551	2021-08-20	KOLAS accredited Lab.

Ref. No.: LR500111907J

### 2. Information about test item

### 2-1 Client & Manufacturer

Company name : Waywearable, Inc

Address

: 12F, 311, Gangnam-daero, Seocho-gu, Seoul, Republic of Korea, 06628

Tel / Fax : +82 10-9171-3765 / +82 2-567-1209

### **2-2 Equipment Under Test (EUT)**

Model name : WAYH1WG

Serial number : Identical prototype

Date of receipt : July 08, 2019

EUT condition : Pre-production, not damaged

Antenna type : Chip Antenna (Max Gain : 1.99 dBi)

Frequency Range : 2402 ~ 2480 MHz

RF output power : Max -0.40 dBm – Conducted

Type of Modulation : QPSK Power Source : 3.7 Vdc

### **2-3 Tested frequency**

	LOW	MID	HIGH
Frequency (MHz) - LoRa	2402	2442	2480

### 2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	CR720	MS-1736	MSI

## 3. Test Report

### 3.1 Summary of tests

FCC Part Section(s)	Parameter	<b>Test Condition</b>	Status (note 1)
15.247(a)	6 dB Bandwidth		С
15.247(b)	Transmitter Peak Output Power	Conducted	С
15.247(e)	Transmitter Power Spectral Density	Conducted	С
15.247(d)	Band Edge & Conducted Spurious emission		С
15.209	Transmitter emission	Radiated	С
15.207	AC Conducted Emissions	Conducted	N/A
15.203	Antenna requirement	-	С

N/A: This product is battery-enabled and excludes the test.

The above equipment was tested by LTA Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247 The test results of this report relate only to the tested sample identified in this report.

The tests were performed according to the method of measurements prescribed in KDB No.558074.

### → Antenna Requirement

Waywearable, Inc. FCC ID: 2AGENWAYH unit complies with the requirement of §15.203. The antenna type is PCB Antenna

Ref. No.: LR500111907J

### 3.2 Technical Characteristics Test

### 3.2.1 6 dB Bandwidth

#### **Procedure:**

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6 dB down one side of the emission. Reset the marker-delta 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 the 6 dB bandwidth of the emission.

### The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz Span = Auto

VBW = 3 X RBW Sweep = auto

Trace = max hold Detector function = peak

**Measurement Data: Complies** 

### **BLE Mode**

Frequency (MHz)	Test Res	cults
	Measured Bandwidth (kHz)	Result
2402	781.0	Complies
2442	760.0	Complies
2480	781.0	Complies

- See next pages for actual measured spectrum plots.

### Minimum Standard:

 $6 \text{ dB Bandwidth} \geq 500 \text{ kHz}$ 

### **Measurement Setup**

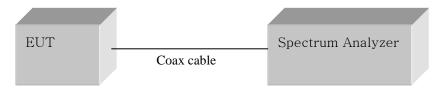
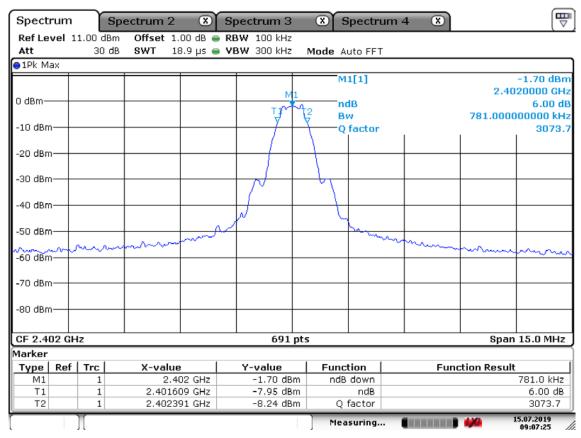
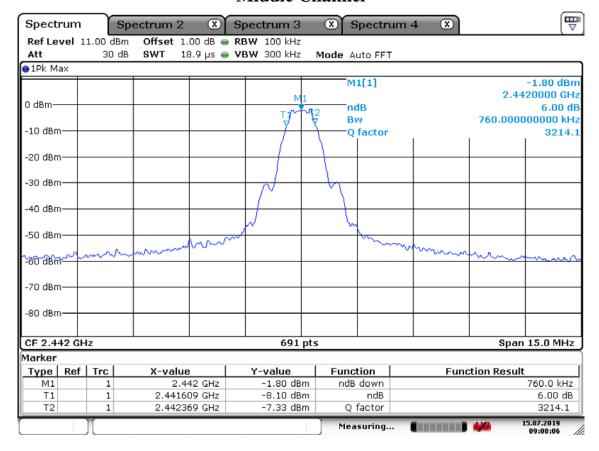


Figure 1: Measurement setup for the carrier frequency separation

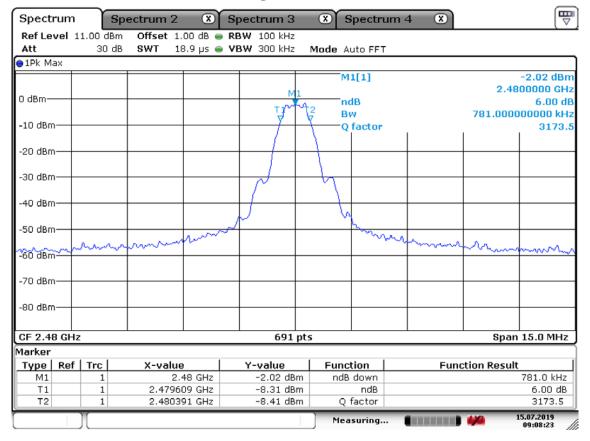
### **Low Channel**



### **Middle Channel**



# **High Channel**



### 3.2.2 Peak Output Power Measurement

### **Procedure:**

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth:

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

 $RBW \ge DTS$  Bandwidth

Sweep = auto

VBW = 3 X RBW

Detector function = peak

**Measurement Data: Complies** 

### LoRa Mode

Frequency (MHz)	Test Results	
	Measured data (dBm)	Result
2402	-0.40	Complies
2442	-0.50	Complies
2480	-0.72	Complies

<sup>-</sup> See next pages for actual measured spectrum plots.

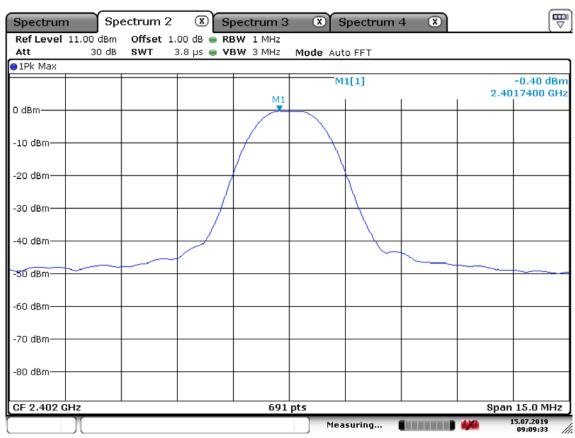
### **Minimum Standard:**

Peak output power	$\leq 1 \text{ W}(30 \text{ dBm})$
-------------------	------------------------------------

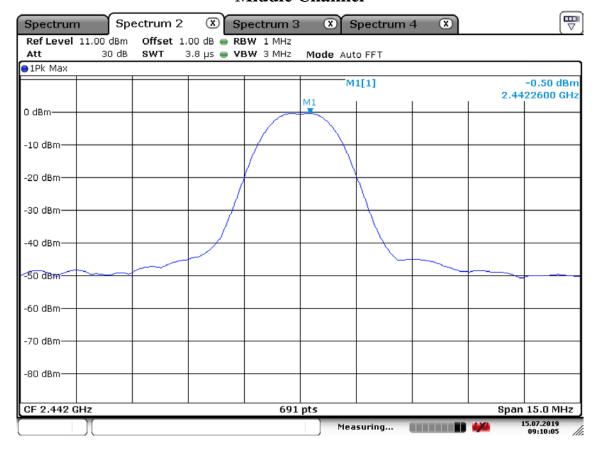
### **Measurement Setup**

Same as the Chapter 3.2.1 (Figure 1)

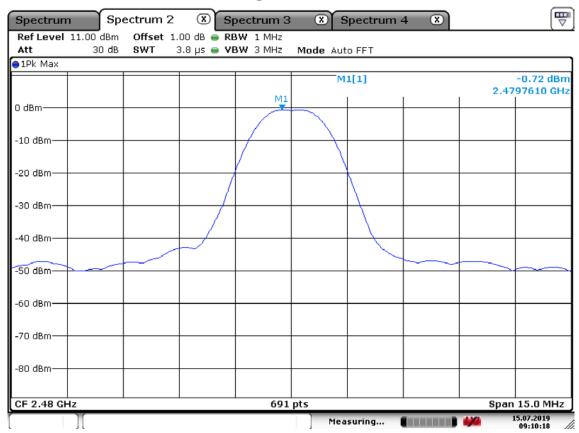
### **Low Channel**



### **Middle Channel**



# **High Channel**



## 3.2.3 Power Spectral Density

### **Procedure:**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

The spectrum analyzer is set to:

 $RBW = 3 \text{ kHz} (3 \text{ kHz} \le RBW \le 100 \text{ kHz})$  Sweep = auto

VBW = 3 X RBW Trace = max hold

Detector function = peak

**Measurement Data: Complies** 

### **BLE Mode**

Frequency (MHz)	Test Results		
	dBm / 3 kHz BW	Result	
2402	-18.10	Complies	
2442	-18.13	Complies	
2480	-18.35	Complies	

- See next pages for actual measured spectrum plots.

### Minimum Standard:

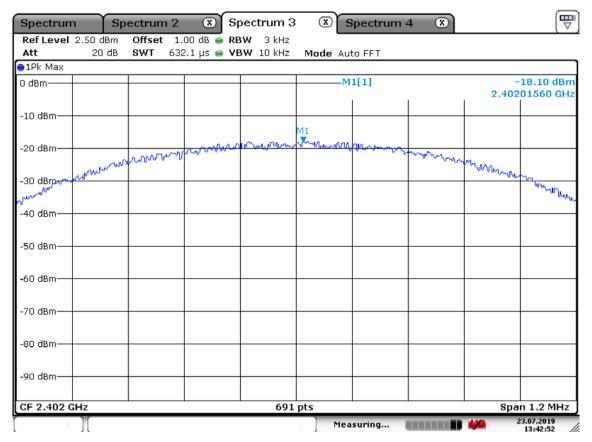
Power Spectral Density	≤ 8 dBm @ 3 kHz BW
------------------------	--------------------

### Measurement Setup

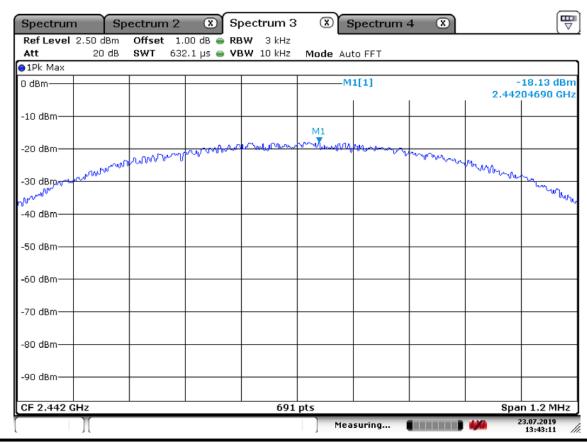
Same as the Chapter 3.2.1 (Figure 1)

# **Power Density Measurement**

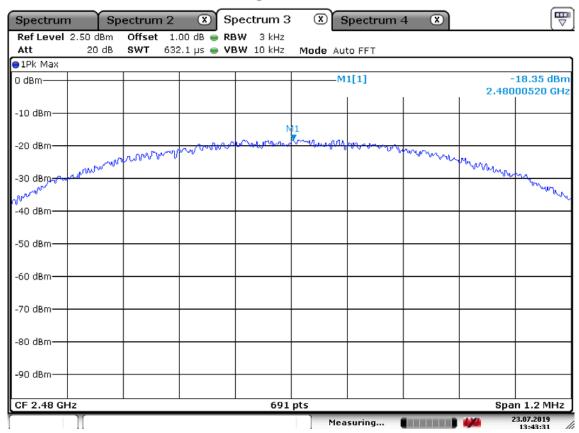
## **Low Channel**



### **Middle Channel**



# **High Channel**



Ref. No.: LR500111907J

### 3.2.4 Band Edge

#### **Procedure:**

The Unwanted emission from the EUT were measured according to the dictates PKPSD measurement procedure in section 11.11 of ANSI C63.10-2013.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB..

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

 $RBW = 100 \text{ kHz} \qquad \qquad VBW \ge 3 \text{ X RBW}$ 

Detector function = peak Trace = max hold

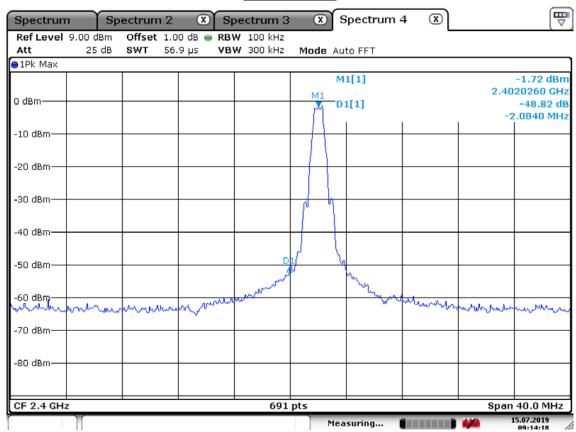
Sweep = auto

### Measurement Data: Complies

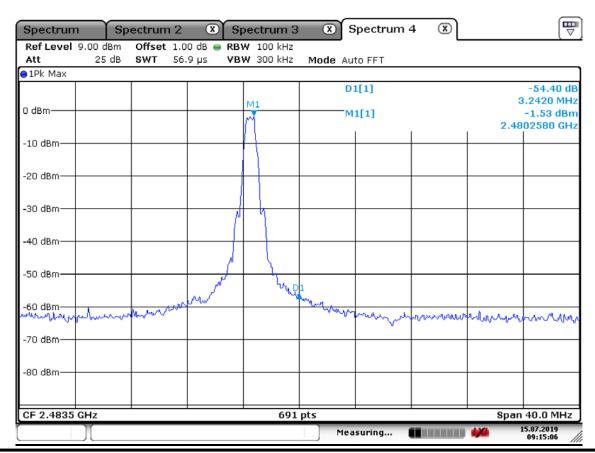
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the require ment.
- See next pages for actual measured spectrum plots.

Minimum Standard:	$\leq 20  \mathrm{dBc}$
William Standard.	= 20 abc

# Lower edge



# Upper edge



### 3.2.5 Conducted Spurious Emissions

### **Procedure:**

The test follows KDB558074. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, set the marker on the peak of any spurious emission recorded.

### The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz Sweep = auto

VBW = 100 kHz Detector function = peak

Trace = max hold

#### Measurement Data: Complies

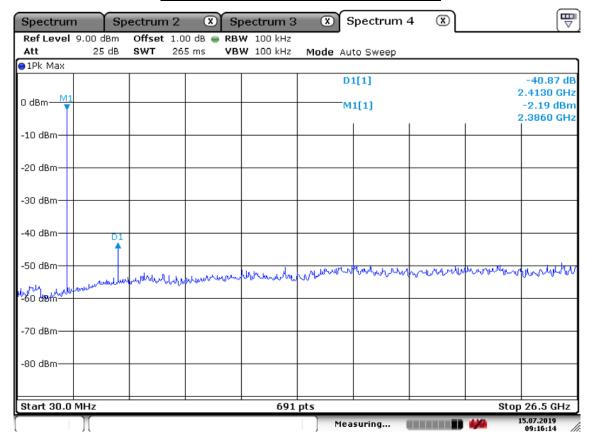
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the require ment.
- See next pages for actual measured spectrum plots.

Minimum Standard:	$\geq 20  \mathrm{dBc}$

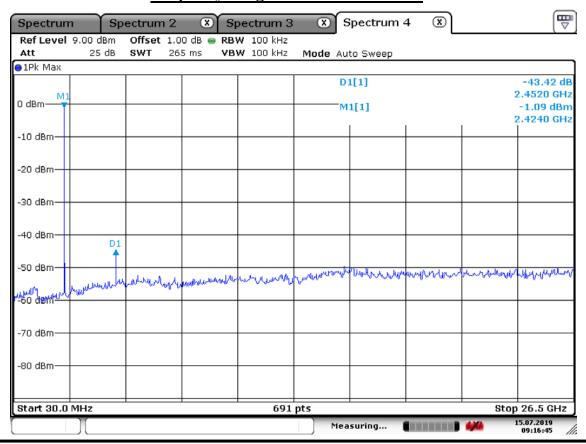
### **Measurement Setup**

Same as the Chapter 3.2.1 (Figure 1)

# <u>Unwanted Emission – Low Channel</u> Frequency Range = 30 MHz ~ 26.5 GHz

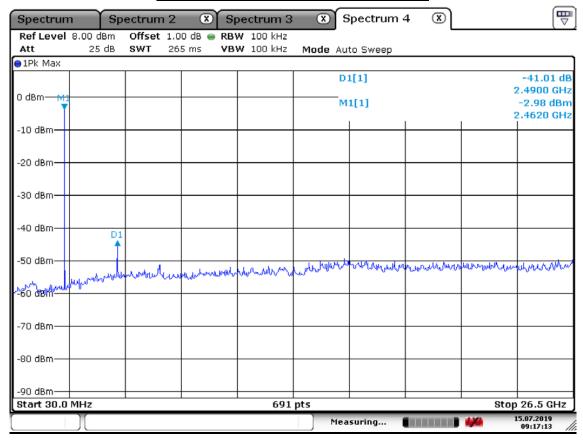


<u>Unwanted Emission – Middle Channel</u> Frequency Range = 30 MHz ~ 26.5 GHz



# Unwanted Emission – High Channel

## Frequency Range = 30 MHz ~ 26.5 GHz



### 3.2.6 Radiated Spurious Emissions

#### **Procedure:**

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.10-2013.

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with

polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

### The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range =  $9 \text{ kHz} \sim 10^{\text{th}} \text{ harmonic.}$ 

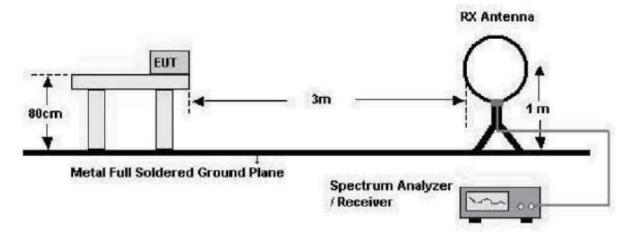
$$RBW = 120 \text{ kHz} (30 \text{ MHz} \sim 1 \text{ GHz})$$
  $VBW \geq RBW$ 

= 1 MHz  $(1 \text{ GHz} \sim 10^{\text{th}} \text{ harmonic})$ 

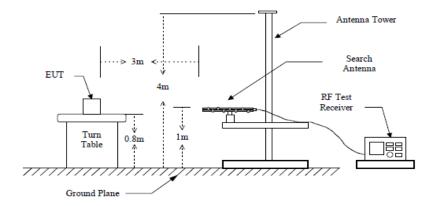
Trace = max hold Detector function = peak

Sweep = auto

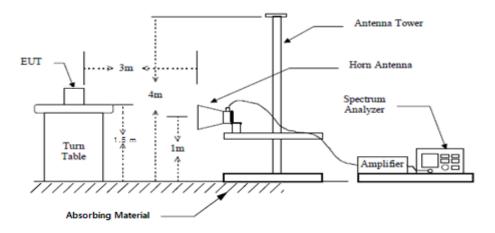
#### below 30 MHz



### below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



### **Measurement Data: Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30MHz.

### Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3 m
0.009 ~ 0.490	2400/F(kHz) (@ <b>300 m</b> )
0.490 ~ 1.705	24000/F(kHz) (@ <b>30 m</b> )
1.705 ~ 30	30(@ <b>30 m</b> )
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

<sup>\*\*</sup> 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.

### Radiated Emissions (Below 1 GHz) - Operating mode



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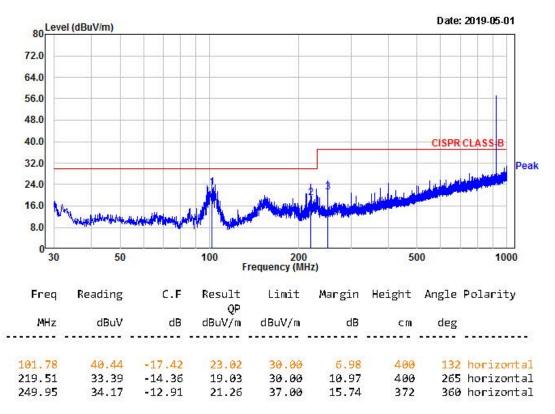
Tel: +82-31-3236008,9 Fax: +82-31-3236010

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EUT/Model No.: WIZCON Temp/Humi: 23 / 31

Tested by: KWON H C Test Mode

: Operating mode



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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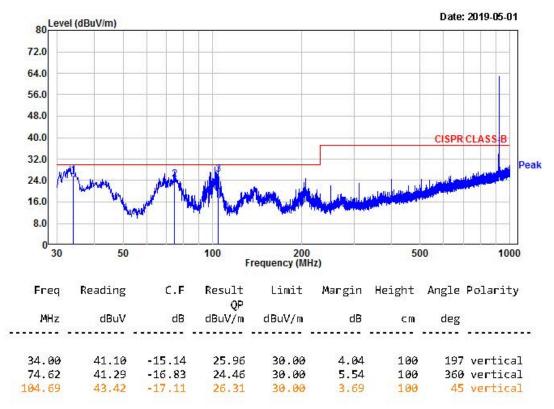
Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-3236008,9 Fax: +82-31-3236010 www.ltalab.com

EUT/Model No.: WIZCoN Temp/Humi: 23 / 31

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Test Mode : Operating mode Tested by: KWON H C



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

### Radiated Emissions (Above 1 GHz) - LOW mode



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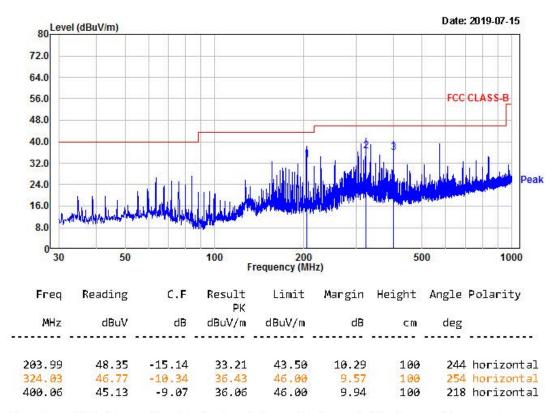
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EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

Test Mode : BLE LOW Tested by: JUNG E H

Power :



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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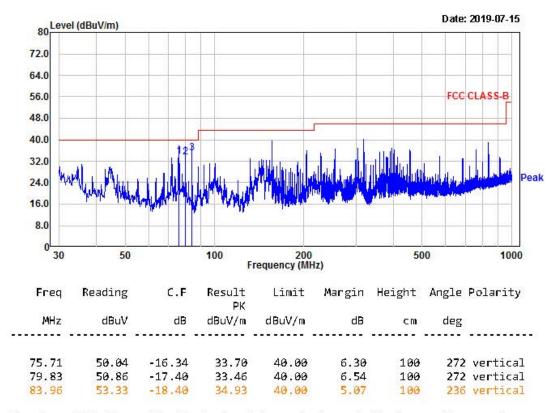
Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-3236008,9 Fax: +82-31-3236010 www.ltalab.com

EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

Test Mode : BLE LOW Tested by: JUNG E H

Power :

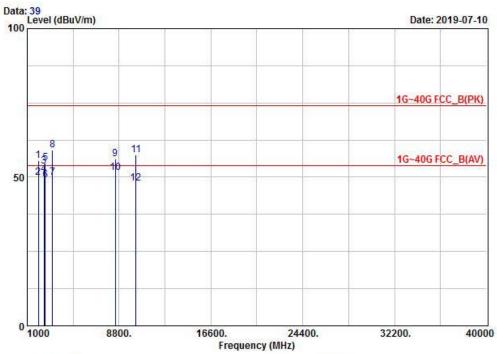


Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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EUT/Model No.: WAYH1WG Test Mode: Low
Tested by : JUNG E H Temp/Humi:



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	1933.70	54.30	1.16	55.46	74.00	18.54	HORIZONTAL
2	1933.70	48.80	1.16	49.96	54.00	4.04	HORIZONTAL
3	2411.50	50.20	3.34	53.54	74.00	20.46	VERTICAL
4	2411.50	47.50	3.34	50.84	54.00	3.16	VERTICAL
5	2533.60	50.40	4.25	54.65	74.00	19.35	HORIZONTAL
6	2533.60	44.80	4.25	49.05	54.00	4.95	HORIZONTAL
7	3143.50	40.50	9.38	49.88	54.00	4.12	HORIZONTAL
8	3143.50	49.80	9.38	59.18	74.00	14.82	HORIZONTAL
9	8466.50	27.60	28.56	56.16	74.00	17.84	VERTICAL
10	8466.50	22.90	28.56	51.46	54.00	2.54	VERTICAL
11	10220.60	27.40	30.13	57.53	74.00	16.47	VERTICAL
12	10220.60	17.80	30.13	47.93	54.00	6.07	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain Blue : Vertical Black : Horizontal

### MID mode



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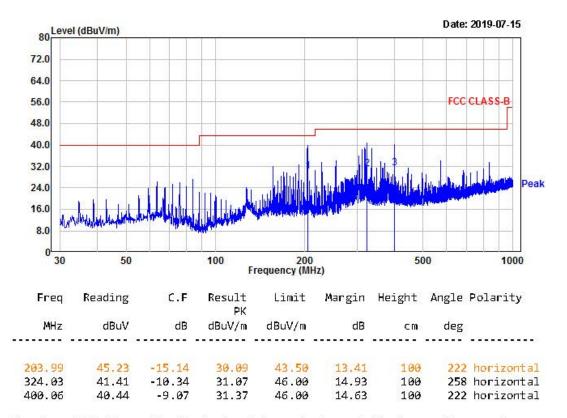
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EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

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Test Mode : BLE MID Tested by: JUNG E H

Power :



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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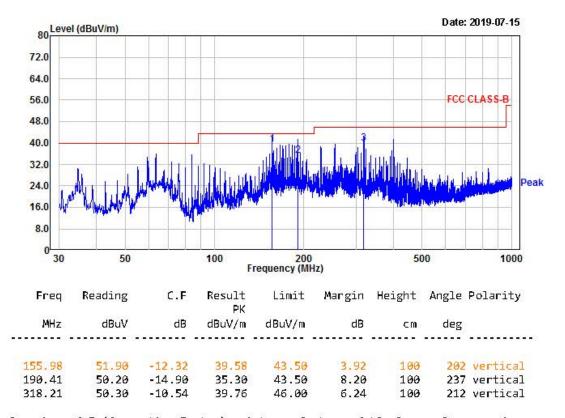
Tel: +82-31-3236008,9 Fax: +82-31-3236010

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EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

Test Mode : BLE MID Tested by: JUNG E H

Power :

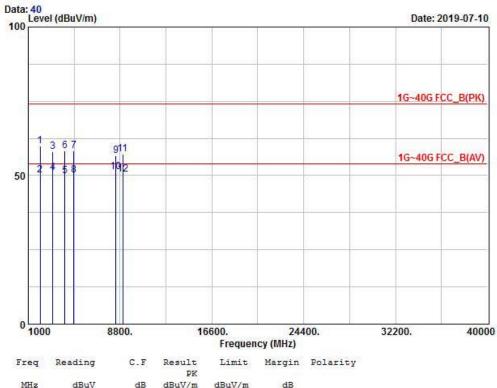


Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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EUT/Model No.: WAYHIWG Test Mode: Mid
Tested by : JUNG E H Temp/Humi:



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	2011.80	58.30	1.63	59.93	74.00	14.07	HORIZONTAL
2	2011.80	48.60	1.63	50.23	54.00	3.77	HORIZONTAL
3	3087.40	49.20	8.78	57.98	74.00	16.02	HORIZONTAL
4	3087.40	42.30	8.78	51.08	54.00	2.92	HORIZONTAL
5	4099.20	35.20	14.80	50.00	54.00	4.00	VERTICAL
6	4099.20	43.60	14.80	58.40	74.00	15.60	VERTICAL
7	4866.70	40.20	18.00	58.20	74.00	15.80	VERTICAL
8	4866.70	32.10	18.00	50.10	54.00	3.90	VERTICAL
9	8457.30	28.20	28.54	56.74	74.00	17.26	HORIZONTAL
10	8457.30	22.80	28.54	51.34	54.00	2.66	HORIZONTAL
11	9022.50	29.30	27.90	57.20	74.00	16.80	VERTICAL
12	9022 50	22 50	27 90	50 40	54 00	3 60	VEDTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain Blue : Vertical Black : Horizontal

### **HIGH mode**



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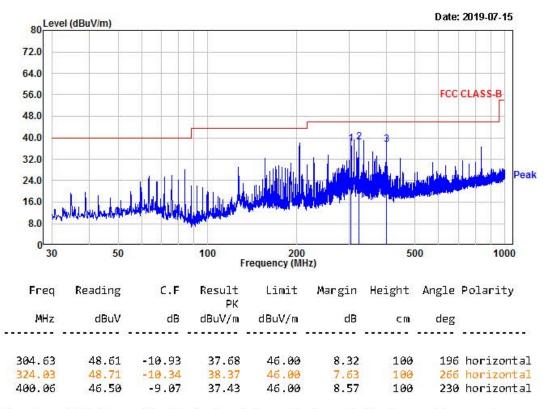
Tel: +82-31-3236008,9 Fax: +82-31-3236010

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EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

Test Mode : BLE HIGH Tested by: JUNG E H

Power :



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



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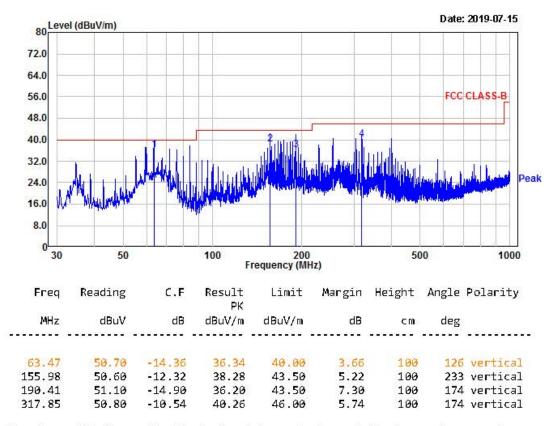
Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-3236008,9 Fax: +82-31-3236010 www.ltalab.com

EUT/Model No.: WAYH1WG Temp/Humi: 25 'C / 46 % R.H.

Test Mode : BLE HIGH Tested by: JUNG E H

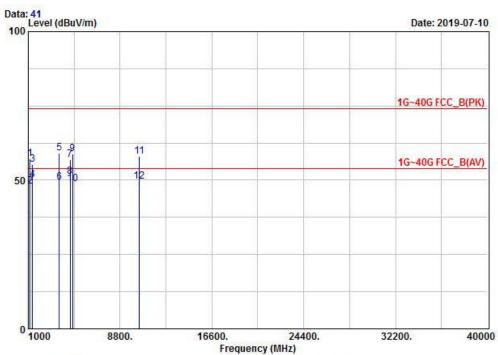
Power :



Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



EMI I Chamber of LTA CO.,LTD.
4, Songjuro 236Beon-gil, Yangji-myeon,
Yongin-si, Gyeonggi-do, Korea Autho.by NVLAP
Tel: +82-31-3236008,9 www.ltalab.com
Fax:+82-31-3236010



	Freq	Reading	C.F	Result PK	Limit	Margin	Polarity
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	1155.20	63.40	-6.27	57.13	74.00	16.87	HORIZONTAL
2	1155.20	54.30	-6.27	48.03	54.00	5.97	HORIZONTAL
3	1355.90	60.20	-4.84	55.36	74.00	18.64	VERTICAL
4	1355.90	54.90	-4.84	50.06	54.00	3.94	VERTICAL
5	3647.90	45.60	13.59	59.19	74.00	14.81	HORIZONTAL
6	3647.90	35.80	13.59	49.39	54.00	4.61	HORIZONTAL
7	4562.80	40.00	16.97	56.97	74.00	17.03	VERTICAL
8	4562.80	34.20	16.97	51_17	54.00	2.83	VERTICAL
9	4756.30	41.20	17.56	58.76	74.00	15.24	HORIZONTAL
10	4756.30	31.20	17.56	48.76	54.00	5.24	HORIZONTAL
11	10440.80	27.20	30.96	58.16	74.00	15.84	VERTICAL
12	10440.80	18.60	30.96	49.56	54.00	4.44	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain Blue : Vertical Black : Horizontal

### 3.2.7 AC Conducted Emissions

### **Procedure:**

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Minimum Standard: FCC Part 15.207(a) / EN 55022

Measurement Data: N/A

Class B

Frequency Range	quasi-peak	Average		
0.15 ~ 0.5	66 to 56 *	56 to 46 *		
0.5 ~ 5	56	46		
5 ~ 30	60	50		

<sup>\*</sup> Decreases with the logarithm of the frequency

Ref. No.: LR500111907J

# APPENDIX TEST EQUIPMENT USED FOR TESTS

	Use	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1		Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2018-09-06
2		SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2019-03-16
3		Attenuator (3 dB)	8491A	37822	НР	1 year	2018-09-06
4		Attenuator (10 dB)	8491A	63196	НР	1 year	2018-09-06
5		EMI Test Receiver (~7 GHz)	ESCI7	100722	R&S	1 year	2018-09-06
6		RF Amplifier (~1.3 GHz)	8447D OPT 010	2944A07684	НР	1 year	2018-09-06
7		RF Amplifier (1~26.5 GHz)	8449B	3008A02126	НР	1 year	2019-03-16
8		Horn Antenna (1~18 GHz)	3115	00114105	ETS	2 year	2018-08-04
9		DRG Horn (Small)	3116B	81109	ETS-Lindgren	2 year	2018-05-03
10		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2018-05-03
11		TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2019-03-16
12		DC Power Supply	6674A	3637A01657	Agilent	-	-
13		Power Meter	EPM-441A	GB32481702	НР	1 year	2019-03-16
14		Power Sensor	8481A	3318A94972	НР	1 year	2018-09-06
15		Audio Analyzer	8903B	3729A18901	НР	1 year	2018-09-06
16		Modulation Analyzer	8901B	3749A05878	НР	1 year	2018-09-06
17		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2018-09-06
18		Stop Watch	HS-3	812Q08R	CASIO	2 year	2018-03-21
19		LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2018-09-06
20		Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2019-03-16
21		Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2019-03-16
22		Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2019-03-16
23		OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2019-03-16
24		Signal Generator(100 kHz ~ 40 GHz)	SMB100A	177621	R&S	1 year	2019-03-16
25		Vector Signal Generator(9kHz ~ 6 GHz)	SMBV100A	255081	R&S	1 year	2019-03-16
26		Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2019-03-16
27		RF Cable	SUCOFLEX	-	Huber+suhner	-	-