

# Test Report

## FCC Part15 Subpart C

Product Name : Wahoo GPS BIKE COMPUTER  
Model No. : WFCC1  
FCC ID : PADWF112  
IC : 10563A-WF112

Applicant : Wahoo Fitness, LLC.  
Address : 90 W. Wieuca Road, #110, Atlanta, Georgia, 30342  
United States

Date of Receipt : Oct. 12, 2015  
Test Date : Oct. 12, 2015 ~ Nov. 03, 2015  
Issued Date : Nov. 05, 2015  
Report No. : 15A0041R-RF-US-P06V02  
Report Version : V1.0

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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# Test Report Certification

Issued Date : Nov. 05, 2015  
Report No. : 15A0041R-RF-US-P06V02



Product Name : Wahoo GPS BIKE COMPUTER  
Applicant : Wahoo Fitness, LLC.  
Address : 90 W. Wieuca Road, #110, Atlanta, Georgia, 30342  
United States  
Manufacturer : Weifang GoerTek Electronics Co.,Ltd  
Address : Gaoxin 2 Road,Free Trade Zone,Weifang,Shandong,  
261205,P.R.China  
Model No. : WFCC1  
FCC ID : PADWF112  
IC : 10563A-WF112  
EUT Voltage : DC 3.5V-4.2V  
Brand Name : Wahoo  
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2014  
ANSI C63.4: 2014; ANSI C63.10: 2013  
KDB 558074 D01 DTS Meas Guidance v03r03  
Industry Canada RSS-Gen Issue 4 / RSS-247 Issue 1  
Test Result : Complied  
Performed Location : Suzhou EMC Laboratory  
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou,  
215006, Jiangsu, China  
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098

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## Laboratory Information

We, **Quietek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

<b>Taiwan R.O.C.</b>	<b>:</b>	<b>BSMI, NCC, TAF</b>
<b>USA</b>	<b>:</b>	<b>FCC</b>
<b>Japan</b>	<b>:</b>	<b>VCCI</b>
<b>China</b>	<b>:</b>	<b>CNAS</b>

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site :<http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site :  
<http://www.quietek.com/>

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### History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
15A0041R-RF-US-P06V02	V1.0	Initial Issued Report	Nov. 05, 2015

**1. General Information**  
**1.1. EUT Description**

Product Name	Wahoo GPS BIKE COMPUTER
Brand Name	Wahoo
Model No.	WFCC1
Working Voltage	DC 3.5V-4.2V
Bluetooth Specification	V3.0+V4.1
Frequency Range	2402- 2480 MHz
Channel Number	V3.0: 79 V4.1: 40
Channel Separation	V3.0: 1MHz V4.1: 2MHz
Type of Modulation	V3.0: GFSK, Pi/4 DQPSK, 8DPSK V4.1: GFSK
Data Rate	V3.0: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK) V4.1: 1Mbps(GFSK)
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List

Bluetooth Working Frequency of Each Channel: (For V4.0)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz	03	2408 MHz
04	2410 MHz	05	2412 MHz	06	2414 MHz	07	2416 MHz
08	2418 MHz	09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz	15	2432 MHz
16	2434 MHz	17	2436 MHz	18	2438 MHz	19	2440 MHz
20	2442 MHz	21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz	27	2456 MHz
28	2458 MHz	29	2460 MHz	30	2462 MHz	31	2464 MHz
32	2466 MHz	33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz	39	2480 MHz

**Bluetooth Antenna List**

Antenna	Manufacturer	Model No.	Peak Gain
PIFA Antenna	Walsin	N/A	2.58dBi for 2.4GHz

## 1.2. Mode of Operation

QuieTek has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit-1Mbps(GFSK_BLE)

Note:

1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

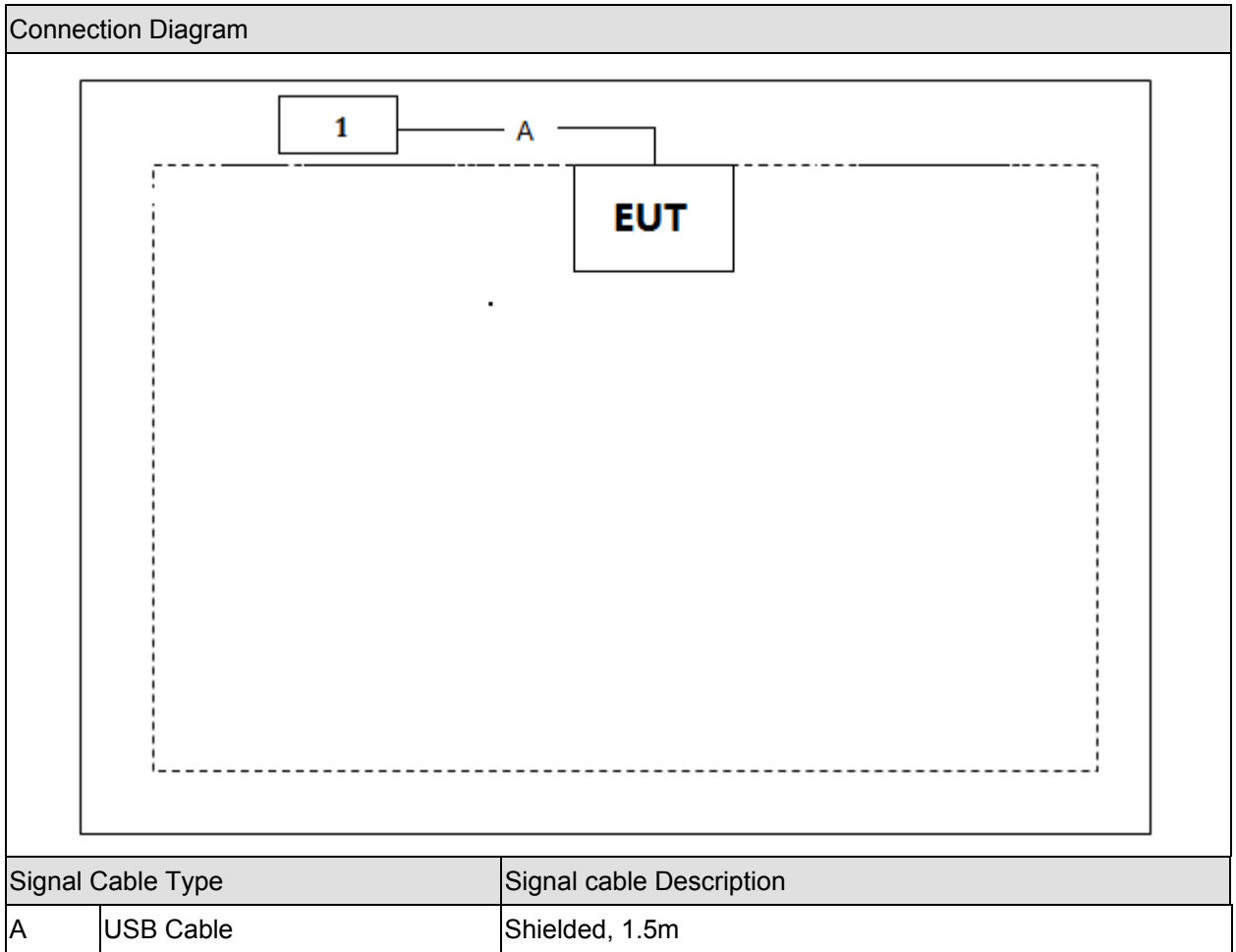


### 1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 N/A	N/A	N/A	N/A	N/A

### 1.4. Configuration of Tested System



### 1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment.
3	Run the RF test software "Blue Test 3", and set the test mode and channel, then press OK to start continue receive.

## 2. Technical Test

### 2.1. Summary of Test Result

- No deviations from the test standards  
 Deviations from the test standards as below description:

#### For FCC

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.209	Yes	No
RF Antenna Conducted Spurious	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No
Operation Frequency Range of 20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 15.215(c)	Yes	No
6dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(2)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(b)(3)	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(e)	Yes	No

**For IC**

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 4 Section 8.8	Yes	No
Radiated Emission	RSS-Gen Issue 4 Section 8.9	Yes	No
RF Antenna Conducted Spurious	RSS-247 Issue 1 Section A5.5	Yes	No
Radiated Emission Band Edge	RSS-247 Issue 1 Section A5.5	Yes	No
Occupied Bandwidth	RSS-Gen Issue 4 Section 6.6 RSS-247 Issue 1 Section A5.2(1)	Yes	No
Power Output	RSS-247 Issue 1 Section A5.4(4)	Yes	No
Power Spectral Density	RSS-247 Issue 1 Section A5.2(2)	Yes	No

## 2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

### 3. Conducted Emission

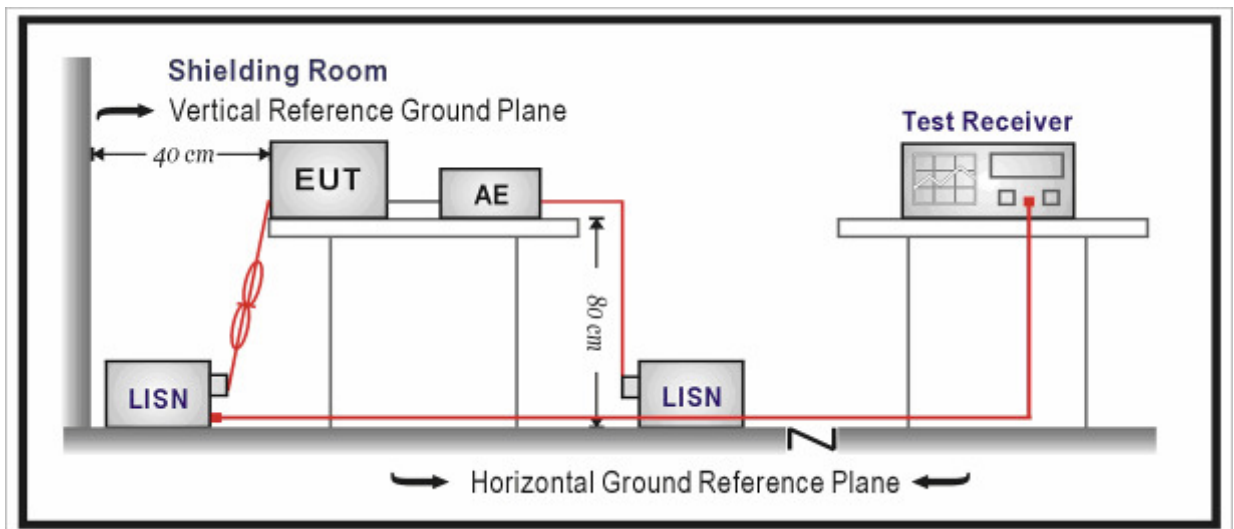
#### 3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2016.03.30
Two-Line V-Network	R&S	ENV216	100043	2016.03.30
Two-Line V-Network	R&S	ENV216	100044	2016.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2016.03.01
50ohm Termination	SHX	TF2	07081401	2016.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2016.01.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

#### 3.2. Test Setup



### 3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

### 3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

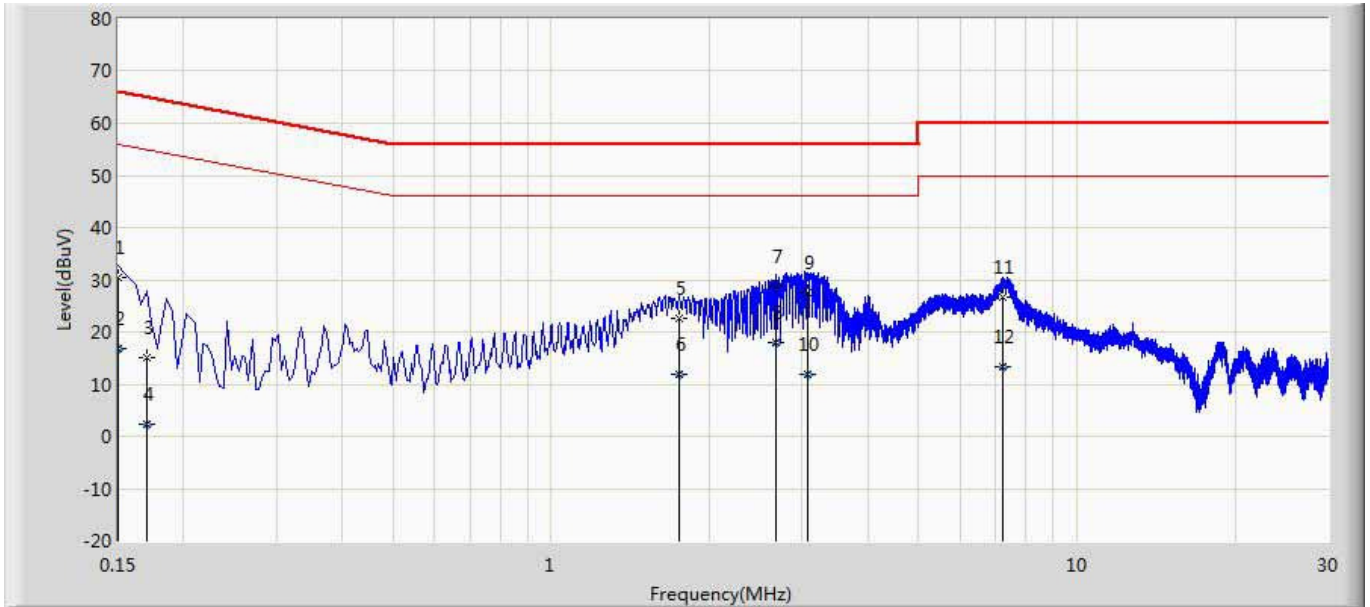
### 3.5. Uncertainty

The measurement uncertainty is defined as  $\pm 2.02$  dB



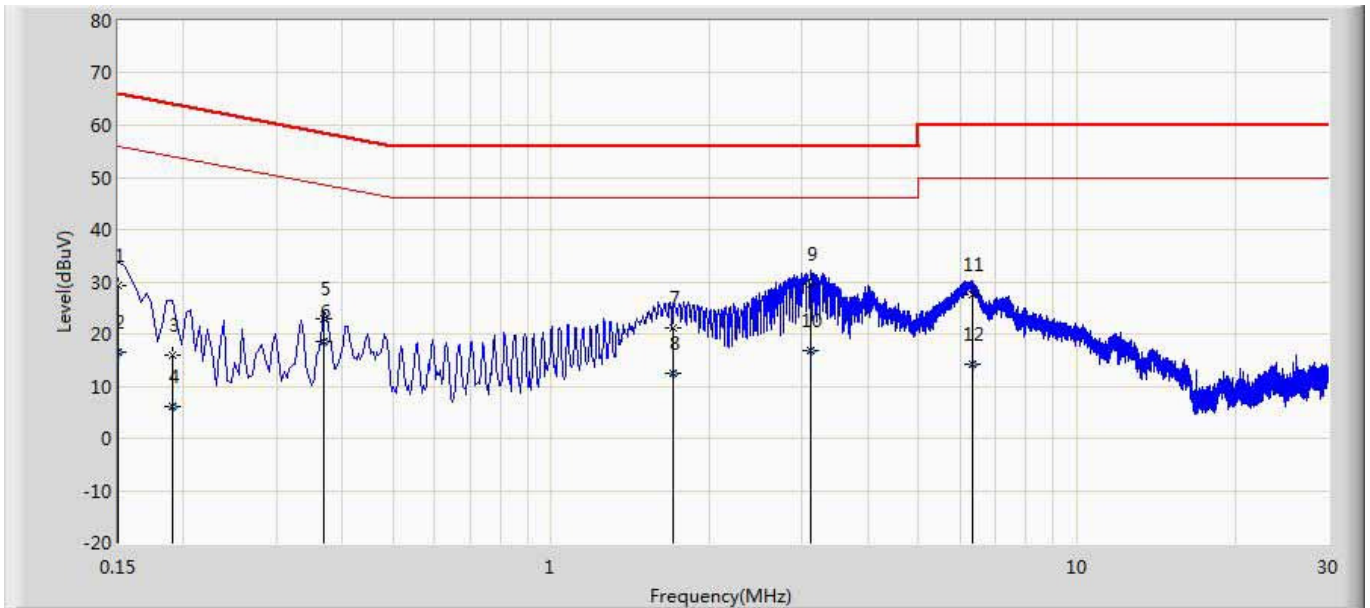
### 3.6. Test Result

Site: TR1	Time: 2015/10/19 - 16:02
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.150	30.541	20.722	-35.459	66.000	9.819	QP
2		0.150	16.938	7.119	-39.062	56.000	9.819	AV
3		0.170	15.193	5.375	-49.767	64.960	9.818	QP
4		0.170	2.195	-7.623	-52.765	54.960	9.818	AV
5		1.750	22.488	12.704	-33.512	56.000	9.784	QP
6		1.750	11.775	1.990	-34.225	46.000	9.784	AV
7	*	2.674	28.682	18.886	-27.318	56.000	9.795	QP
8		2.674	18.112	8.317	-27.888	46.000	9.795	AV
9		3.066	27.575	17.769	-28.425	56.000	9.806	QP
10		3.066	11.868	2.062	-34.132	46.000	9.806	AV
11		7.246	26.592	16.689	-33.408	60.000	9.903	QP
12		7.246	13.302	3.399	-36.698	50.000	9.903	AV

Site: TR1	Time: 2015/10/19 - 16:08
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.150	29.235	19.289	-36.765	66.000	9.946	QP
2		0.150	16.571	6.625	-39.429	56.000	9.946	AV
3		0.190	16.026	6.132	-48.011	64.037	9.894	QP
4		0.190	6.022	-3.872	-48.014	54.037	9.894	AV
5		0.370	23.036	13.074	-35.465	58.501	9.962	QP
6		0.370	18.565	8.603	-29.936	48.501	9.962	AV
7		1.710	21.033	11.070	-34.967	56.000	9.964	QP
8		1.710	12.380	2.416	-33.620	46.000	9.964	AV
9	*	3.122	29.647	19.650	-26.353	56.000	9.997	QP
10		3.122	16.717	6.720	-29.283	46.000	9.997	AV
11		6.314	27.514	17.355	-32.486	60.000	10.159	QP
12		6.314	14.180	4.021	-35.820	50.000	10.159	AV

## 4. Radiated Emission

### 4.1. Test Equipment

#### Radiated Emission / AC-2

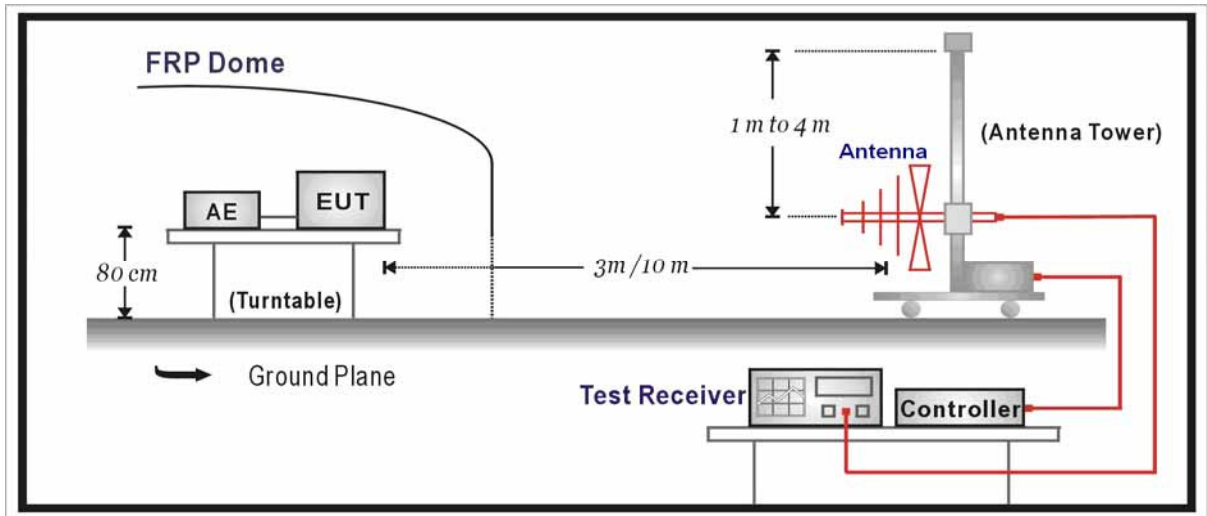
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2016.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2016.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2016.01.08

#### Radiated Emission / AC-5

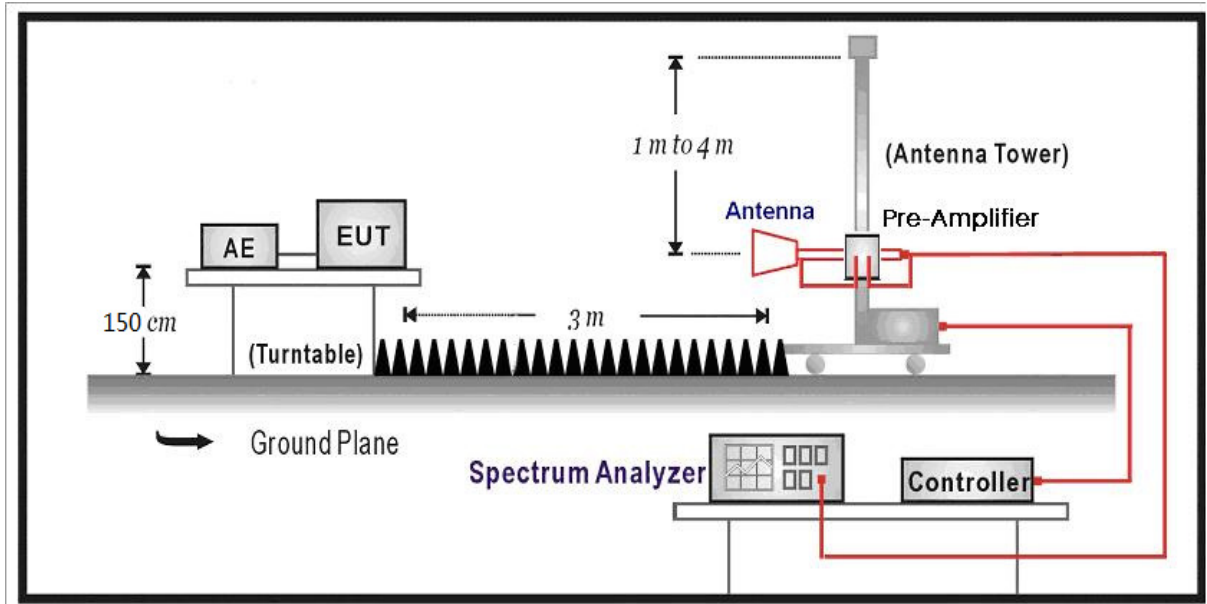
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2016.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.08

## 4.2. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



### 4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

### 4.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2014 and tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

### 4.5. Uncertainty

The measurement uncertainty above 1GHz is defined as ± 3.9 dB  
below 1GHz is defined as ± 3.8 dB

#### 4.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

Mode 1: Transmitter-1Mbps(GFSK\_BLE)

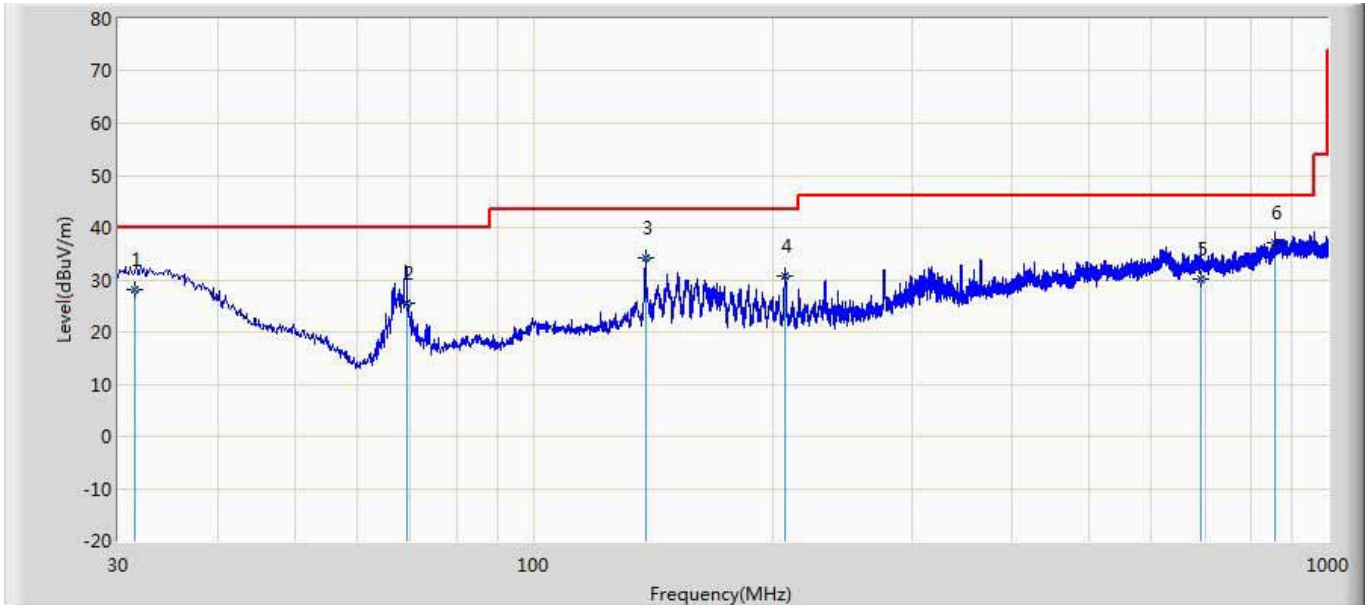
CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	45.6	-6.6	39.0	54(Note 2)	-15.0	PK
	H	7206.0	44.1	-2.9	41.2	54(Note2)	-12.8	PK
	H	9608.0	41.1	0.9	42.0	54(Note2)	-12.0	PK
	V	4804.0	46.3	-6.6	39.7	54(Note2)	-14.3	PK
	V	7206.0	44.7	-2.9	41.8	54(Note2)	-12.2	PK
	V	9608.0	40.6	0.9	41.5	54(Note2)	-12.5	PK
19	H	4880.0	46.3	-6.6	39.7	54(Note2)	-14.3	PK
	H	7320.0	44.6	-2.8	41.8	54(Note2)	-12.2	PK
	H	9760.0	41.1	1.2	42.3	54(Note2)	-11.7	PK
	V	4880.0	45.8	-6.6	39.2	54(Note2)	-14.8	PK
	V	7320.0	44.2	-2.8	41.4	54(Note2)	-12.6	PK
	V	9760.0	41.3	1.2	42.5	54(Note2)	-11.5	PK
39	H	4960.0	46.5	-6.3	40.2	54(Note2)	-13.8	PK
	H	7440.0	44.1	-2.6	41.5	54(Note2)	-12.5	PK
	H	9920.0	41.3	0.8	42.1	54(Note2)	-11.9	PK
	V	4960.0	45.4	-6.3	39.1	54(Note2)	-14.9	PK
	V	7440.0	44.3	-2.6	41.7	54(Note2)	-12.3	PK
	V	9920.0	42.2	0.8	43.0	54(Note2)	-11.0	PK

Note 1: The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

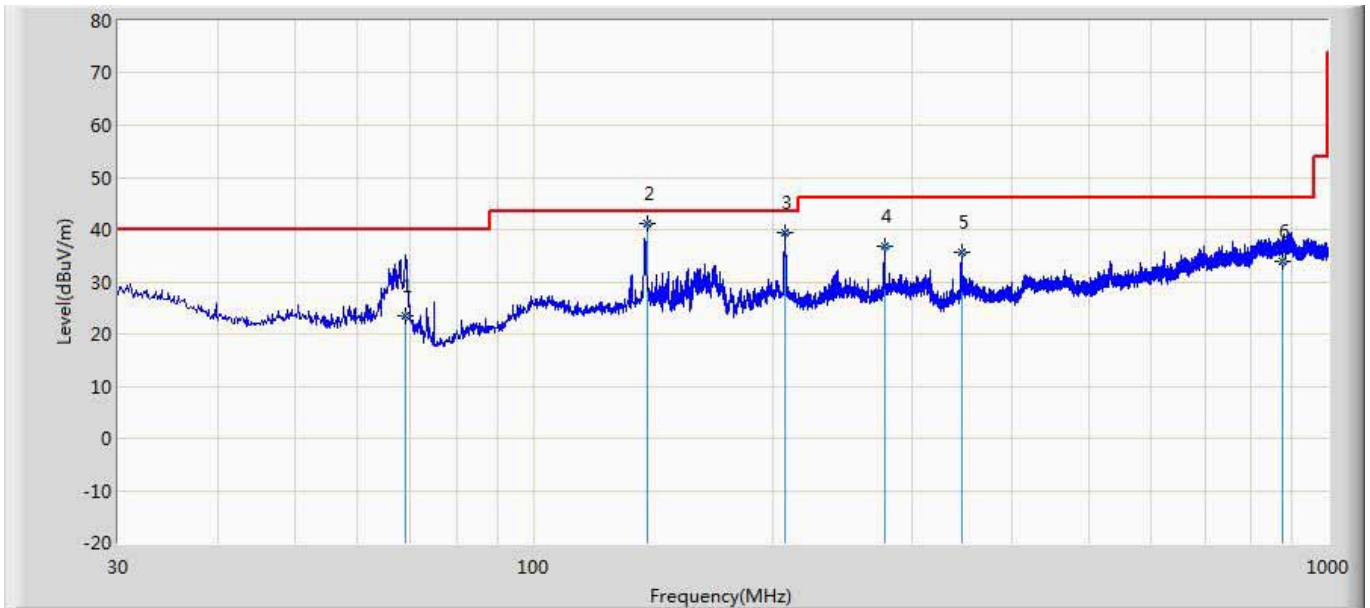
**The worst case of Radiated Emission below 1GHz:**

Site: AC2	Time: 2015/10/20 - 11:55
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_10M(30-1000M)	Polarity: Horizontal
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		31.516	28.075	0.800	-11.925	40.000	27.275	QP
2		69.430	25.365	13.918	-14.635	40.000	11.447	QP
3		138.393	34.307	16.767	-9.193	43.500	17.540	QP
4		207.731	30.709	13.445	-12.791	43.500	17.264	QP
5		691.703	30.203	1.000	-15.797	46.000	29.203	QP
6	*	859.564	37.235	4.912	-8.765	46.000	32.322	QP

Site: AC2	Time: 2015/10/20 - 12:15
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC2_10M(30-1000M)	Polarity: Vertical
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		69.023	23.544	8.333	-16.456	40.000	15.211	QP
2	*	138.919	41.082	22.700	-2.418	43.500	18.382	QP
3		207.612	39.439	16.024	-4.061	43.500	23.414	QP
4		277.014	36.815	12.376	-9.185	46.000	24.439	QP
5		346.305	35.740	11.520	-10.260	46.000	24.220	QP
6		878.403	33.821	0.648	-12.179	46.000	33.173	QP



## 5. RF Antenna Conducted Spurious

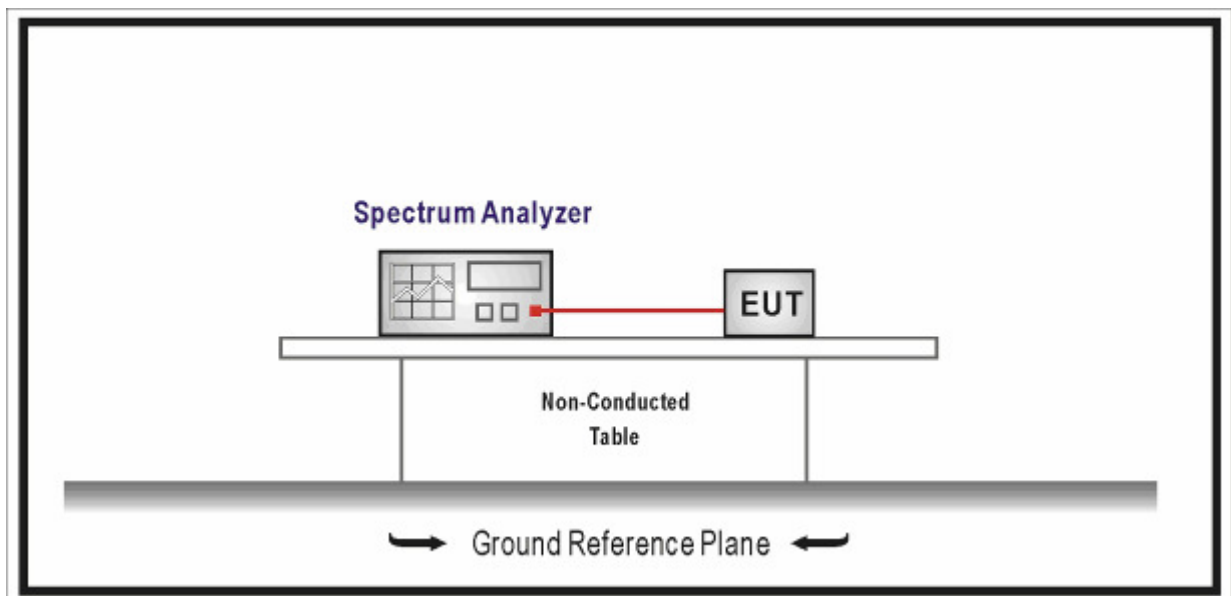
### 5.1. Test Equipment

RF Antenna Conducted Spurious / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 5.2. Test Setup



### 5.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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.

## 5.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW  $\cong$  1% of the 20dB bandwidth

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 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 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

## 5.5. Uncertainty

The measurement uncertainty is defined as  $\pm 1.27$  dB

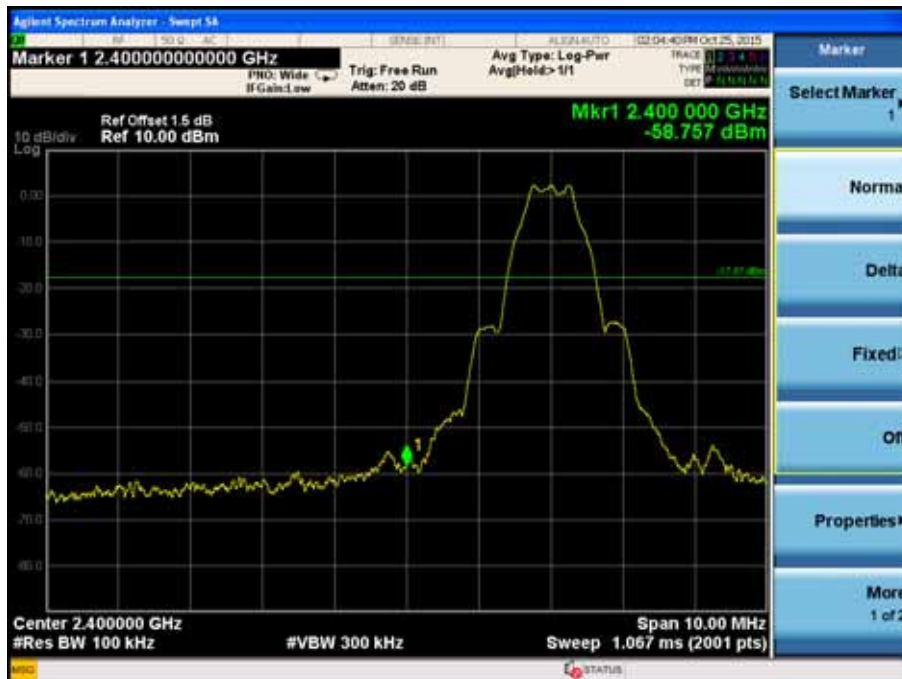
### 5.6. Test Result

Product	:	WAHOO GPS BIKE COMPUTER
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel 00 (2402MHz)-1



Channel 00 (2402MHz)-2



### Channel 00 (2402MHz)-3



### Channel 19 (2440MHz)-1



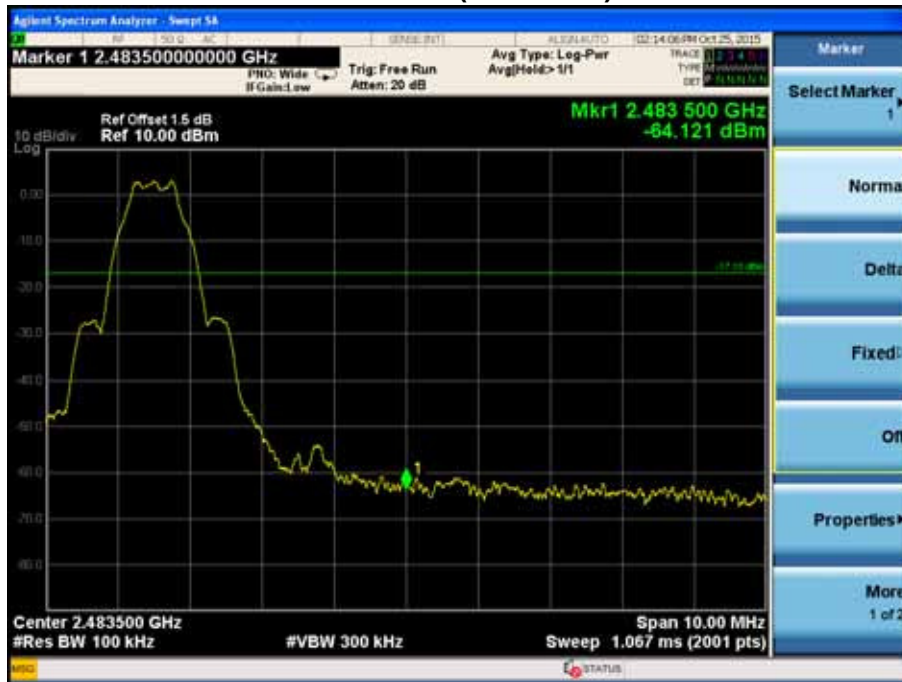
### Channel 19 (2440MHz)-2



### Channel 39 (2480MHz)-1



### Channel 39 (2480MHz)-2



### Channel 39 (2480MHz)-3



## 6. Radiated Emission Band Edge

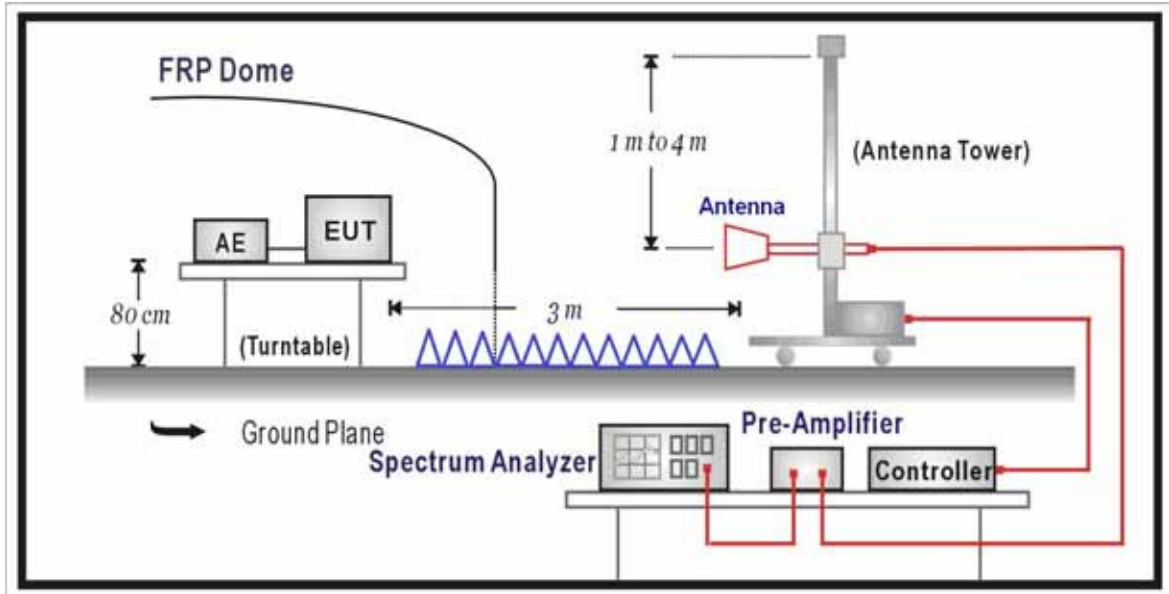
### 6.1. Test Equipment

Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2016.03.30
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	Quietek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2016.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2016.01.05
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2016.08.07
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.08

Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

## 6.2. Test Setup



## 6.3. Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 6.4. Test Procedure

According to ANSI C63.10: 2013.

This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205 of FCC part 15. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.4 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with



sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b) of FCC part 15.

Now set the VBW  $\geq 1 / T$  (the minimum transmission duration), while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209 of FCC Part 15.

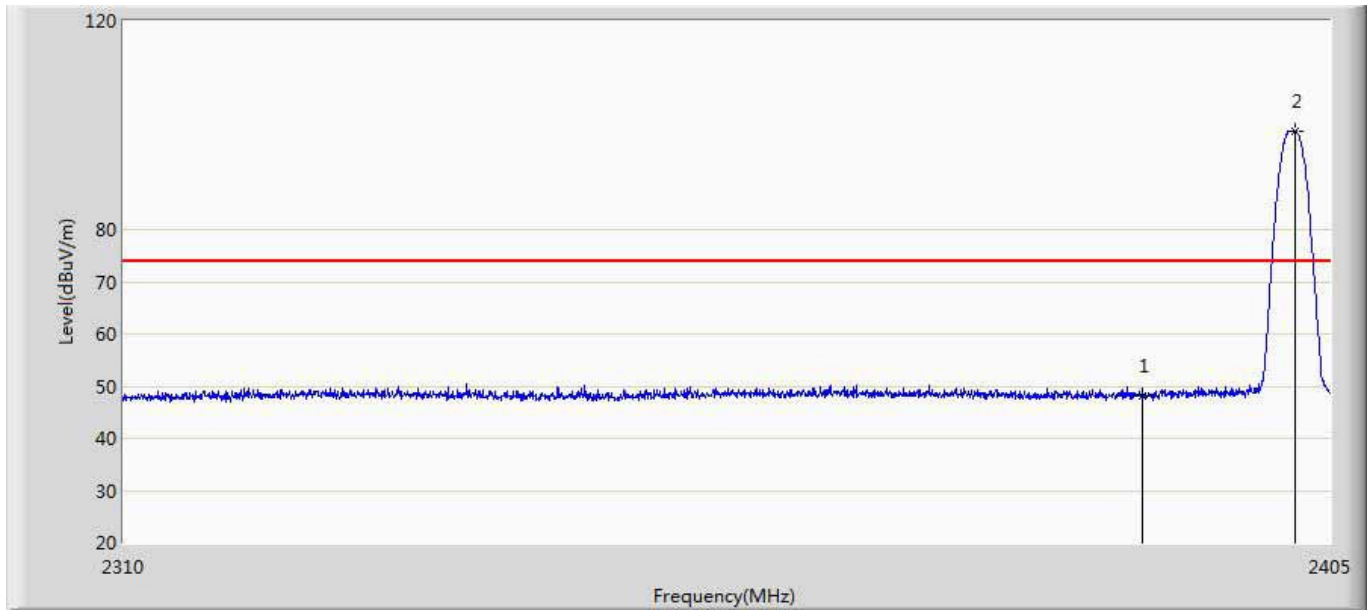
If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

## 6.5. Uncertainty

The measurement uncertainty above 1G is defined as  $\pm 3.9$  dB

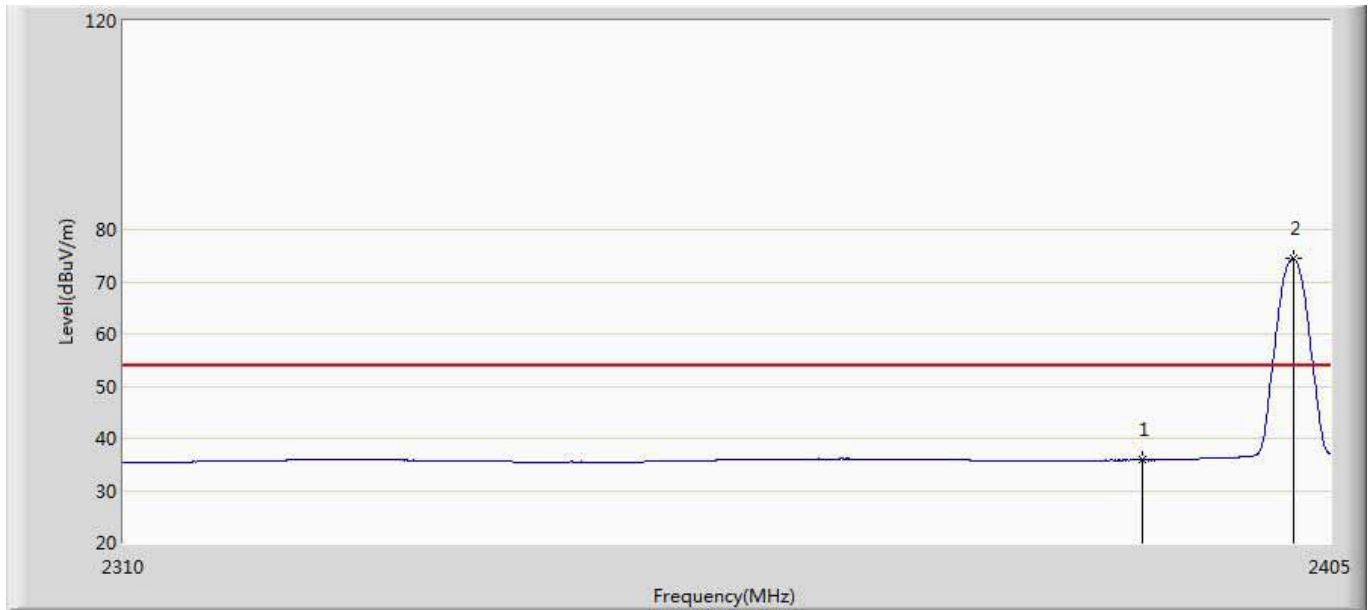
### 6.6. Test Result

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:42
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1:Transmit at CH2402Mhz by BLE	



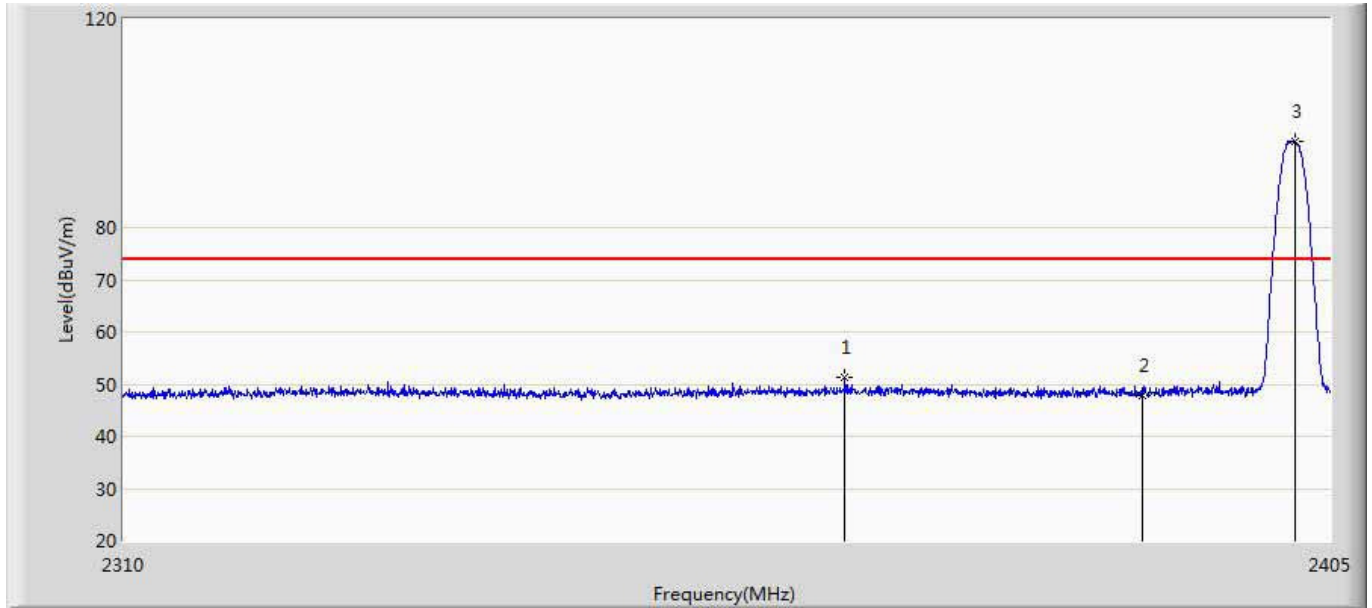
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	48.057	10.702	-25.943	74.000	37.355	PK
2	*	2402.198	98.908	61.567	24.908	74.000	37.342	PK

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:44
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1: Transmit at CH2402Mhz by BLE	



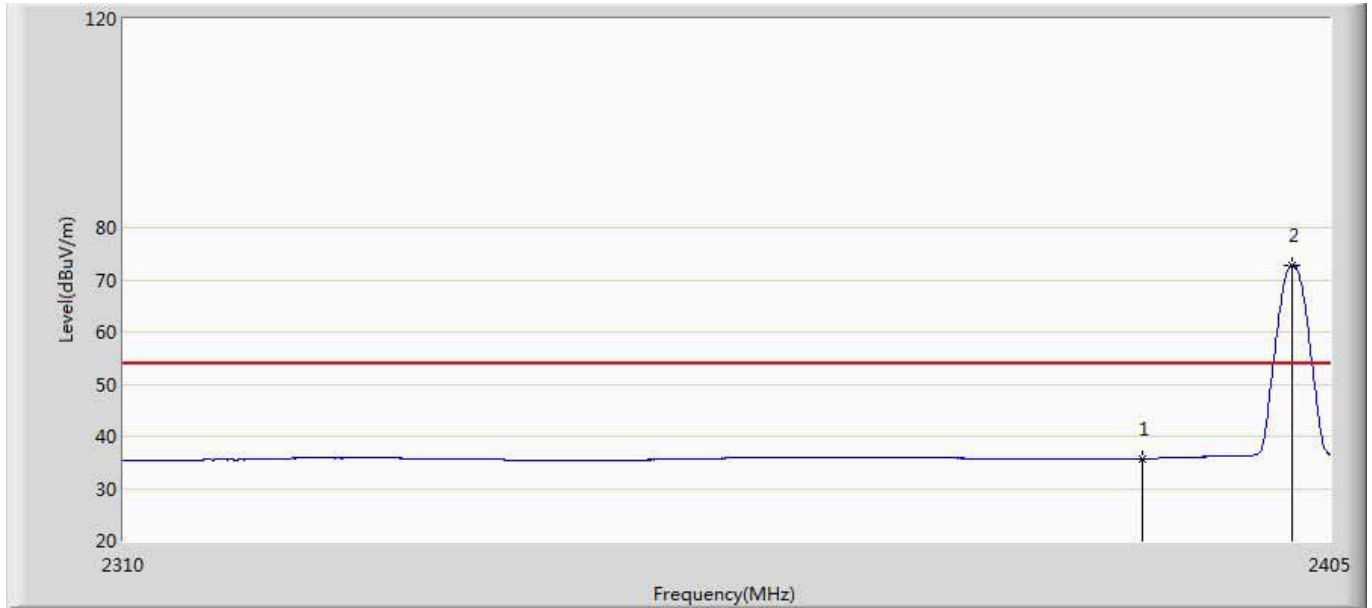
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	35.807	-1.548	-18.193	54.000	37.355	AV
2	*	2402.055	74.428	37.086	20.428	54.000	37.341	AV

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:48
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1:Transmit at CH2402Mhz by BLE	



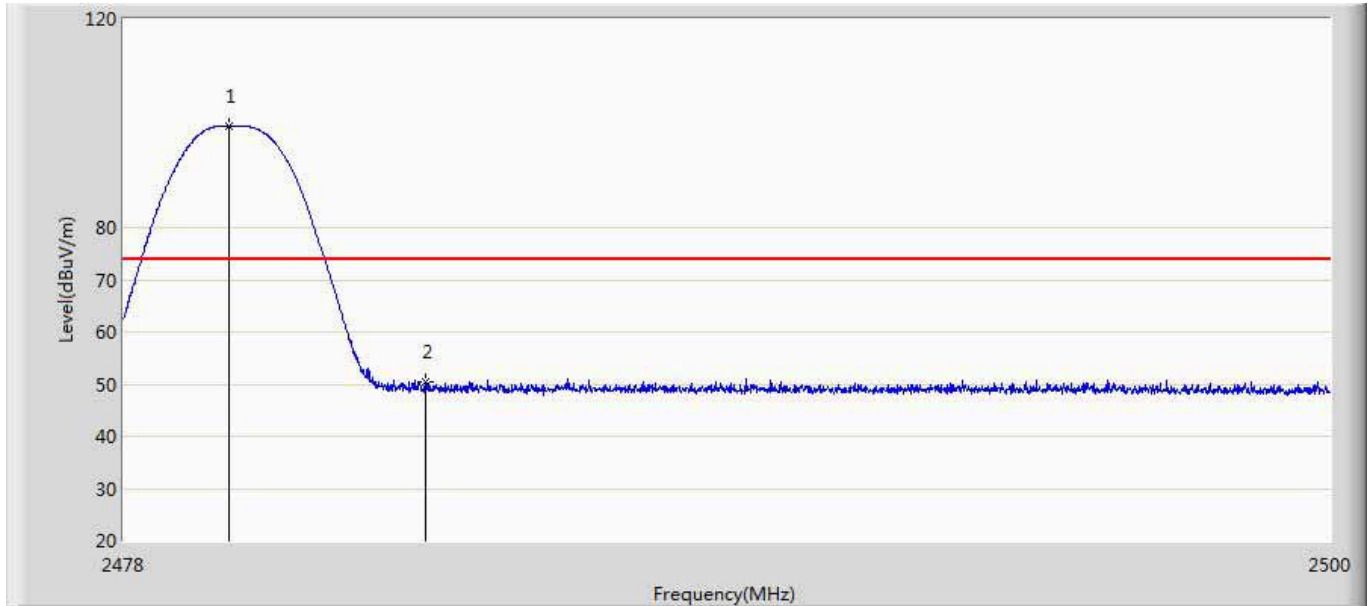
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2366.383	51.187	13.881	-22.813	74.000	37.307	PK
2		2390.000	47.805	10.450	-26.195	74.000	37.355	PK
3	*	2402.198	96.386	59.045	22.386	74.000	37.342	PK

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:51
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1:Transmit at CH2402Mhz by BLE	



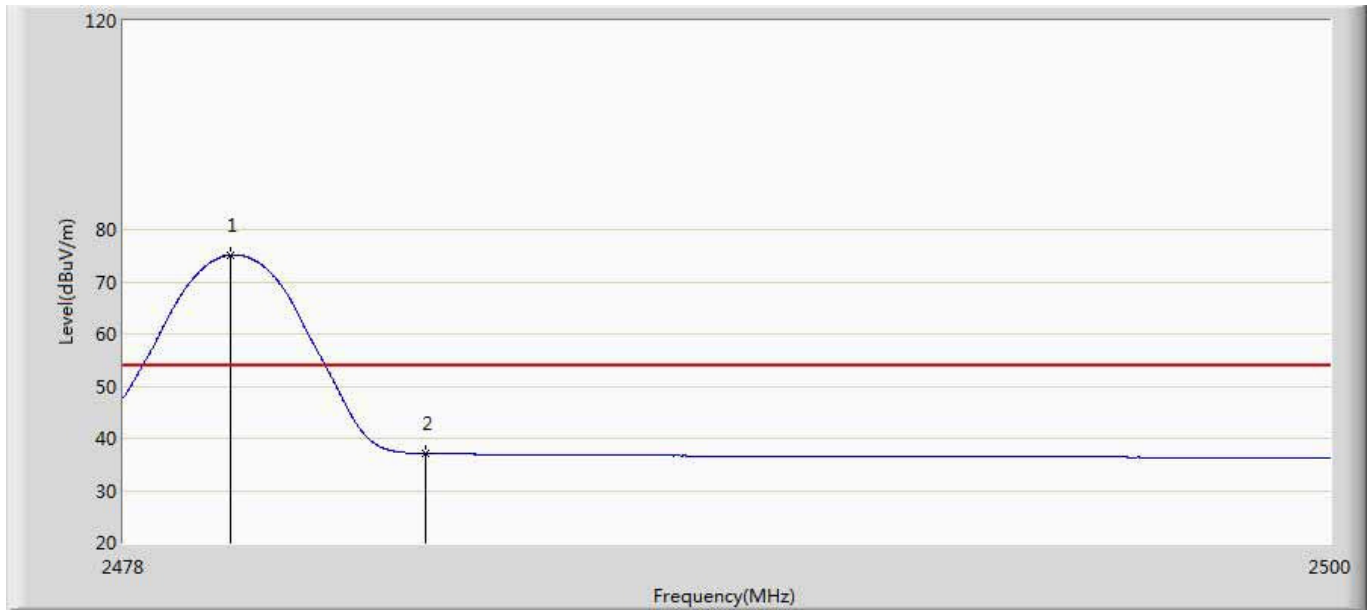
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	35.785	-1.570	-18.215	54.000	37.355	AV
2	*	2401.913	72.809	35.467	18.809	54.000	37.342	AV

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:55
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1: Transmit at CH2480Mhz by BLE	



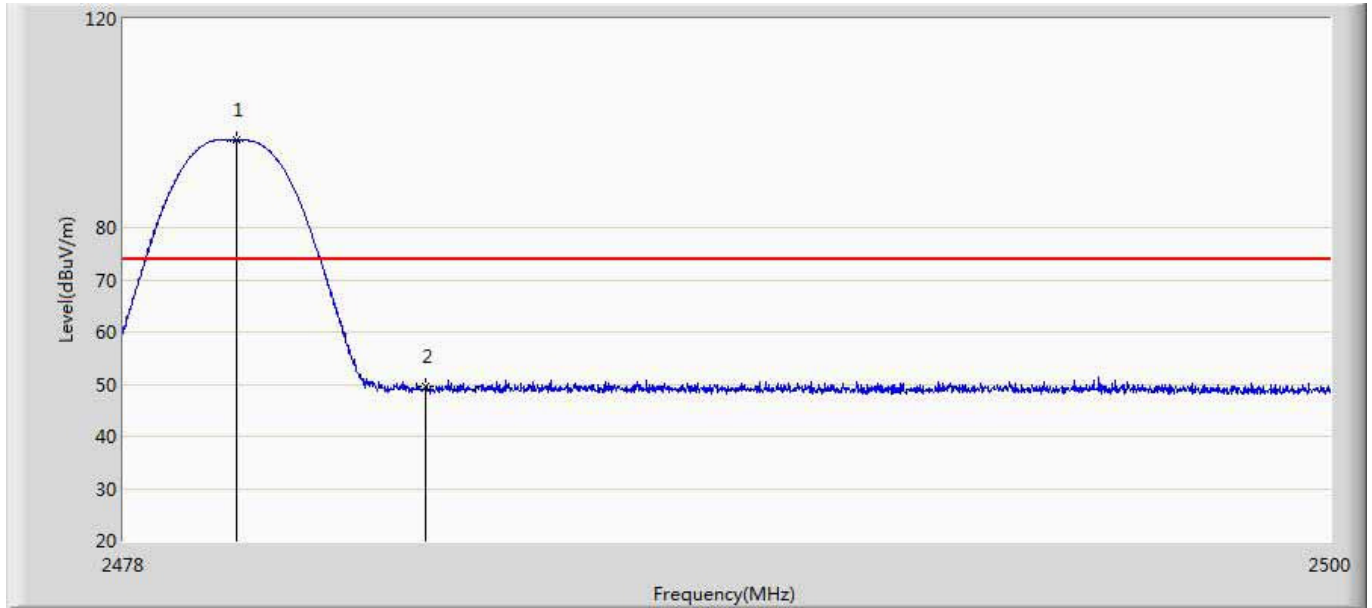
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.925	99.411	61.925	25.411	74.000	37.485	PK
2		2483.500	50.298	12.787	-23.702	74.000	37.511	PK

Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:56
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1: Transmit at CH2480Mhz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.947	75.126	37.640	21.126	54.000	37.486	AV
2		2483.500	37.045	-0.466	-16.955	54.000	37.511	AV

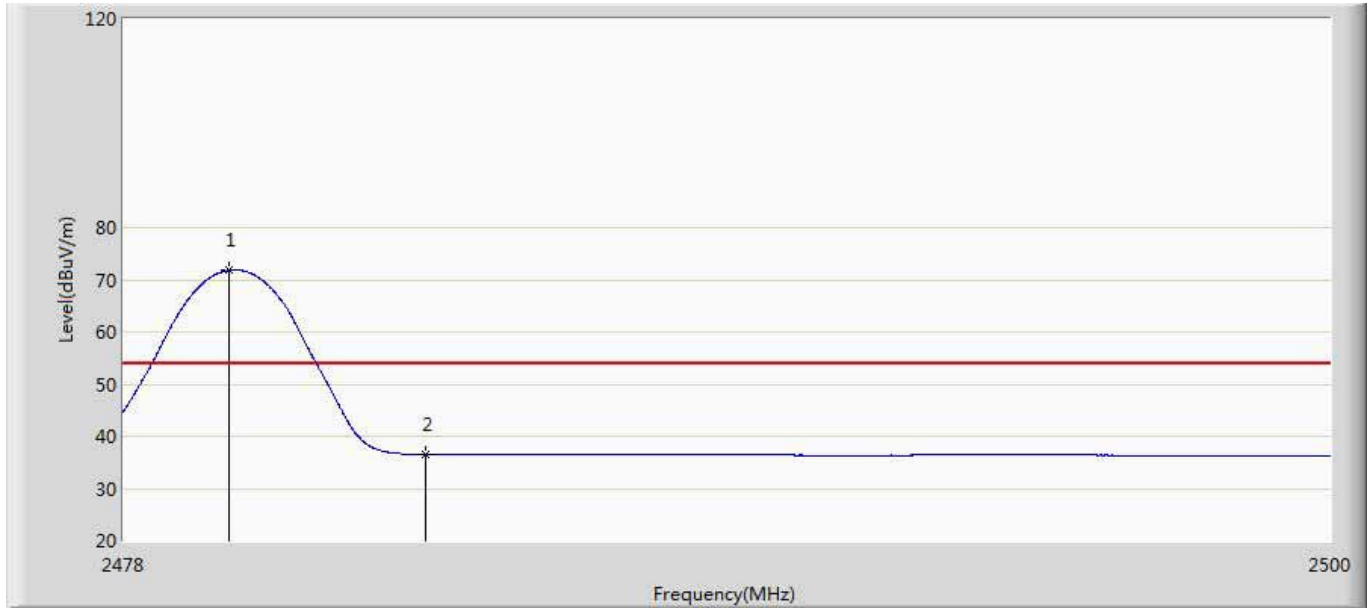
Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:59
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1:Transmit at CH2480Mhz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.046	96.762	59.276	22.762	74.000	37.486	PK
2		2483.500	49.484	11.973	-24.516	74.000	37.511	PK



Engineer: Scott	
Site: AC5	Time: 2015/10/25 - 15:59
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Wahoo GPS BIKE COMPUTER	Power: AC 120V/60Hz
Note: Mode 1:Transmit at CH2480Mhz by BLE	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.914	71.810	34.325	17.810	54.000	37.485	AV
2		2483.500	36.562	-0.949	-17.438	54.000	37.511	AV

## 7. 6dB Bandwidth and Occupied Bandwidth

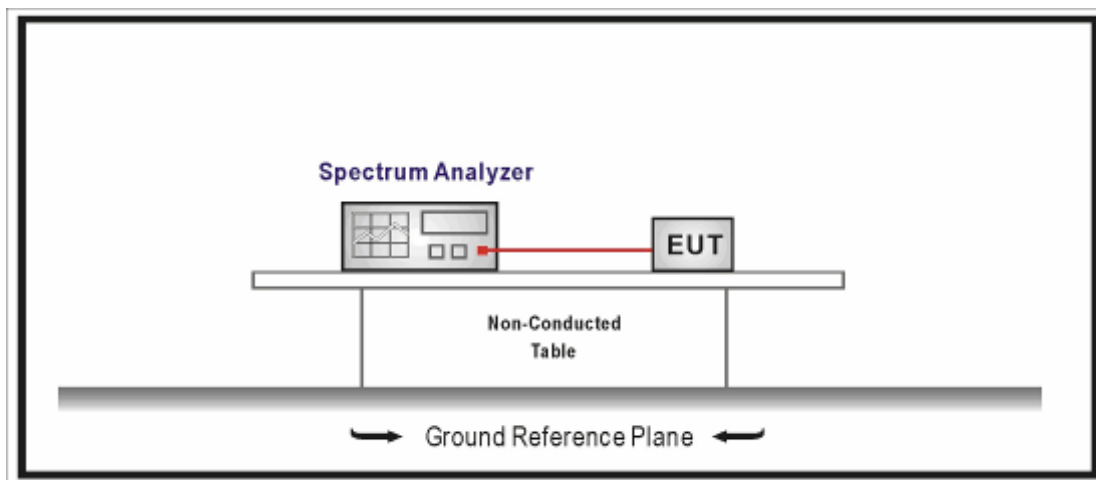
### 7.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 7.2. Test Setup



### 7.3. Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

### 7.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014; tested according to DTS test procedure of ANSI C63.10 requirements.

When the average power is exercised, the measured power is to be referenced to the OBW (99% occupied bandwidth) rather than to the DTS bandwidth according to Clause 11.9.2.1 of ANSI C63.10.

The 99% bandwidth test is using ANSI C63.10 Section 6.9.3 method.

- a) Set RBW = in the range of 1% to 5% of the OBW.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.

- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

## **7.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 1$  kHz

**7.6. Test Result**

Product	:	WAHOO GPS BIKE COMPUTER
Test Item	:	6dB Bandwidth & 99% Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
00	2402	716.1	1052.30	>500	Pass
19	2440	713.4	1053.00	>500	Pass
39	2480	715.7	1052.70	>500	Pass

**Channel 00 (2402MHz)**



### Channel 19 (2440MHz)



### Channel 39 (2480MHz)



## 8. Power Output

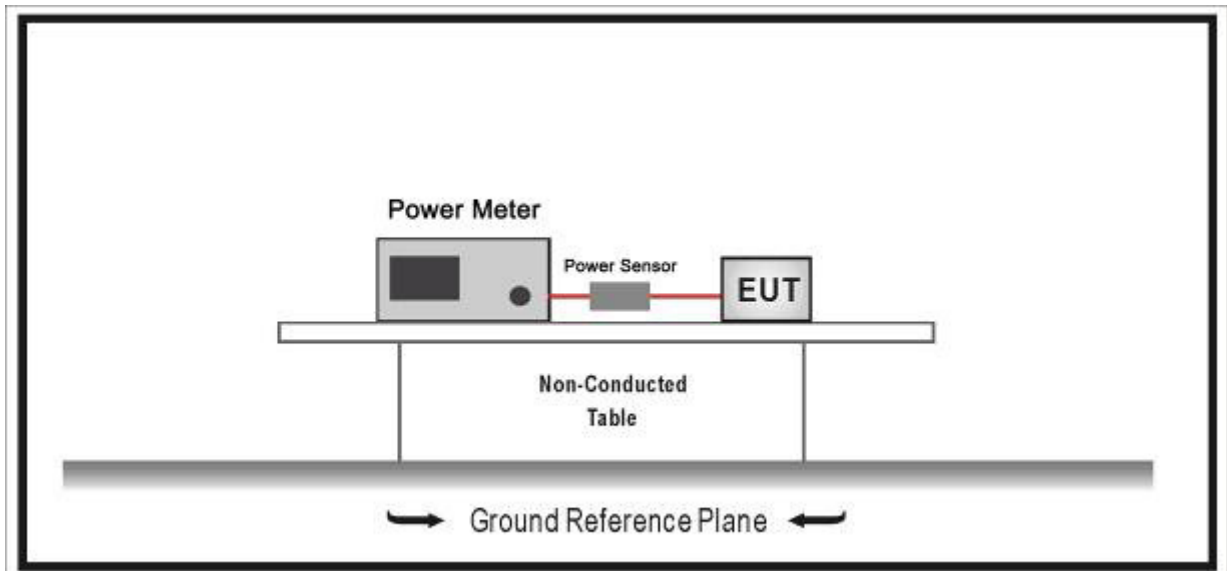
### 8.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Wideband Peak Power Meter	Anritsu	ML2495A	0905006	2015.11.10
Power Sensor	Anritsu	MA2411B	0846014	2015.11.10
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 8.2. Test Setup



### 8.3. Limit

The maximum peak power shall be less 1 Watt (30dBm).

Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

### 8.4. Test Procedure

The EUT was tested according to DTS test procedure of ANSI C63.10 for compliance to FCC 47CFR 15.247 requirements. The maximum conducted output power using ANSI C63.10 section 11.9.1.1 peak power meter method.

1. Power meter and sensor's minimum video bandwidth is 50MHz, larger than occupied bandwidth;
2. Fast responding diode sensors respond immediately to changes in power level to reduce total test time.
3. Use peak detector to test.

## **8.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 1.27$  dB

**8.6. Test Result**

Product	:	WAHOO GPS BIKE COMPUTER
Test Item	:	Power Output
Test Site	:	TR8
Test Mode	:	Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	Power Output (dBm)	Output Power Limit (dBm)	Result
00	2402	3.33	30.00	Pass
19	2440	3.94	30.00	Pass
39	2480	4.19	30.00	Pass



## 9. Power Spectral Density

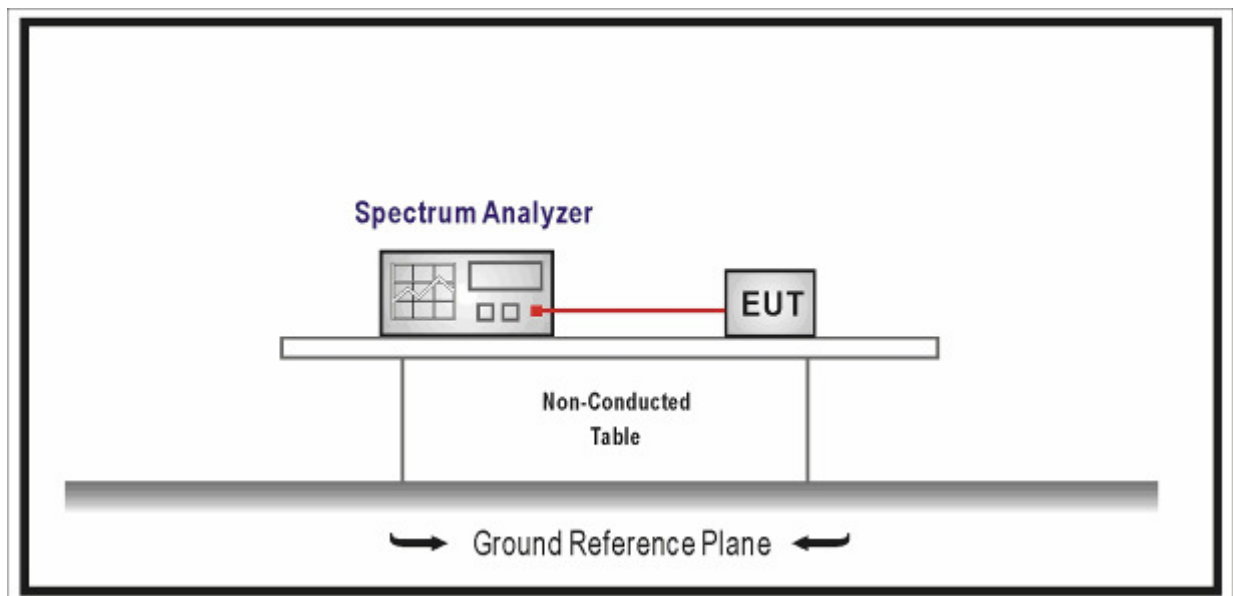
### 9.1. Test Equipment

Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2016.01.05
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 9.2. Test Setup



### 9.3. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiated to the Antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

### 9.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2014; tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ . (Actually we use 3kHz RBW)

- d) Set the VBW  $\geq 3 \times$  RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the band.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

## 9.5. Uncertainty

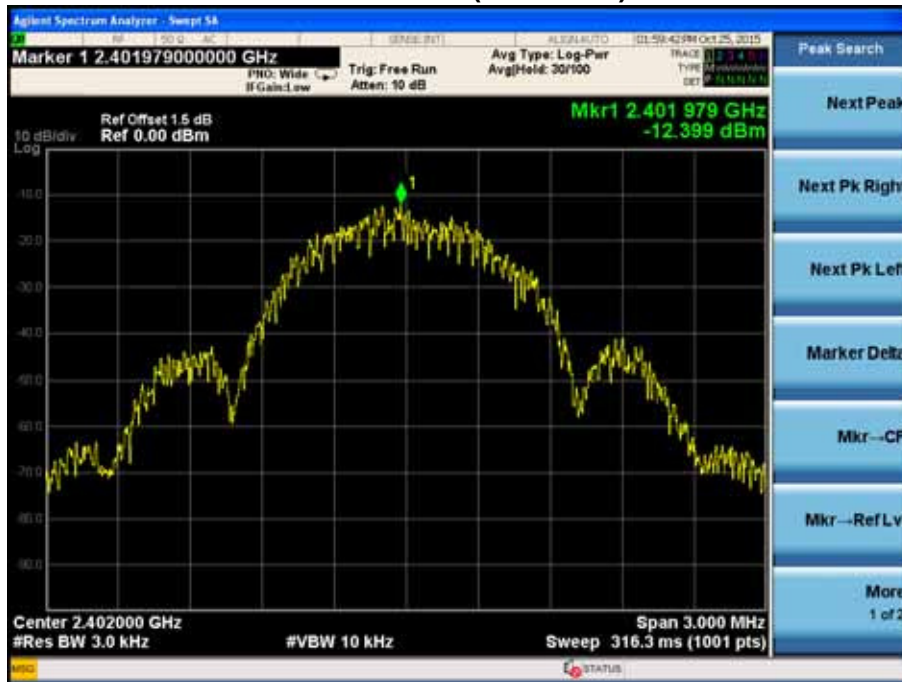
The measurement uncertainty is defined as  $\pm 1.27$  dB

**9.6. Test Result**

Product	: WAHOO GPS BIKE COMPUTER
Test Item	: Power Spectral Density
Test Site	: TR-8
Test Mode	: Mode 1: Transmit-1Mbps(GFSK_BLE)

Channel No.	Frequency (MHz)	Measurement PPSD (dBm)	Limit (dBm)	Result
00	2402	-12.399	8	Pass
19	2440	-11.679	8	Pass
39	2480	-11.533	8	Pass

**Channel 00 (2402MHz)**



### Channel 19 (2440MHz)



### Channel 39 (2480MHz)



The End