

# Test Report

## FCC Part15 Subpart C

Product Name : AK-R1  
Model No. : AK-R1  
FCC ID : 2AB6UAKR1  
IC : 12163A-AKR1

Applicant : August Home, INC.

Address : 657 Bryant Street San Francisco, CA 94107 USA

Date of Receipt : Jul. 20, 2015  
Test Date : Jul. 20, 2015~ Jul. 31, 2015  
Issued Date : Aug. 20, 2015  
Report No. : 1570499R-RF-US-P06V02  
Report Version : V1.2

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.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of QuieTek Corporation.

# Test Report Certification

Issued Date : Aug. 20, 2015  
Report No. : 1570499R-RF-US-P06V02



Product Name : AK-R1  
Applicant : August Home, INC.  
Address : 657 Bryant Street San Francisco, CA 94107 USA  
Manufacturer : August Home, INC.  
Address : 657 Bryant Street San Francisco, CA 94107 USA  
Model No. : AK-R1  
FCC ID : 2AB6UAKR1  
IC : 12163A-AKR1  
EUT Voltage : DC: 3.0V  
Brand Name : August  
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2014  
ANSI C63.4: 2014; ANSI C63.10: 2013  
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 Loufeng  
Hi-Tech Development Zone., Suzhou, China  
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098

Documented By : Elaine Wang Senior Engineer  
Reviewed By : Harry Zhao RF Engineering Manager  
Approved By : Dream Cao Director

## 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/>

If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

### **HsinChu Testing Laboratory :**

No.75-2, 3rd Lin, Wangye Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan, R.O.C.  
TEL:+886-3-592-8858 / FAX:+886-3-592-8859                      E-Mail : [service@quietek.com](mailto:service@quietek.com)

### **LinKou Testing Laboratory :**

No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.  
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789                      E-Mail : [service@quietek.com](mailto:service@quietek.com)

### **Suzhou Testing Laboratory :**

No.99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development Zone., SuZhou, China  
TEL : +86-512-6251-5088 / FAX : 86-512-6251-5098                      E-Mail : [service@quietek.com](mailto:service@quietek.com)

## TABLE OF CONTENTS

Description	Page
1. General Information.....	7
1.1. EUT Description .....	7
1.2. Mode of Operation.....	8
1.3. Tested System Details .....	9
1.4. Configuration of Tested System.....	10
1.5. EUT Exercise Software.....	11
2. Technical Test.....	12
2.1. Summary of Test Result .....	12
2.2. Test Environment.....	14
3. Conducted Emission.....	15
3.1. Test Equipment .....	15
3.2. Test Setup.....	15
3.3. Limit.....	16
3.4. Test Procedure .....	16
3.5. Uncertainty.....	16
3.6. Test Result .....	17
4. Radiated Emission .....	18
4.1. Test Equipment .....	18
4.2. Test Setup.....	19
4.3. Limit.....	20
4.4. Test Procedure .....	20
4.5. Uncertainty.....	20
4.6. Test Result .....	21
5. RF Antenna Conducted Spurious .....	24
5.1. Test Equipment .....	24
5.2. Test Setup.....	24
5.3. Limit.....	24
5.4. Test Procedure .....	25
5.5. Uncertainty.....	25
5.6. Test Result .....	26
6. Radiated Emission Band Edge.....	29
6.1. Test Equipment .....	29
6.2. Test Setup.....	30
6.3. Limit.....	30
6.4. Test Procedure .....	30
6.5. Uncertainty.....	31
6.6. Test Result .....	32

- 7. Operation Frequency Range of 20dB Bandwidth..... 40
  - 7.1. Test Equipment ..... 40
  - 7.2. Test Setup..... 40
  - 7.3. Limit..... 40
  - 7.4. Test Procedure ..... 40
  - 7.5. Uncertainty..... 40
  - 7.6. Test Result ..... 41
- 8. 6dB Bandwidth and Occupied Bandwidth ..... 42
  - 8.1. Test Equipment ..... 42
  - 8.2. Test Setup..... 42
  - 8.3. Limit..... 42
  - 8.4. Test Procedure ..... 42
  - 8.5. Uncertainty..... 43
  - 8.6. Test Result ..... 44
- 9. Power Output..... 46
  - 9.1. Test Equipment ..... 46
  - 9.2. Test Setup..... 46
  - 9.3. Limit..... 46
  - 9.4. Test Procedure ..... 46
  - 9.5. Uncertainty..... 47
  - 9.6. Test Result ..... 48
- 10. Power Spectral Density..... 49
  - 10.1. Test Equipment ..... 49
  - 10.2. Test Setup..... 49
  - 10.3. Limit..... 49
  - 10.4. Test Procedure ..... 49
  - 10.5. Uncertainty..... 50
  - 10.6. Test Result ..... 51

### History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1570499R-RF-US-P06V02	V1.0	Initial Issued Report	Aug. 04, 2015
1570499R-RF-US-P06V02	V1.1	Modify test voltage	Aug. 13, 2015
1570499R-RF-US-P06V02	V1.2	Modify test standard	Aug. 20, 2015

**1. General Information**

**1.1. EUT Description**

Product Name	AK-R1
Brand Name	August
Model No.	AK-R1
Working Voltage	DC 3.0V
Bluetooth Specification	V4.1
Frequency Range	2402- 2480 MHz
Channel Number	V4.1: 40
Channel Separation	V4.1: 2MHz
Type of Modulation	V4.1: GFSK
Data Rate	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
Multilayer Chip Antenna	N/A	AT3216-B2R7HAA_	0.5dBi

## 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.

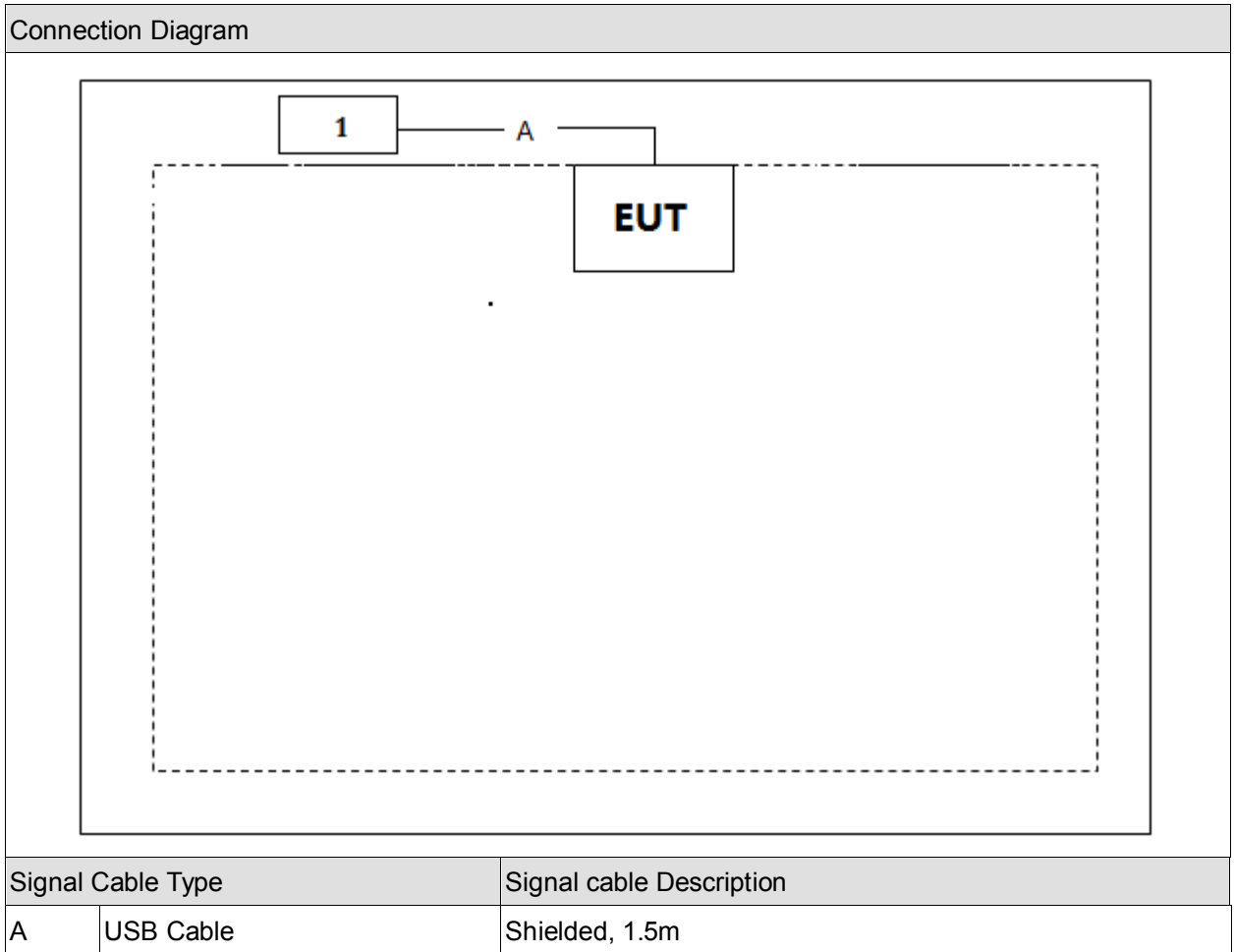


### 1.3. Tested System Details

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, and set the test mode and channel, then press OK to start continue Transmit.

## 2. Technical Test

### 2.1. Summary of Test Result

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

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

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

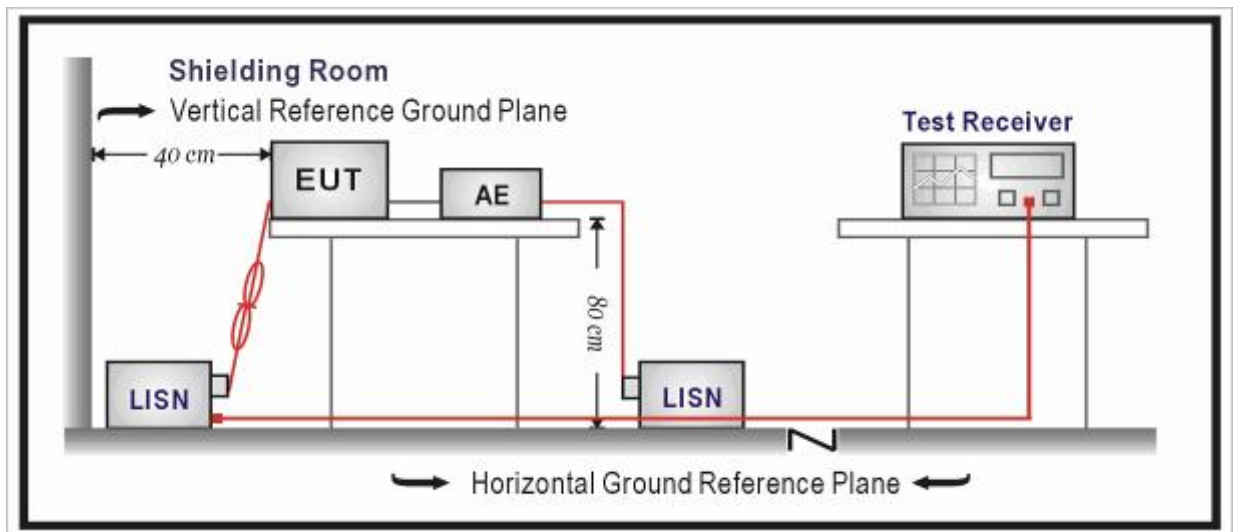
#### 3.1. Test Equipment

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	2015.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2016.03.01
50ohm Termination	SHX	TF2	07081401	2015.09.16
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**

The EUT use battery power,do not need to test this project

## 4. Radiated Emission

### 4.1. Test Equipment

#### Radiated Emission / AC-2

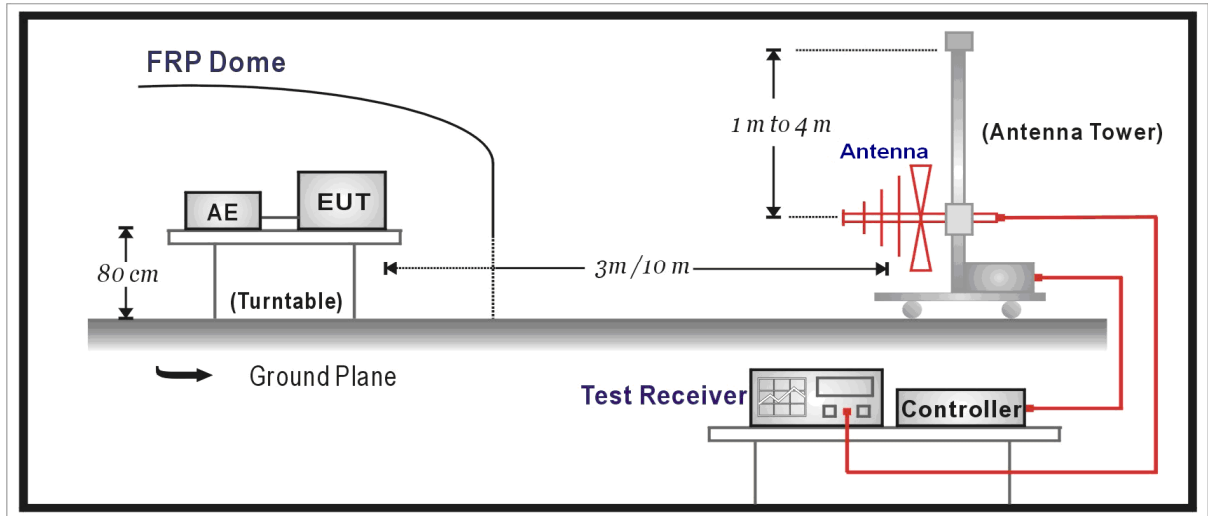
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2016.03.28
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2015.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2016.01.08

#### Radiated Emission / AC-5

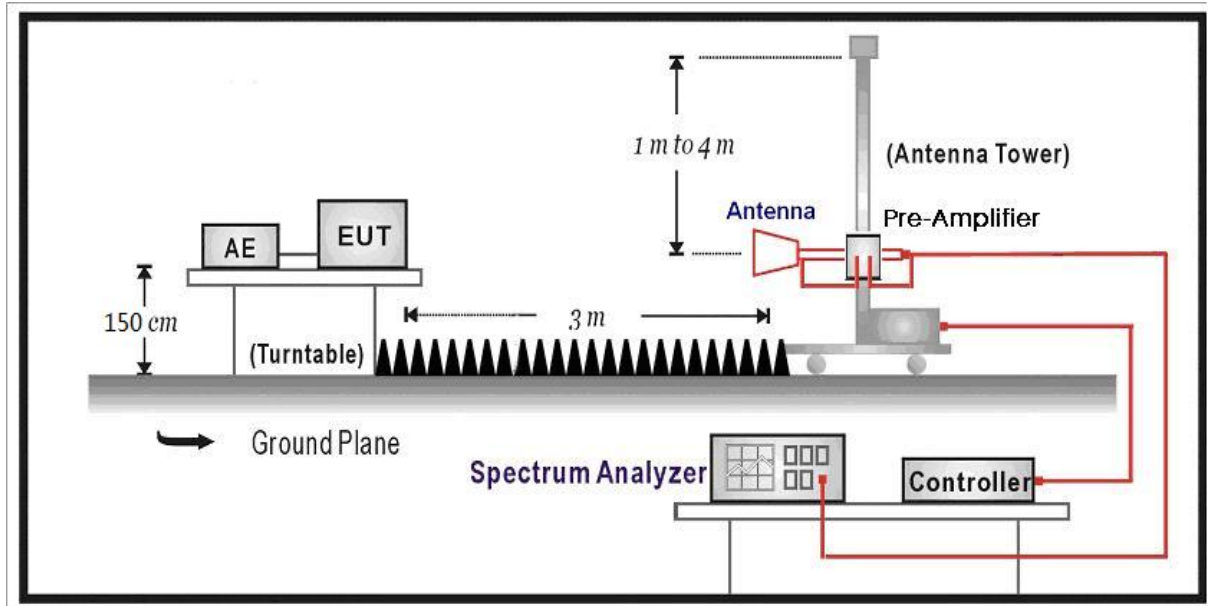
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.05.12
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2015.10.15
Broad-Band Horn Antenna	Schwarzbeck	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)

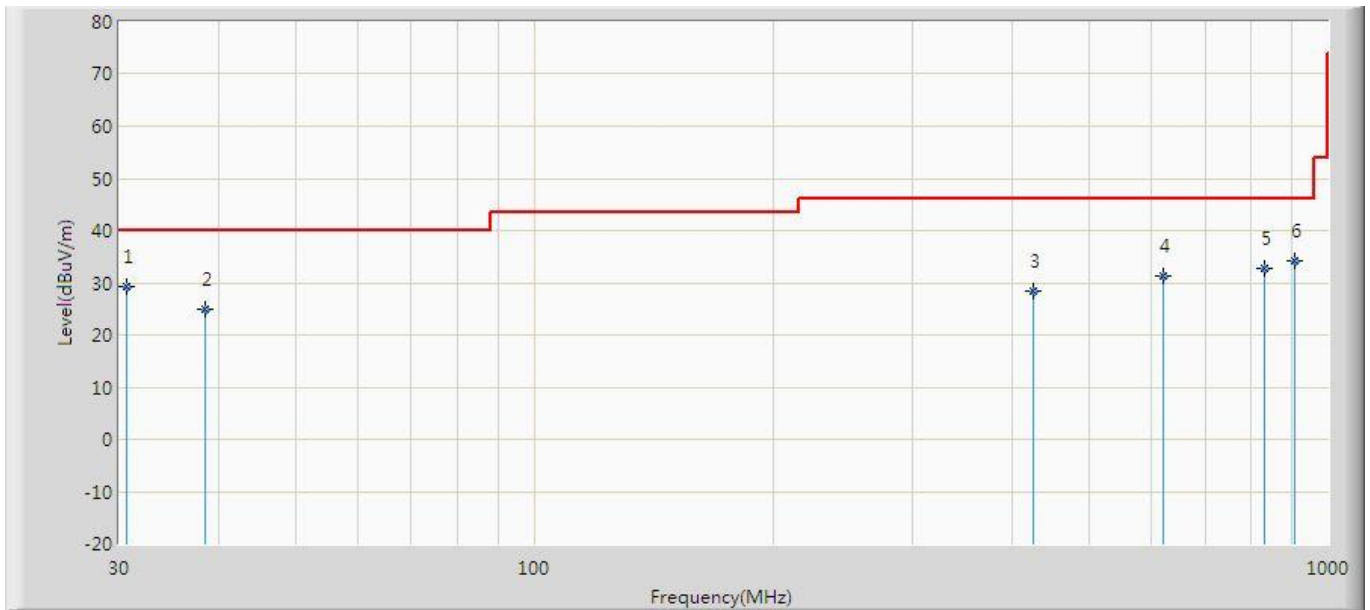
CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	50.7	-6.2	44.5	54(Note2)	-9.5	PK
	V	4804.0	51.3	-6.3	45.0	54(Note2)	-9.0	PK
	H	7206.0	43.0	-1.7	41.3	54(Note2)	-12.7	PK
	V	7206.0	43.1	-1.7	41.4	54(Note2)	-12.6	PK
	H	9608.0	36.5	4.9	41.4	54(Note2)	-12.6	PK
	V	9608.0	36.8	4.9	41.7	54(Note2)	-12.3	PK
19	H	4880	50.9	-6.2	44.7	54(Note2)	-9.3	PK
	V	4880	51.1	-6.2	44.9	54(Note2)	-9.1	PK
	H	7320	41.9	-1.4	40.5	54(Note2)	-13.5	PK
	V	7320	40.9	-1.4	39.5	54(Note2)	-14.5	PK
	H	9760	35.7	5.1	40.8	54(Note2)	-13.2	PK
	V	9760	36.8	5.2	42.0	54(Note2)	-12.0	PK
39	H	4960	50.3	-6.3	44.0	54(Note2)	-10.0	PK
	V	4960	49.3	-6.1	43.2	54(Note2)	-10.8	PK
	H	7440	40.0	-0.8	39.2	54(Note2)	-14.8	PK
	V	7440	41.3	-0.8	40.5	54(Note2)	-13.5	PK
	H	9920	35.6	5.5	41.1	54(Note2)	-12.9	PK
	V	9920	35.9	5.5	41.4	54(Note2)	-12.6	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.

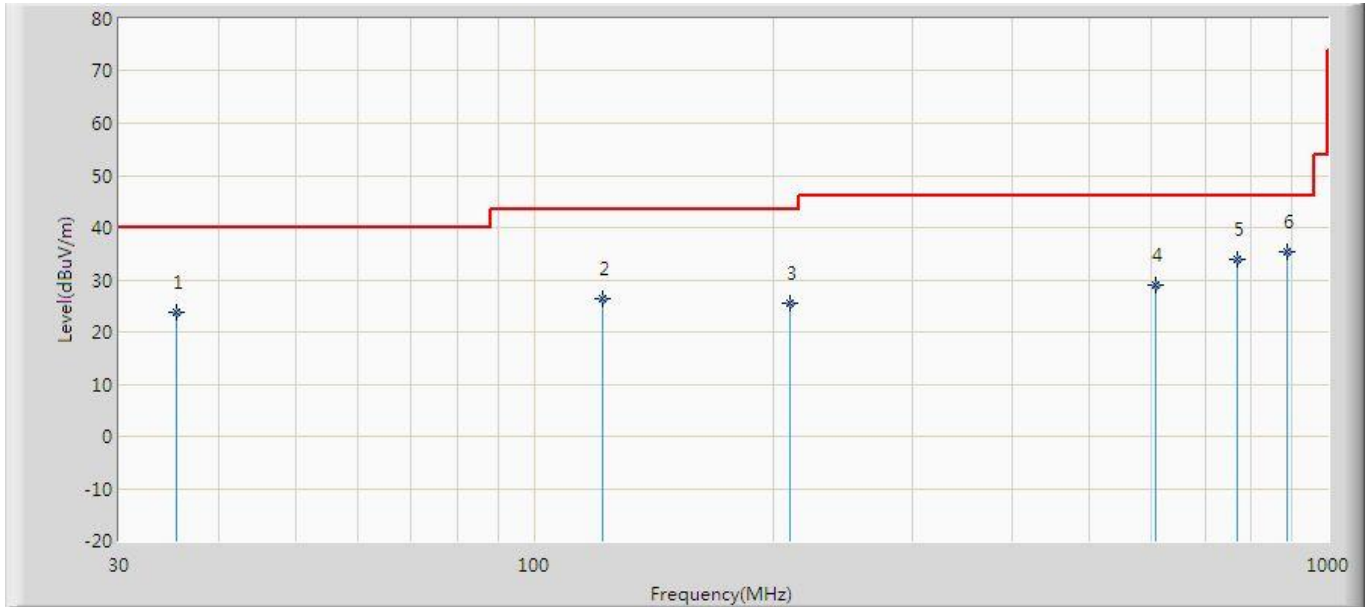
**The worst case of Radiated Emission below 1GHz:**

Site: AC3	Time: 2015/07/31 - 09:51
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC3_10m (30-1000MHz)	Polarity: Horizontal
EUT: AK-R1	Power: DC 3V
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	30.674	29.275	1.700	-10.725	40.000	27.575	QP
2		38.571	25.021	1.600	-14.979	40.000	23.421	QP
3		424.974	28.516	1.100	-17.484	46.000	27.416	QP
4		620.647	31.394	1.800	-14.606	46.000	29.594	QP
5		832.618	32.762	2.100	-13.238	46.000	30.662	QP
6		908.782	34.225	2.300	-11.775	46.000	31.925	QP

Site: AC3	Time: 2015/07/31 - 09:51
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC3_10m (30-1000MHz)	Polarity: Vertical
EUT: AK-R1	Power: DC 3V
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		35.481	23.850	1.600	-16.150	40.000	22.249	QP
2		121.951	26.315	4.800	-17.185	43.500	21.515	QP
3		209.844	25.450	2.100	-18.050	43.500	23.349	QP
4		606.641	29.071	1.800	-16.929	46.000	27.271	QP
5		768.279	33.898	1.600	-12.102	46.000	32.298	QP
6	*	888.049	35.385	2.100	-10.615	46.000	33.285	QP

## 5. RF Antenna Conducted Spurious

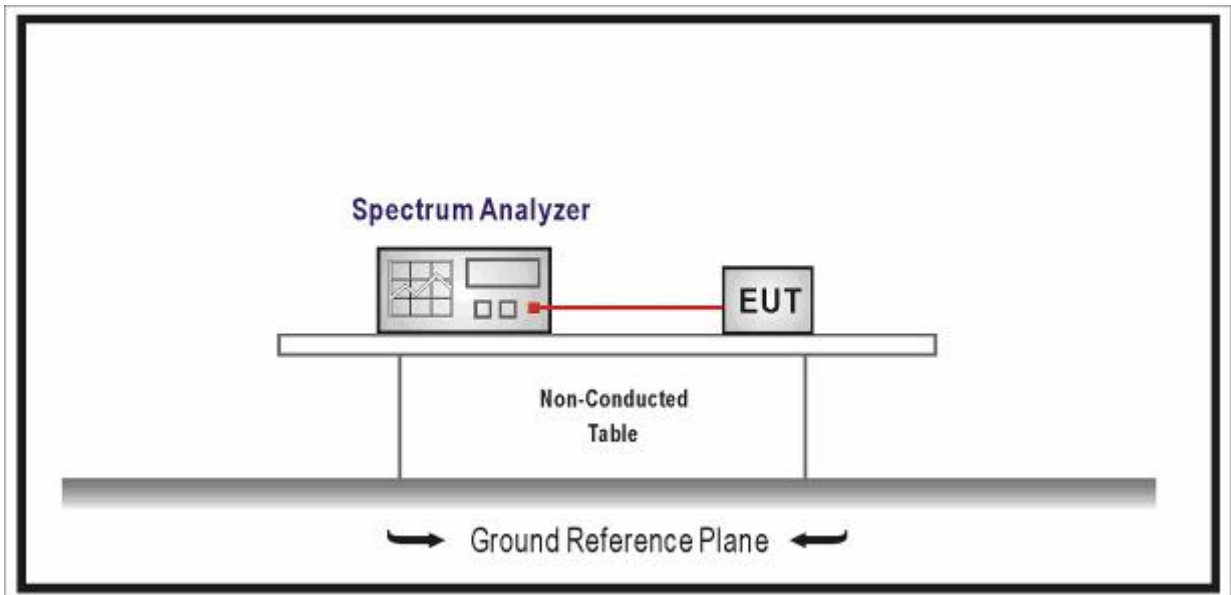
### 5.1. Test Equipment

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.

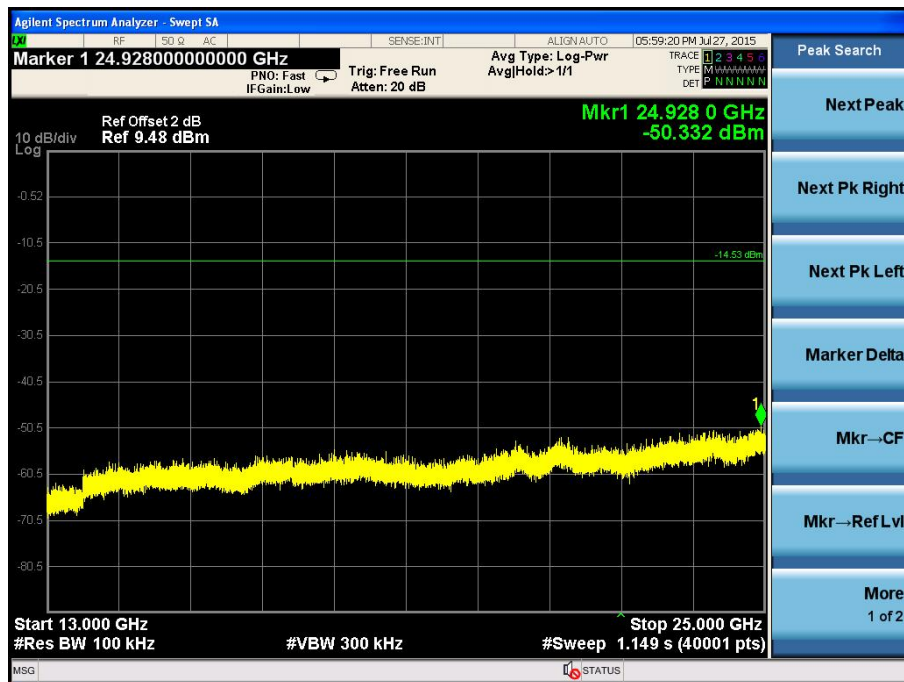
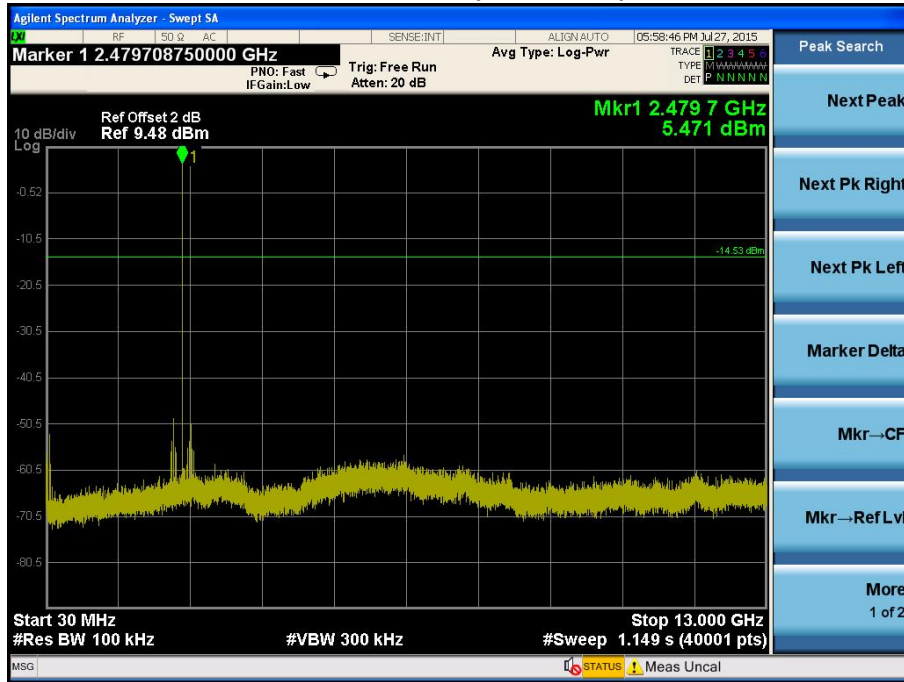
## 5.5. Uncertainty

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

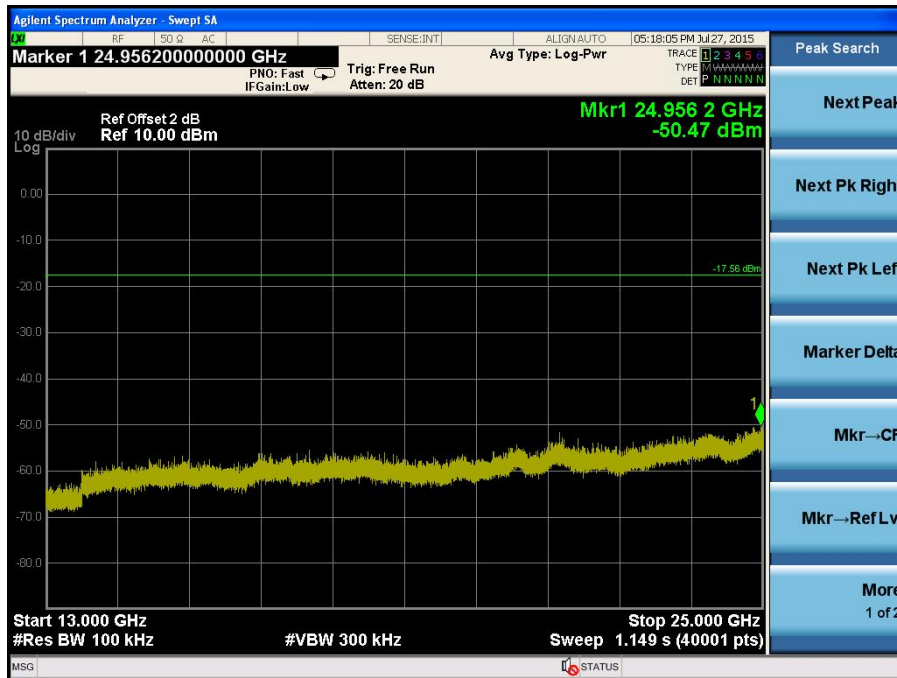
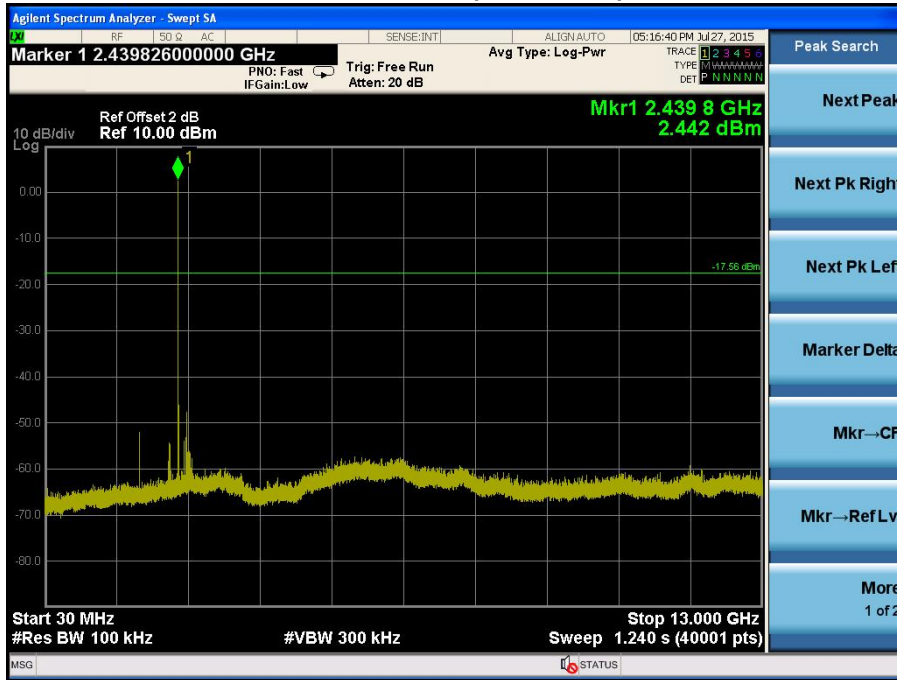
**5.6. Test Result**

Product	: AK-R1
Test Item	: RF Antenna Conducted Spurious
Test Site	: TR-8
Test Mode	: Mode 1: Transmit-1Mbps(GFSK_BLE)

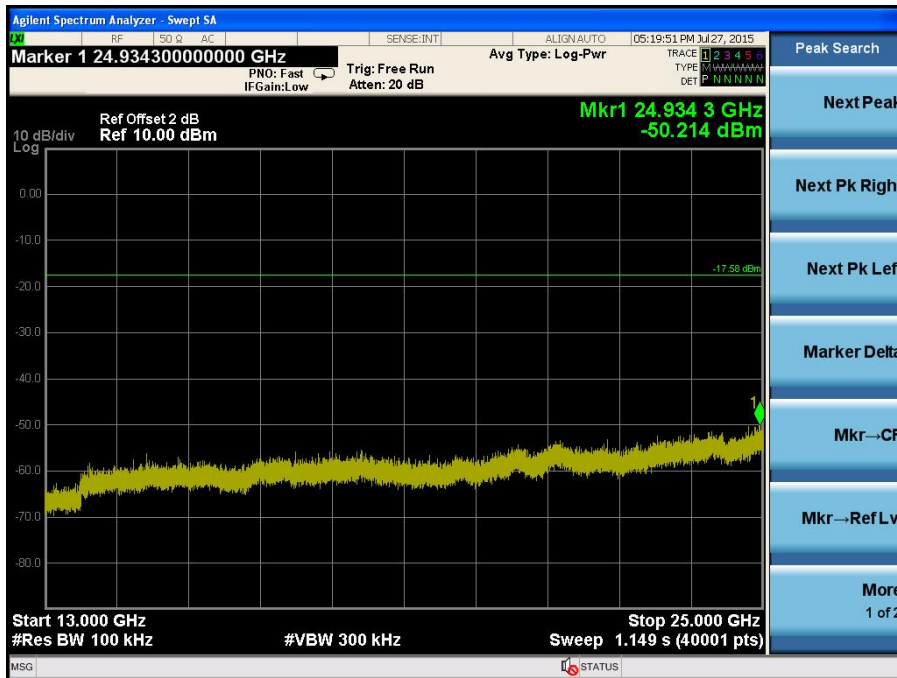
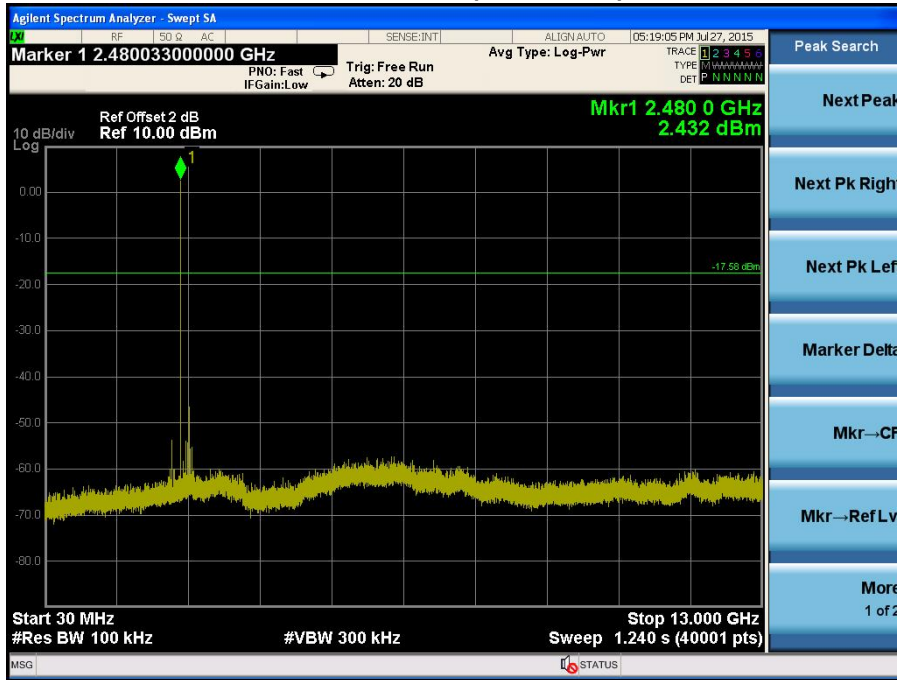
**Channel 00 (2402MHz)**



### Channel 19 (2440MHz)



### Channel 39 (2480MHz)



## 6. Radiated Emission Band Edge

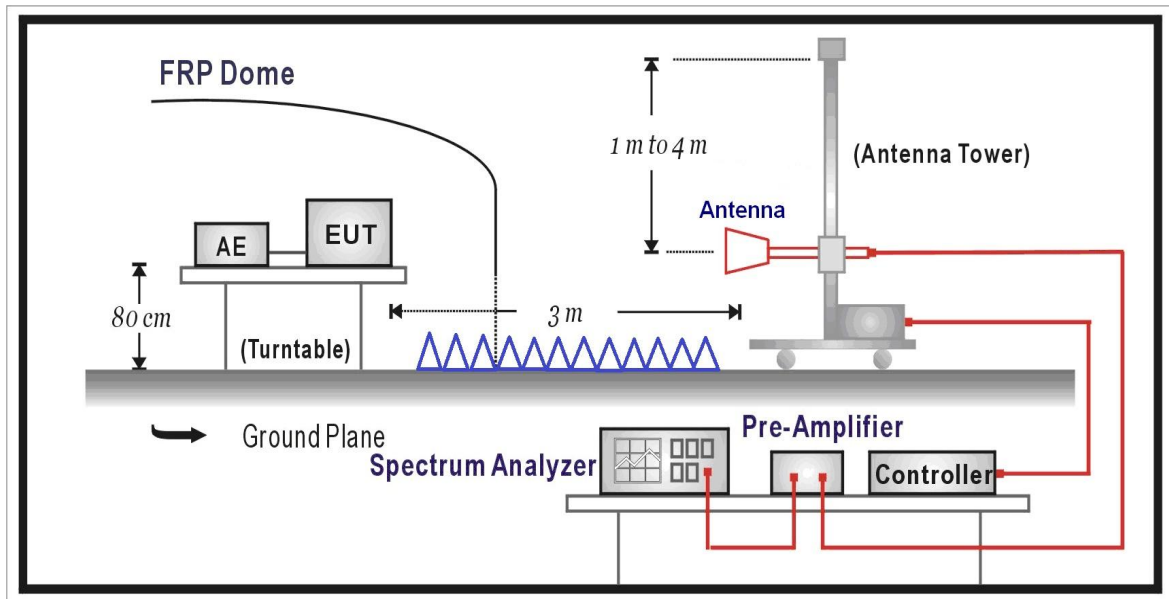
### 6.1. Test Equipment

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	2015.10.15
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	2015.08.07
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.

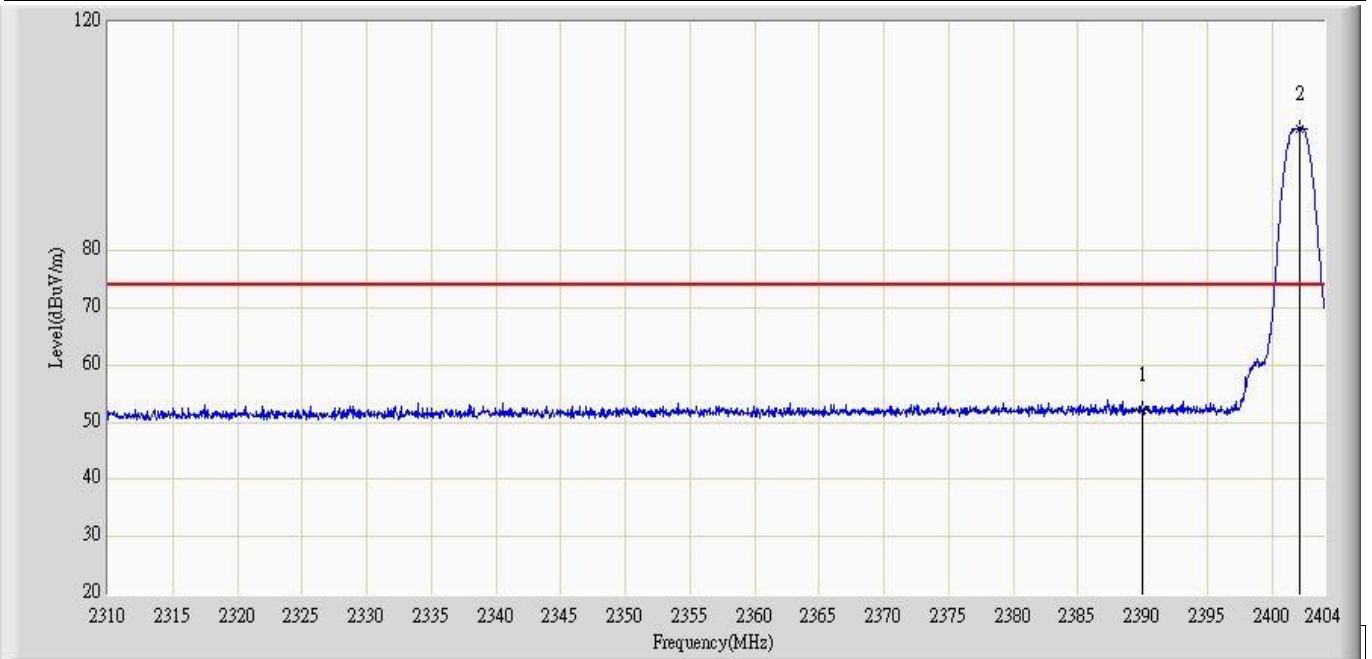
If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

## **6.5. Uncertainty**

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

### 6.6. Test Result

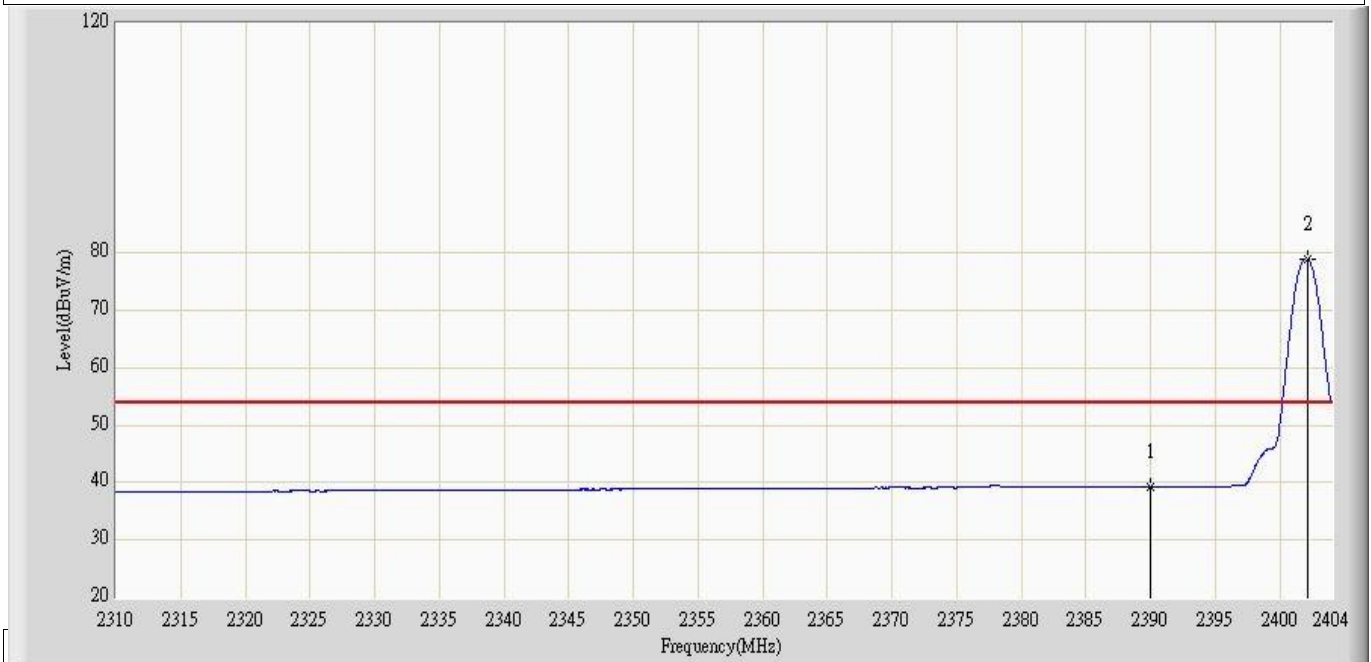
Site: AC5	Time: 2015/07/27 - 14:27
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Horizontal
EUT: Keyboard	Power: DC 3V
Note: Mode1: Transmit at channel 2402MHz by BLE	



	g	rk	(MHz)	Level (dBuV/m)	(dBuV)	(dB)	(dBuV/m)		
1			2390.000	52.128	14.969	-21.872	74.000	37.159	PK
2		*	2402.073	101.429	64.164	N/A	N/A	37.265	PK



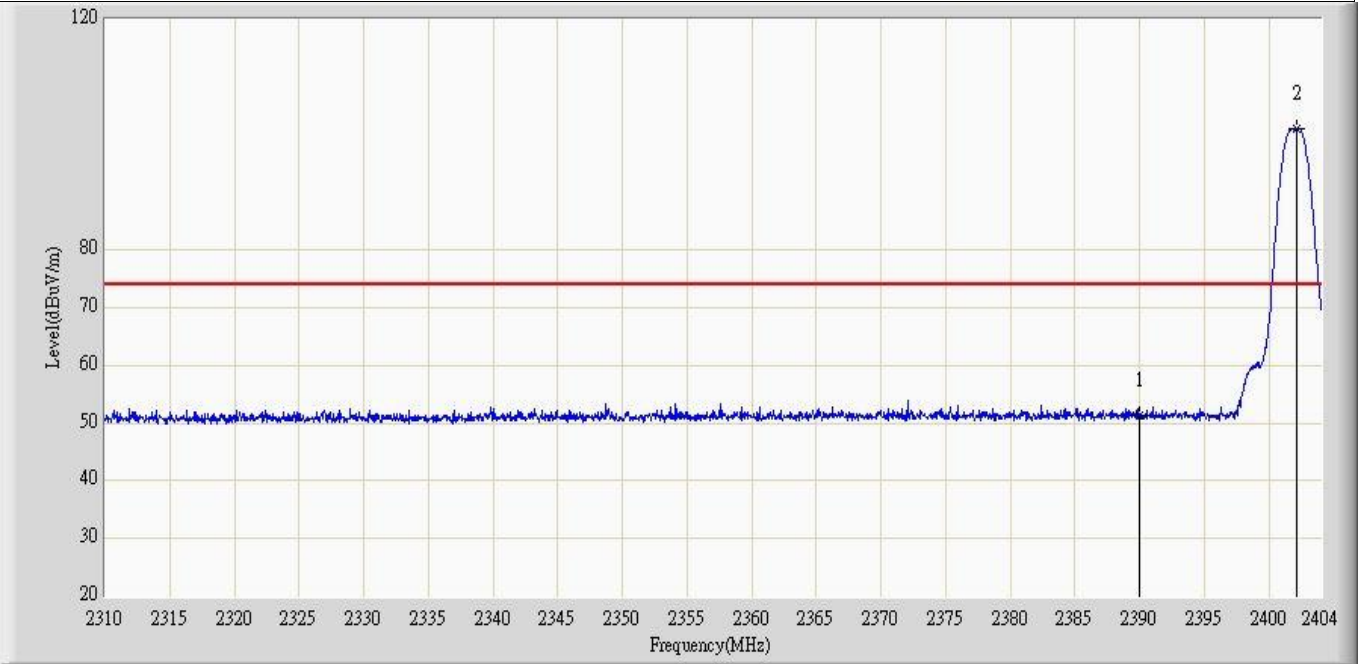
Site: AC5	Time: 2015/07/27 - 14:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Horizontal
EUT: Keyboard	Power: DC 3V
Note: Mode1: Transmit at channel 2402MHz by BLE	



	g	rk	(MHz)	Level (dBuV/m)	(dBuV)	(dB)	(dBuV/m)		
1			2390.000	39.269	2.110	-14.731	54.000	37.159	AV
2		*	2402.073	79.043	41.778	N/A	N/A	37.265	AV

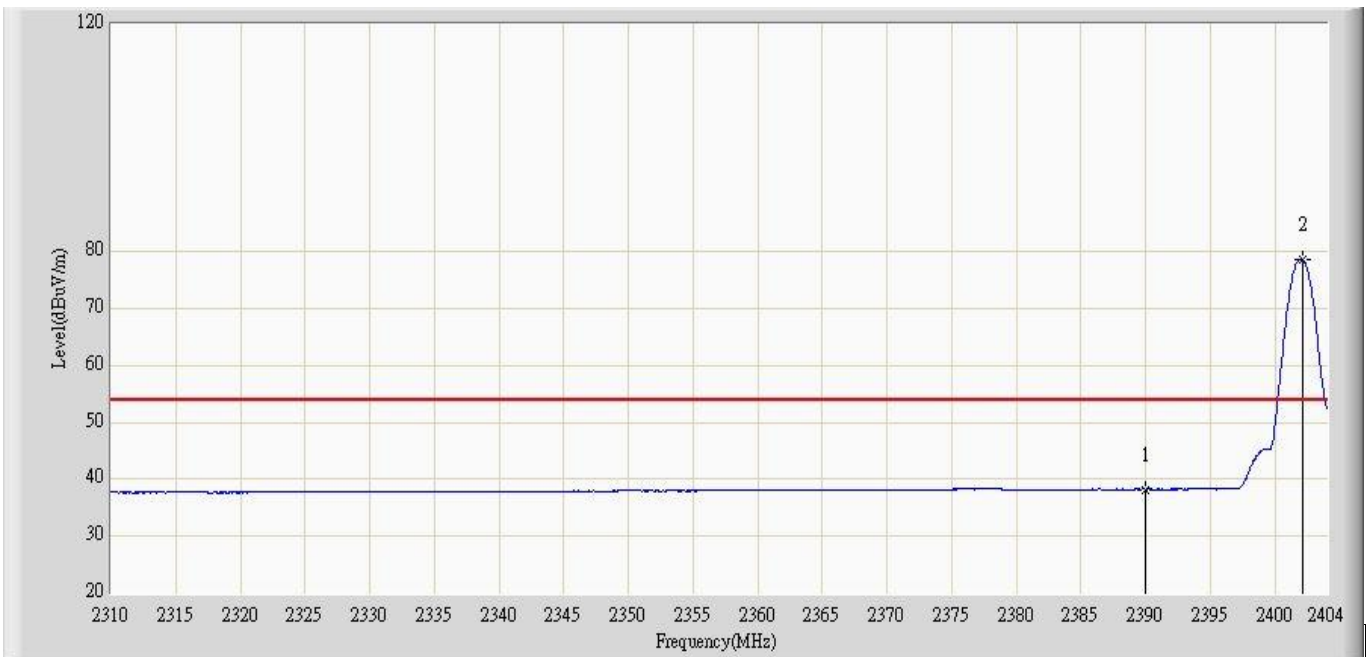
Site: AC5	Time: 2015/07/27 - 14:38
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Vertical
EUT: Keyboard	Power: DC 3V

Note: Mode1: Transmit at channel 2402MHz by BLE



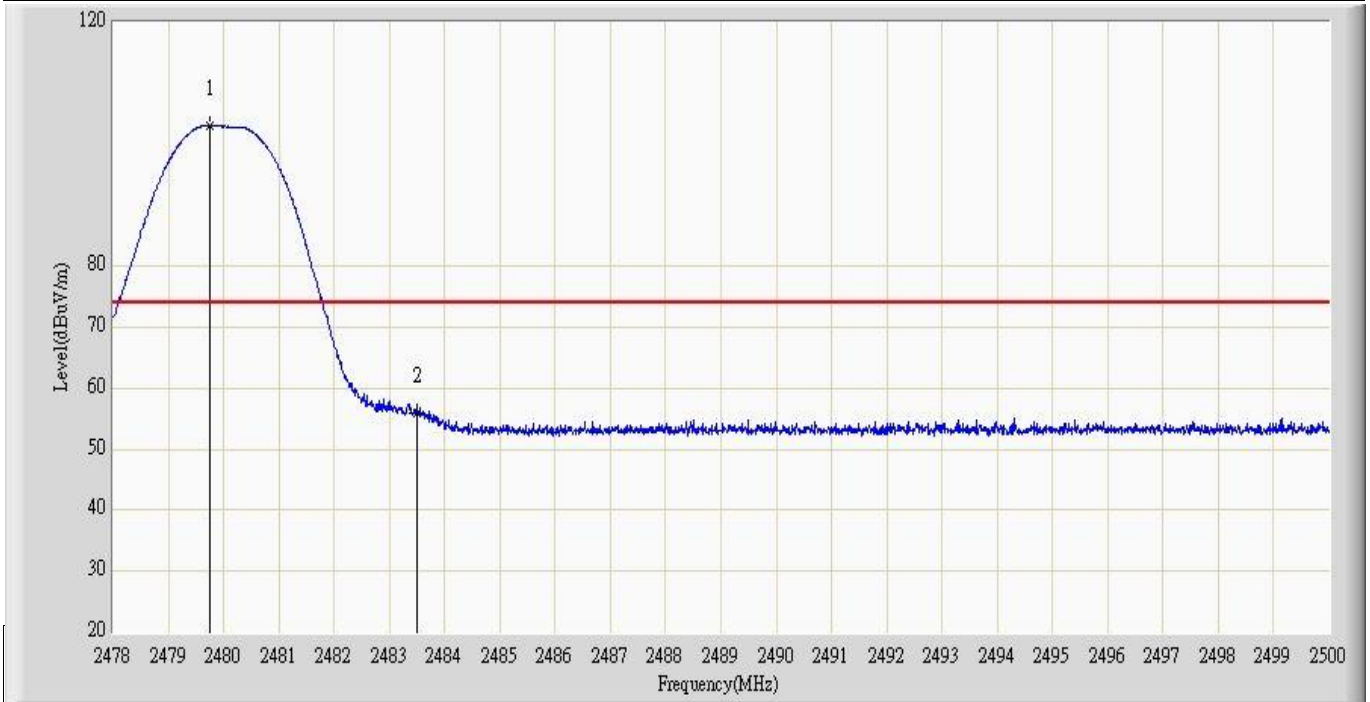
	g	rk	(MHz)	Level (dBuV/m)	(dBuV)	(dB)	(dBuV/m)		
1			2390.000	51.380	14.881	-22.620	74.000	36.499	PK
2		*	2402.073	100.936	64.379	N/A	N/A	36.556	PK

Site: AC5	Time: 2015/07/27 - 14:40
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Vertical
EUT: Keyboard	Power: DC 3V
Note: Mode1: Transmit at channel 2402MHz by BLE	



	g	rk	(MHz)	Level (dBuV/m)	(dBuV)	(dB)	(dBuV/m)		
1			2390.000	38.242	1.743	-15.758	54.000	36.499	AV
2		*	2402.073	78.647	42.090	N/A	N/A	36.556	AV

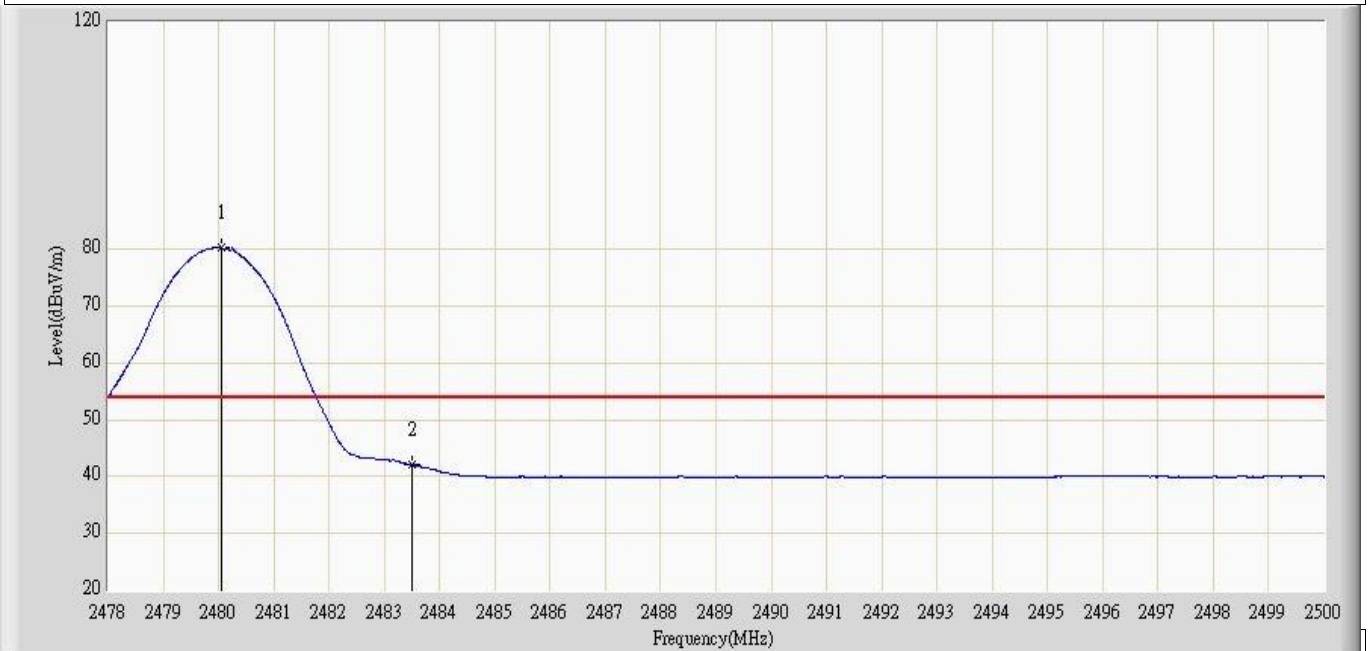
Site: AC5	Time: 2015/07/27 - 14:41
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Horizontal
EUT: Keyboard	Power: DC 3V
Note: Mode1 Transmit at channel 2480MHz by BLE	



				(dBuV/m)					
1	*	2479.738	103.087	65.150	N/A	N/A	37.937	PK	
2		2483.500	56.014	18.044	-17.986	74.000	37.969	PK	

Site: AC5	Time: 2015/07/27 - 14:44
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Horizontal
EUT: Keyboard	Power: DC 3V

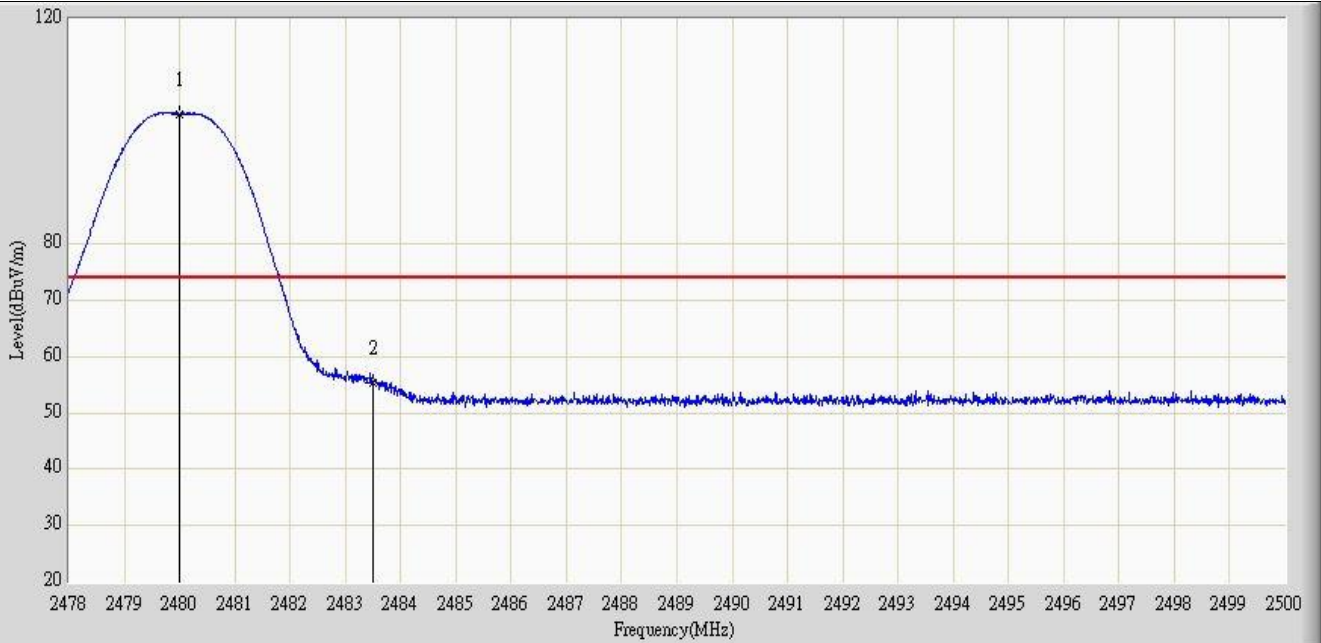
Note: Mode1 Transmit at channel 2480MHz by BLE



No	g	rk	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2480.046	80.213	42.274	N/A	N/A	37.939	AV
2			2483.500	42.125	4.155	-11.875	54.000	37.969	AV

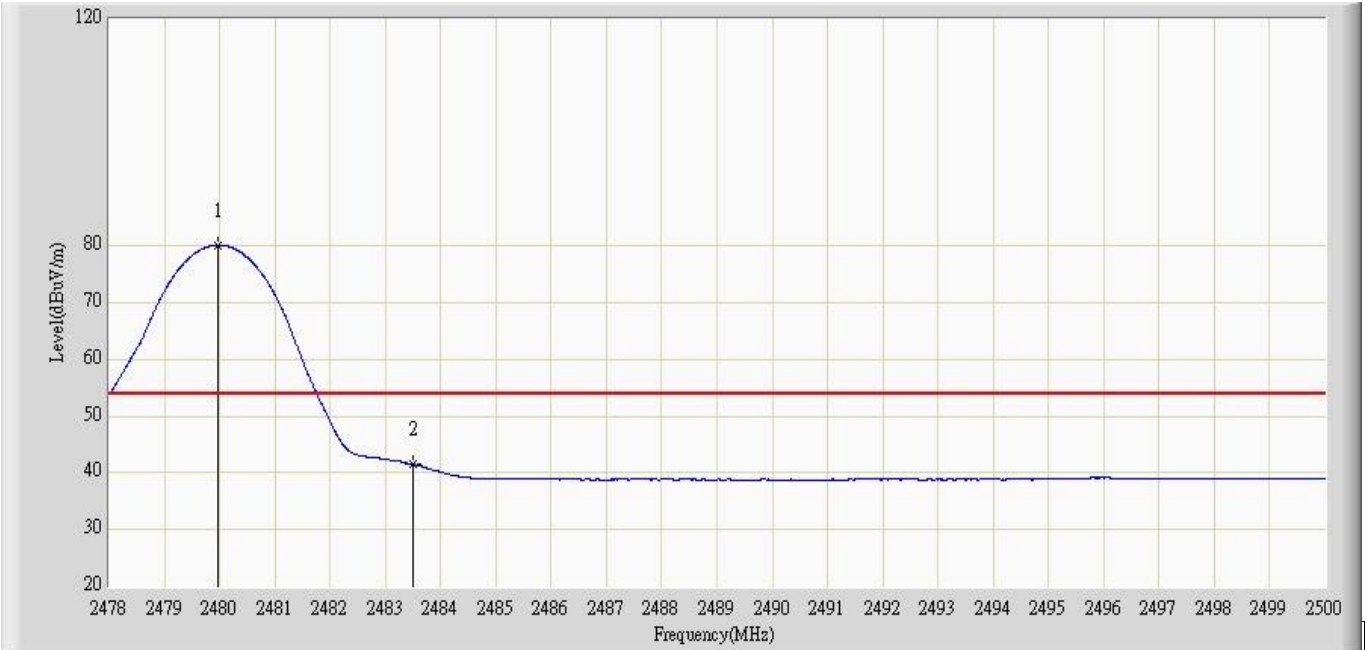
Site: AC5	Time: 2015/07/27 - 14:45
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Vertical
EUT: Keyboard	Power: DC 3V

Note: Mode1 Transmit at channel 2480MHz by BLE



NO	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2480.002	103.163	66.244	N/A	N/A	36.919	PK
2			2483.500	55.448	18.512	-18.552	74.000	36.935	PK

Site: AC5	Time: 2015/07/27 - 14:47
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117(1-18GHz)	Polarity: Vertical
EUT: Keyboard	Power: DC 3V
Note: Mode1 Transmit at channel 2480MHz by BLE	



	g	rk	(MHz)	Level (dBuV/m)	(dBuV)	(dB)	(dBuV/m)		
1		*	2479.969	80.147	43.228	N/A	N/A	36.919	AV
2			2483.500	41.503	4.567	-12.497	54.000	36.935	AV

## 7. Operation Frequency Range of 20dB Bandwidth

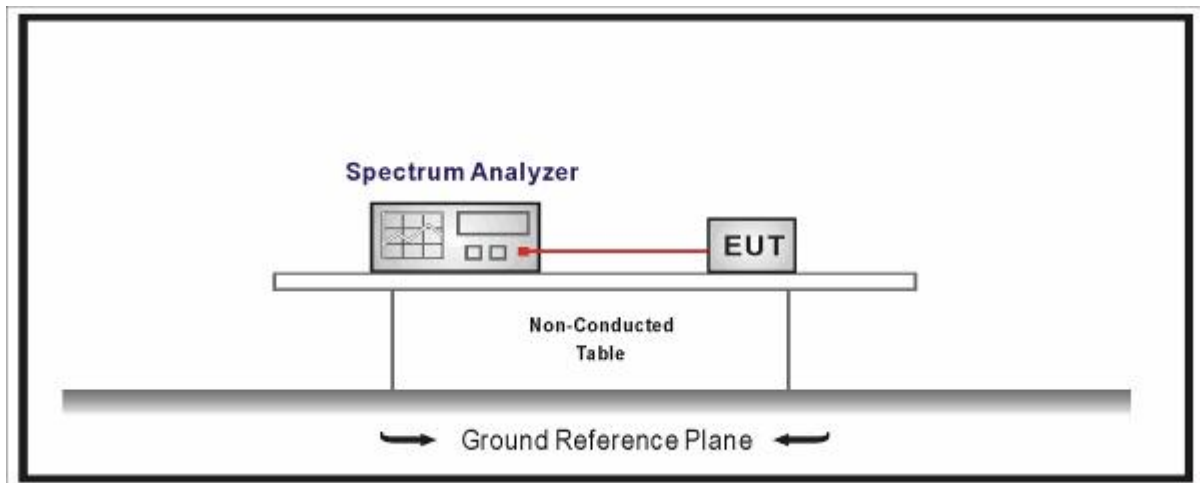
### 7.1. Test Equipment

Operation Frequency Range of 20dB 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

20 dB bandwidth of the emission is contained within the operation frequency band.

### 7.4. Test Procedure

The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

### 7.5. Uncertainty

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



**7.6. Test Result**

Product	: WUVO SPOT
Test Item	: Operation Frequency Range of 20dB Bandwidth
Test Site	: TR-8
Test Mode	: Mode 1: Transmit-1Mbps(GFSK_BLE)

**Channel 00 (2402MHz)**



**Channel 39 (2480MHz)**



## 8. 6dB Bandwidth and Occupied Bandwidth

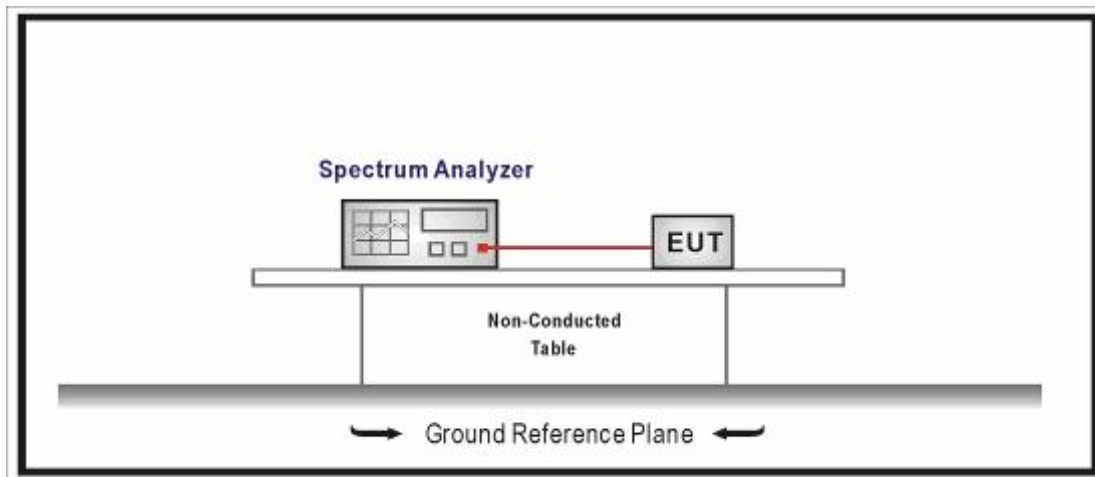
### 8.1. Test Equipment

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.

### 8.2. Test Setup



### 8.3. Limit

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

### 8.4. 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.

## **8.5. Uncertainty**

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

**8.6. Test Result**

Product	: WUVO SPOT
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	686.0	1152.2	>500	Pass
19	2440	685.8	1112.5	>500	Pass
39	2480	680.4	1102.4	>500	Pass

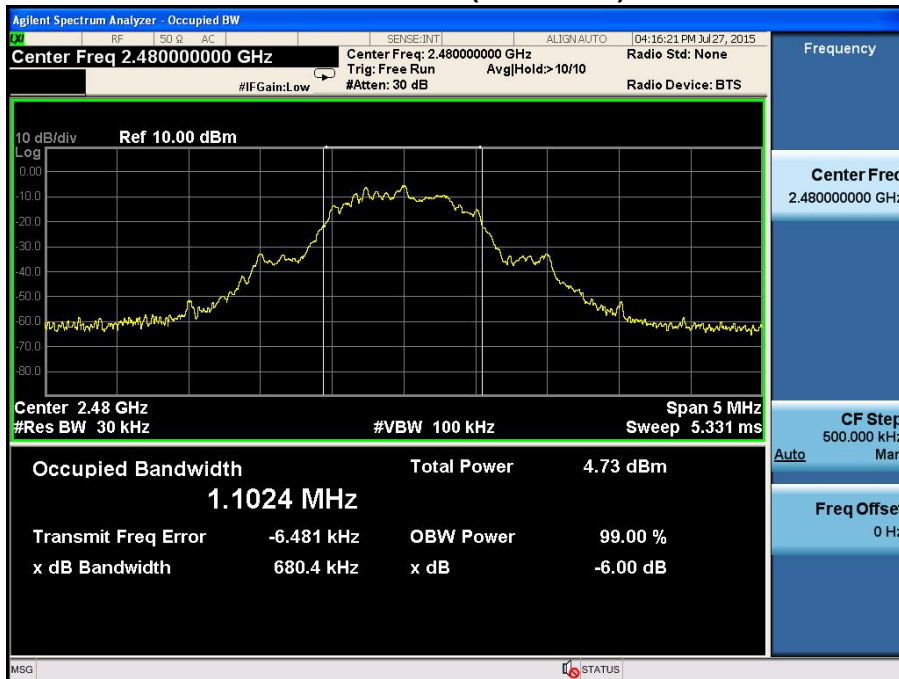
**Channel 00 (2402MHz)**



### Channel 19 (2440MHz)



### Channel 39 (2480MHz)



## 9. Power Output

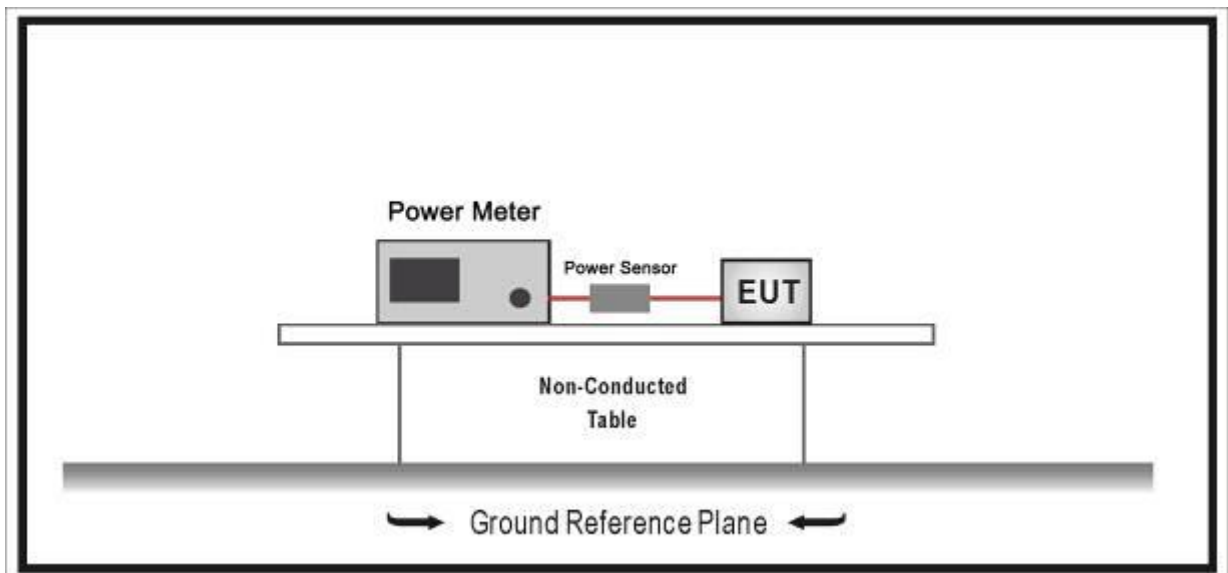
### 9.1. Test Equipment

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.

### 9.2. Test Setup



### 9.3. 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.

### 9.4. 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.

## **9.5. Uncertainty**

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

**9.6. Test Result**

Product	:	WUVO SPOT
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	-3.34	30.00	Pass
19	2440	-3.96	30.00	Pass
39	2480	-3.19	30.00	Pass



## 10. Power Spectral Density

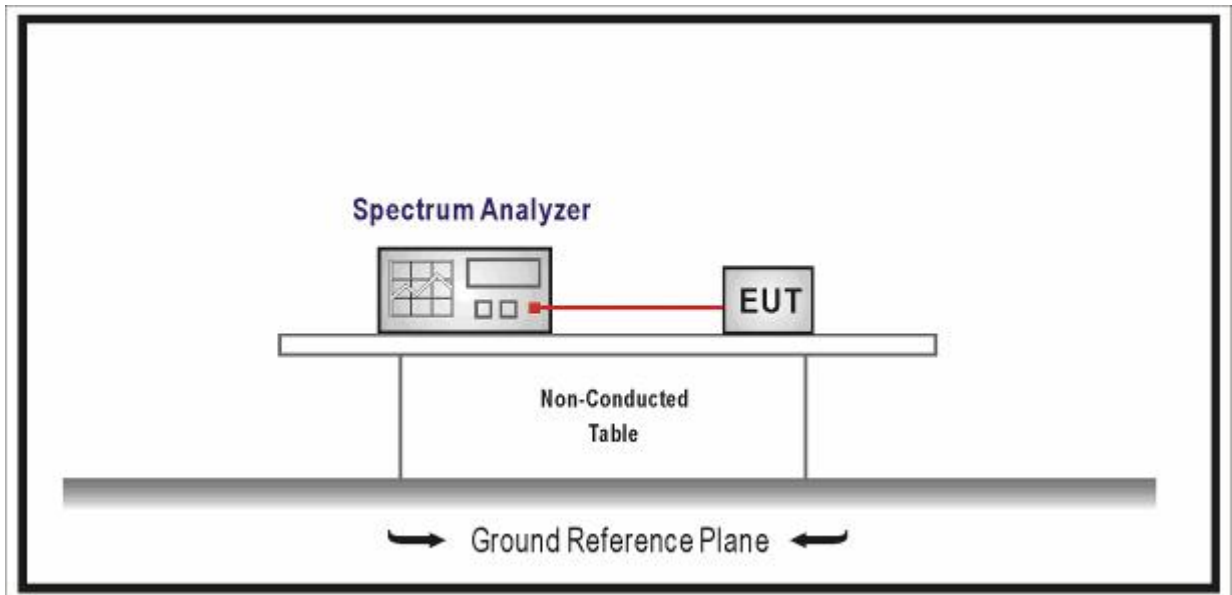
### 10.1. Test Equipment

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.

### 10.2. Test Setup



### 10.3. 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.

### 10.4. 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  $\geq 3 \times \text{RBW}$ .
- 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.

### **10.5. Uncertainty**

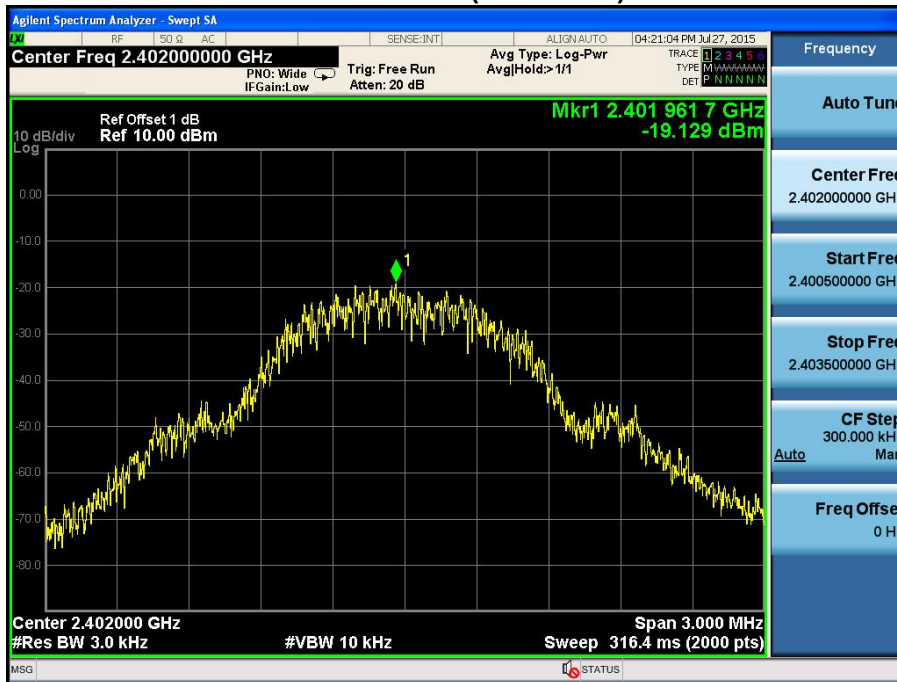
The measurement uncertainty is defined as  $\pm 1.27 \text{ dB}$

**10.6. Test Result**

Product	: WUVO SPOT
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	-19.129	8	Pass
19	2440	-16.209	8	Pass
39	2480	-18.532	8	Pass

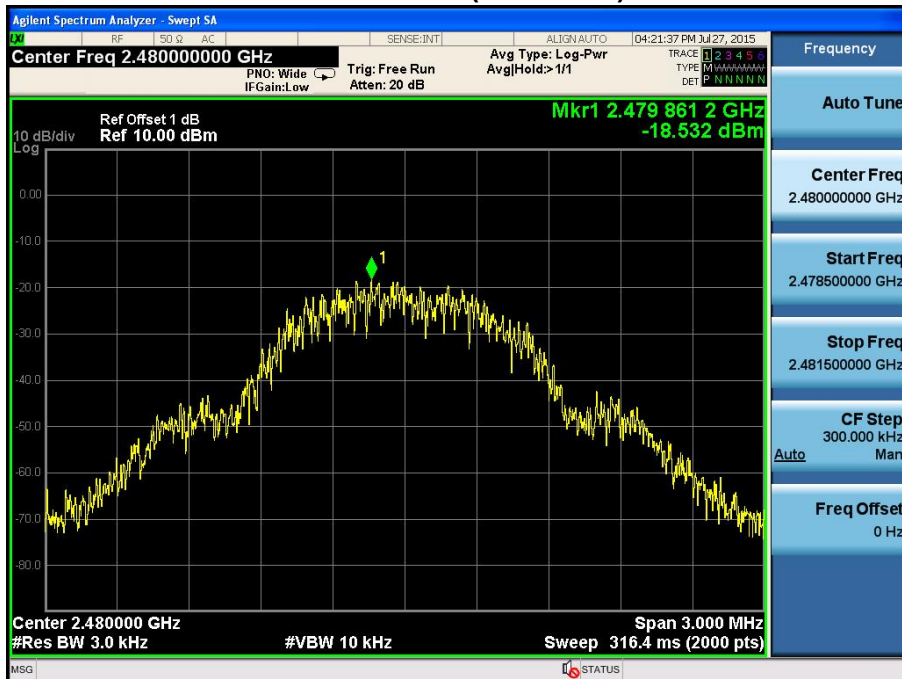
**Channel 00 (2402MHz)**



### Channel 19 (2440MHz)



### Channel 39 (2480MHz)



The End