FCC TEST REPORT

Under
FCC 15 Subpart C, Paragraph 15.247

Operating in 2400 ~ 2483.5 MHz Band

Prepared For :

K-Mark Industrial Ltd.

Flat A,7/F.,Mai On Industrial Bldg.,17-21,Kung Yip St.,Kwai Chung,Hong Kong

FCC ID: VEP-QUADBT
EUT: Razor Quad BT Muff
Model: GWP-RSEQM-BT

April 27, 2017 **Issue Date:**
Original Report **Report Type:**
Jacky Huang **Test Engineer:** Jacky Huang
 **Review By:** Apollo Liu / Manager

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1. General Information

1. 1 Notes

The test results of this report relate exclusively to the test item specified in 1.5. The KMO Lab does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the KMO Lab.

1. 2 Testing Laboratory

Accurate Technology Co., Ltd.
(FCC Registration No.: 752051)
F1, Bldg. A, Changyuan New Material Port
Keyuan Rd., Science & Industry Park, Nanshan
Shenzhen, P.R. China

1. 3 Details of Applicant

Name : K-Mark Industrial Ltd.
Address : Flat A,7/F.,Mai On Industrial Bldg.,17-21,Kung Yip St.,Kwai Chung,Hong Kong

1. 4 Application Details

Date of Receipt of Application	: March 24, 2017
Date of Receipt of Test Item	: March 24, 2017
Date of Test	: March 24~April 14, 2017

1. 5 Test Item

Manufacturer	: K-Mark Industrial (Shen Zhen) Ltd.
Address	: The 2nd Plant ,43 JinShi road, GuangPei Community, GuanLan St, LongHua New District , ShenZhen GuangDong Province , China
Trade Name	: N/A
Model No.(Base)	: GWP-RSEQM-BT
Model No.(Extension)	: N/A
Description	: Razor Quad BT Muff

Additional Information

Product Type	: Bluetooth 4.0 LE (1TX, 1RX)
Radio Type	: Intentional Transceiver
Power Type	: DC 3V(AAA 1.5V*2)
Modulation	: see the below tables
Data Modulation	: Bluetooth: GFSK (1Mbps))
Date Rate (Mbps)	: see the below table
Frequency Range	: 2402~2480MHz
Channel Number	: 40
Antenna	: Internal PCB, -0.61 dBi

Bluetooth

Type of Modulation	Data Rate
GFSK	1Mbps

1. 6 Test Standards

FCC 15 Subpart C, Paragraph 15.247

Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.

2. Technical Test

2. 1 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC Rule	Test Type	Limit	Result	Notes
FCC 15.247(a)(2)	6dB Bandwidth	>=0.5MHz	PASS	Complies
FCC 15.247(b)(1)	Peak Output Power	<=30dBm	PASS	Complies
FCC 15.247(e)	Power Spectral Density	<=8dBm	PASS	Complies
FCC 15.247(d)	Conducted Band Edges and Spurious Emission	<=20dBc	PASS	Complies.
FCC 15.247(d)	Radiated Band Edges and Spurious Emission	FCC 15.209(a) & 15.247(d)	PASS	Complies.
FCC 15.205(a)	Restricted bands requirement	FCC 15.205(a)	PASS	Complies.
FCC 15.207	AC Conducted Emission	FCC15.207(a)	N/A	Complies.
FCC 15.203 & 15.247(b)	Antenna Requirement	N/A	PASS	Complies

* The digital circuit porting of the EUT has been tested and verified to comply with FCC Part 15, Subpart B., Class B Digital Devices and the associated Radio Receiver has also been tested and found to comply with FCC Part 15, Subpart B – Radio Receivers.

2. 2 Antenna Requirement

A. Regulation

FCC section 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

B. Result

The antenna type used in this product is internal Antenna and fixed in the EUT and without connector. That no antenna other than furnished by the responsible party shall be used with the device. The EUT as tested meets the criteria of this rule by being antenna being permanently attached and professionally installed. The EUT is compliant with Section 15.203.

2. 3 Measurement Uncertainty

Measurement	Frequency	Uncertainty
Conducted emissions	0.15MHz~30MHz	1.72
Radiated emissions	30MHz ~ 300MHz	3.88
Radiated emissions	300MHz ~1000MHz	3.86
Radiated emissions	1000MHz ~18000MHz	5.28
Radiated emissions	18000MHz ~26500MHz	4.42
6 dB & 99% Bandwidth	-	5%
Peak Power	-	1.10
Peak Power Spectral Density	-	1.10
Band Edges Measurement	-	1.10

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. EUT Modifications

No modification by test lab.

4. Conducted Power Line Test

4. 1 Test Equipment

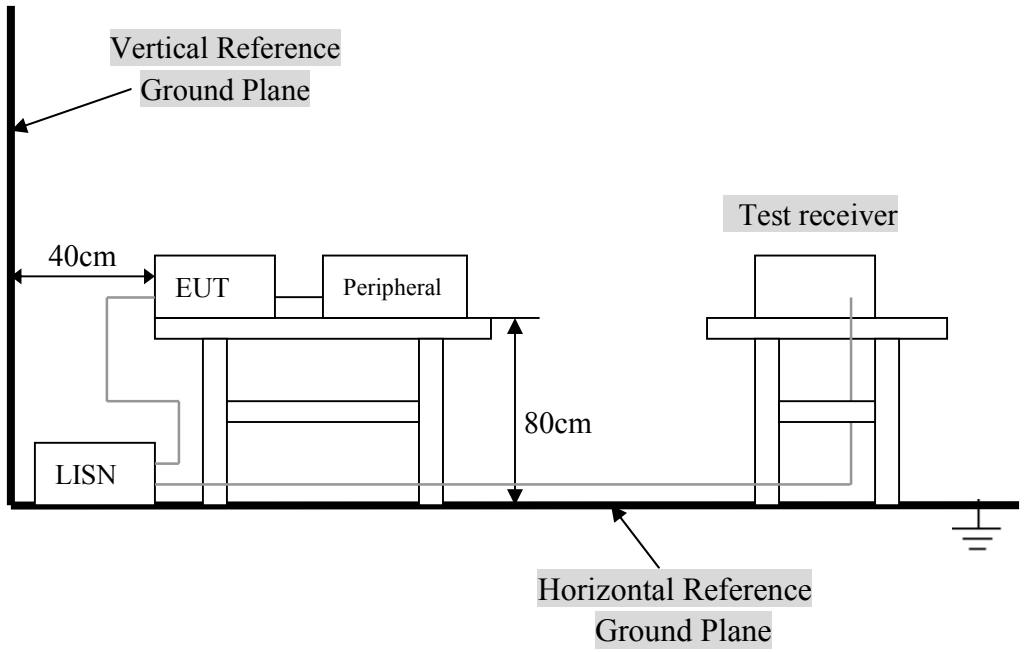
Please refer to Section 10 this report.

4. 2 Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission., the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

4. 3 Test Setup



For the actual test configuration, Please refer to the related items – Photos of Testing.

4. 4 Configuration of the EUT

The EUT was configured according to ANSI C63.10:2013. EUT was used DC3V(AAA 1.5V*2). The operation frequency is from 2402MHz~2480MHz.. Enable the signal transmitted from the EUT to Notebook PC. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

Note:

1) Operating Modes: Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. The EUT operates in normal Bluetooth 4.0 for occupancy duration and frequency separation.
2) Special Test Software & Hardware: Special firmware and hardware provided by the Applicant are installed to allow the EUT to operates in Bluetooth 4.0 or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
3) Transmitter Test Antenna: The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral / non-integral antenna equipment as describe with the test results.
4) Frequency(ies) Tested: 2402MHz, 2440MHz and 2480MHz were pre-tested, The worst case one, was chosen for conducted emission test.
5) Above 1GHz, the 2402MHz, 2440MHz and 2480MHz were tested individually.
6) Normal Test Modulation: Bluetooth 4.0
7) Modulating Signal Source: Internal

* Associated Antenna Descriptions: The antenna used in this product is embedded antenna.

A. EUT

Device	Manufacturer	Model #	FCC ID
Razor Quad BT Muff	K-Mark Industrial (Shen Zhen) Ltd.	GWP-RSEQM-BT	VEP-QUADBT

Field Antenna For 2.4GHz Band

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Remark
0	N/A	PCB Bluetooth Antenna	Internal	N/A	-0.61	TX/RX

Bluetooth Test Modes For 2.4GHz Band

Worst Modulation Mode	Number of Transmit (Ntx)	Frequency (MHz)	Power Setting	Data Rate
BT-1M	1	2402	63	1 Mbps
BT-1M	1	2440	63	1 Mbps
BT-1M	1	2480	63	1 Mbps

B. Internal Devices

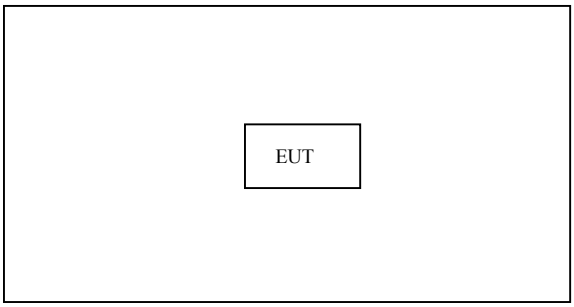
Device	Manufacturer	Model #	FCC ID
N/A			

C. Peripherals

Device	Manufacturer	Model # Serial #	FCC ID/ DoC	Cable
N/A				

4. 5 EUT Operating Condition

Operating condition is according to ANSI C63.10:2013.
A. Setup the EUT and simulators as shown on follow.
B. Enable RF signal and confirm EUT active.
C. Modulate output capacity of EUT up to specification.



4. 6 Conducted Power Line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)	
Frequency Range (MHz)	**QP/AV**
0.15 – 0.5	66-56/56-46
0.5 – 5.0	56/46
5.0 - 30	60/50

NOTE ：In the above table, the tighter limit applies at the band edges.

4. 7 Conducted Power Line Test Result

Product	: Razor Quad BT Muff	Test Mode	: Normal Link / Auto
Test Item	: Conducted Emission Data	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: N/A	Adapter Model	:

The frequency spectrum from 0.15 MHz to 30 MHz was investigated. All readings are quasi -peak values with a resolution bandwidth of 9 KHz.

- Temperature ： 26 ℃
- Humidity ： 53 % RH

FCC Part 15 Paragraph 15.207							
Frequency (MHz)	Emission (dBuV) QP	AV	LINE/ NEUTRAL	Limit (dBuV) QP	AV	Margin (dB) QP	AV
NF			Line				
NF			Neutral				
NF			Line				
NF			Neutral				
NF			Line				
NF			Neutral				

Note: NF = No Significant Peak was Found.

1.Uncertainty in conducted emission measured is <+/ -2dB.
2.The emission levels of other frequencies were very low against the limit.
3.All Reading Levels are Quasi-Peak and Average value.
4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
5.Margin Value = Emission Level - Limit Value.

5. FCC Part 15.247 Requirements for DTS Systems

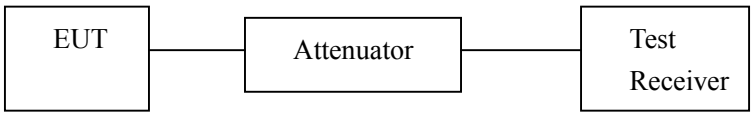
5. 1 Test Equipment

Please refer to Section 10 this report.

5. 2 Test Procedure

6 dB & 99% Bandwidth	Refer to FCC 15.247(a)(2), ANSI C63.10:2013	
Test Method:	FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04. - 8.1 Option 1	
a) Set RBW = 100 kHz. b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize.		g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. *For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.
Peak Power:	Refer to FCC 15.247(b)(3), ANSI C63.10:2013	
Test Method:	FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04. - 9.1.3 PKPM1 Peak power meter method	
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.		
Peak Power Spectral Density:	Refer to FCC 15.247(e), ANSI C63.10:2013	
Test Method:	FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04. - 10.2 Method PKPSD	
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 kHz ≤ RBW ≤ 100 kHz. d) Set the VBW ≥ 3 x 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 RBW. j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
Band Edges Measurement:	Refer to FCC 15.247(d), ANSI C63.10:2013	
Test Method:	FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04.& 15.247	
a. The transmitter output was connected to the spectrum analyzer via a low lose cable. b. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge. c. The band edges was measured and recorded.		

5. 3 Test Setup



5. 4 Configuration of the EUT

Same as section 4.4 of this report

5. 5 EUT Operating Condition

Same as section 4.5 of this report.

5. 6 Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~ 928 MHz, 2400 ~ 2483.5 MHz, and 5725 ~ 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.
According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).
According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

5. 7 Test Result

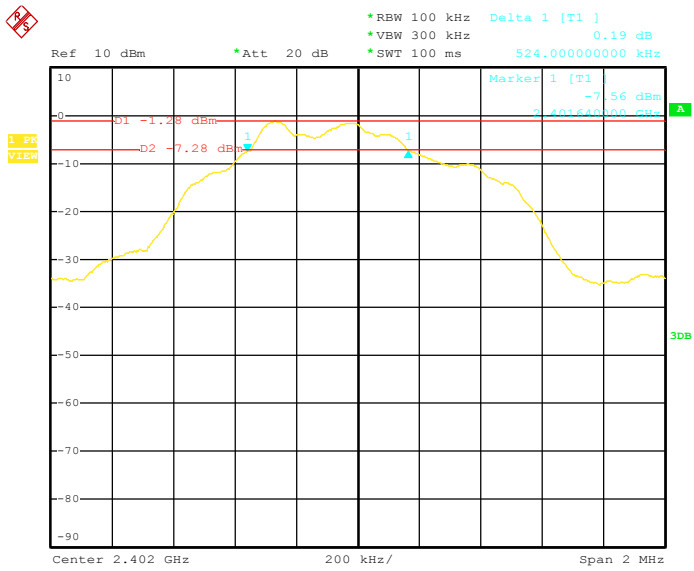
A. 6 dB Bandwidth

Product	: Razor Quad BT Muff	Test Mode	: Bluetooth 4.0 LE
Test Item	: 6 dB BW	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: PASS		

Bluetooth 4.0 LE

Channel	Frequency (MHz)	Bandwidth (MHz)	FCC Limit (kHz)	Result
Low	2402	0.524	>500 kHz	PASS
Mid	2440	0.524		PASS
High	2480	0.536		PASS

CH Low



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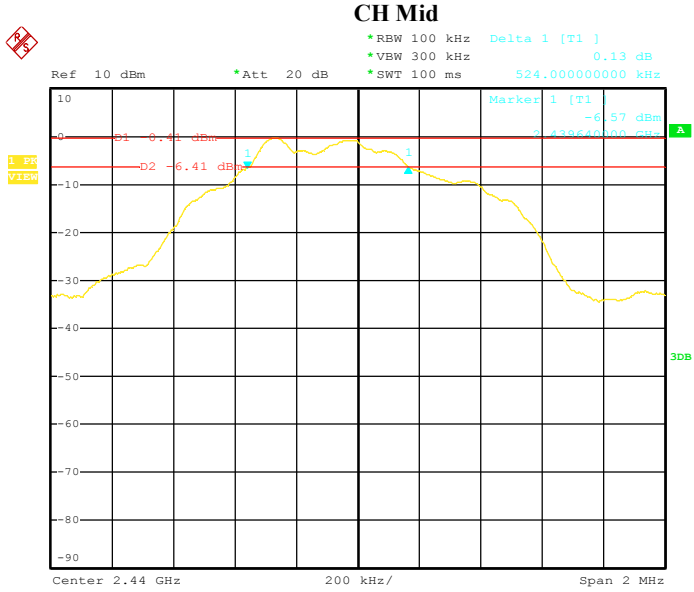
CH Mid



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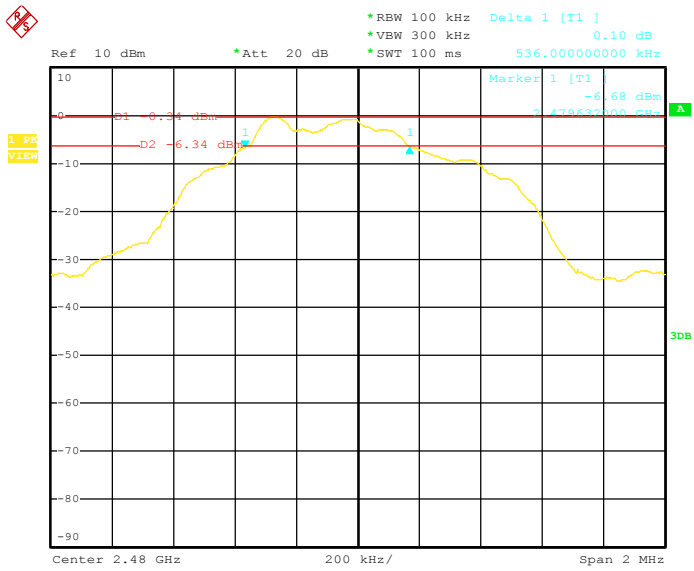
CH High



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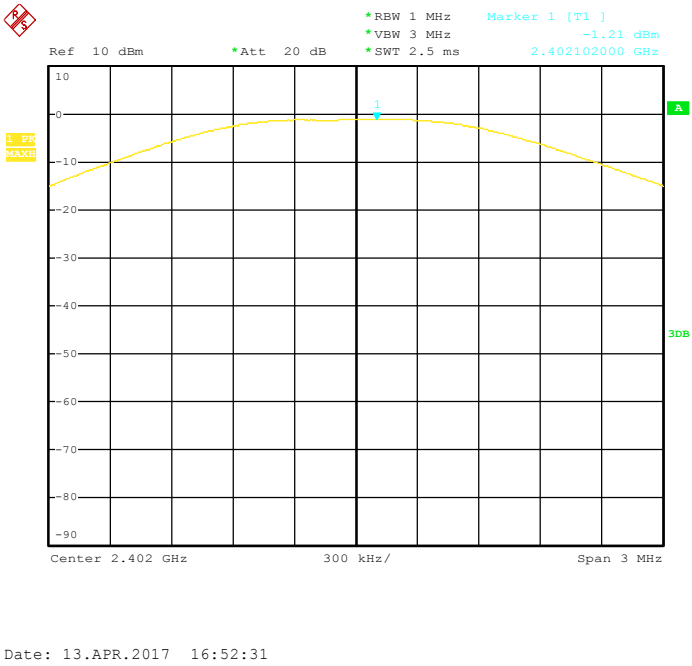
B. Peak Power

Product	: RAZOR QUAD BT MUFF	Test Mode	: Bluetooth 4.0 LE
Test Item	: Peak Power	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: PASS		

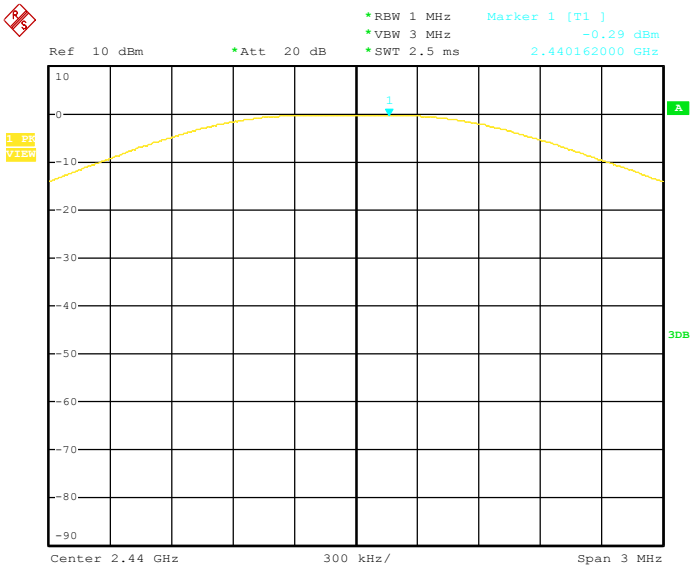
Bluetooth 4.0 LE

Channel	Frequency (MHz)	Output Power (dBm)	FCC Limit (W/dBm)	Result
Low	2402	-1.22	1.00/30.00	PASS
Mid	2440	-0.29		PASS
High	2480	-0.26		PASS

CH Low



CH Mid



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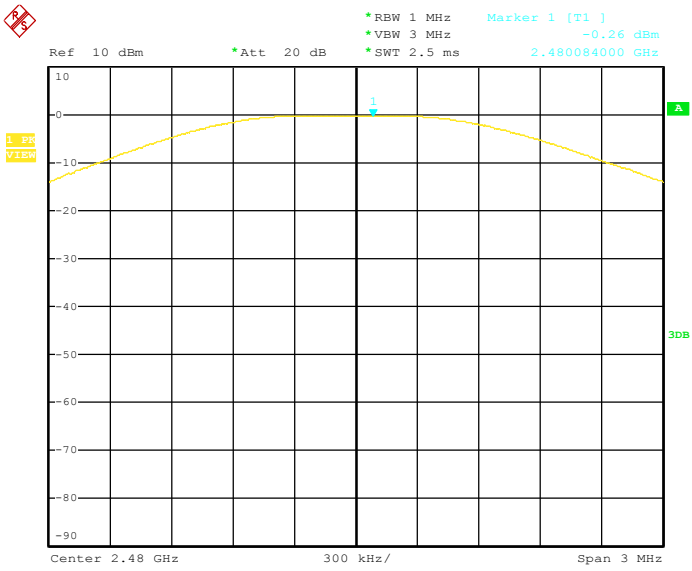
CH High



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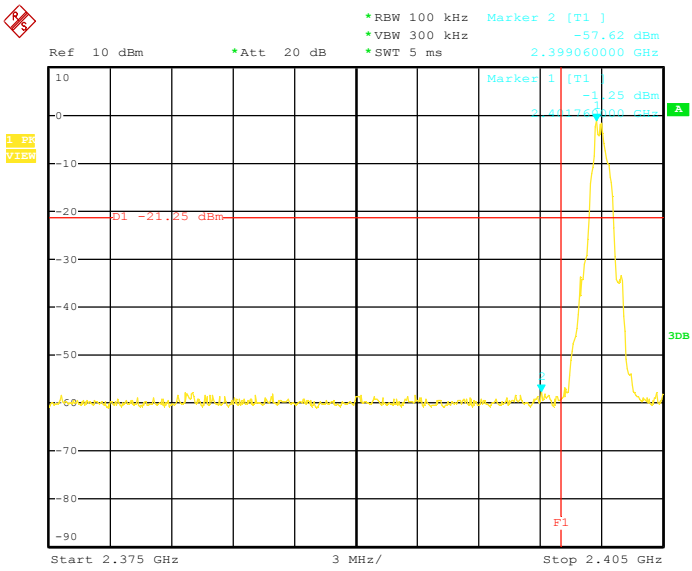
C. Band Edges Measurement

Product	: RAZOR QUAD BT MUFF	Test Mode	: Bluetooth 4.0 LE
Test Item	: Band Edges Measurement	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: **PASS**		

Bluetooth 4.0 LE Channel: Low



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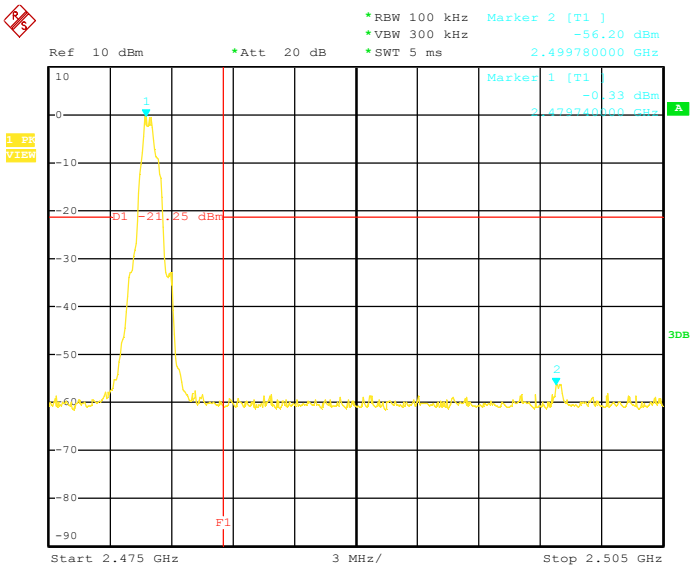
Bluetooth 4.0 LE Channel: High



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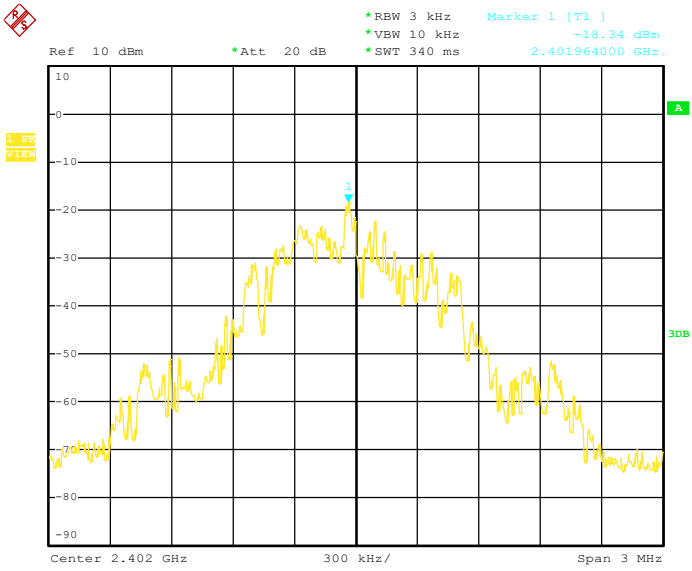
D. Peak Power Spectral Density

Product	: RAZOR QUAD BT MUFF	Test Mode	: Bluetooth 4.0 LE
Test Item	: Peak Power Spectral Density	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: PASS		

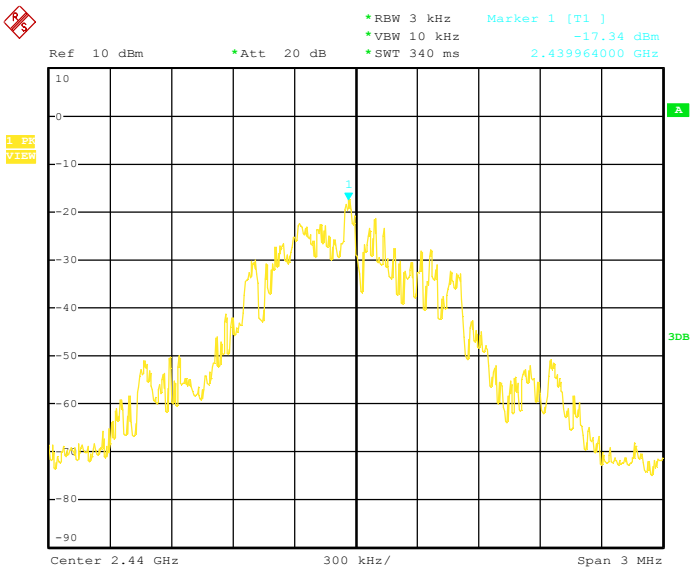
Bluetooth 4.0 LE

Channel	Frequency (MHz)	3kHz PPSD (dBm)	FCC Limit (dBm)	Result
Low	2402	-18.34	8.00	PASS
Mid	2440	-17.34		PASS
High	2480	-17.27		PASS

Channel: Low



Channel: Mid



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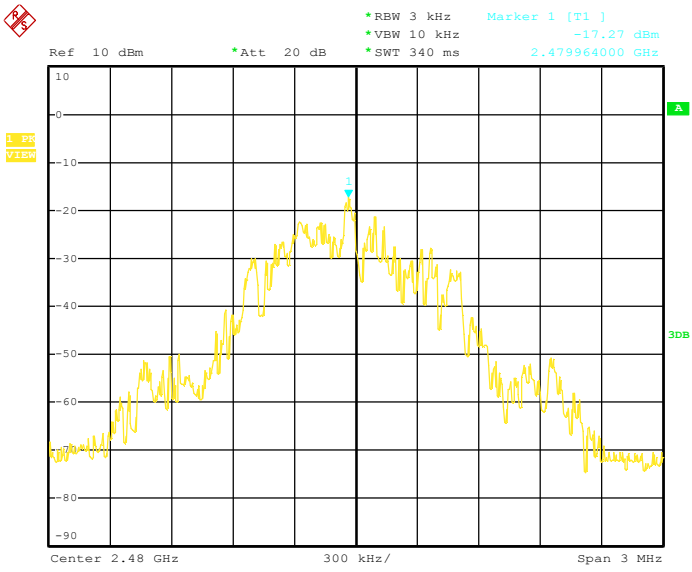
Channel: High



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6. Transmitter Spurious Radiated Emission at 3 Meters

6. 1 Test Equipment

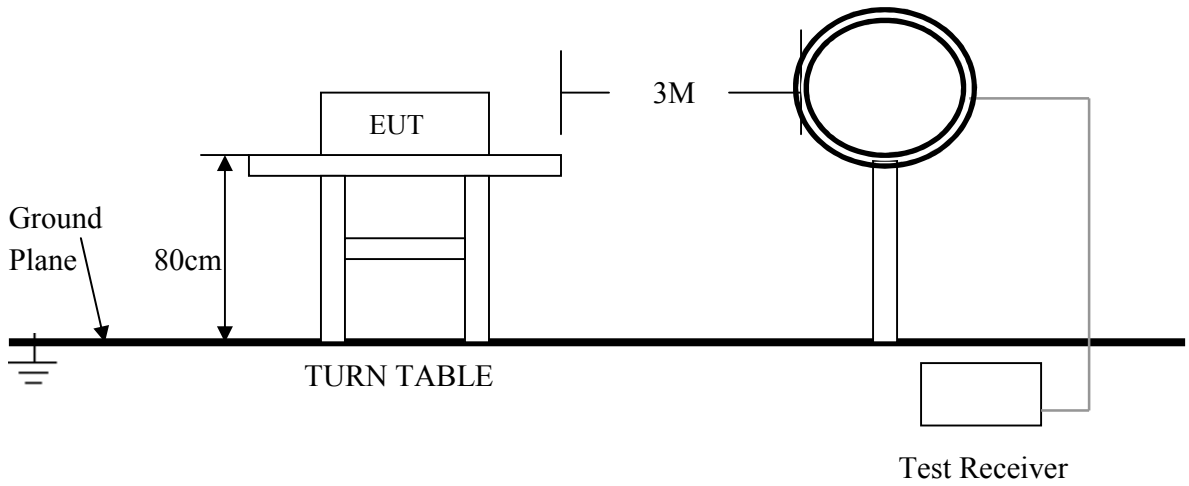
Please refer to Section 10 this report.

6. 2 Test Procedure

1. The EUT was tested according to ANSI C63.10:2013.
2. The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10:2013.
3. The frequency spectrum from 9 kHz to 25 GHz was investigated. All readings from 9 kHz to 150 kHz are quasi-peak values with a resolution bandwidth of 200 Hz. All readings from 150 kHz to 30 MHz are quasi-peak values with a resolution bandwidth of 9 KHz. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 KHz Measurements were made at 3 meters.
4. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. The Receiving antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency. Emissions below 30MHz were measured with a loop antenna while emission above 30MHz were measured using a broadband E-field antenna.
5. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.
6. 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 transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.10:2013.

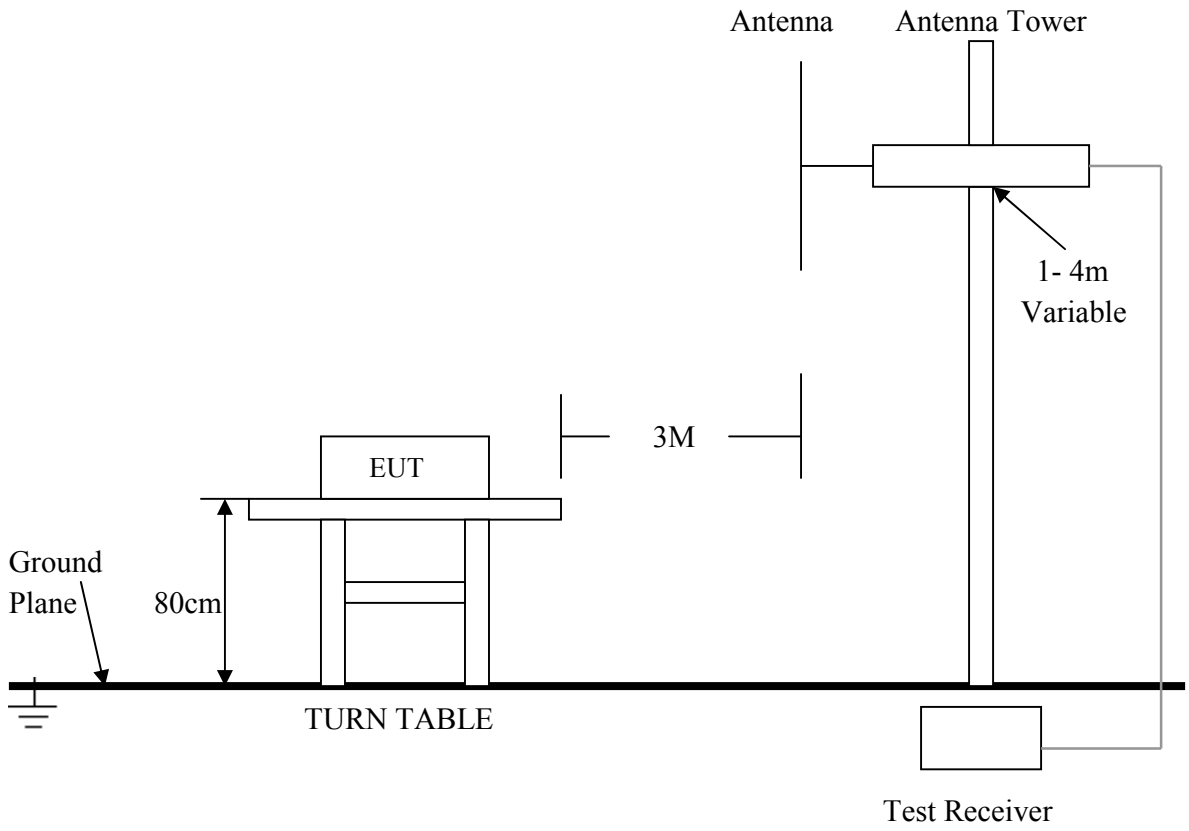
6. 3 Test Setup

For Frequencies below 30 MHz



For the actual test configuration , please refer to the related items – Photos of Testing

For Frequencies above 30 MHz



For the actual test configuration , please refer to the related items – Photos of Testing

6. 4 Configuration of the EUT

Same as section 4.4 of this report

6. 5 EUT Operating Condition

Same as section 4.5 of this report.

6. 6 Limit

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in section 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in section 15.205(a) shall not exceed the general radiated emission limits specified in section 15.209(a)

Note:

Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

47 CFR § 15.237(c): The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in section 15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para, 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	[2]
13.36–13.41.			

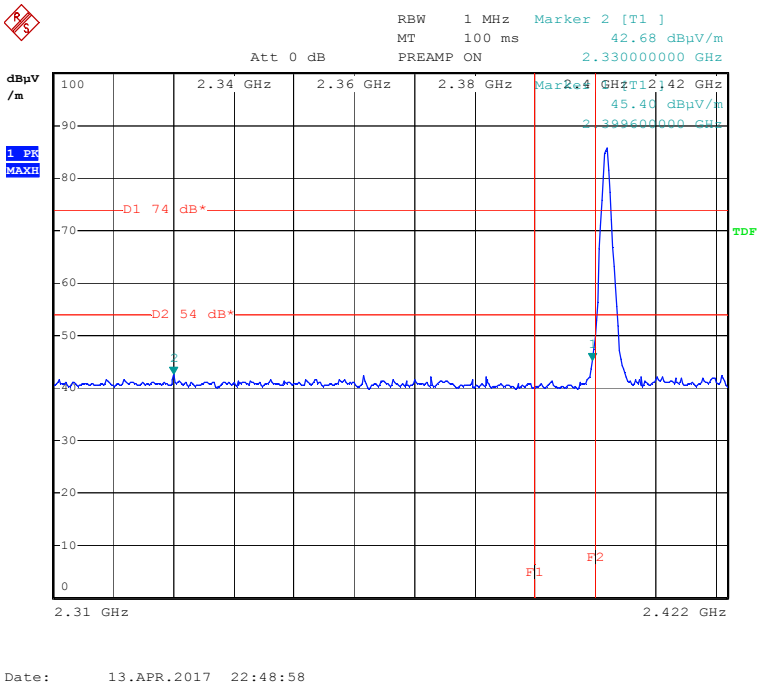
[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

FCC 47 CFR, Part 15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field strength (microvolts/meter)	Measure-ment dis-tance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above 960	500	3

6. 7 Test Result

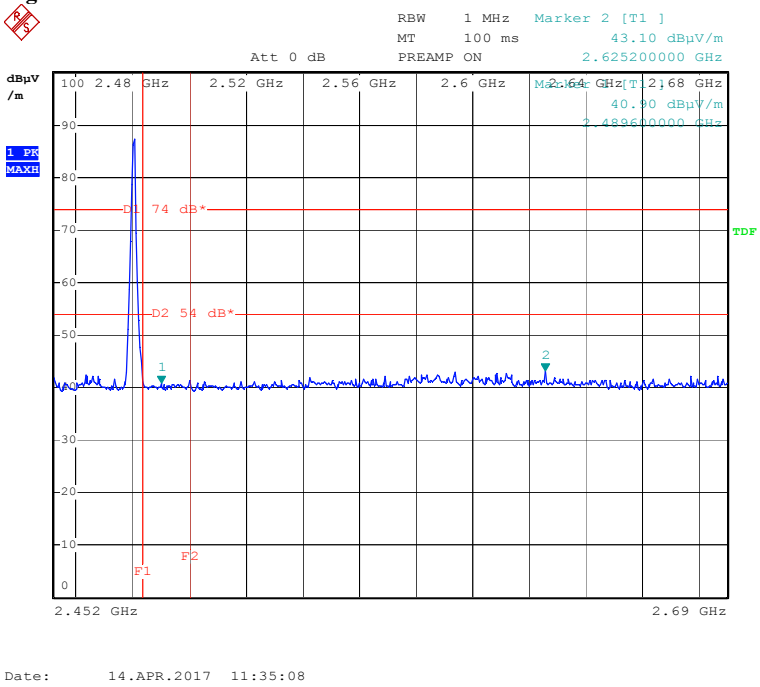
Transmitter Radiated Bandedge Emissions
Bluetooth 4.0 LE CH Low



Transmitter Radiated Bandedge Emissions Result								
Modulation	LE-1Mbps		**Non-restricted Band Emissions**					
Non-restricted Band (MHz)	**Channel (MHz)**	**In-band PSD [i] (dBuV/100kHz)**	**NBE Freq. (MHz)**	**Out-band PSD [o] (dBuV/100kHz)**	**[i] – [o] (dB)**	**Limit (dB)**	**Level Type**	**Pol. note 1**
2390-2400	2402	85.68	2399.600	45.40	40.28	20	PK	H
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical)								

Modulation	LE-1Mbps		**Restricted Band Emissions**					
Restricted BandBand (MHz)	**Channel (MHz)**	**In-band PSD [i] (dBuV/100kHz)**	**RBE Freq. (MHz)**	**Measure Distance (m)**	**Out-Band Level (dBuV/m)**	**Limit (dB)**	**Level Type**	**Pol. note 1**
2310-2390	2402	85.68	2330.000	3	42.46	74	PK	H
2310-2390	2402	/	2330.000	3	/	54	AV	H
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical). Note 2: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is “Pulse On Time”, e.g., LE VBW≥1/625us, VBW=3kHz.								

Bluetooth 4.0 LE CH High



Transmitter Radiated Bandedge Emissions Result								
Modulation	LE-1Mbps		**Non-restricted Band Emissions**					
Non-restricted Band (MHz)	**Channel (MHz)**	**In-band PSD [i] (dBuV/100kHz)**	**NBE Freq. (MHz)**	**Out-band PSD [o] (dBuV/100kHz)**	**[i] – [o] (dB)**	**Limit (dB)**	**Level Type**	**Pol. note 1**
2500-2690	2480	87.36	2625.200	43.10	44.26	20	PK	H
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical)								

Modulation	LE-1Mbps		**Restricted Band Emissions**					
Restricted BandBand (MHz)	**Channel (MHz)**	**In-band PSD [i] (dBuV/100kHz)**	**RBE Freq. (MHz)**	**Measure Distance (m)**	**Out-Band Level (dBuV/m)**	**Limit (dB)**	**Level Type**	**Pol. note 1**
2483.5-2500	2480	87.36	2489.600	3	40.90	74	PK	H
2483.5-2500	2480	/	2489.600	3	/	54	AV	H
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical). Note 2: Average emission setting: RBW=1MHz; VBW ≥ 1/T, where T is "Pulse On Time", e.g., LE VBW≥1/625us, VBW=3kHz.								

Harmonics Radiated Emission Data

CH Low

Frequency	Read Level(dBuV)		Factor	Emission(dBuV/m)		Horiz./	Limit (dBuV/m)		Margin(dB)	
(MHz)	PK	AV	(dB)	PK	AV	Vert.	PK	AV	PK	AV
4804.00	38.34	-	10.10	48.44	-	Horiz./	74.0	54.0	-25.56	-
4804.00	38.11	-	10.10	48.21	-	Vert.	74.0	54.0	-25.79	-
7206.00	34.87	-	13.10	47.97	-	Horiz./	74.0	54.0	-26.03	-
7206.00	34.56	-	13.10	47.66	-	Vert.	74.0	54.0	-26.34	-
24020.00	-	-	-	-	-	Horiz./	74.0	54.0	-	-
24020.00	-		-	-	-	Vert.	74.0	54.0		-

CH Mid

Frequency	Read Level(dBuV)		Factor	Emission(dBuV/m)		Horiz./	Limit (dBuV/m)		Margin(dB)	
(MHz)	PK	AV	(dB)	PK	AV	Vert.	PK	AV	PK	AV
4880.00	38.25	-	10.10	48.35	-	Horiz./	74.0	54.0	-25.65	-
4880.00	38.08	-	10.10	48.18	-	Vert.	74.0	54.0	-25.82	-
7320.00	34.85	-	13.10	47.95	-	Horiz./	74.0	54.0	-26.05	-
7320.00	34.63	-	13.10	47.73	-	Vert.	74.0	54.0	-26.27	-
24410.00	-	-	-	-	-	Horiz./	74.0	54.0	-	-
24410.00	-		-	-	-	Vert.	74.0	54.0		-

CH High

Frequency	Read Level(dBuV)		Factor	Emission(dBuV/m)		Horiz./	Limit (dBuV/m)		Margin(dB)	
(MHz)	PK	AV	(dB)	PK	AV	Vert.	PK	AV	PK	AV
4960.00	48.49	-	10.10	48.49	-	Horiz./	74.0	54.0	-25.51	-
4960.00	48.33	-	10.10	48.33	-	Vert.	74.0	54.0	-25.67	-
7440.00	47.86	-	13.10	47.86	-	Horiz./	74.0	54.0	-26.14	-
7440.00	47.69	-	13.10	47.69	-	Vert.	74.0	54.0	-26.31	-
24800.00	-	-	-	-	-	Horiz./	74.0	54.0	-	-
24800.00	-		-	-	-	Vert.	74.0	54.0		-

Note: (1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss - Preamp Factor.
Factor includes antenna factor, cable loss and amplifier gain.
(3) Span shall wide enough to fully capture the emission being measured;
Set RBW = 1 MHz, VBW= 3MHz for f > 1 GHz for peak measurement.
For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW $\geqslant$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
(4) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
(5) Where an emission level is indicated by a –, levels had a margin greater than 20 dB when compared to the limit.

General Radiated Emission Data

Product	: RAZOR QUAD BT MUFF	Test Mode	: Bluetooth 4.0 LE
Test Item	: Fundamental Radiated Emission Data	Temperature	: 25 ℃
Test Voltage	: DC 5V	Humidity	: 56%RH
Test Result	: **PASS**	Model	:

For Frequency below 30MHz

Freq. (MHz)	Emission (dBuV/m) QP Detector	HORIZ / VERT	Limits (dBuV/m)	Margin (dB)
N/A				
N/A				
N/A				
N/A				
N/A				
N/A				

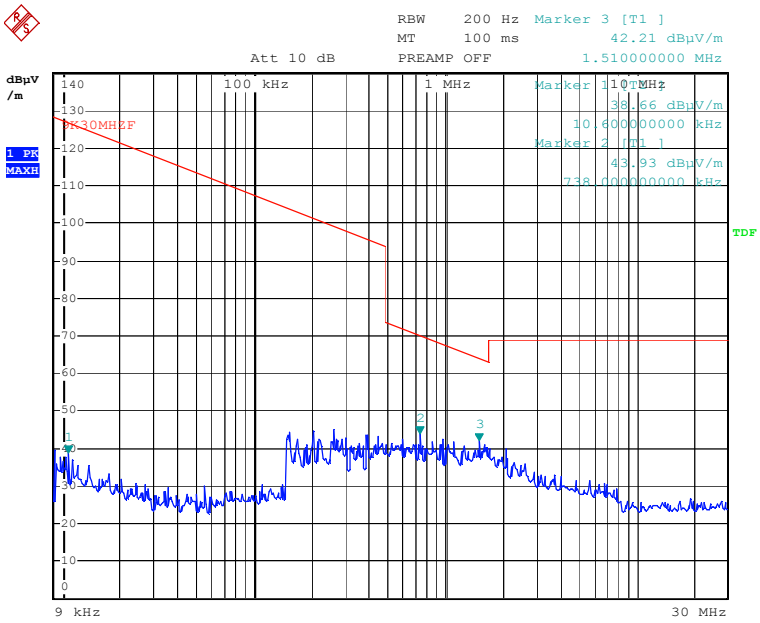
Note: (1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
(3) Emission Level = Reading Level + Probe Factor + Cable Loss.

For Frequency from 30MHz to 1GHz

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
N/A				Horiz./		
N/A				Vert.		
N/A				Horiz./		
N/A				Vert.		
N/A				Horiz./		
N/A				Vert.		

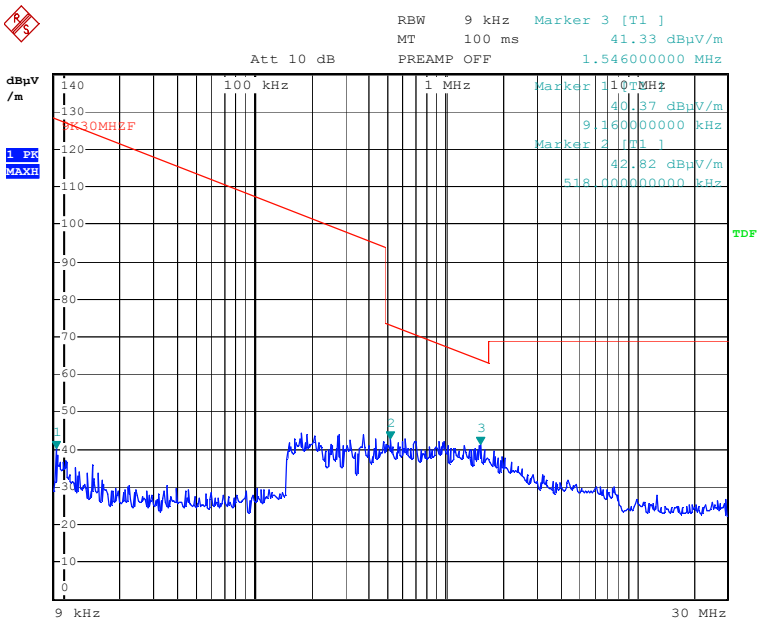
Note: (1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.

Radiated Emission
FCC 15.209



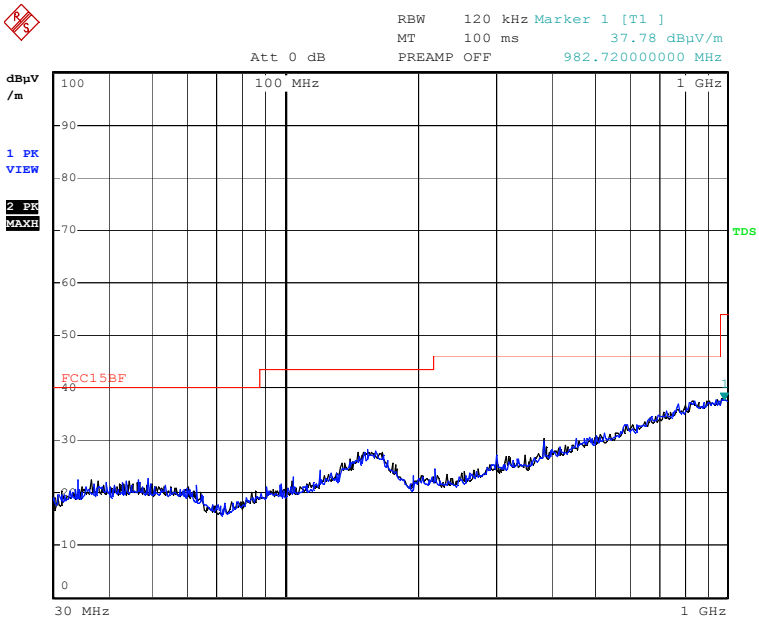
Date: 14.APR.2017 11:44:42

Antenna Polarization: X



Date: 14.APR.2017 11:50:15

Antenna Polarization: Y



Date: 14.APR.2017 12:20:23

7. RF Exposure Requirements

7. 1 Test Equipment

Please refer to Section 10 this report.

7. 2 Limit

According to FCC 15.247(e)(i) and FCC 1.1307(b)(1), Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commissions guidelines.
According to KDB 447498 D01 General RF Exposure Guidance v06, section 4.3.1
SAR Test Exclusion Thresholds for 100 MHz-6GHz and <=5mm

Frequency Range		Maximum measured transmitter power frequency(MHz)	SAR Limitation (mW)
Low Frequency(MHz)	High Frequency(MHz)		
2402	2480	2480	10

7. 3 Test Result

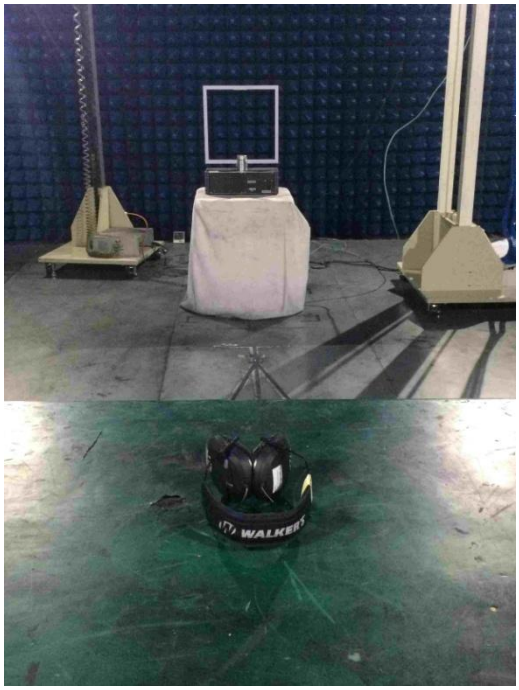
Product	: RAZOR QUAD BT MUFF	Test Mode	: Bluetooth 4.0 LE
Test Item	: RF Exposure	Temperature	: 25 ℃
Test Voltage	: DC 3V	Humidity	: 56%RH
Test Result	: **PASS**		

RF Exposure Requirements	Compliance with FCC Rules
EIRP=PxG Where: P=Power input to antenna G=Power gain of the antenna relative to an isotropic radiator	Maximum output power at antenna input terminal: -0.26dBm = 0.94mW (Bluetooth 4.0 LE, 2480MHz) Prediction distance: <=5mm Antenna gain : -0.61dBi SAR Test Exclusion Threshold is 10mW Bluetooth 4.0 LE : 0.82mW The max. output power E.I.R.P < 10mW Conclusion: No SAR is required.

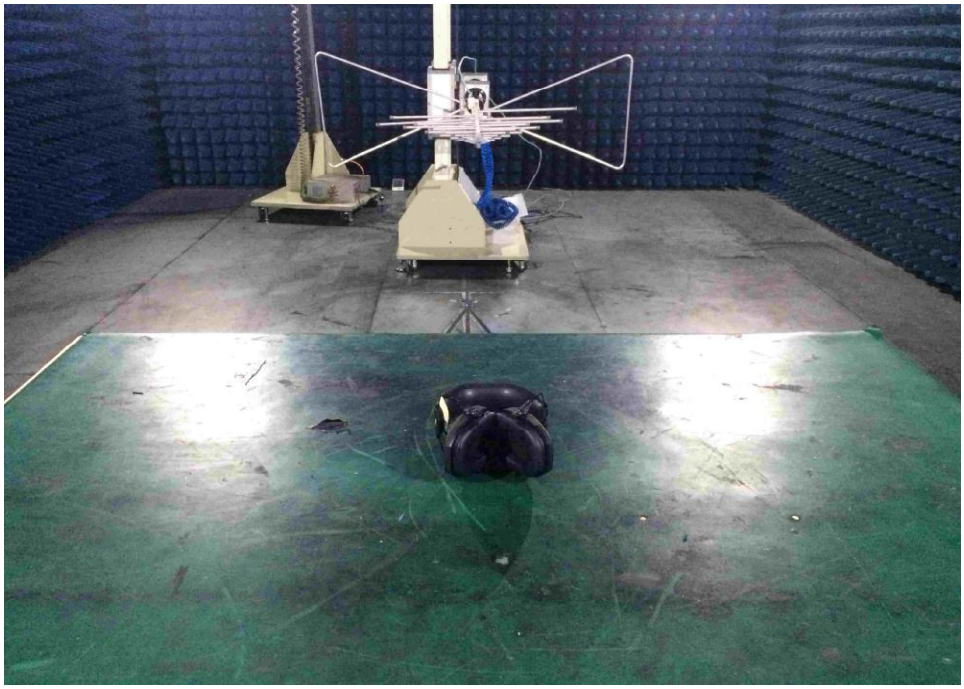
8. Photos of Testing

8. 1 EUT Test Photographs

EMI Test Setup View
Radiated Emission test view (From 9kHz to 30MHz)



Radiated Emission test view (From 30MHz to 1GHz)



Radiated Emission test view (1GHz to 18GHz)

Radiated Emission test view (18GHz to 26.5GHz)

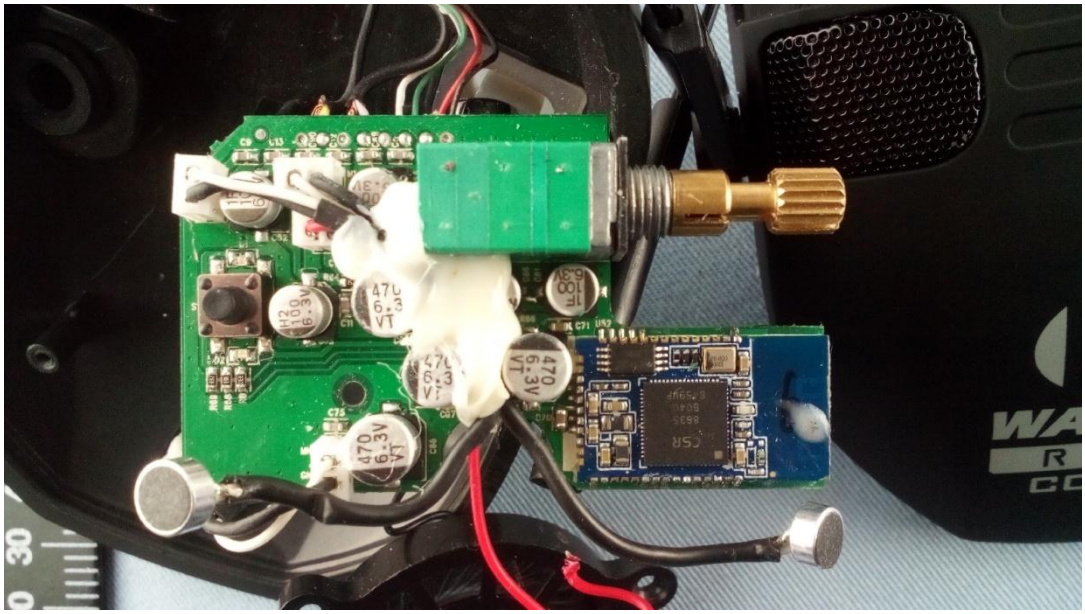
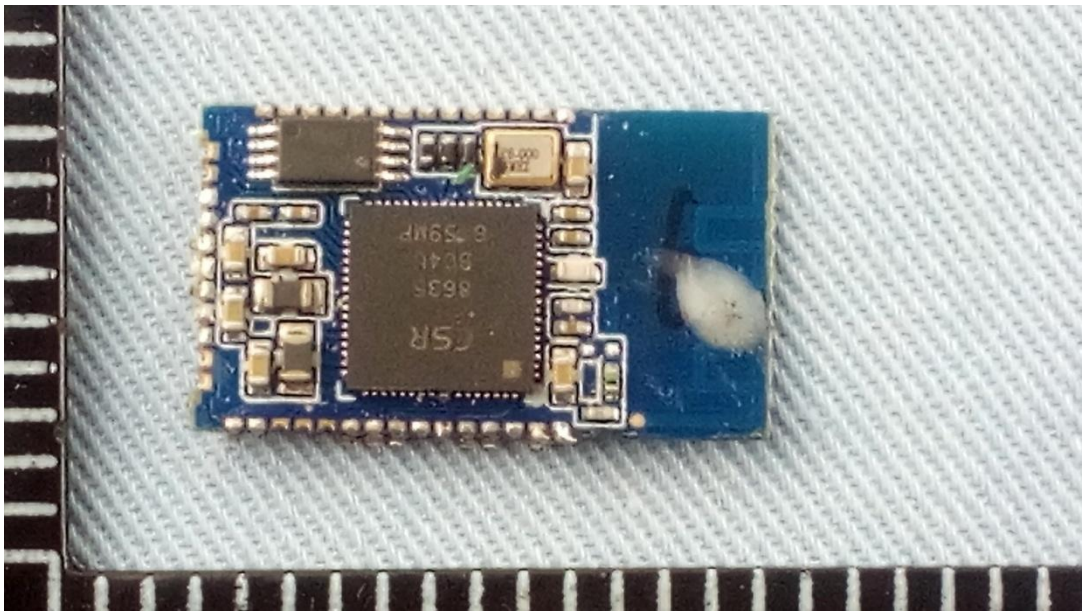
RF conducted tests

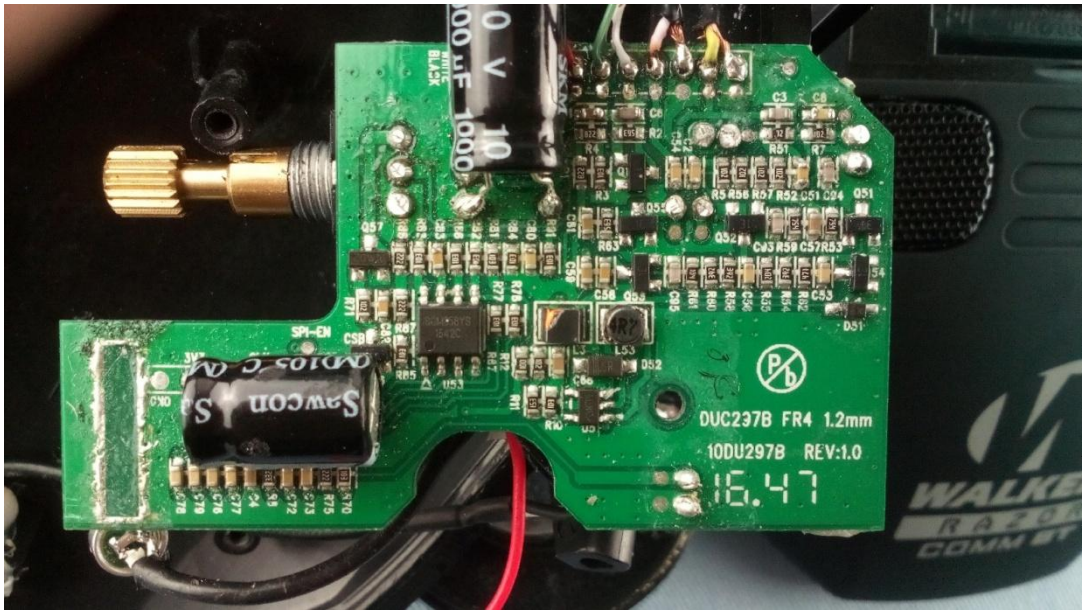
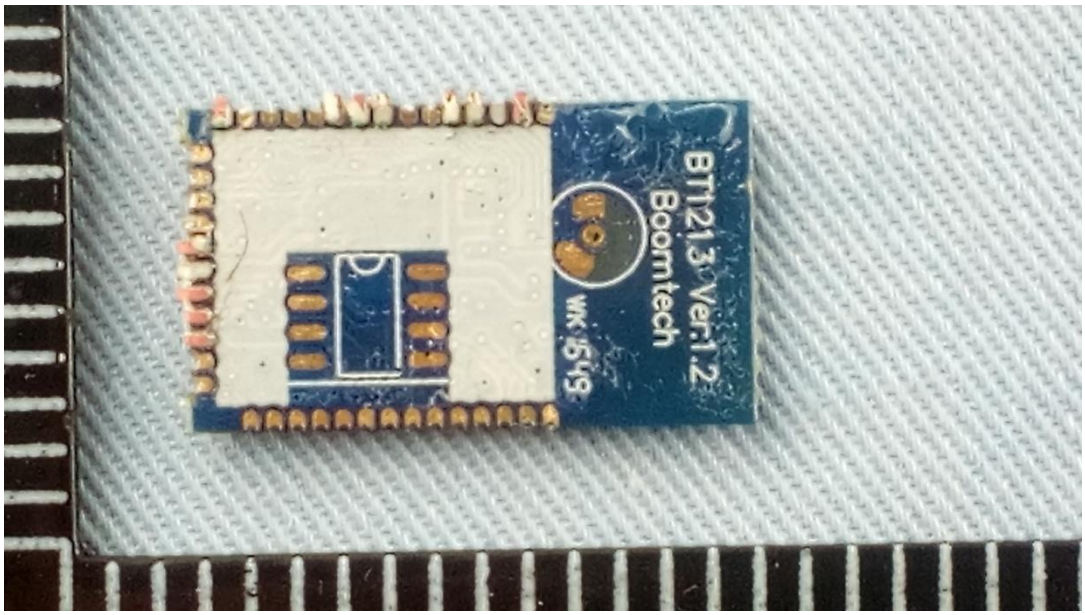

8. 2 EUT Detailed Photographs

EUT top view

EUT bottom view

EUT inside whole view

Main board component side



Main board solder side



9. FCC ID Label

FCC ID: VEP-QUADBT

The following note shall be conspicuously placed in the users manual: "**Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.**"

The Label must not be a stick-on paper label. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT


10. Test Equipment

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Due Date
Spectrum Analyzer	Rohde&Schwarz	FSV40	101495	2018-01-09
Test Receiver	Rohde&Schwarz	ESCS30	100307	2018-01-09
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	2018-01-09
Loop Antenna	Schwarzbeck	FMZB1516	1516131	2018-01-09
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	2018-01-09
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	2018-01-09
RF Switching Unit+PreAMP	Compliance Direction	RSU-M2	38322	2018-01-09
Pre-Amplifier	Rohde&Schwarz	CBLU1183540-01	3791	2018-01-09
Spectrum Analyzer	Rohde & Schwarz	ESPI3	100396/003	2018-01-09
Spectrum Analyzer	Agilent	E7405A	MY45115511	2018-01-09
Test Receiver	Rohde & Schwarz	ESCS30	100307	2018-01-09